General Sewer Plan and Wastewater Facilities Plan Update

Final

TETRA TECH

November 2017

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

November 2017

PREPARED FOR

City of Stevenson
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Stevenson, WA 98648

PREPARED BY

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November 17, 2017

Authorization

The City of Stevenson has authorized a consultant team led by Tetra Tech to prepare the City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update. In addition to Tetra Tech, the consultant team includes Katy Isaksen Associates (financial analysis).

Tetra Tech Project #135-48600-16001

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ACRONYMS/ABBREVIATIONS

Acronym or Abbreviation	Definition
ATS	automatic transfer switch
BOD	biochemical oxygen demand
CCTV	closed-circuit television
CF	cubic feet
CFR	Code of Federal Regulations
CI	Cascade Interceptor
CIP	capital improvement plan
CMOM	Capacity, Management, Operation and Maintenance
CSWD	Criteria for Sewage Works Design
D	depth
DNA	deoxyribonucleic acid
DO	dissolved oxygen
EO	Executive Order
EPA	Environmental Protection Agency
ERU	equivalent residential unit
FEMA	Federal Emergency Management Agency
FM	force main
GIS	geographic information system
gpad	gallons per acre per day
gpcd	gallons per capita per day
gpm	gallons per minute
HP	horsepower
I/I	infiltration and inflow
in	inches
kWh	kilowatt-hour
L	length
LPHO	low-pressure, high output
LPLO	low-pressure, low output
MCC	motor control center
mg/L	milligrams per liter
mgd	million gallons per day
MH	manhole
mJ	millijoule
mL	milliliter
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
MPHO	medium-pressure, high output
MSL	mean sea level
NEIWPCC	New England Interstate Water Pollution Control Commission
nm	nanometer
NOAA	National Oceanic and Atmospheric Administration

Acronym or Abbreviation	Definition
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OMI	Operations Management International (now CH2M contract operations)
Orange Book	Criteria for Sewage Works Design
PLC	programmable logic controller
ppd	pounds per day
PS	pump station
PUD	public utility district
PVC	polyvinyl chloride
RAS	return activated sludge
RPM	rotations per minute
SCADA	supervisory control and data acquisition
SDC	system development charge
SEPA	State Environmental Policy Act
SG	slide gate
TSS	total suspended solids
UV	ultraviolet
W	width
WAC	Washington Administrative Code
WAS	waste activated sludge
WWTP	wastewater treatment plant

AUTHORIZATION

City of Stevenson
Public Works Department
(509)427-5970
7121 E Loop Road, PO Box 371
Stevenson, Washington 98648

November 13, 2017

Department of Ecology
Southwest Regional Office
PO Box 47775
Olympia, WA 98504-7775

RE: National Pollutant Discharge Elimination System (NPDES) Permit No. WA0020672

To whom it may concern:

This letter is to grant authorization to Cynthia L. Bratz, P.E., Senior Project Manager, Tetra Tech, to sign the General Sewer Plan, Facilities Plan, Plan to Maintain Adequate Capacity, and other reports that may be required by the Department of Ecology as per our NPDES/State Waste Discharge Permit.

Sincerely,

Frank Cox
Mayor

EXECUTIVE SUMMARY

The *City of Stevenson General Sewer Plan and Wastewater Facilities Plan* is a comprehensive planning document for all elements of the City of Stevenson's wastewater system—collection, treatment, solids handling and effluent disposal. It addresses all areas currently served by the City's wastewater system as well as those expected to be served by the system over a planning period extending through 2040. The plan identifies improvements needed to collect and treat wastewater in the City's sewer service area and provides a capital improvement plan to implement the improvements.

WASTEWATER SERVICE AREA DESCRIPTION

The City of Stevenson covers 1.79 square miles in the Columbia River Gorge, about 45 miles east of Portland. It is surrounded by unincorporated Skamania County. The nearest neighboring cities are Carson, 3 miles to the northeast, and North Bonneville, 4 miles to the southwest. The City's Urban Area was set by federal statute in 1986 with the creation of the Columbia Gorge National Scenic Area.

The City's wastewater system collects and treats wastewater from all sewered areas of the City of Stevenson. There are currently 437 residential and commercial sewer accounts. These consist of single-family residences (324), commercial customers (68 accounts), public customers (17 accounts) and multi-family residential housing (28 accounts). The City had an estimated population of 1,530 as of 2015, including an estimated 1,081 residents served by the City wastewater system. The remainder of the population is not connected to the wastewater system and instead is served by on-site septic systems.

There are no permitted significant industrial users currently authorized by the Department of Ecology (Ecology) in the City. However, the commercial user category includes both commercial kitchens and beverage producers, which are major sources of wastewater flow and of biochemical oxygen demand (BOD) in the City's wastewater system. Ecology has indicated that the increasing size and number of commercial high-strength wastewater dischargers and their impact on wastewater treatment plant (WWTP) operations will require greater oversight. New and existing large commercial users will be required to obtain discharge permits from Ecology. Based on federal definitions of "significant commercial and industrial operations," discharge permits are expected to be required for dischargers that meet at least one of the following criteria:

- Discharge an average of 25,000 gallons per day or more of process wastewater
- Have average dry-weather flow or load equal to 5 percent or more of the WWTP capacity
- Have a reasonable potential to adversely affect the WWTP's operation or violate pretreatment standards.

GROWTH PROJECTIONS

Wastewater flows are contributed by residential and commercial/industrial/public sources. To simplify wastewater planning and ensure consistency, non-residential sources are often estimated as a comparable residential source, using the concept of the equivalent residential unit (ERU). An ERU represents the amount of wastewater contributed by an average residential household in the planning area.

Residential ERUs will typically grow at a faster rate than overall population because new development can be assumed to occur in sewered areas of the City. The number of residential ERUs are projected to increase by 168 by 2040, an average annual growth rate of 1.19 percent. A projection of future population growth by the City of Stevenson Planning Department, based on historic growth rates for the City and Skamania County, shows population increasing from 1,530 in 2016 to 1,901 in 2040.

In addition to new growth, there are two sewer basins in the City that are likely to receive sewer service during the planning period through planned sewer extensions (Loop Road and Iman Cemetery Road). In each basin, it is assumed that all parcels will convert to sewer from septic within 5 years of construction of the sewer extension.

Non-residential sewer ERUs in the City include commercial, industrial, and public sewer users. In general, non-residential growth in the City is assumed to be proportional to residential growth. However, the City has recently experienced significant growth in the beverage industry (breweries, distilleries, etc.). Beverage sector users were estimated to represent only 55 of the 621 non-residential ERUs at the start of 2016. However, because of their high growth potential and often high-strength wastewater, these ERUs have been broken out as a subset of non-residential ERUs when planning for future growth.

Beverage ERUs are assumed to grow at a rate twice that of the residential ERUs—an average of 2.38 percent per year. This will result in an additional 64 ERUs by 2040. In addition to this steady growth, there was a higher rate of growth in 2016 due to the startup of new beverage industry businesses, which added an estimated 27 ERUs. A total of 89 new beverage ERUs are projected be added by 2040.

All other non-residential ERUs are assumed to grow at a rate equal to that of residential ERUs, or an average of 1.19 percent each year. This will result in an additional 195 ERUs by 2040.

WASTEWATER FLOW AND LOAD PROJECTIONS

Wastewater Flows

Wastewater system improvements must be sized to have adequate capacity for the wastewater flows the system is projected to convey and treat over the course of the planning period. System flows consist of base sewage flow from connected customers (residential and commercial) as well as infiltration and inflow (I/I) into the system from groundwater and stormwater.

The average base wastewater generation in the City is assumed to be 55 gallons per capita per day (based on City winter water use records) and the average household size is assumed to be 2.21 persons per household. With these estimates, one ERU is equivalent to 122 gallons per day of wastewater.

The City has taken steps to control I/I for many years, but like all sanitary sewer systems in western Washington its total wastewater flow rate is still significantly affected by I/I. I/I is commonly evaluated as a unit flow per acre of contributing area. Existing I/I rates were estimated by using WWTP flow data for different design conditions (annual average flow, maximum-month flow, etc.), subtracting the assumed sanitary base flow, and then dividing by the contributing service area. Future I/I rates were estimated by assuming 10 percent increase throughout the planning period as an allowance for future larger storms resulting from climate change. Areas to be served by new sewers were assigned I/I rates based on planning criteria developed in 2014 by King County, Washington.

Wastewater Loads

Wastewater treatment facilities must be sized to have adequate capacity to treat expected pollutant loads to the treatment plant through the end of the planning period. Like wastewater flows, wastewater loads are projected using the projections of future population and development in combination with unit design criteria and peaking factors. The key pollutant loads of interest for planning for Stevenson are BOD and total suspended solids (TSS).

Residential BOD load was assumed to be 0.44 pounds per day per ERU, based on the 0.2 pounds per day per capita recommended in Ecology's *Criteria for Sewage Works Design*. BOD from high-load commercial dischargers ("high-load" is defined as significant quantities of high-strength wastewater; at present, all high-load dischargers in the City are beverage producers) was estimated to be 2.82 pounds per day per ERU, based on results of a September 2016 sampling program conducted by the City. Other non-residential ERUs were assumed to have BOD loads equal to residential ERUs.

Ecology recommends designing for a residential TSS load of 0.2 pounds per day per capita. TSS load data collected during the September 2016 sampling program showed unexpectedly low TSS loads in proportion to BOD load at the same sampling points, despite TSS loads at the WWTP being comparable to BOD loads during the sampling period. As a result, TSS load data from the sampling effort were not used to estimate future TSS load. Instead, projections of TSS load were based on the conservative assumption that future TSS loads will be equal to calculated BOD loads.

BOD and TSS loads were calculated for each year in the planning period based on the estimated number of ERUs. Maximum-month and peak-day loads were calculated for each year using peaking factors calculated from historical peaking factors for the WWTP.

Pretreatment

Two levels of pretreatment for high-load commercial dischargers were evaluated for this facilities plan. Alternative 1 assumes minimal pretreatment, in which high-load dischargers would install and operate pretreatment facilities to reduce their effluent BOD (discharged to the City sewer system) by approximately 20 percent. Alternative 2 assumes pretreatment to domestic strength, in which high-load dischargers would install and operate pretreatment facilities to reduce effluent BOD by approximately 85 percent.

Summary

Table ES-1 summarizes wastewater flow and load design projections based on the above assumptions. These are the flow and load projections that are carried forward as the design conditions for treatment process sizing and alternatives comparisons.

Table ES-1. Current and Projected Flow and Load Design Conditions

	Base (Dry Weather Average)		Maximum Month		Peak Day		Peak Hour	
Parameter	2016	2040	2016	2040	2016	2040	2016	2040
Flow (million gallons/day)	0.135	0.200	0.460	0.657	1.30	1.71	1.96	2.56
BOD (pounds/day)								
No pretreatment	620	1,070	961	1,798	1,985	3,758	n/a	n/a
20% pretreatment	589	989	890	1,611	1,662	2,912	n/a	n/a
85% pretreatment	488	724	658	1,003	1,294	1,916	n/a	n/a
TSS (pounds/day)								
No pretreatment	477	823	787	1,380	2,052	3,240	n/a	n/a
20% pretreatment	453	761	744	1,267	1,980	3,052	n/a	n/a
85% pretreatment	376	557	605	901	1,825	2,646	n/a	n/a

WASTEWATER COLLECTION SYSTEM

Existing Facilities

Stevenson's sanitary sewer collection system conveys flows to the City's wastewater treatment plant. It consists of 55,000 feet of gravity sewer mains, four pump stations, and 2,100 feet of force main. The oldest sewer was installed in 1911 in Russell Street, and consisted of vitrified clay pipe before being replace with concrete pipe in 1972. The wastewater treatment plant was constructed in 1971, and the majority of the gravity collection system was installed in 1972.

System Condition Evaluation

In general, the sewer lines in the worst condition are constructed of concrete and were installed prior to 1980. Concrete sewer pipes are prone to leaks at joints and cracks in the pipe. Newer sewer lines installed since 1990 are generally PVC with rubber gaskets and perform much better preventing I/I.

Each of the City's four pump stations has some or all of the following deficiencies: inadequate pumping capacity, equipment past its design life, access and safety issues, and lack of telemetry for remote monitoring.

Infiltration and Inflow

I/I in the City was analyzed using historical flow data at the WWTP and pump stations, along with rainfall data. This analysis identified areas of the City with I/I issues and showed that there has not been a noticeable increasing trend in I/I in the last 10 years. The City's I/I currently meets the federal definition for excessive inflow but does not meet the definition for excessive infiltration.

Capacity Analysis

Capacity analysis was performed through computer modeling of the collection system under existing peak-day and peak-hour flows. The peak-hour wet-weather flow simulations indicated several gravity sewers that experience flows exceeding 80 percent of full flow capacity and two lines with flows exceeding 100 percent of full capacity. However, surcharging is minimal and no overflows are predicted. Model results also showed that existing peak flows exceed the firm capacities of the Rock Creek and Kanaka Pump Stations.

The model was also run to evaluate collection system conditions under future conditions. The peak-hour wet-weather flow simulations for 2040 indicated that 17 pipe segments would experience flows exceeding 80 percent of their capacity, and 10 of these would see flows exceeding 100 percent of full capacity. No overflows are predicted due to insufficient pipe capacity, as long as pump stations are sized to handle future inflows. Model results showed that 2040 peak flows would exceed the existing firm capacities of the Rock Creek, Fairgrounds, and Kanaka Pump Stations.

Recommended Improvements

The modeling results were used to identify a series of projects to improve the City's collection system and meet current and future demands. Projects were divided into two phases: Phase 1 projects address areas with inadequate capacity for current demands, and Phase 2 projects address areas with inadequate capacity for future demands.

Improvements to the gravity sewer system focus on installing larger pipes to increase capacity in problem areas identified by the model results. Sewer extensions to currently unsewered areas have been laid out to facilitate conversions of existing septic systems and allow future extensions to developable areas in the City. Pump station improvements include full replacement of some pump stations found to have inadequate capacity and phased upgrades to other pump stations to enhance safety, reliability, and operability.

WASTEWATER TREATMENT PLANT EVALUATION

Existing Facilities

The Stevenson WWTP is located on the banks of Rock Creek, on Rock Creek Drive in the west end of Stevenson. The plant is designed for a peak-hour flow of 1.5 million gallons per day. It was constructed in 1971 as a package treatment plant with a chlorine contact tank for disinfection and a sludge lagoon. In 1992, the plant was upgraded with the current oxidation ditch, secondary clarifiers, and ultraviolet (UV) disinfection facility. Some components from the original plant were kept as backup to the new facilities or were converted for use in solids handling.

Permit Compliance

Under current conditions, average monthly influent BOD and TSS loads at the Stevenson WWTP regularly exceed the facility's National Pollutant Discharge Elimination System (NPDES) permit limits. In 2016, average monthly influent BOD loads exceeded the maximum-month influent BOD permit limit seven times, and the average monthly influent TSS load exceeded the permit limit three times.

Effluent permit requirements have been exceeded five times in the last five years. All five exceedances were connected to two events: an unusually high TSS reading in April 2016 that may be the result of a sampling error, and a sludge pump failure in September 2016.

Capacity and Condition

The treatment capacity of the existing WWTP is defined in the design documents for the 1992 upgrade and in the City's NPDES permit. Current flows at the WWTP are within the plant's design capacity, but with expected steady growth in the City the maximum-month and peak-day flows will soon exceed the design hydraulic capacity. Current BOD and TSS loads at the WWTP already exceed the plant's design capacity, by a factor of two in the case of BOD loads, and are expected to continue growing.

Facilities and equipment at the WWTP are generally in good working order but most are at least 25 years old and at or beyond the end of their design life. In addition, most unit processes at the WWTP do not meet current Ecology requirements for redundancy; the plant contains only one unit for major treatment processes like the oxidation ditch and disinfection reactor, and even where two units are in place, they are not adequately sized to operate at design flows with one unit offline.

TREATMENT PLANT IMPROVEMENTS

Based on the assessment of existing conditions and future requirements for the facilities at the Stevenson WWTP, alternatives were identified and evaluated for treatment improvements to ensure that the City can provide reliable wastewater treatment through the end of the planning period. The alternatives include facilities to pretreat high-strength commercial wastewater and facilities to improve treatment, reliability and operations at the WWTP.

Two alternatives were considered for improving the Stevenson WWTP. Alternative 1 (which has two variant options—1A and 1B—based on the secondary treatment technology used) provides WWTP improvements needed if minimal pretreatment is provided for wastewater from high-load dischargers. Alternative 2 provides WWTP improvements needed if wastewater from high-load dischargers is pretreated to domestic strength. These alternatives include upgrades of existing facilities to accommodate redundancy requirements and operational issues, as well as upgrades to provide additional hydraulic, biological treatment and solids handling capacity. The improvements have been tailored to accommodate, wherever possible, continued use of the existing major facilities, including the oxidation ditch, clarifiers, pump building, UV disinfection, outfall, aerobic digester and in-plant pump station.

Alternative 1 would replace the existing headworks with a new larger headworks; modify the existing secondary treatment process by adding selector basins, expanded secondary treatment capacity (oxidation ditches with 1A and conventional activated sludge reactors with 1B), a third final clarifier, and an aeration building; and install a second UV disinfection channel. A new sludge thickening building with mechanical sludge thickener would be added. The existing laboratory/control building would be replaced by a laboratory and operations building. The existing maintenance facility would remain in place. A future maintenance shop and dewatering facility may replace the existing maintenance facility after 2040.

Alternative 2 would have essentially the same WWTP improvements as Alternative 1A, with smaller treatment capacity required because a higher level of pretreatment would be provided.

Table ES-2 summarizes planning-level cost estimates for Alternatives 1B and 2 (Alternative 1B was identified as preferable to Alternative 1A). The total cost shown includes only the improvements at the Stevenson WWTP; the pretreatment improvements are expected to have different funding sources and mechanisms. These estimates are for comparison of the alternatives only. Future cost estimates will narrow the focus and provide a more accurate overall WWTP treatment plant cost for budgeting.

Table ES-2. Planning Level WWTP Cost Estimates

Component	Capital Project Cost		Annual O&M Cost		20-Year Present Worth	
	Alt 1B	Alt 2	Alt 1B	Alt 2	Alt 1B	Alt 2
Pretreatment Improvements at Other Locations						
High-Load Commercial Pretreatment	$711,000	$2,444,000	$10,021	$70,078	$888,000	$3,683,000
Stevenson WWTP Improvements						
Headworks	$1,870,000	$1,037,000	$43,573	$37,844	$2,829,000	$1,706,000
Secondary Treatment	$4,714,000	$5,126,000	$107,667	$133,330	$7,098,000	$7,148,000
Disinfection	$1,090,000	$1,090,000	$23,411	$23,411	$1,504,000	$1,504,000
Solids Handling	$1,066,000	$884,000	$155,040	$163,141	$5,636,000	$3,770,000
Support Facilities	$3,084,000	$3,084,000	$75,269	$75,269	$8,390,000	$8,611,000
Flood Protection	$202,000	$202,000	$1,507	$1,507	$229,000	$229,000
Effluent Pumps	$576,000	$576,000	$7,004	$7,004	$700,000	$700,000
WWTP Mgt Tasks			$62,400	$62,400	$1,103,687	$1,103,687
Lab Labor			$93,600	$93,600	$1,655,531	$1,655,531
Pretreatment Program Labor			$62,400	$62,400	$1,103,687	$1,103,687
WWTP Total (excluding Pretreatment)	$12,602,000	$11,999,000	$631,870	$659,907	$30,248,906	$27,530,906

RECOMMENDED PLAN

The phased improvements to the gravity sewer system and pump stations are all recommended for inclusion in the City's capital improvement plan. All Phase 1 projects are intended to address current problems in the system, including inadequate capacities in some pipes and pump stations, and should be considered high priority. The collection system extensions to unsewered areas should be conducted as required by City growth.

The City's aging WWTP is consistently overloaded and requires upgrades in the near future to protect the environment and accommodate continued growth. Alternative 1B is the recommended treatment plant improvement alternative due to its higher treatment capacity at the WWTP site and ability to accommodate smaller offsite pretreatment facilities. The proposed WWTP improvements will upgrade the plant so that it can reliably treat the wastewater flows and loads projected through 2040.

Predesign for the WWTP improvements is scheduled for 2018. Table ES-3 shows the capital improvement plan through 2022, with yearly costs to implement the recommended collection system and wastewater treatment plant improvements.

Table ES-3. Capital Improvements Plan for the Recommended Alternatives

Item	2018	2019	2020	2021	2022
Wastewater Treatment Plant Improvements (Alt 1B)	$600,000	$600,000	$2,443,000	$8,959,000	
Rock Creek Pump Station (PS-01)	$58,000	$58,000	$238,000	$872,000	
Fairgrounds Pump Station – Phase 1 (PS-02)	$5,000	$5,000	$22,000	$79,000	
Cascade Pump Station – Phase 1 (PS-05)				$3,000	$34,000
Cascade Avenue Sewer – Phase 1 (S-01)				$42,000	$399,000
Kanaka Pump Station – Phase 1 (PS-04)				$73,000	$697,000
Cascade Interceptor - Rock Cr PS to MH CI-4 (S-02)				$65,000	$617,000
Total	$663,000	$663,000	$2,703,000	$10,093,000	$1,747,000

1. INTRODUCTION AND BACKGROUND

1.1 ABOUT THIS PLAN

1.1.1 Purpose

The City of Stevenson needs an up-to-date general sewer plan and wastewater facilities plan to evaluate existing City wastewater infrastructure relative to current and projected flows and loads. Such an evaluation is needed to ensure that the City can continue to meet wastewater discharge permit requirements.

The City's most recent comprehensive wastewater planning document, the September 1991 *City of Stevenson Wastewater Facilities Plan* (the 1991 Facilities Plan) is now 26 years old. A series of technical memorandums evaluating wastewater treatment capacity relative to updated flows were prepared in May 2010, but a more comprehensive update of the 1991 Facilities Plan is needed. A variety of developments in the years since that plan was prepared warrant a complete wastewater comprehensive plan update:

- The City has experienced a rate of growth comparable to the estimates in the 1991 Facilities Plan; however, the total sewered population and wastewater flows have not reached the predicted levels.
- In the last two years, a number of commercial sewer dischargers that typically discharge high-strength wastewater have established themselves in the City. These dischargers include breweries, a distillery, and a cider producer.
- No major upgrades or equipment replacements have been made to the wastewater treatment plant (WWTP) since the 1992 upgrade. As a result, many of the equipment items and unit processes are nearing or at the end of their design life.

1.1.2 Project Scope

This *City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update* is a comprehensive planning document for all elements of the City's wastewater system—collection, treatment, solids handling and effluent disposal. It addresses all areas currently served by the City's wastewater system as well as those expected to be served by the system throughout the planning period through 2040.

The *General Sewer Plan and Facilities Plan Update* identifies improvements needed to collect and treat wastewater in the City's sewer service area and provides a capital improvement plan (CIP) to implement the improvements over the next 23 years. The City will use the CIP as a basis for updating the wastewater facilities development fee that the City charges for new sewer connections.

The updated plan complies with requirements for a wastewater facilities engineering report as defined in Washington Administrative Code (WAC) 173-240-060 and with requirements for a federal wastewater facilities plan as defined in the Code of Federal Regulations under 40 CFR 35.917-1. The plan will be submitted to the Washington Department of Ecology for approval so the City can proceed with design and implementation of the recommended improvements.

Preparation of this updated plan included the following activities:

- Gathering and reviewing key information
- Coordinating with regulatory authorities and preparing an overview of regulations that apply to City wastewater facilities
- Characterizing the basic planning area, including existing and future land use, existing population, and population projections
- Determining the capacity of the existing wastewater collection system and identifying improvements needed to provide reliable sewer service to existing and future development
- Evaluating the existing wastewater treatment system and identifying improvements needed to provide reliable treatment for existing and future development
- Completing all required environmental documentation.

1.2 RELATED STUDIES

The following studies were reviewed in the preparation of this updated plan:

- City of Stevenson Wastewater Facilities Plan. Prepared for the City of Stevenson by KCM. Portland, OR. September 1991.
- City of Stevenson Comprehensive Plan. Prepared for the City of Stevenson by the Stevenson Planning Department with the assistance of Cogan Owens Cogan. Portland, OR. April 2013.
- City of Stevenson Draft Evaluation of Existing Wastewater Treatment Plant Facilities. Prepared for the City of Stevenson by Tetra Tech. Seattle, WA. May 2010.
- City of Stevenson Draft Recommendations for Addressing Treatment Plant Capacity Needs. Prepared for the City of Stevenson by Tetra Tech. Seattle, WA. May 2010.
- City of Stevenson Draft Wastewater Treatment Plant Flow and Load Evaluation. Prepared for the City of Stevenson by Tetra Tech. Seattle, WA. May 2010.
- City of Stevenson Kanaka Pump Station Capacity Report; Cascade Avenue Improvements. Prepared for the City of Stevenson by Berger ABAM. Portland, OR. September 2014.
- City of Stevenson Sewer Population Benchmarks/Projections. Prepared by the City of Stevenson Planning Department. March 2016.
- City of Stevenson Wastewater Treatment Plant Upgrade Operations and Maintenance Manual. Prepared for the City of Stevenson by KCM. Portland, OR. July 1993.
- City of Stevenson Emergency Outfall Work Environmental Record. Prepared for the City of Stevenson by Gray & Osborne, Inc. Seattle, WA. April 2013.
- City of Stevenson Reasonable Potential Analysis. Prepared for the City of Stevenson by Cosmopolitan Marine Engineering. Gig Harbor, WA. March 2013.

1.3 WASTEWATER SERVICE AREA DESCRIPTION

1.3.1 Physical Features

Geographic Limits

The City of Stevenson covers 1.79 square miles in the Columbia River Gorge, approximately 45 miles east of Portland and 5 miles east of Bonneville Dam. It is surrounded by unincorporated Skamania County. The nearest neighboring cities are Carson approximately 3 miles to the northeast and North Bonneville approximately 4 miles to the southwest. The City's Urban Area was set by federal statute in 1986 with creation of the Columbia Gorge National Scenic Area. The planning area for this facilities plan is defined as the Urban Area, which is shown on Figure 1-1.

Source: Stevenson Comprehensive Plan, April 2013

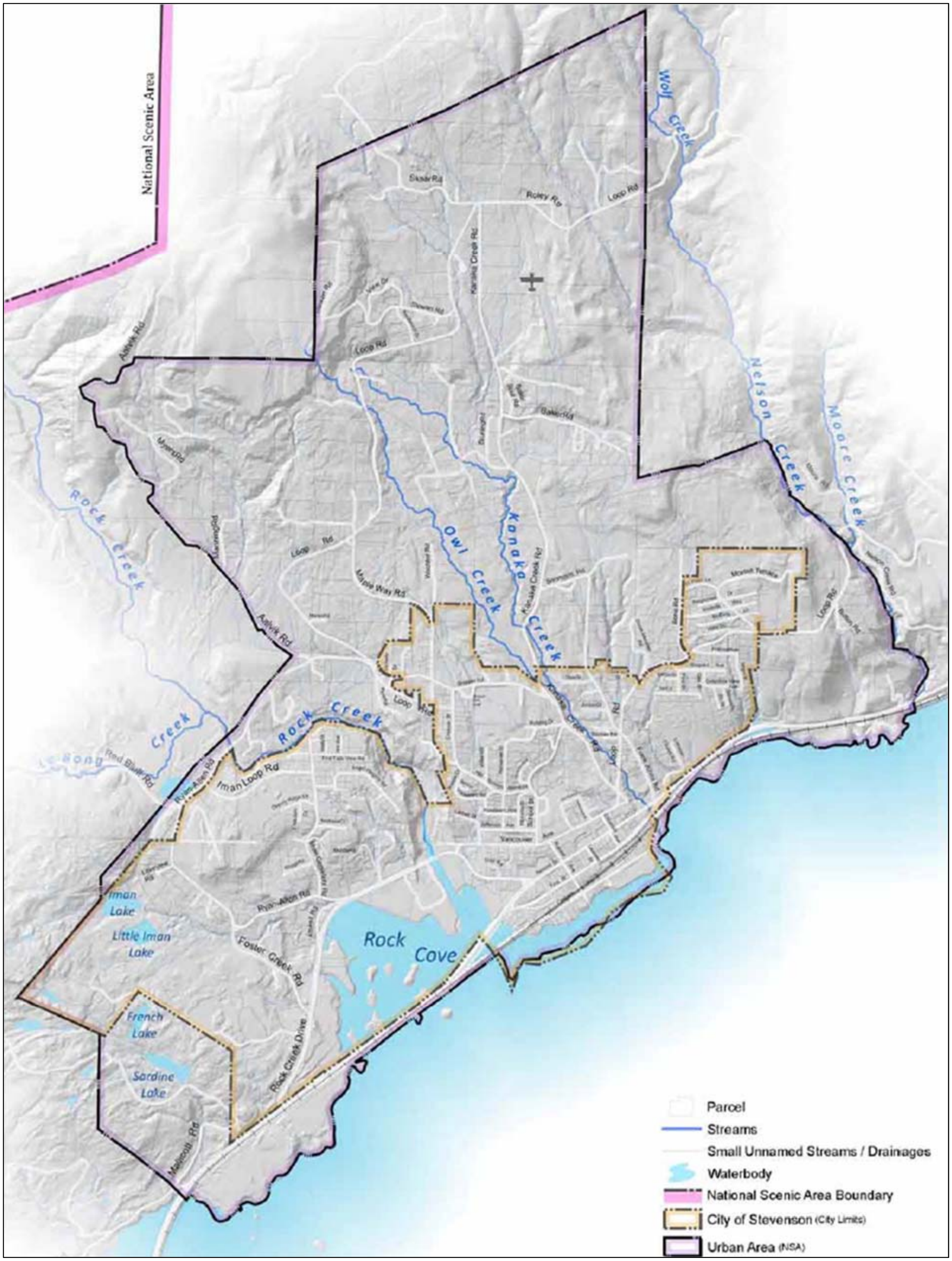

Figure 1-1. Boundary Map

Topography and Geology

The City of Stevenson is on the north bank of the Columbia River, within the scenic Columbia Gorge. Figure 1-2 shows the general vicinity and topography. Stevenson is located on a gently sloping shoreline adjacent to the reservoir pool that Bonneville Dam creates in the Columbia River.

Source: nationalmap.gov

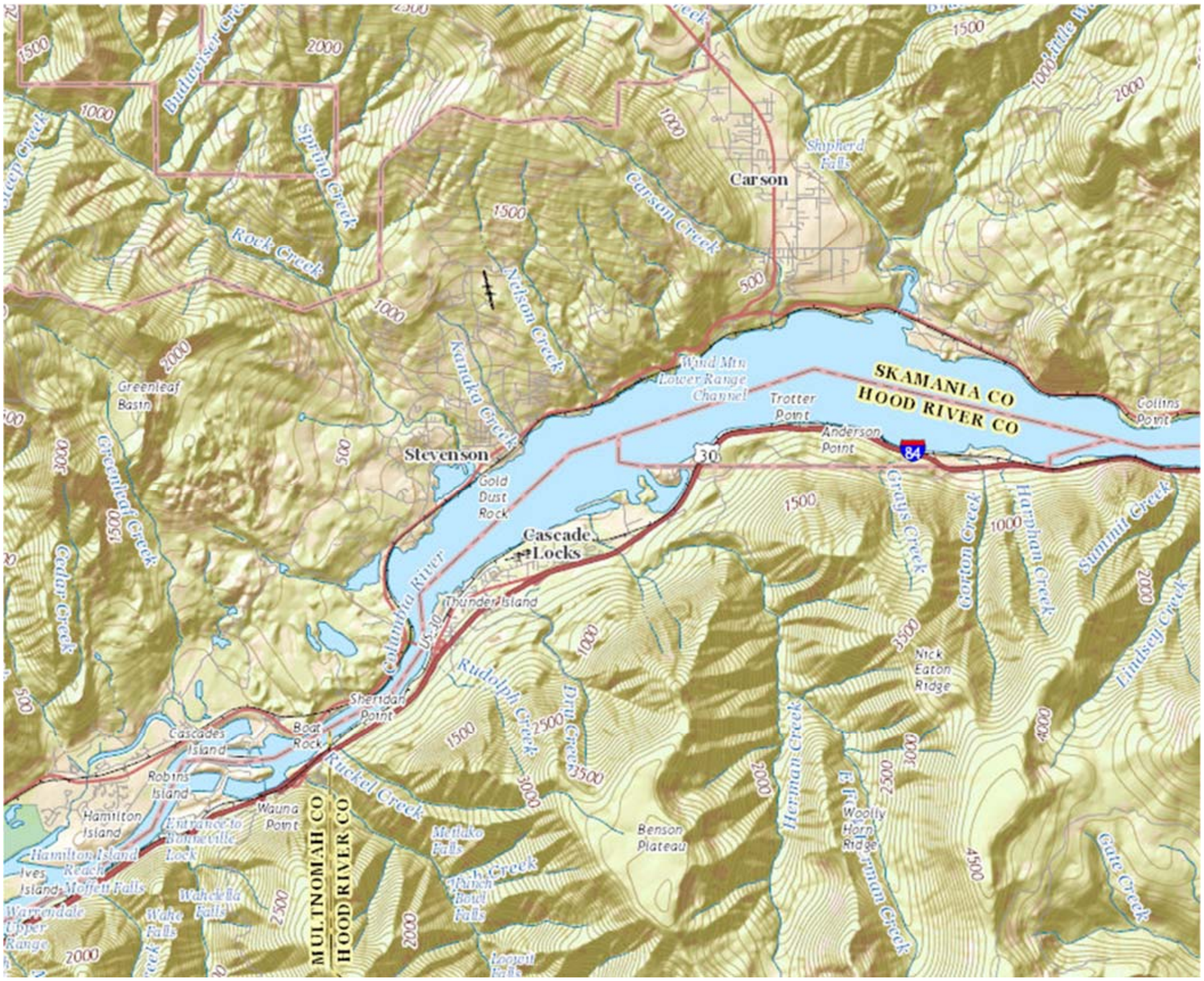

Figure 1-2. Vicinity Map

Elevations within Stevenson's corporate limits range from 74 feet mean sea level (MSL) to more than 450 feet MSL within one mile of the Columbia River shoreline. Land at elevations between 74 feet and 77 feet MSL is susceptible to flooding due to fluctuations in the Bonneville Dam Reservoir. The average reservoir level is 74 feet MSL, with the maximum operating level being 77 feet MSL. Just beyond the boundaries of the city, the geography changes from a steadily rising plane to a series of small, steeply sided valleys. The valley rims reach heights that are 2,000 feet above the river level within 3 miles of its shore. Rock Creek flows through one of the valleys and through the center of the city to its confluence with the Columbia River.

Most of the city lies within the Rock Creek drainage basin, which flows north to south to enter the Columbia River at a point in the Skamania County Fairgrounds. The eastern portion of the City drains to Kanaka Creek prior to entering the Columbia River.

Climate

The climate is generally mild. Stevenson is located between the Coast Range and the Cascade Range of mountains. The Coast Range protects this area from the force of winter storms originating off the Pacific Coast. The Cascade Range prevents the extreme summer temperatures of the eastern portion of the state from affecting the area. The average annual precipitation over the past three years is 79.3 inches, with 75 percent of the rain occurring from November through May. The mean temperature for the region is 50.8 degrees Fahrenheit.

1.3.2 Built Environment

Wastewater System Ownership and Operation

The City of Stevenson owns and operates all portions of its wastewater system, with the exception of the Stevenson Wastewater Treatment Plant, which is owned by the City but operated by CH2M contract operations. CH2M operates the Hood River WWTP and uses this as a home base for its staff that operate the Stevenson plant. Contact information is as follows:

- Stevenson WWTP Phone: (509) 427-5970
- Stevenson WWTP Address: 7121 E Loop Road, Stevenson, WA 98648
- Hood River WWTP Phone: (541) 368-242

Development Served

The City's wastewater system collects and treats wastewater from all sewered areas of the City of Stevenson. There are currently 437 residential and commercial sewer accounts. These consist primarily of single-family residences (324), commercial customers (68 accounts), public customers (17 accounts) and multi-family residential housing (28 accounts). There are no permitted significant industrial users currently authorized by the Department of Ecology (Ecology) in the City. However, the commercial user category includes both commercial kitchens and beverage producers, which are major sources of base flow and biochemical oxygen demand (BOD) in the City's wastewater system. Ecology has indicated that the increasing size and number of commercial high-strength-wastewater dischargers, and their impact on WWTP operations, means that greater oversight will be required in the City. New and existing large commercial users will be required to apply for discharge permits from Ecology.

The City had an estimated population of 1,530 as 2015. This includes an estimated 1,081 residents served by the City wastewater system. The remainder of the population is not connected to the wastewater system and instead is served by on-site septic systems.

The City's growth boundary was federally set under the Columbia River Gorge Scenic Area Act. The City is bounded on the south by the Columbia River and essentially can only grow to the north; growth to the east and west is constrained by Scenic Area boundaries. Topography to the north is steep and in certain areas subject to unstable ground conditions, limiting both the density and types of growth that can occur.

Water Supply

Water in Stevenson is supplied from LaBong Creek, Cedar Springs, and Rock Creek. Water from these sources is treated by the City's 1.0-million-gallon-per-day (mgd) water treatment plant, constructed in 1979. The City also holds water rights for groundwater withdrawals that are currently used as a backup supply. The primary groundwater source is Hegewald Well, with a 650-gallon-per-minute (gpm) installed production capacity. Iman Springs, a supplemental surface water source, is currently off line until transmission facilities can be upgraded.

Adjacent Wastewater Systems

The only wastewater system currently adjacent to the City of Stevenson is the system owned and operated by the City of North Bonneville, about 4 miles southwest of the Stevenson treatment plant. The North Bonneville wastewater system serves all of the City of North Bonneville, with an estimated 2015 population of 971. A regional wastewater treatment approach does not appear practical; the only available community is relatively distant and significant portions of the area between the two communities have limited development potential due to restrictions placed by the Columbia River Gorge National Scenic Area.

1.4 PERMITS, REQUIREMENTS AND REGULATIONS

Wastewater must be collected, treated, and disposed of or reused in a way that protects public health and receiving water quality, generates no objectionable off-site odors or aesthetic nuisances, and complies with all applicable regulations. Wastewater treatment facilities must meet the regulations and requirements of many federal, state, and local regulatory agencies. Appendix A presents rules and regulations that typically apply to wastewater projects. Key points are summarized in the sections below.

1.4.1 Federal Regulations and Guidelines

Programs and policies to protect water quality were first initiated on a nationwide scale by the federal Water Pollution Control Act of 1956. That act has seen numerous amendments, including the Clean Water Act of 1977, which, among other changes, established National Pollutant Discharge Elimination System (NPDES) permits that regulate point discharges into water. The current Water Pollution Control Act requires publicly owned wastewater treatment facilities to provide a minimum of secondary treatment, with the following standards for effluent quality:

- The monthly average of BOD and total suspended solids (TSS) concentrations shall not exceed 30 milligrams per liter (mg/L).
- The weekly average of BOD and TSS concentrations shall not exceed 45 mg/L.
- The monthly average removal of BOD and TSS shall be at least 85 percent.
- The pH of the effluent shall be between 6.0 and 9.0.

Sewage solids generated at wastewater treatment plants is subject to standards set under Part 503 of the Code of Federal Regulations. Solids management requirements under this regulation apply to pathogen reduction, vector-attraction reduction, metals concentrations, reporting, monitoring, and management practices.

An important reference for wastewater treatment plant equipment reliability is the U.S. Environmental Protection Agency’s 1974 *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability*. This document outlines requirements in three reliability classes, with provisions for each common treatment plant unit process.

Beyond these wastewater-specific federal requirements, any work proposed in this facilities plan will have to comply with federal requirements relating to the environment, agricultural lands, and cultural and historic resources.

In addition to regulatory requirements, the U.S. Environmental Protections Agency (EPA) has developed a set of guidelines for wastewater system practices to reduce sewage overflows. The guidelines are recommended but not required. They are presented in the EPA’s Capacity, Management, Operation and Maintenance (CMOM) program. CMOM programs incorporate many standard operation and maintenance activities, but they also include information management to achieve the following:

- Better manage, operate, and maintain collection systems
- Investigate capacity-constrained areas of the collection system
- Proactively prevent sanitary sewer overflows
- Respond to sanitary sewer overflows.

Under the 1977 federal Executive Order 11988, regulatory oversight agencies for federally regulated projects must consider floodplains and their management in making project-related decisions.

1.4.2 State Policies and Regulations

Washington State has developed several requirements pertaining to surface water quality that are relevant for wastewater planning in Stevenson:

- The state's Water Quality Standards for Surface Waters (WAC 173-201A) define expected uses for various segments of the Columbia River, with water quality criteria that apply to each segment depending on its designated uses.

The Washington Department of Ecology oversees the NPDES permitting of the City of Stevenson wastewater treatment plant. The current permit (Permit No. WA0020672), modified in June 2013, defines the following requirements (the permit is provided in Appendix B):

- The following limits are established for influent flow to the treatment plant, per Section S4, Prevention of Facility Overloading (note that the BOD limit is lower than the plant's actual current influent BOD loading, indicating that the plant is overloaded):
    - Average treatment plant influent flow for the maximum month not to exceed 0.45 mgd,
    - BOD influent loading for the maximum month not to exceed 612 pounds per day (ppd)
    - TSS influent loading for the maximum month not to exceed 612 ppd
- Effluent limits are established as summarized in Table 1-1
- Monitoring requirements are defined, including monitoring of effluent nutrient and temperature levels

Table 1-1. NPDES Permit Limits for Stevenson Wastewater Treatment Plan Effluent Discharge

Parameter	Monthly	Weekly
Biochemical Oxygen Demand (5-day)		
Maximum Average Concentration	30 mg/L	45 mg/L
Maximum Average Load	92 ppd	138 ppd
Minimum Average Removal of Influent Load	85%	—
Total Suspended Solids		
Maximum Average Concentration	30 mg/L	45 mg/L
Maximum Average Load	92 ppd	138 ppd
Minimum Average Removal of Influent Load	85%	—
Fecal Coliform Bacteria		
Geometric Mean	200/100 mL	400/100 mL
Daily pH		
Minimum	6.0	
Maximum	9.0	

The state also has its own standards for water reclamation, use and disposal of solids, treatment plant equipment reliability, on-site sewage (septic) systems, and protection of environmental and cultural resources. These standards are described in the Department of Ecology's *Criteria for Sewage Works Design* (the Orange Book).

1.4.3 Local Policies

The City of Stevenson municipal code establishes requirements for installing sewer systems with new or revised development in the city. The code also sets regulations that may apply to work proposed in this facilities plan, relating to critical areas, stormwater management, shoreline protection, and building structural and fire safety.

2. PLANNING INFORMATION

2.1 GROWTH PROJECTIONS

Planning for wastewater system future needs requires projections of growth in the planning area. Such projections determine the expected quantities of wastewater that system facilities need to be able to accommodate over the course of a defined planning period. The planning period for this sewer plan is through 2040. The following sections describe anticipated changes in land use over that period and the associated growth in population.

2.1.1 Residential Population Growth

A projection of future population growth was provided by the City of Stevenson Planning Department, based on historic growth rates for the City and Skamania County. This projection shows population increasing from 1,530 in 2016 to 1,901 in 2040. This equates to a growth rate of approximately 0.87 percent per year. The City's estimates on population per household vary based on the source, but this report assumed it to be approximately 2.21 at the current density.

2.1.2 Equivalent Residential Units

Wastewater flows are contributed by residential and commercial/industrial/public sources, and therefore are affected by planning area population as well as planning area non-residential development. To simplify wastewater planning and ensure consistency, non-residential sources are often estimated as a comparable residential source, using the concept of the equivalent residential unit (ERU). An ERU represents the amount of wastewater contributed by an average residential household in the planning area.

Based on winter water usage records provided by the City, average water use in the City was calculated to be approximately 55 gallons per capita per day (gpcd). Wastewater generation was assumed to be roughly equal to water use. Using the average household size of 2.21 persons per household, this means that one ERU is equivalent to about 122 gallons per day of wastewater. For the majority of water users in the City, winter water use was used to estimate the number of ERUs; however, for Skamania Lodge, an annual average water use was used due to the winter being a low period in water use for this user. The City was estimated to have 489 residential sewer ERUs and 621 non-residential sewer ERUs in 2016.

Residential ERU growth

Residential ERUs will typically grow at a faster rate than overall population because new development can be assumed to occur in sewered areas of the City. As a result, using the population projections discussed above and the average household size of 2.21, the number of residential ERUs is projected to increase by 168 by 2040, an average annual growth rate of 1.19 percent. For sewer modeling purposes, it was assumed that this increase in residential ERUs is expected to be faster in from 2017 through 2020, due to the 83-lot Chinidere residential development currently being built.

In addition to new growth, two sewer basins in the City—Loop Road and Iman Cemetery Road—are likely to receive sewer service during the planning period as a result of planned sewer extensions. Within these basins, it was assumed that all parcels will convert to sewer from septic over a period of five years after each sewer extension is constructed, due to City requirements to connect to public sewers when they are available. The Loop Road sewer extension is conservatively assumed to be constructed in 2021 and result in a total of 54 new sewer ERUs. The Iman Cemetery Road sewer extension is conservatively assumed to be constructed in 2026 and result in 32 new sewer ERUs. If these projects occur at a later date, the change will not affect the City's scheduling of capital projects, because the estimated additional flows are only about 5 percent of the total flow in 2040.

Future Non-Residential ERU Growth

Non-residential sewer ERUs in the City include commercial, industrial, and public sewer users. Non-residential growth in the City is assumed to be approximately proportional to residential growth. However, the City has recently experienced significant growth in the beverage industry (breweries, distilleries, etc.). While beverage sector users were estimated to represent only 55 of the 621 non-residential ERUs at the start of 2016, these users' high growth potential and often high-strength wastewater mean that these ERUs have been broken out as a subset of non-residential ERUs when considering future growth.

Beverage ERUs are assumed to grow at a rate twice that of the residential ERUs, or an average of 2.38 percent each year. This results in an additional 64 ERUs by 2040. In addition to this steady growth, there was a higher rate of growth in 2016 due to the startup of new beverage industry businesses that added an estimated 27 ERUs. The growth rate is expected to return to the estimated 2.38 percent after 2016 because much of the available waterfront building space that is well suited for this type of use is now occupied. Combining the faster growth in 2016 and steady growth thereafter, a total of 89 new beverage ERUs will be added by 2040. It should be noted that the understanding of growth for high load industry is still developing.

All other non-residential ERUs are assumed to grow at a rate equal to that of residential ERUs, or an average of 1.19 percent each year. This will result in an additional 195 ERUs by 2040.

Summary

Table 2-1 and Figure 2-1 summarize the projected growth of residential and non-residential ERUs in Stevenson.

2.2 WASTEWATER FLOWS

Wastewater system improvements must be sized to have adequate capacity for the wastewater flows the system is projected to convey and treat over the course of the planning period. Future wastewater flows are estimated using the projections of future population and development in combination with two types of design criteria:

- Unit design criteria define the typical amount of flow from a single "unit" such as a person, household, business, or acre of land. Numerous sources are available for determining the best accepted standard unit flows and loads for a given planning area.
- Peaking factors define standard ratios between average flows and likely peak values.

System flows consist of base sewage flow from connected customers as well as infiltration and inflow (I/I) into the system from groundwater and stormwater. The sections below describe total flows as well as the individual components of flow.

2.2.1 Historical Total Treatment Plant Influent Flows

Total wastewater flows from the City service area are measured by the effluent flow meter at the wastewater treatment plant. The effluent flow meter provides the only measurement of total treatment plant flows. It provides an accurate indication of daily-average influent flows, but not instantaneous or peak-hour flows, because influent flow variations are attenuated through the plant upstream of the effluent flow meter. Table 2-2 summarizes historical sewage flows measured at the treatment plant.

Table 2-1. ERU Growth Summary

Year	City Population	Residential Sewer ERUs			Non-Residential Sewer ERUs					Total ERUs
		New from Septic Conversion	New from Development	Total	Beverage		Non-Beverage		Total	
					New	Total	New	Total		
Current	1,530	0	0	489		55	0	566	621	1,110
2016	1,543	0	3	492	1	82	7	573	655	1,147
2017	1,557	0	21	513	2	84	7	580	664	1,177
2018	1,570	0	21	534	2	86	7	587	673	1,207
2019	1,584	0	21	555	2	88	7	594	682	1,237
2020	1,598	0	20	575	2	90	7	601	691	1,266
2021	1,612	11	3	590	2	92	7	608	700	1,290
2022	1,626	11	3	604	2	94	7	615	709	1,314
2023	1,640	11	4	619	2	97	7	622	719	1,338
2024	1,655	11	4	634	2	99	7	630	729	1,362
2025	1,669	10	4	647	2	101	7	637	739	1,386
2026	1,684	7	4	658	2	104	8	645	749	1,407
2027	1,698	7	4	669	2	106	8	653	759	1,428
2028	1,713	6	4	679	3	109	8	660	769	1,448
2029	1,728	6	4	689	3	111	8	668	779	1,469
2030	1,743	6	4	700	3	114	8	676	790	1,490
2031	1,758	0	4	704	3	117	8	684	801	1,505
2032	1,774	0	4	708	3	119	8	692	812	1,520
2033	1,789	0	4	712	3	122	8	701	823	1,535
2034	1,805	0	4	717	3	125	8	709	834	1,551
2035	1,821	0	4	721	3	128	8	717	845	1,567
2036	1,836	0	4	726	3	131	9	726	857	1,583
2037	1,852	0	4	730	3	134	9	734	869	1,599
2038	1,869	0	4	734	3	138	9	743	881	1,615
2039	1,885	0	4	739	3	141	9	752	893	1,632
2040	1,901	0	5	743	3	144	9	761	905	1,649
Increase	371	n/a	n/a	254	n/a	89	n/a	195	284	539

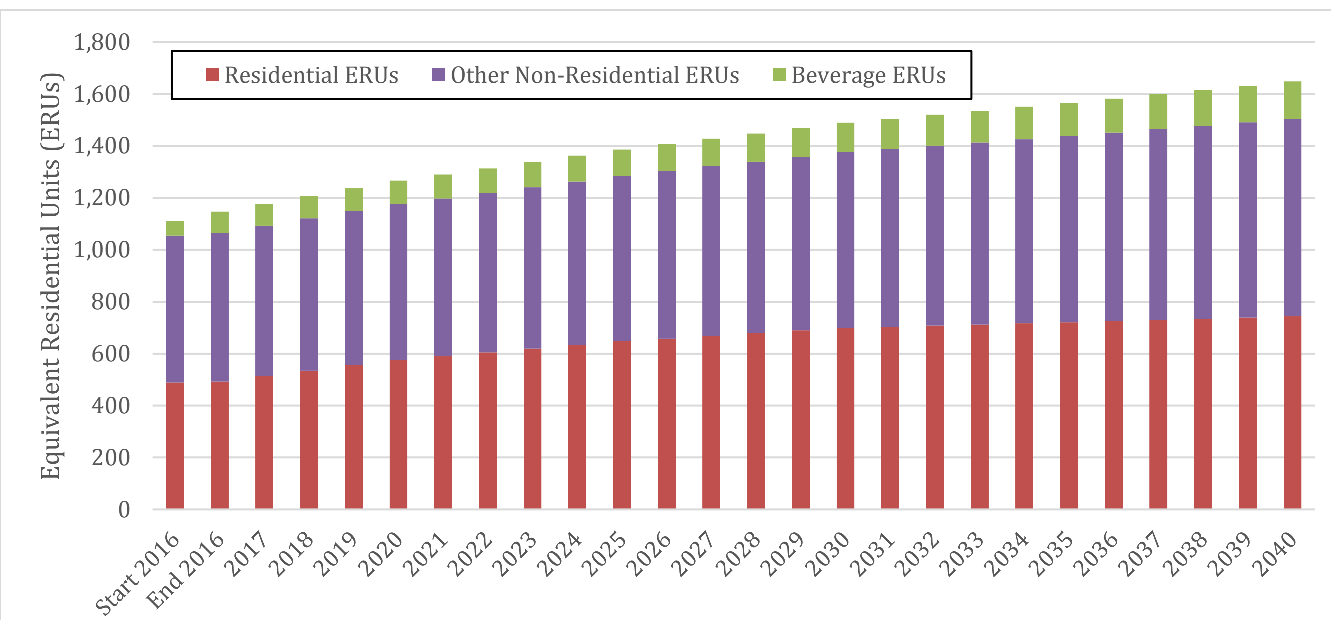

Figure 2-1. ERU Growth Chart

Table 2-2. Historical Treatment Plant Flow Data

Year	Average Dry-Weather Flow (mgd)	Annual Average Flow (mgd)	Maximum-Month Flow (mgd)	Peak-Day Flow (mgd)
2007	0.156	0.180	0.319	0.849
2008	0.167	0.191	0.245	0.967
2009	0.141	0.186	0.289	1.127
2010	0.151	0.201	0.404	0.992
2011	0.108	0.168	0.286	0.940
2012	0.120	0.212	0.424	1.290
2013	0.120	0.141	0.205	0.954
2014	0.107	0.171	0.325	0.805
2015	0.119	0.165	0.401	0.890
2016	0.147	0.190	0.290	0.506

2.2.2 Infiltration and Inflow

The following data are of note:

- Average dry-weather flow during the extremely dry summer of 2015 was 0.119 mgd.
- The annual average flow has grown to 0.165 mgd.
- The maximum-month flow was 0.424 mgd in January 2012.
- The greatest peak-day flow was 1.29 mgd, on January 21, 2012 following an extremely rainy period.

Infiltration and inflow are sources of water other than sanitary sewage entering the sewer system:

- Infiltration is typically defined as groundwater that enters a wastewater conveyance system through cracks or other defects in buried infrastructure. Infiltration can be categorized as rapid or base. Rapid infiltration is observed soon after rainfall events; base infiltration is present during dry periods and is generally associated with high groundwater, which can have seasonal variations.
- Inflow is precipitation runoff that enters a wastewater conveyance system through manhole covers, roof drains or other surface openings connecting to the system. It is difficult to differentiate rapid infiltration from inflow when analyzing flow records. They are often combined and referred to as rainfall-derived I/I.

Figure 2-2 illustrates how base infiltration and rainfall-derived I/I can contribute to total wastewater system flows over a period of several days.

Stevenson's wastewater system must have capacity for both base flow and I/I, which occurs in all sanitary sewer systems in western Washington. The City has taken steps to control I/I for many years. The City's total wastewater flow rate is significantly affected by I/I. The rainfall and flow graph in Figure 2-3 shows that flow at the treatment plant is highly correlated with rainfall.

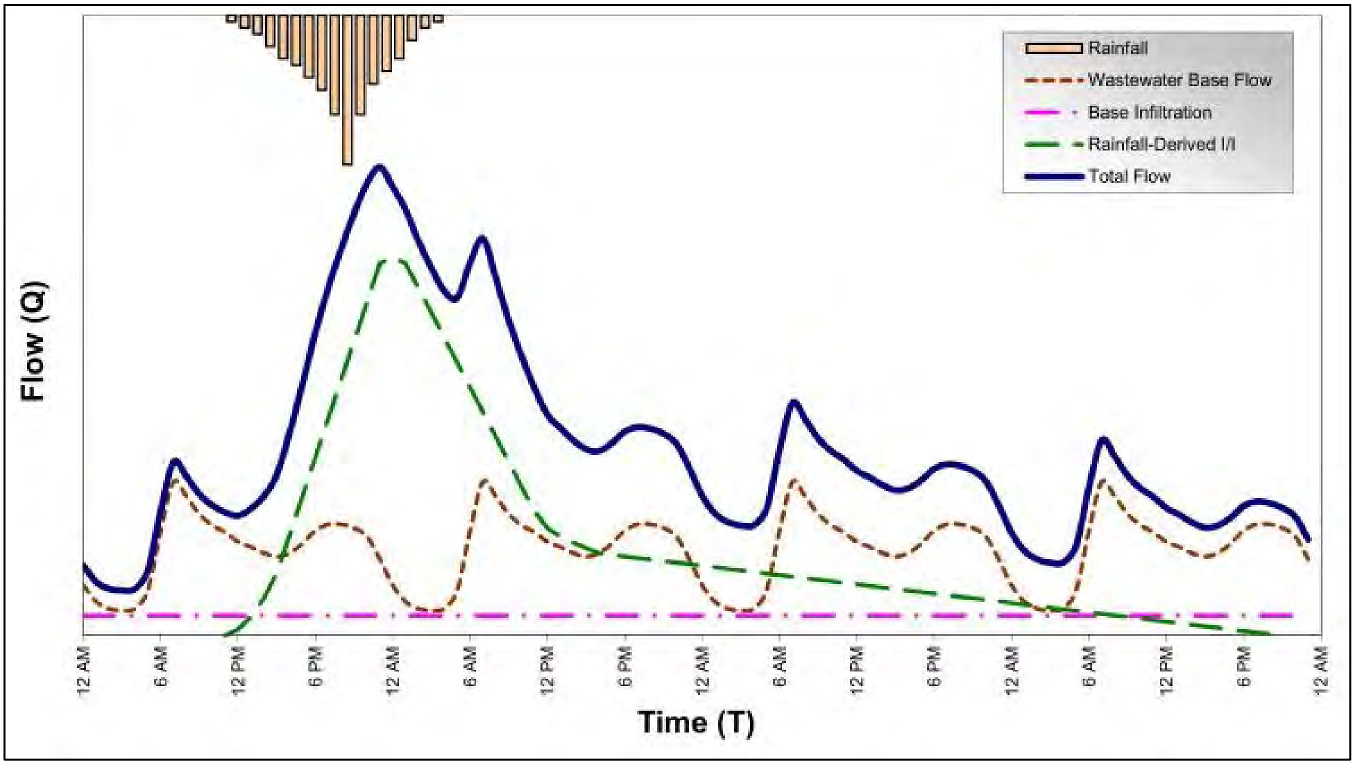

Figure 2-2. Wastewater Components of Flow

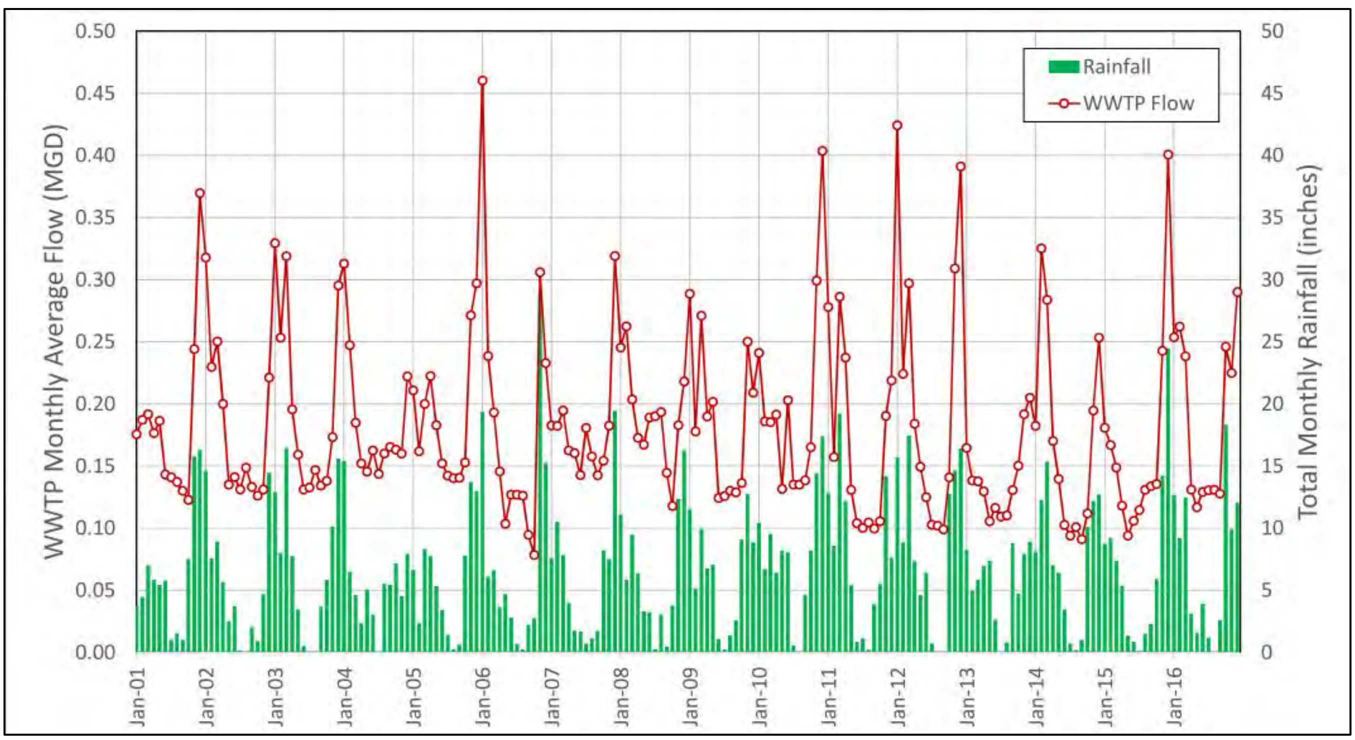

Figure 2-3. WWTP Monthly Average Flow and Total Rainfall 2001 – 2016

Estimated Current I/I

I/I is commonly evaluated as a unit flow per acre of contributing area. The per-acre unit I/I in gallons per acre per day (gpad) was estimated based on WWTP flow data for average annual flow, maximum-month flow, peak-day flow, and peak-hour flow. I/I was calculated from the total flow data by subtracting the assumed sanitary base flow of 0.121 mgd (see Section 2.2.3). The result was then divided by the contributing service area of 335 acres. Based on the analysis of discharge monitoring reports from 2001 through 2016, I/I rates were calculated as shown in Table 2-3.

Table 2-3. Recorded I/I Flows, 2001-2016

	Average Annual Flow	Maximum-Month Flow	Peak-Day Flow	Peak-Hour Flow[c]
Date of Recorded Event	2001 – 2016	January 2006	January 21, 2012	January 21, 2012
Total Recorded Flow	0.18 mgd	0.46 mgd	1.29 mgd	1.94 mgd
Calculated I/I Flow[a]	0.06 mgd	0.34 mgd	1.17 mgd	3.06 mgd
Unit I/I Flow[b]	185 gpad	1,012 gpad	3,499 gpad	5,058 gpad

a. I/I flow calculated as total recorded flow minus the sanitary base flow value listed in Section 2.2.3.
b. Unit I/I flow calculated as I/I flow divided by the service area of 335 acres.
c. Continuous flow monitoring data is not recorded at the WWTP. Peak-Hour Flow is therefore estimated as 1.5 x Peak-Day Flow.

Influence of Climate Change on Precipitation and I/I

For 2030 to 2059, change in annual average precipitation in the Northwest is projected to be within a range of an 11-percent decrease to a 12-percent increase, according to the 2014 National Climate Assessment by the U.S. Global Change Research Program. Very heavy precipitation events have increased nationally and are projected to increase in all regions. Therefore, an increase allowance of 10 percent in I/I in existing sewers due to heavy precipitation events was included in the projection of future flows.

I/I Design Criteria for This Sewer Plan

Facility plan design criteria for I/I are summarized in Table 2-4.

Table 2-4. I/I Design Criteria

	Existing Sewers	New Sewers
Annual Average I/I Unit Flow	204 gpad	100 gpad
Maximum-Month I/I Unit Flow	1,114 gpad	550 gpad
Peak-Day I/I Unit Flow	3,849 gpad	1,700 gpad
Peak-Hour I/I Unit Flow	5,565 gpad	2,500 gpad

These criteria were selected as follows:

- I/I in existing sewers is assumed to increase by 10 percent throughout the planning period from the current levels shown in Table 2-3. This assumes the City will implement an annual I/I maintenance program to prevent existing I/I from increasing due to defects in the collection system infrastructure. The 10-percent increase is an allowance for future larger storms resulting from future climate change.
- I/I for new sewers is assumed to be as follows:
  - A new-sewer peak-hour I/I rate of 2,500 gpad is assumed, based primarily on King County 2014 planning criteria. This represents a realistic level of I/I for new sewers in western Washington.
  - Average annual, maximum-month and peak-day I/I unit flows for new sewers were calculated assuming that the ratio of each of those flows to the peak-hour flow is approximately the same as for existing sewers.

2.2.3 Wastewater Flow Design Criteria

To evaluate the capacity of existing WWTP facilities and size future facilities, the following design conditions were considered:

- Dry weather average—Represents typical influent wastewater flow, expressed as a daily average
- Maximum month—Represents largest 30-day flow anticipated to occur during a continuous 30-day period, expressed as a daily average
- Peak day—Represents largest flow anticipated to occur during a 24-hour period
- Peak hour—Represents largest flow anticipated to occur during a 1-hour period

For future projections, 2025 and 2040 were selected as design years.

Base Flow

Base flows are the direct contributions of sewage to a wastewater system from connected residential and commercial users. As described in Section 2.1.2, the average wastewater generation in the City was assumed to be 55 gallons per capita per day (based on City winter water use records supplemented with annual water use records for Skamania Lodge) and average household size was assumed to be 2.21 persons per household, meaning that one ERU was equivalent to about 122 gallons per day of wastewater. The starting point for both flow and load projections was the start of calendar year 2016, at which time it was estimated that the City had 489 residential sewer ERUs and 621 non-residential sewer ERUs, resulting in an estimated total base flow of 0.135 mgd. For analysis of I/I, a lower base flow of 1.21 mgd for the wet-weather season was used, representing a reduced water use because Skamania Lodge is in its seasonal low water use period.

Maximum-Month Flow

Historical maximum-month flows at the Stevenson WWTP occur in winter, indicating that precipitation-driven I/I in the sewer system is a factor. Due to the importance of weather events, the current maximum-month flow was selected based on the highest observed maximum-month flow: 0.460 mgd, in January 2006.

Peak-Day Flow

Like maximum-month flows, peak-day flows occur in winter and are associated with precipitation events. The current peak-day flow was selected based on the highest observed peak-day flow: 1.290 mgd, on January 21, 2012.

Peak-Hour Flow

Hourly flow data are not collected at the WWTP, so current peak-hour flows were estimated based on the peak-day flow. Peaking factors for peak-day to peak-hour flow were reviewed for nine WWTPs throughout western Oregon and Washington and were found to have an average of 1.50. Using this 1.50 peaking factor and the peak-day flow of 1.290 mgd, the peak-hour flow was calculated to be 1.935 mgd.

2.2.4 Projected Future Flows

Flow projections include two components. First, the base flows increase as a result of new residential users and new or expanded non-residential sewer users. Second, I/I contributions increase as the sewer system both grows and ages. Table 2-5 summarizes flow projections in the design years 2025, 2030, and 2040. Figure 2-4 shows historic flow information (annual dry weather average, maximum month, and peak day) and projected flows (base, maximum month, and peak day).

Table 2-5. Current and Projected Flow Design Conditions

	2016	2025	2030	2040
Base (Dry Weather Average) Flow	0.135 mgd	0.168 mgd	0.181 mgd	0.200 mgd
Maximum-Month Flow	0.460 mgd	0.539 mgd	0.578 mgd	0.657 mgd
Peak-Day Flow	1.30 mgd	1.46 mgd	1.54 mgd	1.71 mgd
Peak-Hour Flow	1.96 mgd	2.19 mgd	2.31 mgd	2.56 mgd

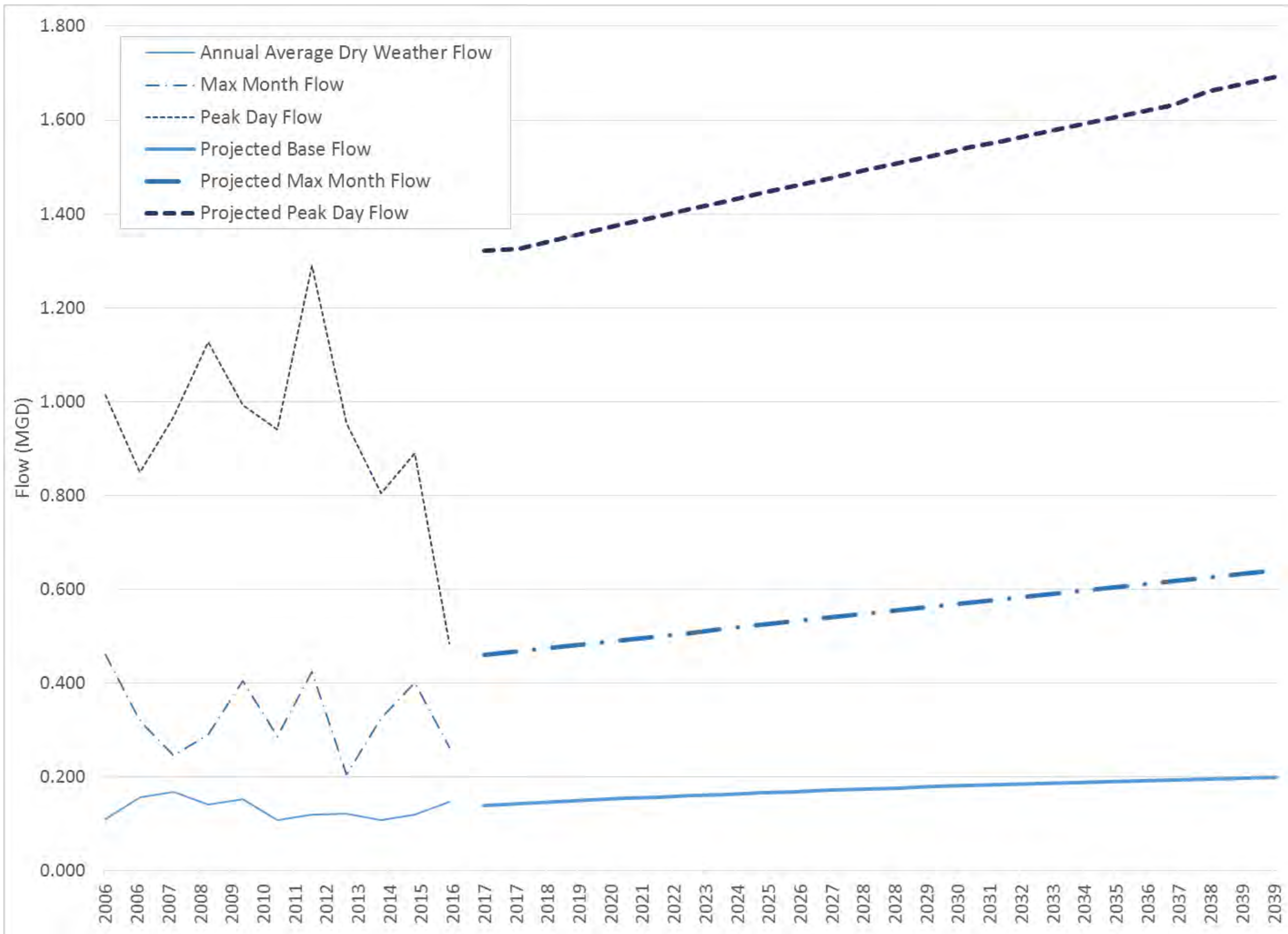

Figure 2-4. Historic and Projected Flows

Projected base flows were calculated using the yearly ERU estimate described in Section 2.1.2 and the assumption that the household size and flow per ERU will remain comparable. Projected maximum-month flows were obtained from the Stevenson sewer system model developed by Tetra Tech, and assume a linear growth in maximum-month flows due to steady growth in I/I flow. Projected peak-day flows were calculated by adding the projected base flow to a peak-day I/I flow. Peak-day I/I flows were obtained from the Stevenson sewer system model developed by Tetra Tech.

Projected peak-hour flows were calculated using the projected base flow, projected peak I/I flows obtained from the sewer system model, and a diurnal peaking factor to account for variations in base sewer usage over the course of a typical day. The diurnal peaking factor used for base flows was 2.0, based on flow monitoring results from a similar project.

2.3 WASTEWATER LOADS

Wastewater treatment facilities must be sized to have adequate capacity to treat expected pollutant loads to the treatment plant through the end of the planning period. Like wastewater flows, wastewater loads are projected using the projections of future population and development in combination with unit design criteria and peaking factors. The key pollutant loads of interest for planning for Stevenson are biochemical oxygen demand (BOD) and total suspended solids (TSS). The sections below describe historical and projected future levels of these loads.

2.3.1 Influent BOD Loads

Historical BOD Loads

Currently, the BOD load in influent wastewater at the plant is measured twice per week. The historical BOD loads measured at the treatment plant from January 2006 to December 2016 are summarized in Figure 2-5 and Table 2-6. BOD loads generally increased during the recorded period, particularly in the last two years when commercial and industrial users are believed to have increased their discharge to the sewer system. Earlier peak loads in the period 2009 to 2012 are believed to have been caused by commercial users; increased regulation of grease trap use at commercial kitchens beginning in early 2012 resulted in lower loads.

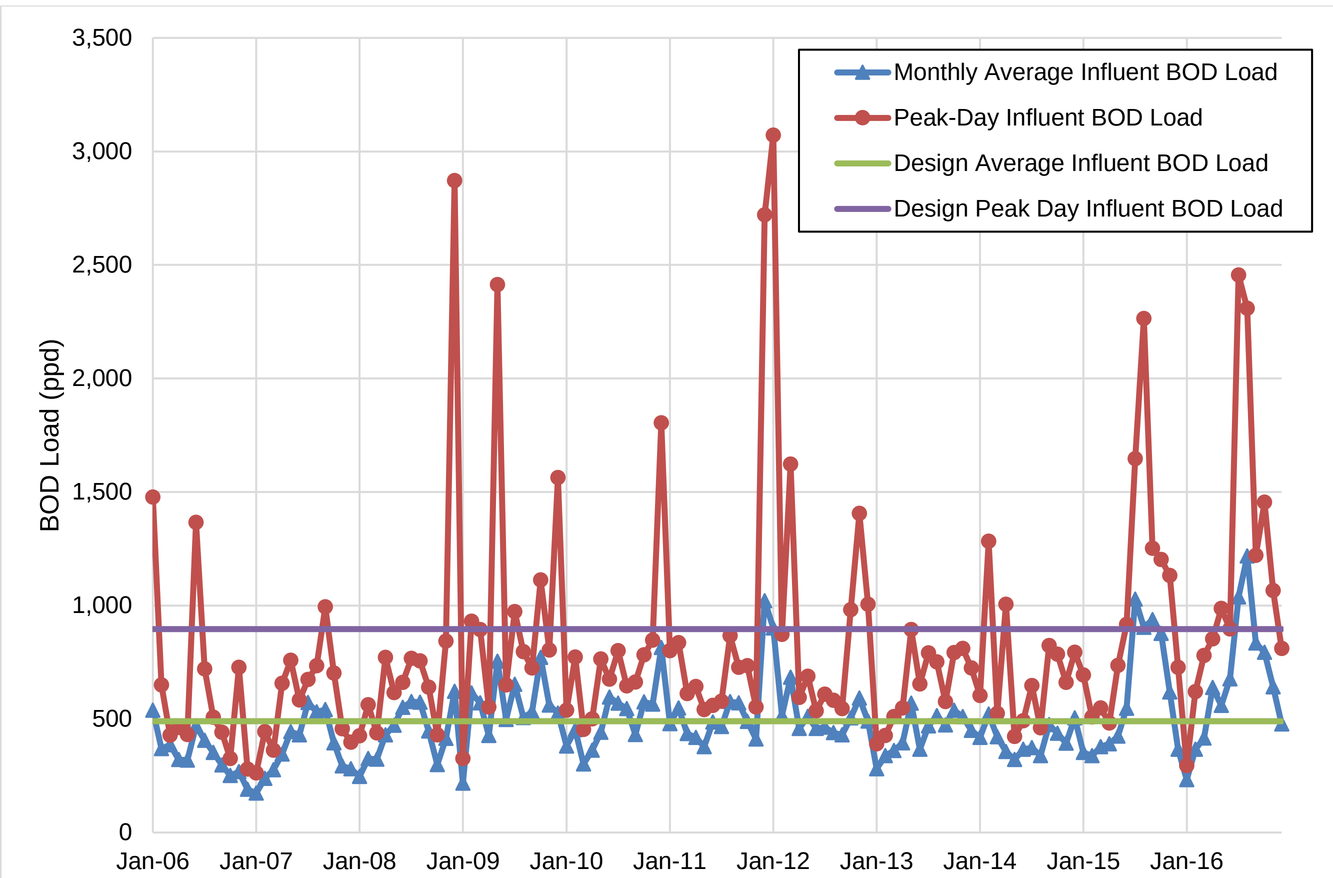

Figure 2-5. Historical Treatment Plant Influent BOD Loads

Table 2-6. Historical BOD Data

Year	Annual Average BOD Load (ppd)	Maximum-Month BOD		Peak-Day BOD	
		Load (ppd)	Peaking Factor	Load (ppd)	Peaking Factor
2006	348	539	1.55	1,477	4.24
2007	377	573	1.52	994	2.64
2008	440	621	1.41	2,871	6.53
2009	552	771	1.40	2,413	4.37
2010	503	815	1.62	1,804	3.59
2011	524	1,021	1.95	2,720	5.19
2012	537	901	1.68	3,071	5.72
2013	439	569	1.30	894	2.04
2014	411	521	1.27	1,282	3.12
2015	597	1,027	1.72	2,263	3.79
2016	664	1,218	1.83	2,456	3.70

BOD Design Criteria for This Facilities Plan

Residential BOD load was assumed to be 0.2 pounds per day (ppd) per capita, as recommended in Table G2-2 of the Department of Ecology's *Criteria for Sewage Works Design* (the Orange Book). Using the average household size of 2.21, this results in a base load of 0.44 ppd per ERU.

BOD load from high-load commercial dischargers ("high-load" is defined as significant quantities of high-strength wastewater; at present, all high-load dischargers in the City are beverage producers) was estimated based on the sampling program results documented in the pretreatment memo included in Appendix F. Samples were collected from three beverage producers, which had average BOD loads of 2.45, 2.82, and 3.05 ppd per ERU during the sampling period. The average of these readings is 2.82 ppd per ERU, which was used as the base load for high–load commercial (beverage) ERUs.

Significant BOD load from these high-load commercial dischargers is new to Stevenson, and the city has only performed one industrial waste survey (sampling program). More BOD data is needed in order to develop a better understanding of industrial dischargers' loadings.

The majority of non-residential, non-beverage wastewater in the City is received from Skamania Lodge. During the sampling program, the BOD load for Skamania Lodge was comparable to the assumed residential BOD load of 0.44 ppd per ERU, and this was used as the base load for non-residential, non-beverage ERUs.

Using these assumed loads and the estimated number of ERUs of each usage type at the start of 2016, the average BOD load was calculated to be 620 ppd. Influent data for October 2015 through September 2016 show that the recorded average BOD load was 653 ppd, which is within 5 percent of the calculated average BOD load, indicating that the selected assumptions are reasonable.

Maximum-Month BOD Load

Maximum-month BOD load was estimated using a peaking factor. Separate peaking factors were calculated for beverage and non-beverage (i.e. residential and other commercial) ERUs, because beverage industries are believed to experience relatively large changes in BOD strength due to batch operations and seasonal changes. Beverage industry peaking factors were estimated using a comparison of maximum-month and average-day BOD values in Stevenson WWTP influent data for the years 2015 and 2016, during which time beverage industries were operating in the City. Non-beverage peaking factors used data for 2013 and 2014, when flow from beverage industries was limited. This method yielded a beverage industry BOD peaking factor of 2.3 and a non-beverage peaking factor of 1.3.

Using the calculated annual average BOD load of 620 ppd and the above beverage and non-beverage peaking factors, the calculated maximum-month BOD load is 961 ppd for the start of 2016, rising to 1,142 ppd by the end of 2016 due to the significant growth of the beverage industry. Influent data for October 2015 through September 2016 show that the recorded maximum-month BOD load was 1,221 ppd, indicating that the selected peaking factor is reasonable.

Peak-Day BOD Load

Current peak-day BOD load was estimated using a comparable peaking factor approach to that used for maximum-month BOD load. This method yielded a beverage industry BOD peaking factor of 5.0 and a non-beverage peaking factor of 2.6.

Future BOD Projections

As described in the base loads section above, BOD loads are calculated for each year in the planning period based on the number of ERUs in the City. Maximum-month and peak-day BOD loads were calculated for each year based on the selected peaking factors multiplied by the average-day BOD loads. Table 2-7 summarizes load projections in the design years 2025 and 2040.

Table 2-7. Current and Projected BOD Design Conditions

	BOD (ppd)		
	Base (Dry Weather Average)	Maximum Month	Peak Day
No pretreatment			
2016	620	961	1,985
2025	852	1,394	2,902
2040	1,070	1,798	3,758
20% pretreatment			
2016	589	890	1,662
2025	795	1,262	2,307
2040	989	1,611	2,912
85% pretreatment			
2016	488	658	1,294
2025	609	835	1,687
2040	724	1,003	1,916

Future Maximum-Month BOD Projections for High-Load Commercial Dischargers

Current high influent BOD loading is higher than the Stevenson WWTP's permitted influent loading limit, per Section S4 of the City's NPDES permit. In response to this issue, the City instituted a sampling and testing program (industrial waste survey) in the fall of 2016 at seven locations, in order to identify and characterize major sources of high load wastewater. The sampling/testing results were used to prepare a preliminary assessment of source control and pretreatment alternatives for the major high load dischargers.

Two pretreatment options were prepared for this facilities plan, to project the impacts for the Stevenson WWTP given two different levels of pretreatment (source control) for the high-load dischargers:

- Option 1—Minimal Pretreatment. Under Option 1, high-load dischargers would install and continuously operate pretreatment facilities that would reduce their effluent BOD (discharged to the City sewer system) by approximately 20 percent.
- Option 2—Pretreatment to Domestic Strength. Under Option 2, high-load dischargers would install and continuously operate pretreatment facilities that would reduce their effluent BOD (discharged to the City sewer system) by approximately 85 percent. This 85-percent reduction in BOD load would mean that the effluent discharged to the City sewer system would be approximately domestic strength.

Figure 2-6 shows BOD loading to the Stevenson WWTP including the 20-percent reduction in BOD load from the high-load commercial dischargers. Figure 2-7 shows BOD loading including pretreatment to domestic strength (85-percent reduction in BOD load) from the high-load commercial dischargers.

Table 2-7 shows historical monthly BOD loads and projected BOD average, maximum-month, and peak-day BOD loads through 2040 with no pretreatment, 20 percent pretreatment, and 85 percent pretreatment. These pretreatment options are integrated into the WWTP improvement alternatives described in Chapter 8 of this facilities plan.

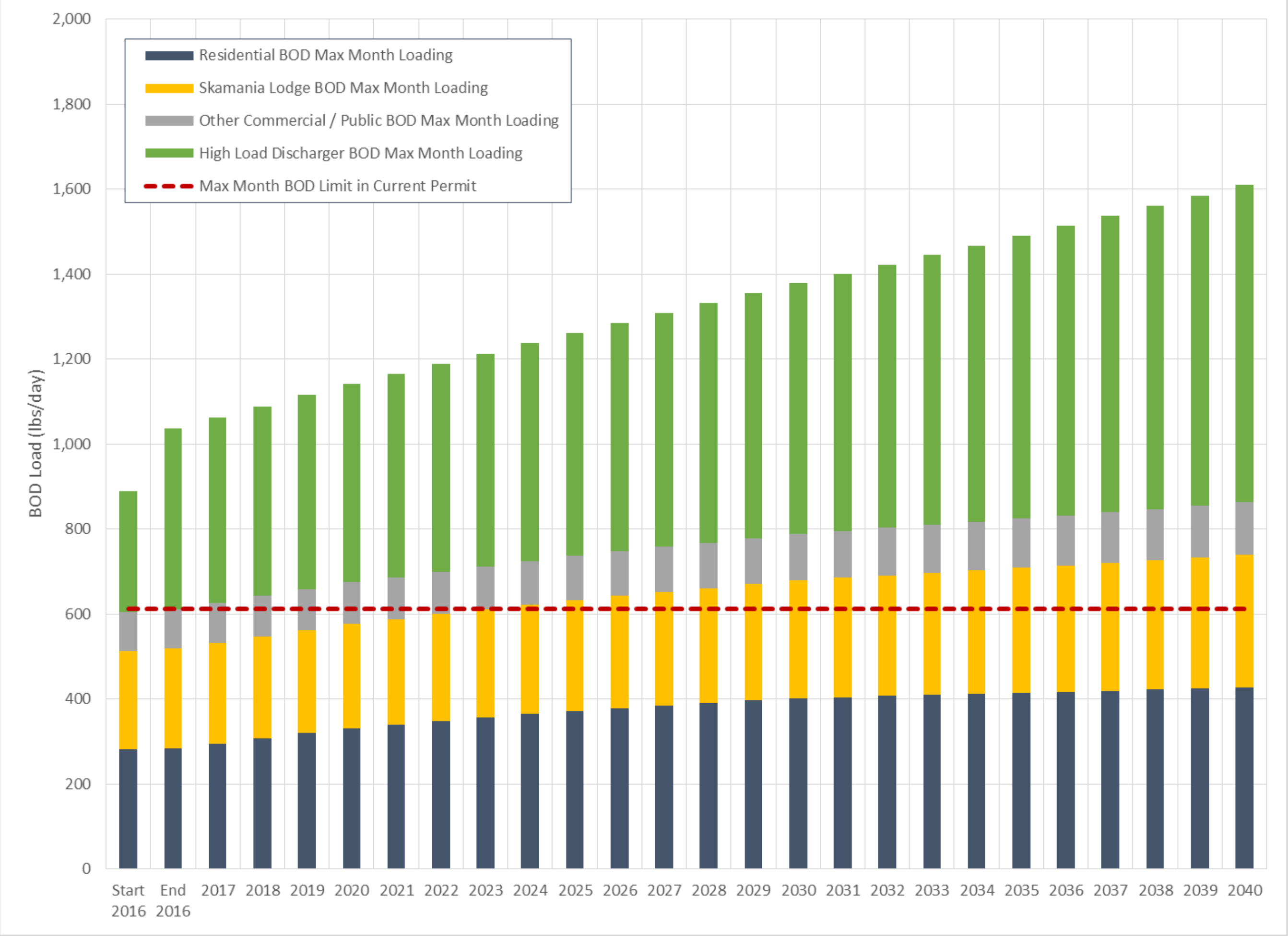

Figure 2-6. Maximum-Month BOD Loading with 20 Percent Pretreatment

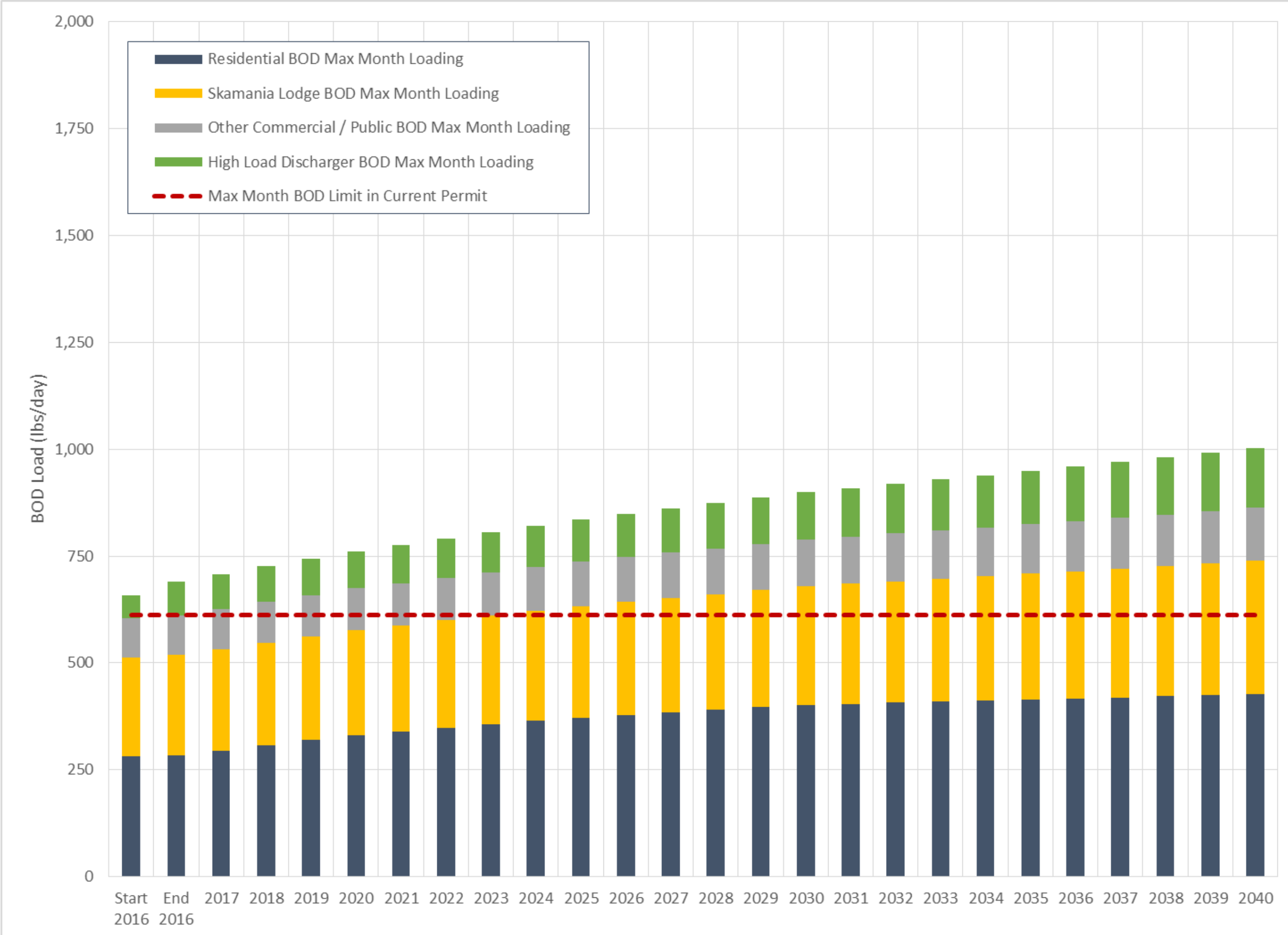

Figure 2-7. Maximum-Month BOD Loading with 85 Percent Pretreatment

2.3.2 Influent TSS Loads

Historical TSS loads

Influent concentrations of TSS are determined from analyses conducted on the same samples collected for BOD analyses. The historical TSS loads measured at the treatment plant from January 2006 to September 2016 are summarized in Table 2-8 and Figure 2-8. TSS loads generally increased during the recorded period. This growth is similar to growth in BOD loads during this period.

TSS Design Criteria for This Facilities Plan

The Orange Book recommends designing for a residential TSS load of 0.2 ppd per capita. TSS load data collected during the sampling program showed unexpectedly low TSS loads in proportion to BOD load at the same sampling points, despite TSS loads at the WWTP being comparable to BOD loads during the sampling period. As a result, TSS load results from the sampling period were not used to estimate future TSS load.

The ratio of BOD to TSS was calculated for daily influent data recorded at the WWTP. The average ratio for the last 10 years was 1.323, and the average ratio for the last two years was 1.291. However, because the reason for the low proportion of TSS loading to BOD loading is not known, for the purpose of projecting TSS loads it has been conservatively assumed that future TSS loads will be equal to future BOD loads.

Table 2-8. Historical TSS Data

Year	Annual Average TSS Load (ppd)	Maximum-Month TSS		Peak-Day TSS	
		Load (ppd)	Peaking Factor	Load (ppd)	Peaking Factor
2006	310	507	1.64	869	2.80
2007	286	403	1.41	522	1.83
2008	360	594	1.65	1,548	4.30
2009	396	592	1.49	1,483	3.74
2010	416	623	1.50	1,018	2.45
2011	431	562	1.30	1,135	2.63
2012	334	437	1.31	1,158	3.47
2013	329	437	1.33	1,161	3.53
2014	397	706	1.78	2,580	6.50
2015	472	848	1.80	1,481	3.14
2016	537	866	1.61	2,273	4.23

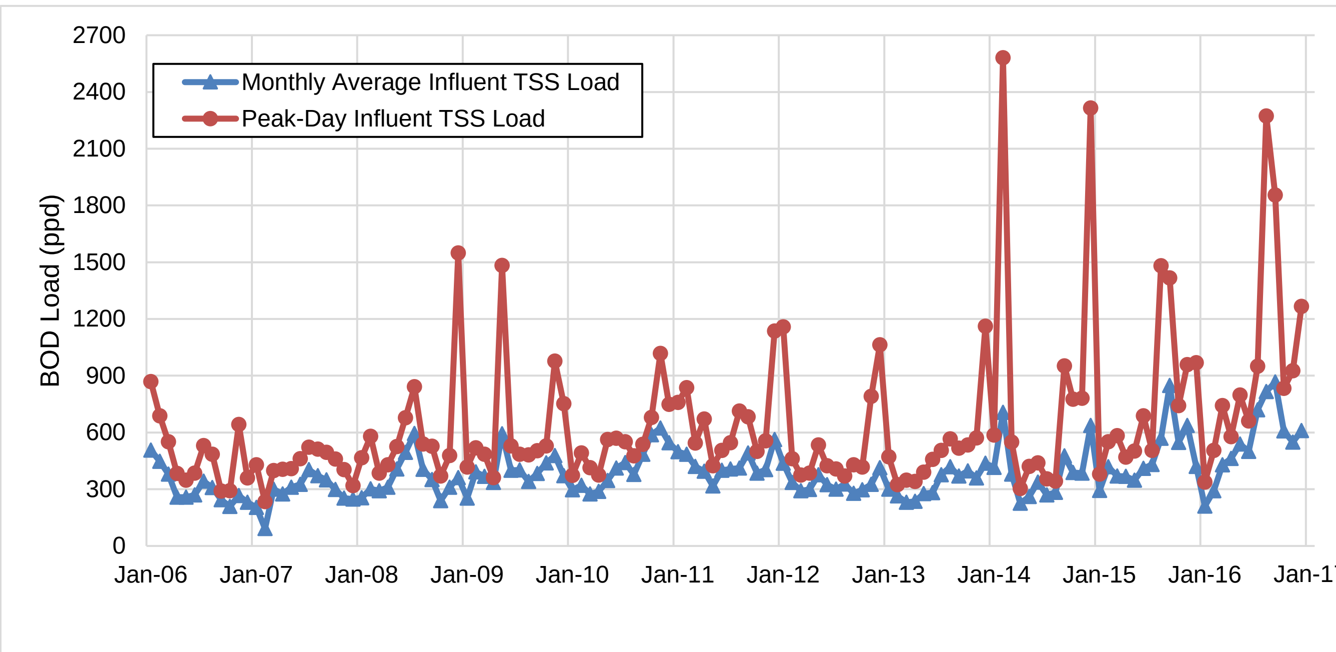

Figure 2-8. Historical Treatment Plant Influent TSS Loads

Using this ratio and the estimated BOD load at the start of 2016, the average TSS load was calculated to be 620 ppd. For the end of 2016, due to the increased flows and loads from rapid growth in the beverage industry, the average TSS load was calculated to be 539 ppd, indicating that the selected assumptions are reasonable.

Future TSS loads

As described in the section above, TSS loads are calculated based on the calculated BOD loads. Table 2-9 summarizes flow projections in the design years 2025 and 2040. Figure 2-9 shows historic monthly TSS loads and projected TSS average, maximum-month, and peak-day TSS loads through 2040 with no pretreatment, 20 percent pretreatment, and 85 percent pretreatment.

Table 2-9. Current and Projected TSS Design Conditions

	TSS (ppd)		
	Base (Dry Weather Average)	Maximum Month	Peak Day
No pretreatment			
2016	620	961	1,985
2025	852	1,394	2,902
2040	1,070	1,798	3,758
20% pretreatment			
2016	589	890	1,662
2025	795	1,262	2,307
2040	989	1,611	2,912
85% pretreatment			
2016	488	658	1,294
2025	609	835	1,687
2040	724	1,003	1,916

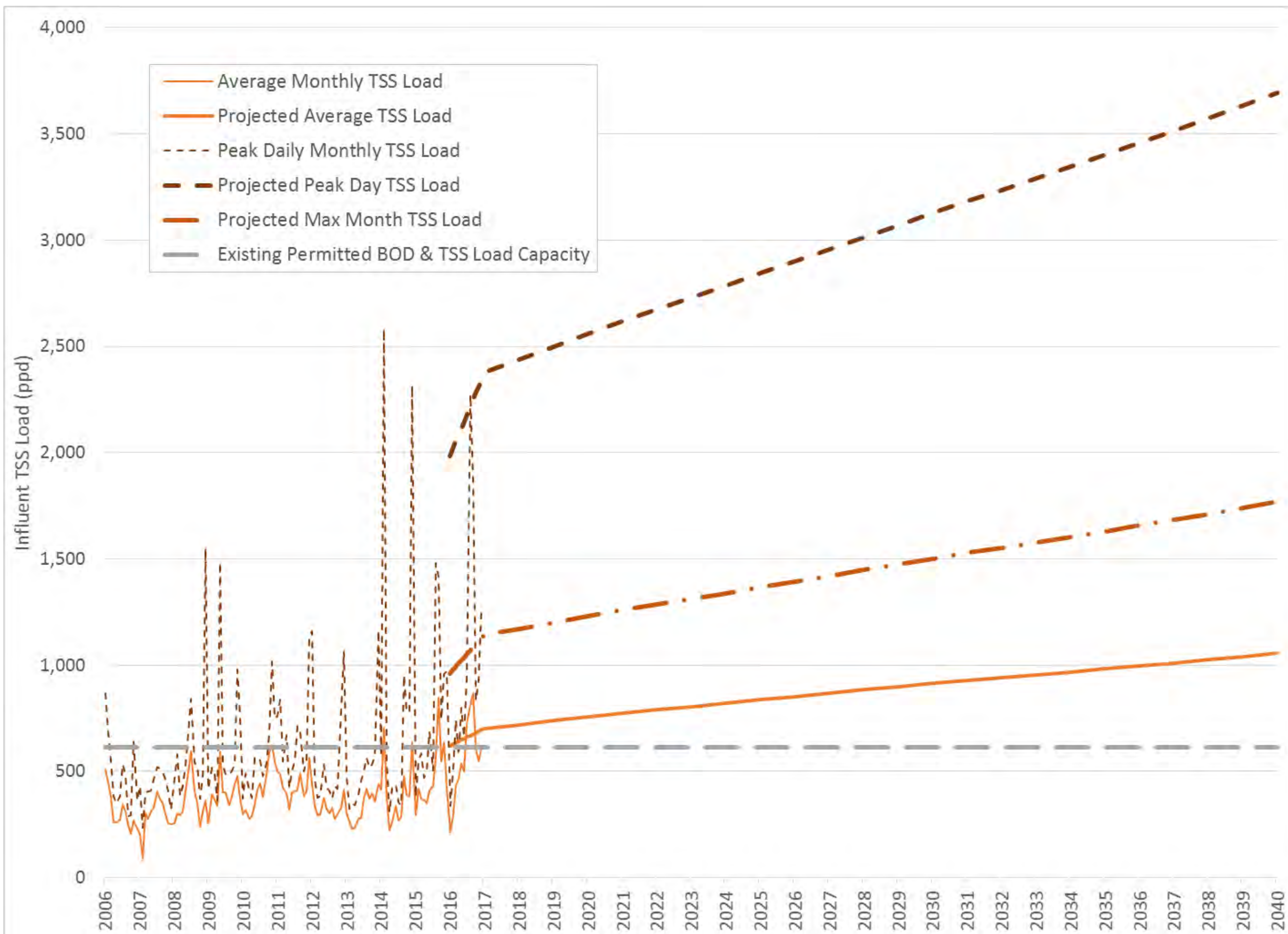

Figure 2-9. Historic and Projected TSS Loads

2.4 WASTEWATER FLOW AND LOAD SUMMARY

Table 2-10 summarizes flow, BOD loads, and TSS loads in the design years 2025 and 2040. For BOD and TSS, projections are shown with no pretreatment, 20 percent pretreatment, and 85 percent pretreatment. Pretreatment is not expected to reduce total flow to the WWTP.

Table 2-10. Current and Projected Flow and Load Design Conditions

Parameter	Base (Dry Weather Average)			Maximum Month			Peak Day			Peak Hour		
	2016	2025	2040	2016	2025	2040	2016	2025	2040	2016	2025	2040
Flow (mgd)	0.135	0.168	0.200	0.460	0.539	0.657	1.30	1.46	1.71	1.96	2.19	2.56
BOD (ppd)												
No pretreatment	620	852	1,070	961	1,394	1,798	1,985	2,902	3,758	n/a	n/a	n/a
20% pretreatment	589	795	989	890	1,262	1,611	1,662	2,307	2,912	n/a	n/a	n/a
85% pretreatment	488	609	724	658	835	1,003	1,294	1,687	1,916	n/a	n/a	n/a
TSS (ppd)												
No pretreatment	620	852	1,070	961	1,394	1,798	1,985	2,902	3,758	n/a	n/a	n/a
20% pretreatment	589	795	989	890	1,262	1,611	1,662	2,307	2,912	n/a	n/a	n/a
85% pretreatment	488	609	724	658	835	1,003	1,294	1,687	1,916	n/a	n/a	n/a

3. EXISTING COLLECTION SYSTEM

3.1 HISTORY OF SYSTEM DEVELOPMENT

Stevenson's sanitary sewer collection system conveys flows to the City's wastewater treatment plant. It consists of approximately 55,000 lineal feet of gravity sewer mains, four pump stations, and approximately 2,100 lineal feet of force main. The majority of the collection system was installed in 1972. The oldest sewer was a vitrified clay pipe installed in 1911 in Russell Street, which was replaced with concrete pipe in 1972. Table 3-1 summarizes major expansions of the collection system.

Table 3-1. Collection System Expansion

Name	Year Built	Location	Length (feet)	Pipe Diameter	Material
Russell Street	1911	Central Downtown Area	1,000	8"	Vitrified Clay Pipe (Replaced 1972)
School Interceptor	1956	North-Central portion of the City, with service to the High School	3,100	10"	Concrete pipe with mortar joints
Main Sanitary Sewer System	1972	Central and eastern portions of the City	33,600	6" – 15"	Concrete pipe with rubber gasket joints
Interceptor F-7	1979	Northeast portion of the City	3,700	6" – 8"	Concrete pipe with rubber gasket joints
Second Street Sewer	1993	Western portion of the City, with service to Skamania Lodge	2,900	8" – 12"	PVC pipe with rubber gasket joints
Angel Heights Subdivision	2005	North-Central portion of the City	3,100	8"	PVC pipe with rubber gasket joints
Hidden Ridge Subdivision	2007	North-Central portion of the City	2,800	8"	PVC pipe with rubber gasket joints
Chinidere Mountain Estates—Phase 1	2009	Eastern Portion of the City near Lutheran Church Road	2,600	8"	PVC pipe with rubber gasket joints

3.2 GRAVITY SEWERS

All flows to the WWTP are delivered by the Fairgrounds Pump Station and Rock Creek Pump Station. Flows to these pump stations are conveyed by gravity sewers ranging in diameter from 6 to 15 inches. Two additional pump stations (Cascade and Kanaka) discharge into the Cascade Interceptor, which conveys flow by gravity to the Rock Creek Pump Station.

Figure 3-1 shows the existing collection system. Figure 3-2 shows existing topography and surface waters. Figure 3-3 shows the potable water system facilities. A complete sewer system map with the City's manhole numbers and pipe sizes is included in Appendix G.

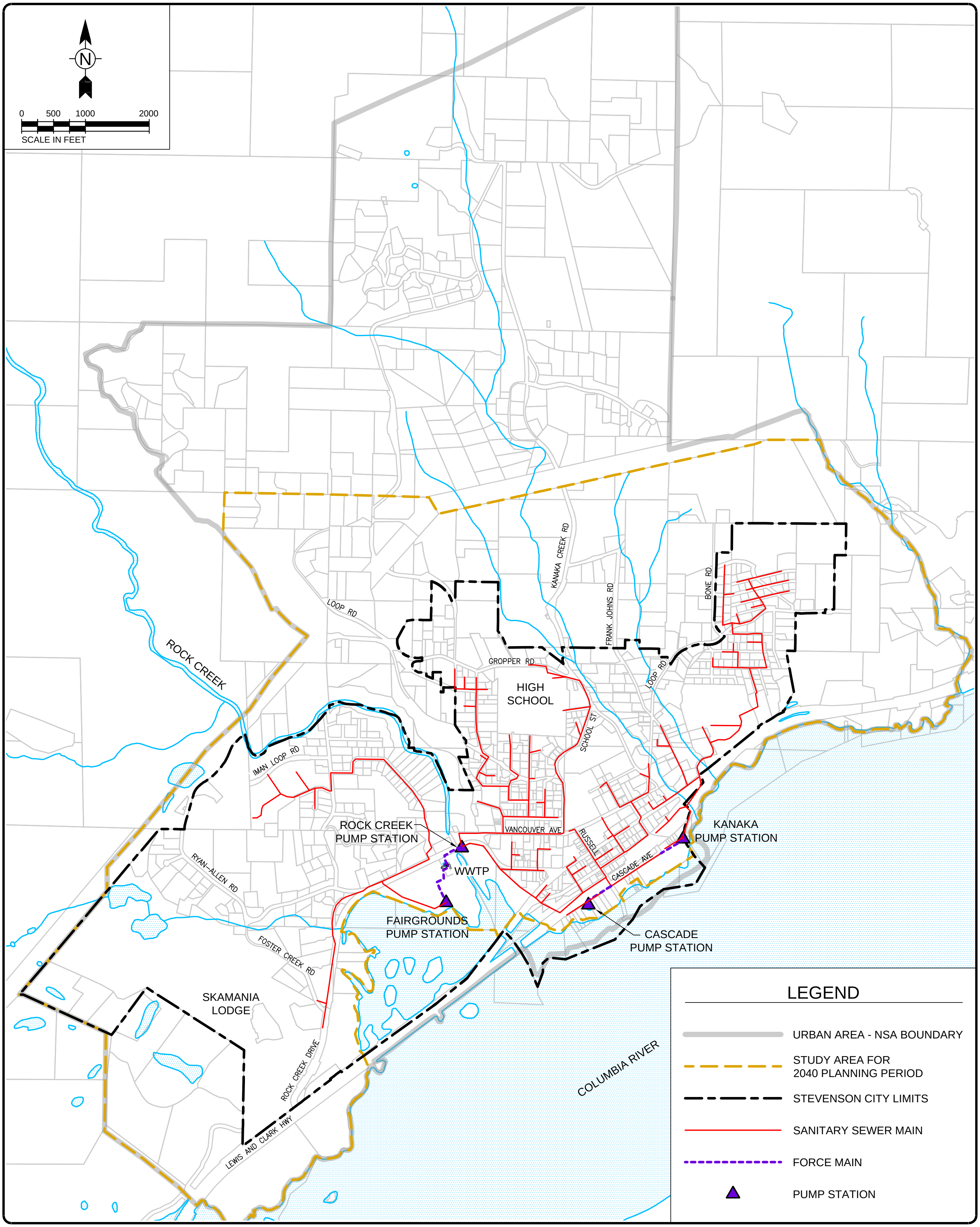

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Figure 3-1.
EXISTING COLLECTION SYSTEM

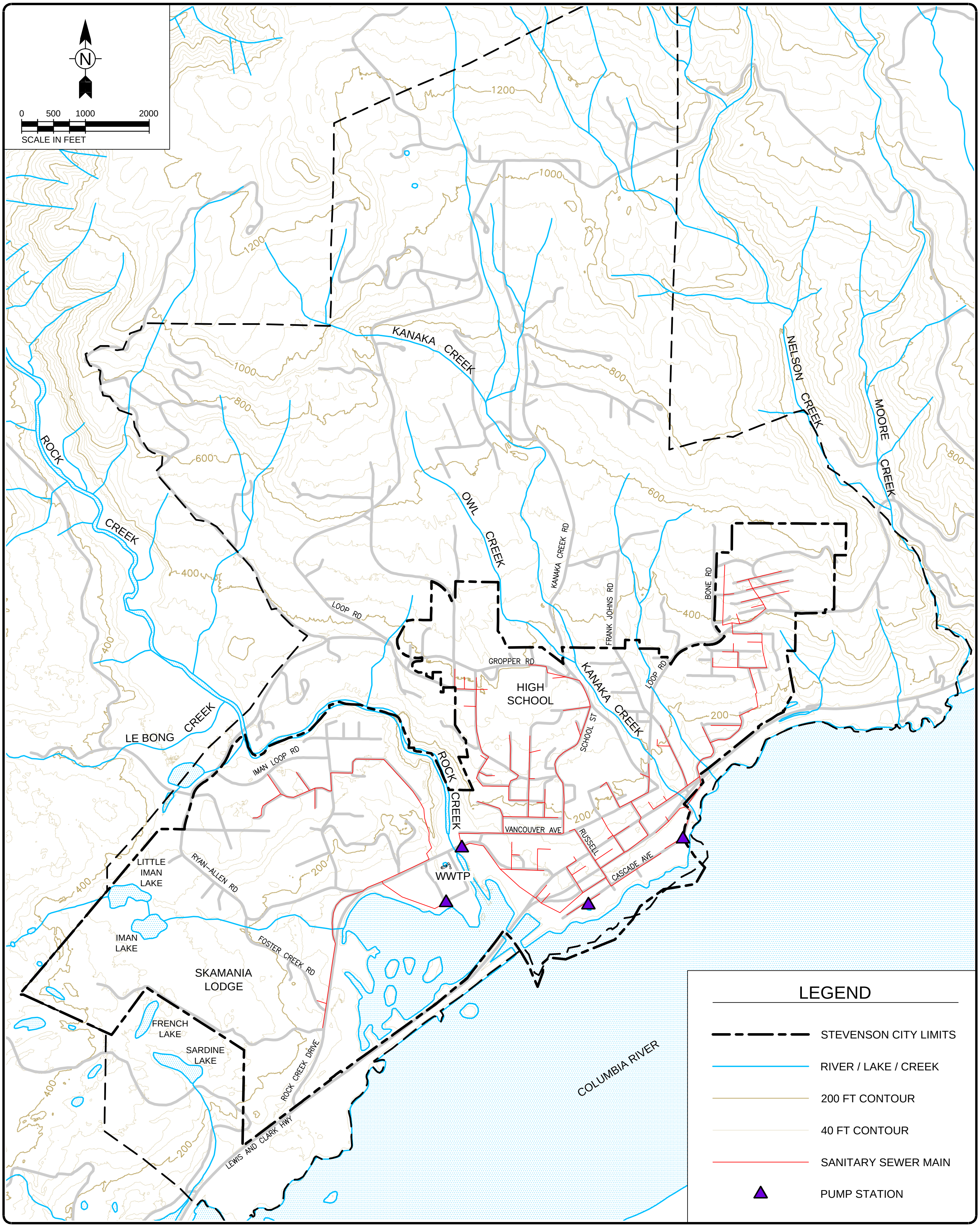

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Figure 3-2.
SURFACE WATERS AND TOPOGRAPHY

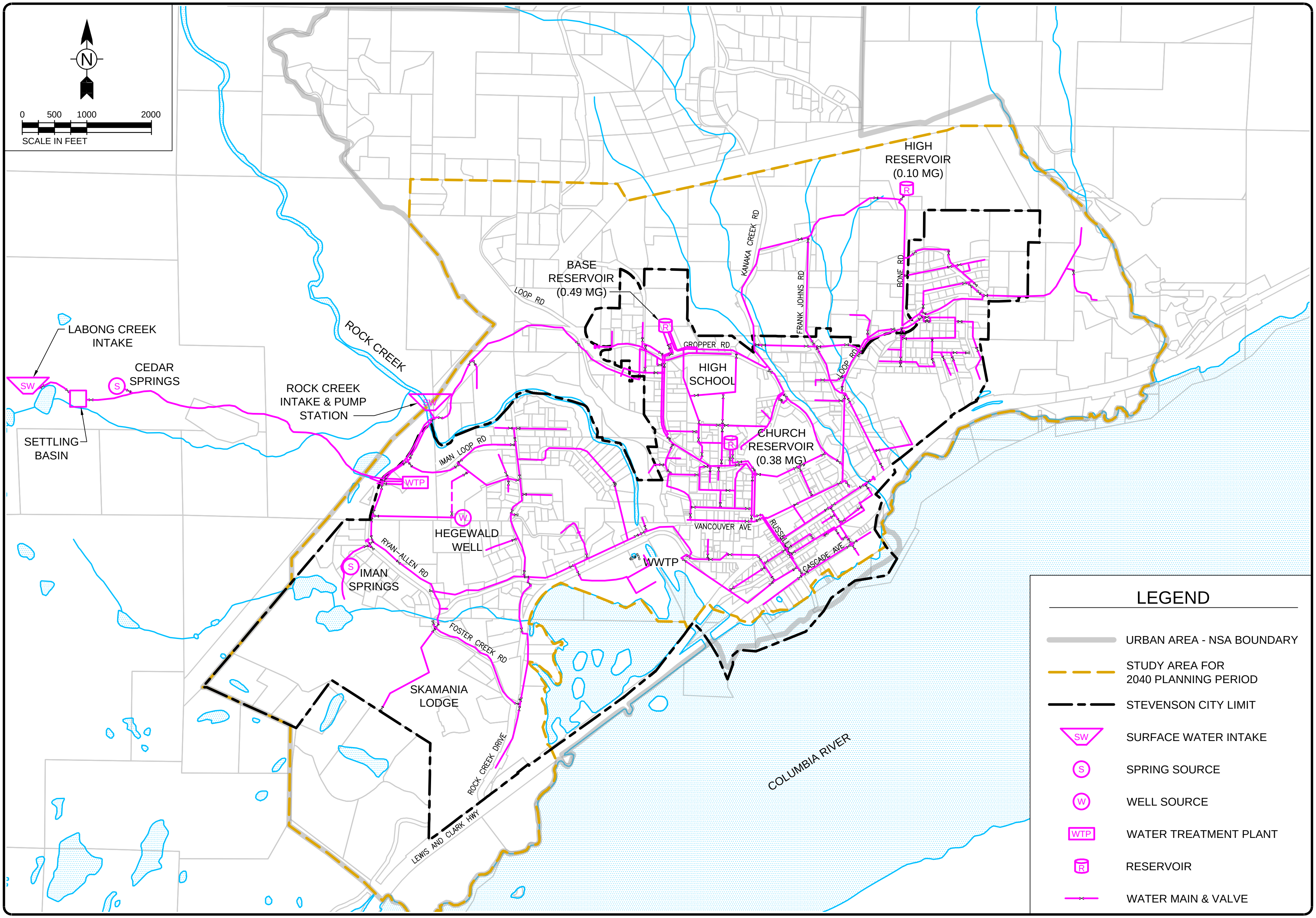

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Figure 3-3.
WATER SYSTEM FACILITIES

3.3 PUMP STATIONS AND FORCE MAINS

3.3.1 Rock Creek Pump Station

The Rock Creek Pump Station (see Figure 3-4) is located on Rock Creek Drive at the east end of the Rock Creek Bridge. The pump station discharges to the WWTP headworks via an 8-inch force main attached to the Rock Creek Bridge.

Figure 3-4. Rock Creek Pump Station Photos

The pump station consists of a separate dry pit and wet well and was originally constructed in 1971. It was upgraded in 1993 with larger pumps to handle increased flows. Standby power is provided by a generator at the WWTP. The overflow for this pump station is via an 8-inch pipe from the wet well, discharging to Rock Creek. A valve is installed on the overflow pipe. When it is closed, overflows would occur through the lid of Manhole (MH) CI-3, approximately 800 feet upstream of the pump station. The controls for the pump station are located at the WWTP. Table 3-2 summarizes design data for the pump station.

3.3.2 Fairgrounds Pump Station

The Fairgrounds Pump Station (see Figure 3-5) is located on Skamania County Fairgrounds just south of the treatment plant. The pump station lifts raw sewage from the areas west of the WWTP and discharges at the WWTP headworks.

Table 3-2. Rock Creek Pump Station Data

Type	Packaged Wet Pit/ Dry Pit
Year Built / Upgraded	1972 / 1993
No. Pumps	2
Original Design Capacity—1 Pump	900 gpm @ 43' total dynamic head
Observed Capacity	
Year Tested	2010
Pump #1 Capacity (gpm)	540
Pump #2 Capacity (gpm)	465
Both Pumps Running (gpm)	685
Motor	20 hp (variable frequency drive), 1760 RPM
Wet Well Dimensions	Wet Pit: 4 feet diameter by 19 feet deep Dry Pit: 7 feet diameter by 19 feet deep
Standby Power	Generator located at WWTP
SCADA (supervisory control & data acquisition) / Telemetry	Autodialer—Power Loss, High Level
Force Main—Size / Length / Material	8" / 490 feet / Cast Iron & Steel

Figure 3-5. Fairgrounds Pump Station Photos

The pump station consists of two self-priming pumps housed in a fiberglass enclosure over a precast concrete wet well. It was built in 1978. Standby power is provided by a generator at the WWTP. No overflow piping is provided. If the pump station fails, overflows would occur through the lid of MH J-1, approximately 200 feet upstream of the pump station. The controls for the pump station are located at the WWTP. Table 3-3 summarizes design data for the pump station, based on prior studies. Information such as motor data and wet well size and configuration were not available.

Table 3-3. Fairgrounds Pump Station Data

Type	Packaged Self Priming
Year Built/ Upgraded	1978
No. Pumps	2
Original Design Capacity—1 Pump	400 gpm (total dynamic head not available)
Observed Capacity:	
Year Tested	2010
Pump #1 Capacity (gpm)	280
Pump #2 Capacity (gpm)	280
Both Pumps Running (gpm)	410
Motor	(Info not available)
Wet Well Dimensions	(Info not available)
Stand-by Power	Generator located at WWTP
SCADA / Telemetry	Autodialer—Power Loss, High Level
Force Main—Size / Length / Material	6” / 800 feet / Unknown

3.3.3 Kanaka Pump Station

The Kanaka Pump Station (see Figure 3-6) is located on Cascade Avenue just west of the public boat launch ramp. The pump station lifts raw sewage from Main F into the Cascade Interceptor, which conveys flow by gravity to the Rock Creek Pump Station.

The pump station consists of two self-priming pumps in a fiberglass enclosure over a precast concrete wet well. It was originally built in 1972 and upgraded in 1993 to handle increased flows. Standby power for the pump station is provided by a 40-kW diesel generator in a wood frame building adjacent to the pump station. The overflow for this pump station is located upstream in MH F-2. Overflows would be directed to Kanaka Creek close to its confluence with the Columbia River. A valve is installed on the overflow pipe. When it is closed, overflows would occur through the lid of MH F-2. Table 3-4 summarizes design data for the pump station.

3.3.4 Cascade Pump Station

The Cascade Pump Station (see Figure 3-7) is located on Cascade Avenue west of Russell Avenue. It serves seven properties between the Columbia River and the railroad tracks. The pump station discharges to the Cascade Interceptor, which conveys flow by gravity to the Rock Creek Pump Station. The pump station, built in 1972, consists of two vacuum primed pumps in a fiberglass enclosure over a precast concrete wet well. Standby power is not provided. Overflow is via a 6-inch pipe from the wet well, discharging to the Columbia River. Table 3-5 summarizes design data for the pump station.

Figure 3-6. Kanaka Pump Station Photos

Table 3-4. Kanaka Pump Station Data

Type	Packaged Self Priming
Year Built / Upgraded	1972 / 1993
No. Pumps	2
Original Design Capacity—1 Pump	200 gpm @ 37’ total dynamic head
Observed Capacity:	
Year Tested	2014 (4” Force Main has since been upsized to 6”)
Pump #1 Capacity (gpm)	143 (Estimated 230 gpm w/ 6” FM)
Pump #2 Capacity (gpm)	122 (Estimated 195 gpm w/ 6” FM)
Both Pumps Running (gpm)	120
Motor	7.5 hp, 1200 RPM
Wet Well Dimensions	4 feet diameter by 12 feet deep
Standby Power	40 kw generator
SCADA / Telemetry	Autodialer—Power Loss, High Level
Force Main—Size / Length / Material	6” (upsized from 4” in 2015) / 410 feet / PVC

Figure 3-7. Cascade Pump Station Photos

Table 3-5. Cascade Pump Station Data

Type	Packaged, Vacuum-Primed
Year Built / Upgraded	1972
No. Pumps	2
Original Design Capacity—1 Pump	80 gpm @ 21' total dynamic head
Observed Capacity	Not Tested
Motor	1.5 hp, 1200 RPM
Wet Well Dimensions	4 feet diameter by 13 feet deep
Standby Power	None
SCADA / Telemetry	None. Audible alarm (horn) for High Level
Force Main—Size / Length / Material	4" / 470 feet / Asbestos Cement

3.4 OPERATION AND MAINTENANCE

3.4.1 Sewers

Sewers are currently inspected in response to reports of potential issues from members of the public. For cleaning or video inspection of sewers, the City primarily uses on-call contractors to perform the work under the supervision of Public Works staff members. Video inspections and cleaning records are available from 1991, 2007 and 2010. The City performed smoke testing in the past to identify cross-connections but has discontinued the practice as no additional inflow sources were identified.

3.4.2 Pump Stations

The collection system pump stations are typically inspected once per week by CH2M contract operations. Maintenance of mechanical equipment is performed as outlined in the operation and maintenance manual for each item. This is supplemented by interim maintenance when issues are identified by inspection or by telemetry warning signals.

3.5 AREAS NOT SERVED BY THE COLLECTION SYSTEM

On-site septic systems currently provide sewage treatment and disposal for approximately 170 residential properties within the city limits. This amounts to about one-third of the residential development in the City. No sewer service is currently provided outside the city limits, and it is assumed that all of these residences are served by on-site septic systems.

Because of the environmental contamination that can result when septic systems fail, the City has adopted measures requiring sewer service for almost all new development within the City. If feasible, conversion to sewer service should also be required for existing properties where septic systems have failed. Conversion of existing septic systems may be difficult and relatively expensive if it requires new construction of sewer mains to extend service to these properties. Several sewer main extension projects recommended in Chapter 5 are intended to facilitate septic conversions and allow future development in areas not currently served by sewers.

4. COLLECTION SYSTEM EVALUATION

4.1 SYSTEM CONDITION

4.1.1 Pipe Condition

In general, the City sewer lines in the worst condition are constructed of concrete and were installed prior to 1980. Concrete sewer pipes are prone to leaks at joints and cracks in the pipe. Sewer lines installed since 1990 are generally PVC with rubber gaskets and perform much better preventing inflow and infiltration. Figure 4-1 shows the location of PVC and concrete pipeline in Stevenson's collection system.

Closed-circuit television (CCTV) inspection of parts of the City's collection system has been conducted in the past as part of previous collection system rehabilitation. Locations of past inspections are shown on Figure 4-1 and summarized in Table 4-1. A field survey of the collection system was conducted in July 2016. A general summary of observations is presented in Table 4-2. Complete survey notes can be found in Appendix H.

4.1.2 Pump Stations

The following sections summarize existing pump station conditions. Estimated flows presented in these sections based on pump run-time data should not be used as a design flow, nor used in place of modeled peak flows, since they reflect average flow to the station over a period of a week or more.

Rock Creek Pump Station

The following deficiencies have been identified at this pump station:

- **Pumping Capacity**—Testing performed in 2010 indicated that the pumping capacities of the station's two pumps are 540 and 465 gpm. Therefore, the firm capacity of the station is only 465 gpm, compared to the original design capacity of 900 gpm. Reasons for the discrepancy could include impeller wear or blockage in the force main. Modeling estimates existing peak-hour flows to be 1,110 gpm (see Section 4.3.3). Operators noted that in December 2015 the station came close to overflowing while both pumps were in continuous operation. Pump run-time records were provided for January and February 2012, all of 2015, and January through September 2016. Table 4-3 summarizes the run-time data, indicating that the pump station is undersized for existing flows.
- **Access to pumps**—Pumps are located in a dry pit 20 feet below ground surface and are accessed by a ladder in a 3-foot diameter entrance tube.
- **Safety**—The control panel and generator are located off-site at the WWTP. This is a concern for lock out/ tag-out and the potential for someone to inadvertently start equipment while it is being worked on.
- **Age**—The electrical and mechanical equipment was upgraded in 1993 and is now 24 years old and potentially reaching the end of its design life (typical design life for pumps and controls is 25 to 35 years).
- **Force Main Size**—The velocity in the force main would be approximately 7 feet per second if pumps were sized to handle existing peak inflow. This is near the limit of good practice; should the future peak flow increase, the force main will need to be upsized to keep the velocity between 3 and 8 feet per second.

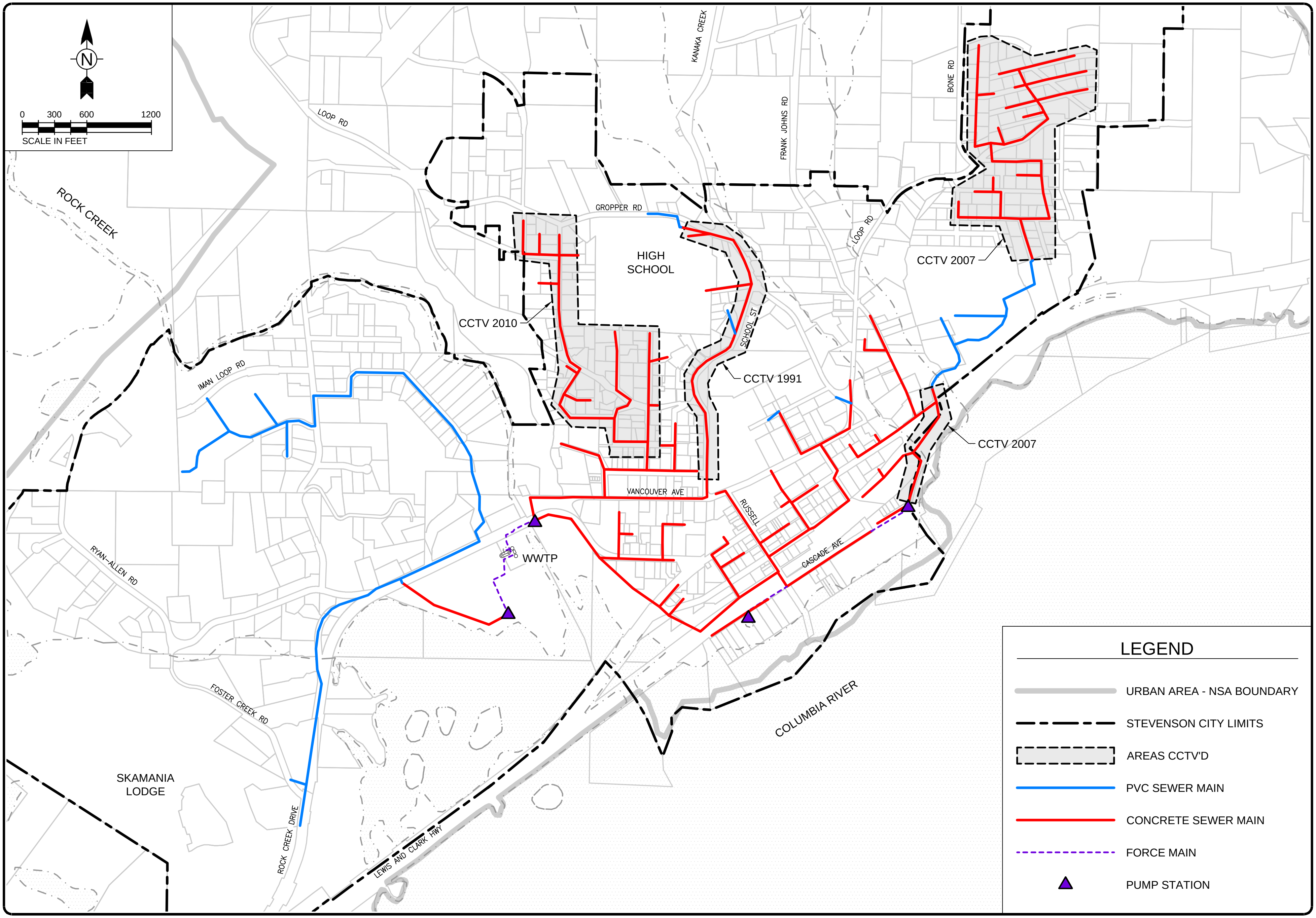

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Figure 4-1.
EXISTING PIPE MATERIAL AND PAST INSPECTIONS

Table 4-1. Summary of Past CCTV Collection System Inspections

Date	Location	Sewers	Description/Conditions
June 1991	From high school, south along School Street to Vancouver Avenue	Constructed in the 1950s, consisting of 3-foot-long segments of concrete pipe with mortar joints	Inspection found many leaking joints. Mortar joints are prone to leakage. This area also has old manholes with brick risers and outside drop connections that can be prone to leaking. 530 pipe joints were pressure tested and 430 joints were sealed with grout. Lines were also cleaned and roots cut.
March 2007	Northeast Area: North of Loop Road near Montell Terrace and Bone Road	Sewers are mostly concrete, constructed in the 1970s	Inspection found many leaks in pipe joints and at manholes. Lines were cleaned and roots removed. Crews performed dig up repairs at locations where the pipe defects were greatest.
March 2010	Central Residential Area: North of Vancouver Avenue and west of School Street. Included Roosevelt Street, Chesser Street, Roselawn Street, and Hotsprings Alameda Road	Sewers are mostly concrete, constructed in the 1970s	Inspection found many leaks in pipe joints and at manholes. Lines were cleaned and roots removed. No repairs were performed.

Table 4-2. Summary Observations from July 2016 Field Survey

Location	Description/Conditions
Northeast Area: North of Loop Road near Montell Terrace and Bone Road	Evidence of slope instability in this area was noted during the July 2016 field survey, including an area around MH F-4-11A where the street has subsided. City staff noted that this entire hillside continually moves. It is likely that the slope instability causes joint separation, pipe breaks and disruption of manholes, allowing I/I. Manhole F-4-11A, in the area where the street subsided, had shifted at its joints. A drainage was noted parallel to the sanitary sewer where the I/I started. I/I is likely entering the system through shifted joints or cracked pipes. With a constantly moving hillside, I/I sources are likely to continue to be created, regardless of improvements and repairs completed.
High School Pool	It has been speculated that the high school pool's subsurface drain system may be connected to the sanitary sewer, but investigation has found no connection. However, it is clear that I/I is coming into the system from this area. Even during summer there is flow into the system from this location, and no extraneous flow enters the system upstream.
Stone Brooke Court	At the end of the cul-de-sac there is a large tree growing over the service line that has likely caused root intrusion through the joints as there is a constant flow of liquid from the service line.
SW Rock Creek Drive	Manholes are lined with grease from Foster Creek Road to about Ryan-Allen Road. Some of the grease is making it to the Fairgrounds Pump Station. Some of the manhole rims show rust. Staff noted that wastewater in this area is often very hot.

Table 4-3. Rock Creek Pump Station—Pump Run-Times

	Time Period	Pump 1 Run-Time (hours /day)	Pump 2 Run-Time (hours /day)	Total Run-Time (hours /day)	Estimated Average Influent Flow (gpm)
Average Dry Weather	7/1/16 – 9/9/16	1.2	1.3	2.5	52
Wet Weather Event 1	12/29/11 – 1/6/12	12.6	11.4	24.0	505
Wet Weather Event 2	12/4/15 – 12/18/15	9.9	11.0	20.9	434

Fairgrounds Pump Station

The following deficiencies have been identified at this pump station:

- **Capacity**—Testing performed in 2010 indicated that the pumping capacities of the station's two pumps are each 280 gpm. Therefore, the actual firm capacity of the station is only 280 gpm, compared to the original design capacity of 400 gpm. Reasons for the discrepancy could include impeller wear or a blockage in the force main. Modeling estimates existing peak-hour flows to be 225 gpm (see Section 4.3.3). Pump run-time records were provided for January and February 2012, and January through September 2016. These records do not indicate that the pump station is undersized for existing flows. An analysis is summarized in Table 4-4. High flows at the pump station appear to be influenced more by occupancy at Skamania Lodge than by I/I.
- **Safety**—The control panel and generator are located off-site at the WWTP. This is a concern for lock out/ tag out and the potential for someone to inadvertently start equipment while it is being worked on.
- **Age**—The electrical and mechanical equipment was installed in 1978 and is now 39 years old, and may be beyond its design life (typical design life for pumps and controls is 25 to 35 years).
- **Pump Efficiency**—Self priming pumps have low pumping efficiency compared to submersible non-clog sewage pumps that are available and widely used today. Current electricity use for pump operation could be potentially be cut in half with the installation of new submersibles.
- **Limited Access to Wet Well**—Pumps are installed in a fiberglass enclosure located on top of the wet well, which leaves limited access to the wet well below for inspection, cleaning, and maintenance. The enclosure is several feet off the ground, making access even more difficult.
- **Priming**—Losing prime can be an issue with this type of pump.

Table 4-4. Fairgrounds Pump Station—Pump Run-Times

	Time Period	Pump 1 Run-Time (hours /day)	Pump 2 Run-Time (hours /day)	Total Run-Time (hours /day)	Estimated Average Influent Flow (gpm)
Average Flow	3/4/16 – 6/3/16	1.8	1.6	3.5	40
Wet Weather Event	1/15/16 – 1/21/16	1.4	3.9	5.3	62
High Flow Period	7/29/16 – 8/26/16	4.4	2.1	6.5	76

Kanaka Pump Station

The following deficiencies have been identified at this pump station:

- **Pumping Capacity**—Testing performed in 2014 indicated that the pumping capacities of the station's two pumps are 143 gpm and 122 gpm. Therefore, the actual firm capacity of the station is only 122 gpm, compared to the original design capacity of 200 gpm. In 2015 the force main was upsized from 4 inches to 6 inches. Based on analysis of the pump curve and system curve, the estimated current pump capacities with the larger force main are 230 gpm and 195 gpm. Modeling estimates existing peak-hour flows to be 325 gpm (see Section 4.3.3). Pump run-time records were provided for January and February 2012, all of 2015, and January through September 2016. Table 4-5 summarizes the pump run-time data.
- **Wet Well Operating Volume**—The existing wet well is undersized, which results in excessive pump cycles and motor wear.
- **Limited Access to Wet Well**—Pumps are installed in a fiberglass enclosure located on top of the wet well, which leaves limited access to the wet well below for inspection, cleaning, and maintenance.
- **Corrosion**—Piping located in the wet well is heavily corroded.
- **Age**—The electrical and mechanical equipment was upgraded in 1993 and is now 24 years old, and potentially reaching the end of its design life (typical design life for pumps and controls is 25 to 35 years).

Table 4-5. Kanaka Pump Station—Pump Run-Times

	Time Period	Pump 1 Run-Time (hours /day)	Pump 2 Run-Time (hours /day)	Total Run-Time (hours /day)	Estimated Average Influent Flow (gpm)
Average Dry Weather	8/12/16 – 8/26/16	0.9	1.1	2.0	18
Wet Weather Event 1	1/20/12 – 1/27/12	7.7	12.4	20.1	109
Wet Weather Event 2	12/4/15 – 12/11/15	7.0	7.5	14.5	128

- **Pump Efficiency**—Self priming pumps have low pumping efficiency compared to submersible non-clog sewage pumps that are available and widely used today. According to the pump curve, the existing pumps are operating at about 35-percent efficiency. Submersible pumps in this size can have efficiencies in the range of 60 percent to 75 percent. Current electricity use for pump operation could be potentially be cut in half with the installation of new submersibles.
- **Priming**—Losing prime can be an issue with this type of pump.

Cascade Pump Station

The following deficiencies have been identified at this pump station:

- **Capacity**—Pump capacity testing has not been performed. The original design capacity is 80 gpm per pump, which is much more than is needed for the seven properties it currently serves. Pump run-time records were provided for January and February 2012, and January through September 2016. These records indicate that the pumps are adequately sized for existing flows. An analysis of pump run-time data is summarized in Table 4-6.
- **Age**—The electrical and mechanical equipment was installed in 1972 and is now 45 years old, and potentially reaching the end of its design life (typical design life for pumps and controls is 25 to 35 years).
- **Limited Access to Wet Well**—Pumps are installed in a fiberglass enclosure located on top of the wet well, which leaves limited access to the wet well below for inspection, cleaning, and maintenance. The enclosure is several feet off the ground, making access even more difficult. The discharge isolation and check valves are located inside the wet well, and they are difficult to access and operate.
- **Remote Notification**—Systems for supervisory control and data acquisition (SCADA) and telemetry are not provided at this pump station to notify operations staff of a pump failure or high wet well level.

Table 4-6. Cascade Pump Station—Pump Run-Times

	Time Period	Pump 1 Run-Time (hours /day)	Pump 2 Run-Time (hours /day)	Total Run-Time (hours /day)	Estimated Average Influent Flow (gpm)
Average Dry Weather	5/22/15 – 9/4/15	0.22	0.09	0.31	1.1
Wet Weather Event	12/4/15 – 12/11/15	0.66	0.01	0.67	2.2

4.1.3 Sanitary Sewer Overflows

A sanitary sewer overflow was reported on November 21, 2016, in which 20 to 30 gallons of sewage spilled onto a gravel parking lot due to a controls failure at the Rock Creek Pump Station. The failure has since been corrected. No other reports of sanitary sewer overflows are available.

There is an overflow configured with a valve located on SW Cascade Avenue east of the Kanaka Pump Station. Since the force main for the Kanaka Pump Station was upgraded to 6-inch diameter, there have been no overflows at this location.

4.1.4 Infiltration and Inflow

Excessive I/I can lead to overflows where sewers have insufficient capacity to convey the I/I flow. I/I can also cause increased pumping costs and increased treatment cost. When planning infrastructure improvements, costs to upsize conveyance and treatment systems should be compared to costs of reducing I/I, in order to determine the most cost-effective use of funding resources.

Areas of Known High I/I

In 1988, Westech Engineering performed a study of I/I in Stevenson's collection system. Based on that study and on interviews with City staff, several areas in the collection system are known to experience significant I/I. These areas are shown on Figure 4-2.

I/I rates will vary throughout a collection system depending on pipe material, age, condition, type of joints, groundwater depth and locations of direct stormwater connections. Per Table 2-3, the peak-hour I/I rate for the entire collection system is 5,058 gpad.

Three rates were used to evaluate and model the collection system:

- Lowest rate for newer PVC pipe
- Medium rate for older concrete pipe
- High rate for areas of known I/I problems (Locations based on input from City staff)

The City's collection system was divided into 28 sub-basins as shown on Figure 4-3. Low, medium, or high I/I rates were assigned to each basin currently served by sewers, based on pipe type and age and known locations of I/I problems. The I/I rates were adjusted iteratively until the total equaled the peak-hour I/I of 5,058 gpad for the collection system as a whole. The resultant three levels of I/I worked out to the following:

- Low = 2,500 gpad
- Medium = 5,000 gpad
- High = 7,850 gpad

Refer to Appendix C for sewer sub-basin design data, including I/I rates assigned to individual basins.

Total Annual Average I/I

Daily flow data were examined from Stevenson's wastewater treatment plant effluent flow meter, as reported in the plant's discharge monitoring reports for the period between 2001 and 2015. The treatment plant flows were compared to daily rainfall data in order to assess total I/I. Rainfall data was obtained from the NOAA Climate Data Center for the gauge at the Bonneville Dam. Table 4-7 lists the yearly data for rainfall, average annual plant flow, and average annual I/I.

Figure 4-4 is a plot of the yearly rainfall and average-day I/I values listed in Table 4-7. The trend line and regression equation are also shown. Table 4-8 compares the observed I/I at the WWTP to the expected I/I calculated using the regression equation in Figure 4-4. The results of Table 4-8 show that there has not been a noticeable increasing trend in I/I from 2007 to present.

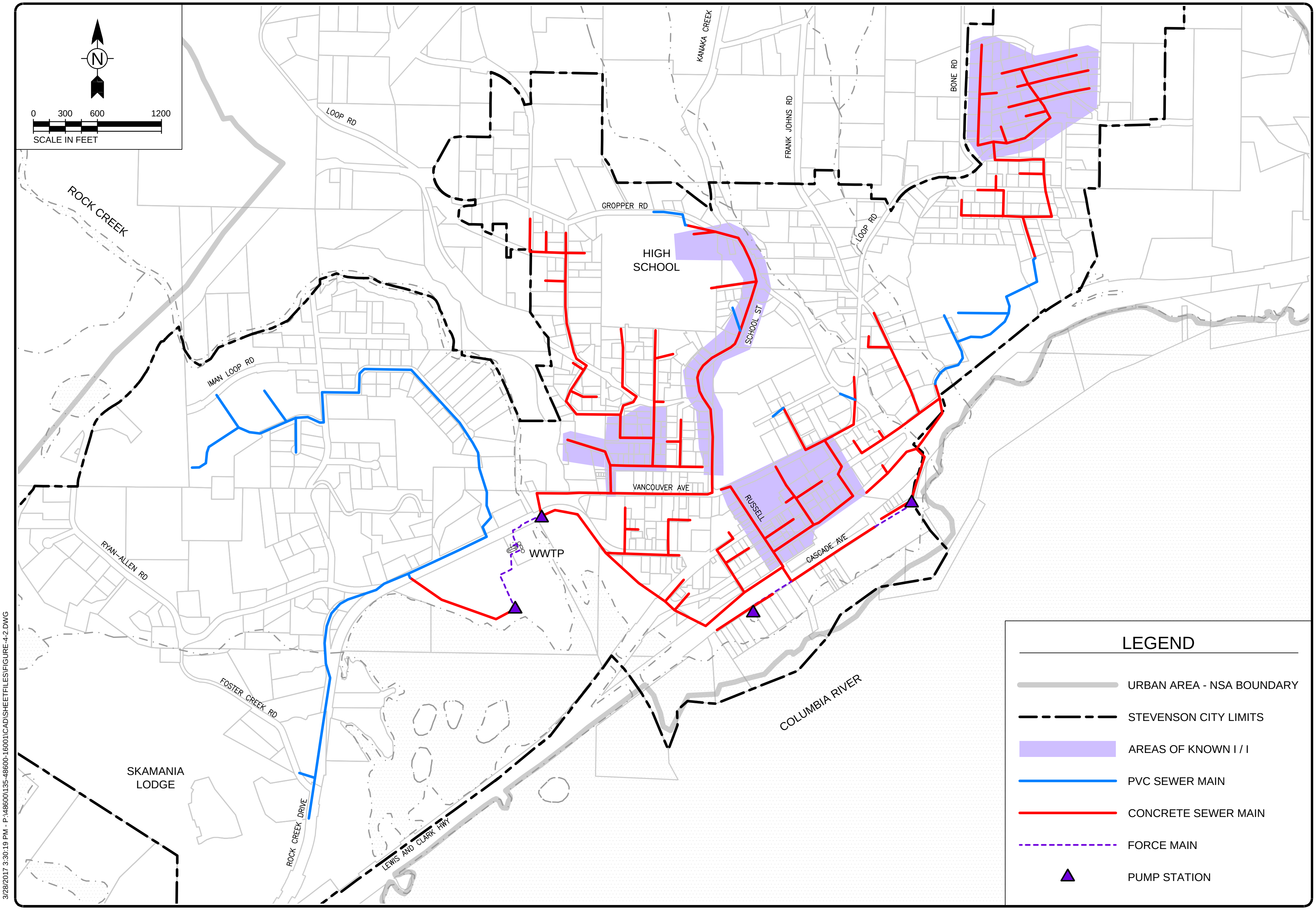

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Figure 4-2.
AREAS OF KNOWN I / I

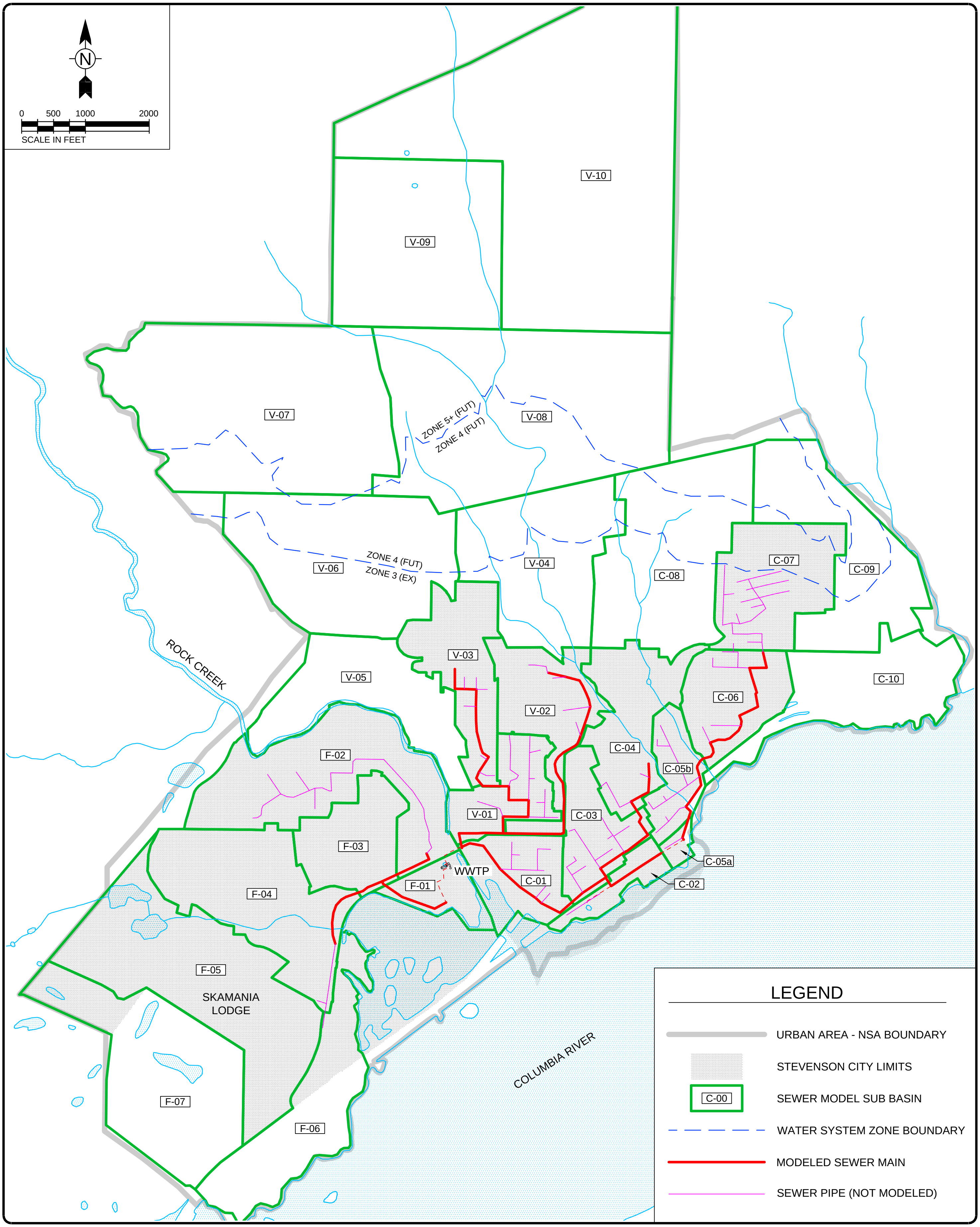

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Figure 4-3.
SEWER SUB BASINS AND
MODELED SEWER MAINS

Table 4-7. Annual Flow and Rainfall at Stevenson Wastewater Treatment Plant, 2001 – 2015

Year	Rainfall (inches)[a]	Average Annual Flow (mgd)[b]	Wastewater Base Flow (mgd)[c]	Average Day I/I (mgd)[d]
2001	75.4	0.184	0.143	0.041
2002	65.3	0.180	0.137	0.043
2003	84.5	0.201	0.138	0.063
2004	67.6	0.185	0.150	0.035
2005	70.6	0.190	0.146	0.044
2006	93.3	0.186	0.111	0.075
2007	72.1	0.180	0.156	0.024
2008	75.5	0.191	0.167	0.024
2009	76.4	0.186	0.133	0.053
2010	94.6	0.201	0.141	0.060
2011	91.7	0.168	0.104	0.064
2012	105.0	0.212	0.110	0.102
2013	67.0	0.141	0.111	0.030
2014	89.6	0.171	0.102	0.069
2015	81.4	0.165	0.116	0.049
Average	80.7	0.183	0.131	0.052

a. Measured at Bonneville Dam rain gauge
b. Average annual flow = Average-day effluent flow at the treatment plant
c. Estimated by average-day effluent flow at the treatment plant between May and October on days when measured rainfall was less than 0.1”
d. Calculated by subtracting wastewater base flow from average annual flow

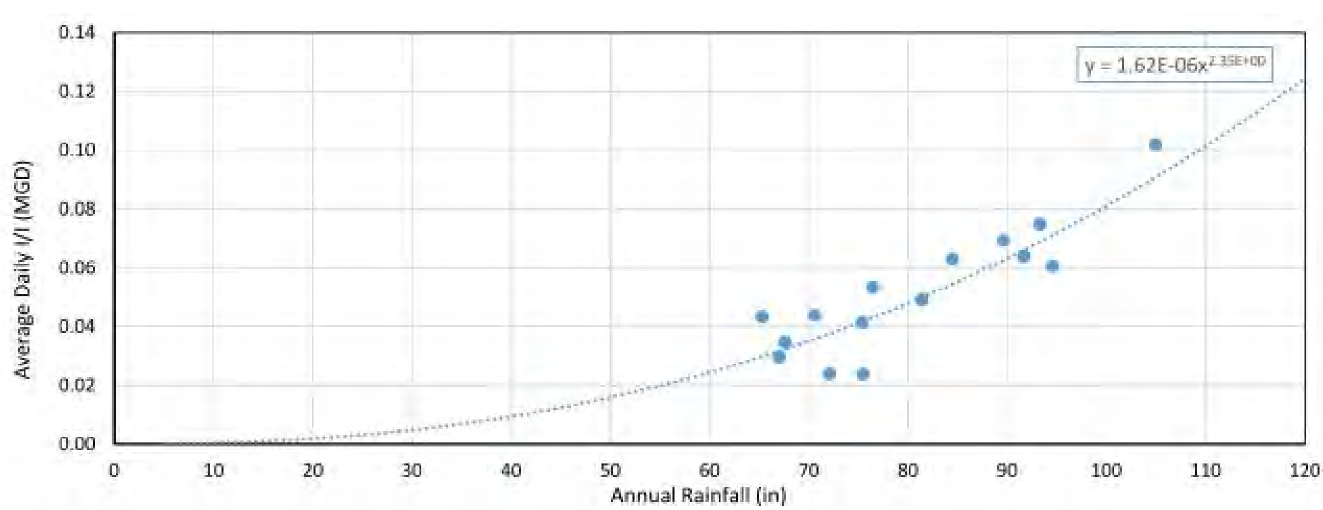

Figure 4-4. Annual Rainfall vs. I/I at Stevenson Wastewater Treatment Plant

Table 4-8. Observed vs Expected Inflow & Infiltration

Year	I/I (mgd)		Difference:
	Observed: Based on Flow Data[a]	Calculated from Equation[b]	
2001	0.041	0.042	(1%)
2002	0.043	0.030	46%
2003	0.063	0.055	15%
2004	0.035	0.032	7%
2005	0.044	0.036	22%
2006	0.075	0.069	8%
2007	0.024	0.038	(37%)
2008	0.024	0.042	(43%)
2009	0.053	0.043	23%
2010	0.060	0.071	(15%)
2011	0.064	0.066	(3%)
2012	0.102	0.091	12%
2013	0.030	0.032	(6%)
2014	0.069	0.063	11%
2015	0.049	0.050	(2%)

a. From Table 4-7. Equal to average annual flow minus wastewater base flow.
b. Calculated based on the total annual rainfall using the regression equation in Figure 4-4.

Evaluation Criteria

The U.S. Environmental Protection Agency (EPA) has established criteria for what it considers excessive I/I. It is based on surveys performed in 270 cities of total sewer system flows on a per capita basis per day. When I/I exceeds the established criteria, the EPA requires additional study to quantify I/I and evaluate corrective measures before providing grants for sewer system improvements. For Stevenson, an equivalent population of 2,199 was determined per Table 4-9.

Table 4-9. Stevenson Equivalent Sewer Service Population

Residential ERUs[a]	Commercial / Industrial ERUs[a]	Total ERUs[a]	Population / ERU[a]	Equivalent Population
489	506	995	2.21	2,199

a. Data from Growth Projections Technical Memorandum dated October 24, 2016

Infiltration

EPA's criterion for excessive infiltration is if the average-day flow per capita (excluding industrial and commercial flows from individual sources contributing 50,000 gallons per day or more) is 120 gallons per capita per day (gpcd) or more over a 7- to 14-day dry period during seasonal high groundwater. This amount allows to 70 gpcd of domestic wastewater base flow and 50 gpcd of infiltration.

For Stevenson, the month of February 2015 was selected to analyze infiltration. Dry weather was experienced for the last half of the month, with only 0.1 inches of rain from February 11 through February 25 (compared to 7.9 inches from February 1 – 10). The period of February 16 – 25, 2015 was used to determine the average dry-weather flow. The average-day treatment plant effluent flow during this period was 117,800 gallons per day; for the equivalent population of 2,199, this is an average of 54 gpcd, well below the EPA criterion of 120 gpcd. Based on this analysis, infiltration is not excessive in Stevenson's wastewater collection system.

Inflow

The EPA has defined inflow as being excessive if the total daily flow (excluding industrial and commercial flows from individual sources contributing 50,000 gallons per day or more) during periods of significant rainfall exceeds 275 gpcd. Table 4-10 lists the 10 highest daily treatment plant effluent flows between 2001 and 2015, as well as the two highest-flow days from December 2015. For an equivalent population of 2,199, peak flows are in the range of 400 to 600 gpcd, which exceeds the EPA criterion of 275 gpcd for excessive rainfall-derived I/I.

Table 4-10. Peak-Day Wastewater Treatment Plant Flows 2001 – 2015

Rank	Date	Flow (mgd)	Flow per capita (gpcd)[a]	24 Hour Rainfall (in)	96 Hour Rainfall (in)
1	21-Jan-2012	1.290	587	1.42	8.40
2	24-Jan-2012	1.240	564	0.67	2.96
3	1-Jan-2009	1.127	513	4.07	6.23
4	19-Jan-2012	1.090	496	2.96	7.10
5	6-Nov-2006	1.013	461	5.08	10.83
6	12-Dec-2010	0.992	451	2.95	6.20
7	28-Dec-2008	0.967	440	2.56	7.24
8	1-Dec-2013	0.954	434	4.71	6.32
9	29-Dec-2011	0.940	427	2.01	6.11
10	16-Jan-2011	0.918	417	3.15	6.78
11	7-Dec-2015	0.890	405	2.46	5.81
14	8-Dec-2015	0.879	400	3.19	8.83

a. Based on an equivalent population of 2,199, which accounts for commercial and industrial wastewater sources.

4.2 EXISTING CAPACITY ANALYSIS

4.2.1 Model Construction

An analysis of the wastewater collection system was performed using Autodesk's Storm and Sanitary Analysis software, which is compatible with and runs on the EPA's Storm Water Management Model software.

Data Sources

As-built drawings provided by the City were used to construct a collection system map. Information provided by Skamania County GIS was used to assist in the creation of the collection system map. Data layers provided by the County included tax lots, contours, streets, building footprints and aerial photographs. Once the collection system map was completed in AutoCAD Civil 3D, the portions of the system to be modeled were imported into the Autodesk Storm and Sanitary Analysis software.

Modeling of Physical System Features

Manholes and Sewers

Stevenson's collection system was laid out in AutoCAD Civil 3D based on the as-built drawings and County GIS data. This included the location of manholes and details on pipe material and diameters. For the portions of the system to be included in the model, manhole rim elevations, pipe invert elevations, and pipe slopes were included.

Downstream Boundary Condition

The downstream boundary conditions for the model (the discharge to Rock Creek Pump Station and Fairgrounds Pump Station) were both modeled as a free discharge outfalls since they discharge directly to the WWTP, and do not have any collection system elements downstream of either station.

Pump Stations

The Rock Creek and Fairgrounds Pump Stations were modeled as free discharge outfalls as discussed above. The Cascade Pump Station was not included in the model since it is relatively small, serving only 7 properties. The Kanaka pump station was included in the model as a pump element. It was assigned a variable discharge rate equal to the inflow rate into the wet well. This approach was selected so that the upstream sewer capacity could be assessed without backwater conditions related to station capacity. Comparison of peak pump station inflows to the firm capacity at each pump station was done separately.

Flow Distribution

Sanitary Base Flow

Base flow was estimated from City water consumption data and was distributed throughout the collection system. Large water users were located based on their physical address and ERUs assigned based on water consumption. All single-family residential services were assumed to be equal to one ERU. They were distributed among 28 sub-basins based on aerial photographs of current development and the County's tax lot data. A peaking factor of 2.0 was applied to the base flow for simulation of peak-hour flows.

Inflow and Infiltration

While the treatment plant data allowed calibration of the peak-day wet-weather flows, limited data was available to calibrate model results across the City or for peak-hour flows; therefore, the model is less accurate for localized areas in the upstream system. No temporary flow monitoring information from mainline sewers was available. However, historical flows at Rock Creek, Fairgrounds, and Kanaka Pumps Stations were estimated for peak wet-weather events based on pump run-time data and pump drawdown test results. Pump run-time data is collected on a weekly basis, so estimates for peak-day and peak-hour flows had to be made. Separate I/I rates were applied to each of the 28 sub-basins as described in Section 4.1.4

Sub-Basins and Flow Input Model Junctions

Estimated existing base flows and I/I were aggregated for each sub-basin and attributed to the flow input model junction. Figure 4-3 shows the delineation of the existing system sub-basins. The sub-basin boundaries were established for existing sewered areas based on location of existing pipe and direction of flow.

In each sub-basin, a model junction was selected to represent the point of flow input. The flow input junctions were selected to be close to the upper end of each basin as a conservative starting point. Where modeling results indicated undersized sewers, the flow input location in that basin was revisited, and adjusted if necessary to more accurately depict actual conditions.

Model Calibration

Model runs were performed for existing peak-day and existing peak-hour flows that were determined in Section 2.2.3. I/I rates were chosen as the variable to calibrate the model, since it has the most uncertainty due to lack of flow monitoring information throughout the collection system. Each sub-basin I/I rate was adjusted iteratively until model runs produced total system flows to the WWTP equal to those established in Section 2.2.3.

4.2.2 Results—Existing Peak-Hour Flow

The results of the modeling simulations are based on the best currently available information; however, they should be considered approximate because of the numerous assumptions used to estimate the distribution of I/I flows in the sewer system as well as the total peak-hour flow at the WWTP. These model results should be re-evaluated as additional flow data becomes available to confirm their accuracy.

Gravity Sewer Piping

The peak-hour wet-weather flow simulations for existing conditions indicate that several gravity sewers exceed 80 percent of full flow capacity. These areas are confined to the Cascade Interceptor and the 8-inch sewer line in Cascade Avenue. Modeling results indicate that two of the lines in the Cascade Interceptor exceed 100 percent of full capacity at current peak-hour flows; however, surcharging is minimal and no overflows are predicted. Figure 4-5 shows the gravity sewer locations that exceed 80 percent and 100 percent capacity.

Pump Stations

Model results show that existing peak flows exceed the firm capacities of Rock Creek and Kanaka Pump Stations. Existing modeled peak-hour flows are compared to existing pump station firm capacities for Rock Creek, Fairgrounds and Kanaka Pump Stations in Section 4.3.3.

4.3 FUTURE CAPACITY ANALYSIS

Two models were created for analysis of future capacity:

- **Year 2040—**The purpose of the Year 2040 model is to identify capacity deficiencies due to growth within the city limits and extensions of sewer system to unsewered areas. Model results are used to recommend improvement projects for implementation within the planning period.
- **Buildout—**The buildout scenario assumes annexation of the entire Stevenson Urban Area, which is not anticipated to occur within the 2040 planning period, or for quite some time afterward. The purpose of this model is to get a rough estimate of ultimate future flows to ensure that proposed gravity sewer improvements, (which can have a design life of 75 years or more) are sized adequately for all potential future flows.

4.3.1 Future Development

Refer to Figure 4-3 for a map of current and future sewer sub-basins. Boundaries for unsewered areas were selected based on anticipated sewer system development which is primarily influenced by topography and right-of-way location. These boundaries should be considered flexible, as development often occurs differently than expected or from what makes sense when looking solely at the sewer system characteristics. Pump stations are assumed to provide service to the sub-basins as shown in Table 4-11. If development occurs differently than shown in Table 4-11, then additional analysis of pump station capacity would be advised.

The sub-basins in the northern part of the urban area (V-07, V-08, V-09, and V-10) are not expected to receive sewer service during the planning period as they are at an elevation above any near term planned water system expansions. These basins were only modeled for build out conditions to ensure proposed gravity sewers are sized to handle potential future flows that are beyond the planning period.

Table 4-11. Pump Station Service Areas

Pump Station Name	Existing Sub-Basins Served	Future Sub-Basins Served
Cascade PS	C-02	-
Fairgrounds PS	F-01 through F-05	F-06, F-07
Kanaka PS	C-05a, C-05b, C-06, C-07	C-09, C-10
Rock Creek PS	C-01 through C-07, V-01 through V-03	C-08 through C-10, V-04 through V-10
Future PS-A	—	F-06, F-07
Future PS-B	—	V-05
Future PS-C	—	C-10

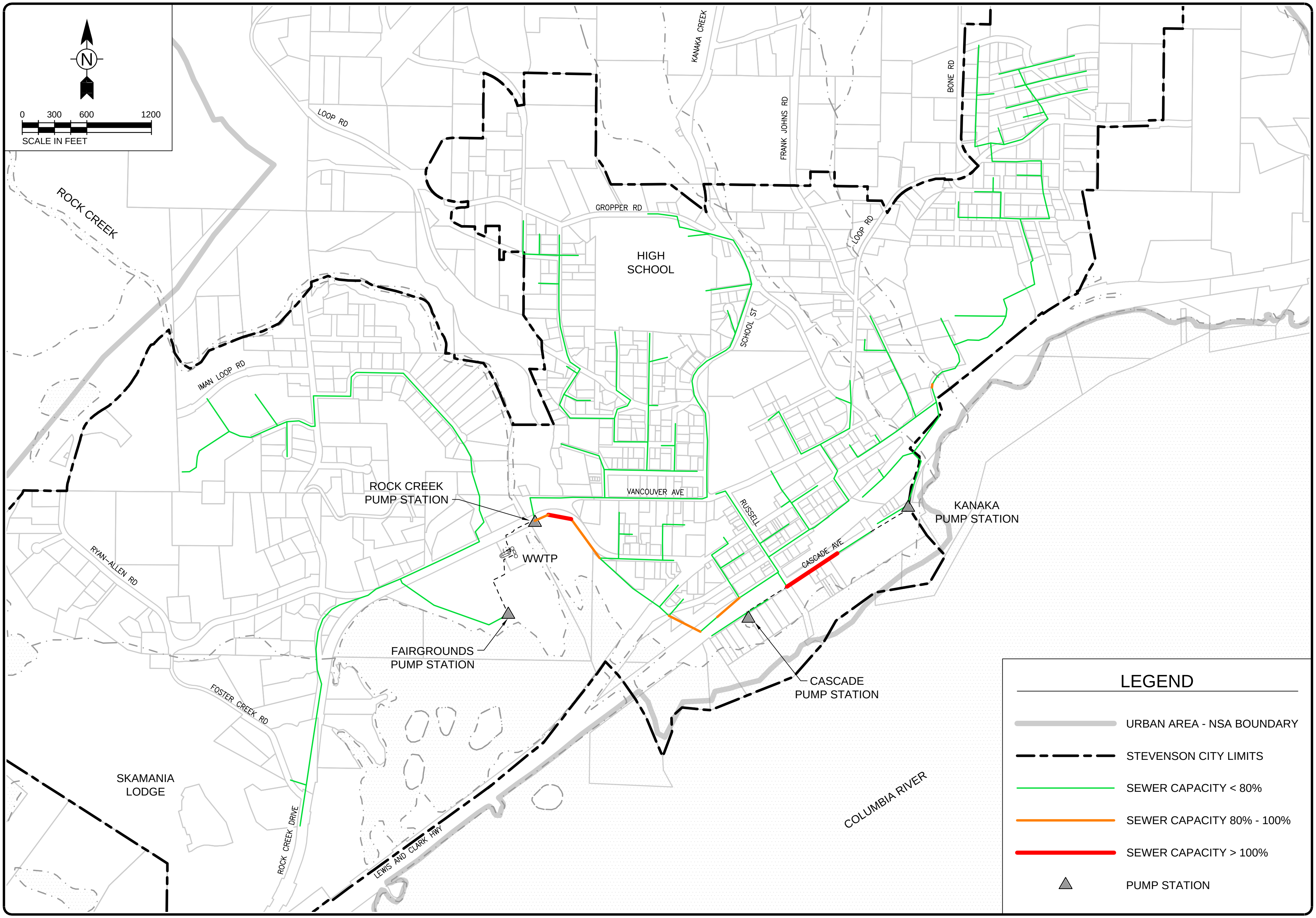

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Figure 4-5.
MODEL RESULTS - EXISTING SYSTEM, PEAK FLOW

Portions of sub-basins V-04, V-06, C-07, C-08, and C-09 are also located at an elevation that is above planned water system expansions. For these basins, growth during the planning period was projected only for the lower elevations areas that have potential to receive water service.

Sub-basin C-10 is not expected to see much, if any, development during the planning period due to steep terrain and shallow bedrock. Construction of a new pump station and force main would likely be required to serve this basin.

Commercial and industrial growth is envisioned in sub-basins V-05, F-06 and F-07. Service to basins F-06 and F-07 would require construction of new pump station and force main. A separate new pump station and force main would likely be required in basin V-05 to avoid gravity sewer construction within the Rock Creek landslide zone.

4.3.2 Model Construction

Flow Distribution

Base Flow—Year 2040

Base flow for the 2040 planning period was modeled as follows:

- **Residential Flow—**The additional sewered population used for the future condition is documented in Section 2.1. This includes additional sewered population resulting from future development and from connection of currently unsewered development. The equivalent residential flow load was based on the housing density associated with the zoning, adjusted uniformly so that the total population matched the estimates in Section 2.1.
- **Commercial Flow—**The additional commercial flows and equivalent residential units used for the future condition are documented in Section 2.1. The equivalent commercial flow was distributed based on input from City staff about expected areas of growth, particularly in the beverage industry.
- **Peaking Factor—**A peaking factor of 2.0 was used for the simulation of diurnal variation in base flows. This was applied to both residential and commercial flows.

Base Flow—Buildout

Flows for buildout in unsewered areas were created based on development density associated with the zoning, including allowances for future right of way, open spaces, and steep slopes. Flows for currently developed areas assume infill of undeveloped properties in accordance with zoning densities, as well as conversion of all existing septic systems.

Inflow and Infiltration

I/I from existing sewered development was assumed to increase by 10 percent from current levels due to climate change as described in Section 2.2.2. I/I for future development was estimated by assuming 2,500 gpad for both the Year 2040 model and the Buildout model. This represents the 2,000 gpad suggested by King County for new development, with a provision for degradation of the collection system over time. King County suggests a 7-percent increase in I/I per decade.

Sub-Basins and Flow Input Model Junctions

Estimated existing base flows and I/I were aggregated for each sub-basin and attributed to the flow input model junction. A model junction was selected to represent the point of flow input at an upper end of the modeled collection system, most likely to receive these future flows. Figure 4-3 shows sewer sub-basins, and Appendix C provides sewer sub-basin design data, including I/I rates, ERUs, and developed area for each sub-basin and each time period used in the model.

4.3.3 Results—Year 2040 Peak-Hour Flow

Gravity Sewer Piping

The peak-hour wet-weather flow simulations for the 2040 planning period indicate that 17 pipe segments exceed 80 percent of full flow capacity, and 10 of these exceed 100 percent of full capacity. These areas are confined to the Cascade Interceptor, the 8-inch sewer line in Cascade Avenue, and Main F upstream of the Kanaka Pump Station. No overflows are predicted due to insufficient pipe capacity, assuming pump stations are sized to handle future inflows. Figure 4-6 shows the gravity sewer locations that exceed 80 percent and 100 percent capacity.

Pump Stations

Model results show that 2040 peak flows exceed the firm capacities of Rock Creek, Fairgrounds, and Kanaka Pump Stations. Existing and Year 2040 modeled peak-hour flows are compared to existing pump station firm capacities for Rock Creek, Fairgrounds and Kanaka Pump Stations in Table 4-12.

Table 4-12. Existing Pump Station Capacities and Modeled Peak Flows

Pump Station	Existing Station Firm Capacity		Modeled Existing Peak-Hour Flow		Modeled 2040 Peak-Hour Flow	
	(gpm)	(mgd)	(gpm)	(mgd)	(gpm)	(mgd)
Rock Creek	465	0.67	1110	1.60	1460	2.10
Fairgrounds	280	0.40	225	0.32	355	0.51
Kanaka	195	0.28	325	0.47	475	0.68
Cascade	80	0.12	N/A[a]			

a. Cascade Pump Station not modeled. Pump run-time records show that station has adequate capacity for existing and future flows.

4.3.4 Results—Buildout Peak-Hour Flow

Refer to Appendix C for a summary of results for buildout peak-hour flows. It lists the following information for each pipe segment in the model:

- Existing pipe diameter, slope and capacity
- Pipe segment design flow for buildout conditions
- Required pipe diameter to convey buildout flows at current pipe slope.

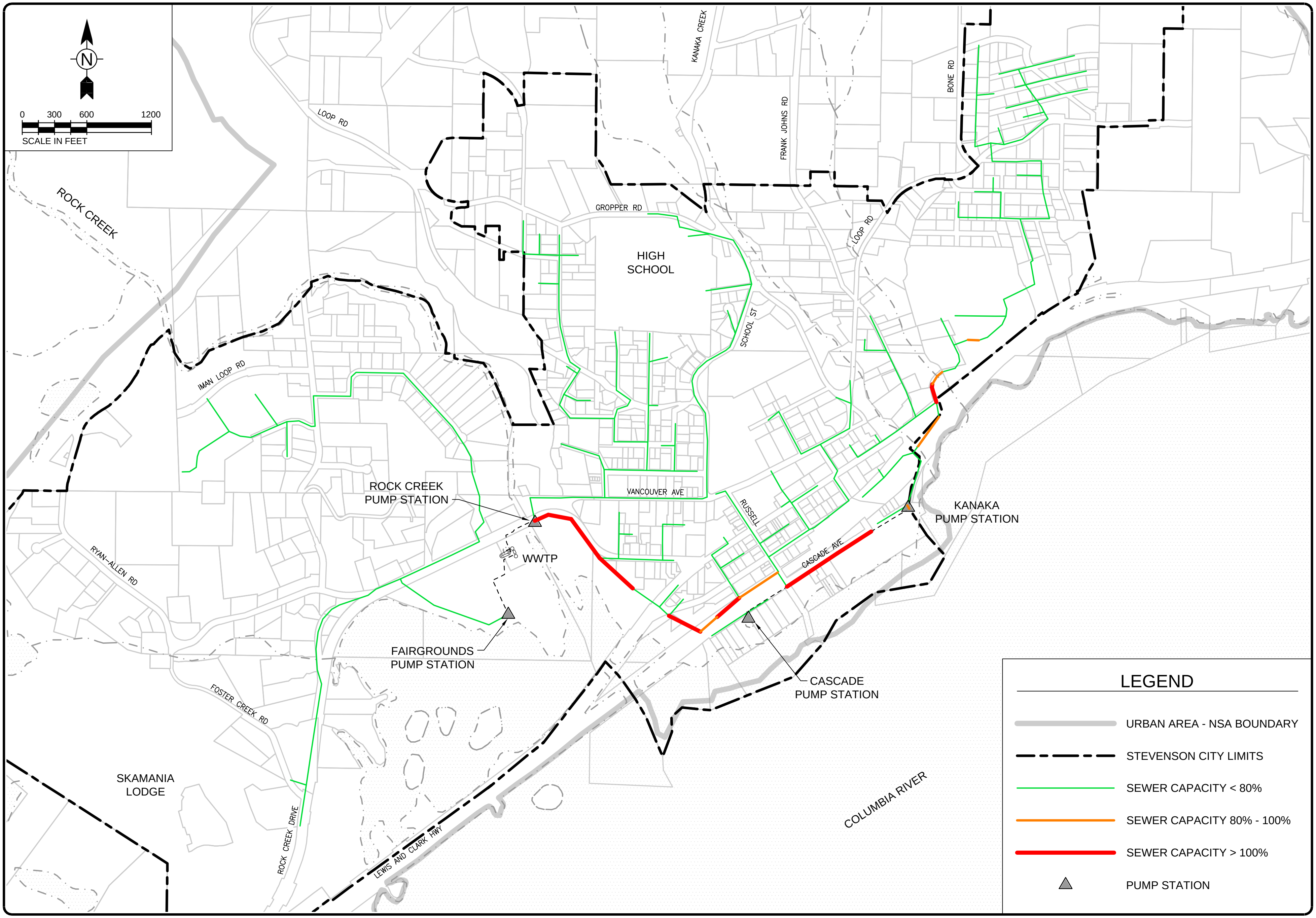

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Figure 4-6.
MODEL RESULTS - YEAR 2040, PEAK FLOW

5. COLLECTION SYSTEM IMPROVEMENTS

The collection system improvements recommended in this section are covered in two phases. Phase 1 covers the period from 2017 through 2025, and Phase 2 covers the period from 2025 through 2040. Estimated overall capital costs are provided for each project. A detailed estimate of overall cost and description of work items that make up the recommended improvements is included in Appendix D.

5.1 GRAVITY SEWER CAPACITY UPGRADES

The following improvements are needed to address capacity deficiencies identified by collection system modeling. Figure 5-1 shows the locations of the proposed collection system improvement projects.

5.1.1 Cascade Avenue Sewer—Phase 1 (Project S-01)

The existing 8-inch sewer in Cascade Avenue, east of Russell Avenue between MH CI-13 and CI-15 is undersized for existing and future peak flows. This line should be upsized prior to any capacity upgrades to the Kanaka Pump Station. The project consists of replacing 920 feet of 8-inch sewer pipe with new 12-inch pipe. The estimated capital project cost is $441,000.

5.1.2 Cascade Interceptor—Phase 1 (Project S-02)

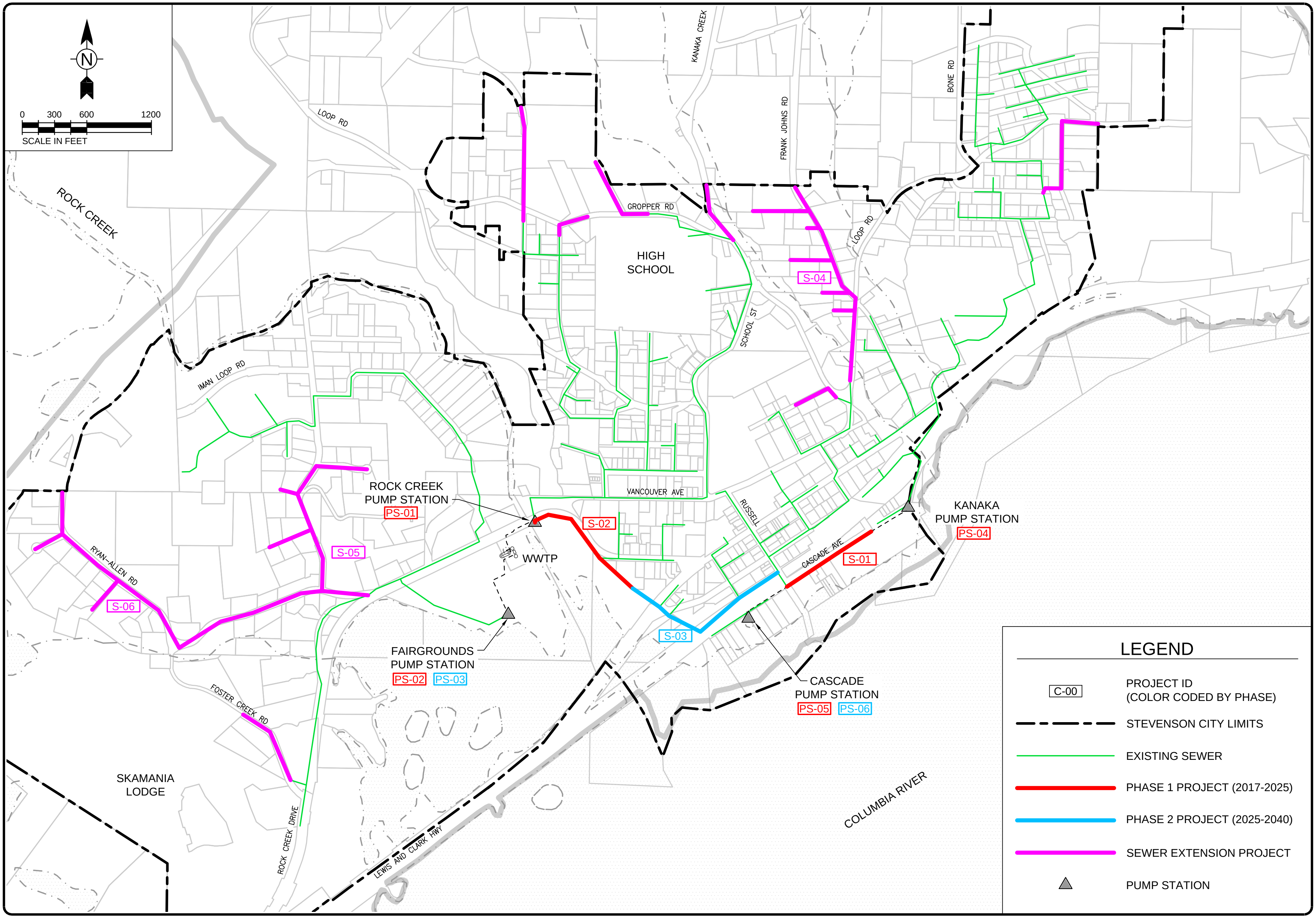
This portion of the existing 12-inch Cascade Interceptor is undersized for both existing and future peak flows, located in Rock Creek Drive starting at the Rock Creek Pump Station and continuing upstream to MH CI-4. The project consists of replacing 1,250 feet of 12-inch sewer pipe with new 18-inch pipe. The estimated capital project cost is $682,000.

5.1.3 Cascade Interceptor—Phase 2 (Project S-03)

This portion of the existing 12-inch Cascade Interceptor is undersized for year 2040 peak flows. It starts at MH CI-4 and continues upstream to MH CI-12 at the intersection of Russell Avenue and Railroad Street. The project consists of replacing 1,650 feet of 12-inch sewer pipe with new 18-inch pipe. The estimated capital project cost is $1,050,000.

5.2 EXTENSIONS TO UNSEWERED AREAS

It is expected that the collection system eventually will be extended to provide service to all currently unsewered development within the city limits. The system also will be extended into any parts of the Urban Area that become annexed to the city in response to requests associated with proposed development. The following projects will facilitate conversions of existing septic systems as well as allow future extensions to potential development. These projects can be constructed in Phase 1 or Phase 2, depending on availability and type of funding, rates of septic failures, and development trends within the City and adjoining Urban Area. Costs assume installation of service laterals to the property line. Installation of sewer laterals on private property and septic system conversions are not included in the costs. These projects are not included in the CIP plan as it is assumed they will be primarily private funded.



7/13/2017 1:24:04 PM - P:\48600\135-48600-16001\CAD\SHEETFILES\FIGURE-5-1.DWG

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City of Stevenson
GENERAL SEWER PLAN UPDATE

Figure 5-1.
PROPOSED COLLECTION SYSTEM IMPROVEMENTS

5.2.1 Main D Extension (Project S-04)

This project will extend Sewer Main D north along East Loop Road and Frank Johns Road to provide an available sewer to connect to for properties currently on septic. Spur lines will be provided to serve properties on Thomas Street, Jordan Street, Carrick Road, and Gale Street. It would also allow for future extension north on Frank Johns Road beyond current city limits to serve new development. The project consists of installing 3,500 feet of 8-inch sewer pipe. It will provide possible sewer connection for 31 properties currently on septic as well as future service to undeveloped properties located near the line. The estimated capital project cost is $1,330,000.

5.2.2 Iman Cemetery Road (Project S-05)

This project will extend sewer closer to properties within city limits that are currently on septic to allow conversion to the sewer system. The new sanitary sewer will start at Rock Creek Drive and Ryan Allen Road, continuing north on Iman Cemetery Road. Spur lines will be provided to serve properties on SW Briggs Road, NW Kaspar Road, and Nicklaus Court. The project consists of installing 2,800 feet of 8-inch sewer pipe. It will provide a possible sewer connection to 20 properties currently on septic as well as future service to undeveloped properties located near the line. The estimated capital project cost is $1,045,000.

5.2.3 Foster Creek Road (Project S-06)

This project will extend sewer closer to properties within city limits that are currently on septic to allow conversion to the sewer system. The new sanitary sewer will start from the intersection of Ryan Allen Road and Iman Cemetery Road, continue east to Foster Creek Road, and then continue north to the intersection of Foster Creek Road and Hollstrom Road. Spur lines will be provided to serve properties on Lakeview Road and SW Jayden Lane. The project consists of installing 4,000 feet of 8-inch sewer pipe. It will provide a possible sewer connection to 24 properties currently on septic as well as future service to undeveloped properties located near the line. The estimated capital project cost is $1,525,000.

5.2.4 Other Extension Projects

Additional extension projects are shown on Figure 5-1, but not assigned a project ID. These projects would likely be privately funded as part of future development. All of these proposed pipes will likely only need to be 8” diameter given the steep terrain and relatively small service areas. Pipe sizing should be verified by the developer during the design review process.

5.3 PUMP STATION UPGRADES

All pump stations need to be outfitted to allow bypass pumping systems to be installed in case of extended power outage or failure of the pump or control systems. Needed modifications would include suction connection, appropriate pump selection, and a discharge connection to the force main.

5.3.1 Rock Creek Pump Station—Phase 1 (Project PS-01)

Modeling indicates that the Rock Creek Pump Station is undersized for both existing and future flows. Pump run-time data and staff observations corroborate the model results. Therefore, full pump station replacement is recommended. This project consists of constructing a new 1,500-gpm firm capacity duplex or triplex submersible pump station with new control panel, auxiliary standby power, and new 12-inch force main to the WWTP. The estimated capital project cost is $1,226,000.

5.3.2 Fairgrounds Pump Station—Phase 1 (Project PS-02)

Modeling indicates that this pump station is adequately sized for current flows, but might be slightly undersized for 2040 flows. It is recommended that flows to this pump station be monitored to verify modeling assumptions and allow for more accurate predictions of existing and future peak-hour flows. In the interim, the following improvements are recommended:

- Provide provision for bypass pumping.
- Install new flow meter on the force main discharge piping.
- Integrate new flow recorder into existing controls.
- Relocate portion of force main if necessary for WWTP expansion.

The estimated capital project cost is $111,000.

5.3.3 Fairgrounds Pump Station—Phase 2 (Project PS-03)

The following Phase 2 work items are recommended at the Fairgrounds Pump Station:

- Replace pump station with new submersible pumps in new wet well.
- Provide a new control panel and instrumentation.
- Provide new electrical equipment, including standby generator and automatic transfer switch.

The estimated capital project cost is $917,000.

5.3.4 Kanaka Pump Station—Phase 1 (Project PS-04)

Modeling indicates that this pump station is undersized for both existing and future flows. Average weekly pump run-times of 14.5 hours per day were observed in December 2015, which is high for systems with large peaking factors, as is suggested by WWTP flow records.

At a minimum, a flow meter should be installed at the pump station to verify modeling assumptions and allow for more accurate predictions of existing and future peak-hour flows. However, full pump station replacement is recommended, given the potential near-term additional flows from development of the Chinidere Mountain subdivision as well as the station deficiencies listed in Section 4.1.2.

Pump station replacement will consist of constructing a new 500-gpm firm capacity duplex submersible pump station with new control panel and auxiliary standby power. The existing 6-inch force main installed in 2015 will not need replacement as it is adequately sized for projected flows. The estimated capital project cost is $770,000.

5.3.5 Cascade Pump Station—Phase 1 (Project PS-05)

The Cascade Pump Station is adequately sized for existing and future flows. The following improvements are recommended:

- Provide provision for bypass pumping.
- Upgrade controls to include an auto-dialer or remote telemetry unit to notify operations staff of high wet well level or equipment malfunction.

The estimated capital project cost is $37,000.

5.3.6 Cascade Pump Station—Phase 2 (Project PS-06)

The following Phase 2 work items are recommended at the Cascade pump station:

- Replace pump station with new submersible pumps in new wet well.
- Provide a new control panel and instrumentation.

The estimated capital project cost is $509,000.

5.4 IMPROVED OPERATION AND MAINTENANCE

5.4.1 Sewers

Sewer Inspection and Cleaning

It is recommended that all City sewers be systematically inspected by CCTV, with the oldest sewers to be inspected in the first two years and the remaining sewers over 10 years. The inspection should be done to the standards of the Pipeline Assessment Certification Program, with the video and subsequent reports archived. This inspection should identify system defects and help identify sewers that need significant maintenance, rehabilitation and replacement. A system of preventive maintenance should be implemented that includes cleaning and removal of tree roots. For sewers of greater significance or with likelihood of recurring issues, a schedule for preventative maintenance should be set.

It is recommended that the City budget $5,000 per year for CCTV work.

Pipe and Manhole Rehabilitation

It is recommended that the City begin a yearly program of pipe and manhole rehabilitation in specific areas, including older parts of the collection system and known areas of high I/I, such as School Street and the downtown areas. Pipe rehabilitation can include new pipe, pipe bursting or cured-in-place pipe lining.

It is recommended that the City budget $80,000 per year for upgrades. Based on results of past I/I repairs, significant reductions in flow are not anticipated. Rather, the control program will likely maintain the collection system’s current I/I rate as it ages.

Geotechnical Considerations

It is recommended that a geotechnical engineer be consulted before making I/I repairs in areas of known or suspected slope instability (such as the northeast area of the collection system), because I/I repairs could change subsurface drainage patterns and increase the risk of a landslide.

5.4.2 Flow Monitoring and Data Collection

Collection of flow monitoring data will enable measurement of base flow and I/I in City sewers. It is recommended that the gravity sewer system be visually checked at key locations to estimate dry-weather and wet-weather flows. Combining velocity readings from a portable velocity sensor with estimates of water depth would enable estimates of flow at each location.

Periodic installation of temporary flow monitors at key locations in the network is also recommended. These flow monitors should record both water depth and water velocity, so that total flow can be derived. Installation of the meters should be at locations that have been screened to ensure that poor site hydraulics do not limit the accuracy of the data collection. A typical flow monitor installation would occur during the wet-weather season between September and April. This period may be extended if specific dry-weather flow information is desired.

5.4.3 CMOM Program

It is recommended that the City implement a Capacity, Management, Operation, and Maintenance (CMOM) program following EPA guidance. A CMOM program should incorporate the following elements:

- Level of service
- Performance measurements
- Information systems
- Asset identification and capitalization
- Failure impact evaluation and risk management
- Condition assessment
- Rehabilitation and replacement planning
- Capacity assurance planning
- Maintenance analysis and planning
- Financial management
- Continuous improvement.

5.5 PRELIMINARY COLLECTION SYSTEM CAPITAL COST ESTIMATE

Planning level capital cost estimates for the recommended collection system improvements are presented in Table 5-1. A detailed cost estimate by work item is included in Appendix D. This is a Class 4 cost estimate as defined by the Association for the Advancement of Cost Engineering International. These costs represent planning level cost estimates in 2017 dollars and should be considered accurate in the range of +50 to -30 percent.

Table 5-1. Planning Level WWTP Capital Cost Estimates

Component	Estimated Capital Cost
Phase 1 Projects 2017-2025	
S-01—Cascade Avenue Sewer	$441,000
S-02—Cascade Interceptor - Rock Cr PS to MH CI-4	$682,000
PS-01—Rock Creek Pump Station	$1,226,000
PS-02—Fairgrounds Pump Station - Phase 1	$111,000
PS-04—Kanaka Pump Station	$770,000
PS-05—Cascade Pump Station - Phase 1	$37,000
Total	$3,267,000
Phase 2 Projects 2025-2040	
S-03—Cascade Interceptor - MH CI-4 to CI-12	$1,050,000
PS-03—Fairgrounds Pump Station - Phase 2	$917,000
PS-06—Cascade Pump Station - Phase 2	$509,000
Total	$2,476,000
Extensions to Unsewered Areas	
S-04—Sewer Main D Extension	$1,330,000
S-05—Iman Cemetery Road Extension	$1,045,000
S-06—Foster Creek Road Extension	$1,525,000
Total	$3,900,000
Annual Operations and Maintenance	
Annual Pump Station Operation & Maintenance	$41,200
Annual Sewer Inspection & Cleaning	$5,000
Annual Pipe and MH Rehab	$80,000

6. EXISTING WASTEWATER TREATMENT PLANT

6.1 WASTEWATER TREATMENT PLANT OVERVIEW

The City of Stevenson Wastewater Treatment Plant (Stevenson WWTP) is located on the banks of Rock Creek, on Rock Creek Drive in the west end of Stevenson. The plant is designed for a peak-hour flow of 1.5 million gallons per day (mgd). It uses an oxidation ditch for treatment and discharges treated and disinfected effluent to the Bonneville Pool of the Columbia River. Figure 6-1 shows the current WWTP site.

Figure 6-1. Stevenson WWTP Site

The Stevenson WWTP was constructed in 1971 and originally consisted of a Smith and Loveless Oxygest package treatment plant with a chlorine contact tank for disinfection and a sludge lagoon. In 1992, the original plant was upgraded with largely new current facilities, including the oxidation ditch, secondary clarifiers, and UV disinfection facility. Some components from the original plant were kept as back-up to the new facilities or for solids handling.

Figure 6-2 shows the overall process diagram of the Stevenson WWTP. Treatment processes are summarized below.

6.1.1 Liquid Treatment

Current processes for the liquid stream at the Stevenson WWTP are as follows:

- Wastewater enters the Rock Creek Pump Station (serving portions of the City east of the WWTP) and Fairgrounds Pump Station (serving portions of the City west of the WWTP). These serve as the WWTP's current influent pump stations.
- The In-Plant Pump Station receives tank drain flow from the solids holding tank, oxidation ditch, secondary clarifiers, solids loading area, and disinfection facilities and pumps to the force main downstream of the Fairgrounds Pump Station, upstream of the headworks.
- The combined force main from the influent pump stations discharges to the headworks facility. The combined raw wastewater flows are typically discharged to the south channel of the headworks, which features a mechanical bar screen to remove screenings entering the plant. The north channel contains a manually cleaned bar screen and is used for overflow and maintenance purposes.
- Screened wastewater flows by gravity to the oxidation ditch, which is aerated by one or two brush rotors.
- Mixed liquor from the oxidation ditch is conveyed to one or both of the secondary clarifiers.
- Secondary effluent from the clarifiers is combined and conveyed to the UV disinfection channel for disinfection.
- Disinfected effluent leaves the WWTP through a 21-inch reinforced concrete outfall pipe from the effluent structure; a portion of the disinfected flow is recycled as non-potable plant reuse water.

6.1.2 Solids Handling

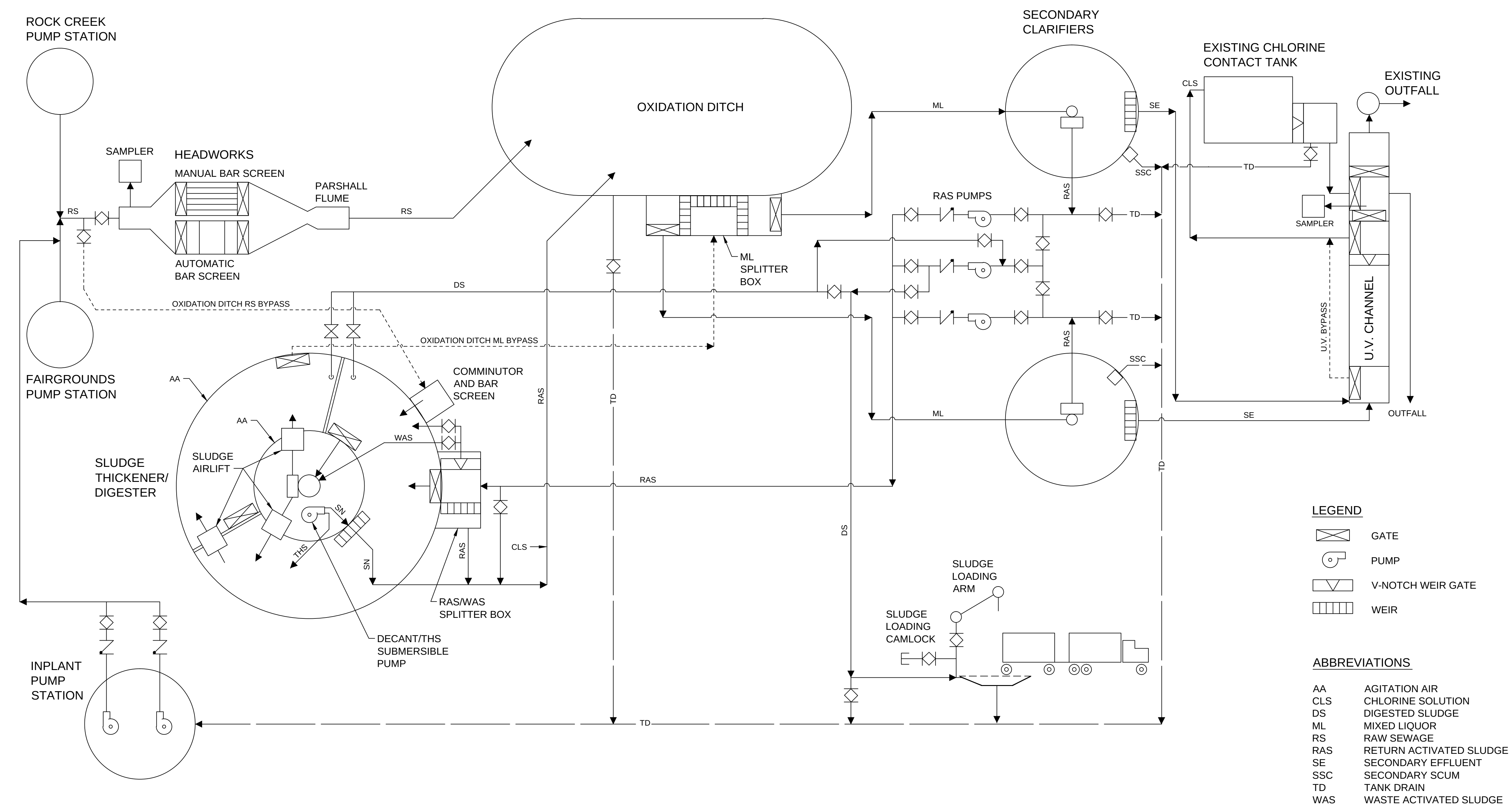
Current processes for the solids stream at the Stevenson WWTP are as follows:

- A pump station located between the secondary clarifiers pumps return activated sludge (RAS) and waste activated sludge (WAS) from the clarifiers to the RAS/WAS splitter box at the sludge holding tank. RAS flows to the oxidation ditch, and WAS flows to the solids holding tank.
- Settled sludge from the aerated solids holding tank is pumped into a 6,000-gallon sludge truck and hauled off-site to the Hood River WWTP digester complex, where it is digested to produce Class B biosolids and land-applied to neighboring agricultural property.

6.2 SYSTEM COMPONENTS

6.2.1 Influent Pumping

Influent to the Stevenson WWTP is pumped by the Rock Creek and Fairgrounds pump stations. For information about the influent pump stations, see Sections 3.3.1 and 3.3.2.



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CITY OF STEVENSON, WA
GENERAL SEWER PLAN UPDATE

EXISTING WWTP
PROCESS FLOW DIAGRAM

Project No.:	135-48600-16001
Date:	MARCH 2017
Designed By:	

Supplemental
FIGURE 6-2

Bar Measures 1 inch

4/3/2017 1:52:31 PM - P:\48600\135-48600-16001\CAD\SHEETFILES\FIGURE-6-2.DWG - BENNETTDAGGETT, HUNTER

6.2.2 Headworks

The Stevenson WWTP headworks (see Figure 6-3) is upstream of the oxidation ditch and consists of two channels (north and south), each 2 feet wide. Raw sewage from the influent pump stations and In-Plant Pump Station discharges to the south channel, where it passes through the mechanical bar screen before going to the oxidation ditch. The north channel contains a manually cleaned bar screen and is used in high flow situations and when repairs to the mechanical bar screen are required.

Slide gates SG-1 and SG-2 (upstream) and SG-3 and SG-4 (downstream) isolate the two channels. A Parshall flume is located downstream of the channels, with a stilling well adjacent to the channel for the future installation of a flow recorder.

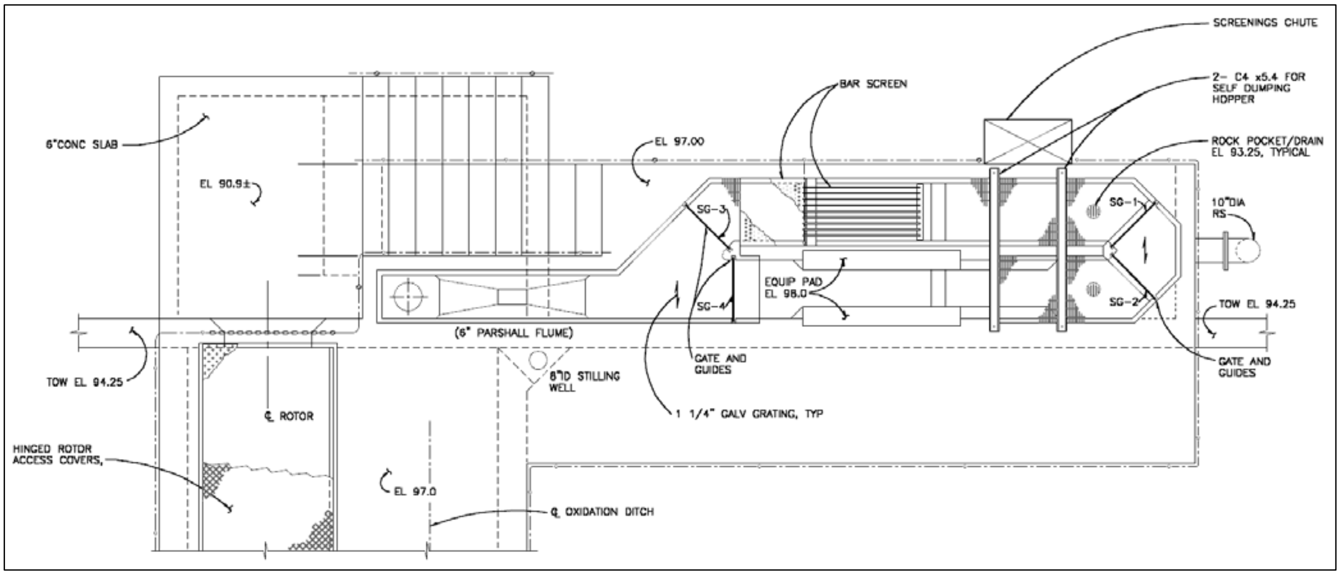


Figure 6-3. Stevenson WWTP Headworks

6.2.3 Oxidation Ditch

The oxidation ditch is a 103-foot-long oval structure with a central dividing wall, located next to the headworks (see Figure 6-4). Screened wastewater from the headworks and RAS from the RAS/WAS splitter box enter the oxidation ditch from pipes in the base of the oxidation ditch and are mixed with the mixed-liquor suspended solids (MLSS) activated sludge already present in the oxidation ditch. Two brush rotors supply oxygen from the air and keep the contents of the oxidation ditch mixed and moving. The rotors are covered with hinged access covers. Each rotor is sized to provide required air and mixing energy at peak design flows; the second rotor is therefore a redundant standby unit. Mixed liquor flows out of the oxidation ditch into the mixed liquor splitter box via a 13-foot-long adjustable weir gate. The splitter box routes mixed liquor to secondary Clarifier #1 or #2 for solids settling and removal.

MLSS consists mostly of microorganisms and non-biodegradable suspended matter. When raw sewage with high organic load mixes with MLSS in the presence of oxygen, the organic load is oxidized by the microbes. Dissolved oxygen (DO) concentration in the oxidation ditch is controlled by adjusting the immersion depth of the brush rotors. High DO levels occur immediately downstream of each operating rotor, and DO levels decrease as the mixed liquor flows downstream, yielding low-DO or anoxic zones downstream. The next operating rotor creates a high-DO zone, and so on, as mixed liquor circulates around the oxidation ditch. These alternating zones may promote nitrification, denitrification, alkalinity recovery and energy conservation.

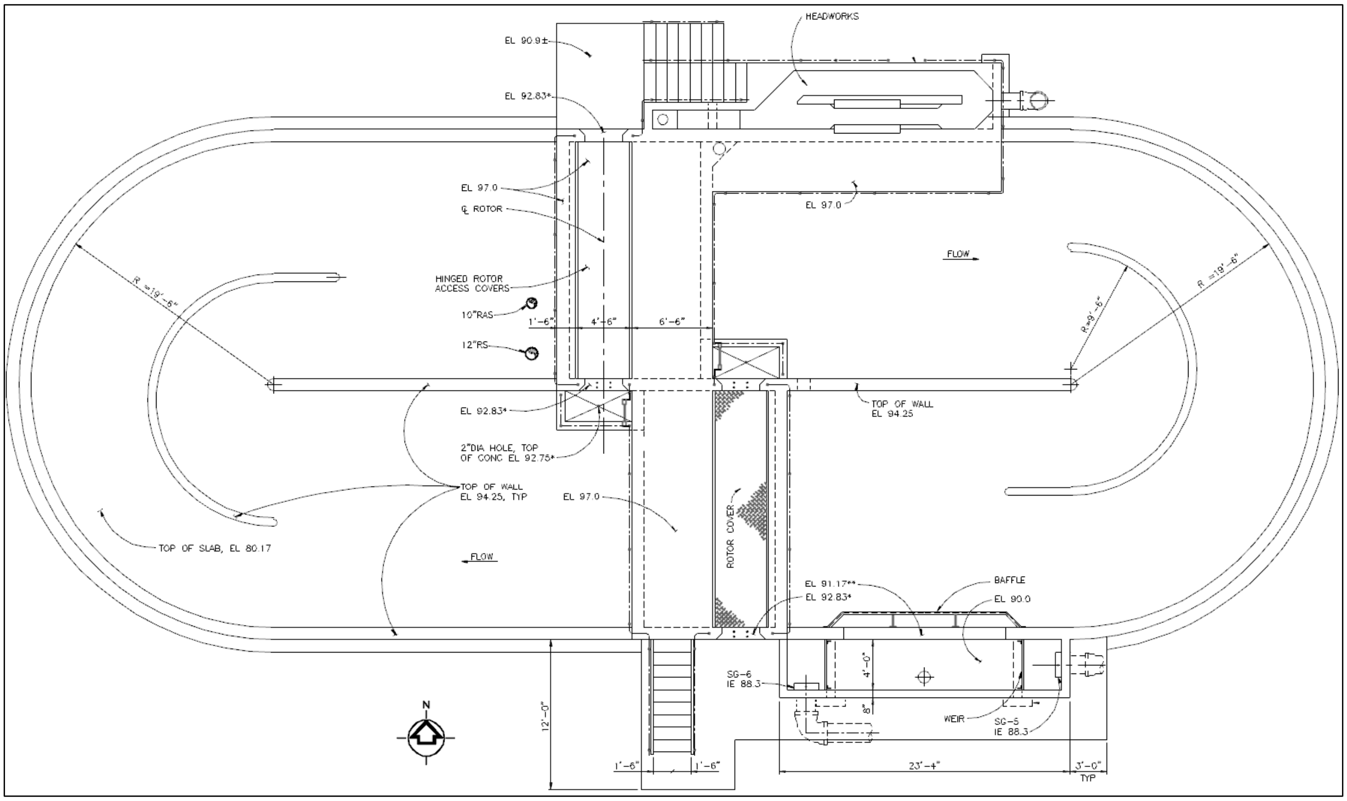


Figure 6-4. Oxidation Ditch

When the rotor immersion depth is increased by manually adjusting the effluent weir at the secondary clarifier flow splitter box, more oxygen is transferred to the mixed liquor, the mixed liquor circulates faster around the oxidation ditch, and energy consumption increases. The immersion depth of the rotor can be controlled by varying the water level, which is accomplished by adjusting the outlet tipping weir up or down using a hand wheel. Aeration and mixing performance can also be adjusted by changing the rotor rotation speed with different size sheaves. Lower speeds provide more mixing and less aeration per horsepower; higher speeds do the opposite.

6.2.4 Clarifiers

The Stevenson WWTP has two secondary clarifiers, as shown in Figure 6-5 and Figure 6-6. MLSS settles in each clarifier and is transported to the center of the clarifier by rotating rake arms. The concentrated, settled sludge is then withdrawn by pumps and pumped to the RAS/WAS splitter box adjacent to the sludge holding tank.

Clarifiers #1 and #2 are each 35 feet in diameter with 14-foot side water depth and 1:12 bottom slope. Mixed liquor enters through a 14-inch pipe from the mixed liquor splitter box at the oxidation ditch. Clarified effluent leaves each clarifier via outlet weirs and a 14-inch diameter pipe to the disinfection facility. Settled sludge is removed from the clarifiers through 8-inch RAS lines and is pumped by three RAS pumps in the RAS pump station adjacent to the two clarifiers. Scum is deposited by the skimmer in a scum box located in each clarifier, where it flows by gravity through a 6-inch pipe to the plant drain system and In-Plant Pump Station.

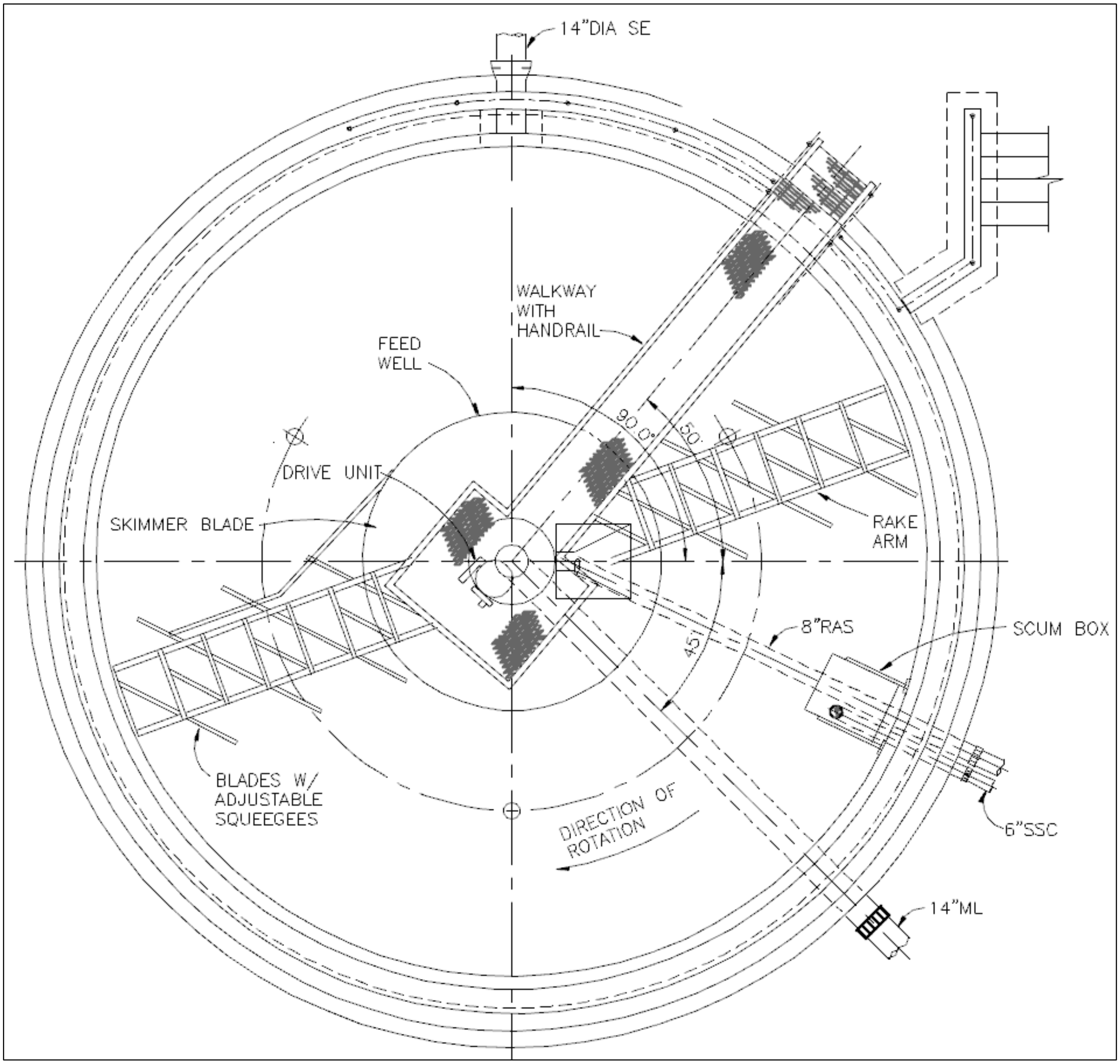


Figure 6-5. Secondary Clarifier (Plan View)

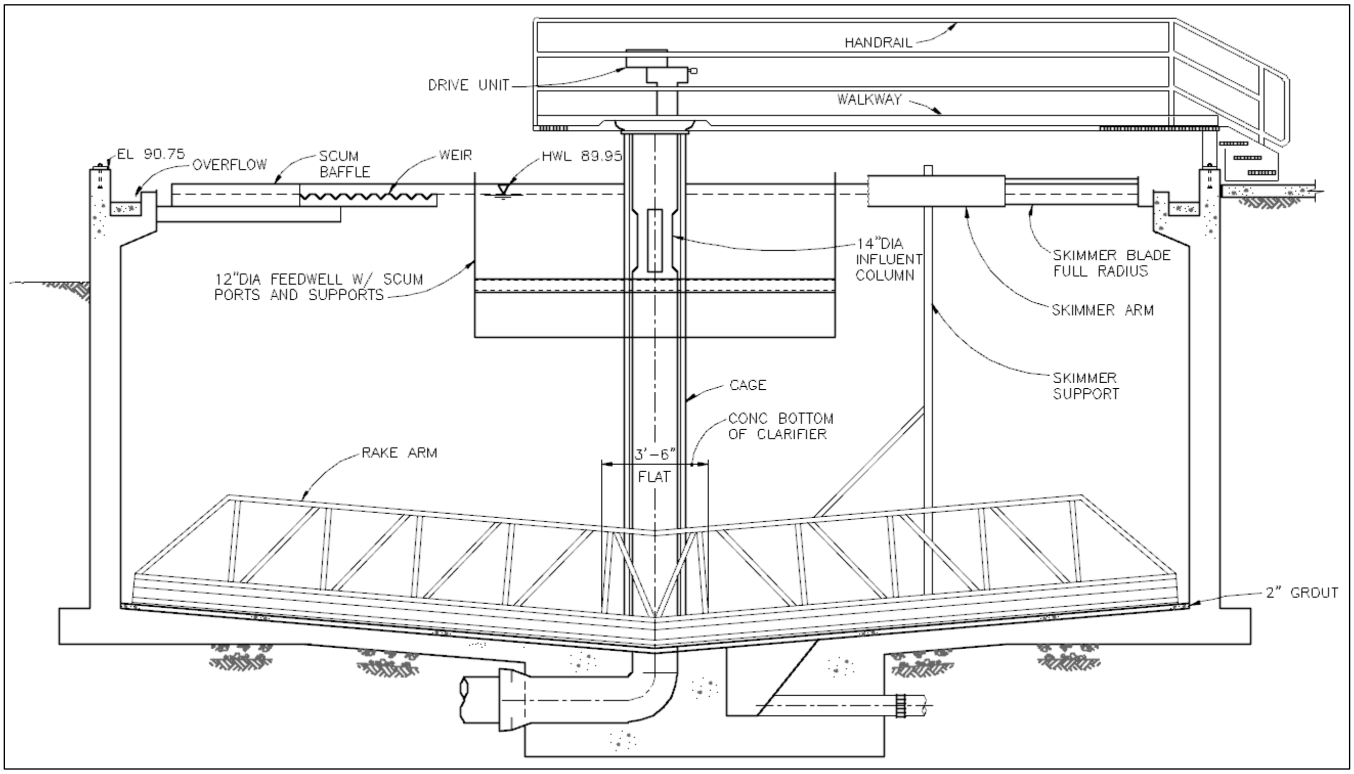


Figure 6-6. Secondary Clarifier (Section View)

6.2.5 Disinfection System

The disinfection system consists of one UV unit in an open channel and a standby chlorine system.

UV Disinfection

The UV disinfection facility consists of an open, concrete channel, UV lamp modules, electrical distribution center and weir to maintain a steady water elevation at the UV lamps, as shown in Figure 6-7. After passing through the UV unit and flowing over the finger weir, disinfected effluent is metered using a V-notch weir and ultrasonic level sensor. After overflowing the V-notch weir, disinfected effluent flows through a stop gate and to the WWTP outfall by gravity.

Chlorine Disinfection

The chlorination system was constructed in 1971 with the original treatment plant and maintained as a standby system in the 1992 upgrade. The system consists of a chlorinator and chlorine contact tank. The chlorinator uses chlorine gas from 150-pound cylinders, delivered through a manually adjusted V-notch chlorinator and dissolved in water at a chlorine injector to form a concentrated chlorine solution, which is injected into the influent pipe approximately 5 feet upstream of the contact tank. The contact tank is a 12-foot by 20-foot concrete tank with an average depth of 5 feet. The tank's single chamber is divided with wooden baffles to produce a serpentine flow.

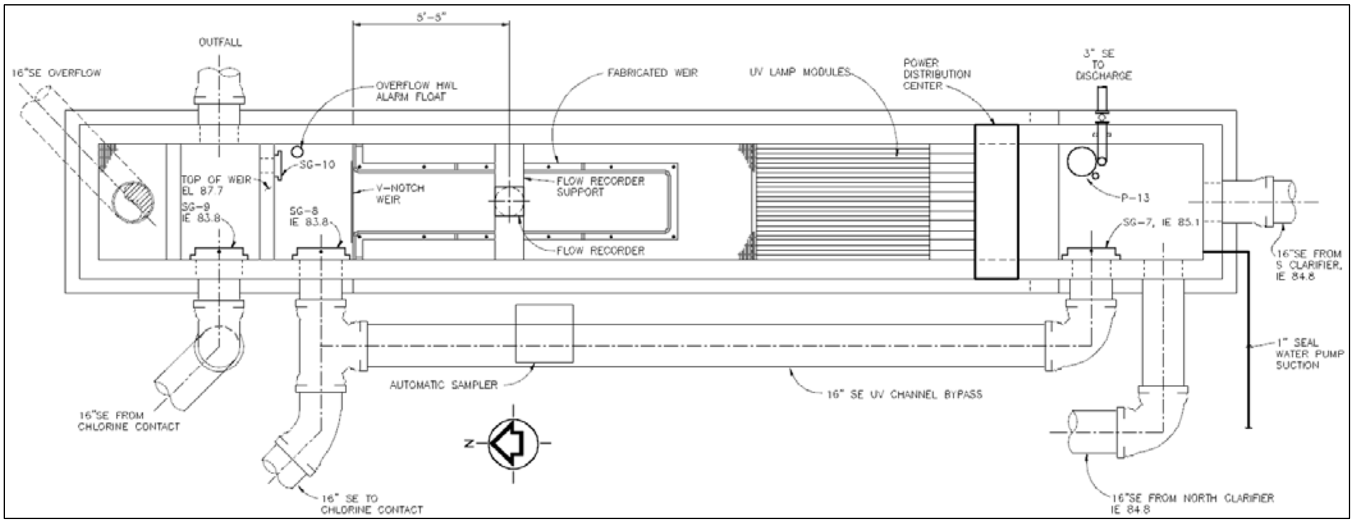


Figure 6-7. UV Disinfection

6.2.6 Effluent Outfall

Disinfected effluent flows by gravity to an effluent manhole and on to the outfall in the Columbia River. The outfall piping consists of approximately 850 feet of 15-inch PVC pipe, followed by approximately 2,020 feet of 18-inch HDPE pipe. Following partial blockage of the existing discharge in 2007 due to landslide activity, the existing outfall was extended by approximately 300 feet in 2013.

The WWTP also has a permitted secondary outfall to Rock Creek, allowable only when the primary outfall is inoperative or during essential maintenance. Discharge to Rock Creek is accomplished using a 10-inch concrete pipe directly to the creek.

6.2.7 Solids Handling

RAS/WAS from the clarifiers is pumped to the RAS/WAS splitter box adjacent to the solids holding tank, which is converted from the original Oxygest treatment plant. The holding tank has a total volume of approximately 170,000 gallons, divided into three chambers:

- The center chamber serves as an inlet and solids thickener, and has a volume of 37,650 gallons.
- The large section of the outer chamber is used for aerobic digestion, and has a volume of 88,000 gallons.
- The smaller section of the outer chamber is used for solids stabilization and storage, and has a volume of 44,000 gallons.

Process flow within the solids facility is shown in Figure 6-8. During normal operation WAS flows from the RAS/WAS splitter box to the center chamber (thickener) for thickening prior to being pumped to the larger outer section (digester) for digestion.

Thickening is accomplished by allowing the solids to settle by gravity prior to being pumped to the outer digester chamber. Sweep arms in the thickener chamber move the thickened solids to the center of the chamber. Six drop legs with three air diffusers each provide aeration in the thickener, and sixteen drop legs with three diffusers each provide coarse bubble aeration and mixing within the digester chamber. Solids transfer between chambers is accomplished using airlifts. Supernatant from the thickener is pumped to the oxidation ditch using a solids decant pump.

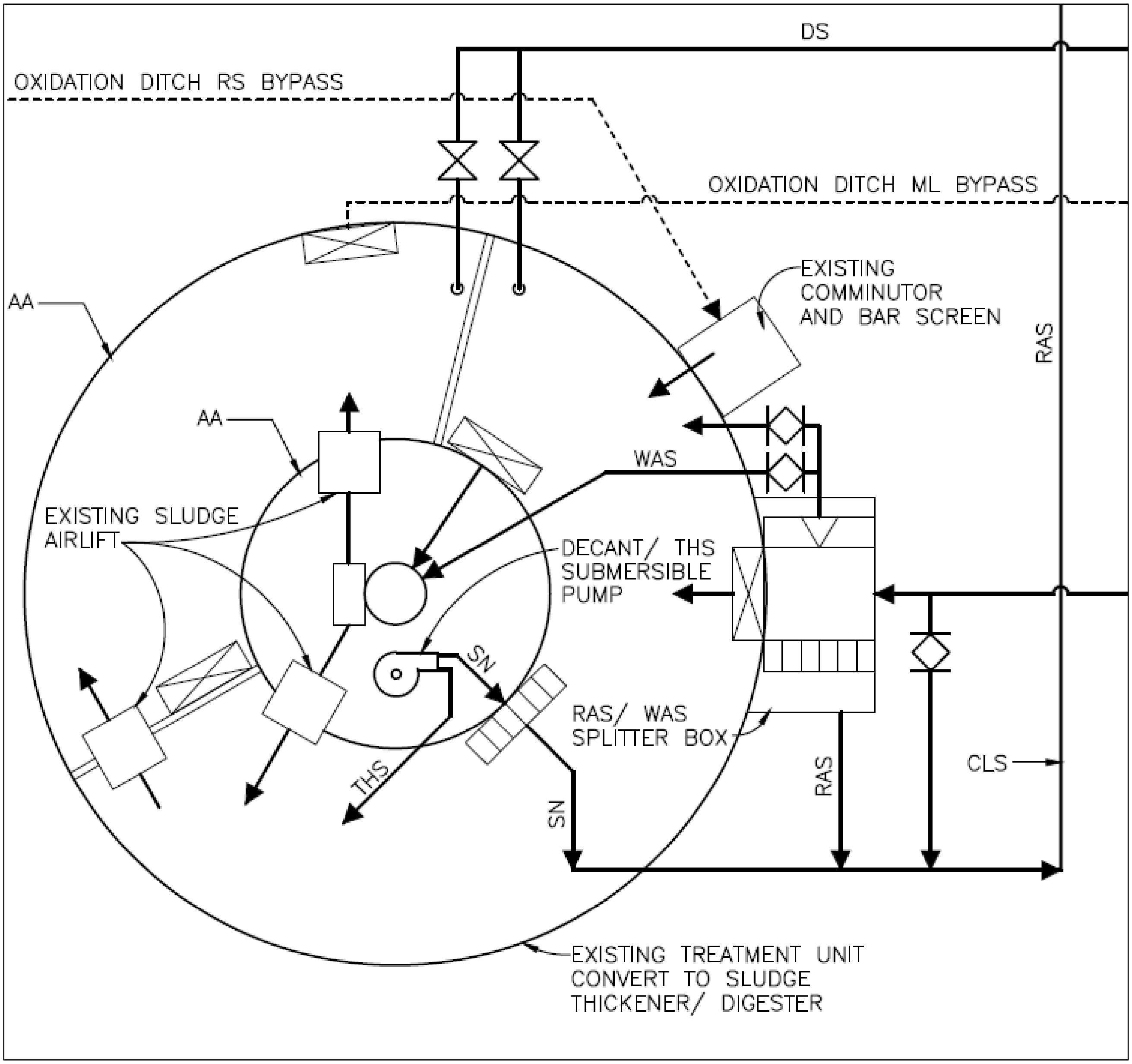


Figure 6-8. Solids Process Flow Schematic

Thickened and partially digested solids are transferred to trucks and hauled to the Hood River WWTP for further digestion and disposal. Solids are withdrawn from either of the outer chambers and pumped to a solids loading arm using P-2, one of the RAS/WAS transfer pumps. The solids hauling truck has a capacity of 6,000 gallons and is typically used to haul two loads per week. This system imposes two limits on the Stevenson WWTP's ability to dispose of solids:

- The hauling truck is owned by Hood River and additional trips are typically not possible. As a result, it is not currently possible to remove a higher total volume of solids.
- The pump used to remove solids from the solids facility and pump to the truck cannot successfully pump sludge with a total solids concentration greater than 2 percent; the typical percentage is reportedly 1.3 percent. As a result, it is not currently possible to remove a higher total mass of solids under the current pumping and hauling regime.

6.2.8 Support Facilities

Flow Measurement

Total WWTP Flow

Total wastewater flows from the City service area are measured with the effluent flow meter at the UV disinfection channel. Disinfected effluent from the UV units flows through the disinfection channel and over a finger weir, where water surface elevation is measured using an ultrasonic level meter upstream of a V-notch weir. This water surface elevation is used to calculate effluent flow. The effluent flow meter provides an accurate indication of daily-average influent flows, but not instantaneous or peak-hour flows, because influent flow variations are attenuated through the WWTP upstream of the effluent flow meter. The headworks includes a Parshall flume, but currently lacks instrumentation for flow measurement.

Internal WWTP Flows

Internal plant flows of liquids and solids are measured at the 6-inch RAS/WAS flow meter on the 8-inch RAS/WAS force main in the RAS/WAS pump building.

Internal Pump Systems

In-Plant Pump Station

The In-Plant Pump Station wet well and valve vault are located below grade adjacent to the RAS/WAS pump building. The wet well is an 8-foot-diameter precast manhole 19 feet deep. The wet well receives sewage wastes from the following sources:

- Laboratory/control building restroom
- Screening area catch basin (adjacent to oxidation ditch)
- Solids loading area catch basin
- RAS/WAS pump building drain
- Scum skimmings from both clarifiers.

In addition, the pump station can be used to drain tanks when required for inspections or maintenance. By changing default valve settings, the pump station can drain the following locations:

- Headworks
- Oxidation ditch
- Both clarifiers
- UV disinfection channel
- Chlorine contact tank.

The pump station includes two submersible pumps, with one duty and one standby. Each pump has a rated capacity of 180 gpm. Each pump’s 6-inch pump discharge line contains a check valve and a plug valve in a vault downstream from the wet well. The two 6-inch discharge lines combine at a wye section. The pump station typically discharges to the WWTP headworks. The discharge can also be pumped to the solids facility through the 10-inch standby raw sewage pipeline.

RAS/WAS Pumping

Three variable-speed sludge pumps for Clarifiers #1 and #2 are located in the RAS/WAS pump building. Each has a rated capacity of 350 gpm at a total dynamic head of 30 feet, and a minimum flow of 190 gpm at 9 feet of total dynamic head. If both Clarifiers #1 and #2 are in service, one pump is set to pump RAS/WAS from Clarifier #1, another is set to pump from Clarifier #2, and the third is a standby pump. RAS/WAS is pumped to the RAS/WAS splitter box adjacent to the solids facility.

Spray Water Pumping

The spray water pump is a submersible unit located in the UV channel, upstream of the UV lamp modules. The spray water pump supplies sprayers at the solids facility for use in foam control.

Laboratory

The WWTP laboratory is located in the laboratory/control building. Laboratory space limitations preclude providing all desired laboratory functions, and available equipment is out of date. The plant laboratory is currently used to measure only pH, dissolved oxygen and sludge settleability. All other laboratory analyses for the Stevenson WWTP are performed at the Hood River WWTP.

Plant Electrical Power Supply

Skamania County PUD supplies electric power to a pad-mounted transformer adjacent to the WWTP entrance. Power at 277/480 volts is supplied to the motor control center (MCC). All loads are fed by circuit breakers in the MCC. Loads of 120/208 volts are served through dry-type step-down transformers and 120/208 panel boards.

Standby Power Generation

Standby power is supplied by the 100-kilowatt diesel generator located in the RAS/WAS pump building. The generator automatically provides power to the WWTP and Rock Creek and Fairgrounds pump stations when any phase of the normal source drops below 80 percent and the standby capacity is at 90 percent of rated voltage. The automatic transfer switch (ATS) switches back to commercial power when all phases of the normal source are 90 percent or more for 30 seconds. The diesel generator has a 150-gallon skid-mounted fuel tank.

Control Systems

The RAS/WAS pump building contains the MCC for the treatment equipment as well as the annunciator panel and auto dialer. The MCC, located in the RAS/WAS pump room, contains the main service entry and breaker, the circuit breakers for the building and existing panels, and the motor controls for the WWTP motors and Rock Creek and Fairgrounds pump station motors. The motor controls contain HAND-OFF-AUTO switches for the equipment. All remote motors have lock-out stops that facilitate maintenance.

The building panel (Panel B) is located in the standby generator room of the RAS/WAS pump building. The building panel contains circuit breakers for the HVAC equipment, UV disinfection systems, seal water pumps, lighting and irrigation system controller, with several spare circuits.

Controls for outside lighting are also located in the standby generator room of the RAS/WAS pump building. These controls are set up to be turned on and off by photocells on the roof of the building, a timer, or a combination of the two.

A panel in the laboratory/control building contains circuit breakers for the laboratory/control building lights, HVAC equipment, digester unit controls, digester air compressors, and chlorination equipment controls.

The annunciator panel is located in the RAS/WAS pump room. Green lights indicate the equipment is operational, while red lights indicate an alarm condition. This panel provides an overview of equipment status, showing the following conditions:

- Rock Creek Pump Station Pump No. 1 fail
- Rock Creek Pump Station Pump No. 2 fail
- Fairgrounds Pump Station Pump fail
- In-Plant Pump Station Pump No. 1 fail
- In-Plant Pump Station Pump No. 2 fail
- In-Plant Pump Station wet well level high
- In-Plant Pump Station wet well level low
- Automatic bar screen fail
- Parshall flume level high
- Oxidation Ditch Rotor No. 1 fail
- Oxidation Ditch Rotor No. 2 fail
- RAS/WAS Pump No. 1 fail
- RAS/WAS Pump No. 2 fail
- RAS/WAS Pump No. 3 fail
- Secondary Clarifier Motor No. 1 fail
- Secondary Clarifier Motor No. 2 fail
- Seal water pump fail
- UV system fail
- Spray water pump fail
- Outfall level high

Under specified alarm conditions, an autodialer will begin calling the programmed phone numbers. It will call as many as eight numbers in turn until the unit is called back or a touch tone key is activated. The autodialer also has the capacity to answer incoming calls and report on alarm status.

7. WASTEWATER TREATMENT PLANT EVALUATION

7.1 PERMIT COMPLIANCE

7.1.1 Influent Limits

The Stevenson WWTP NPDES permit specifies maximum-month influent limits for total flow, BOD load and TSS load. Table 7-1 compares the permit limits to existing flows and loads from WWTP monitoring records.

Table 7-1. Permit Influent Limits and Existing Flows and Loads

Description	Existing	NPDES Permit Limits
Maximum-Month Flow	0.41 mgd (2015)	0.45 mgd
Maximum-Month BOD Load	1,218 ppd (2016)	612 ppd
Maximum-Month TSS Load	866 ppd (2016)	612 ppd

Under current conditions, average monthly influent BOD and TSS loads at the Stevenson WWTP regularly exceed the facility's NPDES permit limits. In 2016, average monthly influent BOD loads exceeded the maximum-month influent BOD permit limit seven times, and the average monthly influent TSS load exceeded the permit limit three times. The influent load data from 2012-2016 are plotted in comparison to permit requirements in Figure 7-1.

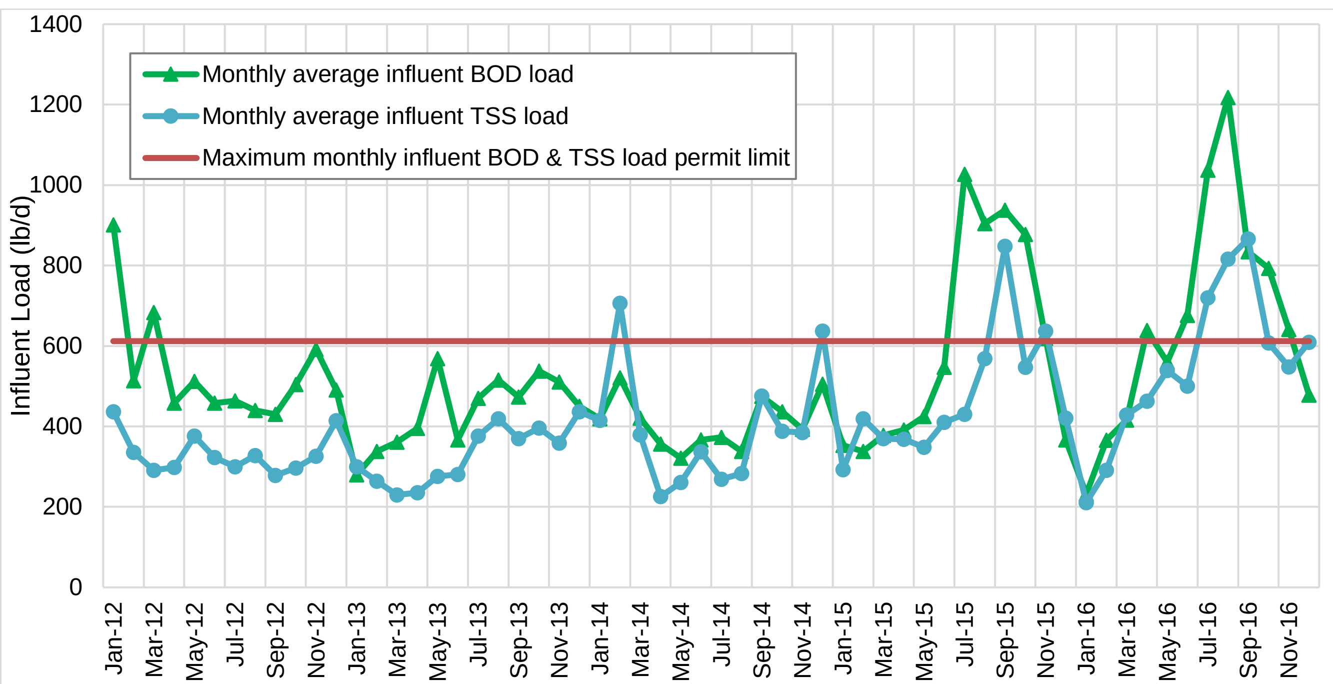


Figure 7-1. 2012-2016 Influent BOD and TSS Load

The permit states that an engineering report must be prepared and a schedule developed for steps to maintain WWTP capacity if flows or loads exceed the limits or if they reach 85 percent of the limits for three or more consecutive months. This facilities plan is intended, in part, to serve as the engineering report to comply with that requirement.

7.1.2 Effluent Limits

The Stevenson WWTP's discharge monitoring reports provide data on the plant's effluent that can be used to assess compliance with the NPDES permit requirements (see Table 1-1). Discharge monitoring report effluent data from 2012 through 2016 were reviewed to assess the plant's recent record of compliance.

BOD and TSS

Effluent BOD and TSS samples are collected and analyzed twice per week. Table 7-2 summarizes the average monthly and highest weekly average BOD and TSS effluent data. The data are plotted in comparison to permit requirements in Figure 7-2 through Figure 7-7.

Table 7-2. Average Monthly and Average Weekly Flow, BOD and TSS

		BOD					TSS				
		Concentration (mg/L)		Load (ppd)			Concentration (mg/L)		Load (ppd)		
	Average Flow (mgd)	Monthly Average	Highest Weekly Average	Monthly Average	Highest Weekly Average	Removal (%)	Monthly Average	Highest Weekly Average	Monthly Average	Highest Weekly Average	Removal (%)
Jan-12	0.424	1.8	5.0	4.5	8.0	99.4	2.7	4.0	7.6	17.0	98.4
Feb-12	0.224	1.1	1.0	2.0	3.0	99.6	2.0	3.0	3.5	4.0	99.0
Mar-12	0.297	1.5	2.0	4.0	6.0	99.5	2.0	2.0	4.3	6.0	98.6
Apr-12	0.184	1.5	2.0	2.2	3.0	99.5	1.9	4.0	2.8	5.0	99.1
May-12	0.149	2.7	3.0	3.1	4.0	99.4	3.4	4.0	4.1	4.0	98.9
Jun-12	0.125	2.2	4.0	2.2	4.0	99.5	2.8	4.0	2.9	4.0	99.1
Jul-12	0.103	2.3	3.0	2.0	3.0	99.6	4.9	10.0	4.4	10.0	98.6
Aug-12	0.102	1.4	2.0	1.2	2.0	99.7	2.6	4.0	2.1	3.0	99.4
Sep-12	0.100	2.0	4.0	2.0	3.0	99.6	3.0	6.0	3.0	5.0	99.0
Oct-12	0.141	2.1	4.0	3.1	9.0	99.6	2.0	4.0	2.9	8.0	99.3
Nov-12	0.309	2.4	4.0	8.6	20.0	98.8	3.3	6.0	9.5	16.0	97.1
Dec-12	0.391	2.0	3.0	7.2	12.0	98.7	3.2	5.0	10.5	14.0	97.4
Jan-13	0.164	1.3	2.0	1.8	2.0	99.4	2.4	3.0	3.2	4.0	98.9
Feb-13	0.138	1.6	2.0	1.7	3.0	99.6	1.4	3.0	1.5	3.0	99.5
Mar-13	0.138	2.0	4.0	2.1	4.0	99.5	2.1	3.0	2.3	4.0	99.1
Apr-13	0.130	1.2	1.0	1.2	2.0	99.7	2.1	3.0	2.2	4.0	99.1
May-13	0.106	1.8	2.0	1.6	2.0	99.7	2.4	4.0	2.3	4.0	99.2
Jun-13	0.116	1.5	2.0	1.3	2.0	99.7	2.8	4.0	2.5	4.0	99.1
Jul-13	0.109	2.0	3.0	1.7	2.0	99.6	2.8	4.0	2.3	4.0	99.4
Aug-13	0.110	1.8	2.0	1.7	2.0	99.7	2.3	3.0	2.0	2.0	99.5
Sep-13	0.131	2.3	2.5	2.6	3.0	99.5	2.8	3.5	3.3	3.5	99.2
Oct-13	0.150	2.1	2.5	2.8	3.5	99.5	2.4	4.0	3.3	6.0	99.3
Nov-13	0.192	2.4	3.0	3.8	4.0	99.2	2.9	4.0	4.9	6.0	99.0
Dec-13	0.205	3.1	6.0	4.4	7.0	99.1	3.8	6.0	5.2	6.0	98.8
Jan-14	0.182	2.0	2.0	2.8	4.0	99.4	3.4	5.0	4.8	6.5	99.0

	Average Flow (mgd)	BOD					TSS				
		Concentration (mg/L)		Load (ppd)		Removal (%)	Concentration (mg/L)		Load (ppd)		Removal (%)
		Monthly Average	Highest Weekly Average	Monthly Average	Highest Weekly Average		Monthly Average	Highest Weekly Average	Monthly Average	Highest Weekly Average	
Feb-14	0.325	2.8	5.0	7.5	13.0	98.8	3.6	6.0	10.5	18.5	98.7
Mar-14	0.284	2.4	3.0	5.3	8.5	98.9	4.0	6.0	8.4	13.5	97.9
Apr-14	0.170	2.0	2.0	2.6	3.0	99.3	2.1	3.0	2.6	3.5	98.8
May-14	0.140	2.6	4.0	2.7	3.5	99.1	4.8	8.0	4.7	7.0	98.1
Jun-14	0.103	2.2	2.6	1.8	2.0	99.5	3.8	4.8	3.1	4.0	99.1
Jul-14	0.094	2.3	3.5	1.5	2.0	100.0	4.7	10.5	2.8	5.0	98.8
Aug-14	0.101	2.6	4.1	2.1	3.6	99.4	3.2	4.8	2.6	4.2	99.1
Sep-14	0.091	2.3	3.2	1.7	2.7	99.6	2.9	4.5	2.1	3.1	99.5
Oct-14	0.112	2.1	2.2	1.8	2.8	99.6	1.8	3.0	1.4	2.0	99.6
Nov-14	0.195	2.1	2.4	3.3	5.7	99.3	2.6	4.3	4.5	10.3	99.1
Dec-14	0.253	3.1	4.0	8.5	23.5	98.8	3.8	8.0	13.1	46.0	98.6
Jan-15	0.181	2.6	4.0	4.3	8.5	99.0	3.8	5.8	6.1	12.7	98.3
Feb-15	0.167	2.1	2.3	3.2	6.3	99.2	3.7	4.5	6.1	13.9	98.9
Mar-15	0.149	2.2	2.7	2.6	3.8	99.4	2.5	3.5	2.7	5.8	99.3
Apr-15	0.118	3.4	7.2	3.2	6.9	99.2	3.1	5.5	2.8	5.3	99.3
May-15	0.094	3.4	7.0	2.7	5.1	99.4	2.9	5.5	2.3	4.0	99.3
Jun-15	0.106	2.2	2.5	1.7	2.0	99.7	1.4	2.3	1.0	2.0	99.7
Jul-15	0.115	3.8	5.1	6.6	4.9	99.7	3.6	6.0	3.4	5.7	99.2
Aug-15	0.131	3.2	5.9	3.6	6.4	99.6	3.9	8.3	4.3	8.9	99.2
Sep-15	0.134	2.2	2.8	2.3	2.9	99.7	2.9	5.5	3.1	6.0	99.6
Oct-15	0.135	2.8	3.3	2.9	3.3	99.7	4.8	6.0	5.0	6.2	99.1
Nov-15	0.243	3.2	7.0	10.8	35.5	99.1	8.7	24.5	34.3	126.7	97.4
Dec-15	0.401	2.5	3.6	10.6	26.3	98.3	4.1	4.5	15.0	33.3	97.7
Jan-16	0.254	2.0	2.0	4.0	7.0	98.5	3.0	4.0	6.0	8.0	97.3
Feb-16	0.262	5.0	4.0	10.0	8.0	97.3	5.0	5.0	11.0	9.0	96.3
Mar-16	0.238	9.0	19.0	23.0	62.0	95.9	15.0	36.0	39.0	122.0	93.5
Apr-16	0.131	8.0	13.0	8.0	14.0	98.8	57.0[a]	163.0[a]	69.0	198.0[a]	87.4
May-16	0.117	7.1	18.0	6.7	16.0	98.8	9.8	23.0	9.1	20.0	98.2
Jun-16	0.129	3.3	4.5	3.4	5.0	99.5	3.6	5.0	3.7	5.0	99.3
Jul-16	0.130	10.0	25.8	11.0	27.0	98.9	6.3	10.2	6.9	11.0	99.0
Aug-16	0.131	6.5	14.0	7.2	15.0	99.4	6.2	10.0	6.8	10.0	99.2
Sep-16	0.128	20.1	40.4	23.8	50.6	97.4	32.8[a]	53.8[a]	39.5	68.0	95.7
Oct-16	0.246	3.0	4.0	6.0	8.0	99.3	5.0	7.0	9.0	10.0	98.6
Nov-16	0.225	4.0	9.0	8.0	17.0	98.9	7.0	18.0	14.0	37.0	97.6
Dec-16	0.290	4.0	8.0	14.0	29.0	97.0	11.0	21.0	34.0	73.0	95.0

a. Failed to achieve permit requirement.

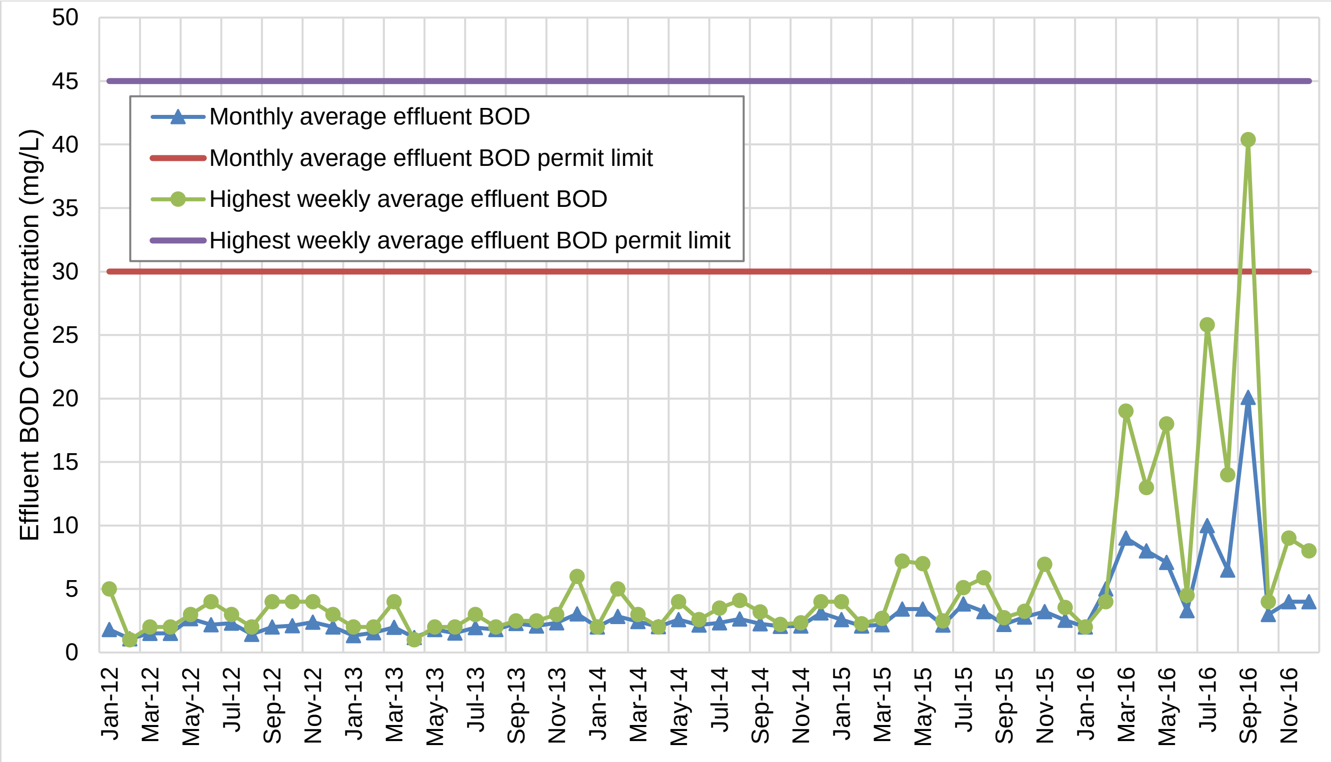


Figure 7-2. 2012-2016 Effluent BOD Concentration

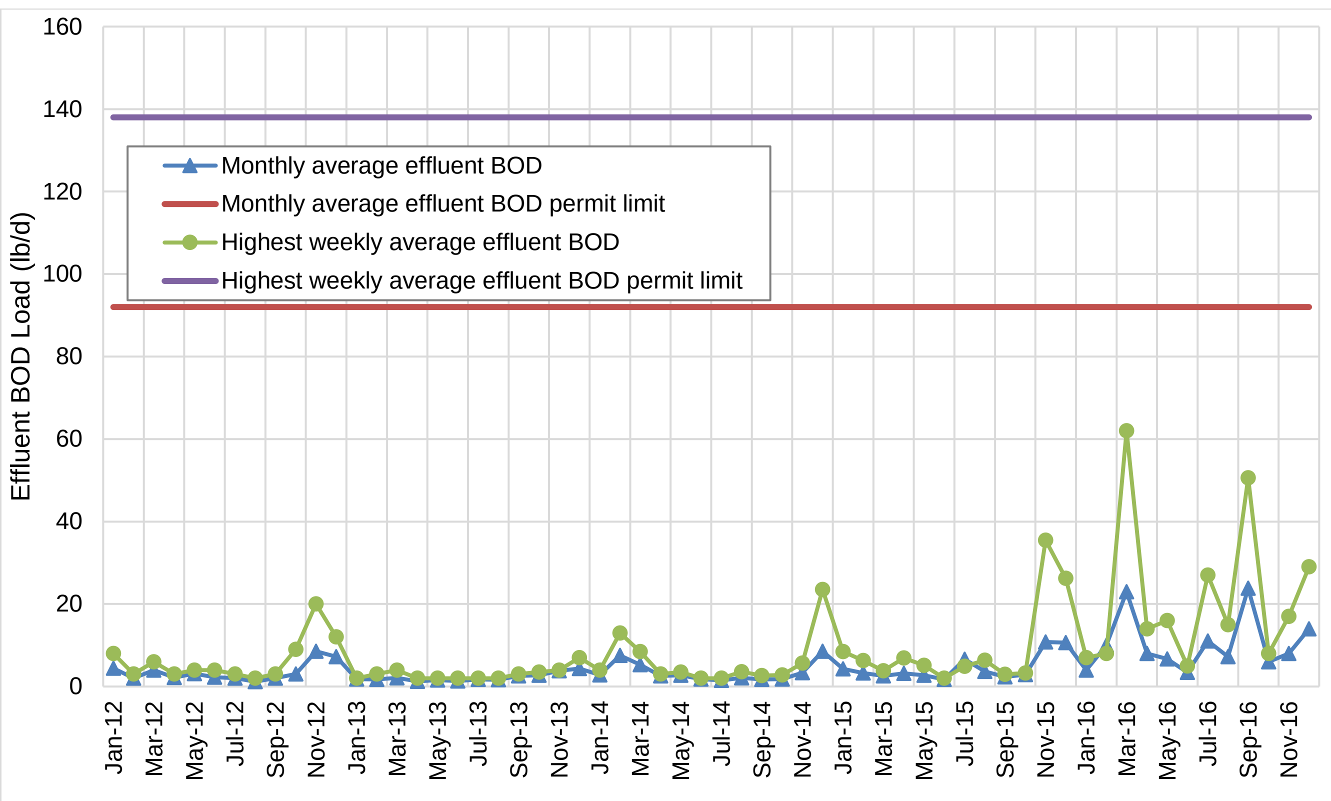


Figure 7-3. 2012-2016 Effluent BOD Load

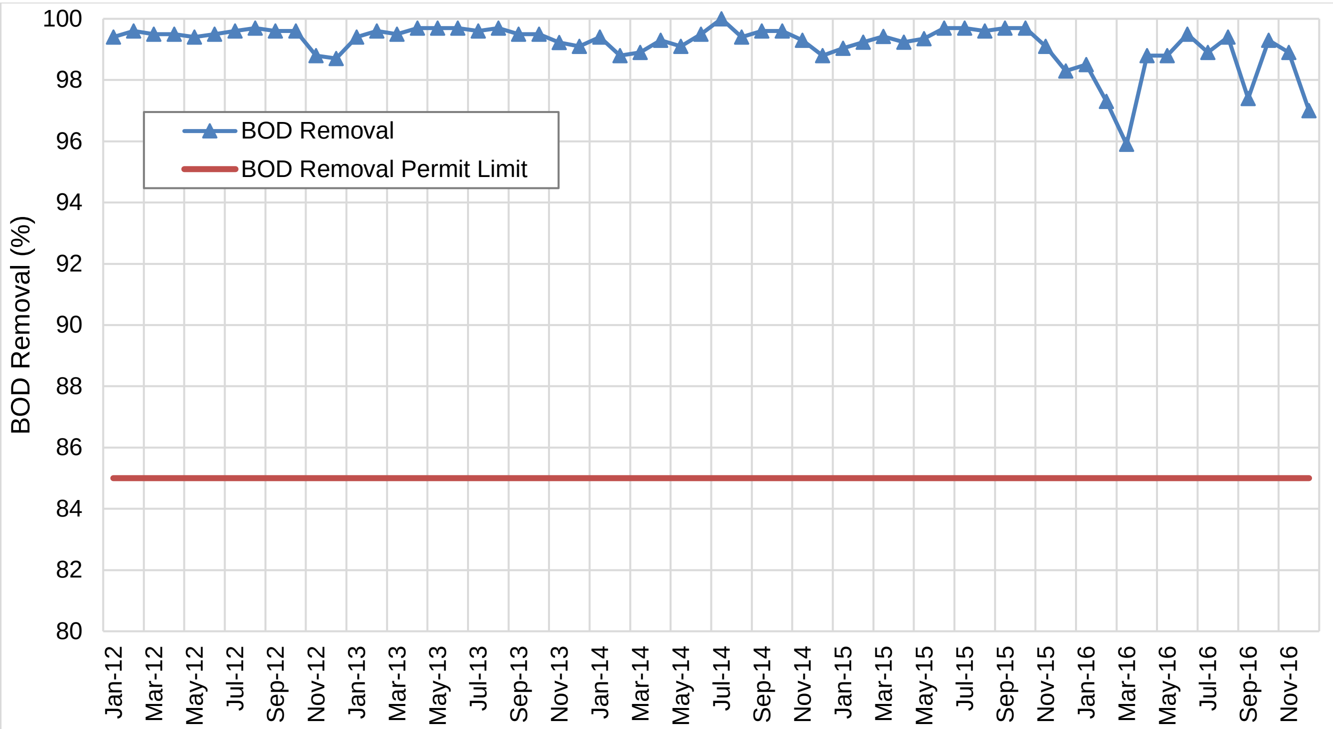


Figure 7-4. 2012-2016 Monthly Percent Removal BOD

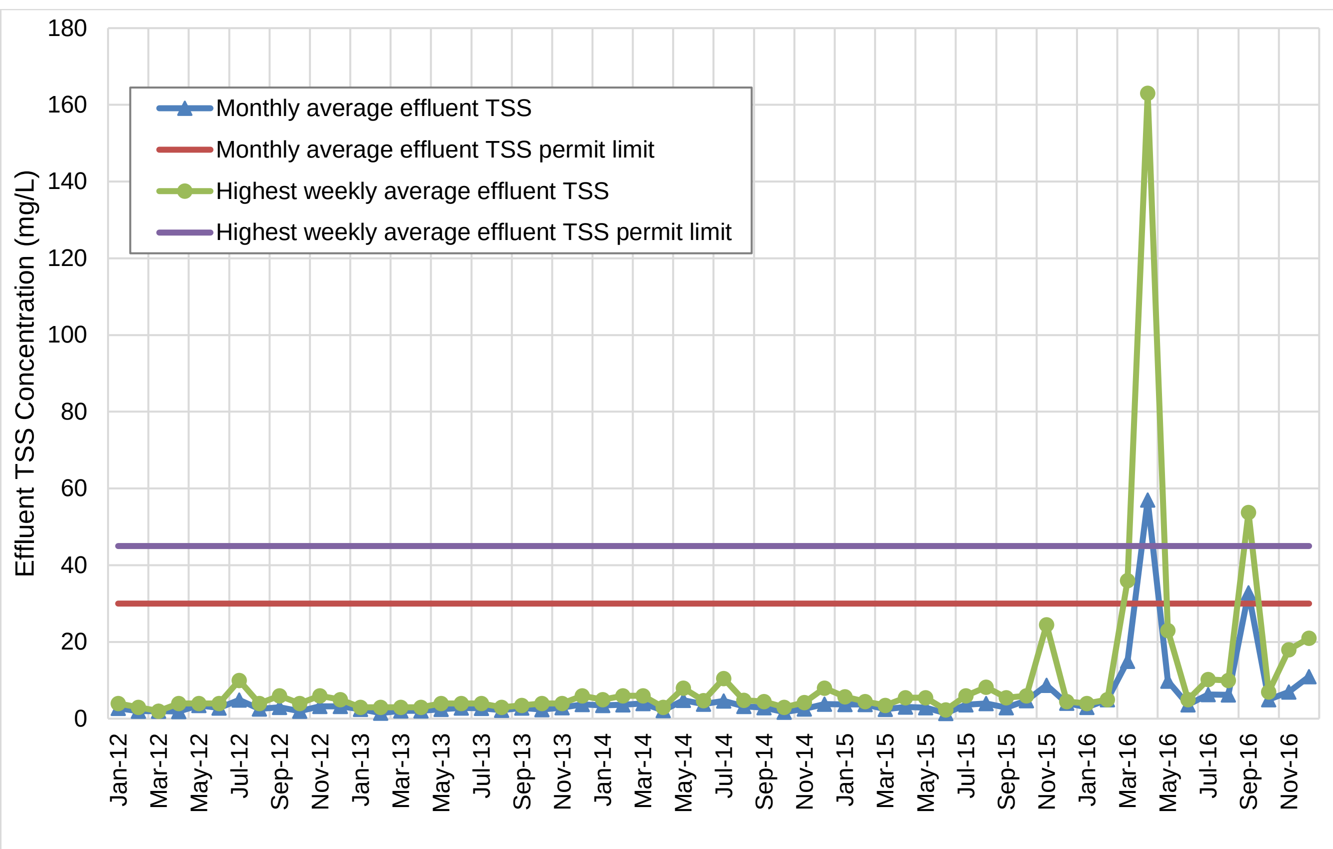


Figure 7-5. 2012-2016 Effluent TSS Concentration

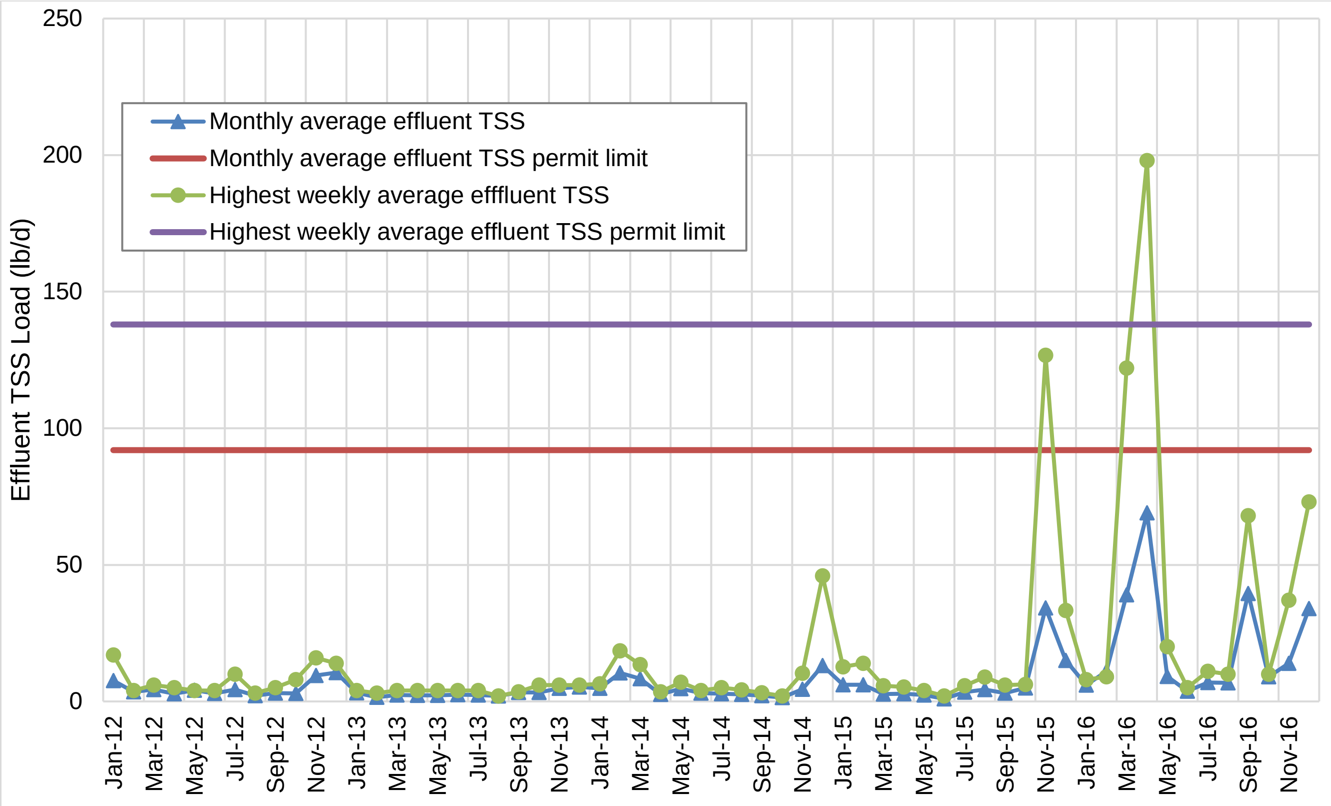


Figure 7-6. 2012-2016 Effluent TSS Load

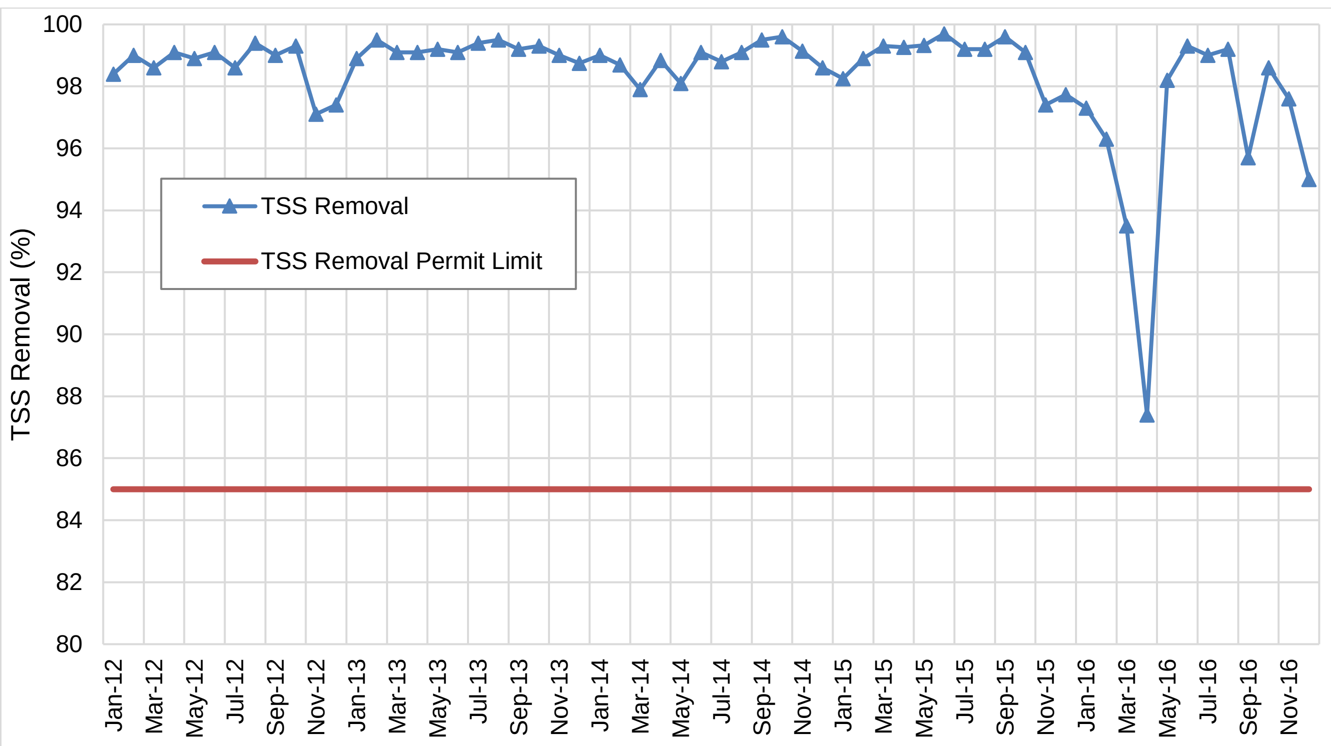


Figure 7-7. 2012-2016 Monthly Percent Removal TSS

The BOD and TSS permit requirements were met in all but the following months:

- Monthly average effluent TSS concentration, April 2016 and September 2016
- Highest weekly average effluent TSS concentration, April 2016 and September 2016
- Highest weekly average effluent TSS load, April 2016

The permit compliance issues in April 2016 are due to effluent TSS data from one day: April 18, 2016. WWTP performance for this day was otherwise normal, with typical influent flows and loads and typical BOD removal. However, the reported TSS removal for the day was 0 percent, which is so low as to indicate possible sampling or laboratory errors.

The permit compliance issues in September 2016 occurred because the RAS pumps failed to start after a power failure.

Fecal Coliform Bacteria

Fecal bacteria samples are collected and analyzed two times each week. Figure 7-8 shows WWTP records for effluent fecal coliform compared to the NPDES permit limit. The plant has met the permit limits consistently since 2012.

pH

Samples are collected and analyzed for pH every day. Figure 7-9 shows WWTP records for effluent pH compared to the NPDES permit limit. The plant has met the permit limits consistently since 2012.

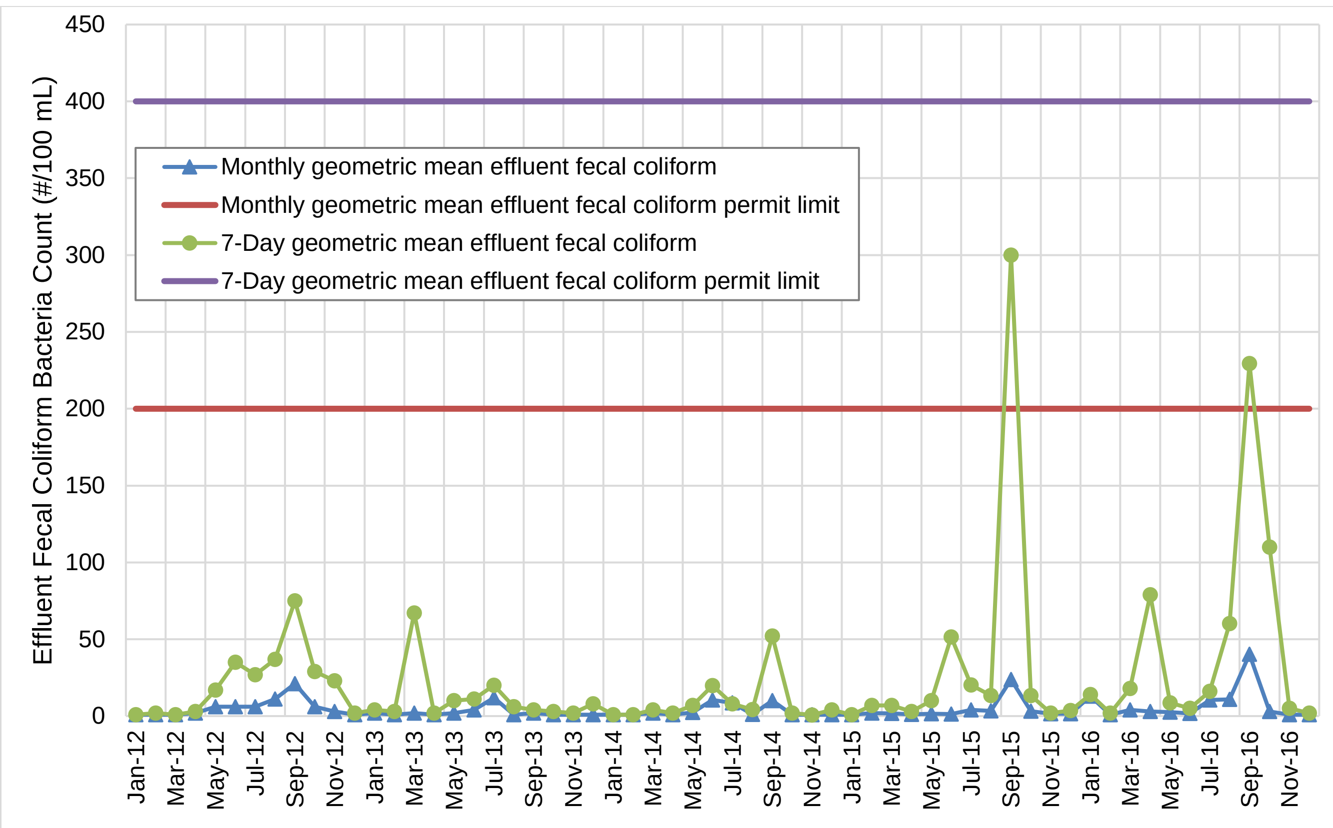


Figure 7-8. 2012-2016 Effluent Fecal Coliform Bacteria Count

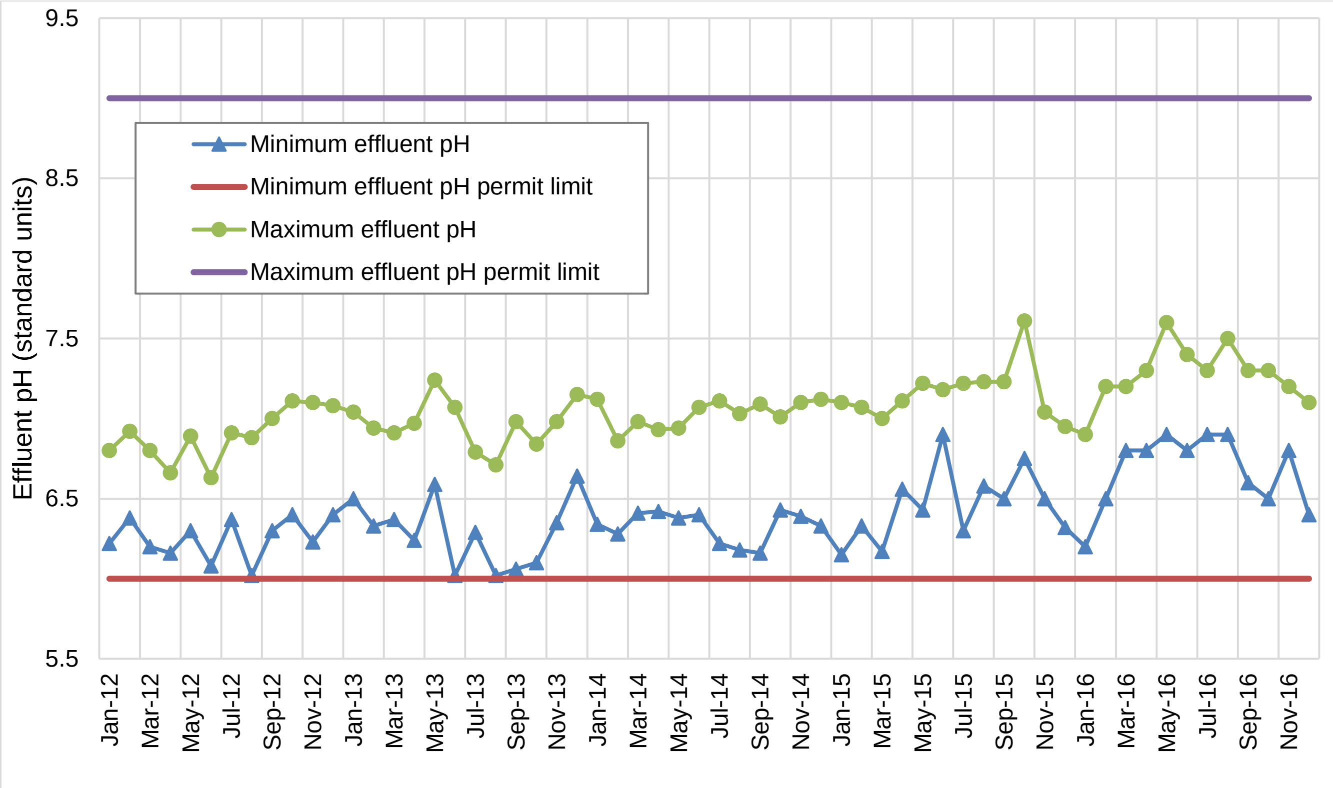


Figure 7-9. 2012-2016 Effluent pH

7.1.3 Notice of Violation and Compliance Schedule

The City received a Notice of Violation from Ecology on April 7, 2017. The City has submitted a Compliance Schedule to Ecology, to demonstrate the steps the City plans to take to expand the WWTP to maintain adequate treatment capacity. The City received an Administrative Order from Ecology, dated June 30, 2017. The Administrative Order includes six requirements that the City must meet in order to comply with the Administrative Order, including submitting this Draft General Sewer Plan and Wastewater Facilities Plan Update (as the Plan for Maintaining Wastewater Treatment Capacity) to Ecology by July 31, 2017.

7.2 LIQUID STREAM CAPACITY AND CONDITION EVALUATION

An analysis was performed to evaluate the ability of each unit process to satisfy Ecology design criteria and existing permit limits under existing and design year flows and loads. Reliability issues were also evaluated for some processes, along with the condition of equipment.

7.2.1 Overall WWTP Design Capacities

Hydraulic Capacity

The hydraulic capacity of the Stevenson WWTP is identified in the 1991 Facilities Plan and 1993 Operations and Maintenance Manual. Table 7-3 summarizes the hydraulic capacities indicated by these documents for the WWTP. The table also shows current flows based on monitoring data. The existing overall WWTP flows are below the plant's design capacity, but with expected steady growth in the City, the maximum-month and peak-day flows will soon exceed the design hydraulic capacity.

Table 7-3. Stevenson WWTP Hydraulic Capacity

Flow	Hydraulic Capacity	Existing Flows (2015-2016)[a]
Dry-Weather Average Flow	0.24 mgd	0.12 mgd (2015-2016)
Maximum-Month Flow	0.45 mgd	0.40 mgd (2015)
Peak-Day Flow	1.00 mgd	0.89 mgd (2015)
Peak-Hour Flow	1.50 mgd	Unknown[b]

a. Existing flows from historical Stevenson WWTP flow data (see Table 2-2).
b. Hourly flows are not available at the Stevenson WWTP.

Treatment Process Capacity

The 1991 Facilities Plan and 1993 Operations and Maintenance Manual also define overall treatment capacity for influent BOD and TSS. Table 7-4 compares these design capacities to reported WWTP influent loads. The existing overall Stevenson WWTP loads exceed the design capacity, as discussed in Section 7.1.1.

Table 7-4. Stevenson WWTP Treatment Process Capacity

Load	Treatment Process Capacity	Highest Reported Loads (2015-2016)[a]
Maximum-Month BOD Load[a] (ppd)	612 ppd	1,218 ppd
Maximum-Month TSS Load[a] (ppd)	612 ppd	866 ppd

a. Existing loads are highest observed loads in 2015 and 2016 (see Figure 7-1).

7.2.2 Influent Pump Station

Influent sewage is pumped from the Rock Creek and Fairgrounds pump stations to the WWTP headworks. See Section 4.1.2 for an evaluation of these pump stations.

7.2.3 Headworks

The headworks is designed to handle a 1.5-mgd peak influent flow through the automatic bar screen in the south channel. Although the headworks has not had capacity issues, it creates a hydraulic bottleneck for the treatment plant. The hydraulic capacity of the headworks would be difficult to expand because the structure has limited freeboard to carry more flow. It also is connected to the existing oxidation ditch, with no room to add a channel or route flows to additional secondary treatment facilities.

The headworks performs screening only and does not provide grit removal; all the grit in the raw wastewater passes through the headworks and either settles in the oxidation ditch or is pumped to the sludge holding tank. Experience has shown that grit does not create problems in mechanically aerated oxidation ditches such as used at the Stevenson WWTP. Based on measurements taken in December 2016, grit accumulations in the oxidation ditch are small, even though the ditch has not been emptied and cleaned out since it was built in 1992.

7.2.4 Oxidation Ditch

The existing oxidation ditch has not experienced hydraulic capacity issues and has generally performed well. The ability to waste sludge is limited by the solids handling facility's capacity issues (see Section 7.4). This is the primary operational issue for the oxidation ditch because it limits flexibility to manage the solids detention time and sludge settleability.

The physical structure of the oxidation ditch is in generally good condition, as are the mechanical components. However, the lack of redundancy prohibits the oxidation ditch from being drained for cleaning and maintenance below the waterline.

7.2.5 Clarifiers

According to Department of Ecology criteria for oxidation ditches, each clarifier should perform acceptably with peak-hour overflow rates up to 700 gallons per day per square foot, with MLSS up to 3,500 mg/L, and with a sludge volume index, which is a measure of sludge settleability, up to 150 mL/g.

Table 7-5 compares recent MLSS and sludge volume index to design criteria from the 1992 upgrade plans and the Ecology Orange Book. The clarifiers are operated below their design capacity and much higher sludge volume index for dry weather, maximum-month and peak-day conditions, and slightly above the peak-hour design capacity, as shown in Table 7-6 and Table 7-7.

Table 7-5. Clarifier MLSS Loading and Sludge Volume Index

	2012-2016 Conditions	Design Capacity[a]	Department of Ecology Criteria	
			Oxidation Ditch	Activated Sludge
MLSS (mg/L)	1,544-5,608	3,000	2,500–3,500	1,500–3,500
Sludge Volume Index (mL/g)	190-433	not specified	150	150

a. Design data shown on Sheet G3 in the construction drawings for the 1992 Wastewater Treatment Facilities Improvements

Table 7-6. Clarifier Hydraulic Loading Rates

	Influent Flow (mgd)		Loading (gallons/day/square foot)			
	2012-2016 Conditions	Design Capacity[a]	2012-2015 Conditions	Design Capacity[a]	Ecology Criteria	
					Oxidation Ditch	Activated Sludge
Dry-Weather Flow	0.15	0.24	78	125		
Maximum-Month Flow	0.42	0.45	218	234		
Peak-Day Flow	1.29	1.0	670	520		
Peak-Hour Flow	1.95 / 1.6[b]	1.5	1013 / 831	780	700	1,200

a. Design data shown on Sheet G3 in the construction drawings for the 1992 Wastewater Treatment Facilities Improvements
b. 1.95 mgd is the estimated combined flow to Rock Creek and Fairgrounds pump stations. Actual peak flows to the treatment plant are limited to the combined capacity of the two pump stations with all pumps running, approximately 1.6 mgd. Higher flows are stored in the sewers upstream of the pump stations as discussed in Section 4.1.2.

Table 7-7. Clarifier Hydraulic and Solids Loading Rates

	Influent Flow (mgd)		RAS Loading (pounds/day/square foot)				
	2012-2016 Conditions	Design Capacity[a]	2012-2016 Conditions[c]		Design Capacity[a]	Ecology Criteria	
			RAS @4000 mg/L	RAS @3000 mg/L		Oxidation Ditch	Activated Sludge
Dry-Weather Flow	0.15	0.24	5	4	6		
Maximum-Month Flow	0.42	0.45	15	11	12		
Peak-Day Flow	1.29	1.0	35	34	26		
Peak-Hour Flow	1.95 /1.6[b]	1.5	51 / 42	38 / 31	33	40	40

a. Design data shown on Sheet G3 in the construction drawings for the 1992 Wastewater Treatment Facilities Improvements
b. Estimated
c. RAS at 3,000 mg/L and RAS at 100% dry-weather flow, 100% maximum-month flow and 1 mgd @ peak-day flow & peak-hour flow

7.2.6 Disinfection

The UV disinfection system has performed well, but the standby chlorine contact chamber has not been used in years. A redundant UV reactor in a second channel would provide a more reliable standby capability, as it could be rotated into service regularly and with less operational complications than required to switch to the chlorine system.

7.3 EFFLUENT DISPOSAL ANALYSIS

The Stevenson WWTP outfall facilities include a primary outfall pipe ending in a single port diffuser in the Bonneville Pool of the Columbia River. A secondary outfall that discharges to Rock Creek can be used only under certain conditions described in the Stevenson NPDES permit: "Secondary Outfall may be used when the Primary Outfall is inoperative or during essential maintenance if the Permittee is working to restore the Primary Outfall at the soonest possible date." Given this requirement, the primary outfall to the Bonneville Pool must be used whenever it is operational.

The primary outfall pipe was extended by approximately 300 feet in 2013 following blockage of the existing outfall location by landslide deposits. The primary outfall is performing well, according to the 2013 Outfall Mixing Zone Study (see Appendix E). In future, an effluent pump station may be required to route flows to the receiving water body during future peak flow conditions.

7.3.1 Evaluation of Reclaimed Water Opportunities

Disinfected effluent could be reused onsite for washdown water and process water as needed. Other opportunities to use reclaimed effluent include:

- Irrigation of golf courses. However, the nearest golf course is Skamania Lodge Golf Course, which would require pumping reclaimed water nearly one mile. Skamania Lodge currently irrigates the golf course with well water.
- Irrigation of City parks. Rainfall is adequate (approximately 80 inches per year) so there is generally little demand for reclaimed water at City parks. The City has adequate water supply and water rights to irrigate parks. Due the scattered location of the City parks, the cost of installing a reclaimed water distribution piping network makes a reclaimed water system economically impractical.

7.4 SOLIDS FACILITIES ANALYSIS

There have been significant problems with the solids handling facilities at the treatment plant in recent years. The facilities are barely able to keep up with solids wasting needed for good performance of the liquid treatment process, and equipment limitations do not allow full use of the thickening facilities.

7.4.1 Solids Holding and Digestion

The converted Oxygest plant is used as a multi-chamber solids thickener, digester, and holding tank. The hydraulic capacity of the facility is generally adequate. The primary limitation on solids handling is the pump, as described below. The facility could otherwise produce more concentrated solids for disposal, increasing the operational capacity of the solids facility and thereby the secondary treatment facilities.

7.4.2 Solids Pumping and Thickening

Solids pumping to trucks for off-site disposal is currently conducted using P-2, one of the RAS/WAS transfer pumps. This pump cannot successfully pump solids with a total solids concentration greater than 2 percent; the typical percentage is reportedly 1.3 percent. In addition, the pumping configuration does not allow other pumps to be used for truck loading, providing no redundancy. A dedicated solids pump capable of pumping higher percent solids would allow the solids facilities to be used more efficiently.

A new sludge thickening facility would provide 6-percent solids consistently to the existing digester, so that it could meet the time and temperature requirements of the 40 CFR Part 503 Regulations (503 Regulations).

7.5 SUPPORT FACILITIES ANALYSIS

7.5.1 Enclosed Structures

The condition of the three main buildings at the plant is as follows:

- The laboratory/control building is original to the treatment plant. The building is nearly 50 years old and is showing signs of age. It is significantly undersized for the current plant and staff. During the next plant upgrade, a new laboratory should be considered to provide additional analytical capacity.
- The maintenance facility is original to the treatment plant. It is used for City vehicles and is not available for WWTP maintenance activities. During the next plant upgrade, new shop facilities should be considered to provide space for maintenance of WWTP equipment and vehicles.
- The pump building was constructed in 1992. The building is in good condition and sufficient in space for its current uses. However, the building does not have spare room for additional pumps and controls, which will be required when the plant is next upgraded. It is likely that an additional building, or expansion of the existing building, will be required at that time.
- The floor of the pump building is at elevation 87.0, 2 to 3 feet below the 89- to 90-foot draft 100-year flood elevations discussed in Section 7.7.2 of this report. The building and the mechanical and electrical equipment inside the building are protected from flooding by the flood wall described in Section 7.7.2. Future plant improvements should raise or relocate the electrical equipment above the 100-year flood to provide more reliable flood protection.

7.5.2 Flow Measurement and Sampling

The headworks includes a Parshall flume to allow for the installation of a flow recorder, which was never installed. If a new headworks is installed to accommodate additional secondary treatment, a flow recorder should be installed to allow more precise measurement of influent flow rather than using effluent flow as a proxy. The existing effluent flow meter in the UV channel is performing adequately, but may need to be replaced when the UV treatment facility is replaced or expanded.

The existing wastewater samplers need modifications to reliably obtain representative samples of treatment plant influent and effluent. Both collect time-composite samples rather than flow-proportional samples, and the influent sampler takes samples from the headworks channel whether the influent pump stations are running or not. These conditions result in unrepresentative samples. The influent sampler is within the Class 1, Division 2 hazardous (classified) zone, which extends 18 inches above the headworks.

7.5.3 Standby Power

The current standby power system is functional but should be upgraded during the next major WWTP upgrade. The existing 100-kW generator was installed in 1992 and is nearing the end of its expected service life. It should be replaced soon for reliable service.

The WWTP is assumed to be classified as a Reliability Class II facility as defined in Table G2-8 of the Orange Book, because its discharge “would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days).” In order to meet current Ecology and EPA standby power requirements for a Reliability Class II facility, a generator larger than the current one will be required so that operation of vital components can be maintained at a level sufficient to maintain biota.

7.5.4 SCADA

The SCADA system has extensive deficiencies:

- The main control panel was built in 1992 and is obsolete and needs to be replaced.
- A new alarm system is needed with more alarms, better alarm logs, callout features and remote access.
- More automation is needed to improve WWTP performance and reliability.
- New input/output blocks and programming are needed for the following processes:
    - Flow-proportional control of samplers
    - Oxidation ditch aeration control based on levels of dissolved oxygen and oxygen reduction potential
    - UV reactor flow pacing and on/off valves
    - Flow control for RAS and WAS pumping
    - Integration of existing pump controls
    - Influent and effluent flow meters
    - Better data management and logging.

7.6 OPERATION AND MAINTENANCE

Currently the WWTP is operated by CH2M contract operations. CH2M provides staff for operations and maintenance 3 to 4 hours per day, five days a week (approximately 0.4 FTE). The City provides WWTP operations staff on weekends, during the week as needed, for emergency response, and to assist with maintenance projects (approximately 0.3 FTE). The total WWTP operations staff from CH2M and the City is less than 1 FTE.

Liquid sludge is currently hauled by CH2M to the Hood River WWTP for treatment and disposal; labor for this is included in the FTE count above. Laboratory compliance samples are collected and transported to Hood River or The Dalles for testing. Laboratory sample transportation time is also included in the FTE count above.

In the event that WWTP influent characteristics exceed the design criteria shown in Section S4.A of the City’s NPDES permit (Prevention of Facility Overloading), CH2M is allowed 5 to 30 days to return the plant effluent to the characteristics required by the NPDES permit.

An operations assessment performed for this facilities plan considered two models to estimate current and projected staffing needs for the Stevenson WWTP:

- “Estimating Staffing for Municipal Wastewater Treatment Facilities” based on EPA Publication MO-1 dated March 1973. This model was determined to be outdated and did not include the type of equipment and treatment levels required at the Stevenson WWTP.
- “Northeast Guide for Estimating Staffing at Publicly and Privately Owned Wastewater Treatment Plants” from the New England Interstate Water Pollution Control Commission (NEIWPCC). This model was sufficient to estimate FTE requirements based on type of treatment and equipment in service.

The assessment found that the Stevenson WWTP is not staffed at recommended levels. According to the NEIWPCC guide, there should be approximately 2 FTEs assigned to an oxidation ditch WWTP with the equipment in the existing facility.

7.7 TREATMENT PLANT SITE ANALYSIS

7.7.1 Stormwater

Stormwater at the treatment plant is captured by catch basins and flows to the outfall facilities with no treatment.

7.7.2 Flood Protection

Ground elevation around the perimeter of the Stevenson WWTP site is more than 3 feet above FEMA's latest draft 100-year flood elevations, effectively providing a more than 3-foot high levee around the site. In 2009 the City constructed an emergency flood protection wall to the north and east of the WWTP site to protect the site from flooding in Rock Creek. The flood protection wall is constructed of precast concrete ecology blocks and includes provisions for a temporary timber wall to block Rock Creek Drive during flood conditions. Drawings for the flood protection wall indicate that the top of the wall will be at least 3 feet above the estimated 100-year flood elevation, meeting the requirements of Executive Order 13690.

The elevation of the lowest storm drain inlet grating in the driveway at the center of the WWTP site is about the same elevation as the 100-year flood, and the floor of the RAS pump building and old treatment plant equipment building are about 1 foot above the 100-year flood. Storm drains at the WWTP site have provisions to prevent backflow into the site during flood conditions.

The 1992 Stevenson Wastewater Facilities Improvements drawings were based on the City of Stevenson datum, which is 3.8 feet lower than the FEMA datum. To avoid confusion from the datum difference, the FEMA flood map is not included in this report.

7.7.3 Security

Site security is provided by a chain link fence around the site. All access gates remain closed and locked when a qualified operator is not on site. The primary access gate to the plant from Rock Creek Drive is left open when an operator is on site. Other access gates are opened when needed but are closed and locked when access is no longer needed. Treatment plant security has not been an issue.

7.7.4 Mitigation, Buffers and Aesthetics

The plant site has adequate buffering from the neighboring community as follows:

- To the south and west, the plant borders the Skamania County Fairground facilities.
- To the north, the plant is bordered by Rock Creek Drive and is largely out of view due to trees and elevation.
- To the east, the plant is bordered by Rock Creek.

The plant is visible from the County Fairground facilities but sheltered from the adjacent road. Aesthetic concerns at the site have not been reported.

8. TREATMENT IMPROVEMENTS

Based on the assessment of existing conditions and future requirements for the facilities at the Stevenson WWTP, alternatives were identified and evaluated for treatment improvements to ensure that the City can provide reliable wastewater treatment through the end of the planning period. The alternatives include facilities to pretreat high-strength commercial wastewater and facilities to improve equipment and operations at the Stevenson WWTP. They also include upgrades of existing facilities to accommodate redundancy requirements and operational issues, as well as upgrades to provide additional hydraulic, biological treatment and solids handling capacity. The improvements have been tailored to accommodate, wherever possible, continued use of the existing major facilities including the oxidation ditch, clarifiers, pump building, UV disinfection, outfall, solids holding tank and In-Plant Pump Station.

8.1 PRETREATMENT FACILITIES

In addition to low-strength wastewater discharged primarily by residential sewer users, significant amounts of high-strength wastewater are discharged by commercial sewer users in Stevenson, as discussed in Chapter 2. Pretreatment is needed for this wastewater so the Stevenson WWTP can operate reliably and effectively. Two groups of businesses discharge high-strength wastewater. One group includes 21 commercial kitchens at restaurants, hotels and schools; the other group consists of four beverage producers—two microbreweries, a distillery and a bottling business.

8.1.1 Commercial Kitchens

The City implemented measures to reduce high-strength wastewater from commercial kitchens several years ago. The City required installation of grease traps to reduce sewer discharges of fats, oils and grease (FOG) and settleable food solids. Also, the City requested that commercial kitchens voluntarily stop putting food waste in the sewer and dispose of it as solid waste instead. These measures significantly reduced BOD loads at the WWTP and provided sufficient control of commercial kitchen wastewater so the plant can operate successfully. Recently, one large commercial kitchen began treating its food waste in a small aerobic digester and discharging to the sewer. The City is evaluating whether this provides adequate reduction of BOD load discharged to the sewer. This facilities plan assumes that the City's existing measures, and possibly allowing on-site digestion of food waste, will provide sufficient control of commercial kitchen wastewater, and no additional pretreatment is needed.

8.1.2 High-Load Dischargers

Based on the fall 2016 industrial waste survey, the City's beverage producers discharge wastewater with BOD concentration approximately 6 times higher on average than normal domestic wastewater, and with significant variations in BOD, pH and temperature. The Stevenson WWTP successfully treated raw beverage wastewater with no pretreatment in the past when quantities were small. However, pretreatment is now needed because the beverage producers have grown and will continue to grow through the end of the planning period in 2040. Commercial dischargers of significant quantities of high-strength wastewater are referred to in this facilities plan as high-load dischargers. This facilities plan considers two levels of pretreatment for high-load wastewater:

- **Minimal Pretreatment**—This would provide the minimal pretreatment needed to prevent upsets at the Stevenson WWTP, and it relies on the Stevenson WWTP to treat most of the pollutants. The pretreatment facilities would include an aerated tank to equalize and aerate the high-load wastewater. The tank would be sized to hold about 2 days of peak high-load commercial wastewater flow. This is estimated to be 100,000 gallons, and the volume would be confirmed during preliminary design. This would eliminate extreme variations in BOD, pH and temperature that can upset the Stevenson WWTP and remove about 20 percent of the BOD. Wastewater would be conveyed to the aerated holding tank with a new pump station and force main.

- **Pretreatment to Domestic Strength**—This would provide pretreatment of wastewater from high-load dischargers to approximately the same strength as domestic wastewater so it would be as easily treated at the Stevenson WWTP as normal residential sewage. The pretreatment facilities would include screening, flow equalization, biological treatment, solids handling and disposal, and possibly chemical addition to adjust influent pH. This would remove about 85 percent of the BOD and suspended solids. Details on the pretreatment facilities are provided in Appendix F.

The actual level of pretreatment that is ultimately provided will be determined jointly by the City and the high-load dischargers based on cost effectiveness and other considerations. Table 8-1 summarizes flows and loads to be treated at the Stevenson WWTP with no pretreatment, minimal pretreatment or pretreatment to domestic strength. It is assumed for this facilities plan that no pretreatment will not be acceptable to the Washington Department of Ecology, since influent loading to the Stevenson WWTP currently needs to be reduced to comply with the City's NPDES permit. The actual level of pretreatment provided will be determined jointly by the City and beverage producers, with approval from Ecology, based on cost effectiveness and other considerations.

Table 8-1. Current and Projected Flow and Load Design Conditions

	Base (Dry Weather Average)			Maximum Month			Peak Day			Peak Hour		
Parameter	2016	2025	2040	2016	2025	2040	2016	2025	2040	2016	2025	2040
Flow (mgd)	0.135	0.168	0.200	0.460	0.539	0.657	1.30	1.46	1.71	1.96	2.19	2.56
BOD (ppd)												
No pretreatment	620	852	1,070	961	1,394	1,798	1,985	2,902	3,758	n/a	n/a	n/a
20% pretreatment	589	795	989	890	1,262	1,611	1,662	2,307	2,912	n/a	n/a	n/a
85% pretreatment	488	609	724	658	835	1,003	1,294	1,687	1,916	n/a	n/a	n/a
TSS (ppd)												
No pretreatment	477	656	823	787	1,093	1,380	2,052	2,663	3,240	n/a	n/a	n/a
20% pretreatment	453	612	761	744	1,014	1,267	1,980	2,531	3,052	n/a	n/a	n/a
85% pretreatment	376	469	557	605	757	901	1,825	2,245	2,646	n/a	n/a	n/a

Significant BOD loads from high-load commercial dischargers are new to Stevenson, and the City to date has performed only one industrial waste survey to measure these loads. More BOD data is needed in order to develop a better understanding of existing industrial dischargers' loadings and to better project future flows and loads.

Two alternatives were identified for improving the Stevenson WWTP. Alternative 1 provides WWTP improvements needed with minimal pretreatment of wastewater from high-load dischargers, and Alternative 2 provides WWTP improvements needed with domestic strength pretreatment of wastewater from high-load dischargers. The following sections describe the two alternatives.

8.2 WWTP ALTERNATIVE 1—IMPROVEMENTS WITH MINIMAL PRETREATMENT

Alternative 1 would include improvements needed at the Stevenson WWTP when minimal pretreatment is provided for high-load commercial wastewater. This alternative would replace the existing headworks with a new, larger headworks; modify the existing secondary treatment process by adding selector basins, expanded secondary treatment capacity and a third final clarifier; and add a second UV disinfection channel. The existing laboratory/control building would be replaced by a new laboratory and operations building. A new aeration building to house blowers and electrical equipment would be constructed. A preliminary site plan for Alternative 1B is shown in Figure 8-1.

8.2.1 Headworks

Under future flow conditions, the existing headworks configuration is not adequate to support the required process facilities. Required headworks functions include screening, flow measurement and flow split to two secondary treatment units (one existing and one new). Grit removal should ultimately be provided, but may not be required at this time. Because of configuration and siting constraints, it will not be possible to expand the existing headworks and provide all of these functions. The following sections assess headworks equipment for screening and grit removal.

Screening/Washing/Compacting Equipment

Recent developments in fine screen technology have led to the prevalent use of 6-millimeter fine screens as standard in the wastewater industry today. Fine screens with washers and compactors can produce a drier and cleaner material. Under EPA requirements, screenings must meet the paint filter test and so must be a drier material.

Screenings washing followed by compacting is frequently used to remove most of the organics from the screenings and then dewater the screenings in order to pass the EPA paint filter test, as required by federal regulations in 40 CFR 264.314 and 40 CFR 265.314. Several fine-screen units combine screening, washing, compacting and conveyance in a single piece of equipment.

Grit Removal

If installed, a grit removal system would be downstream of the screening units. The fine screens would remove the floatable material, debris and rags, which could otherwise wrap around the grit chamber mechanism and other downstream equipment, creating maintenance problems.

Grit removal is a physical separation process. Grit particles have higher densities, and therefore higher settling velocities, than organic particles. Grit removal devices are designed to allow grit to settle while most organic material remains in suspension. Aerated grit chambers, detritus tanks, and vortex grit chambers can all be used.

Aerated Grit Chamber

In a typical aerated grit chamber, air diffusers create a roll or agitation in the chamber to keep small organic particles in suspension while allowing grit to settle. Settled grit is conveyed to a hopper by gravity, with flow currents across a sloping channel floor. Grit is usually removed using air lift pumps. Provisions should be made for purging the grit hopper and pump suction line with high-pressure air or water to break up bridged grit prior to pumping.

The collected grit usually contains organic matter that must be washed, with the organics returned to the waste stream. A grit cyclone/classifier or similar equipment can be used, with the cyclone separating solids from the water stream and classifier to concentrate, wash and dewater the grit. Light organic and inorganic particles are carried over a weir at the back of the classifier and discharged to the treatment process.

Detritus Tank

The detritus tank is a constant-level sedimentation tank with a fairly short hydraulic retention time. The settled grit is scraped spirally toward a hopper by a rotating sweep arm. Detritus tanks require very low hydraulic loading to work efficiently, and thus require a larger footprint than aerated grit or vortex grit chambers. They were installed at many WWTPs prior to the 1990s, but appear to not perform as well as aerated grit and vortex grit chambers, which are currently the most common grit removal systems installed post-1990. For these reasons, detritus tanks were not considered further.

Vortex Grit Chamber

A typical vortex grit chamber consists of a circular basin to which flow enters tangentially. The vortex action causes particles to move to the center of the tank, settle and collect in a hopper. Velocity is maintained low enough to encourage grit settlement and high enough to maintain most organics in suspension to pass through the grit chamber. Air scour or water scour is usually provided at the hopper a few minutes prior to beginning grit pumping, to resuspend organics and break up bridged grit at the grit hopper.

Settled grit can be removed with an airlift pump or horizontal recessed impeller pump. Horizontal recessed impeller pumps, installed with flooded suction, are more reliable and effective in this application. The collected grit usually contains organic matter that must be washed, with the organics returned to the waste stream. A grit cyclone/classifier or similar equipment can be used, with the cyclone separating solids from the water stream and classifier to concentrate, wash and dewater the grit. Light organic and inorganic particles are carried over a weir at the back of the classifier and discharged to the treatment process.

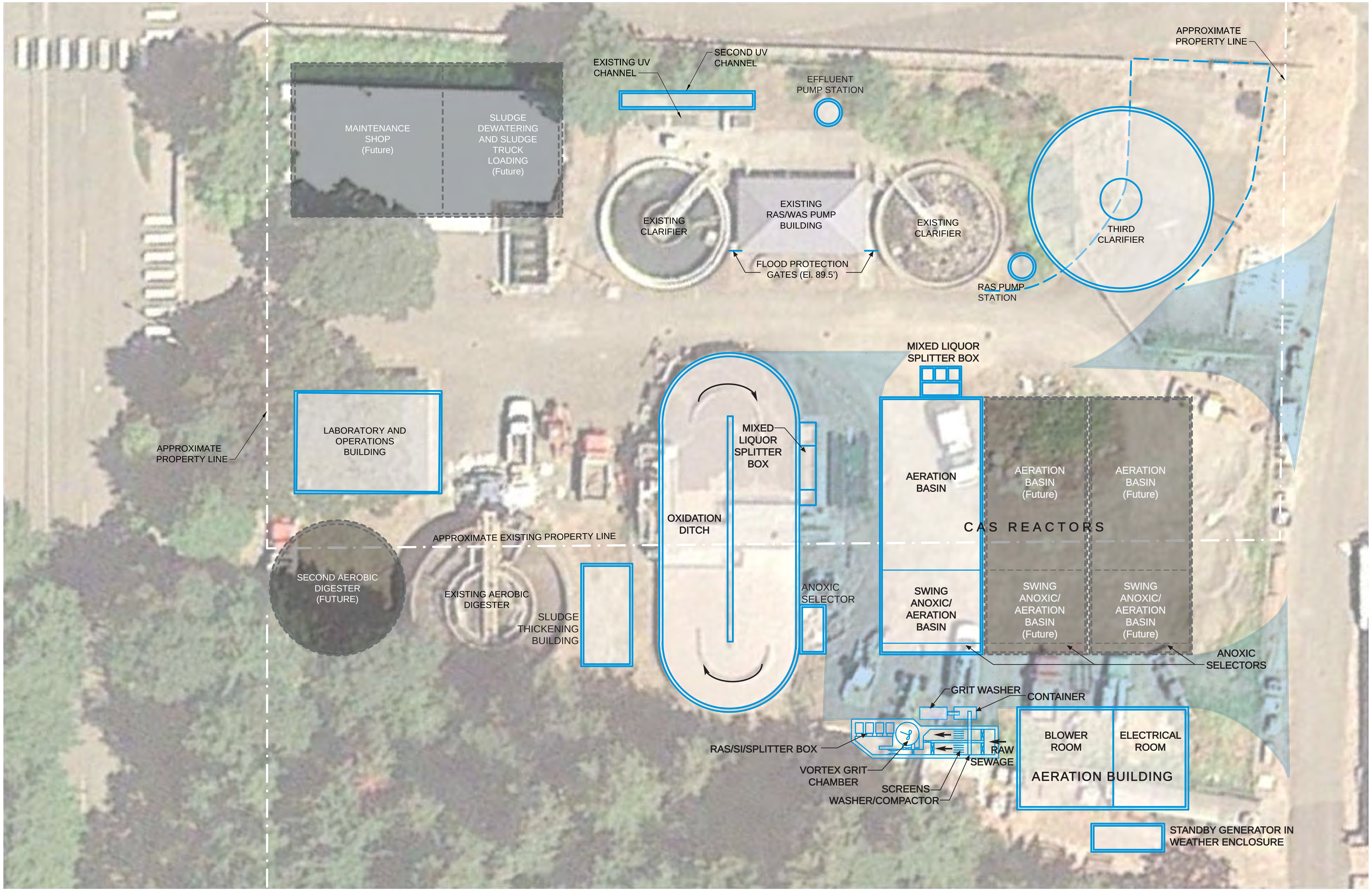
A vortex grit chamber with horizontal recessed impeller pump is preferred from a site footprint standpoint and is the most effective grit removal system compared to aerated grit or a detritus tank. Therefore, it is the system that is shown for the Stevenson WWTP alternatives.

Selected Headworks for Alternative 1

For this facilities plan, equipment costs and descriptions used in the headworks alternatives were based on fine screens and vortex grit removal for conventional activated sludge secondary treatment systems. Grit removal would not be needed for oxidation ditch systems for reasons described below (Alternative 1A – Expand the Existing Oxidation Ditch System). It is recommended that a final equipment evaluation and selection take place during the predesign phase.

Alternative 1 would include a new headworks to be constructed southwest of the existing oxidation ditch. The existing headworks, located on the north side of the oxidation ditch, would be abandoned. The new headworks facility would be designed to handle 2040 peak-hour flow of 2.56 mgd.

Significant yard piping would be required to route flows from the existing Fairgrounds Pump Station and the new Rock Creek Pump Station interceptors to the new headworks. The new headworks would include a junction box for these two interceptors, a new sampling station, and flow metering. A new screening facility would be equipped with one screening channel containing a 6-millimeter fine screen and an emergency bypass channel containing a manual bar screen.



LEGEND

- Initial Upgrades
- Future Upgrades
- New Access Road/Pavement
- Existing Driveway to Be Abandoned

N

0 7.5' 15' 30'

SCALE: 1" = 30'

Figure-8-1_Alt1B_NoPhasing.ai

TETRA TECH

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Portland, OR 97224

CITY OF STEVENSON, WA	Project No.: 135-48600-16001
GENERAL SEWER PLAN UPDATE	Date: OCTOBER 2017
WWTP IMPROVEMENTS ALTERNATIVE 1B	Designed By:
	Supplemental FIGURE 8-1

Bar Measures 1 inch

8.2.2 Secondary Treatment

Under future conditions with minimal pretreatment of high-load commercial wastewater, the single treatment train (existing oxidation ditch and clarifiers) would not be adequate to provide secondary treatment, and would not provide sufficient redundancy, so expansion is required. Higher-rate, more heavily loaded biological reactors would be needed to treat projected BOD loads and fit on the existing site. Additional clarifier capacity would be needed for higher flows. The following sections describe two options to address these treatment needs.

Comparison of Biological Reactors

Two parallel biological reactor trains are needed, as required for Class II reliability and redundancy requirements. Each train would be loaded at less than 20 pounds of BOD per 1,000 cubic feet and a food-to-microorganism ratio (F/M) of approximately 0.1 pounds of BOD per pound of mixed liquor volatile suspended solids (MLVSS) during maximum-month load conditions. This is normal loading for conventional activated sludge and approximately thirty percent higher than the 15 pounds of BOD per 1,000 cubic feet maximum-month design loading of the existing oxidation ditch. The higher loading rate is proposed for economy and because there is insufficient room on the site to use bioreactors loaded at only 15 pounds of BOD per 1,000 cubic feet. The higher loading rate will require more precise operation and control than has been required for the more forgiving, lower loading rate oxidation ditch.

Two options were considered, as described below. Because of the significant differences between these two options, the overall WWTP Alternative 1 has been divided into two alternatives based on which type of secondary treatment process is selected:

- Alternative 1A—Expand the Existing Oxidation Ditch System
- Alternative 1B—Existing Oxidation Ditch with Conventional Activated Sludge Reactor.

Alternative 1A—Expand the Existing Oxidation Ditch System

The existing oxidation ditch has enough volume and aeration capacity to serve as the aeration zone for one of the two required reactor trains. Both brush aerators in the existing ditch would be used to provide sufficient aeration capacity for the design BOD loads and provide Class II reliability in the event that one of the brushes fails. A second oxidation ditch would be constructed at the same size as the existing ditch (105 feet long, 41 feet wide and 15 feet deep). Two new anoxic selector tanks would be constructed external to the oxidation ditches. A submersible low head propeller pump would circulate mixed liquor between the anoxic zone tank and the oxidation ditch aerobic zone. The anoxic tanks would be 20 feet deep to minimize the tank footprint.

To achieve the proposed loading of less than 20 pounds BOD per 1,000 cubic feet and F/M of 0.1 pounds BOD per pound MLVSS, each reactor train would have a total volume of 310,000 gallons: a 300,000-gallon aerobic zone and a 10,000-gallon anoxic selector zone. The aerobic zone would provide carbonaceous BOD removal and nitrification, and the anoxic zone would function as a selector to improve sludge settleability and provide denitrification, alkalinity recovery and pH control.

Grit removal at the headworks could be deferred to a later construction phase, because recent measurements at Stevenson show that only a few inches of grit accumulated in the existing oxidation ditch since it was placed in service 25 years ago, in 1992.

As this facility planning effort progressed, it became apparent that the existing treatment plant site will have little space available for future expansions if the City builds more oxidation ditch biological reactors, which are limited to depths of 12 to 14 feet. Therefore, this option was not carried forward and Alternative 1B was developed with deeper biological reactor tanks and smaller footprints than oxidation ditches.

Alternative 1B—Existing Oxidation Ditch with Conventional Activated Sludge Reactor

This alternative would keep the existing oxidation ditch in operation and build a new conventional activated sludge (CAS) reactor. The new CAS reactor would have the same aerobic zone volume as the existing oxidation ditch—300,000 gallons—but would have a 20-foot side-water depth with about two-thirds the footprint of the 12-foot side-water depth oxidation ditch, minimizing the tank footprint on the small site. Space would be provided for two more identical CAS reactors that could be constructed in the future. The CAS reactors would use fine bubble aeration for more energy-efficient oxygen transfer; blowers would be installed in a new aeration building south of the new headworks.

Each CAS reactor would include a 10,000-gallon anoxic zone at the influent end of the tank. A 10,000-gallon anoxic selector would be constructed external to the existing oxidation ditch, to be operated in series with the oxidation ditch. Each selector tank would have a submersible mixer. A submersible low-head propeller pump would circulate mixed liquor between the CAS tank or oxidation ditch and the anoxic selector tank in each reactor train. Approximately one-third of the CAS reactor would serve as a swing anoxic/aeration basin, capable of functioning as either a mixed anoxic zone or an aerated zone, depending on aeration demand and controlled by SCADA in response to DO feedback from the CAS reactor. This functionality would conserve power and optimize treatment performance.

To achieve the proposed loading of less than 20 pounds BOD per 1,000 cubic feet and F/M of 0.1 pounds BOD per pound MLVSS, the new CAS reactor train would have a total volume of 310,000 gallons: a 300,000-gallon aerobic zone and a 10,000-gallon anoxic selector zone. The aerobic zone would provide carbonaceous BOD removal and nitrification, and the anoxic zone would function as a selector to improve sludge settleability and provide denitrification, alkalinity recovery and pH control.

Grit removal would be required at the headworks to ensure that the fine bubble diffusers would not be fouled by grit settling in the CAS tanks. Annual draining and cleaning of the CAS tanks would be required to inspect and service the diffusers and remove any grit that settles in the tanks.

The main advantage of CAS reactors is that they use deeper tanks with a smaller footprint, have higher treatment capacity for the given footprint, and use less energy. This alternative would have slightly higher capital costs and slightly higher operation and maintenance (O&M) costs than Alternative 1A. The energy savings provided by the fine bubble diffusers typically would not offset the added O&M cost for annual draining and cleaning and aerator servicing required for each CAS reactor, and for the grit removal system, which are not needed with oxidation ditches.

Selected Biological Reactor Process for Alternative 1

Alternative 1B would allow for more treatment capacity on the existing site and is therefore preferred over Alternative 1A. Therefore, no further assessment of Alternative 1A was performed.

Clarifiers

A new clarifier is needed to provide additional capacity for projected peak flows. The new clarifier would be 50 feet in diameter and have the same surface area as the combined area of the two existing clarifiers. This would provide clarifier loading rates well within Ecology's current clarifier loading guidelines for the projected flows at the plant through 2040. The loading rates would also be about 15 percent lower than the existing clarifier design loadings, making the plant easier to operate than the existing plant and ensuring regulatory compliance. RAS pumping for the new clarifier would be provided with two submersible pumps—one duty and one standby—in a wet well next to the new clarifier. This would meet Ecology Class II reliability and redundancy requirements, because the plant would still have 50 percent of the design capacity with the largest clarifier out of service. The existing flow splitter box would be modified or a new flow splitter box would be constructed to route flows to the three clarifiers.

8.2.3 Disinfection

Ultraviolet (UV) disinfection is a physical disinfection method, which uses light in the UV spectrum to disrupt microbial cell DNA, preventing replication. The germicidal wavelength is 254 nm, and low-pressure UV lamps have a high percentage of light output at this wavelength. UV disinfection has been used at the Stevenson WWTP since 1992. The plant's low-pressure, low-output UV system has proven to be a reliable, low-maintenance system.

Comparison of UV Equipment

There are three UV technologies currently on the market:

- Low-pressure, low output (LPLO)
- Medium-pressure, high output (MPHO)
- Low-pressure, high output (LPHO)

Table 8-2 summarizes characteristics of each of these systems.

Table 8-2. Available UV Technologies

UV Lamp Type	Input Power (W)	Efficiency %	Temperature ºC	Manufacturers
LPLO	65 to 80	35 to 38	60	Trojan, Calgon, Siemens, Ozonia (Suez)
LPHO	250 to 1000	38 to 40	110 to 130	Wedeco (Xylem), Trojan, Calgon, Ozonia (Suez), Siemens, Enaqua
MPHO	2,800 to 20,000	10 to 16	400 to 900	Aquionics, Calgon, Trojan

LPLO UV Systems

The Stevenson UV system is a Trojan UV3000 LPLO UV system, which does not have automatic cleaning. The Stevenson UV system has only one bank of UV lamps, with backup disinfection provided by the chlorine contact basin. This UV system is now in need of expansion, so more banks of lamps would be provided in order to meet the future peak-hour design flow rate. With more banks of lamps in operation, some banks can be offline during low flow periods, to optimize energy efficiency. This would create an issue with quartz sleeve fouling, since offline UV banks rapidly foul with biofilm, so would be fouled when brought back online. Other UV technologies are provided with automatic cleaning systems that maintain quartz sleeves in clean condition, so that when banks are brought online, they are in clean condition and ready for effective disinfection. Therefore, UV systems without automatic cleaning, including LPLO systems, were not considered further.

MPHO UV Systems

MPHO UV systems were introduced to the US in the mid-1990s. This type of lamp has a significantly higher output than low-pressure lamps, so fewer lamps are required. MPHO systems have automatic cleaning systems for quartz sleeves. However, this type of lamp uses 3 to 3.5 times the power of LPHO or LPLO systems to deliver an equivalent dose. Although MPHO systems compete well against LPLO and LPHO systems on a capital cost basis, power costs are significantly higher. Labor costs appear to be higher as well, based on data from operating installations. Over a 20-year life, MPHO has a higher overall cost (capital plus O&M) compared to LPLO or LPHO, so it is the worst option based on life cycle cost. There are also redundancy issues associated with smaller installations, such as at the Stevenson WWTP. Therefore, this technology was not considered further.

LPHO UV systems

LPHO UV systems were introduced to the US in the late 1990s. This type of lamp has an output higher than LPLO lamps and lower than MPHO lamps. This is the highest efficiency of the available technologies and is generally the most cost-effective, reliable technology. This technology is the current state of the art and is therefore selected for the UV facility expansion at the Stevenson WWTP.

Selected Disinfection Process for Alternative 1

A second UV channel would be constructed parallel to the existing UV channel, with upstream Parshall flumes providing flow split and flow measurement. The existing UV channel would be retrofitted with two banks of LPHO UV lamps and the second UV channel would also contain two banks of LPHO UV lamps. This would provide the required level of reliability and redundancy for disinfection.

8.2.4 Effluent Pumping

Under normal conditions, effluent could flow by gravity to discharge through the WWTP's primary outfall at the Bonneville Pool of the Columbia River. The plant's NPDES permit requires that this outfall be used (rather than the secondary outfall) whenever it is operational (see Section 7.3). The City's 2013 extension of the primary outfall was designed to accommodate a peak flow of 2.1 mgd, according to Gray & Osborne's 2013 *City of Stevenson Emergency Outfall Work Preliminary Engineering Report*. Therefore, effluent pumping will be needed for peak flows greater than 2.1 mgd.

At a new effluent pump station included in this alternative to accommodate high peak flows, two 15-horsepower effluent pumps would be provided, one duty and one standby. Effluent would be conveyed by gravity from the disinfection facilities to the effluent pump station. An 8-inch force main would connect the effluent pump station to the existing outfall pipeline.

8.2.5 Biosolids Management

Sludge Thickening and Digestion

The converted Oxygest plant is used as a multi-chamber solids thickener, aerobic digester, and holding tank. A new sludge thickener would be provided that would send sludge at 6-percent total solids to the digester. This would increase the solids loading capacity of the existing aerobic digester so that it would meet the time and temperature requirements of federal 503 Regulations to produce Class B biosolids through 2040.

The existing aerobic digester has adequate volume for this practice, but the following improvements would be needed for sludge thickening, aeration and pumping:

- Refurbish the existing aerobic digester, including new partition walls and a new aeration diffuser system with increased oxygen transfer efficiency.
- Construct a new solids thickening building. This building would house two new mechanical thickeners by 2040, along with associated pumps and a polymer system.
- Install a new mechanical thickener (assumed to be a rotary drum thickener) to thicken raw waste sludge to concentrations up to 6 percent and achieve 3-percent solids concentration after volatile solids destruction in the digester.
- Provide two waste sludge pumps to feed thin waste sludge to the thickener from a raw sludge holding chamber in the solids holding tank.
- Provide two thickened sludge pumps to convey thickened sludge to the aerobic digester.
- To provide air to the aerobic digester over a range of operating depths, install two new blowers in the blower room of the new aeration building south of the new headworks.

The mechanical thickening system would increase the concentration of sludge in the aerobic digester instead of continuing to use gravity thickening in the solids holding tank. This would improve performance of the secondary treatment and aerobic digestion facilities. It would eliminate recycle of decanted supernatant with poor settling sludge from the aerobic digester to the secondary treatment process, which can adversely impact sludge settleability. It would increase the solids detention time and volatile solids destruction in the aerobic digester, would produce Class B biosolids, and would reduce the mass and volume of sludge hauled to Hood River or Vancouver.

Biosolids Disposal

Two biosolids disposal options were evaluated, both using Class B biosolids:

- Haul liquid Class B biosolids to a neighboring WWTP for disposal.
- Haul dewatered Class B biosolids to land application site.

Haul Liquid Class B Biosolids to Neighboring WWTP

This alternative would continue the existing solids handling practice of hauling liquid Class B biosolids to the Hood River WWTP for further digestion and land application. The City contract operators have been hauling liquid sludge to the Hood River WWTP for a number of years. Recently, Hood River staff stated that the Hood River plant has a digester out of service (in need of cleaning) and is limited in its solids storage capacity and land application sites. Therefore, Hood River cannot accept more than two trucks of solids (10,000 gallons) per week. The City of Stevenson has contracted with the City of Vancouver through 2018 to allow Stevenson's sludge to be hauled to the Vancouver Westside WWTP for incineration if Hood River is unable to accept sludge.

Haul Dewatered Class B Biosolids to Land Application Site

This option was developed as a theoretical exercise to assess whether it is worth considering dewatering at the Stevenson WWTP. In order to use land application to agricultural land as the end disposal method for solids, the City would need to either buy its own biosolids hauling trucks (and possibly land application equipment) or hire a contract hauler to haul biosolids to agricultural land for land application. This option assumes the use of a contract hauler. It would include construction of a dewatering facility at the WWTP, since hauling dewatered biosolids at 20-percent total solids rather than liquid sludge at 3-percent total solids would reduce the number of trips by 85 percent. The dewatering facility would include sludge feed pumps, one screw press, screw conveyors and a drive-through truck loading station. The screw press is included because it can operate unmanned around the clock.

Stevenson is surrounded by steep forested slopes to the north, east and west, and the Columbia River borders the City to the south. There are no agricultural areas within a 20-mile radius of the City. This option assumes a round-trip hauling distance of 120 miles to the Dallesport/Goldendale area, where there is significant agriculture. The City has not yet begun searching for farmers willing to accept Class B biosolids for land application.

Comparison of Biosolids Disposal Options

Table 8-3 compares estimated costs of the two biosolids management options. Hauling liquid Class B biosolids to neighboring WWTPs has lower present worth costs than constructing a dewatering facility and hauling dewatered biosolids to agricultural land.

Table 8-3. Planning Level Biosolids Disposal Cost Comparison

Component	Capital Project Cost	Annual O&M Cost [b]	20-Year Present Worth
Haul Liquid Biosolids to Neighboring WWTP	n/a[a]	$176,865	$3,128,000
Haul Dewatered Biosolids to Land Application Site	$1,869,000	$105,518	$3,735,000

a. Capital costs are relative and include only those costs that are different between the two disposal options. All capital improvements required for hauling liquid biosolids are also required for hauling dewatered biosolids, so the relative capital cost for this option is zero.

b. O&M costs are relative and include only those costs that are different between the two disposal options. For liquid biosolids, the only O&M costs are for hauling and tipping fees, while for dewatered biosolids the O&M cost also includes labor and power costs for the additional dewatering equipment.

Selected Biosolids Process for Alternative 1

Hauling liquid Class B biosolids to neighboring WWTPs is the approach the City of Stevenson has been using for more than 20 years. It is more cost-effective than dewatering and hauling biosolids to agricultural land. Therefore, the selected biosolids management alternative is to haul liquid Class B biosolids to neighboring WWTPs.

8.2.6 Support Facilities

The support facilities category includes the following facilities that are essential to plant operations:

- New laboratory and operations building
- New aeration building
- New electrical and control facilities, including a new standby generator and SCADA facilities
- Maintenance shop.

Laboratory and Operations Building

The existing laboratory/control building would be demolished and a new laboratory and operations building would be constructed in its place. The operations area would include one office and one control room. The laboratory would be sufficient for process control testing. Samples taken for compliance monitoring would be sent to an outside laboratory, such as Pixis.

Aeration Building

A new building would be constructed south of the new headworks to house blowers for the CAS reactors and the aerobic digesters, as well as electrical equipment.

Electrical and Control Facilities

Existing WWTP electrical and control facilities would be modified as follows:

- A new service entrance and transformer would provide power for expanded plant facilities.
- A new larger generator would be located along the west property border, to replace the existing standby generator. The new generator would be provided with a prefabricated outdoor weatherproof enclosure.
- New MCCs would be located in the pump building generator room.
- A new SCADA control system would be provided, including new control panel and operator workstation in the operations building and remote SCADA access from City Hall and potentially from the Hood River WWTP (for contract operators to monitor the Stevenson WWTP).

Maintenance Shop

The existing maintenance facility would remain in its present location. A new maintenance shop may be built at that location sometime after 2040, to be used for equipment and treatment plant vehicle maintenance.

8.2.7 Flood Protection

Ground elevation around the perimeter of the Stevenson WWTP site is more than 3 feet above FEMA's latest draft 100-year flood elevations, effectively providing a more than 3-foot high levee around the site. The ecology block walls on the north and east sides of the site provide even higher flood protection from high water levels in Rock Creek. The elevation of the lowest storm drain inlet grating in the driveway at the center of the WWTP site is about the same elevation as the 100-year flood, and the floor of the RAS pump building and old treatment plant equipment building are about 1 foot above the 100-year flood. Treatment plant improvements to mitigate flood risk include the following items:

- Install flood stop-log gates at the existing RAS pump building doors. The floor of the building is currently at elevation 87 feet, about 1.2 feet above the 100-year flood elevation.
- Raise the top of the existing in-plant pump station wet well by approximately 3 feet, to meet flood standards. Currently the top of the wet well is at elevation 85.8 feet, about the same elevation as the 100-year flood.
- Add check valves and/or gates on the storm drain and emergency effluent outfalls to prevent backflow into the plant site from Rock Creek during flood conditions.
- Use portable pumps to bail rain water from the low point in the stormwater system when it cannot drain by gravity to Rock Creek during flood conditions.
- The new laboratory and operations building would be constructed at the appropriate elevation to meet flood protection standards. If the project is constructed in phases, the new laboratory and operations building may be deferred to the second phase. For the first phase, a new interim office in the RAS pump building generator room would be provided, with a computer control station, laboratory sink and countertop, instead of flood-proofing the existing office in the original treatment plant equipment building. The original building has light duty stud construction and cannot be readily flood protected with stop logs at the entry doors.
- Use blowers in the proposed new blower building to aerate the aerobic digester instead of flood-proofing the old digester blowers in the original equipment building.
- Use neighboring restrooms during flood conditions instead of flood-proofing the restroom in the original equipment building.

8.3 WWTP ALTERNATIVE 2—IMPROVEMENTS WITH PRETREATMENT TO DOMESTIC STRENGTH

Alternative 2 would include improvements needed at the Stevenson WWTP if pretreatment is provided to reduce high-strength commercial wastewater from high-load dischargers to normal domestic strength. This alternative would replace the existing headworks with a new larger headworks, improve the secondary treatment process by adding selector basins, a second oxidation ditch and a third final clarifier, and add a second UV channel. The existing laboratory/control building would be replaced by a new solids handling/blower building. The existing maintenance facility would be relocated offsite, and a new operations/laboratory/shop facility would be provided at the former location of the maintenance facility. A preliminary site plan for Alternative 2 is shown in Figure 8-2.

8.3.1 Headworks

Under future flow conditions, the existing headworks configuration is not adequate to support the required process facilities. It would require screening, grit removal, flow measurement and flow split to two future oxidation ditches (one is existing). Because of configuration and siting constraints, it would not be possible to expand the existing headworks and provide all of these functions.

Alternative 2 would include a new headworks to be constructed along the west side of the WWTP, similar to that described for Alternative 1, but without grit removal. Space would be provided for future construction of a grit removal system. The existing headworks would be abandoned. Equipment costs and descriptions for this headworks alternative are based on 6-mm fine screens. Because Alternative 2 includes an oxidation ditch secondary treatment system, construction of the vortex grit chamber could be deferred to a later time.

8.3.2 Secondary Treatment

Like Alternative 1, Alternative 2 requires additional biological reactor capacity and a third clarifier for existing conditions and future conditions through the end of the planning period. However, because of the assumed higher level of pretreatment resulting in a significantly lower BOD load to the WWTP, sufficient additional biological reactor capacity could be provided by adding a second oxidation ditch similar to the existing ditch. The ditches would have capacity for 1,222 ppd BOD if loaded at 15 ppd BOD per 1,000 cubic feet and a 0.095 F/M ratio like the existing ditch. They would have 219 ppd BOD reserve capacity in 2040. A lower level of pretreatment (62-percent BOD removal rather than 85-percent removal) would load the ditches to full capacity by 2040.

The two ditches would function like the original ditch, with one duty brush aerator and one standby brush aerator per ditch. An aerobic zone would extend about 75 percent of the way around each ditch downstream of the aerator, and an anoxic zone would extend about 25 percent upstream of the aerator. The second oxidation ditch would be located next to the existing ditch, preserving room on the site to add a third ditch and separate anoxic selector tanks if needed, as shown for Alternative 1A.

A new clarifier, RAS pumps and a flow splitter box would be provided to increase capacity for existing and projected peak flows, the same as for Alternative 1.

8.3.3 Disinfection

Disinfection for Alternative 2 would be the same as for Alternative 1.

8.3.4 Biosolids Management

Biosolids management for Alternative 2 would be the same as for Alternative 1, with liquid biosolids hauled to a neighboring WWTP, except that the sludge thickener and pumps would have smaller capacity, because waste sludge quantities would be less for the oxidation ditch process (which has a longer SRT) than for the CAS reactor process.

8.3.5 Support Facilities

The support facilities for Alternative 2 would be the same as for Alternative 1 except the new power supply and generator would be smaller and fewer new MCCs would be needed.

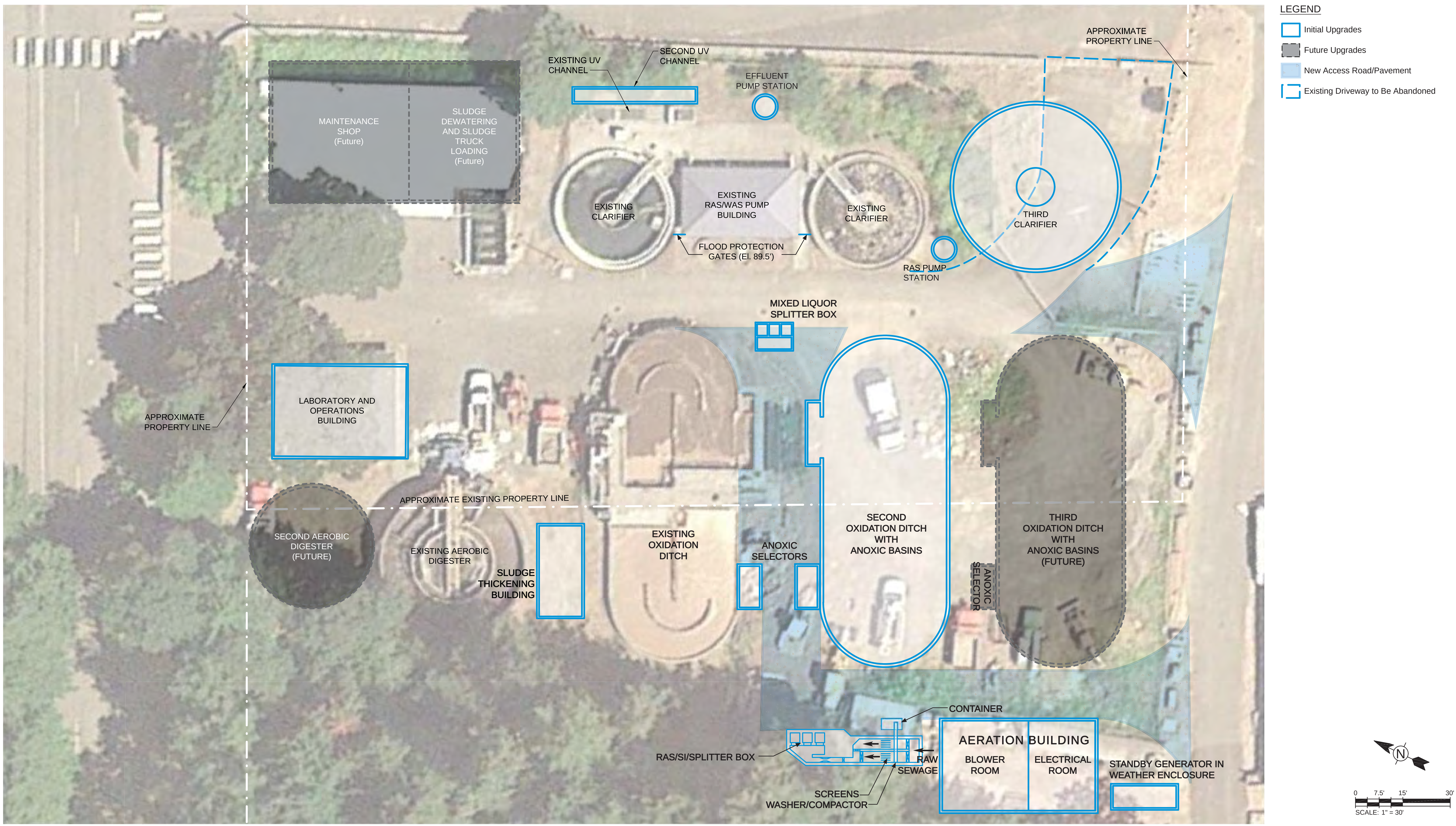

Figure-8-2_Alt2.ai

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CITY OF STEVENSON, WA

GENERAL SEWER PLAN UPDATE

WWTP IMPROVEMENTS
ALTERNATIVE 2

Project No.: 135-48600-16001
Date: NOVEMBER 2017
Designed By:

Supplemental

FIGURE 8-2

Bar Measures 1 inch

8.4 COMPARISON OF ALTERNATIVES

8.4.1 Life-Cycle Cost Comparison, Alternatives 1B and 2

Table 8-4 presents planning level capital cost estimates, annual O&M costs, and 20-year present worth costs for Alternatives 1B and 2. A detailed cost estimate by work item is included in Appendix I. The total cost shown includes only the improvements at the Stevenson WWTP; the pretreatment improvements are expected to have different funding sources and mechanisms. This is a Class 4 cost estimate as defined by the Association for the Advancement of Cost Engineering International. These costs represent planning level cost estimates in 2017 dollars and should be considered accurate in the range of +50 to –30 percent.

Table 8-4. Planning Level Alternatives Capital Cost Comparison

Component	Capital Project Cost		Annual O&M Cost		20-Year Present Worth	
	Alt 1B	Alt 2	Alt 1B	Alt 2	Alt 1B	Alt 2
Pretreatment Improvements at Other Locations						
High-Load Commercial Pretreatment	$711,000	$2,444,000	$10,021	$70,078	$888,000	$3,683,000
Stevenson WWTP Improvements						
Headworks	$1,870,000	$1,037,000	$43,573	$37,844	$2,829,000	$1,706,000
Secondary Treatment	$4,714,000	$5,126,000	$107,667	$133,330	$7,098,000	$7,148,000
Disinfection	$1,090,000	$1,090,000	$23,411	$23,411	$1,504,000	$1,504,000
Solids Handling	$1,066,000	$884,000	$155,040	$163,141	$5,636,000	$3,770,000
Support Facilities	$3,084,000	$3,084,000	$75,269	$75,269	$8,390,000	$8,611,000
Flood Protection	$202,000	$202,000	$1,507	$1,507	$229,000	$229,000
Effluent Pumps	$576,000	$576,000	$7,004	$7,004	$700,000	$700,000
WWTP Mgt Tasks			$62,400	$62,400	$1,103,687	$1,103,687
Lab Labor			$93,600	$93,600	$1,655,531	$1,655,531
Pretreatment Program Labor			$62,400	$62,400	$1,103,687	$1,103,687
WWTP Total (excluding Pretreatment)	$12,602,000	$11,999,000	$631,870	$659,907	$30,248,906	$27,530,906

8.4.2 Qualitative Comparison, Alternatives 1B and 2

Alternatives 1B and 2 are qualitatively similar except as follows:

- Alternative 1B would provide higher treatment capacity at the existing WWTP site.
- Alternative 1B would provide treatment capacity for higher influent loads, which would allow for smaller pretreatment facilities offsite. This means that the existing waterfront building, where three of the high-load commercial facilities are located, would have minimal visual and odor impacts from pretreatment facilities.

8.4.3 Overall Comparison and Recommendation

Capital costs of the two alternatives are within 12 percent of each other, which is within the margin of error for the cost estimates. The 20-year present worth costs are within 13 percent of each other.

It is important to plan for the higher treatment capacity at the existing WWTP provided by Alternative 1B. This alternative also allows for smaller pretreatment facilities, particularly at the waterfront building. It is also important to maintain Stevenson waterfront aesthetics, particularly from a visual and odor standpoint.

Therefore, Alternative 1B is the recommended alternative.

8.5 POTENTIAL PHASING OF RECOMMENDED ALTERNATIVE

A phasing plan was investigated as a potential way to reduce initial construction costs for recommended Alternative 1B. Figure 8-3 shows the layout for this phased approach. Table 8-5 summarizes the estimated capital costs for each phase. A table of design criteria for the two phases is provided in Appendix K.

Table 8-5. Estimated Costs for Phased Project Implementation

Component	Capital Project Cost	
	Alt 1B, Phase 1	Alt 1B, Phase 2
Pretreatment Improvements at Other Locations		
High-Load Commercial Pretreatment	$711,000	$0
Stevenson WWTP Improvements		
Headworks	$1,870,000	$0
Secondary Treatment	$2,230,000	$2,484,000
Disinfection	$1,090,000	$0
Solids Handling	$1,066,000	$0
Support Facilities	$1,819,000	$1,493,000
Flood Protection	$202,000	$0
Effluent Pumps	$0	$576,000
WWTP Total (excluding Pretreatment)	$8,277,000	$4,553,000

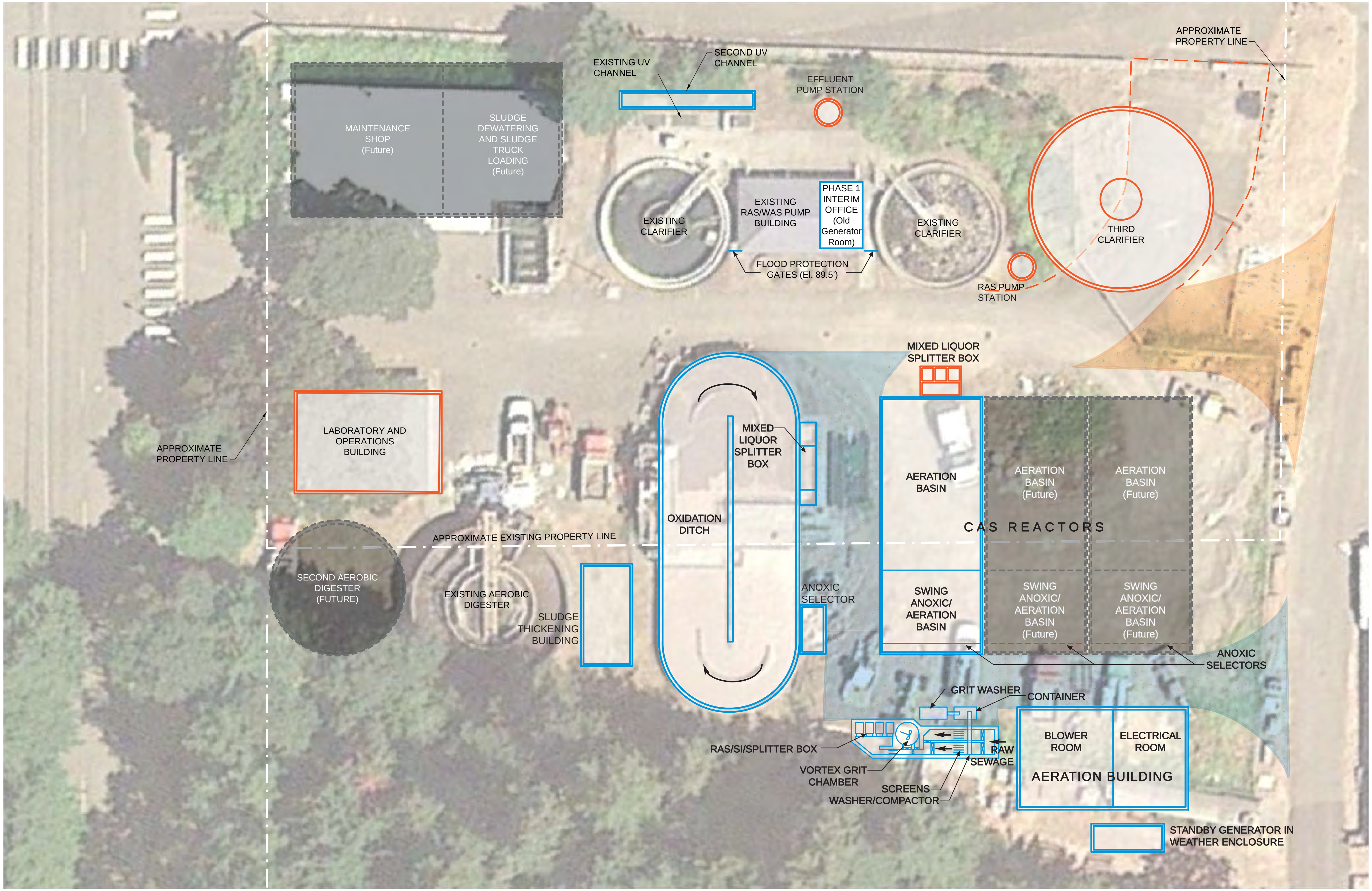
A phased approach would reduce the cost of initial construction (scheduled for 2020-2021) but would increase the overall project cost by approximately $228,000. This is due to postponing the new laboratory and operations building until Phase 2 (in 2030) and providing an interim office in Phase 1 by remodeling the old generator room in the existing RAS/WAS pump building. The existing laboratory/control building would remain through Phase 1 to serve the function of process control laboratory testing and to provide a restroom for plant staff use. This structure is more than 50 years old and is past the end of its useful life. Therefore, if initial project funding allows, it is recommended that Alternative 1B be implemented without phasing.

8.6 FUTURE OPERATION AND MAINTENANCE REQUIREMENTS

The existing WWTP is understaffed, with less than 1 FTE. The New England Interstate Water Pollution Control Commission (NEIWPCC) model provides am accurate, systematic, and cost-effective approach to estimating staffing levels needed to operate and maintain a modern treatment facility. Using the NEIWPCC model specific to an oxidation ditch facility indicates a need for 2 FTEs for the existing Stevenson WWTP.

Assessment using the NEIWPCC model for the future WWTP following construction of the recommended improvements made the following findings:

- A WWTP operator with Class III certification will be required to perform the duties of operator in charge of plant operations and maintenance.
- There will be a need for 3 FTEs for operation and maintenance of the WWTP following construction of the Alternative 1B improvements in 2021.
- There will be a need for 3.5 FTEs for operation and maintenance of the future WWTP by 2040.



LEGEND

- Phase 1 Upgrades
- Phase 2 Upgrades
- Phase 3 Upgrades
- New Access Road/Pavement (Phase 1)
- New Access Road/Pavement (Phase 2)
- Existing Driveway to Be Abandoned in Phase 2

N

0 7.5' 15' 30'
SCALE: 1" = 30'

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CITY OF STEVENSON, WA
GENERAL SEWER PLAN UPDATE

RECOMMENDED ALTERNATIVE 1B
WITH PHASED IMPLEMENTATION

Project No.:	135-48600-16001
Date:	OCTOBER 2017
Designed By:	

Supplemental
FIGURE 8-3

Bar Measures 1 inch

Figure-8-3_Alt1B_wPhasing.ai

The current contract has wording that limits the flexibility, duties and responsibilities of the contract operator. While these limit the cost of the services, they do not always serve the City's best interest with regard to meeting plant permit requirements. The City has two alternatives for future plant operations:

- Renegotiate the contract operations services to better meet the needs of the City.
- Convert to City operation of the WWTP, which would require hiring staff.

An evaluation comparing these alternatives found the following:

- City operations would not be confined by the limits of the contract.
- City operations staff would have leeway to address rapidly changing influent conditions during storm events, conditions with high or variable influent loading, process upsets, and other events that may occur, in order to maintain permit compliance.
- With City operation of the WWTP, the City would have staff operating the water treatment plant, WWTP and collection system. All of these facilities have common types of mechanical equipment, processes (to some degree) and piping. Employee cross-training and job sharing may provide benefits to the City in terms of ability to provide additional staff under emergency conditions, to cover vacations, and to provide effective shifting of labor for maintenance projects.
- With City operation, the City would need to find an operator with Class III certification. This may be difficult since many senior operators have retired in recent years.
- Contract operation provides a cost-effective option. Contract operation provides trained professional staff who work at several wastewater facilities in the area.

These two alternatives can be compared for cost and other criteria if and when the City is ready to consider them.

8.7 ENVIRONMENTAL REVIEW

Treatment improvements would be constructed at the existing WWTP site. A comprehensive, project specific State Environmental Policy Act (SEPA) checklist is attached in Appendix J to address environmental elements of the project.

9. RECOMMENDED PLAN

This chapter summarizes the recommended plan for upgrading the City of Stevenson's wastewater collection and treatment facilities. The recommended plan covers collection system improvements in two phases and WWTP improvements in one phase.

9.1 RECOMMENDED IMPROVEMENTS

9.1.1 Collection System Improvements

Gravity Sewer Capacity Upgrades

The following projects will upgrade existing gravity sewers to provide additional capacity.

- **Cascade Avenue Sewer, Phase 1 (Project S-01)—**Replace 920 feet of 8-inch sewer pipe in Cascade Avenue with new 12-inch pipe
- **Cascade Interceptor, Phase 1 (Project S-02)—**Replace 1,250 feet of 12-inch Cascade Interceptor located in Rock Creek Drive with new 18-inch pipe
- **Cascade Interceptor, Phase 2 (Project S-03)—**Replace 1,650 feet of 12-inch Cascade Interceptor from Rock Creek Drive to Railroad Avenue and Russell Avenue with new 18-inch pipe

Phase 1 projects (to be completed from 2017 to 2025) are those required to address areas identified by modeling to have inadequate capacity for existing flows. Phase 2 projects (to be completed from 2025 to 2040) are those required to address future capacity issues.

Extensions to Unsewered Areas

The following projects are intended to facilitate conversions of existing septic systems and allow future extensions to developable areas in the City. Phasing is not explicitly defined for these projects because their timing will depend on funding, rates of septic failures, and development trends.

- **Main D Extension (Project S-04)—**Extend Sewer Main D north along East Loop Road and Frank Johns Road by installing 3,500 feet of 8-inch sewer pipe
- **Iman Cemetery Road (Project S-05)—**Extend sewer from Rock Creek Drive and Ryan Allen Road continuing north on Iman Cemetery Road by installing 2,800 feet of 8-inch sewer pipe
- **Foster Creek Road (Project S-06)—**Extend sewer from the intersection of Ryan Allen Road and Iman Cemetery Road and continuing east to Foster Creek Road and north to the intersection of Foster Creek Road and Hollstrom Road by installing 4,000 feet of 8-inch sewer pipe

Pump Station Upgrades

The following projects address deficiencies at existing pump stations

- **Rock Creek Pump Station, Phase 1 (Project PS-01)—**Existing equipment is undersized and full pump station replacement is required. Construct new 1,500-gpm firm capacity duplex or triplex submersible pump station with new control panel, auxiliary standby power, and new 12-inch force main to the WWTP.
- **Fairgrounds Pump Station, Phase 1 (Project PS-02)—**Minor upgrades are required, including provision for bypass pumping, new discharge flow meter, and integration of new flow recorder into existing controls. Relocation of a portion of force main may be required to accommodate WWTP expansion.
- **Fairgrounds Pump Station, Phase 2 (Project PS-03)—**Future increases in flow will require additional capacity upgrades, including new submersible pumps in new wet well, new control panel and instrumentation, and new electrical equipment including standby generator and automatic transfer switch.
- **Kanaka Pump Station, Phase 1 (Project PS-04)—**At a minimum, a flow meter should be installed to verify model results that show pump station to be undersized. Pump station replacement is recommended, consisting of a new 500-gpm firm capacity duplex submersible pump station with new control panel and auxiliary standby power.
- **Cascade Pump Station, Phase 1 (Project PS-05)—**Minor upgrades are required, including provision for bypass pumping and upgrade of controls to include an auto-dialer or remote telemetry unit.
- **Cascade Pump Station, Phase 2 (Project PS-06)—**Future increases in flow will require additional capacity upgrades, including replacement of pumps with new submersible pumps in a new wet well and new control panel and instrumentation.

Phase 1 projects (to be completed from 2017 to 2025) are those required to address current capacity or safety issues. Phase 2 projects (to be completed from 2025 to 2040) are those required to address future capacity issues.

Project Prioritization

Table 9-1 shows the Phase 1 collection system improvements sorted by priority. Design and construction of the Rock Creek Pump Station improvements and Phase 1 Fairgrounds Pump Station Improvements have been scheduled to coincide with the WWTP improvements because standby power for the pump stations is provided by the generator at the WWTP, and because control improvements at the pump stations will need to be linked to new control systems at the WWTP. A second group of collection systems improvements has been scheduled for the following year.

Table 9-1. Phase 1 Collection System Improvements Prioritization

Priority	Project ID	Project Name	Year
1	PS-01	Rock Creek Pump Station	2021
2	PS-02	Fairgrounds Pump Station - Phase 1	2021
3	PS-05	Cascade Pump Station - Phase 1	2022
4	S-01	Cascade Avenue Sewer	2022
5	PS-04	Kanaka Pump Station	2022
6	S-02	Cascade Interceptor - Rock Cr PS to MH CI-4	2022

The Phase 2 collection system improvements will need to be initiated when the capacity of the gravity sewer and/or pump station is no longer adequate or when the age of the equipment is causing excessive operation or maintenance issues. Table 9-2 summarizes the trigger or triggers for each of the Phase 2 projects.

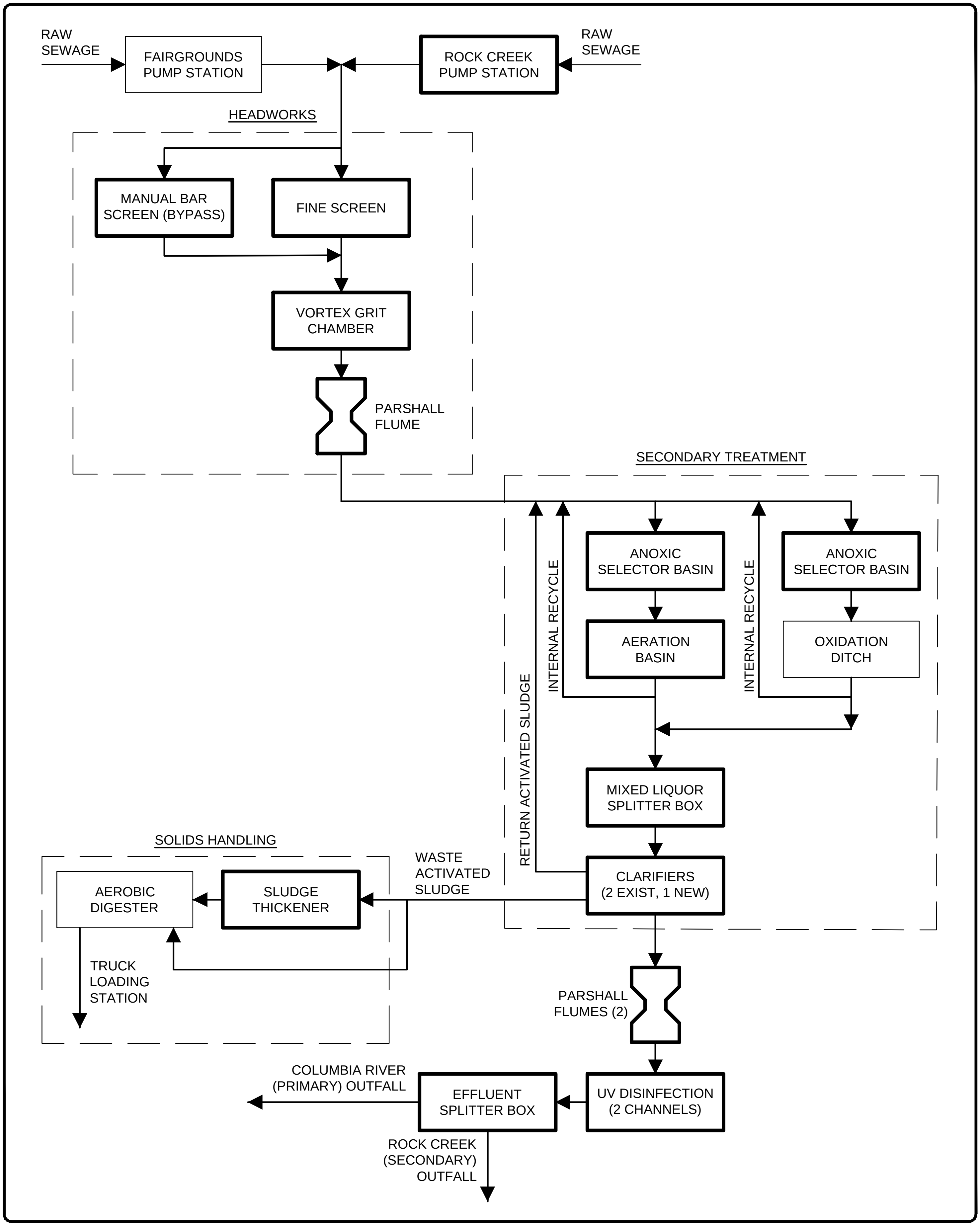
Table 9-2. Phase 2 Collection System Improvements

Project ID	Project Name	Trigger
S-03	Cascade Interceptor - Phase 2	Capacity: The trigger for upgrade will be when the pipe reaches full capacity and surcharges during peak-hour flow. • Existing Pipe Capacity = 650 gpm • Existing Peak-Hour Flow = 580 gpm • Year 2040 Peak-Hour Flow = 810 gpm Full capacity will be reached when approximately 150 new ERUs are added to the Cascade Interceptor service area.
PS-03	Fairgrounds Pump Station - Phase 2	Capacity: • Existing Station Firm Capacity = 280 gpm • Existing Peak-Hour Flow = 225 gpm • Year 2040 Peak-Hour Flow = 355 gpm Full capacity will be reached when approximately 115 new ERUs are added to the pump station service area. Age: The station is 39 years old, whereas the typical design life for pump station mechanical and electrical equipment is 30 years. Increased maintenance time, limited availability of replacement parts, and funding availability are likely triggers for the project.
PS-06	Cascade Pump Station - Phase 2	Age: The station is 45 years old whereas the typical design life for pump station mechanical and electrical equipment is 30 years. Increased maintenance time, limited availability of replacement parts, safety issues related to accessing the equipment, and funding availability are likely triggers for the project.

9.1.2 Wastewater Treatment Plant Improvements

Alternative 1B is the recommended alternative. The improvements would increase plant capacity for conditions projected through 2040. Figure 9-1 shows a flow diagram of the recommended WWTP improvements; Figure 9-2 shows a site plan. Specific improvements, to be implemented before 2022, are as follows:

- **Headworks**—Construct new headworks southwest of the existing oxidation ditch and abandon the existing headworks. The new headworks facility would be designed to handle a peak-hour flow of 2.7 mgd. It would include a junction box for two interceptors, a new sampling station, flow metering, a new screening facility consisting of one screening channel with a 6-mm fine screen and an emergency bypass channel with a manual bar screen, and a vortex grit chamber with horizontal recessed impeller grit pump and grit cyclone/classifiers.
- **Secondary Treatment, Conventional Activated Sludge**—Maintain the existing oxidation ditch in operation and construct one new conventional activated sludge (CAS) biological reactor, with space for two more to be constructed in the future. Provide fine-bubble aeration in the CAS reactors, using blowers to be installed in a new aeration building. Install two 10,000-gallon anoxic selector tanks (one for the oxidation ditch and one for the CAS reactor) equipped with submersible mixers and submersible low-head propeller pumps to circulate mixed liquor between each biological reactor and anoxic selector in each reactor train.
- **Secondary Treatment, Clarifier**—Construct new 50-foot diameter clarifier adjacent to existing clarifiers. Provide RAS pumping using two submersible pumps, one duty and one standby, in a wet well next to the new clarifier. Construct a new flow splitter box to route flows to the three clarifiers.
- **Disinfection**—Construct a second UV channel parallel to the existing UV channel, with upstream Parshall flumes providing a flow split and flow measurement. Retrofit the existing UV channel with two banks of LPHO UV lamps and provide two matching banks of LPHO UV lamps for the new second channel.



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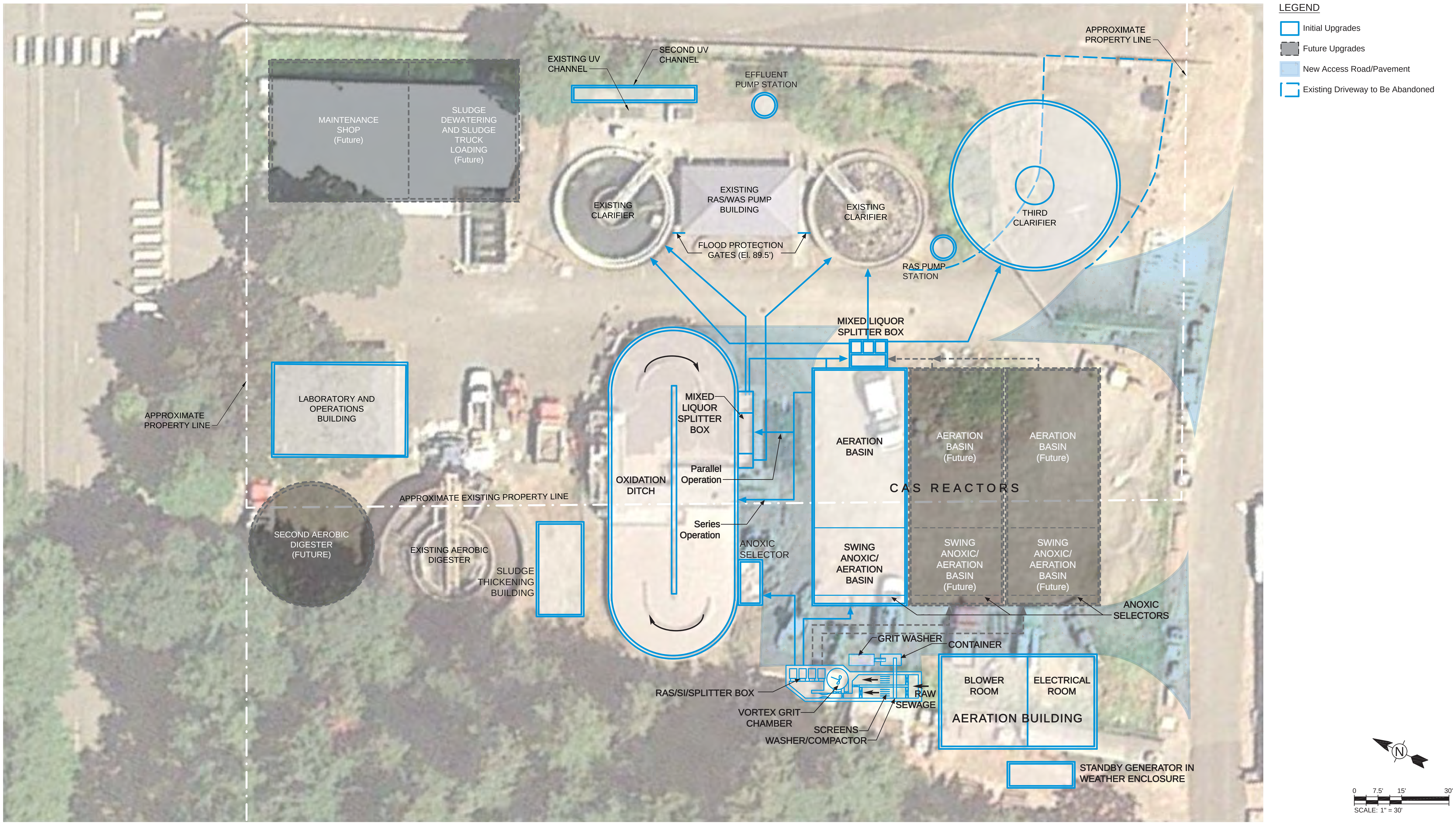
City of Stevenson
GENERAL SEWER PLAN UPDATE

Figure 9-1.
RECOMMENDED IMPROVEMENTS
WWTP FLOW DIAGRAM



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CITY OF STEVENSON, WA
GENERAL SEWER PLAN UPDATE

RECOMMENDED IMPROVEMENTS
WWTP SITE PLAN

Project No.: 135-48600-16001
Date: OCTOBER 2017
Designed By:
Supplemental

FIGURE 9-2

Bar Measures 1 inch

Figure-9-2_RecommednedSitePlan.ai

- **Effluent Pump Station**—Construct a new 15-hp effluent pump station to pump effluent to discharge through the primary outfall to the Bonneville Pool when flows are greater than 2.1 mgd.
- **Sludge Thickening and Digestion**—Construct a new sludge thickening building to house a new mechanical thickener to thicken raw waste sludge, two new waste sludge pumps to feed the thickener, a polymer system to assist with sludge thickening, and two new thickened sludge pumps to convey thickened sludge to the aerobic digester. Refurbish the existing aerobic digester, including new partition walls and a new aeration diffuser system, which will use blowers housed in a new aeration building.
- **Support Facilities**—Demolish the existing laboratory/control building and construct a new laboratory and operations building at that location. Construct a new aeration building to house blowers for the CAS reactors and aerobic digester, as well as electrical equipment. Provide a new service entrance and transformer to provide power for expanded plant facilities. Replace the existing standby generator with a new larger generator located west of the future aeration basins. Provide new MCCs in the pump building generator room. Provide new SCADA control system, including new control panel and operator workstation in the operations building and remote SCADA access from City Hall and potentially from the Hood River WWTP (for contract operators to monitor the Stevenson WWTP).

Design criteria for the recommended upgrades are shown in Table 9-3.

Table 9-3. Design Criteria for Treatment Plant Facilities

Process/Equipment Description	Existing Design	Year 2040
Treatment Plant Rated Capacity		
Flow[a]		
Base (Dry Weather Average)	0.24 mgd	
Maximum Month	0.45 mgd	0.66 mgd
Peak Day	1.0 mgd	1.71 mgd
Peak Hour	1.5 mgd	2.56 mgd
Pollutant Loadings - BOD or SS[a]		
Maximum-Month	611 ppd	1,611 ppd
Peak Day		2,912 ppd
Peak Hour (1.5 peaking factor)		182 pphr
Headworks		
Mechanical Fine Screen		
Number	1 + manual screen bypass	1 + manual screen bypass
Type	Automatic bar screen	6 mm automatic fine screen
Peak Flow Capacity per Screen	1.5 mgd	2.56mgd
Washer Compactor		
Number	None	1
Screenings Volume Reduction	n/a	80%
Organic Constituents Removal from Screenings	n/a	95%
Grit Chambers		
Type	None	Vortex
Number	n/a	1 + bypass
Grit Pumps		
Type	None	Horizontal recessed impeller
Number	n/a	1
Grit Washing / Transport		
Type	None	Cyclone / classifier
Number	n/a	1

Process/Equipment Description	Existing Design	Year 2040
Influent Monitoring		
Influent flow measurement	6-inch Parshall Flume	9-inch Parshall Flume
Influent sampler	Time composite sampler, portable, ice cooled	Flow paced composite sampler, refrigerated
Secondary Treatment		
Biological Reactors		
Anoxic Selectors		
Total Volume (at Reactors 1 & 2)	—	20,000 gallons
Detention Time		
Maximum month (with 50% RAS flow)	—	29 min
Peak day (with 100% MM RAS flow)	—	12 min
Reactor 1		
Type	Oxidation ditch	Oxidation ditch
Volume		
Anoxic selector basin	—	10,000 gallons
Swing Zone (Anoxic/Aerobic)	100,000 gallons	100,000 gallons
Aerobic Zone	200,000 gallons	200,000 gallons
Total	300,000 gallons	310,000 gallons
Dimensions		
Reactor	103 feet long 39 feet wide 12-foot side water depth	103 feet long 39 feet wide 12-foot side water depth
Separate Selector Basin	—	14 feet long 7 feet wide 12-foot side water depth
Aeration		
Type	Brush aerators	Brush aerators
Number	2 (1 active, 1 standby)	2 (1 active, 1 standby)
HP each	40	40
HP total	80	80
PD duty / standby HP	40 / 40	40 / 40
PH duty / standby HP	80 / 0	80 / 0
Reactor 2		
Type		Conventional activated sludge
Volume		
Anoxic selector	—	10,000 gallons
Swing Zone (Anoxic/Aerobic)	—	100,000 gallons
Aerobic Zone	—	200,000 gallons
Total	—	310,000 gallons
Dimensions	—	75 feet long 28 feet wide 20-foot side water depth
Aeration		
Type	—	Blowers and fine bubble diffusers
Number of blowers	—	2 active, 1 standby
HP (each)	—	30
HP (total)	—	90
Capacity cfm (each)	—	500 cfm

Process/Equipment Description	Existing Design	Year 2040
Swing Zone Mixer Power (hp)		4
Recirculation pump		
Capacity 300% MM flow		2 mgd
HP		5
Drive		Variable Frequency Drive
Total Biological Reactors		
Volume	300,000 gallons	620,000 gallons
Detention time (max. month)	16 hours	23 hours
Mixed Liquor Suspended Solids (max month)	3,000 mg/L	3,000 mg/
Mixed Liquor Volatile Solids Concentration (max month)	2550mg/L	2700 mg/L
Mixed Liquor Volatile Solids % of Total (max month)	85%	90%
F/M (max month)	0.094 pounds BOD per pound MLVSS	0.115 pounds BOD per pound MLVSS
Sludge Yield (max month)		0.9 lb / lb BOD applied
Sludge Age (max month)	15 days	11 days
BOD ppd/1000 cf (max month)	15.2 ppd / kcf	19.4 ppd / kcf
Clarifiers		
Number	2	2 existing + 1 new
Diameter	35 feet	2 @ 35 feet + 1 @ 50 feet
Depth	14 feet	14 feet
Area (total)	1,924 square feet	3,887 square feet
Overflow Rate		
Maximum month	234 gal/day/sq foot	170 gal/day/sq foot
Peak Day	520 gal/day/sq foot	440 gal/day/sq foot[b]
Solids Loading Rate		
Maximum month + RAS @ 100% MM	12	8
Peak Day + RAS @ 100% MM	19	15[b]
Peak Hour + RAS @ 100% MM	25	21[b]
Return Activated Sludge Pumping		
Type	Non-clog, centrifugal	Non-clog, centrifugal
Number	3 (2 duty)	3 existing (2 duty) + 2 new (1 duty)
Capacity (each)	350 gpm	400 gpm (new pumps only)
Capacity (total, firm)	700 gpm (1 mgd)	1100 gpm (1.6 mgd)
Drive	Variable frequency drives	Variable frequency drives
RAS Filament Control	Hypochlorite addition	Hypochlorite addition
UV Disinfection		
Reactor Type	Open channel	Open channel
Number	1	2
Peak Flow Capacity (each)	1.5 mgd	2.56 mgd
Light transmittance	65%	65%
Minimum UV dose	—	30 mJ per square cm
Lamp type	Low-pressure, low-output	Low-pressure, high-output

Process/Equipment Description	Existing Design	Year 2040
Effluent Monitoring		
Effluent flow measurement	V-notch weir	Mag meter
Effluent sampler	Time composite, portable sampler, ice cooled	Flow paced composite sampler, refrigerated
Effluent Pumping		
Type	—	Submersible Centrifugal
Number	—	2
Capacity (total, firm)	—	2.56 mgd
Sludge Thickening		
Type	Gravity Decant	Rotary drum screen
Number		1
Capacity		150 gpm
Feed solids mg/l		5,000 mg/l
Thickened solids %		5%
Sludge Pumps		
Thickener feed pumps		
Type		Progressive cavity w/ variable frequency drive
Number		2
Capacity		150 gpm
HP each		10
Thickened sludge pumps		
Type		Progressive cavity w/ variable frequency drive
Number		2
Capacity each		60 gpm
HP each		5 HP
Sludge Holding Tank (Thickener Feed Tank)		
Tank depth	12.5 feet	12.5 feet
Tank Area	320 sf	320 sf
Volume	30,000 gallons	30,000 gallons
Hydraulic Detention time without decant (MM)	2.5 days	0.9 days
Solids concentration	5,000 mg/L	5,000 mg/L
Sludge Digester		
Tank Depth	14.25 feet	14.25 feet
Volume	134,000 gallons	134,000 gallons
Hydraulic Detention Time (without decant)	11 days	41 days
Solids concentration	14,000 mg/L[c]	30,000 mg/L
Volatile solids concentration	83%[c]	84%
Volatile solids destruction	15%[c]	42%
Class B biosolids (>38% VS destruction)	NO	YES

Process/Equipment Description	Existing Design	Year 2040
Sludge Tank Aeration System		
Type	Sock diffusers	Porous diffusers
Aeration blowers		
Number	1 duty + 1 standby	2 duty + 1 standby
Capacity each	440 cfm	660
HP each	20 hp	30 hp
HP total	40 hp	90 hp

Notes: a. Flows and loads from Table 2-10 with 20% pretreatment
b. Year 2040 clarifier hydraulic capacity with two 35' and one 50' diameter clarifiers at design overflow & solids loading rates:
Peak day—3.1 mgd @ 800 gpd/sf and 30 ppd/sf
Peak hour—4.7 mgd @ 1200 gpd/sf and 40 ppd/sf
c. Existing performance

9.2 IMPLEMENTATION SCHEDULE

A summary of the recommended improvements to Stevenson's collection system and wastewater treatment plant and annual capital costs through year 2025 is provided in Table 9-4. Improvements to the wastewater treatment plant as well as the two closely linked pump station projects are expected to be designed in 2018 and 2019; engineering costs have been divided evenly between these two years. Construction of the WWTP and pump station improvements are expected to begin in October 2020 and be complete in November 2021; the costs for construction and engineering services during construction have been allocated by year according to this estimated construction schedule. The remaining Phase 1 collection system improvements have been grouped into a second set of projects for funding purposes; these projects are expected to be designed in 2021 and constructed in 2022.

Phase 2 collection system improvements will be constructed after 2025; their timing will be based on the trigger conditions discussed in Section 9.1.1. Based on current flow and load projections, additional major improvements to the wastewater treatment plant are not expected to be required before 2040.

Table 9-4. Capital Improvements Plan for the Recommended Alternatives

Item	2018	2019	2020	2021	2022	2023	2024	2025
Wastewater Treatment Plant Improvements (Alt 1B)	$600,000	$600,000	$2,443,000	$8,959,000				
Rock Creek Pump Station (PS-01)	$58,000	$58,000	$238,000	$872,000				
Fairgrounds Pump Station – Phase 1 (PS-02)	$5,000	$5,000	$22,000	$79,000				
Cascade Pump Station – Phase 1 (PS-05)				$3,000	$34,000			
Cascade Avenue Sewer – Phase 1 (S-01)				$42,000	$399,000			
Kanaka Pump Station – Phase 1 (PS-04)				$73,000	$697,000			
Cascade Interceptor - Rock Cr PS to MH CI-4 (S-02)				$65,000	$617,000			
Total	$663,000	$663,000	$2,703,000	$10,093,000	$1,747,000	$0	$0	$0

10. FINANCIAL PROGRAM

This chapter describes the City's sewer utility financial history, financial policies, potential capital funding sources and a financing plan for the capital improvements along with the impact on rates and fees.

10.1 FINANCIAL HISTORY

The City owns and operates both a water and a sewer system, and accounts for the combined water/sewer utility in Fund 400, attempting to operate each system in a self-supporting manner. The City prepares an annual budget and reviews rates to ensure the utility can meet its obligations. The sewer portion of the operating expenditures, debt repayment and capital projects were separated from water for this financial analysis. Monthly sewer service charges are the primary source of ongoing revenue. Other miscellaneous revenue includes investment interest, inspection/installation fees, and capital contributions from new connections, known as system development charges (SDCs). The three-year financial history is summarized in Table 10-1.

Table 10-1. Sewer Financial History

Sewer Portion of Water/Sewer Fund 400	2015	2016	2017 Budget
SEWER REVENUE			
Sewer Service Income	$355,173	$377,705	$360,000
Installation Sewer	150	300	50
Interest on Investments (50% of fund total)	2,373	2,689	2,000
Sewer Miscellaneous Income	—	—	50
Sewer Capital Contributions	8,400	14,000	10,000
Total Sewer Revenue	*366,096*	*394,694*	*372,100*
SEWER EXPENDITURES			
Administration, Conservation	26,218	19,845	29,000
Training	1,205	777	2,500
Maintenance	17,853	27,727	25,500
Contracted Processing & Operations	112,930	117,575	124,000
Customer Service & Marketing	47,842	52,473	57,500
Operating - General	51,649	105,959	68,500
Sewer Taxes	8,721	9,256	10,500
Subtotal Operating Expenditures	*266,418*	*333,612*	*317,500*
Debt Service - USDA-RD (principal + interest)	32,670	32,670	32,671
Sewer Capital Projects	91,224	137,380	110,690
Total Sewer Expenditures	*390,312*	*503,662*	*460,861*
Annual Increase (Use) of Reserves	($24,216)	($108,968)	($88,761)

The entry for annual increase (use) of reserves at the bottom of Table 10-1 indicates whether revenue was sufficient to meet expenses each year. If revenue exceeds expenses, then the reserves are increased. If revenue is less than expenditures, then reserves are used to balance the year. This line is negative in each year, as the City has been using some reserves to fund capital improvements and planning that are underway. The use of reserves has been less than the capital projects, so the utility has been self-sustaining when those projects are excluded.

The sewer utility's portion of the 2017 beginning balance was $298,333. This includes $214,050 from system development charges, $51,613 unreserved sewer balance and $32,670 debt reserve for an existing loan for a sewer outfall project. After deducting the debt reserve and the anticipated 2017 use of reserves, there is approximately $177,000 available for future capital investment.

10.2 OUTSTANDING DEBT

The City currently has one outstanding sewer debt issue from the U.S. Department of Agriculture Rural Development program for the recent sewer outfall project. The annual debt payment is $32,670 through 2033. The loan was for $500,000 over 20 years at 2.75-percent interest. There will be a reduction in the final year to reflect the $23,562 that the City returned as unused at project completion.

10.3 CURRENT RATES & CHARGES

The City Council has authority to set rates and charges for the sewer utility to ensure it remains self-sufficient and meets all covenants on outstanding and future debt.

10.3.1 Monthly Sewer Rates

The City bills customers monthly for sewer service. Residential customers (including multi-family and mobile home parks) pay a user charge per dwelling unit. Non-residential customers pay a base user charge plus a volume charge that varies with water usage. Industrial customers pay a negotiated rate when they exceed BOD parameters. A typical single-family customer currently pays a flat rate of $29.95 per month for sewer service. These rates have been in effect since 2010 and are shown in Table 10-2.

Table 10-2. Current Sewer Rates

Customer Class	Monthly	Description
Residential		
Single 3/4" Meter Service	$29.95	flat rate
Multi-family	$29.95	per dwelling unit
Non-Residential		
Transient Quarters	$15.00	per each overnight room/suite + 40% water charges
Other Commercial*		by size of meter + volume:
3/4" Meter	$29.95	+ 40% water charges
1" Meter	$62.25	+ 40% water charges
1-1/2" Meter	$92.75	+ 40% water charges
2" Meter	$140.30	+ 40% water charges
3" Meter	$201.30	+ 40% water charges
4" Meter	$262.30	+ 40% water charges
6" Meter	$433.10	+ 40% water charges

* Up to 400 cubic feet exempt from metered water charge

The volume rate for the commercial sewer customers is based on 40 percent of the water bill, including the water base rate and water usage charges. With this dynamic, the commercial sewer rates were last increased in 2013 when the water rates were adjusted. It is more common for water/sewer utilities to have a separate sewer volume rate. The City may consider separating the sewer volume rate to stand on its own. This would help clarify necessary adjustments for a multi-year rate ordinance.

The City is reviewing rates and system development charges in coordination with this facilities plan to ensure that they adequately cover this plan's CIP, anticipated debt and increased costs of operating the upgraded plant.

10.3.2 Sewer System Development Charge

The sewer system development charge is charged for each new or upgraded connection to the sewer system. These charges are for the right to connect and make use of the system. All connections must obtain a sewer permit and pay the associated inspection fees. The current sewer SDC for a new single-family residence is $2,800. Non-residential customers must convert their anticipated use to ERUs. Common commercial uses are included in a table in Ordinance 993 from 2005. Others need to be determined in order to calculate the appropriate SDC.

10.3.3 Comparison to Other Local Jurisdictions

Table 10-3 compares current sewer rates and connection charges in Stevenson and nearby communities for a single-family residence using 500 cubic feet per month in the winter. Stevenson's monthly rates are lower than those of all the other communities investigated, and its SDCs are in the middle of the identified range.

Table 10-3. Comparison of Single Family Residential Charges

Jurisdiction	Monthly Sewer	Connection Charge
Stevenson	$29.95	$2,800
Bingen	$46.00	$2,000
Goldendale	$31.50	$2,000
North Bonneville	$46.56	$4,500
Washougal	$54.25	$5,620

10.4 AFFORDABILITY AND HARDSHIP

The EPA defines affordable sewer rates as 2 percent of median household income for a community. This also reflects the test applied by Ecology to determine the level of hardship in a community when applying for grants and loans for sewer improvement projects. The level of hardship can influence the financial assistance offered. If the rates are higher than the affordability threshold, the community will be considered in hardship and will receive extra points on its funding application, resulting in potential for a partial grant, lower interest rate, longer repayment term or combination of the three.

The most recent Ecology water quality funding guidelines (FY2018) show a median household income for the City of Stevenson of $43,281, which is 72 percent of the statewide median household income ($60,294). The threshold for hardship at 2 percent of median household income would be residential sewer rates of $72.00 per month. A typical residence in Stevenson currently pays a flat rate of $29.95 per month. This level is considered affordable and is non-hardship. Table 10-4 shows Ecology's hardship designations for the recent program year.

After the CIP funding, additional debt service and increased O&M costs recommended in this plan are included, Stevenson's rate is expected to reach a hardship level.

Table 10-4. Ecology Hardship Continuum for Stevenson's Median Household Income of $43,281

Hardship Designation	Sewer Fee Divided by Median Household Income	Monthly Sewer Fee
Non-hardship	<2%	up to $72
Moderate Hardship	> 2% but <3%	$73 - $108
Elevated Hardship	>3% but <5%	$109 - $180
Severe Hardship	> 5%	$181 +

Based on funding program guidelines for FY2018 with applications due October 2016

10.5 CAPITAL IMPROVEMENT FUNDING

10.5.1 Capital Funding Sources

The City has successfully used a variety of funding sources for capital improvements in the past. These include grants coordinated by the Mid-Columbian Economic Development Council and USDA Rural Development loans for the recent sewer outfall, connection fees, developer extensions, monthly rates, and reserves. Other sources of capital funding available for sewer include state grants and low-interest loans from Ecology's Centennial Clean Water Fund and Clean Water State Revolving Fund. The following sections describe key funding opportunities.

Washington Department of Ecology

The Washington Department of Ecology has an annual competitive cycle for combined water quality funding sources. The application cycle is typically in October of each year. Early planning is recommended, as Ecology requires certain approvals prior to application, including approval of this facilities plan. The loans will be available the following year at low interest. This is the primary state funding program for sewer improvements at this time.

For the WWTP project, a separate application will be necessary for design and preconstruction activities. It appears that the City will be eligible for hardship on the preconstruction program (up to 80 percent of the state's median household income), which could result in up to 50 percent forgivable principal (grant) for the preconstruction activities. Then the plans and specifications will need to be approved by Ecology in order to apply for construction funding. There is a separate category (Step IV) for projects that combine design and construction into one funding application. Step IV projects must be $5 million or less.

The typical Ecology loan is for 20 years. The program is working on the potential for extending to 30 years in some instances. The interest rate is set each program year for standard loans at 60% of a government bond rate. If a community is determined to be in hardship, the loan offer can include principal forgiveness (grant), or lower interest rates.

U.S. Department of Agriculture Rural Development Water and Waste Disposal

The U.S. Department of Agriculture's Rural Development Water and Waste Disposal program is a federal loan program with partial grants in some hardship cases for higher-cost projects, such as the WWTP project. The interest rates vary based on three categories of hardship tied to median household income. The interest rates are adjusted quarterly. Recent rates ranging from 2 to 3.375 percent. Typical loans are for 40 years for a project such as the WWTP upgrade. Applications are open year-round. This program is designed for small communities that cannot borrow with reasonable terms.

Washington Department of Commerce Public Works Trust Fund

The Washington State Department of Commerce Public Works Trust Fund is a competitive low-interest loan program. It has an application cycle in May every other year, with funds available the following year. This program has been on and off hiatus in recent years due to state budget issues. The City can monitor to determine whether the program is open for applications, with the understanding that there is no certainty of funding.

Other Potential Sources

Other potential capital funding sources include the following:

- Appropriation from State Legislature—Requests are typically submitted through the City's legislators and must be sponsored.
- The Washington State Department of Commerce has energy-efficiency grants and the Community Economic Revitalization Board program geared to infrastructure improvements for job creation. The maximum grant is $300,000 for public facilities projects to attract or retain private business, create permanent jobs and promote economic development.
- Community Development Block Grants through the Department of Commerce provide funding for construction of public infrastructure and community facilities based on low to moderate income households in the project area. Recent grants have been up to $750,000.
- The U.S. Department of Commerce Economic Development Administration's Public Works and Economic Development Program supports public infrastructure that is necessary to generate or retain private sector jobs and investments, attract private sector capital and promote regional competitiveness. Typical maximum grants are up to $ 3 million and may be in connection with a required loan.
- Skamania County has an economic development grant/loan program that is funded by the 0.09-percent rural county sales tax.

Online sources of grant information include the Association of Washington Cities, the Municipal Resource Service Center, the funding program matrix of the Infrastructure Assistance Coordinating Council (www.infrafunding.com), and the Public Works Board Website, www.pwb.wa.gov.

10.5.2 Local Funding Sources

Monthly sewer rates can provide an ongoing level of funds for planned capital repairs and improvements. These funds are appropriate for repair and replacement of the sewer system to serve existing customers. System development charges from new connections are also available to fund improvements to the sewer system. The sewer utility is able to borrow from the above-mentioned financial assistance programs, and any loans need to be repaid by sewer rates and connection charges.

The sewer utility is able to sell revenue bonds and/or general obligation bonds to fund planned system improvements. Revenue bonds are repaid by sewer rates and connection fees. General obligation bonds can be repaid by sewer rates and charges or general city tax revenue. The City collects real estate excise taxes that could be assigned to fund a portion of the improvements. Typically, there are other higher priority uses for these funds and they are not available for sewer projects.

The cost of developer-funded projects is not addressed in this financial plan. These projects will be completed as necessary by developers in order to connect their property to the system. When developers complete certain projects that are approved by the City, the infrastructure is deeded over to the City. The developer can negotiate a latecomers/recovery agreement with the City to be reimbursed by new development making use of the facilities constructed by the developer for a specified period of time allowed by state law.

The City has the option to complete area-specific projects and be reimbursed as new development occurs through a special connection charge. The City also has the option to establish a Utility Local Improvement District where the properties specially benefiting from an infrastructure investment would pay their share through an assessment.

In a separate coordinated effort, the City is considering a strength-based rate structure through which higher-strength BOD dischargers would pay higher rates than residential or domestic strength. The current rate structure is based on the volume of flow into the plant, not the strength of the discharge.

10.6 SEWER CAPITAL IMPROVEMENTS

Chapter 9 of this facilities plan identifies $16,222,000 in recommended capital improvements for the sewer system for the first six years (2018 to 2023). These cost estimates are in 2017 dollars for the year of construction and include both collection system and wastewater treatment plant improvements. The 20-year improvements include the extension of sewer into unsewered areas.

10.6.1 Six-Year Capital Improvement Funding

The six-year CIP projects have been reviewed for potential funding sources, such as pay-as-you-go through rates and borrowing from an Ecology or USDA-RD grant/loan. Given the cost of recommended improvements and the level of sewer funds available, the financial plan assumes that the City will need to borrow in two groups:

- The first group will include the design and construction of the WWTP improvements, including the Rock Creek and Fairgrounds Pump Stations, which are connected with the plant. Ecology requires a separate application and loan for preconstruction activities; however, USDA-RD does not separate design and construction.
- The second group will complete the recommended six-year improvements for the collection system when the plant improvements are complete. At less than $5 million, this group would be eligible for a Step IV design and construction loan from Ecology.

The six-year projects are listed by year in Table 10-5 as recommended over the planning period. By grouping projects, the City can save on administrative costs and focus on completing the projects in an efficient manner. Because federal money will be involved in the WWTP loan, federal requirements must be met. Different funding agencies may specify the process in different manners. It may be helpful for the City to request a meeting at which the agencies can help guide City staff through the funding process. This can be done at the Infrastructure Assistance Coordinating Council conference each October in Wenatchee.

Table 10-5. Six-Year Capital Improvements

Six-Year Sewer Capital Improvements	2018	2019	2020	2021	2022	2023
Funding Group 1						
Wastewater Treatment Plant Improvements	600,000	600,000	2,443,000	8,959,000		
Rock Creek Pump Station	58,000	58,000	238,000	872,000		
Fairgrounds Pump Station – Phase 1	5,000	5,000	22,000	79,000		
Funding Group 2						
Cascade Pump Station – Phase 1				3,000	34,000	
Cascade Avenue Sewer – Phase 1				42,000	399,000	
Kanaka Pump Station – Phase 1				73,000	697,000	
Cascade Interceptor - Rock Cr PS to MH CI-4				65,000	617,000	
Total CIP by Year	663,000	663,000	2,703,000	10,093,000	1,747,000	—
Total Six-Year CIP	16,222,000					

The City is placing a high priority on securing grants to make the improvements most affordable to the current ratepayers. Grants and legislative appropriations will help provide funding to complete the project and do not have to be repaid. However, grants and appropriations are typically uncertain in timing, availability and amount. Table 10-6 shows the funding sources without any grants.

Table 10-6. Six-Year CIP Funding Sources - Without Grants

CIP Funding Source	2018	2019	2020	2021	2022	2023
Ecology Loan 1 - WWTP, Influent Pump Stations	663,000	663,000	2,7003,000	9,910,000		
Ecology Loan 2- Pump Stations, Cascade Avenue	-	-	-	183,000	1,747,000	
Total CIP Funding Sources	663,000	663,000	2,703,000	10,093,000	1,747,000	—

New annual debt payments were estimated without grants and with $5 million in grants, as shown in Table 10-7. The annual debt service in 2023 is estimated to be $1,040,000 to complete the six-year CIP as planned if no grants are available. With a $5 million grant, the new debt service would be reduced to $720,000—an annual savings of $320,000. These estimated debt payments assumed 20-year loans at 2.5-percent interest. The timing and amount of debt payments will depend on the actual financing package. While that is not known at this time, it is important for the City to plan to ramp rates up over the years to make it easier for ratepayers.

Table 10-7. Estimated New Annual Debt Payments – With and Without Grants

New CIP Estimated Debt Payments	2018	2019	2020	2021	2022	2023
Ecology Loan 1					894,100	894,100
Ecology Loan 2						123,800
Est. New Debt Payments - Without Grants					*894,100*	*1,017,900*
Est. New Debt Payments - With $5 Million Grants					*573,400*	*697,200*

Debt payments assume 20-year loan at 2.5% interest

10.7 SIX-YEAR FINANCIAL PLAN

With many uncertainties at this time, the six-year financial plan presented here is a conservative plan to show how the City can fund the recommended improvements and changes in O&M costs and be able to afford the new debt service. This plan can be updated and refined as key elements become better known. By being conservative in this plan, the intention is that the CIP can be funded and the projects completed within the planning period.

The base year in the financial plan is the adopted 2017 budget. The following key assumptions were used in making the six-year projections:

- Growth in new homes/ERUs per year = 25
- Cost escalation, general = 3.0 percent
- 2017 SDC for new connections per ERU = $2,800
- Assumed 2018 SDC per ERU = $5,600
- 2017 single family monthly rate = $29.95.

The number of new homes or ERUs used in this financial outlook is lower than the engineering design flow and loads earlier in the plan. This is conservative from a financial perspective because it allows balancing the budget with a lower level of growth.

The current SDC for new connections of $2,800 has been in effect since 2005. The City is reviewing the charge at this time. This outlook assumes a higher number of $5,600 beginning in 2018 through 2023. The 2017 single-family monthly rate is $29.95 per dwelling unit.

10.7.1 Six-Year Rate Outlook

The two scenarios—without grants and with $5 million in grants—are shown to provide a range of impact on the monthly residential sewer rate:

- **Scenario F-1, $0 grant**—Adds a new high-strength rate, no grants, and Ecology loans for the entire CIP. Rates would need to increase $13.50 per month each year through 2023. Savings could be used to reduce the amount borrowed for the collection system improvements after the WWTP financing details are known.
- **Scenario F-2, $5 million grant**—Adds a new high-strength rate, $5 million in grants for the WWTP, and Ecology loans for entire CIP. Rates would need to increase $10 per month each year through 2023. Savings could be used to reduce the amount borrowed for the collection system improvements after the WWTP financing details are known.

The six-year sewer rate outlook is summarized in Table 10-8. It is estimated that the monthly rate would need to be between $90 and $111 per month in 2023, depending on the scenario. These rates would be designated as moderate or elevated hardship on Ecology's continuum and would qualify for grant assistance up to $5 million and a lower interest rate. The City has the option to select a repayment period to 25 years at a slightly higher rate of interest.

Table 10-8. Six-Year Rate Outlook

	Monthly Residential Sewer Rate						
	Existing	2018	2019	2020	2021	2022	2023
Scenario F-1, $0 grant	$29.95	$43.45	$56.95	$70.45	$83.95	$97.45	$110.95
Scenario F-2, $5 million grant	$29.95	$39.95	$49.95	$59.95	$69.95	$79.95	$89.95

The detailed six-year outlook for the sewer fund is shown in Table 10-9. Scenario F-2 is shown with $5 million grant funding toward the WWTP. The City will be working hard to attract maximum grants from a variety of programs, including a legislative appropriation and working with the Mid-Columbia Economic Development Council to assist.

10.7.2 Sewer Revenue

The sewer service charges for 2017 were adjusted upward from the budget to reflect the actual 2016 sewer service income of $377,000. New customers are added each year as paying service charges and the SDC for new connections. Additional new connections will positively impact the sewer bottom line and be available to fund additional projects now or in the future.

The financial plan assumes that the City will implement a strength-based volume rate for sewer where higher-BOD dischargers will pay more than those who generate residential or domestic strength wastewater. The City is working with the high-strength dischargers, and the Council is expected to consider a high-strength volume rate. Therefore, a conservative low revenue estimate has been included, in which the rates would be implemented and stepped up over several years. Scenario F-2 shows $46,000 in 2018, growing to $131,000 in 2021 from the high-strength surcharge. The monthly residential sewer rates for Scenario F-2 would need to grow from $29.95 in 2017 to an estimated $89.95 in 2023.

Table 10-9. Six-Year Sewer Financial Plan (Scenario F-2)

	Est. 2017	2018	2019	2020	2021	2022	2023
Assumptions							
New Homes / ERUs	3.6	25	25	25	25	25	12
General Cost Escalation		3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Installation/Inspection Fee	50	50	50	50	50	50	50
System Development Charge per ERU	$2,800	$5,600	$5,600	$5,600	$5,600	$5,600	$5,600
Monthly Residential Sewer	$29.95	$39.95	$49.95	$59.95	$69.95	$79.95	$89.95
Assumed increase in residential rates/month		$10.00	$10.00	$10.00	$10.00	$10.00	$10.00
SEWER REVENUE							
Sewer Service Income	377,000	515,000	659,000	809,000	965,000	1,127,000	1,281,000
New High Strength Surcharge		46,000	75,000	104,000	131,000	134,900	138,900
Installation Sewer	50	1,250	1,250	1,250	1,250	1,250	600
Interest on Investments	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Sewer Miscellaneous Income	50	50	50	50	50	50	50
Sewer Capital Contributions (SDC)	10,000	140,000	140,000	140,000	140,000	140,000	67,200
Subtotal Sewer Operating Revenue	*379,100*	*564,300*	*737,300*	*916,300*	*1,099,300*	*1,265,200*	*1,422,550*
Subtotal Sewer Capital Contributions	*10,000*	*140,000*	*140,000*	*140,000*	*140,000*	*140,000*	*67,200*
Total Sewer Revenue (Operations + Capital)	*389,100*	*704,300*	*877,300*	*1,056,300*	*1,239,300*	*1,405,200*	*1,489,750*
SEWER EXPENDITURES							
Administration & Training	31,500	32,400	33,400	34,400	35,400	36,500	37,600
O&M - T&D Collection, City	54,000	55,600	57,300	59,000			
NEW: Build Up Collection O&M					112,700	116,100	119,600
O&M - WWTP Plant, City	164,000	168,900	174,000	179,200	—	—	—
NEW: Build Up WWTP O&M					303,700	482,200	441,000
General Operations, Testing, Phone, Insurance	9,000	9,300	9,600	9,900	10,200	10,500	10,800
Customer Service & Marketing	57,500	59,200	61,000	62,800	64,700	66,600	68,600
Sewer Taxes	10,500	17,700	25,200	33,400	42,200	50,700	58,000
Subtotal Operating Expenditures	*326,500*	*343,100*	*360,500*	*378,700*	*568,900*	*708,600*	*735,600*
Existing Debt - USDA-RD (principal + interest)	32,671	32,671	32,671	32,671	32,671	32,671	32,671
New Debt for CIP	—	—	—	—	—	573,400	697,200
Subtotal Debt Expenditures	*32,671*	*32,671*	*32,671*	*32,671*	*32,671*	*606,071*	*729,871*
Sewer Capital Projects	110,690	663,000	663,000	2,703,000	10,093,000	1,747,000	—
Ecology Loan Proceeds for CIP		(663,000)	(663,000)	(2,703,000)	(10,093,000)	(1,747,000)	—
Subtotal Rate-Funded Capital	*110,690*	—	—	—	—	—	—
Total Sewer Expenditures	*469,861*	*375,771*	*393,171*	*411,371*	*601,571*	*1,314,671*	*1,465,471*
Planned use of reserves	*81,000*	—	—	—	—	—	—
Annual Increase (Use) of Reserves	239	328,529	484,129	644,929	637,729	90,529	24,279
Sewer Fund Balance	2017	2018	2019	2020	2021	2022	2023
Sewer Beginning Fund Balance - actual 2017	265,000	184,239	512,768	996,897	1,641,826	2,279,555	2,370,084
Planned use of reserves	(81,000)	—	—	—	—	—	—
Annual Increase (Use) of Reserves	239	328,529	484,129	644,929	637,729	90,529	24,279
Estimated Sewer Ending Balance	*184,239*	*512,768*	*996,897*	*1,641,826*	*2,279,555*	*2,370,084*	*2,394,363*
Target Minimum Balance for Emergency					*700,000*	*700,000*	*700,000*
Ecology Required Debt Reserve on Loans						*573,400*	*697,200*
Available for CIP/Debt Payments					1,579,555	1,096,684	997,163

10.7.3 Sewer Expenditures

The operating expenses are generally projected to increase by cost escalation at 3 percent per year, except that the higher O&M costs estimated in this plan have been included in 2021. The 2021 O&M cost for the collection system is estimated at $112,700. The estimated O&M at the upgraded treatment plant in its first full year of operation is $428,000. The financial plan assumes that the City will step up operations at the plant from 2020 ($179, 000) to 2021 ($304,000) to 2022 ($428,000).

The outlook's bottom line is indicated by what happens to the annual increase (use) of reserves. By stepping the rates up each year so that the future debt payments can be afforded, excess revenue will be generated. This money will be held in reserve and be available to meet the Ecology required debt reserve on anticipated loans; the remainder will be available for future capital sewer projects. As the WWTP project gets well underway, the City will have a sense of what is the best use for the funds. It is recommended that the funds be used to reduce or avoid future loans. In this way, the City will have a better idea of the WWTP project cost and financing package and be able to update the financial plan and rate outlook for the best advantage of the ratepayers.

10.7.4 Sewer Reserves

The target minimum reserve in this financial plan is $700,000, which includes two-months of operating expense for cash flow plus $500,000 emergency reserve. The new debt for the CIP will likely require a debt reserve equivalent to one year's debt payment and has been included in this scenario: $573,000 for 2022 and $697,000 for 2023. These amounts are set aside within the fund balance. The remainder is available for future CIP and/or debt payments. The 2023 ending sewer balance is estimated to be $2.4 million, including $1.4 million in cash flow, emergency and debt reserves, with $1 million available for future sewer investment. The outlook shows approximately $1 million available compared to the cost for the second group of improvements of approximately $2 million.

10.8 FINANCIAL CONCLUSION

The City is under orders from the Department of Ecology to plan for a major upgrade to the WWTP. This is an expensive undertaking and is planned for design in 2018-2019, construction in 2020-2021 and the first full year of operation in 2022. The City does not have the funds available to invest in such a project and will need to secure grants and loans to be able to pay for the project. This is expected to have a significant impact on the monthly rates of all customers to meet the increased O&M costs and the debt service related to the loans. The City is currently seeking grants, reviewing rates, considering adding a high-strength volume rate to have higher strength dischargers pay their share, and reviewing system development charges to make sure new connections also pay their fair share. The City is committed to completing the project and meeting its debt obligations in a fair and equitable manner.

The excess revenue that is generated by stepping rates up will be saved in reserve to reduce or avoid future loans, such as the second loan for collection system improvements. The City will continue to review the financial outlook periodically to make sure that obligations can be met and to avoid drastic impacts on ratepayers.

These projections are based on current known information and reasonable assumptions, and may or may not reflect actual conditions. Results should be monitored each year during the budget process. An increase in new connections above the 25 assumed will improve the City's sewer financial outlook.

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix A. Summary of Regulations

A. SUMMARY OF REGULATIONS

Wastewater must be collected, treated, and disposed of or reused in a way that protects public health and receiving water quality, generates no objectionable off-site odors or aesthetic nuisances, and complies with all applicable regulations. Wastewater treatment facilities must meet the regulations and requirements of many federal, state, and local regulatory agencies. This appendix summarizes applicable rules and regulations that typically apply to wastewater projects.

FEDERAL REGULATIONS AND POLICIES

Federal Water Quality Legislation

Programs and policies designed to protect water quality were first initiated on a nationwide scale by the Federal Water Pollution Control Act of 1956. This act was amended by the Water Quality Act of 1965, the Clean Water Restoration Act of 1966, and the Water Quality Improvement Act of 1970. The Federal Water Pollution Act Amendment of 1972 (Public Law 92-500) replaced the previous language of the act entirely. This act requires states to establish water quality standards for all of their water bodies. The standard must consist of two parts: a designation of the use of the water body; and the water quality criteria that water body must maintain to protect the designated uses from pollution. The State of Washington complies with this regulation through WAC 173-201A, which is described later.

The Clean Water Act of 1977, in further amending the act, required any agency conducting an activity that may result in a discharge into navigable waters to obtain certification from a water pollution control agency verifying that the discharge complies with applicable effluent limitations and water quality standards. The 1977 amendments established the National Pollutant Discharge Elimination System (NPDES) permits, which regulate point discharges into water, and required water quality planning by states. Grants for facilities and training were also authorized under these amendments.

With increased environmental awareness of the extent and effects of nonpoint pollution, including stormwater, Congress passed additional amendments to the Clean Water Act as the Water Quality Act of 1987. Section 319 directs states in developing programs to reduce nonpoint source pollution, which had become increasingly evident as point sources of pollution had been abated. The amendments required each state to do the following:

- Submit a report identifying navigable waters that cannot meet water quality standards without action to control pollution.
- Identify the categories of pollution sources.
- Describe processes for identifying best management practices and control strategies.
- Identify state and local programs for controlling pollution from both point and nonpoint sources.

Federal Effluent Limitations

Section 301 of the Federal Water Pollution Control Act requires all publicly owned wastewater treatment facilities to provide a minimum of secondary treatment unless a special waiver is obtained. This act requires the following:

- The monthly average of biochemical oxygen demand (BOD) and total suspended solids (TSS) concentrations shall not exceed 30 milligrams per liter (mg/L).
- The weekly average of BOD and TSS concentrations shall not exceed 45 mg/L.
- The monthly average removal of BOD and TSS shall be at least 85 percent.
- The pH of the effluent shall be between 6.0 and 9.0.

There can be exceptions to these regulations when treatment plants receive combined sewer flows or certain industrial wastes. However, in general, these are the minimum federal requirements for effluent quality. The Washington State Department of Ecology administers these regulations under the NPDES.

Federal Standards for Use or Disposal of Sludge

Under Code of Federal Regulations Part 503 (40 CFR 503, published in 1993), land-applied sludge must meet requirements for pathogen and vector attraction reduction. Two basic classes for pathogen reduction are established in the regulations. In general, sludge distributed in bagged form must meet Class A requirements. Sludge applied to the land in bulk form must meet Class B requirements. The discussion below focuses on the regulations applicable to bulk land application because that is the only disposal option evaluated in this facilities plan.

Pathogen Reduction

Class A sludge must have levels of fecal coliform organisms below 1,000 per gram of total solids and meet other time and temperature requirements, or the sludge must have been treated with a “process to further reduce pathogens,” as defined by the U.S. Environmental Protection Agency (EPA). These processes include composting, heat drying, heat treatment, thermophilic aerobic digestion, irradiation, and pasteurization.

Class B sludge must have levels of fecal coliform organisms less than 2 million per gram of total solids, or meet other requirements, or the sludge must have been treated with an EPA-defined “process to significantly reduce pathogens.” These processes include aerobic digestion for a mean cell residence time greater than 40 days at 20ºC or 60 days at 15ºC, air drying, anaerobic digestion, composting, or lime stabilization.

Vector Attraction Reduction

The regulations require that land-applied sludge be processed to reduce its “vector attraction.” This means that the sludge should be stabilized sufficiently to not be an attraction to rodents or birds that could spread pathogens contained in the sludge and thereby increase the risk of human exposure. The basic measure of the adequacy of sludge stabilization in the regulations is that the volatile solids concentration in the sludge be reduced through processing by at least 38 percent. A series of alternative procedures are provided for reducing vector attraction, including injection below the ground surface.

Metals

Limits are specified for the concentration of various metals in the sludge and for the cumulative loading of these metals on the land used for its application. Table A-1 lists the concentration limits for any sludge that is land applied. Table A-2 lists further guidelines for sludge that is land applied in bulk. Either the monthly average concentration criteria or the cumulative pollutant loading rate criteria must be met.

Table A-1. Ceiling Concentrations for Metals in Land-Applied Sludge

Parameter	Ceiling Concentration Limit (mg/kg)	Parameter	Ceiling Concentration Limit (mg/kg)
Arsenic	75	Molybdenum	75
Cadmium	85	Nickel	420
Copper	4,300	Selenium	100
Lead	840	Zinc	7,500
Mercury	57		

Table A-2. Metal Concentration Limits for Bulk Sewage Sludge Land Application

Parameter	Monthly Average Concentration Limit (mg/kg)	Cumulative Pollutant Loading Rate (kg/hectare)
Arsenic	41	41
Cadmium	39	39
Copper	1,500	1,500
Lead	300	300
Mercury	17	17
Nickel	420	420
Selenium	100	100
Zinc	2,800	2,800

Other Measures

In addition to regulating biosolids quality, the regulations require management measures, including the following:

- Record-Keeping and Reporting—Records must be kept by the producer describing the quantity and quality of the biosolids that have been applied to specific sites for up to five years. Even if the producer has a contract for biosolids disposal with a private contractor, the producer is ultimately responsible for the record-keeping and reporting.
- Monitoring—The producer is responsible for monitoring the biosolids for metals and specific pathogens on a regular basis.
- Management Practices—Biosolids should not be applied to flooded, frozen, or snow-covered ground, so that biosolids do not enter surface waters.

EPA Reliability Criteria

An important reference for wastewater treatment plant reliability is the EPA's *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability*. This document outlines flood protection and reliability requirements for treatment facilities. Treatment works are required to be protected from damage during a 100-year flood and to remain fully operational during a 25-year flood. Reliability requirements are outlined for three reliability classes, with specific provisions for each unit process:

- Class I—Works discharging into navigable waters that could be permanently or unacceptably damaged by effluent that was degraded in quality for only a few hours. Examples of Reliability Class I works might be those discharging near drinking water reservoirs, into shellfish waters, or in proximity to areas used for water contact sports.
- Class II—Works discharging into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradation, but could be damaged by continued (on the order of several days) effluent degradation.
- Class III—Works not otherwise classified as Reliability Class I or II.

Table A-3 summarizes requirements for component reliability based on class.

Table A-3. Summary of EPA Design Criteria for System and Component Reliability

Component	Class I	Class II	Class III
Trash removal	Required	Same as Class I	Same as Class I
Grit removal	Required if sludge is handled	Same as Class I	Same as Class I
Clean-out of solids	Provisions for cleaning of solids required for components prior to degritting or sedimentation	Same as Class I	Same as Class I
Controlled diversion	Screened, gravity overflow required with alarm, annunciation, and measurement of flow discharged. Holding basin required	Same as Class I, but no holding basin required	Same, as Class I but no holding basin required
Unit operation bypassing	Required except for unit operations with two or more open basins	Same as Class I	Same as Class I
Mechanically cleaned bar screens	Backup manual screen required	Same as Class I	Same as Class I
Pumps	Capacity to handle peak flow with any one pump out of service must be provided	Same as Class I	Same as Class I
Comminution	Overflow bypass must be provided with manual bar screen	Same as Class I	Same as Class I
Primary sedimentation basins	With largest unit out, remaining units shall have design flow of at least 50 percent of the total design flow to that unit	Same as Class I	At least two basins
Final and chemical sedimentation basins, trickling filters, filters, and activated carbon columns	With largest unit out, remaining units shall have design flow of at least 75 percent of the total design flow to that unit	With largest unit out, remaining units shall have design flow of at least 50 percent of the total design flow to that unit; backup not required for chemical sedimentation basins, filters, and activated carbon columns	At least two basins; backup not required for chemical sedimentation basins, filters, and activated carbon columns
Aeration basin	At least two equal volumes shall be provided	Same as Class I	Single basin permissible
Aeration blowers or brush aerators	Sufficient to provide for peak oxygen demands with the largest capacity unit out of service	Same as Class I	At least two units
Diffusers	Designed so that isolation of the largest section of diffusers does not measurably impair oxygen transfer capability	Same as Class I	Same as Class I
Chemical flash mixer	At least two basins or a backup means of adding chemicals	Backup not required	Backup not required
Flocculation basins	At least two basins	Backup not required	Backup not required
Disinfectant contact basins	With largest unit out, remaining units shall have design flow of at least 50 percent of the total design flow to that unit	Same as Class I	Same as Class I
Sludge handling	Alternate methods of sludge disposal or treatment shall be provided for each sludge treatment unit without installed backup capability. No recycles permitted that will compromise liquid treatment.	Same as Class I	Same as Class I
Sludge holding tanks	May be used to back up downstream tanks	Same as Class I	Same as Class I
Sludge pumps	A backup pump shall be provided for each set of pumps that performs the same function. With any one pump out of service, the remaining pumps shall have capacity to handle the peak flow.	Same as Class I	Same as Class I
Anaerobic sludge digestion	At least two digestion tanks shall be provided. At least two of the tanks shall be designed to permit processing all types of sludge normally digested. Tanks shall have sufficient flexibility or backup equipment to ensure that mixing is not lost when any one piece of equipment is out of service. Uninstalled backup is acceptable for mixing equipment	Same as Class I	Same as Class I

Component	Class I	Class II	Class III
Aerobic sludge digestion	Backup aeration basin not required. At least two blowers shall be provided. Uninstalled backup is permissible. Largest section of diffusers can be isolated.		
Sludge holding tanks	May be used to back up downstream tanks	Same as Class I	Same as Class I
Vacuum filter	There shall be sufficient number of vacuum filters to enable the design flow to be dewatered with largest capacity unit out of service. Two vacuum pumps and two filtrate pumps shall service each vacuum filter. These may be uninstalled.	Same as Class I	Same as Class I
Centrifuges	There shall be sufficient number of units to enable the design flow to be dewatered with largest capacity unit out of service. The backup unit may be uninstalled.	Same as Class I	Same as Class I
Incinerators	A backup incinerator is not required. Auxiliary equipment shall be provided with backup.	Same as Class I	Same as Class I
Electric power source	Two separate and independent sources of electric power shall be provided either from two separate utility substations or from a single substation and a works-based generator. Capacity of backup power shall be sufficient to operate all vital components during peak wastewater flow, together with critical lighting and ventilation.	Same as Class I except vital components to support the secondary processes need not be included as long as treatment equivalent to sedimentation and disinfection is provided.	Sufficient to operate screening or comminution, main wastewater pumps, primary sedimentation basins, and disinfection facility during peak flow, together with critical lighting and ventilation.
Power distribution external to the works	The independent sources of power shall be distributed to the works' transformers in a way to minimize common mode failures from affecting both sources.	Same as Class I	Same as Class I
Instrumentation and control systems	Automatic control systems whose failure could result in a controlled diversion or violation of effluent limits shall be provided with a manual override. Instrumentation whose failure could result in a controlled diversion or violation of effluent limits shall be provided with an installed backup sensor and readout. Alarms shall be provided for equipment whose failure could result in a controlled diversion or violation of effluent limits. Vital instrumentation and control equipment shall be designed to permit alignment and calibration without causing a controlled diversion a violation of effluent limits.	Same as Class I	Same as Class I
Auxiliary systems	If a malfunction of the system can result in controlled diversion or violation of effluent limits and the required function cannot be done by any other means, then the system shall have backup capability.	Same as Class I	Same as Class I

Source: U. S. Environmental Protection Agency. Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability. MCD-05, EPA-430-99-74-001. Office of Water Program Operations. Washington, D. C.,

National Environmental Policy Act

The National Environmental Policy Act requires environmental documentation for projects that could have a significant adverse impact on the quality of the natural and human environment. The EPA can declare that a proposed action is categorically exempt from these requirements. Otherwise, the proposing agency must prepare an environmental information document, commonly referred to as an environmental assessment or environmental report. An environmental report considers elements of the environment such as soils, water quality and air quality, and addresses how a proposed project complies with federal and state regulations. The EPA uses the environmental report to determine whether to issue a “finding of no significant impact” or to require an environmental impact statement.

Clean Air Act

The federal Clean Air Act of 1992 requires that all federally funded projects comply with state and regional air quality plans. The local air-quality authority for Skamania County is the Southwest Clean Air Agency; agency requirements are discussed later in this appendix.

Historical and Archaeological Sites

Cultural resources are addressed in over 100 federal laws, regulations, and guidelines, including the National Environmental Policy Act and the National Historic Preservation Act. Section 106 of the Act requires federally assisted undertakings to take into account their effects on historic properties that are included in or may be eligible to be included in the National Register of Historic Places. Historic properties include prehistoric archaeological sites as well as buildings, structures, and other sites. If a project impacts identified historical or archaeological sites, a more detailed evaluation of the site and potential impact of the project on the site will be required. Three elements are involved in cultural resources studies following Section 106 procedures:

- The identification and evaluation of historic properties.
- Assessment of effects of the proposed undertaking on historic properties.
- Consultation among principal parties to consider ways to avoid, reduce, or mitigate adverse effects.

The first element, identification and evaluation, is of most concern at the beginning stages of projects. Methods for identification of historic properties consist of archival research, field survey, and consultation.

Floodplains, Wetlands, and Flood Insurance

The EPA restricts treatment projects on environmentally sensitive lands such as floodplains and wetlands.

Agricultural Lands

It is EPA policy under the Farmland Protection Policy Act (PL 97-98) to protect agricultural lands from “irreversible loss as an environmental or essential food production resource.”

Fish and Wildlife Protection

The Fish and Wildlife Coordination Act requires that projects “controlling or modifying any natural streams or other body of water” be done in a way that protects fish and wildlife resources and habitats.

Endangered Species Act

Projects with a federal “nexus,” including federal permits, approvals or funding, must comply with the Endangered Species Act. Listed species include the following:

- Bull trout—federally threatened and a state species of concern
- Chinook salmon—federally threatened and a state species of concern
- Coho salmon—federal candidate species
- Bald eagle—federal and state threatened species.

Magnuson-Stevens Fishery Conservation and Management Act

In 1998, the National Marine Fisheries Service issued interim final regulations to implement the Essential Fish Habitat (EFH) requirements of the 1996 Sustainable Fisheries Act. This act significantly amended the Magnuson-Stevens Fishery Conservation and Management Act of 1976.

The Magnuson-Stevens Act requires the following: for federal actions that may adversely affect EFH, except activities covered by a General Concurrence, federal agencies must provide a written assessment of the effects of the action on EFH. EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH must always include the critical habitat of endangered and threatened species.

STATE REGULATIONS AND POLICIES

Water Quality Standards for Surface Waters

The federal Clean Water Act allows states to establish more stringent water quality requirements than are required by federal law. Washington's Department of Ecology adopted water quality standards that became effective in 2006 and were most recently revised in 2012. General conditions listed in the standards are as follows (WAC 173-201A-010):

- All surface waters are protected by qualitative criteria, designated uses, and an anti-degradation policy.
- Based on the use designations, criteria are assigned to a water body to protect the existing and designated uses.
- Where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses, the most stringent criterion for each parameter is to be applied.

Surface waters of the state include lakes, rivers, ponds, streams, inland waters, salt waters, wetlands, and all other surface waters and water courses within the jurisdiction of the state of Washington. Standards for freshwaters are based on a given water body's designated uses for aquatic life, recreation, water supply, and miscellaneous uses (wildlife habitat, harvesting, commerce and navigation, boating and aesthetics). The designated uses the Columbia River are listed in Table A-4. Water quality standards that must be met based on these uses are outlined in WAC 173-201A.

Table A-4. Designated Uses for Segments of the Columbia River

	Aquatic Life Uses			Recreation Uses		Water Supply Uses				Misc. Uses				
	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Extraordinary Primary Contact	Primary Contact	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Columbia River from mouth to the Washington-Oregon border (river mile 309.3)			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Water Quality Standards for Surface Waters of the State of Washington. Chapter 173-201A WAC, Amended May 9, 2011. Revised January 2012. Washington Department of Ecology Publication No. 06-10-091

Columbia River Water Quality Limitations

The Columbia River has a Total Maximum Daily Load (TMDL) issued by U.S. EPA for dioxin, which is primarily intended to address discharges from pulp and paper mills. In addition, there is an approved TMDL for Total Dissolved Gas, which is intended to address spill management at dams on the river and resulting effects on fish. Neither TMDL is expected to impact discharge limits at the Stevenson wastewater treatment plant.

U.S. EPA has also been working with the States of Idaho, Oregon and Washington and the Columbia River tribes to establish a temperature TMDL for the Columbia River. This effort began in 2001 and is currently listed by the U.S. EPA as “delayed to allow necessary discussions and information exchange”. If a temperature TMDL is enacted it is likely to impact the Stevenson WWTP; however, at this time it is not known when the TMDL may be promulgated, what its requirements will be, and how relatively small dischargers like Stevenson will be effected.

National Pollutant Discharge Elimination System Permit

Wastewater Effluent

The State of Washington administers the federal effluent limitations through the NPDES program. All wastewater discharges into the waters of the state, including treated effluent from treatment plants, must be permitted through the Department of Ecology with an NPDES Permit. The City of Stevenson’s current NPDES permit, issued on October 6, 2008 and modified June 19, 2013, applies to the City’s wastewater treatment plant. A copy of the permit is included in Appendix B.

Influent Limits

The NPDES permit identifies the following rated capacity for influent wastewater flow to the City’s treatment plant:

- Average flow for the maximum month = 0.45 million gallons per day (mgd)
- BOD loading for the maximum month = 611 pounds per day (ppd)
- TSS loading for the maximum month = 611 ppd

Effluent Limits

Effluent limits in an NPDES permit must be either technology-based or water quality-based. Technology-based limits are based on the treatment methods available to treat specific pollutants. They are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis. Water quality-based limits are calculated so that the effluent will comply with surface water quality standards, groundwater standards, sediment quality standards, or the National Toxics Rule.

Currently, all effluent discharge limits for the Stevenson treatment plant are technology-based. Table A-5 summarizes effluent limits established in the NPDES permit.

Stormwater Discharge

Construction projects that disturb more than 5 acres require a construction general permit for stormwater discharge under NPDES requirements; mitigation measures are required, including preparation of a Storm Water Pollution Prevention Plan. During construction, temporary erosion and sediment control measures are required.

Table A-5. NPDES Permit Limits for Stevenson Wastewater Treatment Plan Effluent Discharge

Parameter	November–July
Biochemical Oxygen Demand (5-day)	
Maximum Average Monthly Concentration	30 mg/L
Maximum Average Monthly Load	92 ppd
Minimum Average Monthly Removal of Influent Load	85%
Maximum Average Weekly Concentration	45 mg/L
Maximum Average Weekly Load	138 ppd
Total Suspended Solids	
Maximum Average Monthly Concentration	30 mg/L
Maximum Average Monthly Load	92 ppd
Minimum Average Monthly Removal of Influent Load	85%
Maximum Average Weekly Concentration	45 mg/L
Maximum Average Weekly Load	138 ppd
Fecal Coliform Bacteria	
Monthly Geometric Mean	200/100 mL
7-Day Geometric Mean	400/100 mL
Daily pH	
Minimum	6
Maximum	9

Standards for Water Reclamation

The Washington State Departments of Health and Ecology jointly released a set of standards for wastewater reclamation projects in September 1997. The *Water Reclamation and Reuse Standards* describe the treatment and quality requirements for a variety of beneficial end uses. Four classes of reuse quality are listed, along with their suitability for various end uses: from Class A (highest quality) to Class D (lowest quality). For uses such as direct injection into a drinking water aquifer, there are more stringent standards than any of these four classes.

Landscape irrigation requires Class A reclaimed water, which is defined as follows:

> *"Class A Reclaimed Water"* means reclaimed water that, at a minimum, is at all times an oxidized, coagulated, filtered, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample.

If surface percolation is used for land application of reclaimed water, a nitrogen reduction step is required in addition to other Class A requirements.

The *Water Reclamation and Reuse Standards* also list requirements for redundancy, including redundant filtration and disinfection equipment. Storage requirements are also listed, including emergency storage and wintertime storage.

State Waste Discharge Permit, Wastewater Effluent

All wastewater disposed of via land application must be permitted through the Department of Ecology with a State Waste Discharge Permit. Disposal via land application is generally taken to mean that the land application process is relied on to provide further treatment. Effluent to be disposed of via land application is assumed not to meet reclaimed water standards before being land applied (similar to septic tank drainfield systems).

In comparison, "water reclamation" via land application is taken to mean that the effluent is treated to a high degree before being land applied, the land is not needed for further treatment, and the land application is for a beneficial use, such as groundwater recharge. Refer to the "Standards for Water Reclamation" above.

Washington State Standards for Use and Disposal of Sludge

WAC 173-308, *Biosolids Management*, establishes guidelines for treatment and land application of biosolids generated by municipal wastewater treatment facilities. These mirror the federal guidelines in 40 CFR 503. The state Department of Ecology has authority to enforce these rules and may, if it chooses, delegate some of the authority to local health departments.

Biosolids facilities in Washington operate under a statewide General Permit for Biosolids Management issued by the Department of Ecology. Rather than being issued an individual permit, facilities apply for, and gain coverage under the general permit. The general permit covers all permitted facilities in Washington and provides authorization of biosolids management in accordance with WAC 173-308.

Washington Department of Ecology Criteria for Sewage Works Design

The Ecology-developed *Criteria for Sewage Works Design*, also known as the Orange Book, is a guide for design of sewage collection and treatment systems. Any projects initiated under the authority of this facilities plan must conform to the most recent revision of the Orange Book that is available at the time the project is designed. The primary goals of the manual are as follows:

- To ensure that the design of sewage collection and treatment systems is consistent with state public health and water quality objectives
- To establish a basis for the design and review of plans and specifications for sewage treatment works and sewerage systems
- To establish the minimum requirements and limiting factors for review of sewage treatment work and sewerage system plans and specifications
- To assist the owner or the owner's authorized engineer in the preparation of plans, specifications, reports, and other data
- To guide departments in their determination of whether to issue approvals, permits, or certificates for sewage treatment works or a sewer systems.

Ecology uses the Orange Book design guidelines to review and approve reports, plans, and specifications. Design guidelines presented in this book will be used to evaluate the capacity of the proposed treatment facility and to establish design criteria. The Orange Book also presents guidelines for wastewater treatment flood protection, reliability and, component design, including the number of units required for operation during peak flows. The Orange Book requires that existing plants be protected against 100-year flood damage (the same as the federal criteria) and that new plants remain fully operational during a 100-year flood (more stringent than the federal 25-year flood federal criteria). In general, state reliability requirements follow the federal requirements outlined in Table A-3. The state applies its reliability classifications to public works as follows:

- Class I—Works whose discharge or potential discharge meets either of the following criteria:
    - ➢ The discharge is into a public water supply or shellfish or primary contact recreation waters.
    - ➢ As a result of its volume or character, the discharge could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted.

- Class II—Works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days).
- Class III—Works not otherwise classified as Reliability Class I or II.

On-Site Sewage Requirements

On-site septic systems or on-site sewage systems are the most common methods of wastewater treatment for homes, commercial establishments, and other places that are not connected to a public sewer system. An on-site sewage system uses a network of pipes, a septic tank and a drainfield to provide subsurface soil treatment and dispersal of sewage. Properly functioning on-site sewage systems protect public health and the environment by preventing untreated wastewater from coming into contact with people, groundwater or surface water. On-site sewage systems are regulated based on wastewater flows:

- Smaller on-site sewage systems are designed for flows up to 3,500 gallons per day (gpd). The State Board of Health promulgates rules for these systems and local health jurisdictions, such as the Skamania County Community Development, have authority for implementation and approval.
- The Washington Department of Health has jurisdiction over the management of large on-site sewage systems disposing of 3,500 to 100,000 gpd.
- Ecology has regulatory authority for all systems over 100,000 gpd.

On-site septic systems may not be used for treatment and disposal of industrial wastewater or combined sanitary sewer and stormwater systems.

Joint Aquatic Resources Permit

State agencies other than the Department of Ecology can be involved in construction and operation of facilities located in critical areas. The Department of Fish and Wildlife is involved in cases involving fish-bearing streams. The Department of Natural Resources has authority for facilities to be constructed on tidelands or along shorelines. To promote efficiency and reduce overlap, state agencies and the U.S. Army Corps of Engineers developed the Joint Aquatic Resources Permit Application, which can be submitted for the following permits:

- The Department of Fish and Wildlife’s Hydraulic Project Approval
- Local agency shoreline management permits
- Department of Ecology Water Quality Certification and Approval for Exceedance of Water Quality Standards
- Corps of Engineers Section 404 and Section 10 Permits
- Marine and aquatic lease.

If construction will be performed in any state waterways, a Joint Aquatic Resources Permit Application may need to be prepared.

State Environmental Policy Act

A State Environmental Policy Act review is an environmental checklist completed to ensure the state that there are no adverse environmental impacts from proposed projects. The checklist for this facilities plan is provided in Appendix J.

The checklist will evaluate potential impacts of work proposed in this facilities plan. If the responsible official determines there will be no probable significant adverse environmental impacts from the proposed projects or that the impacts would be properly mitigated, the lead agency would prepare and issue a “determination of nonsignificance" or "mitigated determination of nonsignificance." The responsible official would send the determination of nonsignificance and environmental checklist to agencies with jurisdiction, Ecology and affected tribes. These entities may submit comments to the lead agency within 15 days. An agency with jurisdiction may assume lead agency status within the 15-day period if it disagrees with the threshold determination.

A "determination of significance," which acknowledges the potential for significant environmental impacts, would require an environmental impact statement that describes existing conditions, addresses and evaluates alternatives, analyzes potential environmental impacts and addresses mitigation measures. A scoping process would have to be conducted at the beginning of the environmental impact statement, in which the City would inform agencies and the public of the proposed projects and solicit comments that would have to be addressed in the environmental impact statement.

State Environmental Review Process; Department of Ecology Documentation

To be eligible for financial assistance from the State Water Pollution Control Revolving Fund, this facilities plan must comply with the State Environmental Review Process (WAC 173-98-100). The process was established "to help ensure that environmentally sound alternatives are selected and to satisfy the state's responsibility to help ensure that recipients comply with the National Environmental Policy Act and other applicable environmental laws, regulations, and executive orders."

In addition, the Department of Ecology has established requirements for environmental documentation in coordination with the U.S. Department of Agriculture's Rural Development program. Requirements include sending out a project description and summary of the proposed action to applicable regulatory agencies and requesting input and comments regarding the proposed action.

Office of Archaeology and Historic Preservation Approval

State laws addressing historic preservation include the Indian Graves and Records Act (RCW 27.44), which prohibits knowingly disturbing a Native American or historic grave, and the Archaeological Sites and Resources Act (RCW 27.53), which requires that anyone proposing to excavate into, disturb, or remove artifacts from an archaeological site on public or private lands obtain a permit from the Office of Archaeology and Historic Preservation.

Archival research, including a check of the Washington state site inventory and records at the Office of Archaeology and Historic Preservation, is conducted prior to any field activity in order to determine if sites are already recorded in the project area or its vicinity. Other information is collected from ethnographic and historic accounts, previous regional cultural resource investigations, maps, photographs, and environmental information. Research to determine the age of landforms involved and the extent of modern disturbance is especially important. Locations of archaeological sites may be identified by this process. The potential for buried and hence undiscovered sites, or uplifted former shorelines favorable for habitation, may also be determined.

Field visits are made after completion of the background research to verify field conditions, discuss construction locations and methods, and identify historic properties. The results of these investigations are presented in a report for submittal to appropriate agencies, including the Office of Archaeology and Historic Preservation. The report includes recommendations for dealing with any sites discovered, additional discovery measures, if necessary, monitoring high-potential locations, and a plan to be enacted in the event archaeological material is encountered during construction.

If during construction, archaeological resources are found, all work will be halted and the concerned tribe and State Office of Archaeology and Historic Preservation will be contacted.

LOCAL REGULATIONS AND POLICIES

City Sewer Regulations

City regulations pertaining to sewers are outlined in Title 13 of the Stevenson Municipal Code. The following are key requirements:

- All properties with access to a public sewer are required to connect to this sewer. Private sewage disposal systems are required for all properties without access to a public sewer system.
- Prohibited discharges to the public sewer include wastes with any of the following properties:
    - Temperature higher than 150°C
    - Flammable or explosive
    - Capable of causing obstructions to the flow in sewers or other interference with the proper operation of the sewer works
    - Toxic or poisonous substance in sufficient quantity to constitute a hazard to humans or animals
    - pH lower than 6.0 or higher than 9.0
    - Suspended solids of such character and quantity that unusual attention or expense is required to handle such material at the sewage treatment plant
    - Noxious or malodorous
- Pretreatment is required for discharge of wastes with BOD greater than 300 mg/L or TSS greater than 350 mg/L or for discharges with an average-day flow greater than two percent of the average-day flow of the City
- City staff are permitted to enter all properties for the purposes of inspection, observation, measurement, sampling, and testing as required to enforce the requirements in Title 13

Critical Areas Regulations

City regulations pertaining to critical areas are outlined in Chapter 18.13 of the Stevenson Municipal Code. The city regulates all uses, activities and development within, adjacent to or likely to affect one or more critical areas. Critical areas regulated include:

- Geologically hazardous areas
- Fish and wildlife conservation areas
- Wetland areas
- Frequently flooded areas
- Critical aquifer recharge areas

The City has prepared a Critical Areas & Geologic Hazards Map that shows approximate boundaries for critical areas in the City. Copies of the map are available online. The map provides only approximate boundaries of known features and is not an adequate substitute for more detailed maps or studies that could identify alternative locations of known features or additional critical areas not illustrated on the maps. Project applicants must determine on a case-by-case basis whether a critical area exists on or near the subject property.

Floodplain Management

The design and construction of capital improvements recommended in this sewer plan must comply with the floodplain management regulations outlined in Title 15 of the Stevenson Municipal Code (Chapter 15.24).

Shoreline Management

All uses, activities, or development occurring within shoreline jurisdictions of the City of Stevenson must conform to the intent and requirements of the City's Shoreline Master Program, as outlined in Stevenson Municipal Code Chapter 18.08. The City's shoreline jurisdiction includes the following:

- Shoreline water bodies
- The area from a water body to 200 feet upland of the ordinary high water mark
- Floodways
- Up to 200 feet of floodplain contiguous with floodways
- Associated wetlands.

The city's regulated shorelines include Rock Creek, Rock Cove, and the Columbia River throughout the city limits.

International Fire Code and National Fire Protection Association

Local county fire officials have authority to enforce the national International Fire Code, which identifies required measures to prevent, control and mitigate dangers related to the use and storage of hazardous chemicals. Local officials have authority to enforce National Fire Protection Association standards. The associations Standard 820, "Fire Protection in Wastewater Treatment and Collection Facilities," is of particular interest.

International Building Code and Washington State Energy Code

Local City building officials have authority to enforce the International Building Code as well as the Washington State Energy Code. These codes govern structural, architectural and mechanical design of buildings.

Southwest Clean Air Agency

The Southwest Clean Air Agency is a local regulatory agency with jurisdiction over air emissions in Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties. The agency's primary concern with wastewater treatment facilities is odor generation. If odor-producing facilities are designed, the Southwest Clean Air Agency should be consulted for input and comments. At least 60 days prior to the construction of such facilities, a notice of construction must be filed with the agency. A permit is required to construct, erect, install, alter, reconstruct, or relocate any stationary or portable device capable of releasing contaminants in the atmosphere.

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix B. NPDES Permit

DEPARTMENT OF ECOLOGY
State of Washington

Issuance Date: October 6, 2008
Effective Date: November 1, 2008
Expiration Date: October 31, 2013
Modification Date: June 19, 2013

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT NO. WA0020672

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7775

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

City of Stevenson
P.O. Box 371
Stevenson, Washington 98648

Plant Location:
686 Southwest Rock Creek Drive
Stevenson, WA 98648

Water Body I.D. No.: WA-CR-1010

Plant Type: Oxidation Ditch

Primary Outfall: Columbia River Bonneville Pool
Discharge Location:
Latitude: 45° 41' 16" N
Longitude: 121° 53' 07" W

Secondary Outfall[1]: Rock Creek
Discharge Location:
Latitude: 45° 41’ 35”
Longitude: -121° 53’ 31”

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is authorized to discharge in accordance with the special and general conditions which follow.

Gregory S. Zentner, P.E.
Acting Southwest Region Manager
Water Quality Program
Washington State Department of Ecology

[1] Secondary Outfall may be used when the Primary Outfall is inoperative or during essential maintenance if the Permittee is working to restore the Primary Outfall at the soonest possible date.

TABLE OF CONTENTS

SPECIAL CONDITIONS

GENERAL CONDITIONS

SUMMARY OF SUBMITTALS

Permit Section	Submittal	Frequency	First Submittal Date
S3.	Discharge Monitoring Report	Monthly	December 15, 2008
S4.B.	Plan for Maintaining Adequate Capacity	As Necessary	
S4.C.	Notification of New or Altered Sources	As Necessary	
S4.D.	Infiltration and Inflow Evaluation	Annual	February 15, 2009
S4.E.	Wasteload Assessment	Annual	February 15, 2009
S5.B.	Operation and Maintenance Manual Update	As Necessary	
S5.G.	Contract Operators Hours	Monthly	With Discharge Monitoring Report
S8.	Pretreatment Industrial Waste Survey	As Necessary	
S9.	General Sewer Plan Update	As Necessary	
G1.	Signature Authorization	As Necessary	
G4.	Reporting a Cause for Permit Modification	As Necessary	
G7.	Application for Permit Renewal	1/Permit Cycle	May 1, 2013

SPECIAL CONDITIONS

S1. DISCHARGE LIMITATIONS

A. Final Effluent Limitations

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee is authorized to discharge municipal wastewater at the permitted location subject to the following limitations:

EFFLUENT LIMITATIONS		
Parameter	**Monthly Average[a]**	**Weekly Average[a]**
Biochemical Oxygen Demand* (5-Day)	30 mg/l, 92 lbs/day 85% Removal	45 mg/l, 138 lbs/day
Total Suspended Solids[b]	30 mg/l, 92 lbs/day 85% Removal	45 mg/l, 138 lbs/day
Fecal Coliform Bacteria	200/100 ml	400/100 ml
pH	Shall not be outside the range 6.0 to 9.0	
[a] The monthly and weekly average for BOD_5 and Total Suspended Solids are based on the arithmetic mean of the samples taken. The averages for fecal coliform are based on the geometric mean of the samples taken.		
[b] The monthly average effluent concentration limitations for BOD_5 and Total Suspended Solids shall not exceed 30 mg/l or 15 percent of the respective influent concentrations, whichever is more stringent.		

B. Mixing Zone Description

For the Primary Outfall, the boundaries of the mixing zone is defined as follows:

CHRONIC: Extend 315 feet downstream and 100 feet upstream. The width shall be 25 percent of the width of the Columbia River at Stevenson/RM 150.

ACUTE: Extend 31.5 feet downstream and 10 feet upstream. The width shall be 25 percent of the width of the Columbia River at Stevenson.

For the Secondary Outfall, the boundaries of the mixing zone are as follows:

CHRONIC: Extend 315 feet downstream and 100 feet upstream from the outfall and occupy 25 percent of the stream width centered on the outfall in Rock Creek.

ACUTE: Extend 31.5 feet downstream and 10 feet upstream from the outfall and occupying 25 percent of the stream width centered on the outfall in Rock Creek.

S2. FINAL TESTING SCHEDULE

The Permittee shall monitor the wastewater and sludge according to the following final schedule:

TESTS	SAMPLE POINT	SAMPLING FREQUENCY	SAMPLE TYPE
Flow	Influent or Final Effluent	Continuous (Report daily totals)	On Line
pH	Influent Final Effluent	Daily	Grab
BOD_5	Influent Final Effluent	2/Week	24-hour Composite Refrigerated
TSS	Influent Final Effluent	2/Week	24-hour Composite Refrigerated
Fecal Coliform	Final Effluent	2/Week 5/Week during July – October for the Secondary Outfall	Grab
Ammonia	Final Effluent	2/week July – October only for Secondary Outfall	24-hour Composite
Sludge Production	Digested Sludge (volume hauled)	Monthly	Measured
Temperature	Final Effluent	Daily	Grab

S3. MONITORING AND REPORTING

The Permittee shall monitor the operations and efficiency of all treatment and control facilities and the quantity and quality of the waste discharged. A record of all such data shall be maintained. The Permittee shall monitor the parameters as specified in Conditions S1 and S2 of this permit.

A. Reporting

Monitoring results obtained during the previous month shall be summarized and reported on a form provided, or otherwise approved, by the Department of Ecology (Ecology), to be submitted no later than the 15th day of the month following the completed reporting period. The report shall be sent to the Department of Ecology, Southwest Regional Office, P.O. Box 47775, Olympia, Washington 98504-7775. Monitoring shall be started on the effective date of the permit and the first report is due on the 15th day of the following month.

Unauthorized discharges such as collection system overflows, plant bypasses, or failure of the disinfection system, shall be reported immediately. Notify Ecology (see General Condition G4), Southwest Regional Office Water Quality compliance Inspector, at 360-586-0363, or Ecology's 24-hour emergency spill response number at 360-407-6300.

B. Records Retention

The Permittee shall retain for a minimum of three years all records of monitoring activities and results, including all reports of recordings from continuous monitoring instrumentation. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director. The Permittee shall retain for a minimum of five years all records pertaining to the monitoring of sludge.

C. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place and time of sampling; (2) the dates the analyses were performed; (3) who performed the analyses; (4) the analytical techniques or methods used; and (5) the results of all analyses.

D. Representative Sampling

Samples and measurements taken to meet the requirements of this condition shall be representative of the volume and nature of the monitored discharge, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

E. Test Procedures

All sampling and analytical methods used to meet the monitoring requirements specified in this permit shall, unless approved otherwise in writing by Ecology, conform to the Guidelines Establishing Test Procedures for the Analysis of Pollutants, contained in 40 Code of Federal Regulations (CFR) Part 136.

F. Accredited Laboratory

All compliance monitoring data, except for flow and temperature, submitted to Ecology as required by this permit, shall be prepared by a laboratory accredited under the provisions of Chapter 173.50 Washington Administrative Code (WAC).

G. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements are consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations or at a minimum frequency of at least one calibration per year.

S4. PREVENTION OF FACILITY OVERLOADING

A. Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded.

Average flow for the maximum month:	0.45 MGD
Influent BOD_5 loading for maximum month:	612 lbs/day
Influent TSS loading for maximum month:	612 lbs/day
Design population equivalent:	1455

B. Plans for Maintaining Adequate Capacity

When the actual flow or wasteload reaches 85 percent of the design capacity (paragraph A above) for three consecutive months, 95 percent capacity for any single month, or when the projected increases would reach design capacity within five years, whichever occurs first, the Permittee shall submit to Ecology, a plan and a schedule for continuing to maintain capacity at the facility sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet this objective.

1. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A above.

2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

3. Limitation on future sewer extensions or connections or additional wasteloads.

4. Modification or expansion of facilities necessary to accommodate increased flow or wasteload.

5. Reduction of industrial or commercial flows or wasteloads to allow for increasing sanitary flow or wasteload.

The plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction. The plan shall specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

C. Notification of New or Altered Sources

The Permittee shall submit written notice to Ecology whenever any new discharge or increase in volume or change in character of an existing discharge into the sewer is proposed which: (1) would interfere with the operation of, or exceed the design capacity of, any portion of the collection or treatment system; (2) would increase the total system flow or influent waste loading by more than ten percent; (3) is not part of an approved general sewer plan or approved plans and specifications; or would be subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act. This notice shall include an evaluation of the system's ability to adequately transport and treat the added flow and/or wasteload.

D. Infiltration and Inflow Evaluation

1. The Permittee shall conduct an infiltration and inflow evaluation. Plant monitoring records may be used to assess measurable infiltration and inflow.

2. A report shall be prepared which summarizes any measurable infiltration and inflow. If infiltration and inflow have increased by more than 15 percent from that found in the first report based on equivalent rainfall, the report shall contain a plan

and a schedule for: (1) locating the sources of infiltration and inflow; and (2) correcting the problem.

3. The report shall be submitted by **February 15, 2009**, and **annually** thereafter.

E. Wasteload Assessment

The Permittee shall conduct an annual assessment of their flow and wasteload and submit a report to Ecology by **February 15, 2009**, and **annually** thereafter. The report shall contain the following: an indication of compliance or noncompliance with the permit effluent limitations; a comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, BOD, and total suspended solids loadings; and the percentage increase in these parameters since the last annual report. The report shall also state the present and design population or population equivalent, projected population growth rate, and the estimated date upon which the design capacity is projected to be reached, according to the most restrictive of the parameters above.

S5. OPERATION AND MAINTENANCE OF MUNICIPAL FACILITIES

A. Certified Operator

In accordance with Chapter 173-230 WAC, the Permittee shall provide an adequate operating staff which is qualified to carry out the operation, maintenance, and testing activities required to ensure compliance with the conditions of this permit. An operator certified for a Class II plant by the state of Washington shall be in responsible charge of the day-to-day operation of the wastewater treatment plant. A Class I operator shall be present at the facility during all shifts when operational changes are made to the treatment process.

B. Operation and Maintenance (O&M) Manual

An approved O&M Manual shall be kept available at the treatment plant. The O&M Manual shall contain the plant process control monitoring schedule. All operators are responsible for being familiar with, and using, this manual. Submit updates to Ecology when changes are made.

C. O&M Program

The Permittee shall institute an adequate O&M program for their entire sewage system. Maintenance records shall be maintained on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records shall clearly specify the frequency and type of maintenance recommended by the manufacturer and shall show the frequency and type of maintenance performed. These maintenance records shall be available for inspection at all times.

D. Short-Term Reduction

If a Permittee contemplates a reduction in the level of treatment that would cause an exceedance of permit effluent limitations on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee shall give written notification to Ecology, if possible, 30 days prior to such activities, detailing the reasons for, length of time of and the potential effects of the reduced level of treatment. If such a reduction involves a bypass, the requirements of Conditions G5 and S6 will apply.

E. Electrical Power Failure

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations either by means of alternate power sources, standby generator, or retention of inadequately treated wastes.

F. Prevent Connection of Inflow

The Permittee shall strictly enforce their sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

G. Contract Operators Hours

Contract operators shall be required to provide adequate maintenance of treatment components, necessary process control, and general housekeeping of buildings and grounds. To ensure adequate attention is allotted to this facility, the contract operator shall maintain a daily log of hours spent on O&M at the plant, and shall report total hours for each month on the Discharge Monitoring Reports submitted to Ecology.

S6. CONSTRUCTION OR MAINTENANCE-RELATED OVERFLOW OR BYPASS

Bypasses of untreated or partially treated sewage during construction or maintenance shall be avoided if at all feasible.

If a construction or maintenance-related overflow or bypass is contemplated, the Permittee shall submit to Ecology, not less than 90 days prior to the contemplated overflow or bypass, a report which describes in detail any construction work which will result in overflow or bypass of wastewater. The report shall contain: (1) an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing; (2) a cost-effective analysis of alternatives including comparative resource damage assessment; (3) the minimum and maximum duration of bypass under each alternative; (4) a recommendation as to the preferred alternative for conducting the bypass; (5) the project date of bypass initiation; (6) a statement of compliance with State Environmental Policy Act (SEPA); and (7) a request for a water quality modification, as provided for in WAC 173-201-100(2).

For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above shall be considered during preparation of the engineering report or facilities plan and plans and specifications, and shall be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Final authorization to bypass may be granted after review of the above information, in accordance with General Condition G5. Authorization to bypass will be by administrative order.

S7. RESIDUAL SOLIDS

Residual solids include screenings, grit, scum primary sludge, waste activated sludge, and other solid waste. The Permittee shall store and handle all residual solids in such a manner so as to prevent their entry into state ground or surface waters. The Permittee shall not discharge leachate from residual solids to state surface or ground waters.

S8. PRETREATMENT

1. The Permittee shall work cooperatively with Ecology to ensure that all industrial users of the wastewater treatment system are in compliance with the pretreatment regulations promulgated in 40 CFR Part 403 and any additional pretreatment regulations that may be promulgated under Section 307(b) and reporting requirements under Section 308 of the Federal Clean Water Act.

2. The Permittee shall perform an industrial user survey, reporting, or other activities (industrial user ordinance and local limits development) as specified by Ecology which are necessary for the proper administration of a state pretreatment program.

3. Significant commercial and industrial operations shall not be allowed to discharge wastes to the Permittee's sewerage system until they have received prior authorization from Ecology in accordance with Chapter 90.48 Revised Code of Washington (RCW) and Chapter 173-216 WAC, as amended.

4. General Prohibitions - In accordance with 40 CFR 403.5(a), non-domestic discharges, which would pass through the treatment works or interfere with their operation or performance, shall not be discharged into the sewerage system.

5. Specific Prohibitions - In accordance with 40 CFR 403.5(b), the following non-domestic discharges shall not be discharged into the system.

   a. Pollutants that create a fire or explosion hazard in the publicly owned treatment works (POTW) (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).

   b. Pollutants that will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0 standard units, unless the works are specifically designed to accommodate such discharges.

   c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.

   d. Any pollutant, including oxygen demanding pollutants, (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.

   e. Heat in amounts that will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities such that the temperature at the POTW exceeds 40°C (104°F) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.

f. Petroleum oil, nonbiodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.

g. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

S9. GENERAL SEWER PLAN UPDATE

For the purpose of authorizing sewer system extensions, the Permittee shall reference an approved General Sewer Plan [see Section 173-240-030 (5) WAC]. Any new or updated plan shall be consistent with Chapter 173-240 WAC "Submission of Plans and Reports for Construction of Wastewater Facilities" (Section -050 General Sewer Plan). The Permittee shall review the General Sewer Plan and Facility Plan and update these plans as necessary to be consistent with any proposed sewer extensions or improvements prior to submission of plans for such project.

If the approved collection system improvements are modified or new projects are proposed prior to the expiration date of this permit, the general sewer plan shall be updated and submitted to Ecology for approval. However, if the plan is not updated, the Permittee shall submit an engineering report for each modified or new sewer project prior to design and construction.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to Ecology shall be signed and certified.

A. All permit applications shall be signed by either a responsible corporate officer of at least the level of vice president of a corporation, a general partner of a partnership, or the proprietor of a sole proprietorship.

B. All reports required by this permit and other information requested by Ecology shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology, and

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of B.2 must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. RIGHT OF ENTRY

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit;

B. To have access to and copy at reasonable times any records that must be kept under the terms of the permit;

C. To inspect at reasonable times any monitoring equipment or method of monitoring required in the permit;

D. To inspect at reasonable times any collection, treatment, pollution management, or discharge facilities; and

E. To sample at reasonable times any discharge of pollutants.

G3. PERMIT ACTIONS

This permit shall be subject to modification, suspension, or termination, in whole or in part by Ecology for any of the following causes:

A. Violation of any permit term or condition;

B. Obtaining a permit by misrepresentation or failure to disclose all relevant facts;

C. A material change in quantity or type of waste disposal;

D. A material change in the condition of the waters of the state; or

E. Nonpayment of fees assessed pursuant to RCW 90.48.465.

Ecology may also modify this permit, including the schedule of compliance or other conditions, if it determines good and valid cause exists, including promulgation or revisions of regulations or new information.

G4. REPORTING A CAUSE FOR MODIFICATION

The Permittee shall submit a new application, or a supplement to the previous application, along with required engineering plans and reports, whenever a material change in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application shall be submitted at least 60 days prior to any proposed changes. Submission of this application does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications should be submitted at least 180 days prior to the planned start of construction. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in the permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. DUTY TO REAPPLY

The Permittee must apply for permit renewal by **May 1, 2013**.

G8. PERMIT TRANSFER

This permit is automatically transferred to a new owner or operator if:

A. A written agreement between the old and new owner or operator containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to Ecology;

B. A copy of the permit is provided to the new owner and;

C. Ecology does not notify the Permittee of the need to modify the permit.

Unless this permit is automatically transferred according to section A. above, this permit may be transferred only if it is modified to identify the new Permittee and to incorporate such other requirements as determined necessary by Ecology.

G9. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G10. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G11. TOXIC POLLUTANTS

If any applicable toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Clean Water Act for a toxic pollutant and that standard or prohibition is more stringent than any limitation upon such pollutant in the permit, Ecology shall institute proceedings to modify or revoke and reissue the permit to conform to the new toxic effluent standard or prohibition.

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by Ecology. Ecology may revoke this permit if the permit fees established under Chapter 173-224 WAC are not paid.

G15. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to $10,000 and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to $10,000 for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be and be deemed to be a separate and distinct violation.

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix C. Modeling Input Data and Results

Base Flow Constants	
People/ERU	2.21
Flow per Capita (gpd)	55
Base Peak Factor	2.0

I/I Rates	Peak Day	Peak Hour
Estimated for PVC	1700	2500
Estimated for Concrete	3500	5000
Known Problem Areas	5400	7850

							I&I (Peak Day)		I&I (Peak Hour)		Total Flow	
Basin ID	Total Area (ac)	Receiving MH	Total ERU's	Base Flow (gpd)	% Sewered	Area Sewered (ac)	I&I Unit Flow (gpad)	I&I Flow (gpd)	I&I Unit Flow (gpad)	I&I Flow (gpd)	Peak Day (gpd)	Peak Hour (gpd)
F-01	25.2	J-2	6	729	45%	11.3	1,700	19,278	2500	28,350	20,007	29,809
F-02	124.7	K-4	30	3647	15%	18.7	1,700	31,799	2500	46,763	35,445	54,056
F-03	51.4	J-6	3	365	10%	5.1	1,700	8,738	2500	12,850	9,103	13,579
F-04	112.3	J-13	12	1459	15%	16.8	1,700	28,637	2500	42,113	30,095	45,030
F-05	162.5	J-13	265	32211	15%	24.4	1,700	41,438	2500	60,938	73,648	125,359
F-06	88.0	J-13	17	2066	25%	22.0	1,700	37,400	2500	55,000	39,466	59,133
V-01	41.0	H-7	97	11790	75%	30.8	3,500	107,625	5000	153,750	119,415	177,331
V-02	61.5	G-22	80	9724	60%	36.9	5,400	199,260	7850	289,665	208,984	309,113
V-03	64.7	H-9	61	7415	35%	22.6	3,500	79,258	5000	113,225	86,672	128,054
C-01	43.7	CI-3	76	9238	60%	26.2	3,500	91,770	5000	131,100	101,008	149,576
C-02	18.1	CI-14	16	1945	70%	12.7	3,500	44,370	5000	63,385	46,314	67,275
C-03	43.3	D-3	92	11183	60%	26.0	5,400	140,292	7850	203,943	151,475	226,308
C-04	65.2	D-12	18	2188	20%	13.0	3,500	45,640	5000	65,200	47,828	69,576
C-05a	5.4	F-1	86	10453	80%	4.3	3,500	15,092	5000	21,560	25,545	42,467
C-05b	29.9	F-6	40	4862	60%	17.9	3,500	62,769	5000	89,670	67,631	99,394
C-06	52.9	F-20	30	3647	30%	15.9	3,500	55,545	5000	79,350	59,192	86,643
C-07	75.5	F-4-2	66	8022	40%	30.2	5,400	163,080	7850	237,070	171,102	253,115
Total	1868		995	120942		334.9	3,499	1,171,989	5,058	1,693,931	1,292,931	1,935,815
										Total (MGD)	1.29	1.94
										Total (gpm)	898	1,344

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix D. Collection System Improvements Preliminary Cost Estimates

City of Stevenson Wastewater Facility Plan/General Sewer Plan
Collection System Planning Cost Estimates
Tetra Tech Inc.
17-Nov-17

		Capital Project Cost	Annual O&M	20 yr Present Worth
Phase 1 Projects 2017-2025				
S-01	Cascade Avenue Sewer	$441,000	$1,200	$462,000
S-02	Cascade Interceptor - Rock Cr PS to MH CI-4	$682,000	$1,900	$716,000
PS-01	Rock Creek Pump Station	$1,226,000	$13,700	$1,468,000
PS-02	Fairgrounds Pump Station - Phase 1	$111,000	$800	$125,000
PS-04	Kanaka Pump Station	$770,000	$9,800	$943,000
PS-05	Cascade Pump Station - Phase 1	$37,000	$300	$42,000
	Total	$3,267,000	$27,700	$3,756,000
Phase 2 Projects 2025-2040				
S-03	Cascade Interceptor - MH CI-4 to CI-12	$1,050,000	$2,700	$1,098,000
PS-03	Fairgrounds Pump Station - Phase 2	$917,000	$10,700	$1,106,000
PS-06	Cascade Pump Station - Phase 2	$509,000	$7,000	$633,000
	Total	$2,476,000	$20,400	$2,837,000
Extensions to Unsewered Areas				
S-04	Sewer Main D Extension	$1,330,000	$4,100	$1,403,000
S-05	Iman Cemetery Road Extension	$1,045,000	$3,300	$1,103,000
S-06	Foster Creek Road Extension	$1,525,000	$4,600	$1,606,000
	Total	$3,900,000	$12,000	$4,112,000
Annual Operations And Maintenance				
	Annual Sewer Inspection & Cleaning		$5,000	
	Annual Pipe and MH Rehab		$80,000	

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Cascade Avenue Sewer

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	12" D3034 PVC Sewer Pipe	920	LF	$96	$88,320
	Side Sewers / Connections	30%	of Mainline		$26,500
	Manhholes	3	EA	$5,400	$16,200
	AC Restoration	570	SY	$50	$28,500
	Subtotal Sewer Infrastructure				*$159,520*
	Utility Support / Relocations	1	LS	$21,000	$21,000
	Bypass Work	5	days	$900	$4,500
	Abandon Existing Sewer	1	LS	$5,500	$5,500
	Traffic Control	15	days	$1,100	$16,500
	Erosion Control	1	LS	$5,500	$5,500
	Misc Restoration / Cleanup	1	LS	$11,000	$11,000
	Subtotal Support Work				*$64,000*
	Construction Subtotal				*$223,520*
	Contractor O&P	12%	of Sub Cost		$26,822
	Mobilization, demobilization, bond	6%	of Sub cost		$13,411
	Total estimated current construction cost				*$263,754*
	Escalation to time of construction	6%			$15,825
	Total estimated construction cost				$279,579
	Contingency	20%			$55,916
	Engineering Design	13%			$41,937
	Construction Management	10%			$33,549
	Sales Tax	8.8%			$29,524
	Total Estimated Construction Cost				$365,000
	Total Estimated Capital Cost				$441,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	2	hr	$60	$200
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$1,000
	Equipment replacement	0.0%			$0
	Total Annual Cost				$1,200
	Present Worth Factor	17.687			
	Present Worth Cost				$21,000

Total Present Worth Project Cost Estimate

	Capital	$441,000
	Operations and Maintenance	$21,000
	Total Present Worth	$462,000

Project: City of Stevenson Wastewater Facility Plan/General Sewer Plan
Subject: Collection System Planning Cost Estimates
Cascade Interceptor - Rock Cr PS to MH CI-4

By : Tetra Tech Inc.
Date : 17-Nov-17

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	18" F679 PVC Sewer Pipe	1,250	LF	$130	$162,500
	Side Sewers / Connections	30%	of Mainline		$48,800
	Manhholes	5	EA	$5,500	$27,500
	AC Restoration	690	SY	$50	$34,500
	Subtotal Sewer Infrastructure				*$273,300*
	Utility Support / Relocations	1	LS	$16,000	$16,000
	Bypass Work	5	days	$900	$4,500
	Abandon Existing Sewer	1	LS	$11,000	$11,000
	Traffic Control	20	days	$1,100	$22,000
	Erosion Control	1	LS	$8,500	$8,500
	Misc Restoration / Cleanup	1	LS	$11,000	$11,000
	Subtotal Support Work				*$73,000*
	Construction Subtotal				*$346,300*
	Contractor O&P	12%	of Sub Cost		$41,556
	Mobilization, demobilization, bond	6%	of Sub cost		$20,778
	Total estimated current construction cost				*$408,634*
	Escalation to time of construction	6%			$24,518
	Total estimated construction cost				$433,152
	Contingency	20%			$86,630
	Engineering Design	13%			$64,973
	Construction Management	10%			$51,978
	Sales Tax	8.8%			$45,741
	Total Estimated Construction Cost				$566,000
	Total Estimated Capital Cost				$682,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	3	hr	$60	$200
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$1,700
	Equipment replacement	0.0%			$0
	Total Annual Cost				$1,900
	Present Worth Factor	17.687			
	Present Worth Cost				$34,000

Total Present Worth Project Cost Estimate

	Capital	$682,000
	Operations and Maintenance	$34,000
	Total Present Worth	$716,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Cascade Interceptor - MH CI-4 to CI-12

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	18" F679 PVC Sewer Pipe	1,650	LF	$130	$214,500
	Side Sewers / Connections	30%	of Mainline		$64,400
	Manhholes	6	EA	$5,500	$33,000
	AC / Gravel / Native Restoration	1,420	SY	$20	$28,400
	Subtotal Sewer Infrastructure				*$340,300*
	Utility Support / Relocations	1	LS	$16,000	$16,000
	Bypass Work	10	days	$900	$9,000
	Abandon Existing Sewer	1	LS	$11,000	$11,000
	Railroad Easement / Flagging	1	LS	$50,000	$50,000
	Traffic Control	5	days	$1,100	$5,500
	Erosion Control	1	LS	$9,000	$9,000
	Misc Restoration / Cleanup	1	LS	$11,000	$11,000
	Subtotal Support Work				*$111,500*
	Construction Subtotal				*$451,800*
	Contractor O&P	12%	of Sub Cost		$54,216
	Mobilization, demobilization, bond	6%	of Sub cost		$27,108
	Total estimated current construction cost				*$533,124*
	Escalation to time of construction	25%			$133,281
	Total estimated construction cost				$666,405
	Contingency	20%			$133,281
	Engineering Design	13%			$99,961
	Construction Management	10%			$79,969
	Sales Tax	8.8%			$70,372
	Total Estimated Construction Cost				$870,000
	Total Estimated Capital Cost				$1,050,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	4	hr	$60	$300
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$2,400
	Equipment replacement	0.0%			$0
	Total Annual Cost				$2,700
	Present Worth Factor	17.687			
	Present Worth Cost				$48,000

Total Present Worth Project Cost Estimate

	Capital	$1,050,000
	Operations and Maintenance	$48,000
	Total Present Worth	$1,098,000

Project: City of Stevenson Wastewater Facility Plan/General Sewer Plan
Subject: Collection System Planning Cost Estimates
Sewer Main D Extension

By : Tetra Tech Inc.
Date : 17-Nov-17

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	8" D3034 PVC Sewer Pipe	3,500	LF	$85	$297,500
	Side Sewers / Connections	30%	of Mainline		$89,300
	Manhholes	10	EA	$5,500	$55,000
	AC Restoration	2,440	SY	$50	$122,000
	Subtotal Sewer Infrastructure				*$563,800*
	Utility Support / Relocations	1	LS	$27,000	$27,000
	Bypass Work	0	days	$900	$0
	Abandon Existing Sewer	0	LS	$11,000	$0
	Traffic Control	25	days	$1,100	$27,500
	Erosion Control	1	LS	$11,000	$11,000
	Misc Restoration / Cleanup	1	LS	$21,000	$21,000
	Subtotal Support Work				*$86,500*
	Construction Subtotal				*$650,300*
	Contractor O&P	12%	of Sub Cost		$78,036
	Mobilization, demobilization, bond	6%	of Sub cost		$39,018
	Total estimated current construction cost				*$767,354*
	Escalation to time of construction	10%			$76,735
	Total estimated construction cost				$844,089
	Contingency	20%			$168,818
	Engineering Design	13%			$126,613
	Construction Management	10%			$101,291
	Sales Tax	8.8%			$89,136
	Total Estimated Construction Cost				$1,102,000
	Total Estimated Capital Cost				$1,330,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	9	hr	$60	$600
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$3,500
	Equipment replacement	0.0%			$0
	Total Annual Cost				$4,100
	Present Worth Factor	17.687			
	Present Worth Cost				$73,000

Total Present Worth Project Cost Estimate

	Capital	$1,330,000
	Operations and Maintenance	$73,000
	Total Present Worth	$1,403,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Iman Cemetery Road Extension

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	8" D3034 PVC Sewer Pipe	2,800	LF	$85	$238,000
	Side Sewers / Connections	30%	of Mainline		$71,400
	Manhholes	6	EA	$5,500	$33,000
	AC Restoration	2,000	SY	$50	$100,000
	Subtotal Sewer Infrastructure				*$442,400*
	Utility Support / Relocations	1	LS	$26,000	$26,000
	Bypass Work	1	days	$900	$900
	Abandon Existing Sewer	0	LS	$11,000	$0
	Traffic Control	15	days	$1,100	$16,500
	Erosion Control	1	LS	$9,000	$9,000
	Misc Restoration / Cleanup	1	LS	$16,000	$16,000
	Subtotal Support Work				*$68,400*
	Construction Subtotal				*$510,800*
	Contractor O&P	12%	of Sub Cost		$61,296
	Mobilization, demobilization, bond	6%	of Sub cost		$30,648
	Total estimated current construction cost				*$602,744*
	Escalation to time of construction	10%			$60,274
	Total estimated construction cost				$663,018
	Contingency	20%			$132,604
	Engineering Design	13%			$99,453
	Construction Management	10%			$79,562
	Sales Tax	8.8%			$70,015
	Total Estimated Construction Cost				$866,000
	Total Estimated Capital Cost				$1,045,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	7	hr	$60	$500
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$2,800
	Equipment replacement	0.0%			$0
	Total Annual Cost				$3,300
	Present Worth Factor	17.687			
	Present Worth Cost				$58,000

Total Present Worth Project Cost Estimate

	Capital	$1,045,000
	Operations and Maintenance	$58,000
	Total Present Worth	$1,103,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Foster Creek Road Extension

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	8" D3034 PVC Sewer Pipe	4,000	LF	$85	$340,000
	Side Sewers / Connections	30%	of Mainline		$102,000
	Manhholes	12	EA	$5,500	$66,000
	AC Restoration	2,800	SY	$50	$140,000
	Subtotal Sewer Infrastructure				*$648,000*
	Utility Support / Relocations	1	LS	$27,000	$27,000
	Bypass Work	0	days	$900	$0
	Abandon Existing Sewer	0	LS	$11,000	$0
	Traffic Control	35	days	$1,100	$38,500
	Erosion Control	1	LS	$11,000	$11,000
	Misc Restoration / Cleanup	1	LS	$21,000	$21,000
	Subtotal Support Work				*$97,500*
	Construction Subtotal				*$745,500*
	Contractor O&P	12%	of Sub Cost		$89,460
	Mobilization, demobilization, bond	6%	of Sub cost		$44,730
	Total estimated current construction cost				*$879,690*
	Escalation to time of construction	10%			$87,969
	Total estimated construction cost				$967,659
	Contingency	20%			$193,532
	Engineering Design	13%			$145,149
	Construction Management	10%			$116,119
	Sales Tax	8.8%			$102,185
	Total Estimated Construction Cost				$1,263,000
	Total Estimated Capital Cost				$1,525,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	10	hr	$60	$600
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$4,000
	Equipment replacement	0.0%			$0
	Total Annual Cost				$4,600
	Present Worth Factor	17.687			
	Present Worth Cost				$81,000

Total Present Worth Project Cost Estimate

	Capital	$1,525,000
	Operations and Maintenance	$81,000
	Total Present Worth	$1,606,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Rock Creek Pump Station

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Wet Well Strucural	1	LS	$85,000	$85,000
	Wet Well Mechanical	1	LS	$11,000	$11,000
	Valve Vault Structural	1	LS	$17,500	$17,500
	Valve Vault Mechanical	1	LS	$45,000	$45,000
	Bypass Manhole	1	EA	$9,000	$9,000
	12" Force Main	500	LF	$85	$42,500
	12" Force Main - Bridge Crossing	1	LS	$27,000	$27,000
	AC Trench Restoration	230	SY	$50	$11,500
	Subtotal Sewer Infrastructure				*$248,500*
	Pumps	2	EA	$35,000	$70,000
	Control Panels	1	LS	$70,000	$70,000
	Prefabricated Control Building	1	LS	$30,000	$30,000
	Instrumentation	1	LS	$16,000	$16,000
	Generator / ATS	1	LS	$65,000	$65,000
	Subtotal Equipment & Controls				*$251,000*
	Electrical Conduit, Materials, Equip Install	1	LS	$32,000	$32,000
	Abandon Existing Facilities	1	LS	$11,000	$11,000
	Bypass Work	1	LS	$11,000	$11,000
	Dewatering	1	LS	$16,000	$16,000
	Erosion Control	1	LS	$5,500	$5,500
	Civil Site Work, Utilities & Restoration	1	LS	$53,000	$53,000
	Construction Subtotal				*$628,000*
	Contractor O&P	12%	of Sub Cost		$75,360
	Mobilization, demobilization, bond	6%	of Sub cost		$37,680
	Total estimated current construction cost				*$741,040*
	Escalation to time of construction	5%			$37,052
	Total estimated construction cost				$778,092
	Contingency	20%			$155,618
	Engineering Design	13%			$116,714
	Construction Management	10%			$93,371
	Sales Tax	8.8%			$82,167
	Total Estimated Construction Cost				$1,016,000
	Total Estimated Capital Cost				$1,226,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	60	hr	$60	$3,600
	Power	13680	KWH	$0.08	$1,100
	Structural Maintenance	1.0%			$3,000
	Equipment replacement	2.0%			$6,000
	Total Annual Cost				$13,700
	Present Worth Factor	17.687			
	Present Worth Cost				$242,000

Total Present Worth Project Cost Estimate

Capital	$1,226,000
Operations and Maintenance	$242,000
Total Present Worth	$1,468,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Fairgrounds Pump Station - Phase 1

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Bypass Pumping Connections	1	LS	$11,000	$11,000
	Flow Meter Vault	1	LS	$3,200	$3,200
	6" Force Main Relocation	200	LF	$65	$13,000
	AC Trench Restoration	120	SY	$50	$6,000
	Subtotal Sewer Infrastructure				*$33,200*
	Flow Meter	1	EA	$5,400	$5,400
	Control Modifications	1	LS	$5,400	$5,400
	Subtotal Equipment & Controls				*$10,800*
	Electrical Conduit, Materials, Equip Install	1	LS	$5,400	$5,400
	Bypass Work	1	LS	$3,200	$3,200
	Civil Site Work, Utilities & Restoration	1	LS	$5,300	$5,300
	Construction Subtotal				*$57,900*
	Contractor O&P	12%	of Sub Cost		$6,948
	Mobilization, demobilization, bond	6%	of Sub cost		$3,474
	Total estimated current construction cost				*$68,322*
	Escalation to time of construction	3%			$2,050
	Total estimated construction cost				$70,372
	Contingency	20%			$14,074
	Engineering Design	13%			$10,556
	Construction Management	10%			$8,445
	Sales Tax	8.8%			$7,431
	Total Estimated Construction Cost				$92,000
	Total Estimated Capital Cost				$111,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	5	hr	$60	$300
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$200
	Equipment replacement	2.0%			$300
	Total Annual Cost				$800
	Present Worth Factor	17.687			
	Present Worth Cost				$14,000

Total Present Worth Project Cost Estimate

	Capital	$111,000
	Operations and Maintenance	$14,000
	Total Present Worth	$125,000

Project: City of Stevenson Wastewater Facility Plan/General Sewer Plan
Subject: Collection System Planning Cost Estimates
Fairgrounds Pump Station - Phase 2

By : Tetra Tech Inc.
Date : 17-Nov-17

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Wet Well Strucural	1	LS	$53,000	$53,000
	Wet Well Mechanical	1	LS	$11,000	$11,000
	Valve Vault Structural	1	LS	$11,000	$11,000
	Valve Vault Mechanical	1	LS	$27,000	$27,000
	Bypass Manhole	1	EA	$9,000	$9,000
	Subtotal Sewer Infrastructure				*$111,000*
	Pumps	2	EA	$18,000	$36,000
	Control Panels	1	LS	$64,000	$64,000
	Instrumentation	1	LS	$16,000	$16,000
	Generator / ATS	1	LS	$48,000	$48,000
	Subtotal Equipment & Controls				*$164,000*
	Electrical Conduit, Materials, Equip Install	1	LS	$21,000	$21,000
	Abandon Existing Facilities	1	LS	$11,000	$11,000
	Bypass Work	1	LS	$11,000	$11,000
	Erosion Control	1	LS	$5,500	$5,500
	Civil Site Work, Utilities & Restoration	1	LS	$42,000	$42,000
	Construction Subtotal				*$365,500*
	Contractor O&P	12%	of Sub Cost		$43,860
	Mobilization, demobilization, bond	6%	of Sub cost		$21,930
	Total estimated current construction cost				*$431,290*
	Escalation to time of construction	35%			$150,952
	Total estimated construction cost				$582,242
	Contingency	20%			$116,448
	Engineering Design	13%			$87,336
	Construction Management	10%			$69,869
	Sales Tax	8.8%			$61,485
	Total Estimated Construction Cost				$760,000
	Total Estimated Capital Cost				$917,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	60	hr	$60	$3,600
	Power	4260	KWH	$0.08	$400
	Structural Maintenance	1.0%			$1,700
	Equipment replacement	2.0%			$5,000
	Total Annual Cost				$10,700
	Present Worth Factor	17.687			
	Present Worth Cost				$189,000

Total Present Worth Project Cost Estimate

	Capital	$917,000
	Operations and Maintenance	$189,000
	Total Present Worth	$1,106,000

Project: City of Stevenson Wastewater Facility Plan/General Sewer Plan
Subject: Collection System Planning Cost Estimates
Kanaka Pump Station

By : Tetra Tech Inc.
Date : 17-Nov-17

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Wet Well Strucural	1	LS	$53,000	$53,000
	Wet Well Mechanical	1	LS	$11,000	$11,000
	Valve Vault Structural	1	LS	$11,000	$11,000
	Valve Vault Mechanical	1	LS	$26,000	$26,000
	Bypass Manhole	1	EA	$9,000	$9,000
	Subtotal Sewer Infrastructure				*$110,000*
	Pumps	2	EA	$21,000	$42,000
	Control Panels	1	LS	$64,000	$64,000
	Instrumentation	1	LS	$16,000	$16,000
	Generator / ATS	1	LS	$53,000	$53,000
	Subtotal Equipment & Controls				*$175,000*
	Electrical Conduit, Materials, Equip Install	1	LS	$21,000	$21,000
	Abandon Existing Facilities	1	LS	$11,000	$11,000
	Bypass Work	1	LS	$11,000	$11,000
	Erosion Control	1	LS	$5,500	$5,500
	Civil Site Work, Utilities & Restoration	1	LS	$43,000	$43,000
	Construction Subtotal				*$376,500*
	Contractor O&P	12%	of Sub Cost		$45,180
	Mobilization, demobilization, bond	6%	of Sub cost		$22,590
	Total estimated current construction cost				*$444,270*
	Escalation to time of construction	10%			$44,427
	Total estimated construction cost				$488,697
	Contingency	20%			$97,739
	Engineering Design	13%			$73,305
	Construction Management	10%			$58,644
	Sales Tax	8.8%			$51,606
	Total Estimated Construction Cost				$638,000
	Total Estimated Capital Cost				$770,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	60	hr	$60	$3,600
	Power	4560	KWH	$0.08	$400
	Structural Maintenance	1.0%			$1,400
	Equipment replacement	2.0%			$4,400
	Total Annual Cost				$9,800
	Present Worth Factor	17.687			
	Present Worth Cost				$173,000

Total Present Worth Project Cost Estimate

	Capital	$770,000
	Operations and Maintenance	$173,000
	Total Present Worth	$943,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Cascade Pump Station - Phase 1

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Bypass Pumping Connections	1	LS	$11,000	$11,000
	Subtotal Sewer Infrastructure				*$11,000*
	Auto Dialer	1	EA	$2,200	$2,200
	Subtotal Equipment & Controls				*$2,200*
	Electrical Conduit, Materials, Equip Install	1	LS	$2,200	$2,200
	Bypass Work	1	LS	$1,600	$1,600
	Civil Site Work, Utilities & Restoration	1	LS	$2,100	$2,100
	Construction Subtotal				*$19,100*
	Contractor O&P	12%	of Sub Cost		$2,292
	Mobilization, demobilization, bond	6%	of Sub cost		$1,146
	Total estimated current construction cost				*$22,538*
	Escalation to time of construction	3%			$676
	Total estimated construction cost				$23,214
	Contingency	20%			$4,643
	Engineering Design	13%			$3,482
	Construction Management	10%			$2,786
	Sales Tax	8.8%			$2,451
	Total Estimated Construction Cost				$30,000
	Total Estimated Capital Cost				$37,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	1	hr	$60	$100
	Power	0	KWH	$0.08	$0
	Structural Maintenance	0.5%			$100
	Equipment replacement	2.0%			$100
	Total Annual Cost				$300
	Present Worth Factor	17.687			
	Present Worth Cost				$5,000

Total Present Worth Project Cost Estimate

	Capital	$37,000
	Operations and Maintenance	$5,000
	Total Present Worth	$42,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Collection System Planning Cost Estimates**
Cascade Pump Station - Phase 2

By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Wet Well Strucural	1	LS	$32,000	$32,000
	Wet Well Mechanical	1	LS	$5,400	$5,400
	Valve Vault Structural	1	LS	$8,600	$8,600
	Valve Vault Mechanical	1	LS	$16,000	$16,000
	Bypass Manhole	1	EA	$6,400	$6,400
	Subtotal Sewer Infrastructure				*$68,400*
	Pumps	2	EA	$8,000	$16,000
	Control Panels	1	LS	$43,000	$43,000
	Instrumentation	1	LS	$11,000	$11,000
	Generator / ATS	0	LS	$0	$0
	Subtotal Equipment & Controls				*$70,000*
	Electrical Conduit, Materials, Equip Install	1	LS	$16,000	$16,000
	Abandon Existing Facilities	1	LS	$5,400	$5,400
	Bypass Work	1	LS	$5,400	$5,400
	Erosion Control	1	LS	$5,400	$5,400
	Civil Site Work, Utilities & Restoration	1	LS	$32,000	$32,000
	Construction Subtotal				*$202,600*
	Contractor O&P	12%	of Sub Cost		$24,312
	Mobilization, demobilization, bond	6%	of Sub cost		$12,156
	Total estimated current construction cost				*$239,068*
	Escalation to time of construction	35%			$83,674
	Total estimated construction cost				$322,742
	Contingency	20%			$64,548
	Engineering Design	13%			$48,411
	Construction Management	10%			$38,729
	Sales Tax	8.8%			$34,082
	Total Estimated Construction Cost				$421,000
	Total Estimated Capital Cost				$509,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	60	hr	$60	$3,600
	Power	370	KWH	$0.08	$100
	Structural Maintenance	1.0%			$1,100
	Equipment replacement	2.0%			$2,200
	Total Annual Cost				$7,000
	Present Worth Factor	17.687			
	Present Worth Cost				$124,000

Total Present Worth Project Cost Estimate

	Capital	$509,000
	Operations and Maintenance	$124,000
	Total Present Worth	$633,000

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix E. Outfall Mixing Zone Study Memorandum

Technical Memorandum

PO Box 1623 • Gig Harbor, WA 98335
Phone (253) 265-2958 • Fax (253) 265-6041
LFOX@cosmopolitaneng.com

TM TITLE: **Stevenson Reasonable Potential Analysis**

DATE: March 20, 2013

TO: Eric Hansen, City of Stevenson

CC: Ken Alexander, Gray & Osborne

PREPARED BY: Lauren Fox, CME

REVIEWED BY: Bill Fox, CME

INTRODUCTION

The main purpose of a mixing zone study is to obtain dilution factors which are then utilized to calculate the reasonable potential of a discharge to violate state and federal water quality standards. If a reasonable potential exists for a certain parameter to exceed standards, Ecology may impose a permit limit on the discharge. This reasonable potential analysis is for informational purposes to G&O and the City of Stevenson only, as Ecology will likely perform its own analysis to determine permit limits.

METHODOLOGY

To calculate the reasonable potential, CME used the EPA spreadsheet tdscalc.xls and dilution factors obtained from the modeling completed for the mixing zone study. Ambient water quality data were obtained from two sources, temperature readings at USGS Station No. 14105700 at the Dalles, and ammonia, pH, and metals data from Ecology sampling at Vancouver in 2007. A thorough search of alternate sources (Oregon DEQ, EPA, USACE) for metals data on the Stevenson reach of the river was performed, but yielded no results. The temperature used to calculate the criteria for total ammonia is a 90th percentile annual maximum 1DMax of 20.6°C, per Table VI-2 of the Permit Writer's Manual.

As there is no data available on the effluent quality for metals, the EPA spreadsheet was used to back calculate the maximum effluent toxics concentration possible before a permit limit would be imposed. An assumed sample set of five separate and discrete effluent samples was assumed. Maximum allowable effluent concentrations were calculated for copper, zinc, and ammonia for each of the three diffuser options presented in the Mixing Zone Study Report.

RESULTS

In all cases, the maximum allowable effluent concentration was calculated that would produce a determination of "no reasonable potential" to exceed mixing zone and water quality standards. This determination was driven by compliance at the edge of the acute boundary for metals (copper, zinc), and at the edge of the chronic boundary for ammonia. In absence of actual priority pollutant data, copper and zinc were chosen as typical indicator toxicants of concern based on our experience at other Washington State treatment plants. If there is a concern over wastewater treatment effluents meeting mixing zone and water quality standards, they are usually of greatest concern for these two metals and ammonia.

Maximum allowable concentrations for each scenario are summarized in the table below, and a copy of the spreadsheet with calculations is attached.

Table 1 Maximum Allowable Concentration

	Current Diffuser		Deep Single-Port Diffuser		Deep 3-Port Diffuser	
	2013	2030	2013	2030	2013	2030
Copper (ug/L)	19	21	23	27	26	29
Zinc (ug/L)	151	172	188	213	205	237
Ammonia (as N) (mg/L)	11	9	14	13	13	10

DISCUSSION

Ammonia

The city recently forwarded results of two effluent samples for ammonia. The results were both non-detected, which indicates full nitrification of the effluent. This was confirmed in discussions between G&O and plant operators, in which they confirmed that the oxidation ditches are run with anoxic zones, which is required for full nitrification.

From this we conclude that any of the three outfall improvement alternatives would comply with ambient ammonia criteria and produce a determination by Ecology of "no reasonable potential" to exceed water quality standards at the mixing zone boundaries. Per EPA and Ecology protocol, no effluent limits should be required.

Metals

Stevenson is a small city with no known commercial or industrial wastewater sources that would suggest unusually high concentrations of metals or other priority pollutants. The concentrations listed in Table 1 should not be difficult to meet for a typical city of this size and character with extended aeration treatment. Therefore, we project that all diffuser options would result in "no reasonable potential" to exceed standards, and thus no effluent limits should be required in future NPDES permits.

AMMONIA WATER QUALITY CRITERIA CALCULATION

NPDES Permit #

Calculation Of Ammonia Concentration and Criteria for fresh water. Based on EPA Quality Criteria for Water (EPA 400/5-86-001) and WAC 173-201A. Revised 1-5-94 (corrected total ammonia criterion). Revised 3/10/95 to calculate chronic criteria in accordance with EPA Memorandum from Heber to WQ Stds Coordinators dated July 30, 1992.

INPUT	
1. Ambient Temperature (deg C; 0<T<30)	20.6
2. Ambient pH (6.5<pH<9.0)	8.24
3. Acute TCAP (Salmonids present- 20; absent- 25)	20
4. Chronic TCAP (Salmonids present- 15; absent- 20)	15
OUTPUT	
1. Intermediate Calculations:	
Acute FT	1.00
Chronic FT	1.41
FPH	1.00
RATIO	14
pKa	9.38
Fraction Of Total Ammonia Present As Un-ionized	6.7269%
2. Un-ionized Ammonia Criteria	
Acute (1-hour) Un-ionized Ammonia Criterion (ug NH3/L)	260.0
Chronic (4-day) Un-ionized Ammonia Criterion (ug NH3/L)	42.0
3. Total Ammonia Criteria:	
Acute Total Ammonia Criterion (mg NH3+ NH4/L)	3.9
Chronic Total Ammonia Criterion (mg NH3+ NH4/L)	0.6
4. Total Ammonia Criteria expressed as Nitrogen:	
Acute Ammonia Criterion as mg N	3.2
Chronic Ammonia Criterion as N	0.51

3/22/2013 10:53 AM
tsdcalc Stevenson

REASONABLE POTENTIAL CALCULATION

NPDES Permit No.

This spreadsheet calculates the reasonable potential to exceed state water quality standards for a small number of samples. The procedure and calculations are done per the procedure in Technical Support Document for Water Quality-based Toxics Control U.S. EPA, March, 1991 (EPA/505/2-90-001) on page 56. User input columns are shown with red headings. Corrected formulas in col G and H on 5/98 (GB)

CALCULATIONS

Parameter	Metal Criteria Translator as decimal Acute	Metal Criteria Translator as decimal Chronic	Ambient Concentration (metals as dissolved) ug/L	State Water Quality Standard: Acute ug/L	State Water Quality Standard: Chronic ug/L	Max concentration at edge of...: Acute Mixing Zone ug/L	Max concentration at edge of...: Chronic Mixing Zone ug/L	LIMIT REQ'D?	Effluent percentile value	Pn	Max effluent conc. measured (metals as total recoverable) ug/L	Coeff Variation CV	s	# of samples n	Multiplier	Acute Dil'n Factor	Chronic Dil'n Factor	COMMENTS
Option 1 - 2013 Flows																		
Copper	0.996	0.996	0.8000	4.6100	3.4700	4.59	1.63	NO	0.95	0.549	18.70	0.60	0.55	5	2.32	11.2	51.0	Existing Outfall
Zinc	0.996	0.996	4.5000	35.3600	32.2900	35.31	11.27	NO	0.95	0.549	151.00	0.60	0.55	5	2.32	11.2	51.0	Existing Outfall
Ammonia (as N)			0.0160	3.2000	0.5100	2.26	0.51	NO	0.95	0.549	10.80	0.60	0.55	5	2.32	11.2	51.0	Existing Outfall
Option 1 - 2030 Flows																		
Copper	0.996	0.996	0.8000	4.6100	3.4700	4.57	1.98	NO	0.95	0.549	21.20	0.60	0.55	5	2.32	12.8	41.0	Existing Outfall
Zinc	0.996	0.996	4.5000	35.3600	32.2900	35.26	14.10	NO	0.95	0.549	172.00	0.60	0.55	5	2.32	12.8	41.0	Existing Outfall
Ammonia (as N)			0.0160	3.2000	0.5100	1.59	0.51	NO	0.95	0.549	8.70	0.60	0.55	5	2.32	12.8	41.0	Existing Outfall
Option 2 - 2013 Flows																		
Copper	0.996	0.996	0.8000	4.6100	3.4700	4.60	1.61	NO	0.95	0.549	23.30	0.60	0.55	5	2.32	14.0	66.0	Extended Open-Ended
Zinc	0.996	0.996	4.5000	35.3600	32.2900	35.27	11.03	NO	0.95	0.549	188.00	0.60	0.55	5	2.32	14.0	66.0	Extended Open-Ended
Ammonia (as N)			0.0160	3.2000	0.5100	2.34	0.51	NO	0.95	0.549	14.00	0.60	0.55	5	2.32	14.0	66.0	Extended Open-Ended
Option 2 - 2030 Flows																		
Copper	0.996	0.996	0.8000	4.6100	3.4700	4.61	1.83	NO	0.95	0.549	26.50	0.60	0.55	5	2.32	15.9	59.0	Extended Open-Ended
Zinc	0.996	0.996	4.5000	35.3600	32.2900	35.23	12.78	NO	0.95	0.549	213.00	0.60	0.55	5	2.32	15.9	59.0	Extended Open-Ended
Ammonia (as N)			0.0160	3.2000	0.5100	1.84	0.51	NO	0.95	0.549	12.50	0.60	0.55	5	2.32	15.9	59.0	Extended Open-Ended
Option 3 - 2013 Flows																		
Copper	0.996	0.996	0.8000	4.6100	3.4700	4.60	1.78	NO	0.95	0.549	26.10	0.60	0.55	5	2.32	15.7	61.0	Extended w/Diffuser
Zinc	0.996	0.996	4.5000	35.3600	32.2900	34.44	12.21	NO	0.95	0.549	205.00	0.60	0.55	5	2.32	15.7	61.0	Extended w/Diffuser
Ammonia (as N)			0.0160	3.2000	0.5100	1.92	0.51	NO	0.95	0.549	12.90	0.60	0.55	5	2.32	15.7	61.0	Extended w/Diffuser
Option 3 - 2030 Flows																		
Copper	0.996	0.996	0.8000	4.6100	3.4700	4.59	2.20	NO	0.95	0.549	29.30	0.60	0.55	5	2.32	17.7	48.0	Extended w/Diffuser
Zinc	0.996	0.996	4.5000	35.3600	32.2900	35.25	15.84	NO	0.95	0.549	237.00	0.60	0.55	5	2.32	17.7	48.0	Extended w/Diffuser
Ammonia (as N)			0.0160	3.2000	0.5100	1.35	0.51	NO	0.95	0.549	10.20	0.60	0.55	5	2.32	17.7	48.0	Extended w/Diffuser

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix F. Pretreatment and Source Control Alternatives Memorandum and Addendum

TETRA TECH

Technical Memorandum

Date:	December 1, 2016		
To:	Eric Hansen, City of Stevenson		
Cc:	File		
From:	Hunter Bennett-Daggett, P.E. Cynthia L. Bratz, P.E.	***Reviewed by:***	Jim Santroch, PE
Project:	General Sewer Plan Update	***Project Number:***	135-48600-16001
Subject:	Pretreatment and Source Control Alternatives		

The purpose of this memorandum is to address Task 15 – Industrial Waste Survey (from our contract scope of work), which states:

> "This task involves identifying and characterizing major sources of high strength wastewater. It also includes a preliminary assessment of source control and pretreatment alternatives for the major sources and preliminary opinions of probable cost for implementing pretreatment improvements."

This TM provides a summary of pretreatment and source control alternatives for accommodating high strength wastewater in the City of Stevenson (the City), and to determine whether on-site pretreatment or treatment at the Stevenson Wastewater Treatment Plant (WWTP) is more cost effective.

BACKGROUND

Historically the majority of sanitary sewer flow in the City has been generated by residential users and light commercial users which typically generate lower strength wastewater comparable to residential wastewater. However, the regional growth of the beverage industry, including breweries, wineries, distilleries, cider makers, and bottlers, has brought new, high strength dischargers to the City. Beverage industries often discharge wastewater that is high in biochemical oxygen demand (BOD) due to the high sugar and/or alcohol content of the products, and depending on pretreatment and housekeeping employed by the industry may also discharge high levels of total suspended solids (TSS). As a result, these users can have a disproportionate impact on the downstream wastewater treatment plant (WWTP), and it is important to evaluate the most efficient and cost-effective method for the City to accommodate these users while maintaining compliance with their wastewater discharge permit.

HIGH STRENGTH WASTEWATER SAMPLING PROGRAM

Tetra Tech worked with the City to develop a sampling plan focusing on locations with potentially high wastewater strength discharge. This sampling plan was executed by the City between August 30th and September 30th 2016. In total, 67 samples were collected at seven different locations:

- Skamania Lodge, which is the largest single discharger to the City's wastewater system
- Fairgrounds Pump Station, one of two pump stations delivering flow to the WWTP

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- Jester & Judge Cider, which produces hard cider as well as operating as a contract production facility (as LDB Beverage) for other beverage companies without their own large-scale production facilities
- Kanaka Pump Station, which receives flow from Jester & Judge Cider
- The Waterfront Building that currently houses Backwoods Brewing Company and Skunk Brothers Spirits and which is considered a likely site for additional beverage industry expansion
- Walking Man Brewing, which operates both a brewery and an on-site brew pub serving food
- Rock Creek Pump Station, the second pump station delivering flow to the WWTP and serving the majority of the City

Figure 1 shows the City's wastewater system and identifies locations in the system that were sampled. At each location, composite samplers were set to collect samples every 15 minutes, and each composite sample was collected after 24 hours and sent to a certified laboratory for analysis. At the time the samples were collected, water temperature and pH were also recorded. In order to estimate total flow, pump run times, water meter readings, or flow meter readings were also recorded at the start and finish of each sampling period. In general, samples were collected four times each week.

Sampling data for the WWTP are collected as part of normal operations; pH and effluent flow are recorded each day, while BOD and TSS are typically sampled and recorded twice each week. For each day of the sampling program, relevant data from the WWTP were compiled along with the sampling program results for comparison purposes.

SAMPLING PROGRAM RESULTS

Sampling results in both concentration and load are described in this section.

Concentration

Table 1 summarizes the concentration sampling results for Skamania Lodge and the three beverage producer locations. For each sampling location, the minimum, maximum, and average concentration is listed; the number of data points ranged from seven (for the Waterfront Building) up to 16 (for Skamania Lodge). The results for the WWTP are included for comparison purposes. Results for the pump stations have not been included in this table or used for further analysis. Concentration data from the pump stations did not correspond well to same-day influent samples at the WWTP, possibly due to variations in sample timing.

Skamania Lodge includes both a hotel and a restaurant, and its wastewater strength would typically be expected to be approximately twice that of residential wastewater; the data show that it is within this range. Of the three beverage producer sample locations, Jester & Judge Cider / LDB Beverage (J&J) produces the highest strength and volume of wastewater and also shows the highest variability in volume and strength, possibly due to its role as a contract facility handling products from other beverage companies in addition to normal variation in flow and load as part of the bottling/canning process. J&J's average concentration of BOD was more than six times higher than the levels observed at the WWTP, and its average TSS concentrations was more than four times higher. In addition, J&J wastewater showed wide swings in pH, ranging from 4.9 to 12.6. Walking Man Brewery (WMB) and the Waterfront Building both produced high strength wastewater, with concentrations three and four times higher than the WWTP influent average, respectively. In addition, both of these dischargers showed significant spikes in BOD and COD but less variability in TSS.

Table 1. High Strength Wastewater Sampling Results - Concentration

	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	NH3-N (mg/L)	TP mg/L)	Total FOG (mg/L)	pH	Water Temp (°F)	Flow (gpd)
Skamania Lodge									
Minimum	251	450	88	21.3		25	5.5	68	45,972
Maximum	672	1,370	324	21.3		135	6.8	93	77,538
Average	440	808	196	21.3		63	6.3	81	61,043
Jester & Judge Cider / LDB Beverage									
Minimum	361	860	60				4.9	63	1,646
Maximum	19,600	59,600	21,200				12.6	115	17,952
Average	5,922	17,407	3,343				8.6	84	8,645
Waterfront Building / Backwoods Brewing / Skunk Brothers Spirits									
Minimum	1,200	1,970	106				7.6	66	2,178
Maximum	5,730	17,800	1,240				12.6	103	3,944
Average	3,564	6,597	545				10.3	77	2,915
Walking Man Brewery									
Minimum	726	1,390	66	3.9	5.2		4.6	62	1,623
Maximum	7,550	34,700	754	3.9	5.2		6.7	73	4,204
Average	2,903	7,288	285	3.9	5.2		5.7	68	2,582
Wastewater Treatment Plant									
Minimum	546		390				6.6		53,000
Maximum	1,753		2,180				9.1		152,000
Average	869		808				7.5		115,000
Typical Residential Wastewater[a]									
Minimum	110	250	25	12	4	50			
Maximum	350	800	85	45	12	100			
Average	190	430	210	25	7	90			

a. Based on low, average, and high strength domestic wastewater per *Wastewater Engineering, 4th Edition*, Metcalf & Eddy, 2003

Load

Table 2 shows average loading results for each sampling site and the WWTP, based on the flows observed during the sampling periods. In general, loading is a more useful metric for assessing the impact of wastewater strength at the WWTP, as it incorporates both the relative strength and volume of wastewater from a discharger.

Table 2. High Strength Wastewater Sampling Results - Loading

Sampling Location	Average BOD (ppd)	Average COD (ppd)	Average TSS (ppd)	Average NH3-N (ppd)	Average TP (ppd)	Average Total FOG (ppd)	Average Flow (gpd)
Skamania Lodge	223	411	101	9.3		33	61,043
Jester & Judge Cider / LDB Beverage	175	411	57				8,645
Waterfront Bldg / Backwoods Brewing / Skunk Brothers Spirits	73	146	12				2,915
Walking Man Brewery	60	146	6	0.1	0.2		2,582
Wastewater Treatment Plant	903		831				115,000

In the City's 1991 Wastewater Facilities Plan, Skamania Lodge's projected loading for the end of the planning period (2011) was estimated to be 92 ppd average and 132 ppd maximum month, based on a concentration of 200 mg/L. The average loading from Skamania Lodge during the sampling period was 1.69 times higher than this projected maximum month.

All three beverage producer sample locations contribute significant BOD loadings, with J&J contributing a loading more than twice as high as the Waterfront Building and WMB. However, for TSS loadings only J&J appears to be a significant contributor; its average TSS loadings are about five and 10 times higher than the Waterfront Building and WMB, respectively.

Table 3 shows the range of percent contributions of each sampling location to the total flow and loading at the WWTP, using the average loadings shown from Table 2. For each source, the percentages are calculated based on 25 percent and 75 percent of the loading range divided by the average loading at the WWTP.

Table 3. Flow and Load Contributions by Source at WWTP

Flow/Load Source	Skamania Lodge	Jester & Judge Cider / LDB Beverage	Waterfront Bldg / Backwoods Brewing / Skunk Brothers Spirits	Walking Man Brewery	All Other Sources
Flow Contribution	47 – 61%	5 – 12%	2 – 3%	2 – 3%	**21 – 44%**
BOD Load Contribution	22 – 38%	12 – 24%	6 – 10%	5 – 13%	**15 – 55%**
TSS Load Contribution	11 – 20%	9 – 26%	1 – 2%	1 – 2%	**49 – 79%**

Due to the statistically small data set, these percentages should be regarded only as a snapshot rather than as fully representative of typical contributions by these high strength dischargers to the WWTP. However, during the sampling period, Table 3 indicates the significant influence of the high strength dischargers to the WWTP. The beverage producers, in particular, are contributing a significant percentage of the BOD measured at the WWTP, especially when compared to their relatively low flow contribution.

A mass balance approach was used to validate the above sampling results, using the following equation:

WWTP Load – High Strength Dischargers Load = Load from All Other Sources

"All Other Sources" includes residential users as well as commercial users that were not included in the high strength sampling program. The City is estimated to have 489 residential Equivalent Residential Units (ERUs) and 160 non-residential ERUs in addition to the ERUs included in the sampling program. The average BOD load contributed by "All Other Sources" during the sampling period was 372 ppd, which is equivalent to 0.52 ppd per ERU and 0.24 ppd per capita. This per capita loading is close to the typical 0.2 ppd per capita BOD residential loading criteria recommended in the Department of Ecology Orange book Table G2-1, and indicates that the BOD mass balance and industrial waste monitoring BOD data are reasonably accurate.

The same calculation for TSS loading results in 0.97 ppd per ERU and 0.44 ppd per capita for "All Other Sources"; this is higher than would be expected. Further investigation is needed, but possible explanations for the apparently high TSS load from "All Other Sources" include:

- Limited number of data points
- Sampling anomalies
- Variability in the beverage producers' processes that may or may not have been captured in this sampling
- Possible TSS introduced to the system through infiltration and inflow (I/I)
- Steep sewers which convey volatile suspended solids and organic material to the WWTP quickly, so the material does not have time to decompose as it frequently does in a sewer system with shallower slopes

EFFECTS OF HIGH STRENGTH WASTEWATER AT WWTP

The Stevenson WWTP had a major upgrade in 1991. The 1991 WWTP design criteria include the following:

- Influent BOD loading
  - Dry weather average: 490 ppd
  - Maximum month average: 612 ppd *
- Influent TSS loading
  - Dry weather average: 490 ppd
  - Maximum month average: 612 ppd *
- Oxidation Ditch BOD Loading
  - Dry weather average: 12 ppd / 1,000 CF
  - Maximum month average: 15 ppd / 1,000 CF

If these design criteria are routinely exceeded it indicates that additional capacity is needed at the WWTP. In addition, criteria marked above with an asterisk (*) are included in the WWTP's National Pollutant Discharge Elimination System (NPDES) permit. When a plant reaches 85 percent of these criteria for three consecutive months or 95 percent of the criteria for a single month, it triggers the submission of a plan for maintaining capacity to the Washington Department of Ecology (DOE).

Table 4 shows the average and max month data from the Stevenson WWTP during the last three years and during the high strength wastewater sampling period and compares these data to the design criteria.

Table 4. Influent Loading at WWTP Compared to Design Criteria

	Influent BOD Loading		Influent TSS Loading		Oxidation Ditch BOD Loading	
	(ppd)	Percent of Design Criteria	(ppd)	Percent of Design Criteria	(ppd/1000 CF)	Percent of Design Criteria
2014						
Dry Weather Average	385	79%	336	69%	9.6	80%
Maximum Month Average	521	85%	706	115%	13.0	87%
2015						
Dry Weather Average	786	160%	525	107%	19.7	163%
Maximum Month Average	1,027	168%	848	139%	25.7	171%
2016 (January – September)						
Dry Weather Average	865	177%	688	140%	21.6	180%
Maximum Month Average	1,218	199%	866	142%	30.5	202%
Sampling Period						
Average	903	184%	831	170%	22.6	188%
Maximum	1,828	299%	2,273	371%	45.7	304%

Both dry weather average and maximum month average loading have consistently exceeded the design criteria in 2015 and 2016. In addition, a significant increase in loading can be observed in just the last three years. In 2014, influent BOD loading exceeded the design criteria on 20 percent of sampling days; this rose to 49 percent in 2015 and 64 percent in 2016. More detailed analysis of the scale and timing of upgrades needed at the WWTP to accommodate increasing influent loads will be included in the General Sewer Plan Update; however, Table 4 shows that influent loads already exceed the design criteria of the WWTP by a significant margin.

Despite the influent loading consistently exceeding the design criteria in 2015 and 2016, the WWTP has not exceeded its permitted effluent limits for BOD. Two exceedances for TSS did occur in 2016, but these may be related to solids handling issues at the WWTP rather than strictly influent loading. Given this compliance record it is recommended that the City pursue rerating for the WWTP, increasing the oxidation ditch's design criteria to account for actual performance data. This process has been successful at similar plants in Washington, although construction of additional secondary treatment capacity in the near future is likely to be required. The performance data indicates that rerating the oxidation ditch for 150 percent to 200 percent of its current design (from 490 ppd dry weather average to 735 or 980 ppd) is a reasonable target.

ALTERNATIVES

In order to maintain consistent permit compliance at the WWTP, the City will need to reduce incoming wastewater loading or increase its capacity to treat that load. The results of the sampling program demonstrates that high strength wastewater dischargers represent a significant percent of the City's wastewater loading, and addressing the growing contribution of these dischargers should be included in the City's approach for handling wastewater loading. The approaches for handling wastewater loading include the following, which are described in this section:

- Source Control
  - Promote Best Practices
  - Implement Strength-based Sewer Fees
  - Enforce Pretreatment Requirements
- On-site Pretreatment
- Upgrades to the Wastewater Treatment Plant

Source Control

Source control is typically the first step in addressing high strength discharges. This is because addressing high strength discharge at the source often produces faster and more cost-effective results than changes to wastewater infrastructure. Even if infrastructure upgrades are also required, starting with source control allows these upgrades to be sized more efficiently. Source control focuses on providing high strength dischargers with both an incentive to reduce wastewater strength and the information on how to accomplish that reduction.

Promote Best Practices

The sampling results indicate that beverage industries within the City are significant contributors of loading to the WWTP, particularly with regard to BOD. Beverage industries typically employ a wide range of processes, many of which can be optimized.

In April 2016, Tetra Tech prepared a Brewery Wastewater Guidance Document for the City, with the intention that this document can be used as a basis for conversations with beverage industries and also distributed to these dischargers. The document recommends a water survey to quantify how, where, and when water is used, identifies processes that typically generate high strength wastewater, and lists best practices to reduce water use and wastewater strength.

If the City wishes to implement this option, the recommended approach would be to meet individually with each high strength discharger to discuss the need for source control, provide a copy of a guidance document for addressing high strength wastewater, and discuss issues specific to the discharger that are relevant to source control. This process should be repeated for new dischargers. Regular annual check-ins would also be recommended in the case that management or day-to-day operational staff at the dischargers has changed. Although this process will be relatively time-intensive for City staff, it appears that it will currently only be necessary at five or less facilities in the City.

Implement Strength-Based Sewer Fees

Many municipalities have implemented sewer fees that incorporate wastewater strength to reflect the additional cost of treating high strength wastewater. Typically this is done by tying the cost per unit (gallons or cubic feet) to a BOD range. For instance, the City of Hood River charges $2.09 /1,000 gallons for BOD less than 401 mg/L, $3.14/1000 gal for BOD less than 801 mg/L, and $4.17 /1000 gal for BOD greater than 801 mg/L. If the City used a similar metric, all of the beverage industry dischargers evaluated during the September 2016 sampling program would be charged the highest sewer rate. Alternately, the City could cap the wastewater strength allowable for discharge to the sewers, requiring high strength dischargers to implement their own pretreatment.

City Ordinance 613 5(C), 1972, 13.08.230, Prohibited discharges to public sewer prohibits discharge of "Any waters or wastes having a pH lower than 6.0 or higher than 9.0" and "Any waters or wastes containing suspended solids of such character and quantity that unusual attention or expense is required to handle such material at the sewage treatment plant."

Every site sampled in September 2016, including Skamania Lodge, showed wastewater outside the allowable pH range. In addition, the prohibition on suspended solids could reasonably be applied to the high strength dischargers, given that the high-BOD solids they discharge to the WWTP may require upgrades to fully accommodate.

The City's current water and sewer rate structure does not have provision for wastewater strength-based charges. However, the rate structure could be updated using the existing ordinance as a basis and neighboring cities such as Hood River and Portland as examples. Even if alternate arrangements, such as dischargers contributing to construction and operation of centralized pretreatment, are ultimately regarded to be preferable to charging strength-based sewer fees, the existence of these fees would offer the City an additional enforcement option in the future.

Enforce Pretreatment Requirements

Another option is to cap the wastewater strength allowable for discharge to the sewers, requiring high strength dischargers to implement their own pretreatment. Again, the City's existing Code of Ordinances provides a basis for the requirements. *City Ordinance 613 5(E), 1972, 13.08.250, Pretreatment-Required when-Facilities plan approval* allows the City's superintendent to require pretreatment for any wastewater having "(1) a BOD demand greater than three hundred milligrams per liter, or (2) containing more than three hundred fifty milligrams per liter of suspended solids or (3) having an average daily flow greater than two percent of the average daily sewage flow of the city." Every site sampled in September 2016 met all of these conditions on at least one sampling day.

In addition, *City Ordinance 613 5(I), 1972, 13.08.290, Provisions not to prevent special agreements for industrial waste pretreatment* allows for "special agreement or arrangement between the city and any industrial concern whereby an industrial waste of unusual strength or character may be accepted by the city for treatment subject to payment therefor by the industrial concern."

13.08.250 can potentially be used to require pretreatment for every high strength discharger in the City, this ordinance could be used to negotiate alternative arrangements with the dischargers, either in the form of strength-based sewer fees or contributions to the construction and operation of additional wastewater infrastructure.

On-Site Pretreatment

Many of the high-strength dischargers included in this sampling program are clustered in one area of the City, primarily located in buildings owned by the Port of Skamania County (the Port). Jester & Judge Cider (LDB Beverage), Backwoods Brewing, and Skunk Brothers Spirits are all located in adjacent Port buildings. Together, these dischargers represented 11 percent of the flow, 27 percent of the BOD loading, and 8 percent of the TSS loading observed during the sampling program. Pretreating wastewater from these dischargers on-site would reduce the influent loading at the WWTP, and would allow the use of treatment technologies designed specifically for treating smaller volumes of high strength wastewater.

It is assumed that site pretreatment would be provided by installing a packaged wastewater treatment system; these types of systems typically include above-ground steel tanks, equipment such are aerators, pumps, controls and site piping. The type of treatment could be based on aerobic biological treatment, comparable to what is used at the WWTP, or on anaerobic treatment that allows the use of smaller tanks and higher treatment rates.

Installation of a pretreatment facility would make the Port buildings a more desirable location for current and future beverage industry dischargers because it reduces the need for individual dischargers to implement pretreatment themselves.

Upgrades to Wastewater Treatment Plant

The City's WWTP was significantly upgraded in 1993. The 2017 General Sewer Plan Update will include a capital improvement plan for future WWTP improvements required to maintain NPDES permit compliance under year 2040 flows and loading conditions. From a loading perspective, additional secondary treatment capacity will need to be installed. Rerating of the existing oxidation ditch can be pursued to bring permitted influent load capacity in line with documented treatment performance. The General Sewer Plan Update will include evaluation of secondary process improvements, including converting the oxidation ditch process to a conventional activated sludge process with selector basin. Secondary process improvements and existing permit compliance data would justify rerating the WWTP capacity.

Even if loads and concentration from high-strength dischargers were reduced using other methods discussed in the above sections, it appears that the additional secondary treatment capacity will still be required in the near future. Table 5 shows the same data as Table 4, with the loading reduced by 25 percent to account for source control and/or pretreatment.

Table 5. Pretreated Influent Loading at WWTP Compared to Design Criteria

	Influent BOD Loading		Influent TSS Loading		Oxidation Ditch BOD Loading	
	(ppd)	Percent of Permitted Design Criteria	(ppd)	Percent of Permitted Design Criteria	(ppd/1000 CF)	Percent of Permitted Design Criteria
2015						
Dry Weather Average	590	120%	394	80%	14.7	123%
Maximum Month Average	770	126%	636	104%	19.2	128%
2016 (January – September)						
Dry Weather Average	649	132%	516	105%	16.2	135%
Maximum Month Average	914	149%	650	106%	22.8	152%
Sampling Period						
Average	677	138%	623	127%	16.9	141%
Maximum	1,371	224%	1,705	279%	34.2	228%

The 25-percent reduction was selected because the combined loading contribution of Jester & Judge and the Waterfront Building during the sampling period was 27 percent (see Table 3) and the total reduction of BOD load in the pretreatment system is expected to be at least 94 percent to bring the high strength discharge concentration down to approximately residential concentration.

ESTIMATED COSTS

Preliminary cost estimates for each alternative are discussed below. The costs below are intended to be used as order-of-magnitude comparisons.

Source Control

The costs associated with source control will consist of time spent by City personnel on implementation and enforcement.

On-Site Pretreatment

Cost estimates were solicited from vendors of packaged treatment systems used at other sites for treating wastewater similar to brewery/distillery wastewater. Two systems were reviewed; each capable of treating high strength wastewater (BOD > 5,000 mg/L) to near domestic strength (BOD < 350 mg/L). One system was a sequencing batch reactor (aerobic treatment), sold by Cloacina Package Treatment Solutions, and the second system was a Gas Energy Mixing and Expanded Granular Sludge Bed (anaerobic treatment), sold by Clean Water Technology. Preliminary costs for both systems were comparable at approximately $1.0M. Other acceptable pretreatment technologies exist. Further evaluation of on-site pretreatment systems is recommended if on-site pretreatment is selected for further planning, design and construction.

The estimated total cost opinion for the pretreatment system is shown in Table 6. This cost opinion has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. Costs are stated as order-of-magnitude estimates in 2016 dollars, and are developed from material received from the system vendors. According to the Association for the Advancement of Cost Engineering, order-of-magnitude estimates are normally expected to be accurate to within plus 80 percent to minus 50 percent of the actual cost. The final costs will depend on actual labor and material costs, competitive market conditions, final project costs, implementation schedule, and other variable factors.

Table 6. Pretreatment System Cost Estimate

Item	Estimated Cost
Pretreatment system incl. equipment, installation, construction costs	$1,000,000
Subtotal	***$1,000,000***
Contingency @ 20%	$200,000
Subtotal	***$1,200,000***
Design, Administration, CMS @ 20%	$240,000
Subtotal	***$1,440,000***
Total Capital Cost (as of November 2016)	**$1,440,000**

Upgrades to Wastewater Treatment Plant

A capital improvement plan (CIP) will be included in the General Sewer Plan Update, which will include projects needed to keep up with growth and maintain permit compliance through the year 2040. It is likely that the CIP will include additional secondary treatment capacity, solids handling capacity and other recommended improvements to accommodate the high influent loading observed during the sampling period and prior two years. For simplicity, costs included here are limited to the secondary treatment process.

The estimated total cost opinion for a complete oxidation ditch is shown in Table 7. Other methods of providing additional secondary treatment capacity will also be considered, but for preliminary cost estimating purposes a second oxidation ditch comparable in size to the existing ditch has been used as a basis. This cost opinion has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. Costs are stated as order-of-magnitude estimates in 2016 dollars, and are developed from past project experience and EPA fact sheets. According to the Association for the Advancement of Cost Engineering, order-of-magnitude estimates are normally expected to be accurate to within plus 80 percent to minus 50 percent of the actual cost. The final costs will depend on actual labor and material costs, competitive market conditions, final project costs, implementation schedule, and other variable factors.

Table 7. Oxidation Ditch Cost Estimate

Item	Estimated Cost
Oxidation ditch incl. equipment, installation, construction costs	$2,000,000
Subtotal	***$2,000,000***
Contingency @ 20%	$400,000
Subtotal	***$2,400,000***
Design, Administration, CMS @ 20%	$480,000
Subtotal	***$2,880,000***
Total Capital Cost (as of November 2016)	**$2,880,000**

Cost Comparisons

To roughly evaluate the cost effectiveness of on-site pretreatment and secondary treatment at the WWTP under a variety of design conditions, these capital costs were divided by the pounds of BOD removed by the proposed treatment system. The results are shown in Table 8. Comparison of these initial unit costs indicate that on-site pretreatment becomes more cost effective with larger industrial BOD loads, and that treatment at the City WWTP becomes more cost effective as its allowable loading rates (rerating) increase. The cost effectiveness will be considered in more detail in the General Sewer Plan Update including capital costs for solids handling and other facilities and operation and maintenance costs.

Table 8. Cost Comparison

Design Condition	Cost per Pound of BOD Removed
On-Site Pretreatment	
Current conditions (influent loading of 248 ppd, 94% removal by pretreatment system)	$6,200
Full capacity of treatment system (influent loading of 1,000 ppd, 94% removal)	$1,500
Additional Secondary Treatment at WWTP (oxidation ditch or comparable)	
Current design criteria for oxidation ditch (average dry weather loading of 490 ppd of BOD)	$5,900
Rerated design criteria for oxidation ditch (150% of existing, 735 ppd of BOD)	$3,900
Rerated design criteria for oxidation ditch (200% of existing, 980 ppd of BOD)	$2,900

RECOMMENDATIONS

The purpose of this memorandum is to provide a preliminary assessment of source control and pretreatment alternatives for the major sources. Recommendations for handling wastewater loading include the following:

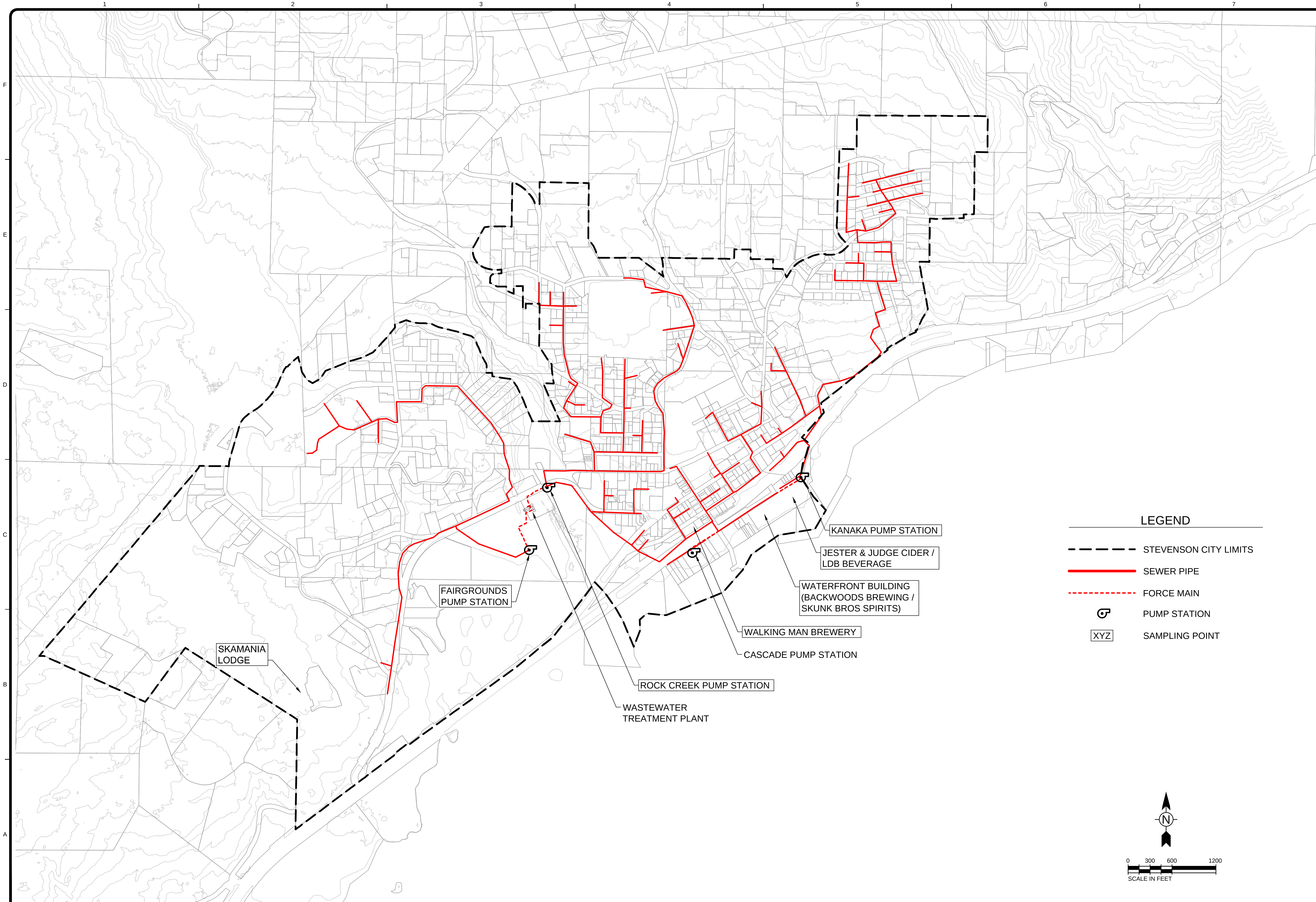
- Source Control
  - Promote Best Practices
  - Implement Strength-based Sewer Fees
  - Enforce Pretreatment Requirements
- On-site Pretreatment
- Upgrades to the Wastewater Treatment Plant

Source control and pretreatment of high strength wastewater discharges should be implemented in order to stabilize WWTP operations and maximize the operating life of current and future WWTP facilities. Source control can be implemented directly by the City without significant capital cost and should be initiated as soon as reasonable.

On-site pretreatment should also be considered, as the preliminary cost information presented in this memo indicates that pretreatment is roughly as cost effective as WWTP expansion when considering BOD load reduction under current conditions, and significantly more cost effective than WWTP expansion if beverage industries continue to grow and the pretreatment facility is operated at its design capacity. On-site pretreatment does not eliminate the need for short-term upgrades at the WWTP, but will help stabilize WWTP operations and maximize the operating life of current and future WWTP facilities. Further development of the on-site pretreatment system option at the Waterfront Building is recommended since it would be accessible to three of the beverage industry high strength dischargers, and potentially others in the future.

The Stevenson WWTP needs additional secondary treatment capacity in order to accommodate the influent loading rates observed in the last two years. The General Sewer Plan Update will include evaluation of secondary process improvements, including converting the oxidation ditch process to a conventional activated sludge process with selector basin. Secondary process improvements and existing permit compliance data would justify rerating the WWTP capacity.

Additional analysis and cost information will be included in the General Sewer Plan Update.



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MARK	DATE	DESCRIPTION	BY

CITY OF STEVENSON
GENERAL SEWER PLAN UPDATE

WASTEWATER COLLECTION SYSTEM AND SAMPLING LOCATIONS

Project No.: 135-48600-16001
Designed By:
Drawn By:
Checked By:

FIG-1

Bar Measures 1 inch

11/30/2016 11:00:53 AM - P:\48600\135-48600-16001\CAD\CONCEPTUAL\PRETREATMENT MEMO FIGURES.DWG - BENNETTDAGGETT, HUNTER

Technical Memorandum

Date:	September 22, 2017		
To:	Eric Hansen, City of Stevenson		
From:	Hunter Bennett-Daggett, P.E.	***Reviewed by:***	Cynthia L. Bratz, P.E.
Project:	General Sewer Plan Update	***Project Number:***	135-48600-16001
Subject:	Pretreatment and Source Control Alternatives - Addendum		

This addendum documents revisions to the TM issued December 1, 2016, specifically to the load calculations for the high strength wastewater sampling program conducted in Stevenson during September 2016. These revisions were made based on input received at meetings with the high load dischargers, and were included in the July 2017 draft of the General Sewer Plan.

The primary revision was the addition of a consumption factor in calculating flows. Breweries and similar commercial water users consume or package a significant percentage of the water they receive; the Brewers Association Water and Wastewater Manual states that the average brewery discharges 70% of its incoming water as wastewater. In comparison, most homes and businesses discharge nearly all incoming water as wastewater. For each high strength sampling location, a consumption factor was selected and flows were multiplied by this factor for use in calculating loading. The reasoning for each location is summarized below.

- Skamania Lodge: flow data based on water meter. Minimal consumption expected; consumption factor of 1.0 was selected.
- Jester & Judge Cider / LDB Beverage: flow data based on water meter. LDB provided 60 days of data during which 57% of metered water was sent to sewer. Consumption factor of 0.60 was selected.
- Waterfront Bldg / Backwoods Brewing / Skunk Brothers Spirits: flow data based on wastewater, metered at onsite pump station. Consumption is already accounted for; consumption factor of 1.0 was selected.
- Walking Man Brewery: flow data based on water meter. Location has a brewery, with consumption expected to be approximately 0.70 based on Brewers Association Manual, and a restaurant, with consumption factor expected to be closer to 1.0. An intermediate consumption factor of 0.85 was selected.

Applying the selected consumption factors resulted in lower flows for the two sampling locations and as a result lower loads as well. Table 2 is an updated version of the table contained in the December 2016 TM.

Table 2. High Strength Wastewater Sampling Results - Loading

Sampling Location	Average BOD (ppd)	Average COD (ppd)	Average TSS (ppd)	Average NH3-N (ppd)	Average TP (ppd)	Average Total FOG (ppd)	Average Flow (gpd)
Skamania Lodge	223	411	101	9.3		33	61,043
Jester & Judge Cider / LDB Beverage	105	247	34				5,187
Waterfront Bldg / Backwoods Brewing / Skunk Brothers Spirits	69	139	11				2,646
Walking Man Brewery	51	124	5	0.1	0.2		2,195
Wastewater Treatment Plant	903		831				115,000

15350 SW Sequoia Pkwy, Suite 220, Portland, OR 97224
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One other minor revision was made to the December 2016 calculations, which left out one day of sampling for the Waterfront Bldg / Backwoods Brewing / Skunk Brothers Spirits location.

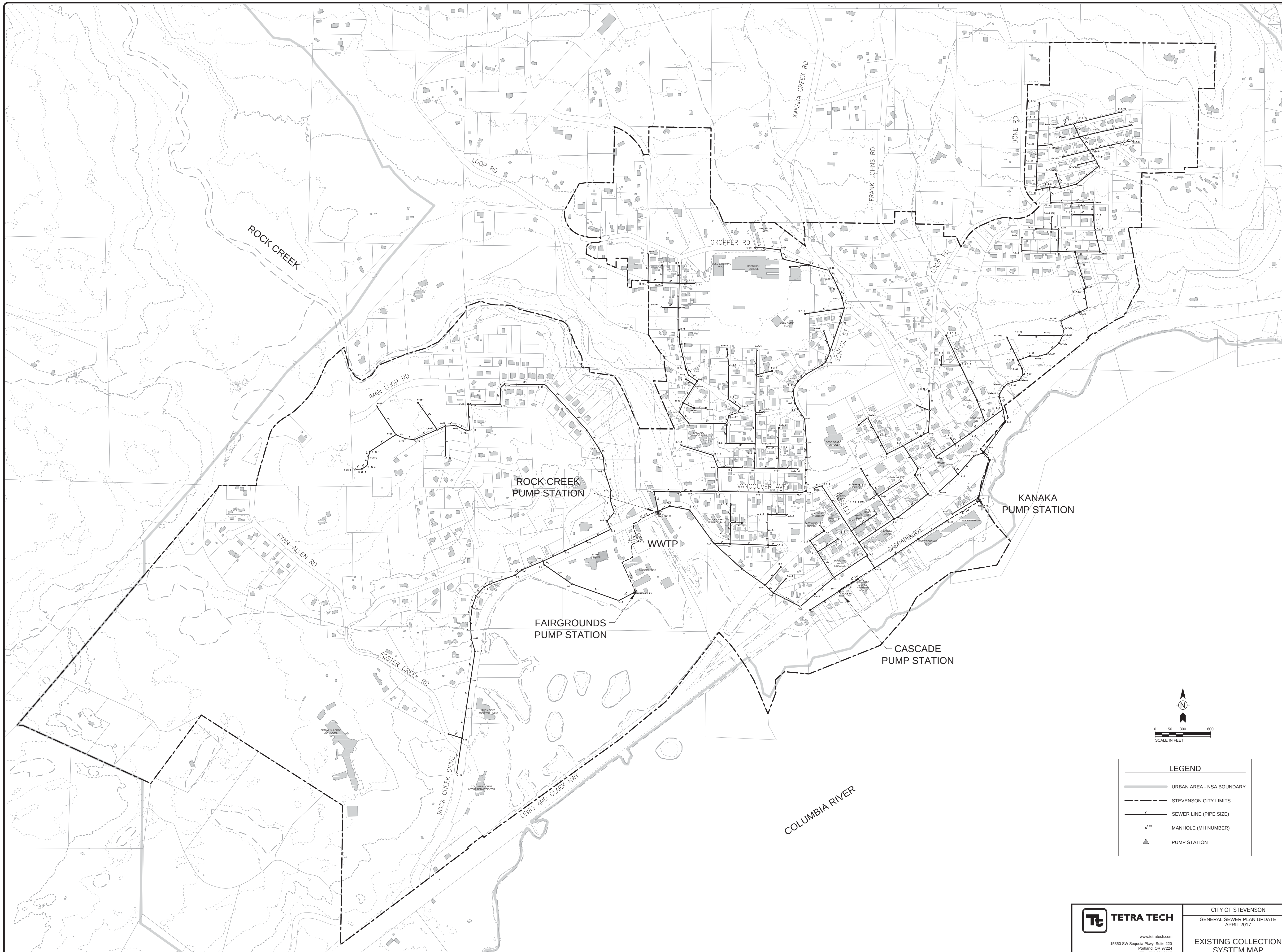
Table 3 from the December 2016 TM was also modified to account for the revised loads.

Table 3. Flow and Load Contributions by Source at WWTP

Flow/Load Source	Skamania Lodge	Jester & Judge Cider / LDB Beverage	Waterfront Bldg / Backwoods Brewing / Skunk Brothers Spirits	Walking Man Brewery	All Other Sources
Flow Contribution	47 – 61%	3 – 7%	2 – 3%	2 – 3%	27 – 47%
BOD Load Contribution	22 – 38%	7 – 14%	6 – 10%	4 – 11%	27 – 60%
TSS Load Contribution	11 – 20%	5 – 16%	1 – 2%	1 – 2%	60 – 82%

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix G. Sewer System Map



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CITY OF STEVENSON

GENERAL SEWER PLAN UPDATE
APRIL 2017

EXISTING COLLECTION
SYSTEM MAP

Bar Measures 1 inch

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix H. Survey Notes

CITY OF STEVENSON

COLLECTION SYSTEM SITE VISIT 7.20.16

Specific manholes were inspected based upon the following criteria:

- Discharge manholes for a pump station
- Pump station wet well
- Potential hydraulic issues based upon the hydraulic model
- Potential hydraulic issues due to geometry (large transition in pipe slope, "T" intersections)

General comments

- The entire north east part of the community is a land slide prone area. They have had broken water line. It is likely that there are some pipes separated at the joints.
- Much of the pipe in the community is concrete pipe with a 4-foot lay length installed in the 1970's. This means there are a lot of pipe joints.

Manhole F-7-6

Location: Ridgecrest Drive west of Montell Terrace (NE)

- Has a rain lid
- Self is damp
- Walls are damp
- No other indication of surcharging
- There is a drainage way that parallels the pipe from El Paso Lane to Ridgecrest Drive (dry right now) which then enters a culvert under Ridgecrest Drive, and it is suspected that it infiltrates the collection system at this point.

Manhole F-4-11A

Location: Ridgecrest Drive (NE)

- The road around the manhole has dropped apparently from land movement (this is a landslide prone area).
- The top cone appears to have shifted

Manhole F-7-3

Location: Vista Drive and Loop Road (NE)

- Has a rain lid
- Self is damp
- Walls are damp
- No other indication of surcharging

Manhole F-20

Location: Columbia View Ave. and Fir Street (NE)

- There is a drainage discharge from a home into a ditch right next to the manhole lid. It is suggested to install a rain lid or put a 90-degree bend on the pipe and extend it past the manhole.
- Some offsets at joints
- Self is damp
- No other indication of surcharging

Manhole F-18

Location: South end of Fir Street in a grassy field (NE)

- Looks fine
- The lid is approximately 3-feet above ground. Apparently when the subdivision is built out this will be at ground level. Until then it is difficult to replace the lid if it slips off the top.

Manhole F-7

Location: Lutheran church Road near the Hwy (E)

- There is visible leakage across the shelf

Manhole F-4

Location: Cascade Avenue east of Kanaka Creek (E)

- The top is shifted slightly
- It is not clear that the discharge pipe is low enough to go under the creek (record drawings indicate that it does).

Manhole F-3

Location: Cascade Avenue west of Kanaka Creek (E)

- The discharge pipe is not low enough to go under the creek (record drawings indicate that it does). This looks like an inverted syphon.

Manhole F-2

Location: Cascade Avenue west of Kanaka Creek (E)

- This manhole has an authorized overflow. There is a pipe discharging from the manhole to the creek. It has a valve on it that must be kept shut. The City is allowed to ope the valve if they think there will be an overflow coming.

Manhole Kanaka Wet Well

Location: East end of Cascade Avenue (near river)

- Limited access as the package suction lift pump station is partially over the wet well.
- Concrete looks in good condition
- Pipe is heavily corroded
- No apparent grease problem
- Suction lift duplex package hydronix station with a 40 kw generator

Manhole CI - 15

Location: Cascade Avenue (near river)

- Discharge manhole for the Kanaka Pump Station
- Chipped at the concrete
- Concrete is in good condition, no evidence of hydrogen sulfide corrosion

Manhole Cascade Pump Station wet well

Location: West end of Cascade Avenue (near river)

- Access is extremely limited
- The top 2-feet of the wet well is a steel can and it appears the side can open to provide more access to the wet well.
- Valves are in the wet well and difficult to access and operate.
- Duplex air primed pumps in a fiberglass hut above the wet well. It sits about 2-feet above ground, but the ground falls away making access on the river side very difficult.

Manhole C1-13

Location: Cascade Avenue & Russel Avenue (near river)

- Discharge manhole for the cascade Pump Station
- Chipped at the concrete
- Concrete is in good condition, no evidence of hydrogen sulfide corrosion

Manhole Skamania Lodge

Location: Following the grease trap

- Deep manhole
- The pipe up to the flow line was white with grease
- Staff indicates that there are times when there is a lot of heat in the manhole
- Manhole rim and lid corroded badly enough that the lid did not fit
- The grease trap is very large and pumped twice a year

Manhole J-17

Location: Foster Creek Road near Rock Creek Drive (W)

- This is where Skamania Lodge discharges
- Manhole rim and lid are corroding
- The pipe is lined with grease
- There is a strong smell

- There is sometimes a lot of heat in the manholes

Manhole J-14

Location: Rock Creek Drive just north of the assisted living center (W)

- Manhole rim and lid are corroding
- The pipe is lined with grease
- There is a strong smell
- There is sometimes a lot of heat in the manholes
- The assisted living center has approximately 60 residents and a commercial kitchen
- There is a grease trap (staff will check on the size). It is not clear what the maintenance is on the grease trap.

Manhole J-7 through J-12

Location: Attwell Road (parallel with Rock creek Drive) (W)

- Manhole rim and lid are corroding
- The pipe is lined with grease
- There is a strong smell
- There is sometimes a lot of heat in the manholes
- In the past there have been high water levels

Manhole J-4

Location: Rock creek Road at the entrance to Rock Creek Park

- "T" intersection of major lines
- The channels are well defined
- Appears to be working well

Manhole J-2

Location: Rock Creek Park

- This is the low point and where overflow can occur
- There were overflows about 5 to 10 years ago

Manhole K-3

Location: Rock Creek Road (near the WWTP)

- Well define 90-bend in the channel
- Manhole is only 3- deep
- Very little development upstream, but significant sewer line. When houses are constructed and flow increases, this is a manhole to watch for surcharge and overflow.

Manhole Rock Creek Pump Station

Location: East of rock creek

- There are plans to move the bridge to the north, as well as the pump station
- This is a wet well/dry well pump station and it is deep
- The power and standby power comes from the WWTP (safety concern for lock out/tag out).
- Comes very close to overflowing

Manhole VI - 5

Location: Vancouver Ave and Lasher Street

- "T" intersection
- Appears in good condition

Manhole H - 8

Location: View Point (uphill of apartments)

- Appears in good condition

Manhole G - 6

Location: Hot Springs Alameda Road and School Street

- Riser is stack bricks with grout
- The riser may be moving
- The shelf is very wet, has puddles
- Just uphill the road is subsiding. Staff should watch this as it could be the start of a sink hole.

Manhole G – 14A & G – 14B

Location: School Street & Stone Brooke Court

- There is a constant stream of clear liquid
- Past the last manhole there is a clean-out with a large tree next to it. Potentially the roots
- Walls are damp
- No other indication of surcharging

Manhole F-7-3

Location:

- Has a rain lid
- Self is damp
- Walls are damp
- No other indication of surcharging

Manhole F-7-3

Location:

- Has a rain lid
- Self is damp
- Walls are damp
- No other indication of surcharging

Manhole F-7-3

Location:

- Has a rain lid
- Self is damp
- Walls are damp
- No other indication of surcharging

Manhole F-7-3

Location:

- Has a rain lid
- Self is damp
- Walls are damp
- No other indication of surcharging

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix I. Wastewater Treatment Improvements Preliminary Cost Estimates

City of Stevenson Wastewater Facility Plan/General Sewer Plan
Planning Cost Estimate
Tetra Tech Inc.
17-Nov-17

	Capital Project Cost Unphased	Capital Project Cost Phase 1	Capital Project Cost Phase 2 (2030)	Average Annual O&M Cost Labor	Average Annual O&M Cost Power	Average Annual O&M Cost Maint	Average Annual O&M Cost Total	20 yr Present Worth
Alt 1B: Minimum Pretreatment								
High-Load Commercial Pretreatment	$711,000	$711,000	$0	$1,560	$2,716	$5,745	$10,021	$888,000
Headworks	$1,870,000	$1,870,000	$0	$26,880	$984	$15,708	$43,573	$2,829,000
Secondary Treatment	$4,714,000	$2,230,000	$2,484,000	$36,960	$40,992	$29,715	$107,667	$7,098,000
Disinfection	$1,090,000	$1,090,000	$0	$6,300	$5,782	$11,329	$23,411	$1,504,000
Solids Handling	$1,066,000	$1,066,000	$0	$33,840	$5,901	$6,148	$155,040	$5,636,000
Support Facilities (1)	$3,084,000	$1,819,000	$1,493,000	$48,960	$2,085	$24,224	$75,269	$8,390,000
Flood protection	$202,000	$202,000				$1,507	$1,507	$229,000
Effluent pumps	$576,000		$576,000	$1,080	$43	$5,881	$7,004	$700,000
Subtotal				**$155,580**			**$423,491**	
WWTP Mgt Tasks				$62,400			$62,400	$1,103,687
Lab Labor				$93,600			$93,600	$1,655,531
Pretreatment Program Labor				$62,400			$62,400	$1,103,687
Total	$13,313,000	$8,988,000	$4,553,000	$373,980	$58,502	$209,408	$641,891	$31,136,906
Total (City costs only)	**$12,602,000**	**$8,277,000**	**$4,553,000**	$372,420	$55,787	$203,663	**$631,870**	$30,248,906
Alt 2: Domestic Strength Pretreatment								
High-Load Commercial Pretreatment	$2,444,000			$31,200	$12,888	$25,991	$70,078	$3,683,000
Headworks	$1,037,000			$26,760	$526	$10,559	$37,844	$1,706,000
Secondary Treatment	$5,126,000			$34,800	$53,304	$45,226	$133,330	$7,148,000
Disinfection	$1,090,000			$6,300	$5,782	$11,329	$23,411	$1,504,000
Solids Handling	$884,000			$18,720	$7,987	$8,142	$163,141	$3,770,000
Support Facilities (1)	$3,084,000			$48,960	$2,085	$24,224	$75,269	$8,611,000
Flood protection	$202,000					$1,507	$1,507	$229,000
Effluent pumps	$576,000			$1,080	$43	$5,881	$7,004	$700,000
Subtotal				**$167,820**			**$511,585**	
WWTP Mgt Tasks				$62,400			$62,400	$1,103,687
Lab Labor				$93,600			$93,600	$1,655,531
Pretreatment Program Labor				$62,400			$62,400	$1,103,687
Total	$14,443,000			$386,220	$82,614	$261,151	$729,985	$31,213,906
Total (City costs only)	$11,999,000			$355,020	$69,726	$235,161	**$659,907**	$27,530,906

(1) Includes 3/4 FTE lab staff, 1/2 FTE for pretreatment program, and 1/2 FTE for WWTP management tasks
(2) Does not include employee compensation for vacation and holidays
(3) Year 2040 O&M Costs for Items not phased
(4) For Phased items, O&M costs were the average of Ph 1 and Ph 2
(5) This is a Class 4 cost estimate as defined by the Association for the Advancement of Cost Engineering International. These costs represent planning level cost estimates in 2017 dollars and should be considered accurate in the range of +50 to -30 percent.

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Pretreatment - Aerated Equalization Tank
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	WMB Force Main - 4" HDPE, Installed	1,400	LF	$25	$35,000
	Railroad Crossing for WMB Force Main	1	LS	$10,000	$10,000
	Concrete Bottom Slab - Equalization Tank	40	CY	$500	$20,000
	Concrete Top Slab - Equalization Tank	40	CY	$800	$32,000
	Concrete Walls - Equalization Tank	90	CY	$700	$63,000
	Subtotal Structural				*$160,000*
	Packaged Aeration System	1	LS	$50,000	$50,000
	Packaged Pump Station from EQ Tank	1	LS	$30,000	$30,000
	Packaged Pump Station from WMB	1	LS	$20,000	$20,000
	equipment installation	30%		$30,000	$30,000
	Subtotal Equipment				*$130,000*
	Piping and Miscellaneous Mechanical	10%	of Equip		$13,000
	Electrical	10%	of Equip		$13,000
	Instrumentation and Control	10%	of Equip		$13,000
	Subtotal Structural, Mechanical, Elect, I&C				*$329,000*
	Contractor O&P	12%	of Sub Cost		$39,480
	Mobilization, demobilization, bond	6%	of Sub cost		$19,740
	Site Work	5%	of Sub cost		$16,450
	Total estimated current construction cost				*$404,670*
	Escalation to time of construction	3.00%			$12,140
	'Total Estimated Construction Cost w/o Contingency & Engr				$416,810
	Contingency	30%			$125,043
	Engineering Design	13%			$67,732
	Services During Construction	10%			$54,185
	Sales Tax	8.8%			$47,683
	Total Estimated Construction Cost w/ Contingency & Tax				$590,000
	Total Estimated Capital Cost, incl Engineering				$711,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	26	hr	$60	$1,560
	Power - WMB Pump Station	548	KWH	$0.08	$44
	Power - Equalization Tank Blower	32,850	KWH	$0.08	$2,628
	Power - Pump Station from Pretreatment	548	KWH	$0.08	$44
	Structural Maintenance	1.0%			$1,846
	Equipment replacement	2.0%			$3,899
	Total Annual Cost				$10,021
	Present Worth Factor	17.687			
	Present Worth Cost				$177,000

Total Present Worth Project Cost Estimate

	Capital	$711,000
	Operations and Maintenance	$177,000
	Total Present Worth	$888,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 2: Domestic Strength Pretreatment
Pretreatment - Package System to Reduce BOD by 85%
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	WMB Force Main - 4" HDPE, Installed	1,400	LF	$25	$35,000
	Railroad Crossing for WMB Force Main	1	LS	$10,000	$10,000
	Subtotal Structural				*$45,000*
	Packaged Industrial Pretreatment System	1	LS	$750,000	$750,000
	Packaged Pump Station from Pretreatment	1	LS	$30,000	$30,000
	Packaged Pump Station from WMB	1	LS	$20,000	$20,000
	equipment installation	20%		$160,000	$160,000
	Subtotal Equipment				*$960,000*
	Piping and Miscellaneous Mechanical	5%	of Equip		$48,000
	Electrical	5%	of Equip		$48,000
	Instrumentation and Control	5%	of Equip		$48,000
	Subtotal Structural, Mechanical, Elect, I&C				*$1,149,000*
	Contractor O&P	12%	of Sub Cost		$137,880
	Mobilization, demobilization, bond	6%	of Sub cost		$68,940
	Site Work	3%	of Sub cost		$34,470
	Total estimated current construction cost				*$1,390,290*
	Escalation to time of construction	3.00%			$41,709
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,431,999
	Contingency	30%			$429,600
	Engineering Design	13%			$232,700
	Services During Construction	10%			$186,160
	Sales Tax	8.8%			$163,821
	Total Estimated Construction Cost w/ Contingency & Tax				$2,025,000
	Total Estimated Capital Cost, incl Engineering				$2,444,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	520	hr	$60	$31,200
	Power - WMB Pump Station	548	KWH	$0.08	$44
	Power - Industrial Pretreatment System	160,000	KWH	$0.08	$12,800
	Power - Pump Station from Pretreatment	548	KWH	$0.08	$44
	Structural Maintenance	1.0%			$519
	Equipment replacement	2.0%			$25,471
	Total Annual Cost				$70,078
	Present Worth Factor	17.687			
	Present Worth Cost				$1,239,000

Total Present Worth Project Cost Estimate

	Capital	$2,444,000
	Operations and Maintenance	$1,239,000
	Total Present Worth	$3,683,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Headworks with Grit Removal Phase 1
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Shed Cover	1	ea	$5,000	$5,000
	Form and Pour Concrete	180	CY	$900	$162,000
	Misc (fire extinguishers, grating, sign, pipe heat trace & insulate)	1	ea	$5,000	$5,000
	Subtotal Structural				*$172,000*
	Fine Screen (6 mm) with screening bagger	1	ea	$84,500	$84,500
	Washer Compactor	1	ea	$60,000	$60,000
	Manually-cleaned Bar Screen	1	ea	$3,000	$3,000
	Vortex Grit Chamber	1	ea	$50,000	$50,000
	Grit Pump and Grit Cyclone/Classifier	1	ea	$98,000	$98,000
	Sampler	1	ea	$5,000	$5,000
	Parshall Flumes	2	ea	$4,000	$8,000
	Gates	8	ea	$6,000	$48,000
	equipment installation	30%		$106,950	$106,950
	Subtotal Equipment				*$463,450*
	Piping and Miscellaneous Mechanical	30%	of Equip		$106,950
	Electrical	30%	of Equip		$139,035
	Instrumentation and Control	12%	of Equip		$55,614
	Subtotal Structural, Mechanical, Elect, I&C				*$937,049*
	Contractor O&P	12%	of Sub Cost		$112,446
	Mobilization, demobilization, bond	6%	of Sub cost		$56,223
	Site Work	5%	of Sub cost		$46,852
	Total estimated current construction cost				*$1,152,570*
	Escalation to time of construction	3.00%			$34,577
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,187,147
	Contingency	20%			$237,429
	Engineering Design	13%			$178,072
	Services During Construction	10%			$142,458
	Sales Tax	8.8%			$125,363
	Total Estimated Construction Cost w/ Contingency & Tax				$1,550,000
	Total Estimated Capital Cost, incl Engineering				$1,870,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	560	hr	$60	$33,600
	Power - Fine Screens	6,570	KWH	$0.08	$526
	Power - Grit Pump	5,460	KWH	$0.08	$437
	Power - Grit Cyclone/Classifier	273	KWH	$0.08	$22
	Structural Maintenance	1.0%			$1,984
	Equipment replacement	2.0%			$17,651
	Total Annual Cost				$54,220
	Present Worth Factor	17.687			
	Present Worth Cost				$959,000

Total Present Worth Project Cost Estimate

	Capital	$1,870,000
	Operations and Maintenance	$959,000
	Total Present Worth	$2,829,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 2: Domestic Strength Pretreatment
Headworks without Grit Removal
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Shed Cover	1	ea	$5,000	$5,000
	Form and Pour Concrete	1	ea	$113,400	$113,400
	Misc (fire extinguishers, grating, sign, pipe heat trace & insulate)	1	ea	$5,000	$5,000
	Subtotal Structural				*$123,400*
	Fine Screen (6 mm) with screening bagger	1	ea	$84,500	$84,500
	Washer Compactor	1	ea	$60,000	$60,000
	Manually-cleaned Bar Screen	1	ea	$3,000	$3,000
	Sampler	1	ea	$5,000	$5,000
	Parshall Flumes	2	ea	$4,000	$8,000
	Gates	4	ea	$6,000	$24,000
	equipment installation	30%		$55,350	$55,350
	Subtotal Equipment				*$239,850*
	Piping and Miscellaneous Mechanical	30%	of Equip		$55,350
	Electrical	30%	of Equip		$71,955
	Instrumentation and Control	12%	of Equip		$28,782
	Subtotal Structural, Mechanical, Elect, I&C				*$519,337*
	Contractor O&P	12%	of Sub Cost		$62,320
	Mobilization, demobilization, bond	6%	of Sub cost		$31,160
	Site Work	5%	of Sub cost		$25,967
	Total estimated current construction cost				*$638,785*
	Escalation to time of construction	3.00%			$19,164
	'Total Estimated Construction Cost w/o Contingency & Engr				$657,948
	Contingency	20%			$131,589.61
	Engineering Design	13%			$98,692
	Services During Construction	10%			$78,954
	Sales Tax	8.8%			$69,479
	Total Estimated Construction Cost w/ Contingency & Tax				$859,000
	Total Estimated Capital Cost, incl Engineering				$1,037,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	446	hr	$60	$26,760
	Power - Fine Screens	6,570	KWH	$0.08	$526
	Structural Maintenance	1.0%			$1,424
	Equipment replacement	2.0%			$9,135
	Total Annual Cost				$37,844
	Present Worth Factor	17.687			
	Present Worth Cost				$669,000

Total Present Worth Project Cost Estimate

	Capital	$1,037,000
	Operations and Maintenance	$669,000
	Total Present Worth	$1,706,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Secondary Treatment - One New Aeration Basin, Keep Existing Ox Ditch Online, Add Selector Basins - Phase 1
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Earthwork	4,510	CY	$15	$67,650
	Dewatering & Shoring	1	LS	$60,000	$60,000
	Demolish Existing Oxidation Ditch Equipment and Vane Walls	0	LS	$30,000	$0
	Protect Existing Oxidation Ditch Structure	1	LS	$10,000	$10,000
	Add DO probe, automate effluent weir actuator	1	LS	$20,000	$20,000
	Concrete Divider Wall - Existing Ox Ditch	0	CY	$900	$0
	Concrete Walls - Aeration Basin	195	CY	$900	$175,762
	Concrete Bottom Slab - Aeration Basin	119	CY	$700	$83,358
	Aluminum Handrail (2 Rails)	150	LF	$160	$24,000
	Aeration Building	1,000	SF	$200	$200,000
	Subtotal Structural				*$640,770*
	Aeration Blowers	3	ea	$20,000	$60,000
	VFDs for Blowers	3	ea	$10,000	$30,000
	Aeration Diffuser System	1,000	SCFM	$70	$70,000
	DO Probe	2	ea	$2,000	$4,000
	ORP Probe	2	ea	$2,000	$4,000
	Level Transmitter	2	ea	$2,000	$4,000
	Mixer	2	ea	$12,000	$24,000
	Circulation Pump	2	ea	$13,000	$26,000
	equipment installation	30%		$66,600	$66,600
	Subtotal Equipment				*$288,600*
	Piping and Miscellaneous Mechanical	30%	of Equip		$66,600
	Electrical	30%	of Equip		$86,580
	Instrumentation and Control	12%	of Equip		$34,632
	Subtotal Structural, Mechanical, Elect, I&C				*$1,117,182*
	Contractor O&P	12%	of Sub Cost		$134,062
	Mobilization, demobilization, bond	6%	of Sub cost		$67,031
	Site Work	5%	of Sub cost		$55,859
	Total estimated current construction cost				*$1,374,133*
	Escalation to time of construction	3.00%			$41,224
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,415,357
	Contingency	20%			$283,071
	Engineering Design	13%			$212,304
	Services During Construction	10%			$169,843
	Sales Tax	8.8%			$149,462
	Total Estimated Construction Cost w/ Contingency & Tax				$1,848,000
	Total Estimated Capital Cost, incl Engineering				$2,230,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	600	hr	$60	$36,000
	Power - Aeration Basin Blowers	328,500	KWH	$0.08	$26,280
	Power - Selector Basin Mixers	19,710	KWH	$0.08	$1,577
	Power - Selector Basin Circulation Pumps	39,420	KWH	$0.08	$3,154
	Power - Ox Ditch Brush Aerators	262,800	KWH	$0.08	$21,024
	Structural Maintenance	1.0%			$7,392
	Equipment replacement	2.0%			$10,992
	Total Annual Cost				$106,418
	Present Worth Factor	17.687			
	Present Worth Cost				$1,882,000

Total Present Worth Project Cost Estimate

	Capital	$2,230,000
	Operations and Maintenance	$1,882,000
	Total Present Worth	$4,112,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B Unphased or Phase 2
Secondary Treatment - Mixed Liquor Splitter Box, Third Final Clarifier, RAS Pump Station and Replace Brush Aerators at Ox Ditch
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Earthwork	1,790	CY	$15	$26,850
	Dewatering & Shoring	1	LS	$50,000	$50,000
	Concrete Slab - Final Clarifier	90	CY	$800	$72,000
	Concrete Walls - Final Clarifier	100	CY	$1,000	$100,000
	Concrete Grout - Final Clarifier	20	CY	$1,000	$20,000
	Concrete Slab - RAS Pump Station	10	CY	$800	$8,000
	Concrete Walls - RAS Pump Station	20	CY	$1,000	$20,000
	Concrete Walls - Mixed Liquor Splitter Box	40	CY	$900	$36,000
	Concrete Bottom Slab - Mixed Liquor Splitter Bo:	10	CY	$700	$7,000
	Aluminum Handrail (2 Rails)	170	LF	$160	$27,200
	Subtotal Structural				*$367,050*
	Clarifier Mechanism and Equipment	1	LS	$200,000	$200,000
	RAS Pumps (1 duty, 1 standby)	2	ea	$22,500	$45,000
	VFD for RAS pump	1	ea	$10,000	$10,000
	6" RAS Flow Meter	1	ea	$10,000	$10,000
	4" WAS Flow Meter	1	ea	$6,500	$6,500
	Splitter Box Gates	3	ea	$10,000	$30,000
	Replace Brush Aerators at Ox Ditch	1	LS	$100,000	$100,000
	equipment installation	30%		$81,450	$81,450
	Subtotal Equipment				*$482,950*
	Piping and Miscellaneous Mechanical	30%	of Equip		$81,450
	Electrical	30%	of Equip		$144,885
	Instrumentation and Control	12%	of Equip		$57,954
	Subtotal Structural, Mechanical, Elect, I&C				*$1,134,289*
	Contractor O&P	12%	of Sub Cost		$136,115
	Mobilization, demobilization, bond	6%	of Sub cost		$68,057
	Site Work	5%	of Sub cost		$56,714
	Total estimated current construction cost				*$1,395,175*
	Escalation to time of construction (2030)	13.00%			$181,373
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,576,548
	Contingency	20%			$315,310
	Engineering Design	13%			$236,482
	Services During Construction	10%			$189,186
	Sales Tax	8.8%			$166,483
	Total Estimated Construction Cost w/ Contingency & Tax				$2,058,000
	Total Estimated Capital Cost, incl Engineering				$2,484,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	280	hr	$60	$16,800
	Power - Clarifier Drive	13,140	KWH	$0.08	$1,051
	Power - RAS Pumps	65,700	KWH	$0.08	$5,256
	Power - WAS Pumps	2,730	KWH	$0.08	$218
	Structural Maintenance	1.0%			$4,645
	Equipment replacement	2.0%			$19,420
	Total Annual Cost				$47,391
	Escalation to time of construction (2030)	13.00%			$6,161
	Present Worth Factor	9.370			
	Present Worth Cost				$502,000

Total Present Worth Project Cost Estimate

	Capital	$2,484,000
	Operations and Maintenance	$502,000
	Total Present Worth	$2,986,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Haul Dewatered Biosolids to Land Application Site
By : **Tetra Tech Inc.**
Date : **13-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Dewatering Building w/ ventilation	1,500	SF	$200	$300,000
	Subtotal Structural				*$300,000*
1	Huber Screw Press model: Q-Press 280	1	EA	$280,000	$280,000
2	Polymer Unit	1	EA	$0	$0
3	Sludge Flow Meter	1	EA	$0	$0
4	Sludge Feed Pump	1	EA	$0	$0
5	Compressor	1	EA	$0	$0
6	Polymer Flow Meter	1	EA	$0	$0
7	Polymer injection ring and mixing device	1	EA	$0	$0
8	Huber Standard Control Panel	1	EA	$0	$0
9	Sludge Conveyor w/ 3 hp motor 20' long	1	EA	$25,000	$25,000
10	equipment installation	30%		$84,000	$84,000
	Subtotal Equipment				*$389,000*
	Piping and Miscellaneous Mechanical	30%	of Equip		$84,000
	Electrical	30%	of Equip		$116,700
	Instrumentation and Control	12%	of Equip		$46,680
	Subtotal Structural, Mechanical, Elect, I&C				*$936,380*
	Contractor O&P	12%	of Sub Cost		$112,366
	Mobilization, demobilization, bond	6%	of Sub cost		$56,183
	Site Work	5%	of Sub cost		$46,819
	Total estimated current construction cost				*$1,151,747*
	Escalation to time of construction	3.00%			$34,552
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,186,300
	Contingency	20%			$237,259.96
	Engineering Design	13%			$177,945
	Services During Construction	10%			$142,356
	Sales Tax	8.8%			$125,273
	Total Estimated Construction Cost w/ Contingency & Tax				$1,549,000
	Total Estimated Capital Cost, incl Engineering				$1,869,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	940	hr	$60	$56,400
	Power - Sludge Conveyor	4095	KWH	$0.08	$328
	Power - Screw Press	683	KWH	$0.08	$55
	Power - Sludge Pumps	6,825	KWH	$0.08	$546
	Structural Maintenance	1.0%			$3,461
	Equipment replacement	2.0%			$14,683
	Polymer	560	lb	$2.00	$1,119
	Solids Hauling w/Tipping Fee	143,487	gal	$0.20	$28,927
	Total Annual Cost				$105,518
	Present Worth Factor	17.687			
	Present Worth Cost				$1,866,000

Total Present Worth Project Cost Estimate

	Capital	$1,869,000
	Operations and Maintenance	$1,866,000
	Total Present Worth	$3,735,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 2: Domestic Strength Pretreatment
Secondary Treatment - Second Oxidation Ditch, Selector Basins and Mixed Liquor Splitter Box
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Earthwork	3,140	CY	$15	$47,100
	Dewatering & Shoring	1	LS	$60,000	$60,000
	Protect Existing Oxidation Structure	1	LS	$10,000	$10,000
	Exterior Concrete Walls - Oxidation Ditch	170	CY	$900	$153,000
	Concrete Divider Wall - Oxidation Ditch	40	CY	$900	$36,000
	Concrete Vane Walls - Oxidation Ditch	30	CY	$900	$27,000
	Concrete Bottom Slab - Oxidation Ditch	200	CY	$700	$140,000
	Concrete Elevated Slab - Oxidation Ditch	20	CY	$1,200	$24,000
	Concrete Walls - Mixed Liquor Splitter Box	40	CY	$900	$36,000
	Concrete Bottom Slab - Mixed Liquor Splitter Box	10	CY	$700	$7,000
	Concrete Walls - Selector Basins	40	CY	$900	$36,000
	Concrete Bottom Slab - Selector Basins	20	CY	$700	$14,000
	Aluminum Handrail (2 Rails)	392	LF	$160	$62,720
	Aeration Building	800	SF	$200	$160,000
	Subtotal Structural				*$812,820*
	Oxidation Ditch Equipment	1	LS	$150,000	$150,000
	DO Probe	1	ea	$2,000	$2,000
	ORP Probe	1	ea	$2,000	$2,000
	Level Transmitter	2	ea	$2,000	$4,000
	Splitter Box Gates	3	ea	$10,000	$30,000
	Mixer	2	ea	$12,000	$24,000
	Circulation Pump	2	ea	$13,000	$26,000
	equipment installation	30%		$71,400	$71,400
	Subtotal Equipment				*$309,400*
	Piping and Miscellaneous Mechanical	30%	of Equip		$71,400
	Electrical	30%	of Equip		$92,820
	Instrumentation and Control	12%	of Equip		$37,128
	Subtotal Structural, Mechanical, Elect, I&C				*$1,323,568*
	Contractor O&P	12%	of Sub Cost		$158,828
	Mobilization, demobilization, bond	6%	of Sub cost		$79,414
	Site Work	5%	of Sub cost		$66,178
	Total estimated current construction cost				*$1,627,989*
	Escalation to time of construction	3.00%			$48,840
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,676,828
	Contingency	20%			$335,366
	Engineering Design	13%			$251,524
	Services During Construction	10%			$201,219
	Sales Tax	8.8%			$177,073
	Total Estimated Construction Cost w/ Contingency & Tax				$2,189,000
	Total Estimated Capital Cost, incl Engineering				$2,642,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	300	hr	$60	$18,000
	Power - Brush Aerators	525,600	KWH	$0.08	$42,048
	Power - Selector Basin Mixers	19,710	KWH	$0.08	$1,577
	Power - Selector Basin Circulation Pumps	39,420	KWH	$0.08	$3,154
	Structural Maintenance	1.0%			$9,377
	Equipment replacement	2.0%			$11,784
	Total Annual Cost				$85,939
	Present Worth Factor	17.687			
	Present Worth Cost				$1,520,000

Total Present Worth Project Cost Estimate

	Capital	$2,642,000
	Operations and Maintenance	$1,520,000
	Total Present Worth	$4,162,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
All Alternatives
UV Disinfection
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Earthwork	410	CY	$15	$6,150
	Dewatering & Shoring	1	LS	$10,000	$10,000
	Form and Pour Concrete Channel	1	ea	$50,000	$50,000
	RAS/WAS Pump Building expansion to include shed cover and rain protection for UV system ballast enclosures and control panel	280	sf	$100	$28,000
	Modify Existing Channel	1	ea	$5,000	$5,000
	Demolition of Existing Outfall Manholes	2	ea	$2,000	$4,000
	Aluminum Handrail (2 Rails)	45	LF	$160	$7,200
	Subtotal Structural				*$110,350*
	UV Equipment (for 2 channels, 2 banks/channel)	1	ea	$160,600	$160,600
	Effluent Sampler	1	ea	$5,000	$5,000
	Parshall Flumes	2	ea	$7,500	$15,000
	Splitter Box Gates	3	ea	$7,500	$22,500
	equipment installation	30%		$60,930	$60,930
	Subtotal Equipment				*$264,030*
	Piping and Miscellaneous Mechanical	30%	of Equip		$60,930
	Electrical	30%	of Equip		$79,209
	Instrumentation and Control	12%	of Equip		$31,684
	Subtotal Structural, Mechanical, Elect, I&C				*$546,203*
	Contractor O&P	12%	of Sub Cost		$65,544
	Mobilization, demobilization, bond	6%	of Sub cost		$32,772
	Site Work	5%	of Sub cost		$27,310
	Total estimated current construction cost				*$671,829*
	Escalation to time of construction	3.00%			$20,155
	'Total Estimated Construction Cost w/o Contingency & Engr				$691,984
	Contingency	20%			$138,397
	Engineering Design	13%			$103,798
	Services During Construction	10%			$83,038
	Sales Tax	8.8%			$73,074
	Total Estimated Construction Cost w/ Contingency & Tax				$903,000
	Total Estimated Capital Cost, incl Engineering				$1,090,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	105	hr	$60	$6,300
	Power	72,270	KWH	$0.08	$5,782
	Structural Maintenance	1.0%			$1,273
	Equipment replacement	2.0%			$10,056
	Total Annual Cost				$23,411
	Present Worth Factor	17.687			
	Present Worth Cost				$414,000

Total Present Worth Project Cost Estimate

	Capital	$1,090,000
	Operations and Maintenance	$414,000
	Total Present Worth	$1,504,000

Project: City of Stevenson Wastewater Facility Plan/General Sewer Plan
Subject: Planning Cost Estimate
Alt 2: Domestic Strength Pretreatment
Secondary Treatment - Mixed Liquor Splitter Box, Third Final Clarifier, RAS Pump Station
By : Tetra Tech Inc.
Date : 17-Nov-17

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Earthwork	1,790	CY	$15	$26,850
	Dewatering & Shoring	1	LS	$50,000	$50,000
	Concrete Slab - Final Clarifier	90	CY	$800	$72,000
	Concrete Walls - Final Clarifier	100	CY	$1,000	$100,000
	Concrete Grout - Final Clarifier	20	CY	$1,000	$20,000
	Concrete Slab - RAS Pump Station	10	CY	$800	$8,000
	Concrete Walls - RAS Pump Station	20	CY	$1,000	$20,000
	Concrete Walls - Mixed Liquor Splitter Box	40	CY	$900	$36,000
	Concrete Bottom Slab - Mixed Liquor Splitter Bo	10	CY	$700	$7,000
	Aluminum Handrail (2 Rails)	170	LF	$160	$27,200
	Subtotal Structural				*$367,050*
	Clarifier Mechanism and Equipment	1	LS	$200,000	$200,000
	RAS Pumps (1 duty, 1 standby)	2	ea	$22,500	$45,000
	VFD for RAS pump	1	ea	$10,000	$10,000
	6" RAS Flow Meter	1	ea	$10,000	$10,000
	4" WAS Flow Meter	1	ea	$6,500	$6,500
	Splitter Box Gates	3	ea	$10,000	$30,000
	equipment installation	30%		$81,450	$81,450
	Subtotal Equipment				*$382,950*
	Piping and Miscellaneous Mechanical	30%	of Equip		$81,450
	Electrical	30%	of Equip		$114,885
	Instrumentation and Control	12%	of Equip		$45,954
	Subtotal Structural, Mechanical, Elect, I&C				*$992,289*
	Contractor O&P	12%	of Sub Cost		$119,075
	Mobilization, demobilization, bond	6%	of Sub cost		$59,537
	Site Work	5%	of Sub cost		$49,614
	Total estimated current construction cost				*$1,220,515*
	Escalation to time of construction (2030)	13.00%			$158,667
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,379,182
	Contingency	20%			$275,836
	Engineering Design	13%			$206,877
	Services During Construction	10%			$165,502
	Sales Tax	8.8%			$145,642
	Total Estimated Construction Cost w/ Contingency & Tax				$1,801,000
	Total Estimated Capital Cost, incl Engineering				$2,173,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	280	hr	$60	$16,800
	Power - Clarifier Drive	13,140	KWH	$0.08	$1,051
	Power - RAS Pumps	65,700	KWH	$0.08	$5,256
	Power - WAS Pumps	2,730	KWH	$0.08	$218
	Structural Maintenance	1.0%			$4,645
	Equipment replacement	2.0%			$15,826
	Total Annual Cost				$43,797
	Escalation to time of construction (2030)	13.00%			$5,694
	Present Worth Factor	9.370			
	Present Worth Cost				$464,000

Total Present Worth Project Cost Estimate

	Capital	$2,173,000
	Operations and Maintenance	$464,000
	Total Present Worth	$2,637,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Haul Liquid Biosolids to Neighboring WWTP
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Solids Thickening Building w/ventilation	900	SF	$200	$180,000
	Subtotal Structural				*$180,000*
	500 pph Rotary Screen Thickener System with Polymer Feed and Controls	1	LS	$90,000	$90,000
	Thin and Thick Sludge Pumps	3	EA	$17,500	$52,500
	Replace Blowers for Existing Solids Holding Tank	1	LS	$22,500	$22,500
	equipment installation	30%		$49,500	$49,500
	Subtotal Equipment				*$214,500*
	Piping and Miscellaneous Mechanical	30%	of Equip		$49,500
	Electrical	30%	of Equip		$64,350
	Instrumentation and Control	12%	of Equip		$25,740
	Subtotal Structural, Mechanical, Elect, I&C				*$534,090*
	Contractor O&P	12%	of Sub Cost		$64,091
	Mobilization, demobilization, bond	6%	of Sub cost		$32,045
	Site Work	5%	of Sub cost		$26,705
	Total estimated current construction cost				*$656,931*
	Escalation to time of construction	3.00%			$19,708
	'Total Estimated Construction Cost w/o Contingency & Engr				$676,639
	Contingency	20%			$135,327.72
	Engineering Design	13%			$101,496
	Services During Construction	10%			$81,197
	Sales Tax	8.8%			$71,453
	Total Estimated Construction Cost w/ Contingency & Tax				$883,000
	Total Estimated Capital Cost, incl Engineering				$1,066,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	940	hr	$60	$56,400
	Power - Thickener	780	KWH	$0.08	$62
	Power - Sludge Pumps	3,900	KWH	$0.08	$312
	Power - Blowers	118,260	KWH	$0.08	$9,461
	Structural Maintenance	1.0%			$2,076
	Equipment replacement	2.0%			$8,170
	Polymer	2,527	lb	$2.00	$5,054
	Solids Hauling w/Tipping Fee	877,307	gal	$0.20	$176,865
	Total Annual Cost				$258,400
	Present Worth Factor	17.687			
	Present Worth Cost				$4,570,000

Total Present Worth Project Cost Estimate

	Capital	$1,066,000
	Operations and Maintenance	$4,570,000
	Total Present Worth	$5,636,000

Project: City of Stevenson Wastewater Facility Plan/General Sewer Plan
Subject: Planning Cost Estimate
Alt 2: Domestic Strength Pretreatment
Solids Handling and Miscellaneous Facilities
By : Tetra Tech Inc.
Date : 17-Nov-17

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Solids Handling Building	900	SF	$200	$180,000
	Subtotal Structural				*$180,000*
	200 pph Rotary Screen Thickener System with Polymer Feed and Controls	1	LS	$50,000	$50,000
	Thin and Thick Sludge Pumps	3	EA	$10,000	$30,000
	Replace Blowers for Existing Solids Holding Tank	1	LS	$22,500	$22,500
	Truck Loading Station	1	LS	$20,000	$20,000
	equipment installation	30%		$36,750	$36,750
	Subtotal Equipment				*$159,250*
	Piping and Miscellaneous Mechanical	30%	of Equip		$36,750
	Electrical	30%	of Equip		$47,775
	Instrumentation and Control	12%	of Equip		$19,110
	Subtotal Structural, Mechanical, Elect, I&C				*$442,885*
	Contractor O&P	12%	of Sub Cost		$53,146
	Mobilization, demobilization, bond	6%	of Sub cost		$26,573
	Site Work	5%	of Sub cost		$22,144
	Total estimated current construction cost				*$544,749*
	Escalation to time of construction	3.00%			$16,342
	'Total Estimated Construction Cost w/o Contingency & Engr				$561,091
	Contingency	20%			$112,218
	Engineering Design	13%			$84,164
	Services During Construction	10%			$67,331
	Sales Tax	8.8%			$59,251
	Total Estimated Construction Cost w/ Contingency & Tax				$733,000
	Total Estimated Capital Cost, incl Engineering				$884,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	312	hr	$60	$18,720
	Power - Thickener	390	KWH	$0.08	$31
	Power - Sludge Pumps	1,170	KWH	$0.08	$94
	Power - Blowers	98,280	KWH	$0.08	$7,862
	Structural Maintenance	1.0%			$2,076
	Equipment replacement	2.0%			$6,065
	Polymer	1,850	lb	$2.00	$3,700
	Solids Hauling w/Tipping Fee	618,020	gal	$0.20	$124,593
	Total Annual Cost				$163,141
	Present Worth Factor	17.687			
	Present Worth Cost				$2,886,000

Total Present Worth Project Cost Estimate

	Capital	$884,000
	Operations and Maintenance	$2,886,000
	Total Present Worth	$3,770,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
All Alternatives
Flood Protection
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Stop gates for doorways	4	Ea	2000	$8,000
	Earthwork	150	CY	$15	$2,250
	Import structural fill	100	CY	$30	$3,000
	Dewatering & Shoring	1	LS	$3,000	$3,000
	Manholes	2	EA	$5,000	$10,000
	Precast valve vault	1	LS	$15,000	$15,000
	Precast wetwell- 8' dia	1	LS	$30,000	$30,000
	Subtotal Structural				*$71,250*
	Storm Pumps (1 duty, 1 standby)	0	ea	$10,000	$0
	Pump Station piping & valves	0	LS	$25,000	$0
	8" Gravity storm drains	100	LF	$100	$10,000
	6" Force main	100	LF	$80	$8,000
	equipment installation	30%		$0	$0
	Subtotal Equipment				*$18,000*
	Piping and Miscellaneous Mechanical	30%	of Equip		$0
	Electrical	50%	of Equip		$9,000
	Instrumentation and Control	15%	of Equip		$2,700
	Subtotal Structural, Mechanical, Elect, I&C				*$100,950*
	Contractor O&P	12%	of Sub Cost		$12,114
	Mobilization, demobilization, bond	6%	of Sub cost		$6,057
	Site Work	5%	of Sub cost		$5,048
	Total estimated current construction cost				*$124,169*
	Escalation to time of construction	3.00%			$3,725
	'Total Estimated Construction Cost w/o Contingency & Engr				$127,894
	Contingency	20%			$25,579
	Engineering Design	13%			$19,184
	Services During Construction	10%			$15,347
	Sales Tax	8.8%			$13,506
	Total Estimated Construction Cost w/ Contingency & Tax				$167,000
	Total Estimated Capital Cost, incl Engineering				$202,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor		hr	$60	$0
	Power - Clarifier Drive		KWH	$0.08	$0
	Power - RAS Pumps		KWH	$0.08	$0
	Power - WAS Pumps		KWH	$0.08	$0
	Structural Maintenance	1.0%			$822
	Equipment replacement	2.0%			$685
	Total Annual Cost				$1,507
	Present Worth Factor	17.687			
	Present Worth Cost				$27,000

Total Present Worth Project Cost Estimate

	Capital	$202,000
	Operations and Maintenance	$27,000
	Total Present Worth	$229,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
All Alternatives
Effluent Pumping
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Earthwork	150	CY	$15	$2,250
	Import structural fill	100	CY	$30	$3,000
	Dewatering & Shoring	1	LS	$3,000	$3,000
	Manholes	2	EA	$7,000	$14,000
	Precast valve vault	1	LS	$15,000	$15,000
	Precast wetwell- 8' dia	1	LS	$30,000	$30,000
	Subtotal Structural				*$67,250*
	Effluent Pumps (15 hp, 1 duty, 1 standby)	2	ea	$30,000	$60,000
	Pump Station piping & valves	1	LS	$30,000	$30,000
	16" Gravity sewer	20	LF	$150	$3,000
	8" Force main	40	LF	$80	$3,200
	equipment installation	30%		$27,000	$27,000
	Subtotal Equipment				*$123,200*
	Piping and Miscellaneous Mechanical	30%	of Equip		$18,000
	Electrical	50%	of Equip		$61,600
	Instrumentation and Control	15%	of Equip		$18,480
	Subtotal Structural, Mechanical, Elect, I&C				*$288,530*
	Contractor O&P	12%	of Sub Cost		$34,624
	Mobilization, demobilization, bond	6%	of Sub cost		$17,312
	Site Work	5%	of Sub cost		$14,427
	Total estimated current construction cost				*$354,892*
	Escalation to time of construction	3.00%			$10,647
	'Total Estimated Construction Cost w/o Contingency & Engr				$365,539
	Contingency	20%			$73,108
	Engineering Design	13%			$54,831
	Services During Construction	10%			$43,865
	Sales Tax	8.8%			$38,601
	Total Estimated Construction Cost w/ Contingency & Tax				$477,000
	Total Estimated Capital Cost, incl Engineering				$576,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	18	hr	$60	$1,080
	Power - Effluent Pumps	540	KWH	$0.08	$43
	Structural Maintenance	1.0%			$776
	Equipment replacement	2.0%			$5,105
	Total Annual Cost				$7,004
	Present Worth Factor	17.687			
	Present Worth Cost				$124,000

Total Present Worth Project Cost Estimate

	Capital	$576,000
	Operations and Maintenance	$124,000
	Total Present Worth	$700,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B Unphased or Phase 2
Support Facilities
RAS/WAS Pump Building Expansion; new Lab and Ops Building; new Standby Generator; new SCADA System
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Demolition of Existing Buildings	0	CF	$1	$0
	Selective Demolition of RAS/WAS Pump Bldg	200	CF	$50	$10,000
	Lab and Operations Building	1,200	SF	$300	$360,000
	Remodel RAS/WAS Pump Building for office/HMI station	0	SF	$200	$0
	Electrical Building	400	SF	$200	$80,000
	Chain Link Fence	500	LF	$30	$15,000
	Subtotal Structural				*$465,000*
	Relocate 3W Water System	1	LS	$50,000	$50,000
	Lab Equipment	1	LS	$100,000	$100,000
	Replace Standby Generator	1	EA	$120,000	$120,000
	SCADA System Equipment	1	LS	$250,000	$250,000
	equipment installation	30%		$156,000	$156,000
	Subtotal Equipment				*$676,000*
	Piping and Miscellaneous Mechanical	30%	of Equip		$156,000
	Electrical	30%	of Equip		$166,800
	Instrumentation and Control	12%	of Equip		$81,120
	Subtotal Structural, Mechanical, Elect, I&C				*$1,544,920*
	Contractor O&P	12%	of Sub Cost		$185,390
	Mobilization, demobilization, bond	6%	of Sub cost		$92,695
	Site Work	5%	of Sub cost		$77,246
	Total estimated current construction cost				*$1,900,252*
	Escalation to time of construction	3.00%			$57,008
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,957,259
	Contingency	20%			$391,451.83
	Engineering Design	13%			$293,589
	Services During Construction	10%			$234,871
	Sales Tax	8.8%			$206,687
	Total Estimated Construction Cost w/ Contingency & Tax				$2,555,000
	Total Estimated Capital Cost, incl Engineering				$3,084,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	1020	hr	$60	$61,200
	Labor - WWTP Mgt Tasks	1040	hr	$60	$62,400
	Lab Labor	1560	hr	$60	$93,600
	Pretreatment Prog Labor	1040	hr	$60	$62,400
	Power - 3W Water System	137	KWH	$0.08	$11
	Power - Buildings	32,400	KWH	$0.08	$2,592
	Structural Maintenance	1.0%			$5,364
	Equipment replacement	2.0%			$24,916
	Polymer		lb	$2.00	$0
	Total Annual Cost				$312,483
	Present Worth Factor	17.687			
	Present Worth Cost				$5,527,000

Total Present Worth Project Cost Estimate

	Capital	$3,084,000
	Operations and Maintenance	$5,527,000
	Total Present Worth	$8,611,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Support Facilities - Phase 1
RAS/WAS Pump Building Expansion; new Lab and Ops Building; new Standby Generator; new SCADA System
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Demolition of Existing Buildings	0	CF	$1	$0
	Selective Demolition of RAS/WAS Pump Bldg	200	CF	$50	$10,000
	Lab, and Operations Building	0	SF	$300	$0
	Remodel RAS/WAS Pump Building for office/HMI station	240	SF	$200	$48,000
	Electrical Building	400	SF	$200	$80,000
	Chain Link Fence	500	LF	$30	$15,000
	Subtotal Structural				*$153,000*
	Relocate 3W Water System	1	LS	$50,000	$50,000
	Lab Equipment	0	LS	$100,000	$0
	Replace Standby Generator	1	EA	$120,000	$120,000
	SCADA System Equipment	1	LS	$200,000	$200,000
	equipment installation	30%		$111,000	$111,000
	Subtotal Equipment				*$481,000*
	Piping and Miscellaneous Mechanical	30%	of Equip		$111,000
	Electrical	30%	of Equip		$108,300
	Instrumentation and Control	12%	of Equip		$57,720
	Subtotal Structural, Mechanical, Elect, I&C				*$911,020*
	Contractor O&P	12%	of Sub Cost		$109,322
	Mobilization, demobilization, bond	6%	of Sub cost		$54,661
	Site Work	5%	of Sub cost		$45,551
	Total estimated current construction cost				*$1,120,555*
	Escalation to time of construction	3.00%			$33,617
	'Total Estimated Construction Cost w/o Contingency & Engr				$1,154,171
	Contingency	20%			$230,834.25
	Engineering Design	13%			$173,126
	Services During Construction	10%			$138,501
	Sales Tax	8.8%			$121,880
	Total Estimated Construction Cost w/ Contingency & Tax				$1,507,000
	Total Estimated Capital Cost, incl Engineering				$1,819,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	1020	hr	$60	$61,200
	Labor - WWTP Mgt Tasks	1040	hr	$60	$62,400
	Lab Labor		hr	$60	$0
	Pretreatment Prog Labor	1040	hr	$60	$62,400
	Power - 3W Water System	137	KWH	$0.08	$11
	Power - Buildings	6,480	KWH	$0.08	$518
	Structural Maintenance	1.0%			$1,765
	Equipment replacement	2.0%			$17,489
	Total Annual Cost				$205,783
	Present Worth Factor	9.370			
	Present Worth Cost				$1,928,000

Total Present Worth Project Cost Estimate

	Capital	$1,819,000
	Operations and Maintenance	$1,928,000
	Total Present Worth	$3,747,000

Project: **City of Stevenson Wastewater Facility Plan/General Sewer Plan**
Subject: **Planning Cost Estimate**
Alt 1B: Minimum Pretreatment
Support Facilities - Phase 2
RAS/WAS Pump Building Expansion; new Lab and Ops Building; new Standby Generator; new SCADA System
By : **Tetra Tech Inc.**
Date : **17-Nov-17**

Capital Cost Estimate

Item	Description	Quantity	Unit	Unit cost, $	Cost, $
	Demolition of Existing Buildings	0	CF	$1	$0
	Selective Demolition of RAS/WAS Pump Bldg	0	CF	$50	$0
	Lab and Operations Building	1,200	SF	$300	$360,000
	Expanded RAS/WAS Pump Building	0	SF	$200	$0
	Chain Link Fence	0	LF	$30	$0
	Subtotal Structural				*$360,000*
	Relocate 3W Water System	0	LS	$50,000	$0
	Lab Equipment	1	LS	$100,000	$100,000
	Replace Standby Generator	0	EA	$120,000	$0
	SCADA System Equipment	1	LS	$50,000	$50,000
	equipment installation	30%		$45,000	$45,000
	Subtotal Equipment				*$195,000*
	Piping and Miscellaneous Mechanical	30%	of Equip		$45,000
	Electrical	30%	of Equip		$58,500
	Instrumentation and Control	12%	of Equip		$23,400
	Subtotal Structural, Mechanical, Elect, I&C				*$681,900*
	Contractor O&P	12%	of Sub Cost		$81,828
	Mobilization, demobilization, bond	6%	of Sub cost		$40,914
	Site Work	5%	of Sub cost		$34,095
	Total estimated current construction cost				*$838,737*
	Escalation to time of construction (2030)	13.00%			$109,036
	'Total Estimated Construction Cost w/o Contingency & Engr				$947,773
	Contingency	20%			$189,554.56
	Engineering Design	13%			$142,166
	Services During Construction	10%			$113,733
	Sales Tax	8.8%			$100,085
	Total Estimated Construction Cost w/ Contingency & Tax				$1,237,000
	Total Estimated Capital Cost, incl Engineering				$1,493,000

Operations and Maintenance Cost Estimate (per year)

Item	Description	Quantity	Unit	Unit Cost	Annual Cost
	Labor	1020	hr	$60	$61,200
	Labor - WWTP Mgt Tasks	1040	hr	$60	$62,400
	Lab Labor	1560	hr	$60	$93,600
	Pretreatment Prog Labor	1040	hr	$60	$62,400
	Power - 3W Water System	137	KWH	$0.08	$11
	Power - Buildings	64,800	KWH	$0.08	$5,184
	Structural Maintenance	1.0%			$4,556
	Equipment replacement	2.0%			$8,148
	Total Annual Cost				$297,499
	Escalation to time of construction (2030)	13.00%			$38,675
	Present Worth Factor	9.370			
	Present Worth Cost				$3,150,000

Total Present Worth Project Cost Estimate

	Capital	$1,493,000
	Operations and Maintenance	$3,150,000
	Total Present Worth	$4,643,000

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix J. SEPA Checklist

City of Stevenson, WA
Wastewater Treatment Plant
Facility Upgrades

SEPA Checklist

PREPARED BY:

TETRA TECH

November 2017

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TABLE OF CONTENTS

FIGURES

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A. Background

A.1. Name of proposed project, if applicable:

City of Stevenson Wastewater Treatment Plant Facility Upgrades

A.2. Name of applicant

City of Stevenson Public Works Department

A.3. Address and phone number of applicant and contact person:

Eric Hansen
Public Works Director
City of Stevenson
Stevenson City Hall
7121 E. Loop Road
PO Box 371
Stevenson, WA 98648
509-427-5970

A.4. Date checklist prepared:

July 6, 2017, revised and finalized November 17, 2017

A.5. Agency requesting checklist

- City of Stevenson
- Washington Department of Ecology

A.6. Proposed timing or schedule (including phasing, if applicable):

The proposed project would begin in fall 2020. Construction would be expected to last approximately one year.

A.7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Yes. Several future facility upgrades are planned and were considered in the design for the proposed project. The proposed site configuration would leave room for future construction of a third aeration basin and second digester as well as future expansion of the solids handling building. See Figure 1 for the location of these potential future projects. These upgrades are not evaluated as part of this State Environmental Policy Act (SEPA) checklist. Additional, project-specific documentation to fulfill SEPA requirements would be prepared prior to their implementation. In connection with the proposed project, maintenance facilities would be relocated offsite following the demolition of the existing maintenance shop at the north corner of the property to allow for construction of the proposed shop, lab, and operations building.

A.8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Cultural Resource Survey Report, City of Stevenson Waste Water Treatment Plant Expansion, Alex Bourdeau, Archaeologist, 1992

A.9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

The City has applied with Skamania County for a property line adjustment which would allow all facilities to be found on City property. That application is pending.

A.10. List any government approvals or permits that will be needed for your proposal, if known.

- Department of Ecology Approval
- City of Stevenson Critical Areas Permit Written Determination of Exemption
- City of Stevenson Building Permit (requires submittal of Application for Improvement)
- City of Stevenson Shorelines Permit
- Southwest Clean Air Agency, Minor Emissions Permit
- Department of Archaeology and Historic Properties Letter of Concurrence

A.11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The proposed improvements to the Stevenson Wastewater Treatment Plant (Plant) would include replacing the existing headworks with a new, larger headworks, modifying the existing secondary treatment process by adding selector basins, expanding the secondary treatment capacity, adding a third final clarifier, adding a second ultraviolet (UV) disinfection channel, adding a sludge thickening building and an aeration building. The existing laboratory/control building would be replaced by a new laboratory and operations building. Approximately two-thirds of the 1.7-acre site would be affected by construction activities. A preliminary site plan for the proposed project is shown in Figure 1.

A.12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The Plant is located at 686 Southwest Rock Creek Drive, Stevenson, WA 98648, at the intersection of Southwest Rock Creek Drive and Rock Creek Park Road, in the central portion of the City of Stevenson (Figure 2). The cadastral location of the Plant is Township 2N, Range 7E, Section 1 (Figure 2). The Plant is located on a relatively flat portion of land adjacent to Rock Creek, south and east of Southwest Rock Creek Drive (Figure 3). The total area of the work site is approximately 1.7 acres.

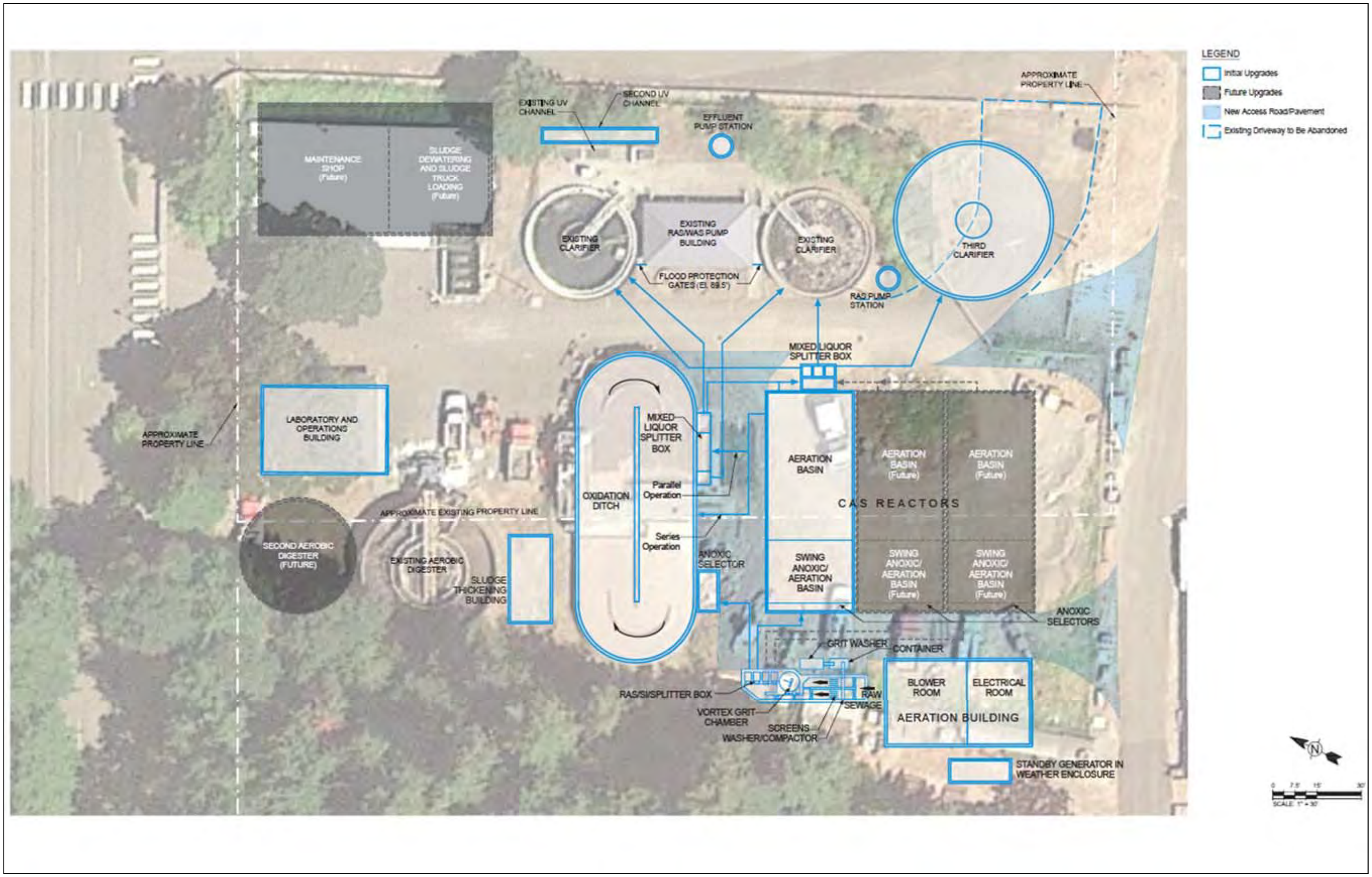

Figure 1. Preliminary site plan for the proposed project.

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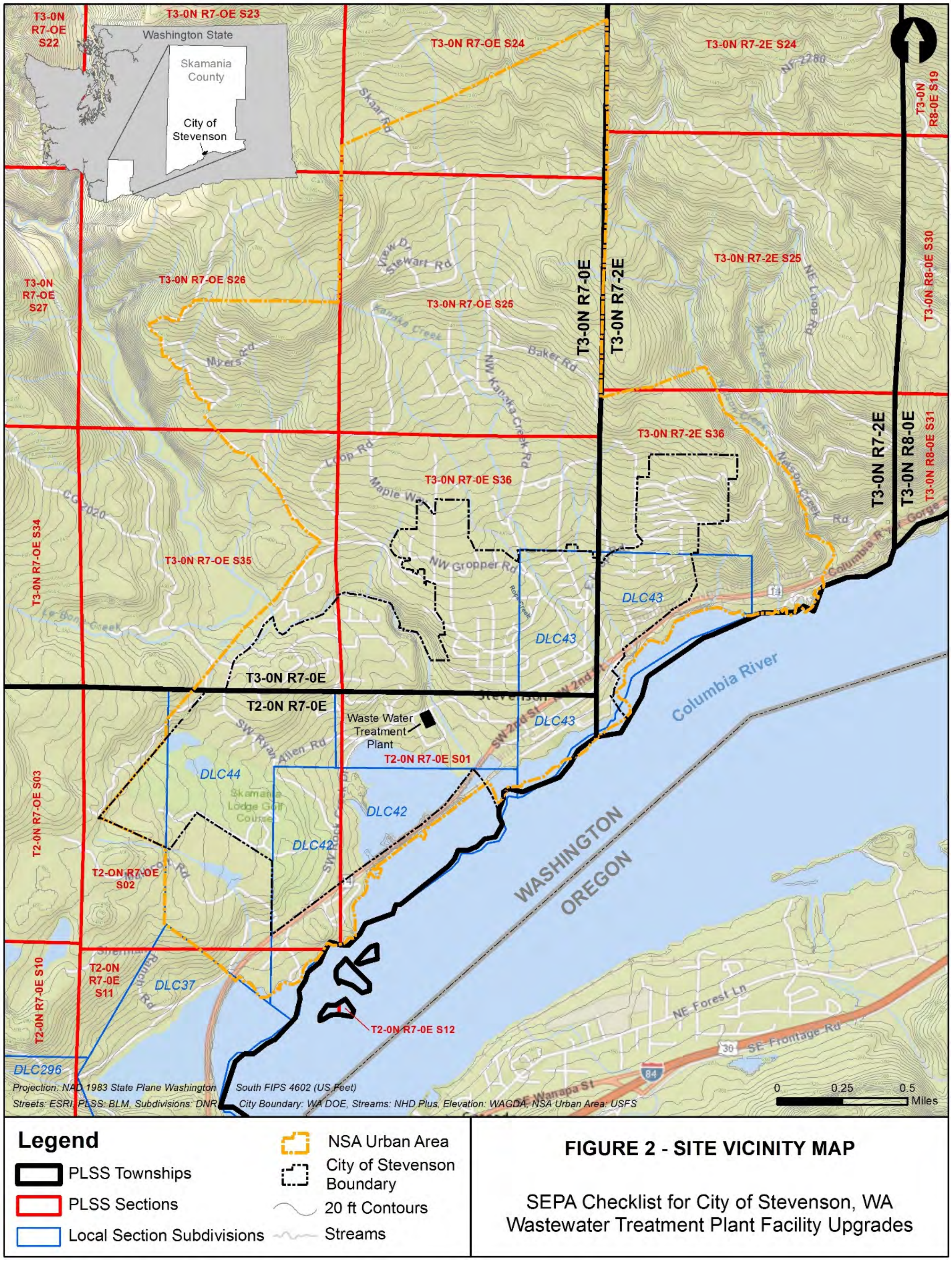
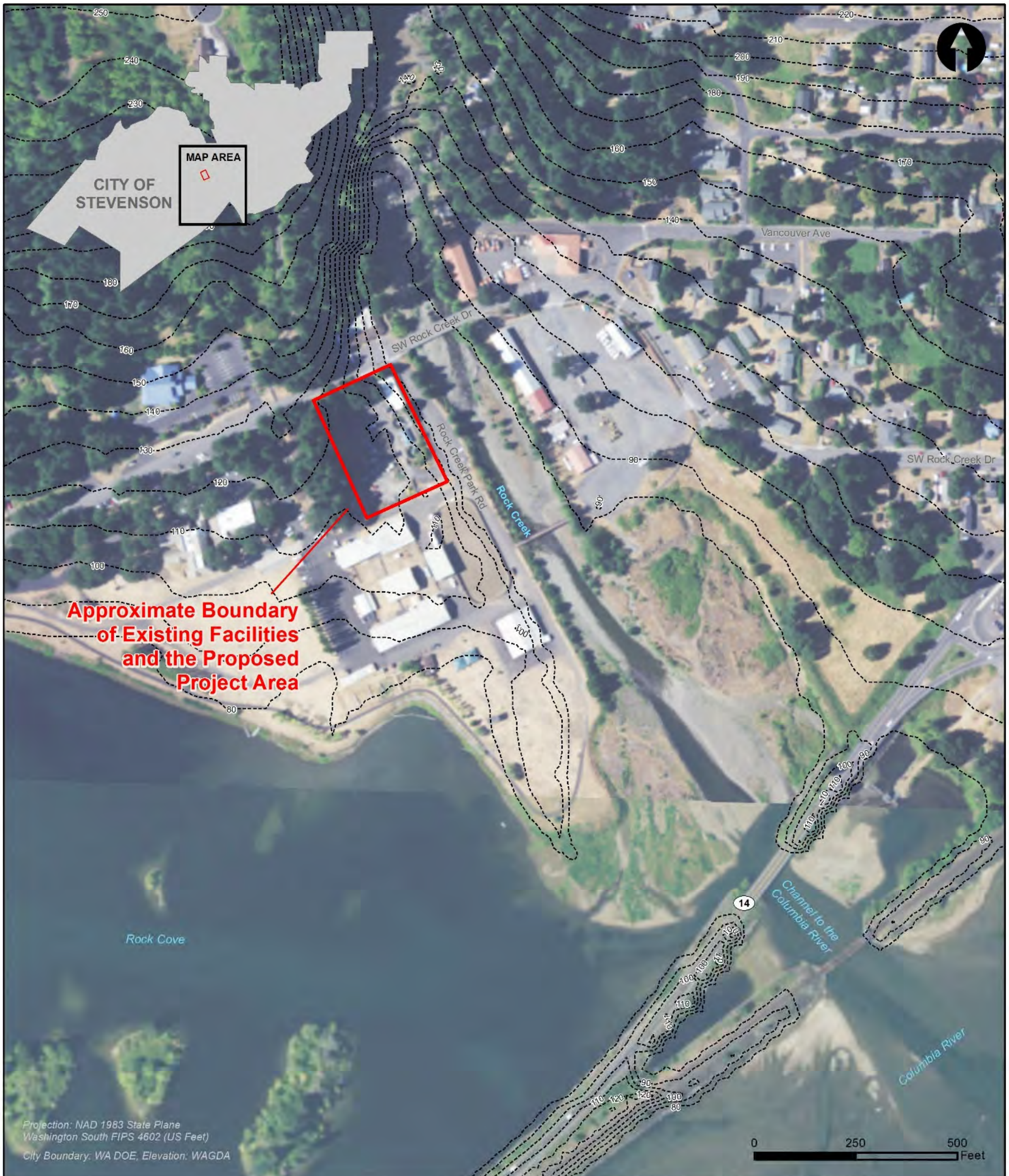


FIGURE 2 - SITE VICINITY MAP

SEPA Checklist for City of Stevenson, WA
Wastewater Treatment Plant Facility Upgrades



Legend

Project Area

10 ft Contours

FIGURE 3 - PROJECT LOCATION

SEPA Checklist for City of Stevenson, WA
Wastewater Treatment Plant Facility Upgrades

Currently, some of the existing facilities (e.g., the existing digester and oxidation ditch) impinge on Skamania County property (Figure 1). This has been known to and accepted by the City and Skamania County for over 20 years. The public works department has submitted a request to Skamania County for a property line adjustment that would extend this property line to the northwest, so that all existing and future Plant facilities would be located entirely on City property. The City-owned portion of the lot is parcel 02070120120100 (address: 686 Southwest Rock Creek Drive). The County-owned portion of the lot is part of a larger parcel that also includes the County Fairgrounds and the Hegewald Center: parcel 02070120120000 (address: 710 Southwest Rock Creek Drive).

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B. Environmental Elements

B.1. Earth

B.1.a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____________

The City of Stevenson covers a wide range of topography, from flat terraced areas along the Columbia River to the gradual and steep slopes of the lower walls of the Columbia River Gorge (Figure 2).The Plant itself is on a relatively flat site at a lower elevation, close to the Columbia River and to Rock Cove (Figure 3).

B.1.b. What is the steepest slope on the site (approximate percent slope)?

According to the Natural Resources Conservation Service (NRCS) soil survey for the surrounding area, slopes on the project site range from 0 to 5% (NRCS 2017).

B.1.c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The eastern portion of the project site is underlain by Arents, a well-drained gravelly to extremely gravelly sandy loam that forms on river terraces (NRCS 2017). The western portion of the site is underlain by Bonneville stony sandy loam that is comprised of a surface layer of stony sandy loam and subsurface layers of extremely gravelly coarse sandy loam and extremely gravelly coarse sand. This soil unit also forms on river terraces, and is classified as somewhat excessively drained (NRCS 2017). Both soil types are classified as Farmland of Statewide Importance according to the NRCS Web Soil Survey (NRCS 2017), but the land is zoned for "Public Use and Recreation" by the City (City of Stevenson 2013a, 2014), is already committed to urban uses, and is not agricultural land of long term commercial significance. All work associated with the proposed project would occur within the Plant footprint on previously disturbed land.

B.1.d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

The City of Stevenson is situated on the northern side of the Columbia River Gorge, and developed areas within its boundaries are located both on the flat terraced areas adjacent to the Columbia River as well as on the gradual and steep slopes of the lower walls of the Gorge. As a result, some development has occurred on land that is geologically hazardous or unstable. Multiple landslides have occurred within the city limits, prompting the city to delineate geologic hazard areas such as unstable soils, potentially unstable slopes (slope > 25%), known landslide areas, and debris flow hazard zones (City of Stevenson 2008, 2013a). This information is used to inform development. The hillslopes north and west of the Plant are classified as potentially unstable, and several landslides have occurred on these slopes, most notably the Rock Creek landslide that began in 2006 (City of Stevenson 2008, WA DOE 2013). The Plant itself, however, is located on a relatively flat terrace (slope 0 - 5%; NRCS 2017) formed by the Columbia River. Although adjacent to Rock Creek, it is located outside of the debris flow hazard zone associated with this stream (City of Stevenson 2008, 2013a). The two soil types that underlie the site both have low percentages of clay (Arents: 14%, Bonneville: 3.5%) and low linear extensibility (1.5%) and therefore have low shrink-swell potential (NRCS 2017). There are no active fault lines in the vicinity of Stevenson or the project site (WA DNR 2014, 2017a). The closest known active fault line is approximately 11 miles east-northeast of the project site, near Drano Lake (WA DNR 2017a). Given these factors, there is little indication of unstable soils in the immediate vicinity of the project site.

B.1.e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

No fill would be needed for the proposed project.

During the construction phase approximately 6,700 cubic yards (cy) of soil would be excavated and removed from the site. Two buildings, the existing maintenance shop and the existing lab and blower building, would be demolished. The total existing volume of those two buildings is roughly 42,000 cubic feet, the majority of which is empty space. In total, about 400 cy of demolished material, including both building and equipment demo, would be removed from the site to an appropriate disposal site. The total area of excavation would be limited to 10,500 square feet, approximately 14% of the 1.7-acre site (1.7 acres = 74,052 square feet), but roughly two-thirds of the site (~49,000 square feet) would be expected to be affected by construction activities. The current elevation of the ground surface at the site is approximately 90 feet above mean sea level (MSL). The maximum excavation required would be to 67 feet above MSL (33 feet below grade) and would be associated with construction of the first and second aeration basins.

B.1.f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Construction associated with the proposed project would begin in fall 2020 and would continue for approximately 12 months, through the rainy season. On site construction associated with the proposed project would involve excavation, demolition, some cutting into an existing hill for construction of the proposed aeration building, and grading within the footprint of the proposed structures. Grading would not increase the slope of any part of the site or alter on-site drainage patterns, and all work would be conducted within the footprint of the Plant on previously disturbed ground. Both soil types found onsite are classified as having only a slight hazard of soil loss from unsurfaced areas (NRCS 2017). Nonetheless, there is the potential for erosion to occur on site during the construction phase. In order to limit on-site erosion and the runoff of eroded materials to Rock Creek, a Stormwater Pollution Prevention Plan and sediment and erosion control plan would be prepared and implemented (see B.1.h). Once the proposed project is complete, operation of the newly configured Plant would not cause erosion to occur.

B.1.g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Following completion of the proposed project, an additional 14,000 square feet of the site would be covered by impervious surfaces. This estimate includes areas that are currently gravel, but would have structures installed in those locations as part of the facility upgrade.

B.1.h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

A Stormwater Pollution Prevention Plan and sediment and erosion control plan would be prepared, would be included in the construction drawings, and would be implemented on site during the construction phase. The contractor would be required to comply with these plans. Sediment and erosion control measures implemented during the construction phase would include the installation of filter fences, hay bales, and silt stacks, as well as the placement of sediment control inserts around existing catch basins. Stormwater management on site following completion of the project would be consistent with current practice, as described in section B.3.c.1.

B.2. Air

B.2.a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Emissions from construction equipment would occur during construction. Components of construction emissions generally include reactive organic gases (ROG), carbon dioxide (CO_2), nitrogen oxides (NO_x), particulate matter (PM) 2.5 microns or less in diameter ($PM_{2.5}$), and PM 10 microns or less in diameter (PM_{10}). Dust could be generated by construction equipment, but would be contained by regular watering.

During operations, emissions could occur as a result of light equipment use, energy generation equipment, boilers, and from the treatment basins.

The proposed project area is within the air basin managed by the Southwest Clean Air Agency (SWCAA), which is in attainment for all criteria pollutants (St. Clair 2017). The agency did not expect the proposed project to result in violations of regional or federal air quality standards, and did not require emissions modeling to estimate the effects. However, the Plant will apply for and attain a Minor Emissions Permit from the SWCAA for construction and operations. This permit is issued to plants, businesses, and agencies that emit small amounts of criteria pollutants during construction and operations. As part of the application process, the Plant will inventory its emissions based on the type, number, and operating hours of equipment used at the site, and develop a model to estimate yearly emissions. Yearly emissions have not been calculated to date, but are likely to be relatively minor.

B.2.b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No. Stevenson is a small town with minimal industrial components or other uses that may contribute to extensive emissions or odors. No surrounding land uses were identified as having the potential to affect the proposed project in terms of odor or emissions.

B.2.c. Proposed measures to reduce or control emissions or other impacts to air, if any:

The Plant does not currently have any odor control facilities. No complaints have been received from neighboring properties. The upgraded facility would not be expected to produce more odors than the current facility. No measures are proposed to reduce impacts to air, as impacts to air quality and odor would be less than significant.

B.3. Water

B.3.a. Surface Water:

B.3.a.1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The Columbia River runs alongside the southeastern edge of the City of Stevenson (Figure 2). In the southern portion of the city, along the Columbia River, is a man-made cove, Rock Cove, which is separated from the Columbia River by a dike built for State Route (SR) 14 and the railroad line (Figures 2 and 3). The closest surface water body to the Plant is Rock Creek, which runs adjacent to Rock Creek Park Road, approximately 60 feet east of the edge of the Plant property, and drains into Rock Cove and the Columbia River (Figures 2 and 3). Rock Creek is a fish-bearing stream (City of Stevenson 2008). The creek is classified as a Type S stream habitat by the City (City of Stevenson 2013a). According to section 18.13.095 of the City Municipal Code, “Type S streams typically include shorelines of the state and have flows averaging twenty or more cubic feet per second” (City of Stevenson 2017a). Rock Creek is in fact a designated “Shoreline of the State”, as the mean annual flow of the creek is greater than 20 cubic feet per second (City of Stevenson 2015a, 2015b, 2015c). The shorelines of Rock Creek upstream and 60 feet downstream of the Southwest Rock Creek Drive bridge are classified as a riverine wetlands under the United States Fish and Wildlife Service National Wetlands Inventory (USFWS 2017b). The Washington Department of Natural Resources does not classify the shorelines of Rock Creek as wetlands of high conservation value (WA DNR 2017d). The City does not classify the shorelines of Rock Creek as wetlands (City of Stevenson 2013a). South of the bridge over Rock Creek, Rock Creek Park Road restricts the western extent of the riparian area. The Plant is located immediately to the west of Rock Creek Park Road.

According to the 2015 Washington Department of Ecology Water Quality Assessment approved by the United State Environmental Protection Agency (USEPA), the section of the Columbia River that passes by Stevenson has a category 5 listing for temperature, indicating that water temperatures in this section exceed established criteria (WA DOE 2015). A Total Maximum Daily Load (TMDL) for water temperature in the Columbia River is being developed. This section already has a TMDL for dioxin in fish tissues, which was established by the USEPA in 1991. This section also has several category 2 listings, which indicate parameters for which there is evidence of a water quality problem, but for which the impairment is not yet severe enough to merit a category 5 listing. In this section of the Columbia River, the category 2 parameters of concern are water pH and polychrolinated biphenyls, chlordane, and 4,4’-dichlorodiphenyldichloroethylene (DDE) in fish tissues. None of the creeks, surface water bodies, or coves that lie within or run through the City of Stevenson are listed as impaired in the 2015 Water Quality Assessment (WA DOE 2015).

Brazilian elodea (*Egeria densa*), an invasive aquatic macrophyte, has been documented in all of the 8-digit hydrologic unit code watersheds that drain into the lower Columbia River, including the watershed that contains the City of Stevenson (USGS 2017). However, the only recorded observation of Brazilian elodea in the Columbia River itself occurred in Columbia County, downstream of Stevenson (USGS 2017). Eurasian watermilfoil (*Myriophyllum spicatum*) has been observed throughout the Columbia River, both above and below Stevenson, but not near Stevenson or in Rock Cove (USGS 2017). The New Zealand mudsnail (*Potamopyrgus antipodarum*) has been recorded in the lower Columbia River, primarily in Pacific and Cowlitz Counties in Washington and Multnomah, Clatsop, and Columbia Counties in Oregon, downstream of Stevenson, and in the Middle Columbia River in Benton County, Washington, upstream of Stevenson, but has not been recorded in Skamania County (USGS 2017). Yellow iris is present on the shoreline of waterbodies throughout southern Washington and northern Oregon, but has not been recorded at any site near Stevenson (USGS 2017). The project would not involve work in or alongside a waterbody (see additional details in answer to B.3.a.2, below), and, as such, would not spread any water-based invasive species if any should exist in the surrounding area.

B.3.a.2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

As the Plant is located within 200 feet of Rock Creek (the Plant is 60 feet west of Rock Creek), the proposed project would be conducted adjacent to (within 200 feet of) surface waters, and would therefore require a Shoreline Permit from the City of Stevenson. However, all of the construction associated with the proposed project would occur within the footprint of the existing Plant in previously disturbed areas. There is no riparian zone or wetland within the project footprint. No excavation grading, fill, painting, demolition, paving, or other construction-related activities would occur outside of the Plant boundaries. During construction, erosion and sediment control measures and a stormwater pollution prevention plan would be implemented (see details in section B.3.c, below) in order to prevent runoff of material into Rock Creek. None of the equipment used onsite would be in contact with the shoreline area or the water itself, and would not have the potential to spread invasive species should any be present in the area. With the stormwater and sediment erosion mitigation measures in place, impacts to Rock Creek or the associated riverine habitat would be less than significant. All project work would remain consistent with requirements of the City of Stevenson Shoreline Permit, if obtained.

B.3.a.3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Does not apply. No fill or dredge material would be placed in or removed from surface water or wetlands as a part of the proposed project.

B.3.a.4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No. The proposed project would not require any new surface water withdrawals or diversions.

B.3.a.5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

The flood insurance rate map (FIRM) for the City of Stevenson is the Federal Emergency Management Agency (FEMA) FIRM 530161A, which was effective 07/17/1986. The project area has not yet been mapped in the FEMA National Flood Hazard Layer. The Plant does not lie within the 100-year floodplain (Figure 4). The proposed project would occur within the footprint of the existing Plant, outside of the 100-year floodplain (Figure 4).

FIGURE 4 - FLOODPLAIN MAP

SEPA Checklist for City of Stevenson, WA
Wastewater Treatment Plant Facility Upgrades

B.3.a.6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The Plant currently discharges effluent to the Bonneville Pool of the Columbia under an existing National Pollutant Discharge Elimination System (NPDES) permit (Permit WA0020672). The Bonneville Pool outfall is the primary outfall. The facility is also permitted to discharge effluent through a secondary outfall to Rock Creek when the primary outfall is under maintenance or is otherwise inoperable. The Plant is currently designed to handle an average flow for the maximum month of 450,000 gallons per day (WA DOE 2017). Over time, as the town grows, the volume of wastewater is expected to increase from the current dry weather average of approximately 147,000 gallons per day to a dry weather average of about 200,000 gallons per day by 2040. The proposed project, while upgrading the treatment facilities at the Plant and increasing its capacity, would not directly result in any additional wastewater discharge. Following completion of the proposed project, the requirements of the existing NPDES permit would continue to be met.

During the construction phase of the proposed project, erosion and sediment control measures would be implemented on site (see details in section B.3.c., below) in order to prevent stormwater runoff into Rock Creek.

B.3.b. Ground Water:

B.3.b.1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

The proposed project would not include any changes to groundwater use, and would not involve new groundwater withdrawals or discharges to groundwater.

B.3.b.2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

None. There are no septic systems on site, as all sewage generated on site is processed alongside incoming sewage from the service area. With the current system, waste material delivered through the sewer system is treated on site and discharged to the Columbia River under an NPDES permit. Residual solids are stored and dewatered and then hauled offsite to an approved facility. No solid liquid waste material is discharged into the ground. These procedures would remain unchanged following completion of the proposed project.

B.3.c. Water runoff (including stormwater):

B.3.c.1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Under current conditions, a portion of stormwater generated onsite discharges directly into Rock Creek. Catch basins located in close proximity to the wastewater tanks and equipment capture the remainder of the stormwater, which then flows to the plant headworks where it is combined with influent wastewater and is treated and discharged to the Columbia River along with the other treated effluent. During construction, all catch basins would be protected with sediment control devices. In addition, a Stormwater Pollution Prevention Plan and sediment and erosion control plan would be prepared, would be included in the construction drawings, and would be implemented on site during the construction phase. The contractor would be required to comply with these plans. Implementation of these measures would prevent runoff of stormwater to Rock Creek during the construction phase. Following completion of the project, stormwater management on site would be consistent with current practice.

B.3.c.2) Could waste materials enter ground or surface waters? If so, generally describe.

Construction would occur during the wet season, and would have the potential to lead to erosion and discharge of sediment, the release of pollutants bound to sediment, and the production of pollutants associated with construction, such as trash, solvents, sanitary waste from portable restrooms or sewage treatment facilities, and concrete curing compounds. The discharge of these pollutants during construction could impair the quality of any surface water that they flow into. As a result, sediment and erosion control measures would be implemented during the construction phase of the proposed project to prevent inadvertent discharge of stormwater to Rock Creek. Stormwater generated onsite that passes through sediment control devices into the on-site catch basins would be treated in the Plant headworks and discharged to the Columbia River along with the other treated effluent. Details on the proposed sediment and erosion control measures are provided in the answer to B.3.d, below.

B.3.c.3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

Construction of the aeration building at the southwest corner of the site would require some cutting into the existing hill. Other grading on site would be limited to the footprint of the new structures. This cutting and grading would not significantly alter on-site drainage patterns. Completion of the proposed project would increase the impervious area onsite by approximately 14,000 square feet. This estimate includes areas that are currently gravel, but would have structures installed in those locations as part of the facility upgrade. This increase in impervious surfaces would result in a minor increase in surface water runoff generation on site. As under current conditions, a portion of the stormwater generated on site would discharge into Rock Creek. The magnitude of the increase in discharge to Rock Creek would be small, and would not be sufficient to lead to increased channel incision or higher flow velocities in the creek, particularly as the discharge point is near the mouth of Rock Creek.

B.3.d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

A Stormwater Pollution Prevention Plan and sediment and erosion control plan would be prepared, would be included in the construction drawings, and would be implemented on site during the construction phase. The contractor would be required to comply with these plans. Sediment and erosion control measures would include the installation of filter fences, hay bales, and silt stacks, as well as the placement of sediment control inserts around existing catch basins.

B.4. Plants

B.4.a. Check the types of vegetation found on the site:

__X__deciduous tree: alder, maple, aspen, other
__X__evergreen tree: fir, cedar, pine, other
__X__shrubs
_____grass
_____pasture
_____crop or grain
_____Orchards, vineyards or other permanent crops.
_____wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
_____water plants: water lily, eelgrass, milfoil, other
__X__other types of vegetation

B.4.b. What kind and amount of vegetation will be removed or altered?

The plant community at the site includes shrubs used for landscaping, ruderal species, and mature deciduous and evergreen species. The project would avoid mature trees to the degree possible, per City ordinance, but up to 4 large trees (big-leaf maple and ash) could be removed to allow for construction. The project could also result in removal of landscaping species or weedy, ruderal species.

B.4.c. List threatened and endangered species known to be on or near the site.

The United States Fish and Wildlife Service (USFWS) identifies species that may occur at particular areas or habitat types on its Environmental Conservation Online System (ECOS) website (USFWS 2017a). A search of this site did not indicate the presence or potential presence of any listed plant species in the vicinity of the Plant. Township 2N, Range 7E, Section 1 (in which the Plant is located) is not listed as containing natural heritage features by the Washington State Department of Natural Resources Natural Heritage Program (WA DNR 2017b). Review of the Washington Department of Natural Resources Rare Plants and High Quality Ecosystems dataset indicated that there are no recorded rare plants or high quality ecosystems in the vicinity of the Plant (WA DNR 2017c).

B.4.d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

If vegetation were removed during implementation of the proposed project, it would be replaced and/or reseeded with native species in accordance with City of Stevenson standards for vegetation protection and re-establishment and with landscaping requirements for the "Public Use and Recreation" zoning classification. Chapter 17, Section 23.030 of the City of Stevenson Municipal Code stipulates that "Where practical, existing trees, other than those within ten feet or within the footprint of proposed buildings and structures, parking and loading areas, access roads and open space areas, should be retained" (City of Stevenson 2017a). In accordance with these guidelines, the proposed project would avoid mature trees to the degree possible.

B.4.e. List all noxious weeds and invasive species known to be on or near the site.

Noxious weeds and invasive species likely to be on or near the site include Scotch broom *(Cytisus scoparius),* Himalayan blackberry *(Rubus armeniacus),* garlic mustard *(Alliaria petiolata),* Bohemian knotweed *(Polygonum bohemicum),* tansy ragwort *(Senecio jacobaea),* diffuse knapweed *(Centaurea diffusa),* orange hackweed *(Hieracum aurantiacum),* and garden loosestrife *(Lysimachia vulgaris).*

B.5. Animals

B.5.a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

birds: hawk, heron, eagle, songbirds, blue jay, crow, osprey
mammals: deer, bear, beaver, coyotes, pocket gophers, ground squirrels, grey squirrels
fish: salmon, trout

B.5.b. List any threatened and endangered species known to be on or near the site.

In this instance, species that were identified on USFWS's ECOS site as potentially occurring in the vicinity of the plant include gray wolf *(Canis lupus),* North American wolverine *(Gulo gulo luscus),* northern spotted owl *(Strix occidentalis caurina),* yellow-billed cuckoo *(Coccyzus americanus),* bull trout *(Salvelinus confluentus),* and several runs of anadromous fish. Of these, only the yellow-billed cuckoo, bull trout, and anadromous fish may occur in the area, but they would not occur at or near the Plant due to lack of habitat. The Plant currently discharges effluent to the Bonneville Pool of the Columbia (or to Rock Creek if the primary outfall is damaged) under an existing NPDES permit. The proposed project would not directly result in any additional wastewater discharge, and would not impact fish habitat in Rock Creek or the Columbia. The yellow-billed cuckoo may occur in the trees at or near the Plant on a passerine basis, but would not nest in the trees at the Plant.

B.5.c. Is the site part of a migration route? If so, explain.

The Columbia River is a migration route for anadromous fish, and a major stopover for migratory waterfowl. Rock Creek offers a spawning migration route for listed anadromous fish including steelhead trout and coho salmon. The proposed project would have no impact on spawning or migration routes in either waterbody. Numerous migratory waterfowl stop in the areas waterways and nearby wildlife refuges. However, the site itself offers no habitat for migratory species other than for small passerine birds that may forage, roost, or nest in the trees at the plant during their migration. Some migratory waterfowl likely use Rock Creek Bay for foraging and resting, but would be at sufficient distance from construction and operations that they would not be disturbed.

B.5.d. Proposed measures to preserve or enhance wildlife, if any:

If large trees were proposed to be removed during construction, the site would be surveyed by a qualified biologist for the presence of nesting birds that are protected under the Migratory Bird Treaty Act. If nesting migratory birds are identified, Plant staff would either delay construction until after the nesting season is over (generally mid-August), or would consult with USFWS staff to develop mitigation measures.

B.5.e. List any invasive animal species known to be on or near the site.

No invasive animal species are known to occur at or near the site. Non-native fishes may be present in Rock Creek Bay and the nearby Columbia River, but would not occur in the construction or operation area.

B.6. Energy and Natural Resources

B.6.a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Upon completion of the propose project, the Plant's energy requirements would increase from approximately 200 horsepower (hp) (149 kilowatts [kW]) to 400 hp (298 kW). The Plant operates primarily on electricity to run the treatment facilities and the administrative building. Electricity is imported to the Plant from the Bonneville Power Administration grid that serves the area, and a large standby power generator would be installed as part of the project to allow for operational redundancy, replacing an existing standby power generator of small capacity.

B.6.b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No. Project actions involving construction of above-ground facilities would meet local building height restrictions, and would not interfere with the use of solar energy on adjacent properties.

B.6.c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Records on power use in 2016 at the Stevenson WWTP were provided by CH2M contract operations. These records indicate that total annual power use was 272,240 kW hours for 2016.

The design for the selected alternative would include a conventional activated sludge secondary treatment system, using aeration basins with 20-ft side water depth and fine bubble diffusers. This system would have better oxygen transfer efficiency and so would be more energy efficient than the existing oxidation ditch. The new UV system would have dose-pacing capability, and would be more energy efficient than the existing UV system. The project proponent would implement energy-efficient building practices and equipment, and it is anticipated that operations would continue to be efficient in terms of energy use.

B.7. Environmental Health

B.7.a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

Construction and some future maintenance activities would require petroleum, oil, lubricants, paint, asphalt, and other potentially hazardous materials to be transported to, temporarily stored on, and used at the project site, and would generate waste. The routine transport, use, or disposal of these materials and petroleum products would carry some risk compared to situations not involving these materials. Details on proposed measures to mitigate these risks are provided in the answer to B.7.a.5., below.

B.7.a.1) Describe any known or possible contamination at the site from present or past uses.

There is no known contamination on site from present or past uses. Operations of the Plant are not of the type that would normally lead to contamination.

B.7.a.2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

No major hazardous liquid or gas transmission pipelines are located within 660 feet (0.125 miles) of the project area. The nearest gas transmission pipeline runs southwest-northeast, parallel to the Columbia River, at a higher elevation, and is approximately 0.6 miles north and northwest of the project site (USDOT 2017).

B.7.a.3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

Construction and some future maintenance activities would require petroleum, oil, lubricants, paint, asphalt, and other potentially hazardous materials to be transported to, temporarily stored on, and used at the project site, and would generate waste. There is currently an above-ground diesel storage tank by the existing standby generator. Upon completion of the proposed project this would be used by the new, larger emergency generator.

B.7.a.4) Describe special emergency services that might be required.

Technological upgrades to the Plant would include installing a new supervisory control and data acquisition (SCADA) system and a larger standby power generator. The larger generator would allow more equipment to be on emergency power during a power loss, bringing the Plant into compliance with State requirements. The SCADA system would allow a more fully automated startup of Plant systems following a power loss. In addition, Plant communications and remote control capabilities would be significantly improved.

Following completion of the facility upgrades, the Plant would update its emergency plan to revise emergency access routes within the Plant property and to establish inspection procedures for new facilities. No substantive changes to special emergency services would be required as a result of the proposed project.

B.7.a.5) Proposed measures to reduce or control environmental health hazards, if any:

The construction contractor(s) would be responsible for the proper handling, storage, use, transport, disposal, and cleanup of hazardous substances, petroleum products, and waste. The construction contractor(s) would be responsible for appropriately and accurately characterizing waste to determine whether it meets the criteria for hazardous waste. Safety Data Sheets (formerly known as Material Safety Data Sheets) for all relevant chemicals would be kept on-site and available for review by all site personnel, and all hazardous materials would be used and stored in accordance with the manufacturer's instructions and applicable regulations.

A construction-specific hazardous materials management plan and site-specific health and safety plan would be prepared by the construction contractor(s) prior to construction to ensure that the routine transport, use, or disposal of hazardous materials during construction would be done in compliance with federal, state, and local laws, ordinances, and regulations, and to help avoid and minimize potential accidents or spills during construction. The plans would conform to applicable federal, state, and municipal laws, ordinances, and regulations and would detail relevant Best Management Practices. They would be implemented for the duration of the construction. The plans would be on-site during construction and would be distributed to all workers and managers prior to the start of construction.

B.7.b. Noise

B.7.b.1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Noise in the area is typical of a developed small town. Noises are associated with automobile traffic, light industry, use of the Plant itself, and rail traffic. Operations of the Plant are not a substantial source of noise. The proposed project would not be affected by these sources of noise.

B.7.b.2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Noise would be generated by use of standard construction equipment, including backhoes, fork lifts, bulldozers, front-end loaders, excavators, and dump trucks, as well as dewatering equipment for deeper excavations. This type of equipment generates combined noise levels of up to 85 decibels at 50 feet, but attenuates rapidly beyond that. Sensitive receptors in the area include nearby churches, the closest of which is 315 feet (0.06 miles) from the site, but the churches would not normally be operational during construction hours. Normal construction hours would be consistent with the Skamania County Code noise regulations (chapter 8, section 22; Skamania County 2017b). Construction would occur on weekdays between 8:00 AM and 5:00 PM.

On average, 2 – 10 truck trips would be required each day of the construction period to bring or remove material to/from the site. Haul trucks entering or leaving the site would generate occasional noise increases, but the low frequency of trucks and low speed limits on surrounding streets would provide adequate control of haul truck noise.

Upon completion of construction, operation of the upgraded facilities would not generate additional noise beyond current levels. Operational noise levels are low and would continue to be low. Operational noises could include use of light machinery, occasional use of generators, and normal noises generated by employees. As a result, neither construction nor operations would result in a substantial permanent increase in ambient noise levels in the project area.

B.7.b.3) Proposed measures to reduce or control noise impacts, if any:

During the construction phase of the proposed project, all construction equipment would be required to be in proper operating condition with well-maintained exhaust and intake mufflers, consistent with manufacturers' standards and Skamania County Code (chapter 8 section 22.050; Skamania County 2017b). Any equipment idling for more than 5 minutes would be turned off. Construction hours would be limited to between 8 a.m. and 5 p.m. on weekdays.

B.8. Land and Shoreline Use

B.8.a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The current use of the site is the same as the proposed use of the site, which is as a wastewater treatment plant. Surrounding land uses include a church and a small business located across Southwest Rock Creek Drive from the Plant and the Skamania County Fairgrounds located adjacent to the Plant. The Plant and all surrounding properties are in a land use area designated as "Government, Educational, Public Assembly (Churches)" in the City of Stevenson Comprehensive Plan (City of Stevenson 2013a). The proposed project would not expand the footprint of the current facility, would not divide any established community, and would not change any land use or land use designation at or near the Plant.

B.8.b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

There is no photographic evidence of past uses of the site as anything but a wastewater treatment plant, but aerial photographs of the site prior to 1991 have not been found. Due to its regional location, the site was likely forested originally, but it was likely deforested during early settlement and not used as working forest land. No farmlands or forest lands would be converted to other uses. All lands that would be affected are previously developed and are part of the Plant.

B.8.b.1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

There are no working farmlands or forest lands in the vicinity, and none would be affected in any way by the proposed project, or vice versa.

B.8.c. Describe any structures on the site.

The site currently contains a maintenance shop, a pump building, three small operations buildings, an oxidation ditch, two clarifier tanks, and a digester tank.

B.8.d. Will any structures be demolished? If so, what?

The existing maintenance shop, in the north corner of the property, would be demolished and replaced with a new shop, lab, and operations building (Figure 1). The existing lab and blower building would be demolished and replaced with a new blower and solids handling building (Figure 1). The existing oxidation ditch would be converted to three anoxic basins, which would require demolition of the internal walls of the oxidation ditch, but the footprint of the structure would remain the same (Figure 1).

B.8.e. What is the current zoning classification of the site?

The Plant is in an area zoned as “Public Use and Recreation” (City of Stevenson 2013a, 2014). City public works facilities, support buildings and structures, shops, and yards are classified as Principal Uses permitted within this zone (chapter 17, section 34.020 of the City of Stevenson Municipal Code; City of Stevenson 2017a). No changes to the zoning designation are proposed. The density requirements for this zone are as follows: minimum lot size: 10,000 square feet; maximum lot coverage by permanent structures and buildings: 35%; maximum building height: 35 feet; minimum front setback: 25 feet; minimum side setback: 10 feet, or 25 feet in designated shoreline areas; minimum rear setback: 10 feet; building setback from designated shorelines: 50 feet (chapter 17, section 34.050 of the City of Stevenson Municipal Code; City of Stevenson 2017a).

B.8.f. What is the current comprehensive plan designation of the site?

The land use in the Plant location is designated in the City of Stevenson Comprehensive Plan as “Government, Educational, Public Assembly (Churches)” (City of Stevenson 2014). There are no changes proposed that would require a comprehensive plan amendment.

B.8.g. If applicable, what is the current shoreline master program designation of the site?

The site is located near Rock Creek, which is a designated “Shoreline of the State”, as the mean annual flow of the creek is greater than 20 cubic feet per second (City of Stevenson 2015a, 2015b, 2015c). Rock Cove is also a designated “Shoreline of the State” (City of Stevenson 2015a, 2015c). Both are shown on the preliminary jurisdiction map produced as part of the City of Stevenson’s Comprehensive Shoreline Master Program Update (City of Stevenson 2015c). The Plant is located almost entirely within the 200-foot “Shorelands” buffer zone of Rock Creek, but is outside the 200-foot “Shorelands” buffer zone for Rock Cove. The Plant is adjacent to the reach of Rock Creek classified as “Reach 1” in the first draft of the Inventory and Characterization Report prepared as part of the Shoreline Master Program Update (City of Stevenson 2015b). The current preliminary shoreline environment designation for areas along Reach 1 of Rock Creek that are zoned as “Public Use and Recreation” is “Urban Conservancy” (City of Stevenson 2015b). The proposed project would occur within the limits of the existing Plant on previously disturbed ground and would not destabilize or further modify the shoreline of Rock Creek, degrade the shoreline environment, or result in a net loss of shoreline ecological function. The proposed project would remain consistent with Shoreline Master Program Guidelines (WAC 173-26) as well as requirements of the City of Stevenson Shorelines Permit, if obtained.

The nearby Columbia River is a designated "Shoreline of State-Wide Significance" (City of Stevenson 2017a), but the project site is not located within the 200-foot "Shorelands" buffer zone of the Columbia River.

B.8.h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

The site is not located within any critical areas designated by the City in the latest critical areas map (City of Stevenson 2008). However, the site is adjacent to Rock Creek, which is designated as a Type S stream habitat by the City of Stevenson, a subcategory of the Riparian Area category of Fish and Wildlife Habitat Conservation Areas, which are one of the five types of critical areas regulated in the City of Stevenson (City of Stevenson 2013a). The riparian habitat buffer for Type S stream habitat is 150 feet (City of Stevenson 2013a). Part of the existing Plant lies within this buffer, as would a portion of the proposed facilities. Therefore, the proposed project would occur within the buffer of a City-designated critical area. According to section 18.13.010 of the City Municipal Code, a buffer "surrounds and protects critical area functions from adverse impacts" (City of Stevenson 2017a). Under City code, "critical areas include their protective buffer areas" and buffers are subject to the same regulations as critical areas themselves (Section 18.13.20; City of Stevenson 2017a). However, the Municipal Code also identifies specific developments, activities, and uses that are exempt from the provisions of the Critical Area regulations provided that the project is issued a "written determination of exemption" and that the project otherwise complies with applicable City, state, and federal laws (Section 18.13.025; City of Stevenson 2017a). One of the specified exempt forms of development is the "Repair, operation, maintenance, replacement, reconstruction, and relocation" of specific utilities, provided "That any such activity…does not extend outside the previously disturbed area" (Section 18.13.025; City of Stevenson 2017a). Existing above- and below-ground storm and sanitary sewer systems are included amongst the list of utilities eligible for exemption (Section 18.13.025; City of Stevenson 2017a). The proposed project appears to meet the exemption criteria, as it is comprised of maintenance and replacement of the stormwater and sewage treatment facilities at the existing Plant and would occur entirely within the existing boundary of the Plant on previously disturbed land. The project would not further intrude upon the buffer or the stream habitat. In addition, the project would employ all reasonable mitigation measures to avoid impacts to Rock Creek and its associated buffer. The Plant will complete a Critical Areas Permit Application for a "written determination of exemption." The proposed project would comply with any requirements of the "written determination of exemption", should it be issued.

Despite its location in the buffer of a City-designated critical area, use of the site as a wastewater treatment plant, as a use that was existing at the time of that the Critical Areas chapter of the Municipal Code was published in 2008 (City of Stevenson 2017b), "may continue so long as it is used in an equivalent or less intensive manner, footprint, and location and for the same purpose" (Section 18.13.085, City of Stevenson 2017a). The propose project would conform with these requirements, as the use and footprint of the site would not change.

The City of Stevenson Critical Areas Ordinance is currently being reviewed and updated, and it is not known if the updated ordinance with change the designation of any portion of the project area.

B.8.i. Approximately how many people would reside or work in the completed project?

There would be no residents of the Plant. The Plant employs 1 person presently, and could employ up to 4 full-time staff by Year 2020.

B.8.j. Approximately how many people would the completed project displace?

No people, businesses, or residences would be displaced by the proposed project.

B.8.k. Proposed measures to avoid or reduce displacement impacts, if any:

No measures are proposed or needed to reduce displacement impacts.

B.8.l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed project would continue to operate on the same lands and in the same manner as it did prior to the project. It is consistent with Stevenson's Comprehensive Plan and land use and zoning designations.

B.8.m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

There are no impacts to these types of lands, therefore no measures to reduce impacts are proposed.

B.9. Housing

B.9.a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None. The proposed project would not create any housing units.

B.9.b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None. No housing would be displaced, eliminated, or changed as a result of the proposed project.

B.9.c. Proposed measures to reduce or control housing impacts, if any:

There are no impacts to housing, therefore no measures to reduce impacts are proposed.

B.10. Aesthetics

B.10.a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The tallest height of any proposed structure, including vents, would be 20 feet. The new buildings would be clad in green corrugated metal siding. The total area of windows on the exterior would be minimal, as is typical for utility buildings.

B.10.b. What views in the immediate vicinity would be altered or obstructed?

During construction of the proposed project, the presence of construction equipment, land clearing and earth moving, and increased generation of dust from exposed soils could all contribute to diminished aesthetic appeal of the project area. However, this impact would be temporary and would therefore be less than significant. Following construction, the newly constructed facilities and refurbished existing facilities would not change the visual character of the area, and would blend into the current industrial appearance of the Plant. The new construction would meet all requirements of applicable zoning designations.

The city of Stevenson is a one of thirteen urban areas within the Columbia River Gorge National Scenic Area that is exempt from Scenic Area regulations (Columbia River Gorge Commission 2017). The Plant falls within the designated urban area for Stevenson (Figure 2).

The portion of SR14 that passes Stevenson, which runs along the dike separating Rock Cove and the Columbia River (Figure 2), is part of two scenic byways: the Columbia River Gorge Scenic Byway and Area, and the Lewis and Clark Trail Scenic Byway (WSDOT 2017b). The Plant is not located on a Scenic byway nor is it visible from the byways.

The Plant property is slightly lower in elevation than Southwest Rock Creek Drive, which runs along the northwestern edge of the property. As a result, the facility upgrades would be visible from the road, but the view would be visually similar to the current view and would remain industrial in character. Views over the Plant, to the Skamania County Fairgrounds and the hills beyond, would remain unobstructed.

B.10.c. Proposed measures to reduce or control aesthetic impacts, if any:

None. Aesthetic impacts would be less than significant.

B.11. Light and Glare

B.11.a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

The proposed project would not produce any additional light or glare beyond what is already produced by the existing facility. No new outdoor lighting would be installed, and the area of non-mirrored glass windows on the exterior of new buildings would be minimal.

B.11.b. Could light or glare from the finished project be a safety hazard or interfere with views?

No, as there would be no new sources of light or glare associated with the proposed project.

B.11.c. What existing off-site sources of light or glare may affect your proposal?

Off-site sources of light and glare are minimal. These consist of light posts placed at irregular intervals along Southwest Rock Creek Drive and security lighting on nearby buildings. The proposed improvements would not be affected by any off-site sources of light or glare.

B.11.d. Proposed measures to reduce or control light and glare impacts, if any:

None. The proposed project would not have any light or glare impacts.

B.12. Recreation

B.12.a. What designated and informal recreational opportunities are in the immediate vicinity?

There are several designated and informal recreational areas in the immediate vicinity of the Plant. Immediately adjacent to the Plant to the south are the Skamania County Fairgrounds. The Fairgrounds include a large outdoor arena, a smaller covered arena, several barns, an exhibit hall, restroom facilities, festival campsites, and grassy areas that serve as viewing areas (Skamania County 2017a). Several events are hosted at the Fairgrounds on an annual basis, including the Skamania County Fair, the bluegrass festival GorgeGrass, a community garage sale, the Country Chic Vintage Sale, the Pumpkin Patch festival, the Gorge Blues & Brews Festival, and the Annual Teardrop Trailer campout. Public camping at the fairgrounds is permitted on a first-come/first-served basis when no events are scheduled (Skamania County 2017a). The Fairgrounds therefore provide both designated and informal recreational opportunities.

A designated public pedestrian and bicycling path, the Mill Pond Trail, runs along the edge of the Fairgrounds on the shore of Rock Cove, providing public access to the waterfront (City of Stevenson 2013a). The path continues through Rock Creek Park, which is immediately west of the Skamania County Fairgrounds. Designated recreation opportunities at Rock Creek Park include multi-use fields, picnic areas, a picnic shelter, a playground, and a small skate park (Skamania County 2017a).

Immediately adjacent to the Plant to the west is the Hegewald Center, the community services center. The facility houses the Skamania County Facilities & Recreation, Community Health, and Senior Services departments (Skamania County 2017a). The Center has an auditorium and several conference rooms, and can be rented for public and private meetings, workshops, and training. Several County-sponsored fitness and community-education classes are taught at the Hegewald Center as part of the County's Recreation Program (Skamania County 2017a).

B.12.b. Would the proposed project displace any existing recreational uses? If so, describe.

No. Recreational uses in the surrounding area would not be displaced as a result of the proposed project.

B.12.c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

None. No mitigations measures are necessary, as the propose improvements would have no impact on recreation.

B.13. Historic and cultural preservation

B.13.a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers ? If so, specifically describe.

A search of the Washington Information System for Architectural and Archaeological Records Data revealed only one site that may be considered eligible for listing under Section 106 of the National Historic Preservation Act (NHPA) in the Area of Potential Effect (APE). This structure is a railroad bridge located approximately three-quarters of a mile from the Plant. The bridge would not be affected visually or by any other means by the project. Several other sites within the APE were determined to be either ineligible for listing or no determination has been made. None of these sites are located closer than one-half mile from the project area.

B.13.b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

A cultural resources survey performed in 1992 found no cultural resources, including evidence of historic or Native American use (Bourdeau 1992). A subsequent search in 2013 found a similar lack of records (City of Stevenson 2013b). Archeological monitoring was performed near the site for an outfall extension project, during which no cultural resources were identified (City of Stevenson 2017c).

B.13.c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

As described above, the City has performed a standard database search for cultural and historic resources through the Washington Information System for Architectural and Archaeological Records Data. Archaeological monitoring by use of underwater video inspection was performed for a recent project occurring near the project area.

B.13.d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

The City will implement its inadvertent discovery policy for this project. Under this policy, in the event that any archeological or historic materials are encountered during project activity, work in the immediate area will stop and the following actions will be taken:

1. Implement reasonable measures to protect the discovery site, including any appropriate stabilization or covering;
2. Take reasonable steps to ensure the confidentiality of the discovery site, and
3. Take reasonable steps to restrict access to the discovery site.

The City will notify the concerned tribes and all appropriate county, state, and federal agencies, including the DAHP. The City will ask the tribes and agencies to discuss possible measures to remove or avoid cultural material and reach an agreement with the City regarding actions to be taken and disposal of material.

If human remains are discovered, appropriate law enforcement agencies shall be notified first, and the above steps followed. If the remains are determined to be native, consultation with the affected tribes will take place in order to mitigate the final disposition of said remains. The City will also comply with all applicable state and federal laws regarding discovery of cultural and historic resources.

B.14. Transportation

B.14.a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

The Plant has two entrances, either of which could be accessed by construction equipment. The service entrance is on Rock Creek Park Road, which runs generally north to south for two blocks, and feeds into Southwest Rock Creek Drive (Figure 3). The main entrance to the Plant is on Southwest Rock Creek Drive, which is a two-lane street that starts approximately 1 mile southwest of the site, and ends approximately 0.25 miles northeast of the site (Figures 2 and 3). Both ends of Southwest Rock Creek Drive feed into SR14, which is a state route generally running along the banks of the Columbia River (Figures 2 and 3). SR14, also known as the Lewis and Clark Highway, is the primary throughway in the vicinity. In this area, it has two lanes of travel, one in either direction. Average daily vehicle trips both ways in this stretch of SR14 were approximately 7,600 in 2015 (WSDOT 2017a).

B.14.b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

Skamania County Public Transit stops at the Skamania County Fairgrounds, located adjacent to the Plant. The bus stop is approximately 150 yards from the work area.

B.14.c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

There would be no additional parking spaces associated with the project, and no spaces would be eliminated. The Plant could need to increase staff by up to 2 workers after the project was constructed, but existing parking would be sufficient to accommodate this increase.

B.14.d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

No, no improvements or new transportation facilities would be needed as a result of this project.

B.14.e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No, the project would not use or occur in the vicinity of water, rail or air transportation. The nearest rail line is a Burlington Northern Santa Fe rail line located approximately 0.25 mile from the Plant. This rail line would not be affected by the project in any way.

B.14.f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

The proposed project would only increase the treatment capacity of the Plant, and is not expected to increase vehicular traffic unless additional staff members are hired. In the event that up to two additional staff were hired, the project would increase vehicular trips by two passenger trips during the morning commute and two passenger trips in the evening commute.

B.14.g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No, operation of the Plant would continue to be confined to the Plant's existing footprint, and would not affect or be affected by the movement of any types of products on roads or streets in the area.

B.14.h. Proposed measures to reduce or control transportation impacts, if any:

No such measures are needed or proposed.

B.15. Public Services

B.15.a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

The proposed project would allow for an increase in treatment of wastewater consistent with the City of Stevenson's projected growth rate. The City currently has 1,110 Equivalent Residential Units (ERUs), a number that is projected to increase to 1,649 ERUs by 2040. In this way, it indirectly increases the need for public services as it contributes to growth of the City, but this impact is not significant. The project itself is a public service.

B.15.b. Proposed measures to reduce or control direct impacts on public services, if any.

No measures are needed to reduce or control direct impacts on public services.

B.16. Utilities

B.16.a. Circle utilities currently available at the site:

Electricity, natural gas, water, refuse service, telephone, sanitary sewer, ~~septic system~~, other ___standby generator___

B.16.b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

No new utilities are proposed for the project. The existing electrical features that feed energy to the Plant are sufficient to convey the increased electricity that would be needed to power the additional facilities. Electricity is imported to the Plant from the Bonneville Power Administration grid that serves the area. Projected growth for the City of Stevenson could lead to future need for additional sewer pipelines to bring wastewater to the Plant. This expansion would occur as a separate project and is not included in the proposed project.

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: [signature]

Name of signee Leana Johnson

Position and Agency/Organization City Administrator, City of Stevenson

Date Submitted: 11/17/17

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Acronyms

City	City of Stevenson, Washington
CO_2	Carbon dioxide
cy	Cubic yards
DDE	Dichlorodiphenyldichloroethylene
ECOS	Environmental Conservation Online System
ERU	Equivalent residential units
FEMA	Federal Emergency Management Agency
FIRM	Flood insurance rate map
hp	Horsepower
kW	Kilowatt
MSL	Mean sea level
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination Service
NRCS	Natural Resources Conservation Service
Plant	City of Stevenson Wastewater Treatment Plant
PM	Particulate matter
$PM_{2.5}$	particulate matter 2.5 microns or less in diameter
PM_{10}	particulate matter 10 microns or less in diameter

City of Stevenson General Sewer Plan and Wastewater Facilities Plan Update

Appendix K. Design Criteria for Phased WWTP Improvements

K. Design Criteria for Phased WWTP Improvements

Design Criteria for Phased Treatment Plant Facility Improvements			
Process/Equipment Description	Existing Design	Phase 1, Year 2030	Phase 2, Year 2040
Treatment Plant Rated Capacity			
Flow[a]			
Base (Dry Weather Average)	0.24 mgd		
Maximum Month	0.45 mgd	0.57 mgd	0.66 mgd
Peak Day	1.0 mgd	1.54 mgd	1.71 mgd
Peak Hour	1.5 mgd	2.31 mgd	2.56 mgd
Pollutant Loadings - BOD or SS[a]			
Maximum-Month	611 ppd	1,401 ppd	1,611 ppd
Peak Day		2,552 ppd	2,912 ppd
Peak Hour (1.5 peaking factor)		159 pphr	182 pphr
Headworks			
Mechanical Fine Screen			
Number	1 + manual screen bypass	1 + manual screen bypass	1 + manual screen bypass
Type	Automatic bar screen	6 mm automatic fine screen	6 mm automatic fine screen
Peak Flow Capacity per Screen	1.5 mgd	2.56mgd	2.56mgd
Washer Compactor			
Number	None	1	1
Screenings Volume Reduction	n/a	80%	80%
Organic Constituents Removal from Screenings	n/a	95%	95%
Grit Chambers			
Type	None	Vortex	Vortex
Number	n/a	1 + bypass	1 + bypass
Grit Pumps			
Type	None	Horizontal recessed impeller	Horizontal recessed impeller
Number	n/a	1	1
Grit Washing / Transport			
Type	None	Cyclone / classifier	Cyclone / classifier
Number	n/a	1	1
Influent Monitoring			
Influent flow measurement	6-inch Parshall Flume	9-inch Parshall Flume	9-inch Parshall Flume
Influent sampler	Time composite sampler, portable, ice cooled	Flow paced composite sampler, refrigerated	Flow paced composite sampler, refrigerated

Process/Equipment Description	Existing Design	Phase 1, Year 2030	Phase 2, Year 2040
Secondary Treatment			
Biological Reactors			
Anoxic Selectors			
Total Volume (at Reactors 1 & 2)	—	20,000 gallons	20,000 gallons
Detention Time			
Maximum month (with 50% RAS flow)	—	34 min	29 min
Peak day (with 100% MM RAS flow)	—	14 min	12 min
Reactor 1			
Type	Oxidation ditch	Oxidation ditch	Oxidation ditch
Volume			
Anoxic selector basin	—	10,000 gallons	10,000 gallons
Swing Zone (Anoxic/Aerobic)	100,000 gallons	100,000 gallons	100,000 gallons
Aerobic Zone	200,000 gallons	200,000 gallons	200,000 gallons
Total	300,000 gallons	310,000 gallons	310,000 gallons
Dimensions			
Reactor	103 feet long 39 feet wide 12-foot side water depth	103 feet long 39 feet wide 12-foot side water depth	103 feet long 39 feet wide 12-foot side water depth
Separate Selector Basin	—	16 feet long 7 feet wide 12-foot side water depth	16 feet long 7 feet wide 12-foot side water depth
Aeration			
Type	Brush aerators	Brush aerators	Brush aerators
Number	2 (1 active, 1 standby)	2 (1 active, 1 standby)	2 (1 active, 1 standby)
HP each	40	40	40
HP total	80	80	80
PD duty / standby HP	40 / 40	40 / 40	40 / 40
PH duty / standby HP	80 / 0	80 / 0	80 / 0
Reactor 2			
Type		Conventional activated sludge	Conventional activated sludge
Volume			
Anoxic selector	—	10,000 gallons	10,000 gallons
Swing Zone (Anoxic/Aerobic)	—	100,000 gallons	100,000 gallons
Aerobic Zone	—	200,000 gallons	200,000 gallons
Total	—	310,000 gallons	310,000 gallons
Dimensions	—	75 feet long 28 feet wide 20-foot side water depth	75 feet long 28 feet wide 20-foot side water depth
Aeration			
Type	—	Blowers and fine bubble diffusers	Blowers and fine bubble diffusers
Number of blowers	—	2 active, 1 standby	2 active, 1 standby
HP (each)	—	30	30
HP (total)	—	90	90
Capacity cfm (each)	—	500 cfm	500 cfm

Process/Equipment Description	Existing Design	Phase 1, Year 2030	Phase 2, Year 2040
Swing Zone Mixer Power (hp)		4	4
Recirculation pump Capacity 300% MM flow HP Drive		 2 mgd 5 Variable Frequency Drive	 2 mgd 5 Variable Frequency Drive
Total Biological Reactors			
Volume	300,000 gallons	620,000 gallons	620,000 gallons
Detention time (max. month)	16 hours	26 hours	23 hours
Mixed Liquor Suspended Solids (max month)	3,000 mg/L	3,000 mg/	3,000 mg/
Mixed Liquor Volatile Solids Concentration (max month)	2550mg/L	2700 mg/L	2700 mg/L
Mixed Liquor Volatile Solids % of Total (max month)	85%	90%	90%
F/M (max month)	0.094 pounds BOD per pound MLVSS	0.100 pounds BOD per pound MLVSS	0.115 pounds BOD per pound MLVSS
Sludge Yield (max month)		0.9 lb / lb BOD applied	0.9 lb / lb BOD applied
Sludge Age (max month)	15 days	12 days	11 days
BOD ppd/1000 cf (max month)	15.2 ppd / kcf	16.9 ppd / kcf	19.4 ppd / kcf
Clarifiers			
Number	2	2	2 existing + 1 new
Diameter	35 feet	35 feet	2 @ 35 feet + 1 @ 50 feet
Depth	14 feet	14 feet	14 feet
Area (total)	1,924 square feet	1,924 square feet	3,887 square feet
Overflow Rate Maximum month Peak Day	 234 gal/day/sq foot 520 gal/day/sq foot	 296 gal/day/sq foot 580 (800) gal/day/sq foot[d]	 170 gal/day/sq foot 440 gal/day/sq foot[b]
Solids Loading Rate Maximum month + RAS @ 100% MM Peak Day + RAS @ 100% MM Peak Hour + RAS @ 100% MM	 12 19 25	 15 27 37	 8 15[b] 21[b]
Return Activated Sludge Pumping			
Type	Non-clog, centrifugal	Non-clog, centrifugal	Non-clog, centrifugal
Number	3 (2 duty)	3 (2 duty)	3 existing (2 duty) + 2 new (1 duty)
Capacity (each)	350 gpm	350 gpm	400 gpm (new pumps only)
Capacity (total, firm)	700 gpm (1 mgd)	700 gpm (1 mgd)	1100 gpm (1.6 mgd)
Drive	Variable frequency drives	Variable frequency drives	Variable frequency drives
RAS Filament Control	Hypochlorite addition	Hypochlorite addition	Hypochlorite addition
UV Disinfection			
Reactor Type	Open channel	Open channel	Open channel
Number	1	2	2
Peak Flow Capacity (each)	1.5 mgd	2.56 mgd	2.56 mgd
Light transmittance	65%	65%	65%

Process/Equipment Description	Existing Design	Phase 1, Year 2030	Phase 2, Year 2040
Minimum UV dose	—	30 mJ per square cm	30 mJ per square cm
Lamp type	Low-pressure, low-output	Low-pressure, high-output	Low-pressure, high-output
Effluent Monitoring			
Effluent flow measurement	V-notch weir	Mag meter	Mag meter
Effluent sampler	Time composite, portable sampler, ice cooled	Flow paced composite sampler, refrigerated	Flow paced composite sampler, refrigerated
Effluent Pumping			
Type	—	Submersible Centrifugal	Submersible Centrifugal
Number	—	2	2
Capacity (total, firm)	—	2.56 mgd	2.56 mgd
Sludge Thickening			
Type	Gravity Decant	Rotary drum screen	Rotary drum screen
Number		1	1
Capacity		150 gpm	150 gpm
Feed solids mg/l		5,000 mg/l	5,000 mg/l
Thickened solids %		5%	5%
Sludge Pumps			
Thickener feed pumps			
Type		Progressive cavity w/ variable frequency drive	Progressive cavity w/ variable frequency drive
Number		2	2
Capacity		150 gpm	150 gpm
HP each		10	10
Thickened sludge pumps			
Type		Progressive cavity w/ variable frequency drive	Progressive cavity w/ variable frequency drive
Number		2	2
Capacity each		60 gpm	60 gpm
HP each		5 HP	5 HP
Sludge Holding Tank (Thickener Feed Tank)			
Tank depth	12.5 feet	12.5 feet	12.5 feet
Tank Area	320 sf	320 sf	320 sf
Volume	30,000 gallons	30,000 gallons	30,000 gallons
Hydraulic Detention time without decant (MM)	2.5 days	1.1 days	0.9 days
Solids concentration	5,000 mg/L	5,000 mg/L	5,000 mg/L
Sludge Digester			
Tank Depth	14.25 feet	14.25 feet	14.25 feet
Volume	134,000 gallons	134,000 gallons	134,000 gallons
Hydraulic Detention Time (without decant)	11 days	47 days	41 days
Solids concentration	14,000 mg/L[c]	30,000 mg/L	30,000 mg/L
Volatile solids concentration	83%[c]	84%	84%
Volatile solids destruction	15%[c]	43%	42%
Class B biosolids (>38% VS destruction)	NO	YES	YES

Process/Equipment Description	Existing Design	Phase 1, Year 2030	Phase 2, Year 2040
Sludge Tank Aeration System			
Type	Sock diffusers	Porous diffusers	Porous diffusers
Aeration blowers			
Number	1 duty + 1 standby	2 duty + 1 standby	2 duty + 1 standby
Capacity each	440 cfm	660 cfm	660
HP each	20 hp	30 hp	30 hp
HP total	40 hp	90 hp	90 hp

a. Flows and loads from Table 2-10 with 20% pretreatment

b. Year 2040 clarifier hydraulic capacity with two 35’ and one 50’ diameter clarifiers at design overflow & solids loading rates:
   Peak day—3.1 mgd @ 800 gpd/sf and 30 ppd/sf
   Peak hour—4.7 mgd @ 1200 gpd/sf and 40 ppd/sf

c. Existing performance

d. Year 2030 clarifier hydraulic capacity with two 35’ diameter clarifiers at design overflow rates:
   Lower Overflow Rate, Peak day—1.11 mgd @ 580 gpd/sf
   Standard Overflow Rate, Peak Day—1.54 mgd @ 800 gpd/sf
   Ecology will consider evaluating existing clarifier overflow rate (and potentially re-rating from 580 gal/day/sq foot to the design value of 800 gal/day/sq foot) after new biological reactors are operational and sufficient performance data has been collected and submitted to demonstrate acceptable, consistent sludge settleability.