LAKE STEVENS
SEWER DISTRICT

LAKE STEVENS SEWER DISTRICT

General Sewer/Wastewater Facility Plan

G&O #20408.07
October 2022

Gray & Osborne, Inc.

LAKE STEVENS SEWER DISTRICT

SNOHOMISH COUNTY **WASHINGTON**

LAKE STEVENS SEWER DISTRICT

GENERAL SEWER/WASTEWATER FACILITY PLAN

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LIST OF ABBREVIATIONS

7-DAD	7-Day Average of the Daily Maximum
AA	Average Annual
AAF	Average Annual Flow
ADWF	Average Dry Weather Flow
AKART	All Known, Available and Reasonable Methods of Prevention, Control and Treatment
AL0	Baseline Threshold
AL1	Secondary Threshold
ANSI	American National Standards Institute
AORT	Actual Oxygen Transfer Rates
BOD	Biochemical Oxygen Demand
BOD_5	5-Day Biochemical Oxygen Demand
$CaCO_3$	Calcium Carbonate
$CBOD_5$	5-Day Carbonaceous Biochemical Oxygen Demand
CFR	Code of Federal Register
CIP	Capital Improvement Plan
CMOM	Capacity, Management Operation and Maintenance
COD	Chemical Oxygen Demand
CWA	Clean Water Act
DEA	Developer Extension Agreement
DMR	Daily Monitoring Report
DNA	Deoxyribonucleic Acid
DNS	Determination of Nonsignificance
DO	Dissolved Oxygen
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EQ	Exceptional Quality
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
F/M	Food to mass
FOG	Fats, Oils and Grease
FONSI	Finding of No Significant Impact

gpcd	Gallons Per Capita Per Day
gpd	Gallons Per Day
gph	Gallons Per Hour
GFC	General Facility Charge
Gfd	Gallons Per Square Foot Per Day
GMA	Growth Management Act
hp	Horesepower
HPA	Hydraulic Project Approval
I/I	Inflow & Infiltration
ILA	Interlocal Agreement
kWh	Kilowatt hours
lb/d	Pounds Per Day
LSMC	Lake Stevens Municipal Code
LSSD	Lake Stevens Sewer District
LSUGA	Lake Stevens UGA
MCP	Master Control Panel
mg/L	Milligrams Per Liter
mgd	Million Gallons Per Day
µg/L	Microgram Per Liter
mL	Milliliter
MLSS	Mixed Liquor Suspended Solids
MM	Maximum Month
MMF	Maximum Month Flow
MPN	Most Probable Number
MW	Megawatt
NBOD	Nitrogenous Biochemical Oxygen Demand
NEPA	National Environmental Policy Act
NH_3	Ammonia
NH_4^+	Ammonium
NOAA	National Oceanic & Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
OFM	Office of Financial Management

PDF	Peak Day Flow
PDC	Power Distribution Unit
PHF	Peak Hour Flow
PLC	Programmable Logic Controller
POTW	Publicly Owned Treatment Works
PFRP	Process To Further Reduce Pathogens
PSCAA	Puget Sound Clean Air Agency
PSNGP	Puget Sound Nutrient General Permit
psi	Pounds per square inch
PSIU	Potential Significant Industrial User
PUD	Public Utility District
QA/QC	Quality Control and Quality Assurance
rbCOD	Readily Biodegradable Chemical Oxygen Demand
RCW	Revised Code of Washington
RDT	Rotary Drum Thickening
RUTA	Rural-Urban Transition Area
SCC	Snohomish County Code
scfm	Standard Cubic Feet per Minute
SCS	Soil Conservation Service
SEPA	State Environmental Policy Act
SIU	Significant Industrial User
SMA	Shoreline Management Act
SOTR	Standard Oxygen Transfer Rates
SRT	Solids Residence Time
SSO	Sanitary Sewer Overflow
SWDP	State Waste Discharge Permit
SR	State Route
TCLP	Toxic Characteristic Leachate Procedure
TIN	Total Inorganic Nitrogen
TMDL	Total Maximum Daily Load
TS	Total Solids
TSS	Total Suspended Solids
TTF	Time-to-Filter
UGA	Urban Growth Area
ULID	Utility Local Improvement District
UV	Ultraviolet

VFA	Volatile Fatty Acids
VFD	Variable Frequency Drive
VSR	Volatile Solids Reduction
VSS	Volatile Suspended Solids
WAC	Washington Administrative Code
WAS	Waste Activated Sludge
WEF	Water Environment Federation
WLA	Waste Load Allocation
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This *General Sewer/Wastewater Facility Plan* (*Facility Plan*) for the Lake Stevens Sewer District (District) addresses the District's planning needs for wastewater collection, transmission, treatment, and disposal for the 20-year planning period. The *Facility Plan* was prepared in accordance with the provisions of the Revised Code of Washington (RCW), Section 90.48, *Water Pollution Control*, Washington Administrative Code (WAC) Section 173-240-050, *General Sewer Plan*, and WAC 173-240-060, *Engineering Report*. Development of the Plan has been coordinated with the Comprehensive Plans of both the City of Lake Stevens and Snohomish County.

POPULATION AND FLOW FORECASTS

Chapter 3 provides detailed information regarding Lake Stevens Urban Growth Area planning and population projections. An annual growth rate of 1.43 percent is used for residential and school connections and 3.5 percent for commercial connections.

Table E-1 presents population projections for the District.

TABLE E-1

Existing and Future LSSD ERUs

	Equivalent Residential Units (ERUs)			
	Residential	**Commercial**	**School**	**Total**
Existing[(1)]	12,767	812	146	13,725
2021	12,949	870	150	13,969
2027	14,251	1,069	164	15,484
2031	15,175	1,227	173	16,575
2041	17,702	1,731	200	19,632

(1) Existing year for Residential ERUs is 2020 and for Commercial and School connections is 2019.

Chapter 5 provides a detailed evaluation of past flows and loadings, as well as projections for the future. WWTP records for the period from 2013 through 2020 were reviewed and analyzed to determine current wastewater characteristics and influent loadings. Current wastewater flows and loadings were used in conjunction with projected population data to determine projected future wastewater flows and loadings.

Flow monitoring was conducted to confirm existing flow assumptions and to estimate infiltration and inflow (I/I). In general, I/I is assumed to be constant at 1,616 gallons per acres per day (gpad) throughout the 20-year planning period for the developed portions of the service area. (This means ongoing I/I reduction efforts in those areas are assumed to compensate for increased I/I due to growth in the sewer area and deterioration of existing infrastructure.) An estimated peak hour I/I rate of 1,000 gpad is assumed for new service areas.

Tables E-2 and E-3 summarize the current and projected influent flow and loading projections, respectively.

TABLE E-2

Current and Projected WWTF Influent Flows

Projected Flows (mgd)								
Flow Type	**NPDES Permit Limit**	**85 Percent NPDES Permit Limit**	**2021**	**2027**	**2031**	**2036**	**2041**	**Buildout**
Average Dry Weather	--		2.42	2.68	2.87	3.12	3.40	3.79
Average Annual(1)	--		2.92	3.21	3.41	3.69	3.98	4.42
Maximum Month(1)	5.01	4.26	3.79	4.10	4.32	4.62	4.94	**5.41**
Peak Day(1)	--		6.96	7.33	7.60	7.96	8.36	8.92
Peak Hour(1)	--		9.17(3)	9.74(3)	10.14(3)	10.69(3)	11.28(3)	12.14(3)

(1) AAF, MMF, PDF are the sum of ADWF in Table 5-10 and the relevant I/I flow in Table 5-11. Flows are reflective of the 20-year storm event that occurred in the winter of 2019-2020.

(2) BOLD values exceed anticipated NPDES Permit Limits (current design limits).

(3) PHF is the sum of the peak hour base flow and I/I flow in Table 5-11. A peaking factor of 1.3 was used to calculate the peak hour base flow; refer to Table 5-8 Note 4 for data source.

TABLE E-3

Current and Projected WWTF Influent Loadings

ERUs and Loadings (lb/d)	**NPDES Permit**	**85% NPDES Permit**	**2021**	**2027**	**2031**	**2036**	**2041**	**Buildout**
Total ERUs	--		13,969	15,484	16,575	18,041	19,632	21,923
Annual Average BOD_5	--		6,210	6,883	7,368	8,020	8,727	9,745
Max Month BOD_5	10,730	9,121	6,825	7,565	8,098	8,815	9,592	10,711
Peak Day BOD_5	--		10,406	11,534	12,347	13,439	14,625	16,331
Annual Average TSS	--		5,435	6,024	6,448	7,019	7,638	8,529
Max Month TSS	10,190	8,662	5,950	6,595	7,059	7,684	8,361	9,337
Peak Day TSS	--		9,773	10,832	11,596	12,621	13,734	15,337
Annual Average NH_3-N			759	841	900	980	1,066	1,191
Max Month NH_3-N			831	921	986	1,073	1,168	1,304
Peak Day NH_3-N			932	1,033	1,106	1,204	1,310	1,463

COLLECTION SYSTEM EVALUATION

FLOW MONITORING

Flow monitoring was conducted to more accurately estimate infiltration and inflow (I/I) contribution within the District's collection system. Six flow meters were installed around the District's collection system to compare conditions in both older and newer portions of the system. An evaluation of that monitoring effort is provided in Appendix D.

COLLECTION SYSTEM MODELING

Chapter 4 summarizes the collection system and its condition. Chapter 6 summarizes hydraulic modeling of, and recommended improvements for, the collection system.

Hydraulic modeling, conducted with InfoSewer modeling software, identified existing and future capacity deficiencies in pipes and lift stations.

COLLECTION SYSTEM PIPING

The District's collection system includes approximately 126 miles of sewer pipes and 3,750 manholes, as well as a dosing station (to provide high velocity flows to reduce solids settling). As described in Chapter 4, approximately 20 percent of this system is more than 40 years old and shows evidence of infiltration at pipe defects such as misaligned joints, cracks, fractures and holes.

It is recommended that an annual gravity sewer repair and replacement program be established to identify and correct deficiencies in the oldest sections of collection system. The plan will assume that 20 percent of the manholes and 15 percent of the pipes that are currently more than 40 years old will be repaired or replaced as part of an annual replacement program over the next 10 years.

It is also recommended because of its age and inability to remotely detect overflows that the District's dosing station be rehabilitated and access improved within the next 10 years. The equipment and controls should be modernized and communication systems replaced with those meeting current standards.

The results of the hydraulic model are presented in detail in Chapter 6. Where pipes within the collection system were found to have insufficient capacity for either existing or future flows, replacement projects were planned scheduled based on the estimated severity and timing of the capacity deficiency.

LIFT STATIONS

As described in Chapter 4, the District owns, operates and maintains 29 lift stations within its sanitary sewer system. Basic information about each lift station is listed in Chapter 4.

Information from both the 2016 *Lift Station Condition Assessment* and site inspections in 2021 was used to prioritize lift station rehabilitation projects. It is recommended that the following lift stations be rehabilitated within the next 6 years: Lift Stations 1, 2, 3, 3C, 4, 6 and 7. In addition, it is recommended that the following lift stations be rehabilitated within the next 10 years: Lift Stations 5, 8, 10, 11, 12, 14 and 15.

Table E-4 shows the existing and projected flows to each of the District's lift stations as determined through the hydraulic model. Note that Lift Stations 9 and 10 serve less than 10 houses each and were not included in the hydraulic model.

TABLE E-4

Lift Station Capacity Summary (Existing and 20 Year)

Lift Station ID	Lift Station Capacity (gpm)	Existing Peak Flow (gpm)	Existing Surplus (+)/ Def (-) (gpm)	20-Year Peak Flow (gpm)	20-Year Surplus (+)/ Def (-) (gpm)
LS 1	59	**84**	**-25**	**95**	**-36**
LS 2	239	108	131	135	104
LS 3	307	71	236	98	209
LS 4	580	304	276	356	224
LS 5	800	661	139	**803**	**-3**
LS 6	312	130	182	160	152
LS 7	200	**249**	**-49**	**295**	**-95**
LS 8	540	530	10	**649**	**-109**
LS 11	400	304	96	355	45
LS 12	2,000	936	1,064	1,101	899
LS 14	480	215	265	282	198
LS 15	5,250	2,969	2,281	3,316	1,934
LS 16	155	13	142	14	141
LS 17	800	344	456	627	173
LS 18	290	142	148	Temporary LS	
LS 19	290	184	106	282	8
LS 20	1,650	1,000	650	1,139	511
LS 21	130	76	54	88	42
LS 22	1,544	837	707	1,162	382
LS 1C	650	**1,578**	**-928**	**1,834**	**-1,184**

TABLE E-4 – (continued)

Lift Station Capacity Summary (Existing and 20 Year)

Lift Station ID	Lift Station Capacity (gpm)	Existing Peak Flow (gpm)	Existing Surplus (+)/ Def (-) (gpm)	20-Year Peak Flow (gpm)	20-Year Surplus (+)/ Def (-) (gpm)
LS 2C	700	**810**	**-110**	**1,017**	**-317**
LS 3C	200	69	131	91	109
LS 4C	100	47	53	58	42
LS 5C	200	6	194	Temporary LS	
LS 6C	100	23	77	50	50
LS 8C	670	**730**	**-60**	**900**	**-230**
LS 9C	150	19	131	36	114

WWTF EVALUATION

Chapter 7 provides a detailed evaluation of each unit process of the District's Wastewater Treatment Facility (WWTF). A spreadsheet-based mathematical model was developed to evaluate the ability of the WWTF to hydraulically convey the projected flows. The analysis starts with establishing the 100-year flood level of the receiving water and then proceeds upstream through each unit process in the plant. When the hydraulic capacity of the conveyance system or unit process is exceeded, flow can be restricted causing the water level in upstream facilities to increase, impacting their performance and potentially causing overflows.

The hydraulic capacity of the existing WWTF is sufficient for the projected peak flows through buildout.

Buildout flows will require a third influent screen to be installed. It is anticipated that the third influent screen will be installed within an existing channel that was designed to be empty until peak flows necessitate its use and a screenings washer-compactor.

The mainstream treatment processes (liquid and solid treatment) were modelled using GPS-X software. To ensure that the GPS-X model was representative of WWTF performance, the model was calibrated using plant data for average dry weather conditions between 2013 and 2020. Based on this evaluation, the existing WWTF is capable of providing adequate treatment to comply with all of the existing effluent permit limits through the planning period, as well as at the projected buildout flows and loads.

The WWTF needs a significant concentration of readily biodegradable carbon compounds in the aeration basin influent to ensure denitrification. The existing gravity thickener provides the opportunity to generate additional readily biodegradable carbon (in the form of Volatile Fatty Acids, or VFAs) from the WWTF influent through an on-site fermentation process. Generating these VFAs in the gravity thickener could decrease the amount (and cost) of external carbon added. It is recommended that the District trial the production of in the existing gravity thickener because of the potential savings in chemical costs, which cannot be accurately estimated from modeled results.

Based on the evaluation of condition of the mainstream treatment and facility support systems, several equipment items are expected to reach the end of their service lives within the planning period. Given that most major equipment at the WWTF have typical service lives of between 15 and 30 years, while the WWTF has been in operation for nearly 10 years, the WWTF will enter a period of potential high frequency of equipment overhaul and replacement.

The membranes in the Membrane Bioreactor (MBR) are due for replacement. The replacement project will consist of replacing the membrane modules in the existing cassettes and refurbishment of the existing membrane cassettes. This would require the manufacturer's service technicians to replace any worn plastic parts and update the hardware. In addition, the impellers on the permeate pumps would be replaced.

The design peak day flow capacity of the ultraviolet (UV) disinfection system is projected to be exceeded prior to 2031. This is expected to coincide with the end of the useful life of the existing UV system. A replacement UV system would consist of two duty modules and one standby module, in addition to a new power distribution center (PDC). For ease of construction, it is assumed that the second UV channel is equipped with the new system to prevent any lapse in disinfection (or need for a temporary disinfection system) during construction.

WWTF staff are pilot testing alternatives to sodium hydroxide for alkalinity addition. As discussed in Chapter 7, the alternatives would consist of magnesium hydroxide-based or calcium carbonate-based slurries in addition to continuing with sodium hydroxide. Implementation of a final effluent alkalinity addition system is recommended after at least one full year of use of the new mixed liquor alkalinity addition system and new supplemental carbon addition system (discussed in detail in Chapter 7).

Planning level estimates for equipment replacement costs are provided in Table E-5 to help the District prepare for anticipated increases in facility O&M costs. These equipment replacement costs would add to existing O&M costs.

COMPLIANCE WITH THE PUGET SOUND NUTRIENT GENERAL PERMIT

It is anticipated that new permit requirements significantly impacting the WWTF may come from the Puget Sound Nutrient General Permit (PSNGP). The PSNGP is summarized in Chapter 2, and Chapters 7 and 8 provide discussions of the PSNGP in the context of WWTF capital and operating impacts from the new standards. The PSNGP will require the WWTF to reduce effluent loads of total inorganic nitrogen (TIN) such that the annual effluent load is no more than 127,000 lbs/year. If this level is exceeded, the District must submit for review a proposed approach to reduce the annual effluent load below 127,000 lbs/year. If this level is exceeded for two consecutive years or three times during the permit term, the District must implement the proposed approach to reduce nitrogen loads. Note: The PSNGP has been appealed and subject to a legal challenge, so it is possible that the limits and conditions will change.

Chapter 7 includes discussion of compliance with the PSNGP. Improving denitrification at this facility to the level required to meet the proposed limits (127,000 lbs/year) in the PSNGP would require the addition of an external carbon source to increase the ratio between readily biodegradable carbon and nitrogen entering the anoxic zones in the aeration basins.

The PSNGP suggests that the PSNGP may ask treatment plants to target an effluent TIN concentration of 3 mg-N/L or less after the first permit cycle. As a result, the PSNGP will require the District to submit a nutrient reduction evaluation by the end of 2025. This evaluation will need to include an AKART analysis, economic evaluation, and environmental justice review of alternatives to reduce effluent TIN to a level that is as close to 3 mg/L as feasible. Based on the results of the WWTF modeling effort that was performed as part of the Plan, the existing WWTF is not capable of achieving and effluent TIN concentration of 3 mg/L without significant improvements and additional infrastructure. Therefore, if the 3 mg/L effluent TIN limits are put into effect within the planning period, significant improvements to the WWTF will be required.

TABLE E-5

Anticipated Major Equipment Replacement Costs

Years	Anticipated Major Replacement Items	Estimated Cost
2021-2026	• Flash mixer gearbox • Aeration basin fine bubble diffuser membranes • Anaerobic digester clean and inspection	$450,000 ($90,000/year)
2027-2031	• Sodium hypochlorite (NPW) metering pumps • Primary sludge pumps • Gravity thickener mechanisms • Thickening centrifuge • Digester draft tube mixers • Boiler tubes • Dewatering centrifuge	$1,330,000 ($266,000/year)

TABLE E-5 – (continued)

Anticipated Major Equipment Replacement Costs

Years	Anticipated Major Replacement Items	Estimated Cost
2032-2036	• Influent band screens and washer/compactors • Headworks compressor • Primary clarifier mechanisms • Primary effluent band screens and washer/compactors • Deoxygenation zone jet mixer • Flash mixer • Anoxic zone jet mixer • Aeration basin fine bubble diffuser membranes • Centrate pumps • Odor system drain MH pump • Grit declassifiers • Anaerobic digester clean and inspection	$2,832,000 ($566,300/year)
2037-2041	• Process blowers • Plant compressors and dryers • Non-potable water pumps • Biofilter fans • Industrial water pumps • Cooling water pumps • Boilers • Digester heat exchangers • Waste gas burner	$3,102,000 ($620,400/year)

Table E-6 provides a list of current recommended minor improvements at the WWTF.

TABLE E-6

Current WWTF Minor Improvements

Area	Project Description
Aeration Basins	Raise anoxic zone walls with small (4" x 1") stainless steel angles
	Estimated Cost: $6,000
Equipment Building	Replace corroded membrane backpulse water pipe sections
	Estimated Cost: $50,000
Blower Room	Install stand-alone cooling units for each process blower enclosure
	Estimated Cost: $25,000

Table E-7 summarizes the recommended major improvements to the WWTF within the 6-, 10- and 20-year planning periods.

TABLE E-7

WWTF Major Improvements

Improvement Project	Estimated Cost
6-Year Projects	
Mixed Liquor Alkalinity Addition System(1)	$130,300
Final Alkalinity Addition System	$79,600
Supplemental Carbon Addition System	$231,100
Membrane Replacement and System Improvement Project	$3,411,000
3-Month Fermenter-Thickener Trial Study	$110,000
10-Year Project	
UV Disinfection System Improvements	$986,000
20-Year Projects	
None	
Buildout	
Influent Screenings System Improvements	$996,000

(1) Includes structural modification costs needed to accommodate supplemental carbon addition system.

BIOSOLIDS MANAGEMENT

Chapter 8 provides an evaluation of the District's biosolids treatment and management systems. The 20-year net present worth and feasibility of Class A and Class B alternatives were evaluated. The primary alternatives 20-year net present worth determined were:

- Class A Biosolids Production – Thermal Drying $15,346,000
- Class B Biosolids Production – Contracted Hauling $3,632,000

Although production of Class A biosolids would provide a benefit to the community because the biosolids could be utilized by the general public, the disadvantages, including substantially higher costs, issues with operability and reliability, and site footprint, outweigh those benefits. It is recommended that the District continue to haul Class B biosolids to permitted land application sites.

Table E-8 shows the recommended improvements to the biosolids management system.

TABLE E-8

Biosolids Improvements

Improvement Project	Estimated Cost
6-Year Projects	
Fermenter-Thickener	TBD Based on Trial Study
10-Year Project	
None	
20-Year Projects	
WAS Thickening Rotary Drum Thickening System	$669,000

CAPITAL IMPROVEMENT PLAN AND FINANCIAL ANALYSIS

Chapter 9 summarizes the capital improvement plan and financial analysis. The proposed system improvements in the CIP are shown below in Table E-9. Each project cost estimate includes sales tax, construction contingency, and design engineering, construction management and permitting. All project costs are based on 2021 dollars. Cost inflation of 5 percent per year from 2022 to 2024 and 2 percent per year thereafter was assumed.

To pay for the capital improvements, the District's Board of Commissioners passed a Resolution to increase the General Facility Charge from $10,400 to $13,500 per ERU, effective May 1, 2022. To fund ongoing maintenance and operations of the sewer system, the Board passed a Resolution to increase the monthly sewer rate from $86 to $99 per ERU, effective June 1, 2022.

TABLE E-9

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
Years 1-6 (2022-2027)						
Gravity Sewer System Repair and Replacement			Annual	$1,500,000	$1,500,000	Replace 2,300 LF of pipe and 13 MHs annually. 20 percent of MHs and 15 percent pipes over 40 years old over 10-year CIP
Anoxic Zone Wall Improvements	WWTF	Capital	2022	$6,000	$6,000	Raise Anoxic Zone Walls to prevent short-circuiting
New LS 23 and FM	H5	Donated	2021 (Complete)	$1,580,000	$ -	Construct 401 gpm LS and 2,150 LF 6" FM
TIN Optimization Report	WWTF	Capital	2022	$30,000	$30,000	WWTF Process Performance Assessment and Initial Selection of Optimization Strategy per requirements of Nutrient Permit – currently due in March 2023
Backpulse Pipe Replacement	WWTF	Capital	2022 (Complete)	$25,000	$25,000	Replace corroded membrane backpulse water pipe sections
20th Street NE and Bus. Loop Road to LS 2C	E2-B	Capital	2022	$1,150,000	$1,150,000	Replace 1,560 LF 10" with 15" gravity
Sewer System Comprehensive Plan/Facility Plan Update	Comp	Capital	2022	$345,000	$345,000	Evaluate existing WWTF in context of actual operation data to support increased capacity within same footprint

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
SR 9 Gravity Crossing	G7-B	Capital	2022 (Under Construction)	$500,000	$500,000	Extend 8" gravity sewer in 16" casing across SR 9 to allow gravity sewer service from Basin C2-2 to Basin G1-8 and to proposed LS G1
LS 2C Upgrade	E2-A	Capital	2022	$2,700,000	$2,700,000	Upgrade LS 2C from 700 gpm to 1,250 gpm
LS 2C Force Main	E2-C	Capital	2022	$2,730,000	$2,730,000	Construct 3,800 LF 10" FM; bypass LS 1C via existing 8" PVC FM
LS 5C Decommission & LSs 4C & 6C Rehabilitation	E4	Capital	2022	$1,710,000	$1,710,000	Construct up to 641 LF 8" to LS 4C and decommission LS 5C; Rehab of LS 6C
LS 8C Upgrade & Rehabilitation	D6	Donated	2022	$1,040,000	$ -	Increase Capacity from 600 to 1,050 gpm; Includes Replacing 360 LF of 8" FM with 10" FM
Lift Station 11 Rehabilitation	G4	Capital	2022	$590,000	$590,000	Lift Station Rehabilitation per general condition assessment - LS 11
New LS G7 & FM	G7-A	Donated	2022 (Under Construction)	$1,410,000	$ -	Construct 140 gpm LS and 1,300 LF 4" FM
Process Blower Enclosure Cooling	WWTF	Capital	2022	$87,200	$87,200	Repair and improve Blower Room HVAC

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
Mixed Liquor Alkalinity Addition System Improvements	WWTF	Capital	2022	$130,300	$130,300	Install magnesium hydroxide/ calcium carbonate storage and dosage system
Carbon Addition System	WWTF	Capital	2022	$231,100	$231,100	Pilot and install supplemental COD addition storage and dosage system
District Office Upgrades - Generator	VBC-A	Capital	2022	$250,000	$250,000	Install Emergency Generator and Electrical system upgrade to District office
WWTF Membrane Replacement	WWTF	Capital	2023	$3,858,000	$3,858,000	Replace WWTF membranes per Manufacturer's Recommendations - Paid $482,250 annually 2023 - 2030
LS 1C Rehabilitation	E1-A	Capital	2023	$740,000	$740,000	Rehabilitate existing structures and pumping, electrical, control and instrumentation systems, including replacement generator. Increase capacity to 821 gpm
Lift Station 3C Rehabilitation	E7	Capital	2023	$550,000	$550,000	Lift Station Rehabilitation per general condition assessment - LS 3C

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
Centennial Townhomes DEA	E5-A	Donated	2023	$340,000	$ -	Construct 400 LF 10" gravity
LS 1 Rehabilitation	B2	Capital	2024	$779,000	$779,000	Rehabilitate LS 1 to increase capacity to 100 gpm and add Generator
Lift Station 6 Rehabilitation	D5	Capital	2024	$793,000	$793,000	Lift Station Rehabilitation per general condition assessment - LS 6
New LS H8 and FM	H8	75 percent Donated/ 25 percent Capital	2024	$1,790,000	$447,500	Construct 140 gpm LS and 1,200 LF 4" FM; Hisey Project
New Gravity Line - Industrial Area	D7-A	Capital	2024	$520,000	$520,000	Construct 840 LF 8" Grav in Easement Area in NE Corner of UGA
District Office Upgrades - 2nd Floor	VBC-B	Capital	2024	$250,000	$250,000	Allowance for upgrade of District office including accessibility improvements and 2nd Floor Remodel - full scope and budget to be determined
Nutrient Reduction Evaluation	WWTF	Capital	2025	$200,000	$200,000	Evaluate alternatives to meet 3 mg/L TIN per requirements of Nutrient Permit
131st Avenue NE	E5-B	Capital	2025	$1,020,000	$1,020,000	Construct 1,400 LF 8" gravity

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
Lift Station 4 Rehabilitation	D3	Capital	2025	$902,000	$902,000	Lift Station Rehabilitation per general condition assessment - LS 4
Lift Station 3 Rehabilitation	D4	Capital	2025	$624,000	$624,000	Lift Station Rehabilitation per general condition assessment - LS 3
Lift Station 2 Rehabilitation	B4	Capital	2026	$780,000	$780,000	Lift Station Rehabilitation per general condition assessment - LS 2
New Gravity Line - Industrial Area	D7-B	Capital	2026	$970,000	$970,000	Construct 3,160 LF 8" gravity in Easement Area in NE Corner of UGA
LS 9 Decommissioning	H7	Capital	2026	$180,000	$180,000	Construct 170 LF 8" gravity
Vactor and CCTV Truck Replacement		Capital	2027	$650,000	$650,000	Replace existing vactor and CCTV equipment at end of useful life
New LS E8 and FM	E8-A	Capital	2027	$2,360,000	$2,360,000	Construct 140 gpm LS and 3,800 LF 4" FM
Basin E8 Collection System (North Machias Road)	E8-B	Capital	2027	$2,200,000	$2,200,000	Construct 4,000 LF 8" gravity

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
New LS E9 and FM	E9-A	Capital	2027	$1,710,000	$1,710,000	Construct 140 gpm LS and 1,700 LF 4" FM
26th, 27th and 28th Places NE	E9-B	Capital	2027	$1,590,000	$1,590,000	Construct 2,650 LF 8" gravity
New LS C4 and FM	C4	75 percent Donated/ 25 percent Capital	2027	$1,340,000	$335,000	Construct 140 gpm LS and 900 LF 4" FM
Lift Station 7 Rehabilitation and Upgrade	H3-A	50 percent Donated/ 50 percent Capital	2027	$ 752,000	$ 376,000	Lift Station Rehabilitation per general condition assessment - LS 7 and Increase capacity to 310 gpm
Years 7-10 (2028-2031)						
Comprehensive Plan Update		Capital	2028	$200,000	$200,000	Full 6-year update to Comprehensive Sewer Plan
Mitchell Road Main Replacement	E1-B	Capital	2028	$560,000	$560,000	Replace 444 LF 8" with 12" gravity
97th Drive SE and 99th Avenue SE	G7-C	Capital	2028	$1,490,000	$1,490,000	Construct 1,150 LS 8" gravity
Lift Station 8 Rehabilitation	H2	Capital	2028	$554,000	$554,000	Lift Station Rehabilitation per general condition assessment - LS 8 and Increase capacity to 866 gpm

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
LS 15 Upgrade and Rehabilitation	D1-A	Capital	2028	$1,033,000	$1,033,000	Increase capacity to 5,430 gpm and rehabilitate per condition assessment. 10- to 20-Year CIP
LS 2C FM Extension	E2-E	Donated	2028	$1,680,000	$ -	Construct 4,700 LF 10" FM from LS 1C to MH 701. Replaces 50 Year Old FM.
Hartford Road	D7-C	Capital	2029	$280,000	$280,000	Construct 450 LF 8" gravity
Dosing Station Reconstruction	A4	Capital	2029	$1,080,000	$1,080,000	Modernize Dosing Station, Upgrade communication system and improve pipeline access
WAS Thickener	WWTF	Capital	2030	$668,800	$668,800	Install WAS rotary drum thickener system in Digester Building
UV System Addition	WWTF	Capital	2030	$986,000	$986,000	Install additional UV banks to existing UV channel.
Lift Station 12 Rehabilitation	B3	Capital	2030	$760,000	$760,000	Lift Station Rehabilitation per general condition assessment - LS 12
New LS E10 and FM	E10	75 percent Donated/ 25 percent Capital	2030	$1,600,000	$400,000	Construct 140 gpm LS and 1,300 LF 4" FM

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
New LS G6 and FM	G6	75 percent Donated/ 25 percent Capital	2030	$1,390,000	$347,500	Construct 140 gpm LS and 1,050 LF 4" FM
Lift Station 5 Rehabilitation and Upgrade	D2	Capital	2031	$536,000	$536,000	Lift Station Rehabilitation per general condition assessment and upgrade to 880 gpm
Lift Station 14 Rehabilitation	B5	Capital	2031	$386,000	$386,000	Lift Station Rehabilitation per general condition assessment - LS 14
Lift Station 10 Rehabilitation	6	Capital	2031	$585,000	$585,000	Rehabilitation of LS 10, Year 2031
Years 11-20 (2032-2041)						
Lift Station 20 Rehabilitation	A1	Capital	2032	$397,000	$397,000	Lift Station Rehabilitation per general condition assessment - LS 20
New LS C3 and FM	C3	75 percent Donated/ 25 percent Capital	2032	$1,560,000	$390,000	Construct 182 gpm LS and 1,400 LF 4" FM
New LS C5 and FM	C5	75 percent Donated/ 25 percent Capital	2032	$1,730,000	$432,500	Construct 140 gpm LS and 1,250 LF 4" FM
Lift Station 16 Rehabilitation	A2	Capital	2033	$423,000	$423,000	Lift Station Rehabilitation per general condition assessment - LS 16

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
Lift Station 9C Rehabilitation	E6	Capital	2033	$401,000	$401,000	Lift Station Rehabilitation per general condition assessment - 9C
Purple Pennet and Nyden Farms Roads	H3-B	Capital	2034	$760,000	$760,000	Construct 1,050 LF 8" gravity
Lift Station 19 Rehabilitation	G2	Capital	2035	$465,000	$465,000	Lift Station Rehabilitation per general condition assessment - LS 19
New LS G3 and FM	G3	75% Donated / 25% Capital	2035	$1,420,000	$355,000	Construct 140 gpm LS, 800 LF 4" FM
Lakeview Drive Sewers	D1-E	Donated	2035	$2,710,000	$ -	Construct 5,300 LF 8" gravity (ULID?)
Cedar Road Sewers - West Side	D1-B	Donated	2035	$1,130,000	$ -	Construct 1,550 LF 8" gravity (ULID?)
Cedar Road Sewers - East Side	D1-C	Donated	2035	$930,000	$ -	Construct 1,250 LF 8" gravity (ULID?)
Soper Hill Sewers	D1-D	Donated	2035	$1,980,000	$ -	Construct 2,800 LF 8" gravity
Decommission LS 18	C2-A	Capital	2035	$130,000	$130,000	Decommission LS 18 after Project C2-B
White Oaks Sewer Extension	C2-B	Donated	2035	$6,450,000	$ -	Construct 3,600 LF 10" gravity and 6,800 LF 8" gravity

TABLE E-9 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Construction Cost	Estimated District Contribution	Description
Lift Station 21 Rehabilitation	H4	Capital	2035	$317,000	$317,000	Lift Station Rehabilitation per general condition assessment - LS 21
Lift Station 17 Rehabilitation	C1	Capital	2037	$456,000	$456,000	Lift Station Rehabilitation per general condition assessment - LS 17
Vernon Road West @ VRD	B1-A	Capital	2037	$1,280,000	$1,280,000	Replace 473 LF 24" with 30" gravity and 550 LF 24" with 36" gravity
Vernon Road West Trunk @ LS 15 Discharge	B1-C	Capital	2039	$1,040,000	$1,040,000	Replace 902 LF 21" gravity with 24" gravity
Lift Station 22 Rehabilitation	H1	Capital	2040	$453,000	$453,000	Rehabilitation of LS 22
91st Avenue SE	B1-B	Capital	2041	$1,370,000	$1,370,000	Replace 1,700 LF 8" with 12" gravity in 91st Avenue SE.

CHAPTER 1

INTRODUCTION

BACKGROUND

Lake Stevens Sewer District is located in west-central Snohomish County, between Ebey Slough and the Pilchuck River. The District was formed in 1957 to address water quality problems in Lake Stevens that were primarily caused by defective on-site sewage disposal systems. The District's first wastewater treatment plant was a 1.4-acre oxidation lagoon put into service in 1965.

The District formed Utility Local Improvement Districts (ULIDs) to extend the collection system in the 1960s and 1970s. At that time, the collection system included only sanitary sewers.

In 1971, the wastewater treatment plant was expanded from the initial oxidation lagoon to include an additional 8.5-acre lagoon. In 1986, that facility was converted to an activated sludge secondary treatment plant. This plant was replaced in 2012 with a membrane bioreactor treatment plant in an upland location, and the lagoon activated sludge secondary treatment plant located in the flood plan was decommissioned.

In 2013, the District began operation a new membrane bioreactor wastewater treatment facility located north of the intersection of Sunnyside Boulevard and SR 204. The WWTF includes a headworks facility with flow measurement and screening, primary clarifiers with grit removal capability, influent screening, aeration basins with anoxic and aerobic zones, membrane bioreactor basins and ultraviolet (UV) disinfection. The flow is discharged to Ebey Slough.

Until 2005, the City of Lake Stevens owned and managed the sewer collection system within the City at that time. An Interlocal Agreement (ILA) between the City and District provided a framework for the unification of the sewer system within the Lake Stevens Urban Growth Area (LSUGA). Per the terms of the ILA, the City transferred their sewer system to the District to own and manage until 2032 (20 years after completion of the new WWTF). The year of transfer could be accelerated or delayed by mutual agreement between the District and City governing bodies.

GENERAL

This 2021 *General Sewer/Wastewater Facility Plan* (*2021 Sewer Plan*) for the Lake Stevens Sewer District addresses the District's planning needs for wastewater collection, transmission, treatment, and disposal for the 20-year planning period. This Plan was prepared in accordance with the provisions of the Revised Code of Washington (RCW), Section 90.48, *Water Pollution Control*, Washington Administrative Code (WAC)

Section 173-240-050, *General Sewer Plan*, WAC 173-240-060, *Engineering Report* and federal requirements for wastewater facility plans. Development of the Sewer Plan has been coordinated with the Comprehensive Plans of both the City of Lake Stevens and Snohomish County.

The *2021 Sewer Plan* provides proposed conceptual designs, cost estimates, schedules, and financing plan for recommended major facility improvements. A State Environmental Policy Act (SEPA) checklist is provided in Appendix A. The projects described in the Sewer Plan are consistent with Washington State regulations relating to the prevention and control of discharge of pollutants into waters of the state, anti-degradation of existing and future beneficial uses of ground waters, and anti-degradation of surface waters.

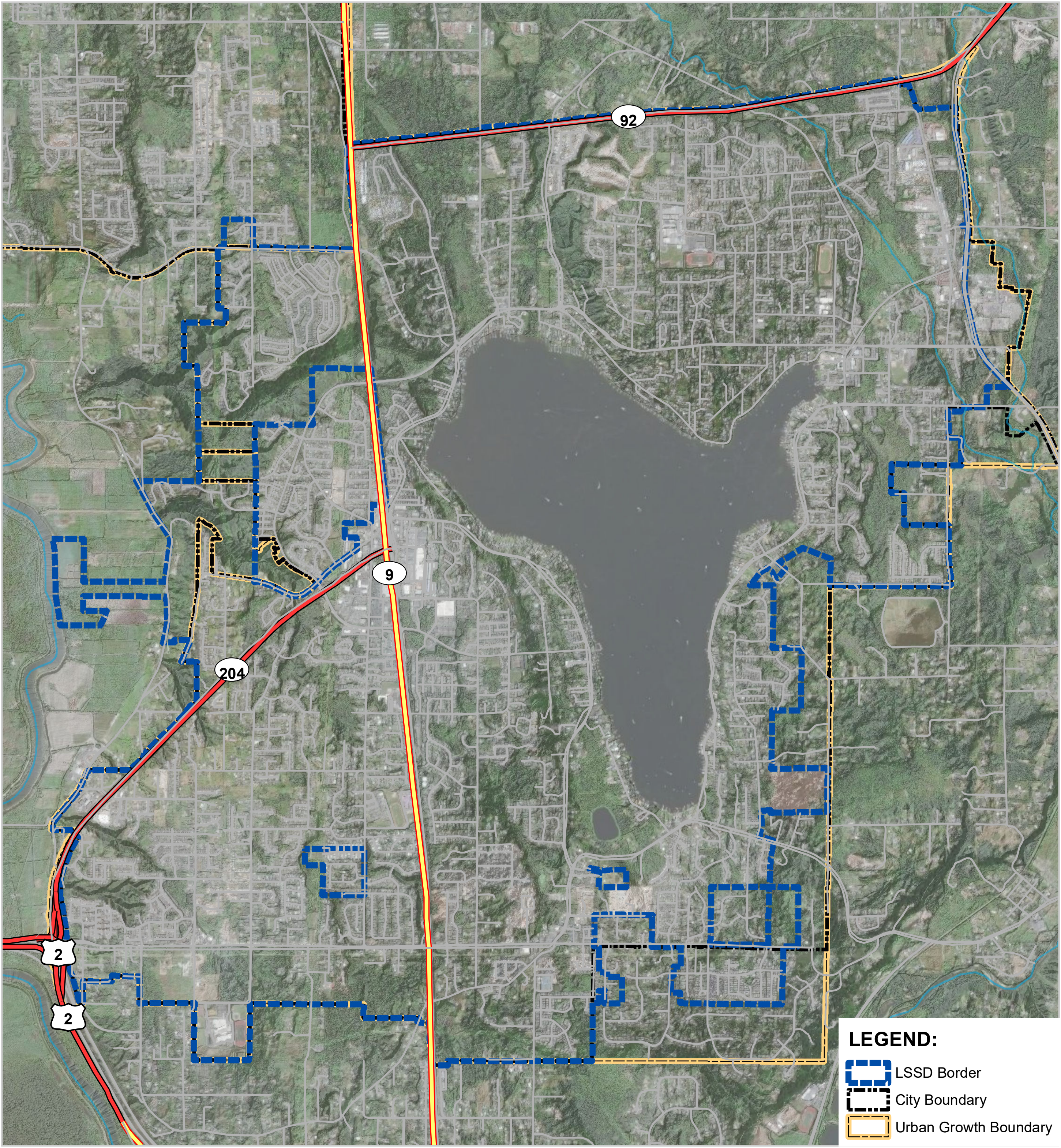
The Lake Stevens Sewer District is located within Snohomish County in northwest Washington State as shown in Figure 1-1.

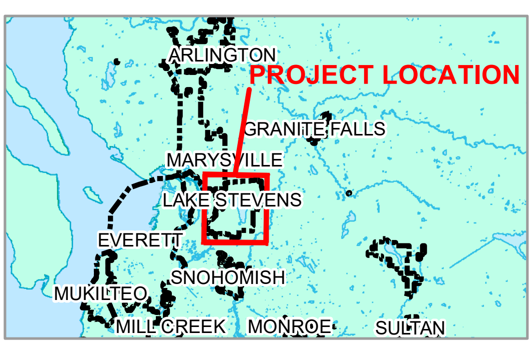
SCOPE OF WORK

Since the *2021 Sewer Plan* is intended to be both a General Sewer Plan and a Wastewater Facilities Plan, the Sewer Plan evaluates both the wastewater collection system and the wastewater treatment system in detail. This evaluation includes collection and treatment system modeling, analysis and a capital improvement plan with cost analysis and schedule.

The scope of work for the *2021 Sewer Plan* includes the following items:

- Background Information
    - Summarize Background Information
    - Evaluate and Document Regulations, Requirements and Permits
    - Research and Document Land Use and Planning Area
- Collection System
    - Evaluate Existing Collection System
    - Monitor Flows
    - Assess Sewer Pipe Condition
    - Evaluate Infiltration and Inflow
    - Project Flows
    - Model Sewer System Capacity
    - Develop Plan for Future Collection System
    - Recommend Collection System Improvements





LAKE STEVEN SEWER DISTRICT

SEWER COMP-FACILITY PLAN
FIGURE 1-1
LOCATION MAP

Gray & Osborne, Inc.

- Wastewater Treatment Plant (WWTF)
  - Assess Condition, Capacity, Reliability and Performance of Existing WWTF
  - Project Future Flow and Loadings to the WWTF
  - Model WWTF
  - Evaluate Filterability at WWTF
  - Analyze WWTF Alternatives, Including Staff Workshop
  - Develop Plan for WWTF
- Biosolids Treatment and Management
  - Evaluate Existing Biosolids Management and Treatment System
  - Project Sludge Quantities
  - Evaluate Future Biosolids Treatment and Management Options
- Water Reuse
  - Evaluate Treatment Alternatives for Water Reuse
  - Assess Reclaimed Water Demand
  - Evaluate Feasibility of Water Reuse
- Prepare Plan, Including Meeting with District Staff
- Rate Study and Financing
  - Prepare Rate Study
  - Develop Financial Plan
- Present Plan to District Board
- Prepare SEPA Checklist

RELATED PLANNING DOCUMENTS

The following documents were consulted in the preparation of this General Sewer/Wastewater Facility Plan.

LAKE STEVENS SEWER DISTRICT

Lake Stevens Sewer District Sanitary Sewer Comprehensive Plan, 2016

The 2016 Plan is an update of the District's 2007 *Sanitary Sewer Comprehensive Plan*. The 2016 Plan updated projected populations and flows within the District's sanitary sewer collection system. That plan forecast that the WWTF will need additional maximum month average daily flow capacity by the year 2025 and that flow and loading capacity was adequate through year 2029.

A focus of this plan was to incorporate upgrades to the District's aging infrastructure. A Lift Station Condition Assessment was completed to provide a basis for prioritizing improvements.

The 2016 Plan included the following recommendations:

- Adopt an increased general facilities charge (GFC) that incorporates regional latecomer basins if possible.
- Implement a District pretreatment and FOG program along with associated permitting policy and procedures.
- Continue coordination with the City of Lake Stevens with respect to integration of land use and utility planning, and for coordinated integration of agency capital improvement plans. Amend the Plan if required by updates to land use designations.
- Develop an ongoing asset evaluation program to collect data on the condition of the existing collection system, to support future planning for collection system repairs, upgrades and replacements, in the context of monitoring and managing inflow and infiltration and proactive asset management of the collection system.
- Implement the projects identified for District funding per the Capital Improvement Plan, with focus on those necessary to remove existing moratoria determinations. These include construction of the South Lake Regional Lift Station and Lift Station 17 Upgrades.
- Evaluate staff needs with respect to increase in assets, customers and service area extent and add staff as determined appropriate.
- Complete a WWTF capacity rating analysis by year 2020 (anticipated to be part-way through the next NPDES permit period) to determine if existing facility will adequately handle and treat flows greater than presently permitted.

- Complete an update of the District Developer Standards, including developer extension agreement policies, standard forms, construction specifications and standard details.

Lake Stevens Sewer District Wastewater Facilities Plan, September 2006

The 2006 *Wastewater Facilities Plan* (*2006 Facilities Plan*) provided a basis of design for the District's WWTF that was put into service in 2012. It includes a conceptual plan for future upgrades to the WWTF.

The 2006 Facilities Plan recommended replacing the District's WWTF with a new Membrane Bioreactor Plant.

CITY OF LAKE STEVENS

2015 – 2035 City of Lake Stevens Comprehensive Plan, 2015, Updated 2019

The City of Lake Stevens Comprehensive Plan (City Comp Plan) was originally adopted in 1994 and received major updates in 2006 and 2015. This document was developed to comply with the State's Growth Management Act (GMA), and is consistent with the planning policies of Snohomish County and neighboring jurisdictions. Land use, transportation, housing, parks, recreation and open space, cultural and historic resources, environmental resources, economic development, capital facilities and utilities, and an implementation element are all addressed for the LSUGA in this document.

The City's 2015-2035 Comprehensive Plan includes numerous goals and policies. In the context of land use, and the need for public facilities to serve the projected land uses. The City plan includes goals and policies to support growth and development consistent with the County Comprehensive Plan and to coordinate land use decisions with capital improvement needs, in a fiscally responsible manner.

The City adopted its 2015-2035 Comprehensive Plan in September 2015 and last amended it in November 2019. The most recent update to the Plan included implementation of Snohomish County's Buildable Lands methodology to estimate net density of developed land. This method provides a more accurate determination of an attainable yield versus a mathematical yield that may or may not be achieved.

The City Comprehensive Plan shows an annual residential growth rate of 1.43 percent between 2014 and 2035 and a population within the LSUGA of 46,380 in 2035. This *2021 Sewer Plan* will use this residential growth rate and 2035 population. Between 2035 and 2041, population will be extrapolated at the annual growth rate of 1.43 percent for a 20-year LSUGA population of 50,520.

The City Comprehensive Plan shows an annual jobs growth of 3.5 percent between 2014 and 2035 and the number of jobs within the LSUGA to be 7,821 in 2035. This 3.5 percent growth rate will be applied to commercial connections to the District for the 20-year planning period.

The City Comprehensive Plan states that the average household size in the LSUGA is 2.87. This household size will be used for all conditions in the *2021 Sewer Plan*.

Snohomish County Comprehensive Plan, 2015-2019

The *Snohomish County Comprehensive Plan* consists of the following five components:

- General Policy Plan – A plan that includes goals and objectives and policies that serve as a guide to the county's growth and development from the present through 2035. This Plan was last updated in October 2017.

- Future Land Use Map – Graphically depicts the 20-year vision of the preferred land use pattern. It identifies the urban growth areas around cities and towns, as well as urban, rural and resource lands. The map is implemented through numerous zoning classifications and development regulations. This map was last updated in June 2019.

- Transportation Element – A plan for transportation facilities and services to support the needs of the projected 2035 population. This element was last updated in November 2018.

- Capital Facilities Plan – An inventory of the county's public facilities and utilities, establishes level of service standards necessary to support development, and prioritizes facilities needed to support the needs of the projects 2035 population. This Plan was last updated in July 2015.

- Parks and Recreation Element – A plan for park and recreation facilities and services to support the needs of the projected 2035 population. This Plan was last updated in July 2015.

SNOHOMISH COUNTY

Snohomish County Growth Monitoring Report, 2020

Snohomish County regularly publishes a report that assesses the growth targets for each UGA in the County.

This report indicates that the average annual growth rate for the LSUGA between 2000 and 2010 was 2.7 percent and that that rate between 2010 and 2020 was 1.9 percent. It states that the 2020 and 2035 populations for the LSUGA are 39,629 and 46,380, respectively. It states that the 2035 population capacity, based on the buildable lands methodology as 48,397 and an annual average housing unit increase of 185.

Snohomish County Buildable Lands Report, 2012

This plan includes detailed analysis of the then-current land status, zoning and future land use, critical areas and easements, additional housing unit capacity and additional employment capacity for each UGA in the County. The analysis removes unbuildable lands, such as easements and critical areas from areas to which gross densities allowed within each land use are applied. This report is currently being updated with publication anticipated in 2021.

SNOHOMISH COUNTY PUD NO. 1

Snohomish PUD No. 1 Water System Plan, 2011

The Snohomish PUD No. 1 owns and operates the domestic water system serving customers within the District, as well as the nearby communities of Arlington and Granite Falls.

The *2011 Water System Plan* presents an inventory of existing facilities, evaluates the current and future water demand, describes compliance with the water reservation program and water rights and source reliability, assesses drinking water quality, and recommends capital improvements to meet demand and address system deficiencies. In addition, the Plan provides recommendations for the operation and maintenance of the water system.

Historic water consumption data from the *2011 Water System Plan* was incorporated into the flow and loading analysis.

CHAPTER 2

REGULATORY REQUIREMENTS

Federal and state regulatory requirements were used in developing the design criteria for improvements to the wastewater collection, treatment, and disposal facilities for the District. The purpose of this chapter is to identify and summarize the regulations that affect the planning, design, and approval of improvements discussed in this plan.

This chapter does not describe each regulation in detail; rather, it addresses important facets of the regulations that affect the planning and design process. Subsequent sections of this report address technical requirements of the regulations at a level of detail appropriate for the evaluation provided by that section. Chapters 6, 7, and 8 contain more detailed information regarding wastewater collection and treatment system and biosolids management regulations.

FEDERAL AND STATE STATUTES, REGULATIONS, AND PERMITS

This section discusses some of the various federal and state laws that may affect wastewater system construction and operations, as well as other relevant permits, programs, and regulations.

FEDERAL CLEAN WATER ACT

The Federal Water Pollution Control Act is the principal law regulating the water quality of the nation's waterways. Originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was given the common title of the "Clean Water Act" (CWA). The CWA has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the Water Pollution Control State Revolving Fund (SRF) that provides low-cost financing for a range of water quality infrastructure projects.

Effluent Discharge Requirements

The National Pollutant Discharge Elimination System (NPDES) program was established by Section 402 of the CWA and its subsequent amendments. The Department of Ecology administers NPDES permits for the U.S. Environmental Protection Agency (EPA). Most NPDES permits have a 5-year term and place limits on the quantity and quality of pollutants that may be discharged to water bodies.

The State of Washington administers the federal effluent limitations through the NPDES program. All wastewater discharges into the waters of the state must be permitted through the Department of Ecology with an NPDES permit. The current Lake Stevens Sewer

District WWTF NPDES Permit WA0020893 and fact sheet are attached as Appendix B. The permit was issued in 2017 and will expire October 31, 2022. The District's current NPDES permit effluent limitations are summarized in Table 2-1.

TABLE 2-1

Summary of District WWTF NPDES Permit Effluent Limits

Low Flow (July through October) Limits		
Parameter	**Average Monthly**	**Average Weekly**
Carbonaceous Biochemical Oxygen Demand (5-day) ($CBOD_5$)	25 milligrams/liter (mg/L) 85% removal of influent BOD_5	40 mg/L
Total Suspended Solids (TSS)	30 mg/L 971 lbs/day 85% removal of influent TSS	45 mg/L 1,456 lbs/day
Parameter	**Minimum**	**Maximum**
pH	6.0 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean**	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200 cfu /100 milliliter (mL)	400 cfu /100 mL
Parameter	**Average Monthly**	**Maximum Daily**
NBOD + CBOD	235 lb/day	747 lb/day
Copper	12.1 µg/L	24.2 µg/L
High Flow (November through June) Limits		
Parameter	**Average Monthly**	**Average Weekly**
Carbonaceous Biochemical Oxygen Demand (5-day) ($CBOD_5$)	25 milligrams/liter (mg/L) 1,045 lbs/day 85% removal of influent BOD_5	40 mg/L 1,671 lbs/day
Total Suspended Solids (TSS)	30 mg/L 1,254 lbs/day 85% removal of influent TSS	45 mg/L 1,880 lbs/day
Total Ammonia (as N)	The Permittee must operate the facility to minimize Ammonia in the discharge	
Parameter	**Minimum**	**Maximum**
pH	6.0 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean**	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200 cfu /100 milliliter (mL)	400 cfu /100 mL

Notably, Section 200 of Chapter 172-201A of the Washington Administrative Code (WAC) set fecal coliform level limits to expire on 12/31/2020. The bacterial indicator is instead *Escherichia coli* (*E. coli*). For the purposes of evaluating wastewater treatment performance within the planning period, *E. coli* is discussed as the bacterial indicator for primary contact recreation in later chapters.

The permit identifies the following limits for influent flow and load:

- Maximum month flow – 5.01 mgd
- Monthly Average Dry Weather Flow – 3.88 mgd
- Maximum month BOD_5 loading – 10,730 lbs/day
- Maximum month TSS loading – 10,190 lbs/day

More information about water-quality permitting is provided in the Surface Water Quality Standards discussion later in this chapter.

Industrial Pretreatment/Source Control

Section 307 of the CWA established the National Pretreatment Program; 40 CFR Part 403 lists the federal pretreatment requirements. This program is designed to protect publicly owned treatment works (POTW) from pass-through of pollutants or interference with the treatment process from industrial or other non-residential discharges that are not "domestic-equivalent" (similar in quality to domestic wastewater).

If considered significant, industrial discharges to municipal wastewater collection/treatment systems are typically addressed in State Waste Discharge Permits (SWDPs). There are currently no SWDPs issued to facilities in the District's service area.

The NPDES Permit requires the District is to submit one Industrial User Survey per permit cycle. The survey must list all existing, new and proposed significant industrial users (SIUs) and potential significant industrial users (PSIUs) discharging or proposing to discharge to the District's sewer system. The NPDES Permit states that the District must develop a list of SIUs and PSIUs by means of a telephone book search, a water utility billing records search and a physical reconnaissance of the service area.

Total Maximum Daily Loads

The CWA requires states to establish (Total Maximum Daily Load) TMDL programs for parameters not meeting applicable surface water quality standards as identified on Section 303(d) water quality impaired lists. A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet the water quality standards. A TMDL also identifies the sum of allowable loads of a single pollutant from all point and nonpoint sources, and determines a margin of safety to ensure protection of the waterbody in case there are unknown pollutant sources or unforeseen events that may impair water quality.

The Department of Ecology issued a TMDL Study for the Snohomish River Estuary dated August 1999, from Possession Sound to river mile 20. The TMDL model assessed the capacity of the estuary system to assimilate oxygen consuming pollutants from point and nonpoint sources. The water quality model predicted that the wastewater treatment plants along the river would cause violations of the dissolved oxygen standards under critical conditions. The TMDL study recommended waste load allocations (WLAs) for the following point sources of carbonaceous and nitrogenous biochemical oxygen demand (CBOD and ammonia): the Cities of Snohomish, Marysville and Everett and Lake Stevens Sewer District.

The WLAs for the District WWTF are 283 pounds per day of ammonia and 174 pounds per day of CBOD.

PUGET SOUND NUTRIENT GENERAL PERMIT

In December 2021, Ecology released the Puget Sound Nutrient General Permit (PSNGP), following release of prior drafts in January 2021 and July 2021. The Nutrient Permit went into effect in January 2022. The PSNGP would establish annual effluent loads of Total Inorganic Nitrogen (TIN) for WWTFs that discharge to Puget Sound. TIN is the sum of both dissolved and suspended nitrate-nitrite and ammonia. The PSNGP established loading “Action Level” thresholds in terms of pounds per year of TIN. The Action Level loading threshold established in the PSNGP for the District’s WWTF is 127,000 pounds TIN/year.

WWTFs are classified as Small, Moderate or Dominant in the PSNGP based on the magnitude of their annual effluent TIN loading. The District’s WWTF is classified as a moderate TIN discharger, and, as such, must follow the narrative limits in Section S5 of the PSNGP for Monitoring, Nitrogen Optimization Plan, Action Level Exceedance Corrective Actions, and Nutrient Reduction Evaluation.

Monitoring

The PSNGP will add some monitoring requirements for the District. Table 2-2 summarizes the District’s existing versus new/modified testing requirements mandated by the PSNGP for both influent and effluent. (Only new or modified requirements are shown.)

TABLE 2-2

New or Modified Testing Requirements

Test	Current Frequency Required by District NPDES Permit	Future Minimum Required Frequency After Nutrients General Permit Issuance	Current Frequency Required by District NPDES Permit	Future Minimum Required Frequency After Nutrients General Permit Issuance
	Influent		**Effluent**	
Total Ammonia	None	**1/week**	3/week July-October only	**1/week – November – June and continuing of 3/week July-October**
Nitrate plus Nitrite Nitrogen	None	**1/month**	None	**1/week**
Total Kjeldahl Nitrogen (TKN)	None	**1/month**	None	**1/month**
Total Inorganic Nitrogen (TIN)	None	None	None	**1/week**
Total Organic Carbon (TOC)	None	None	None	**1/quarter**

Other influent and effluent testing is mandated by the PSNGP but incorporation of those requirements does not alter the District's existing monitoring frequency.

Some of these tests are already performed by the District or the third-party laboratories it uses. District staff routinely analyze effluent ammonia and nitrate concentrations in house and record this data on their plant process data sheets, but do not submit this nitrate data on their monthly DMRs. Effluent nitrate/nitrite concentrations are also analyzed once a month at the Everett WWTP laboratory and these data are reported on the District's DMRs.

The District's laboratory accreditation scope is limited to: turbidity, TSS, pH, ammonia, nitrite, orthophosphate, total phosphorus, BOD, CBOD, and fecal coliform. The District will either have to obtain accreditation for the other parameters or utilize third-party laboratories.

Nitrogen Optimization Plan

Per Section S5C of the PSNGP, the District and other Permittees must "develop, implement and maintain a Nitrogen Optimization Plan to evaluate operational strategies for maximizing nitrogen removal from the existing treatment plant to stay below the calculated action level. Each Permittee must document their actions taken, any action level exceedances, and apply an adaptive management approach at the WWTP."

The Nitrogen Optimization Plan includes the following requirements:

1. Treatment Process Performance Assessment
2. Optimization Implementation Reports
3. Influent Nitrogen Reduction Measures/Source Control

<u>Treatment Process Performance Assessment</u>

- Treatment Process Performance Assessment
  - Process modeling (or equivalent)
    - Evaluate current (pre-optimization) process performance to determine the existing empirical TIN removal rate for the WWTP.
    - Develop an initial assessment approach to evaluate possible optimization strategies at the WWTP prior to and after implementation.
  - Identify and evaluate optimization strategies, with a focus on strategies that can be implemented in one year (includes an assessment of reasonableness for cost and timeframe)
  - Report with initial selection required by July 1, 2022.

<u>Annual Nitrogen Optimization Implementation Reports</u>

The District must submit an Optimization Implementation Report annually starting March 31, 2023. The report is required to include:

- Strategy Implementation

  This task includes an assessment of costs, challenges, and impacts to the overall treatment process for the optimization approach implemented.

- Discharge Evaluation

  This task includes quantification of influent and effluent nitrogen loads, and comparison of percent removal from that predicted by process modeling (or equivalent evaluation).

Influent Nitrogen Reduction Measures/Source Control

Per the PSNGP, the District must develop an ongoing program to reduce influent TIN loads from septage handling practices, commercial, dense residential and industrial sources and submit documentation with the Annual Report. Quoting the PSNGP, the program must:

- “Review non-residential sources of nitrogen and identify any possible pretreatment opportunities.”

- “Identify strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings.”

Action Level Exceedance Corrective Actions

After an action level is exceeded, with the next Annual Report, the Permittee must submit for review a proposed approach to reduce the most recent calculated annual effluent nitrogen load to below the Action Level. This must be an abbreviated engineering report or technical memo, unless Ecology has previously approved a design document with the proposed solution. The proposed approach must utilize solutions that can be implemented within 5 years.

If the District exceeds an action level two years in a row, or for a third year during the permit term, the Permittee must begin to reduce nitrogen loads by implementing the proposed approach. The District must submit an update to the District’s Operation and Maintenance Manual no later than 6 months following implementation.

Nutrient Reduction Evaluation

A Nitrogen Reduction Evaluation (NRE) must be submitted to Ecology by December 31, 2025. The NRE must include:

1. An AKART (All Known And Reasonable means of prevention control and Treatment) Analysis

   The AKART Analysis must “present an alternative representing the greatest TIN reduction that is reasonably feasible.”

   The AKART Analysis must include assessments of:

   - Site-specific main stream treatment plant upgrades;

   - Side stream treatment opportunities;

- Alternative effluent management options (e.g., disposal to ground, reclaimed water beneficial uses);
- The viability of satellite treatment;
- Other nutrient reduction opportunities that could achieve a final effluent concentration of **<u>3 mg/L TIN</u>** (or equivalent load reduction) on both an annual average and seasonal average basis.

The AKART Analysis must include:

- Wastewater Characterization, including current flowrates and growth trends within the sewer service area and influent and effluent quality.
- Treatment Technology Analysis

  Identification and screening of potential treatment technologies for meeting two different levels of treatment:

  - AKART for nitrogen removal (annual basis), and
  - 3 mg/L TIN (or equivalent load), as an annual average and seasonal average

Achieving effluent TIN of < 3 mg/L for the District's WWTF is expected to require extensive capital and operating costs, and may be deemed unaffordable in the economic evaluation (discussed below).

2. Economic Evaluation

   The economic evaluation must include capital, operation and maintenance costs and 20 year net present value, cost per pound of nitrogen removed, and rate structure evaluation. An assessment of affordability to fund potential alternatives for enhanced treatment will be a major part of the economic evaluation.

3. Environmental Justice (EJ) Review

   The EJ Review must evaluate impacts to communities of color, Tribes, indigenous communities, and low income populations, and assess mitigation of impacts.

4. Selection of the most reasonable treatment alternative based on the AKART assessment; and the selected alternative(s) for achieving an effluent concentration of 3 mg/L TIN.

5. Viable Implementation Timelines

   Viable implementation timelines that include funding, design, and construction for meeting both the AKART and 3 mg/L TIN preferred alternatives.

Timeline for PSNGP Requirements

Table 2-3 summarizes the timeline for activities required by the PSNGP. As with all the information in this memorandum, this timeline should be reviewed and updated after the issuance of the final permit.

TABLE 2-3

Timeline for PSNGP Requirements

Due Date	Permit Condition	Description
July 1, 2022	S5.C.1	Treatment Process Performance Assessment and Initial Selection of Optimization Strategy
March 31, 2023 (annual)	S5.C.2	Optimization Implementation Report
March 31, 2024 (annual)	S5.C.2	Optimization Implementation Report
March 31, 2025 (annual)	S5.C.2	Optimization Implementation Report
December 31, 2025	S5.C.1	Nutrient Reduction Evaluation

More information about the impact of the PSNGP on the District is included in Chapter 7 and the Nutrient General Permit Compliance Roadmap in Appendix K.

STANDARDS FOR USE OR DISPOSAL OF SLUDGE

The District treats biosolids to Class B standards with an anaerobic digestion system, and dewaters and hauls to third party, permitted utilization site for land application. An evaluation of alternatives for the District's future biosolids treatment and management is provided in Chapter 8.

The generation and use of biosolids, and the disposition of solid waste in general generated from wastewater treatment plants (WWTFs), is subject to both federal and state regulations. The following information is provided to guide the District in its biosolids management efforts.

FEDERAL BASIS OF REGULATIONS

Based on the 1977 and 1987 amendments to the Clean Water Act, the U.S. Environmental Protection Agency (EPA) established requirements for the final use and disposal of municipal sewage sludge, published in 1993 under 40 CFR 503. These regulations identify three methods for legal disposal or final use of sewage sludge: surface disposal, land application, and incineration. For each of the three methods of disposition, EPA has identified pollutant limits, operational standards, management practices, monitoring, and recordkeeping and reporting requirements. Under the 503 regulations, the EPA placed considerable emphasis on the beneficial use of sludge through a properly managed land application program.

WASHINGTON STATE REGULATIONS

Washington State regulates biosolids under Chapter 70.95J of the RCW. Washington does not have fully delegated authority from the EPA, but has the authority to issue separate state permits for biosolids management. Chapter 70.95J recognizes biosolids as a valuable commodity, and specifies implementation of a program that maximizes beneficial use. The state requirements are found in Chapter 173-308 of WAC. The state program meets federal minimum requirements and has added requirements including, but not limited to, the following:

- Biosolids must not contain a significant amount of manufactured inerts (e.g., plastics, debris). Typically, and in the District's case, this requirement is met by screening the wastewater at the municipality's treatment plant.

- For all practical purposes, the state rule does not allow biosolids to be disposed of (e.g., landfill) on a long-term basis.

- Biosolids generators and all entities managing biosolids must obtain a state permit and pay permit fees.

Implementation at State Level

In 1998, the State of Washington promulgated WAC 173-308 "Biosolids Management" governing the use and disposal of sewage sludge. Most of the requirements in the federal regulations pertaining to pollutant limits, pathogen reduction, vector attraction reduction, operational standards, and management practice are in essentially the same form within the state regulation. The state regulation requires that any facility generating municipal sewage sludge or material derived from municipal sewage sludge obtain clearance under the State General Permit for Biosolids Management.

REQUIREMENTS FOR LAND APPLICATION

There are three fundamental elements in the federal and state biosolids management regulations that establish minimum criteria for land application of biosolids:

1. Pollutant Concentrations and Application Rates
2. Pathogen Reduction Measures
3. Vector Attraction Reduction Measures

Pollutant Concentrations

Maximum allowable concentrations for nine heavy metals are listed in Table 2-4. If a biosolids sample exceeds the ceiling concentration of any of the nine heavy metals, it cannot be land applied. A lower pollutant threshold concentration is required for Exceptional Quality (EQ) biosolids, as shown in Table 2-4. If biosolids are shown to be within these concentrations, they may be eligible for relatively unrestricted land application, providing they meet the Class A biosolids requirements and vector attraction reduction requirements given below. As shown in Table 2-4, the District's biosolids are well below the biosolids threshold concentrations for all nine metals.

TABLE 2-4

Allowable Biosolids Trace Pollutant Concentrations for Land Application(1)

Element	Symbol	Ceiling Concentration (mg/kg)(1)	EQ Limit (mg/kg)(2)	Lake Stevens Sewer District Maximum, 2017-2020	Lake Stevens Sewer District Average(3), 2017-2020
Arsenic	As	75	41	3.9	2.8
Cadmium	Cd	85	39	2.1	1.5
Copper	Cu	4,300	1,500	475	348
Lead	Pb	840	300	14	9.1
Mercury	Hg	57	17	6.0	0.8
Molybdenum	Mo	75	(4)	13.4	6.5
Nickel	Ni	420	420	20.3	15.4
Selenium	Se	100	100	11.3	8.4
Zinc	Zn	7,500	2,800	838	664

(1) WAC-173-308 Table 1.
(2) WAC-173-308 Table 3.
(3) Average of Samples with Detectable Concentration of Element.
(4) Under review by EPA. Until the EPA completes its review, the effective limit is 75 mg/kg.

Cumulative and annual trace pollutant loading rates are designated for nine heavy metals (Table 2-5). Once a cumulative loading limit is reached for a particular limiting pollutant, the land may no longer receive biosolids containing any level of the limiting pollutant. EQ biosolids are not subject to cumulative loading limits. Assuming that the pollutant concentrations in the District's biosolids are consistent with the concentrations reported in Table 2-5, the cumulative loading limits will not be a concern for the District's land application sites.

TABLE 2-5

Biosolids Pollutant Loading Limits for Land Application(1)

Element	Symbol	Cumulative Loading Limit (lb/ac)	Annual Loading Limit (lb/ac)
Arsenic	As	37	1.8
Cadmium	Cd	35	1.7
Copper	Cu	1,340	67
Lead	Pb	268	13
Mercury	Hg	15	0.76
Molybdenum	Mo	(2)	(2)
Nickel	Ni	375	19
Selenium	Se	89	4.5
Zinc	Zn	2,500	125

(1) 40 CFR Part 503.13 Tables 2 and 4.
(2) Under review by EPA.

It is possible that future regulations will be imposed for microconstituents, or trace organic compounds in biosolids. There is some concern regarding leaching from biosolids and into ground, surface, an ultimately drinking waters. Many communities in the U.S., particularly in the Midwest and Northeast where environmental groups and the media are raising concerns, are postponing major capital expenditures associated with biosolids due to the uncertainty associated with this issue. EPA is in the process of evaluating the risks of trace organic compounds in biosolids, in particular PFAS (perfluoroalkyl substances), colloquially knows as "forever chemicals" for their persistence. Many industrial and consumer products are known to contain, and serve as sources of, PFAS, including carpet cleaning and treatment products, stain resistant and porous waterproofing materials, treated paper food packaging, non-stick cookware, treated floor waxes and sealants, cosmetics and firefighting foams. Washington State issued a PFAS Chemical Action Plan in November 2021, with recommendations to:

1. Drinking water is safe;
2. Environmental PFAS contamination – contaminated sites and identified industries;
3. PFAS in products; and
4. Manage PFAS in wastewater (municipal and industrial), landfills, and biosolids.

Although there may be some new regulations associated with biosolids, and impacts to how they are managed, ultimately, implementation of PFAS source control, implemented for commercial dischargers and for consumer products, is expected to be the major impact of the risk analysis. The PFAS issue does present some uncertainty for biosolids planning for the District. None of the Class A or Class B treatment options considered in Chapter 8 would significantly reduce PFAS concentrations. Only combustion and oxidation processes like incineration and pyrolysis have been shown to remove PFAS,

Pathogen Reduction Measures

In order for biosolids to be land applied, they must meet specific criteria demonstrating a minimum level of treatment to reduce the density or limit the growth of pathogenic bacteria. By meeting these minimum criteria, a biosolids sample is referred to as meeting Class B pathogen reduction requirements. Class B biosolids must meet one or more of the criteria listed in both Tables 2-6 and 2-7.

A higher level of treatment, known as a process to further reduce pathogens (PFRP), will permit biosolids to meet Class A pathogen reduction requirements. Tables 2-6 and 2-7 provide the pathogen reduction standards for Class B biosolids. Tables 2-8 to 2-9 lists the EPA-approved PFRPs for Class A biosolids. When biosolids meet the Class A standard, they may be eligible for relatively unrestricted land application, provided they meet the EQ trace pollutant limits described above and the vector attraction reduction requirements as described below.

TABLE 2-6

Class B Biosolids – Pathogen Reduction Requirements

Alternative 1	Fecal coliform are less than 2,000,000 most probable number (MPN) or 2,000,000 colony-forming units per gram of total solids. Seven samples are collected at each sampling event. Geometric means are used to determine compliance.
Alternative 2	Use a process to significantly reduce pathogens (PSRP); see Table 2-5.
Alternative 3	Use a process equivalent to a PSRP.

TABLE 2-7

Class B Biosolids – Processes to Significantly Reduce Pathogens (PFRPs)

Aerobic Digestion	Biosolids are agitated with air or oxygen to maintain aerobic conditions for a specific time and at a specific temperature, ranging from 40 days at 20 degrees C to 60 days at 15 degrees C.
Air Drying	Biosolids are dried on sand beds or on paved or unpaved basins. The biosolids dry for at least 3 months. During 2 of the 3 months, the ambient average daily temperature is above 0 degrees C.
Anaerobic Digestion	Biosolids are treated in the absence of air for a specific time and at a specific temperature, ranging between 15 days at 35 to 55 degrees C and 60 days at 20 degrees C.
Composting	Using the within-vessel, static aerated pile, or windrow composting methods, the temperature of the biosolids is raised to 40 degrees C or higher and remains at 40 degrees C or higher for 5 days. For 4 hours during the 5 days, the temperature in the compost pile exceeds 55 degrees C.
Lime Stabilization	Enough lime is added to the biosolids to raise the pH to 12 after 2 hours of contact.

TABLE 2-8

Class A Biosolids – Pathogen Reduction Requirements

All Alternatives	Fecal coliform <1,000 MPN per gram total solids, or salmonella <3 MPN per 4 grams total solids.
Alternative 1	Meet specified time/temperature requirements (see Table 2-7).
Alternative 2	Maintain pH above 12 for 72 hours, with temperature during the 72-hour period >52°C for 12 hours. After 72 hours at pH above 12, biosolids are air dried to >50 percent total solids.
Alternative 3	Procedure for documenting that a biosolids treatment process meets Class A standards. Viable helminth ova <1 viable helminth ova per 4 grams total solids and enteric viruses <1 plaque-forming unit per 4 grams total solids. Retesting required when biosolids meet these requirements before the pathogen treatment process. When the treatment process is shown to reduce helminths and viruses and the pathogen treatment conditions are documented, the biosolids are Class A when the documented conditions are used.
Alternative 4	Procedure for documenting that a biosolids product meets Class A standards. Viable helminth ova <1 viable helminth ova per 4 grams total solids and enteric viruses <1 plaque-forming unit per 4 grams total solids.
Alternative 5	Use an approved PFRP, see Table 2-8.
Alternative 6	Use process approved as equivalent to an approved PFRP.

TABLE 2-9

Class A Biosolids – Time and Temperature Requirements

Temperature (°C)	≥7% Solids			<7% Solids		
	Days	**Hours**	**Minutes**	**Days**	**Hours**	**Minutes**
50	14			5		
52	7			3		
54	4			2		
56	2			1		
58		24			10	
60		13			5	
62		7			3	
64		4			2	
66		2				41
68			57			30
70			30			30
Above 70			20			30

Note: The table applies to all pathogen reduction processes except when the percent solids of the biosolids are 7 percent or higher and small particles are heated by warmed gases or an immiscible liquid.

TABLE 2-10

Class A Biosolids – Processes to Further Reduce Pathogens(1)

Composting	Using either the within-vessel composting method or the static aerated pile composting method, the temperature of the biosolids is maintained at 55 degrees C or higher for 3 days. Using the windrow composting method, the temperature of the biosolids is maintained at 55 degrees C or higher for 15 days or longer. During the period when the compost is maintained at 55 degrees C or higher, there shall be at least five turnings of the windrow.
Heat Drying	Biosolids are dried by direct or indirect contact with hot gases to reduce the moisture content to 10 percent or lower. Either the temperature of the biosolids particles exceeds 80 degrees C or the wet bulb temperature of the gas in contact with the biosolids as it leaves the dryer exceeds 80 degrees C.
Heat Treatment	Liquid biosolids are heated to a temperature of 180 degrees C or higher for 30 minutes.

TABLE 2-10 – (continued)

Class A Biosolids – Processes to Further Reduce Pathogens[(1)]

Thermophilic Aerobic Digestion	Liquid biosolids are agitated with air or oxygen to maintain aerobic conditions, maintaining 55 to 60 degrees C for 10 days.
Beta Ray Irradiation	Biosolids are irradiated with beta rays from an accelerator at dosages of at least 1.0 megarad at room temperature (approximately 20 degrees C).
Gamma Ray Irradiation	Biosolids are irradiated with gamma rays from certain isotopes, such as Cobalt 60 and Cesium 137, at room temperature (approximately 20 degrees C).
Pasteurization	The temperature of the biosolids is maintained at 70 degrees C or higher for 30 minutes or longer.

(1) Biosolids stabilized to these standards meet Class A pathogen reduction requirements if the end product has:

- Fecal coliform <100 MPN per gram total solids; or
- Salmonella <3 MPN per 4 grams total solids.

Vector Attraction Reduction Measures

The third minimum requirement for biosolids to be land applied is the vector attraction requirement. This measure is designed to make the biosolids less attractive to disease-carrying pests such as rodents and insects. These measures typically reduce the liquid content and/or volatile solids content of the biosolids or make the biosolids relatively inaccessible to vector contact by soil injection or tilling. A total of ten vector attraction reduction alternatives are available for land-applied municipal sewage (see Table 2-11).

If biosolids meet the lower pollutant threshold limits (EQ limits), Class A pathogen reduction requirements, and vector attraction reduction requirements, they are eligible for relatively unrestricted application. Biosolids of this type are referred to as "Exceptional Quality." If biosolids meet the higher pollutant threshold limits, Class B pathogen reduction requirements, and vector attraction reduction requirements, they can then be land applied but are subject to a number of restrictions regarding public contact and ultimate crop use.

TABLE 2-11

Vector Attraction Reduction Alternatives

No.	Description
1.	Biosolids digestion process with >38 percent volatile solids reduction.
2.	Test end product of an aerobic digestion process: 40-day anaerobic test at 30 to 37 degrees C. Acceptable stabilization if <15 percent volatile solids reduction occurs during the test.
3.	Test end product of aerobic digestion process having <2 percent solids: 30-day aerobic test at 20 degrees C. Acceptable stabilization if <15 percent volatile solids reduction occurs during the test.
4.	Facilities with aerobic digestion. Specific oxygen uptake rate (SOUR) test using end product of digestion process. Acceptable stabilization if uptake is <1.5 mg oxygen per total solids per hour at 20 degrees C.
5.	Facilities with aerobic digestion. Time/temperature requirement: 14 days, residence time at digestion temperatures >40 degrees C with average digestion temperature >45 degrees C.
6.	High pH stabilization: biosolids pH >12 for 2 hours and >11.5 for 24 hours.
7.	Treatment by drying. Not to include unstabilized primary wastewater solids. Total solids content >75 percent before mixing with other material.
8.	Treatment by drying. Can include unstabilized primary wastewater solids. Total solids >90 percent before mixing with other materials.
9.	Land application process. Injection into soil. No biosolids on soil surface 1 hour after application (Class B) and septage for 8 hours after application (Class A).
10.	Land application process. Soil incorporation by tillage within 8 hours, Class A biosolids only. Soil incorporation by tillage within 6 hours of application for Class B biosolids and septage.
11.	Sludge monofills only – does not apply to biosolids/septage.
12.	High pH treatment before land application. Acceptable stabilization if pH is >12 for 30 minutes.

(1) When septage has not been previously treated in any process other than a septic system.

LAND APPLICATION LIMITATIONS

For Class B biosolids, waiting periods are required to allow time for pathogens to die off before harvest. For Class B biosolids, the following minimum waiting periods apply:

- Minimum of 30 days for a food crop between biosolids application and harvest.

- Minimum of 14 months between biosolids application and harvest if the biosolids contact the harvested portion of the food crop.

- Minimum of 20 to 38 months between biosolids application and harvest for root crops.

It may not be feasible to raise some food crops (e.g., root crops and low-growing fruits and vegetables) on sites that use Class B biosolids because the waiting period is more than one growing season.

Land Application Permitting

WAC-173-308-310 lists permitting requirements for municipalities managing biosolids. The primary permit required for biosolids management activities is the Washington state *General Permit for Biosolids Management*. Treatment works treating domestic sewage that apply for coverage under this permit must submit either a complete permit application, or a notice of intent which is followed at a later date by complete permit information. The contents of a complete permit application are described in WAC 173-308-310(5), and in summary include the following:

- A statement of the applicable activity(ies) for which coverage under the permit is sought.
- The name of the general permit (Biosolids Management).
- Basic facility information including name, name of contacts, location, and relevant jurisdictions.
- Information on other environment permits.
- Maps showing the location of the facility.
- Biosolids data, including pollutant and nitrogen concentrations, and data from existing land application sites.
- A basic description of the applicant's biosolids management practice.
- Information regarding the specific vector attraction reduction and pathogen reduction methods employed.
- Land application plans, as required.
- Information on past, current, and future biosolids production and use.
- Other information the applicant deems helpful or that is required by the department.

- Proof of public notice, as required under proposed WAC 173-308-310(11)(a)(v). Substantiation of public notice is required for the initial application for coverage under the general permit as well as for subsequent site-specific land application plans submitted for approval.

The permittee must carry out public notice as required under WAC 173-308-310(11), and public hearings if required, in accordance with WAC 173-308-310(12), and comply with requirements of the State Environmental Policy Act (SEPA) as stipulated under WAC 173-308-310(030).

Provisional *coverage* under the general permit is effective on receipt of a complete permit application or notice of intent. Provisional coverage allows a permit holder to continue existing practices in compliance with the basic requirements of the rule and permit. Formal coverage is obtained after review and approval of the permit application, including any plans submitted with the application, by Ecology. Review of specific sites proposed at a later date may lead to additional conditions in site-specific land application plans, which become fully enforceable elements of a facility's permit coverage on approval by the department.

Provisional *approval* can be granted under WAC 173-308-310(17). Provisional approval is essentially permission to carry on an existing practice or to engage in a new or altered practice if certain conditions are met. Facilities operating under provisional approval have standing under the permit but are subject to further review and approval at a later time. They must comply with all applicable standards of the rule and permit, including timely submittal of an application or notice of intent. They must comply with requirements of the local health department, and may not obtain provisional approval if Ecology objects. They are not accountable under provisional approval, however, for compliance with additional or more stringent requirements that may eventually be imposed after final review. Provisional approval for new operations or for significant changes to existing operations operates similar to that for existing operations, except that public notice must be carried out and there must be no sustainable objections to a proposal.

BIOSOLIDS MONITORING

Producers of biosolids are required to monitor for pollutant concentrations, pathogen reduction, or vector attraction reduction. The required monitoring frequencies depend on the quantity of biosolids produced. These rates are summarized in Table 2-12. Based on its rate of biosolids production, the District has a minimum monitoring frequency of quarterly.

TABLE 2-12

Minimum Frequency of Monitoring

Annual Biosolids Production (dry tons)	Frequency
Greater than zero but less than 320	Once per year
Equal to or greater than 320 but less than 1,653	Once per quarter
Equal to or greater than 1,653 but less than 16,535	Once per 60 days
Equal to or greater than 16,535	Once per month

In WAC 173-308, jurisdictions, such as the District, are defined as being responsible for the treatment, transport, use, and disposal of the biosolids produced under its management. Therefore, in addition to monitoring biosolids quality, the District is responsible for the biosolids it produces from the point of production to the point of land application. The Department of Ecology recommends that in addition to meeting the minimum monitoring requirements for biosolids quality, biosolids producers should periodically monitor the storage, transport, and land application of their biosolids to ensure that each step conforms to State regulations, regardless of whether these activities are being contracted to a third party.

COMPLIANCE WITH THE STATE ENVIRONMENTAL POLICY ACT

Treatment works treating domestic sewage that come under this permit must also comply with requirements of the State Environmental Policy Act (SEPA) per WAC 173-308-030. Generally, compliance involves completing an environmental checklist to be reviewed by the lead SEPA agency, which makes a threshold determination of environmental impacts and carries out a public notice of the determination. Potential outcomes are a Determination of Nonsignificance (DNS), Mitigated Determination of Nonsignificance, or Determination of Significance. The latter leads to preparation of an environmental impact statement (EIS). If an EIS must be prepared, approval for the activity in question cannot be obtained under this permit until the EIS is completed. It is expected that most biosolids related proposals will not result in significant adverse environmental impacts, and in most cases a DNS will probably be issued (this has been the bulk of past experience). Mitigation may be appropriate in some cases, but alternatively can probably be addressed as a condition of permit coverage or approval of a general or site-specific land application plan.

When the proponent is a governmental agency (e.g., a municipality operating a wastewater treatment plant) it is expected that lead agency status will fall to the proponent agency in accordance with WAC 197-11-926.

Public Notice

The Department of Ecology requires public notice as a part of the process of issuing a general permit. Public notice requirements for facilities subject to this permit vary depending on the purpose the notice is serving and the quality of biosolids being managed. When a facility applies for initial coverage under the general permit it must carry out public notice for that purpose as specified in WAC 173-308-310(11). Notification must be made to the general public, affected local health departments, and interested parties. Generally, publication in a newspaper is required for initial public notice. Notification of affected local health jurisdictions and interested parties is by direct mail. When biosolids that do not meet the most stringent standards of the rule will be applied to the land, posting of sites is also required. Some facilities may add new sites in accordance with an approved general land application plan after they have received initial approval of coverage under the general permit. If public notice has not been previously carried out for those new sites, it must be done before biosolids can be applied. For sites added at a later date, required notice is limited to posting of the site, notification to Ecology and/or the local health department, and persons on an interested party list maintained by the permit holder. Public notice may also be necessary if a hearing or meeting is required under WAC 173-308-310(12), and to comply with requirements of the State Environmental Policy Act under Chapter 197-11 WAC.

LANDFILL DISPOSAL OF BIOSOLIDS

Ecology recognizes that at times circumstances may require that sewage sludge be disposed of in a landfill. Disposal in a monofill, what the federal program calls “placing” of sewage sludge, will remain under the jurisdiction of the state solid waste program and the separate federal sewage sludge program. This permit provides for disposal of sewage sludge in a municipal solid waste landfill as a management option on an emergency, temporary, or long-term basis as defined in WAC 173-308-080 and implemented in WAC 173-308-300. Uses of biosolids as a component of final or intermediate covers, where vegetation will be established, is considered a beneficial use. Use of sewage sludge in daily cover is considered disposal, the same as disposal directly in the landfill cell.

A need to dispose on an emergency basis is generally expected to occur as a result of circumstances largely beyond the control of an operator and is defined as having duration of less than 1 year. Disposal on an emergency basis is automatically approved under this permit if certain conditions are met. Disposal as a temporary management option may occur for reasons similar to those for an emergency basis but is expected to require at least one but not more than 5 years to resolve. In these cases, an approved plan is required to demonstrate that disposal is not being sought as a long-term management option. When disposal is contemplated as a management option with no intent to pursue other alternatives, or for a period of more than 5 years, it is considered to be a long-term management option. This option will only be approved if a facility can demonstrate that other management options are economically infeasible. It is important to note that the demonstration must be one of infeasibility, and not simply greater expense.

Sewage sludge that is disposed of in a municipal solid waste landfill must pass a free liquids test – the “paint filter test” – and not be hazardous waste in accordance with WAC 173-308-300(4) and (5). This approach is also consistent with regulations for municipal solid waste landfill management found in WAC 173-351-200(9) and 220(10), and also the requirements of 40 CFR Part 258 for municipal solid waste landfills. Part 503.4 and WAC 173-308-300(3) also require that any landfill receiving sewage sludge be in compliance with the requirements of Part 258.

RECORD KEEPING AND REPORTING

The general permit implements requirements for record keeping and reporting in accordance with proposed WAC 173-308-290 and –295. Permit holders must keep records of the information used to develop applications for coverage under this permit, and must also keep records, including signed certification statements, regarding on-going biosolids management practices. Annual reports are required of all permit holders. In accordance with requirements of federal rules, annual reports from the larger, what are sometimes called “major” facilities, are required to be more comprehensive. The record-keeping requirement allows for periodic inspection and verification of a facility’s performance. The annual reporting function also supports verification of facility practices and allows the collection of information necessary to efficient management of the overall state biosolids program.

BIOSOLIDS PERMIT FEES

The permit fee system multiplies a basic cost per residential equivalent (the rate) times the number of residential equivalents (the base). WAC 173-308-320 indicates five basic rates for coverage under this permit, dependent on the biosolids management options chosen.

SITE SELECTION CRITERIA FOR LAND APPLICATION

Land application is a commonly employed alternative for the ultimate disposition of biosolids and septage. Once all criteria have been met for pathogen reduction and vector attraction reduction (and additionally for biosolids only, pollutant concentrations), the next step is to select a site suitable for biosolids or septage application.

A biosolids application site must meet certain minimum criteria to meet specific regulatory requirements as well as minimum functional standards. This section will be divided between site criteria that are specifically dictated by regulation and those criteria that are based on agronomic science.

Regulatory Criteria for Land Application Siting

The WAC-173-308 and EPA 503 regulations have specific requirements for Class B biosolids application sites, including buffers and prohibited areas. There may also be local land use regulations or policies that apply in specific areas. This section deals primarily with those requirements found in the federal 503 and state WAC-173-308 regulations.

Endangered Species Habitat – Biosolids may not be applied to the land if it is likely to enter a wetland area or adversely affect an endangered species or its critical habitat.

Surface Waters Proximity – Biosolids may not be applied within 100 meters of any well or surface water body, including wetlands.

Pathogen Reduction Factor - Unless biosolids meet Class A pathogen reduction requirements, biosolids shall only be applied to sites where public access can be restricted. Land immediately adjacent to residential areas, well-traveled roads, parks and recreation areas would not be desirable application sites for anything but Class A biosolids.

Recommended Buffers for Biosolids Application Sites

<u>Property Lines and Roads</u>

The *Biosolids Management Guidelines for Washington State* (published by Ecology, July 2000) recommend minimum property buffers for biosolids application sites as shown in Table 2-13.

TABLE 2-13

Recommended Property Buffers for Application Sites for Biosolids and Domestic Septage

Landmark	Distance (ft)
Property Line	5 – 50
Dwelling	50 – 200
Major Arterial or Highway	50 – 100
Minor Road (Dirt or Gravel)	5 – 50

These property buffers do not distinguish between the type of pathogen reduction classification (A or B) under which the biosolids are regulated. For Class B biosolids use of the more conservative buffer distance is the recommended goal. Local land use regulations or policies, on a site-specific basis, may require larger buffer areas.

Drinking Water Wells

The *Biosolids Management Guidelines for Washington State* recommend a distance of 2 feet between the top layer of soil and the water table and recommend a 100 to 200 feet setback distance between biosolids application sites and drinking water wells.

TABLE 2-14

Recommended Property Buffers for Wastewater Land Treatment and Application Sites

Wastewater Land Treatment Sites	
Disinfected Wastewater	500 ft
Non-Disinfected Wastewater	1,000 ft
Wastewater Land Application Sites	
Class A Reclaimed Water	50 ft
Class B Reclaimed Water	100 ft

A wastewater land treatment site is somewhat analogous to a site where Class B biosolids are applied, while a land application site is somewhat analogous to a Class A biosolid application site. The analogy lies in the role of the soil-crop system. With Class B biosolids, just as with a wastewater land treatment system, the soil-crop system is used to provide further treatment. With Class A biosolids, as with wastewater land application systems, the land is not required to provide additional treatment to reduce the potential hazard of the waste.

For initial planning purposes the wastewater setback distances shown above may be considered in developing preliminary estimates of distances between biosolids application sites and potable water wells.

Siting Based on Agronomic Criteria

The following criteria are taken from the *Biosolids Management Guidelines* and the *Managing Nitrogen from Biosolids* manual for Washington State. They are intended to provide guidance for site selection based on those characteristics of a site that make it suitable for sustaining a cover crop. Because a primary concern in land application of septage is prevention of leaching of nitrate to groundwater, a key parameter in determining the agronomic rate for land application is the available nitrogen content in the septage. Maintaining a cover crop is absolutely essential for a biosolids or domestic septage application program to be successful. For site-specific cases, it is usually appropriate to consult with a professional soil scientist or agronomist to verify proper application rates or if unique circumstances exist which are not addressed by these general guidelines.

Topography

Land used for biosolids or domestic septage application should generally be well drained, but not excessively. Drainage characteristics are related to soil type, depth to restrictive layer as well as slope. Generally, for agricultural sites, slopes up to 3 percent will be suitable for biosolids or domestic septage application if the depth to the restrictive layer is not too shallow, e.g., less than 20 inches. For slopes between 3 percent and 8 percent, soils should have a deep mantle and be low in silt and clay. Slopes greater than 8 percent are generally not recommended for biosolids or domestic septage applications because of the potential for erosion and runoff.

For land applications in existing forests, sites with steeper slopes may be used. For application in the dry season, the maximum recommended slope is 30 percent for application on a site with good vegetative cover, and 15 percent on a site with poor vegetative cover. For application in the wet season, the maximum recommended slope is 15 percent for application on a site with good vegetative cover, and 8 percent on a site with poor vegetative cover.

Soil Depth

The depth of the soil mantle is important for sustaining a cover crop. Deeper soil depths can retain greater quantities of water, support a better root structure and thereby allow crops to survive long dry weather periods.

Soil depth is important with biosolids and domestic septage application because deeper soils can act as a type of “filter” to prevent nutrients from leaching to groundwater. The processes of nitrification and denitrification remove ammonia nitrogen from wastewater. Both processes are assisted by long detention times in the soil matrix. Denitrification also requires an absence of free oxygen to cause soil bacteria to use nitrate for respiration purposes instead of oxygen. Thus, the deeper the soil, the better the environment is for denitrification to occur. A deep soil mantle is beneficial in preventing groundwater pollution.

A soil depth greater than 20 inches is desirable for biosolids or domestic septage application. A depth of 40 inches or more is ideal. A soil that is shallower than 20 inches will have lower crop yields and limit biosolids application rates.

Soil Texture

Soil textures range from fine to coarse. Finely textured soils are more prone to runoff, whereas coarse soils are well drained. Soil texture by itself is not a selection criterion, but must be considered as a factor in site selection. For example, a sandy soil, though well drained, does not have the ability to retain nutrients while a clay soil has a good capacity for nutrient and water retention. Adding and incorporating biosolids or septage in either type of soil (sandy or clay) would likely prove beneficial because the biosolids can improve porosity in the clay soils and nutrient/moisture retention capacity in the sandy soils.

Soil Structure

Soil structure is the arrangement and stability of soil particles. An ideal soil structure has about half solids and half pore spaces. At maximum moisture holding capacity about half the pore space is filled with water.

Soil Color

Color is an indicator of drainage. Well-drained soils have horizons that are uniformly red, brown or black. Poorly drained soils are gray and may contain brown or red colored mottles. Obviously, well-drained soils are preferred for biosolids domestic application. Poorly drained soils are not good application sites and may be an indication that they are wetlands. Soils suspected of being wetlands should be evaluated by a qualified wetlands or soil scientist to verify they are not wetlands prior to any biosolids or domestic septage land application. State biosolids regulations require a minimum 10-foot buffer between wetlands and biosolids or domestic septage application sites.

Crop Selection and Management

Crop selection is a critical element of designing a biosolids or domestic septage application site. Nutrient uptake rates vary by crop species. Certain crops are capable of nutrient uptake in winter months, while others are not.

In general, perennial grasses, legumes and poplar trees have the highest nutrient uptake rates. However, maintaining these high uptake rates requires proper crop management. By frequently cutting at early stages of growth, nutrient uptake rates are maximized. Table 2-15 is provided as a guide for nutrient uptake rates for different crops.

When the temperature drops, plant growth is curtailed. If biosolids or domestic septage are over-applied in the winter months when nitrogen uptake is low, it is possible that runoff or leaching of nitrogen from the application site could occur. To prevent this from occurring it is necessary to create a plan for biosolids application that ensures that nitrogen loadings match uptake rates for a given period.

Whatever the crop selected, if it is not properly managed the crop will not provide the nutrient uptake targeted in the design of the biosolids or domestic septage application site. This means that the crop must be supplied with proper ratios of all critical nutrients, including phosphorous and potassium, as well as water sufficient to meet crop water requirements. Regular harvesting of crops is needed to maintain the growth process whereby nitrogen is assimilated into the plant biomass. Without including all of these factors in the design and management of a biosolids or domestic septage application program, it is not possible to assume that a given crop will provide the predicted nitrogen uptake rate.

TABLE 2-15

Estimated Nutrient Uptake Rates for Selected Crops (lb/acre*yr)

Crop	Nitrogen	Phosphorus	Potassium
Forage Crops			
Alfalfa	200-480	20-30	155-200
brome grass	116-200	35-50	220
coastal bermuda grass	350-600	30-40	200
Kentucky bluegrass	180-240	40	180
quack grass	210-250	27-41	245
reed canary grass	300-400	36-40	280
rye grass	180-250	55-75	240-290
sweet clover	158	16	90
tall fescue	135-290	26	267
orchard grass	230-250	20-50	225-315
Field Crops			
Barley	63	15	20
Corn	155-172	17-25	96
Cotton	66-100	12	34
grain sorghum	120	14	62
Potatoes	205	20	220-288
Soybeans	94-128	11-18	29-48
Wheat	50-81	15	18-40
Forests			
Hybrid poplar	270-360	--	--
Douglas fir plantation	135-220	--	--

Climate

Climate may be a limiting factor for calculating biosolids application rates. Winter biosolids application is typically impacted by:

- Lower agronomic uptake rates;
- Poor conditions for vehicle traffic on the application site;
- Potential for runoff due to freezing ground.

Each of these factors must be considered in choosing a site for biosolids application if year-round use of the site is required. In recent years, Ecology in western Washington has increasingly curtailed winter land application of biosolids unless appliers can demonstrate that the crops/forest take up all the available nitrogen; crop nitrogen uptake is typically at a minimum in the winter.

PROPOSED CAPACITY, MANAGEMENT, OPERATION AND MAINTENANCE REGULATIONS

EPA has proposed a new round of regulations titled Capacity, Management Operation and Maintenance (CMOM). Though the regulations are yet to be formally adopted by EPA, some municipalities are anticipating the adoption and have moved forward with implementation. CMOM focuses on the failure of collection systems and requires a program for long-term financing and repair. Under its authority granted by the federal Clean Water Act, EPA seeks to address sanitary sewer overflows (SSO) under the CMOM program. It is expected that elements of CMOM could be incorporated into NPDES permits.

In general, the CMOM requirements can be summarized in the following elements:

1. General performance standards including system maps, information management, and odor control.

2. Program documentation including the goals, organizational and legal authority of the organization operating the collection system.

3. An overflow response plan that requires response in less than 1 hour and is demonstrated to have sufficient and adequate personnel and equipment, etc. Estimated volumes and duration of overflows must be accurately measured and reported to the regulatory agency.

4. System evaluation requires that the entire system be cleaned on a scheduled basis (for example, once every 5 years), be regularly TV inspected, and that a program for short- and long-term rehabilitation replacement be generated. EPA has proposed, as a rule of thumb, a 1.5 to 2 percent system replacement rate which implies that an entire collection system is replaced somewhere in the range of a 50- to 70-year time period.

5. A capacity assurance plan that will use flow meters to model Inflow and Infiltration (I/I), ensure lift stations are properly operated and maintained, and that source control is maintained.

6. A self-audit program to evaluate and adjust performance.

7. A communication program to communicate problems, costs, and improvements to the public and decision-makers.

EPA is considering some changes in design standards for collection systems including requiring that sanitary sewer overflows not occur except in extreme storms. They have also decided that they will not predefine the type of storm, leaving that decision to the design engineer.

FEDERAL ENDANGERED SPECIES ACT

Waters of the Snohomish River Estuary support a variety of fish and wildlife species, including the following that are currently listed as Threatened or Endangered under the Federal Endangered Species Act (ESA): steelhead, Chinook and bull trout.

ESA listings impact activities that affect salmon and trout habitat, such as water uses, land use, construction activities, and wastewater disposal. Impacts to the District may include longer timelines for permit applications and more stringent regulation of construction impacts on in-water work and riparian corridors. The presence of ESA-listed species and associated critical habitat in the vicinity has the potential to impact future WWTF and outfall improvement projects.

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal permits or funding. Federally delegated activities such as NPDES permits or Section 401 certification are considered state actions and do not require NEPA compliance. If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued; otherwise, an Environmental Assessment (EA) or Environmental Impact Statement (EIS) would be required. NEPA is not applicable to projects that do not include a federal component or nexus. If there is a federal nexus, the District will need to follow NEPA procedures in order to obtain any permits required for upgrades to the WWTF, which are outlined in the Capital Improvement Plan of this document.

When both federal and state licenses or permits are required, then both NEPA and SEPA requirements must be met. WAC 197-11-610 allows the use of NEPA documents to meet SEPA requirements.

FEDERAL CLEAN AIR ACT

The Federal Clean Air Act requires all wastewater facilities to plan to meet the air quality limitations of the region. Lake Stevens Sewer District falls in the jurisdiction of the Puget Sound Clean Air Agency (PSCAA). PSCAA is responsible for enforcing federal, state and local outdoor air quality standards and regulations in King, Kitsap, Pierce and Snohomish counties of Washington State.

WETLANDS

Dredging and Filling Activities in Natural Wetlands (Section 404 of the Federal Water Pollution Control Act)

A U.S. Army Corps of Engineers permit is required when locating a structure, excavating, or discharging dredged or fill material in waters of the United States or transporting dredged material for the purpose of dumping it into ocean waters. Typical projects requiring these permits include the construction and maintenance of piers, wharves, dolphins, breakwaters, bulkheads, jetties, mooring buoys, and boat ramps. If wetland fill activities cannot be avoided, the negative impacts can be mitigated by creating new wetland habitat in upland areas. If other federal agencies agree, the Corps would generally issue a permit.

Wetlands Executive Order 11990

This order directs federal agencies to minimize degradation of wetlands and enhance and protect the natural and beneficial values of wetlands. This order could affect the siting of lift stations and sewer lines.

STATE STATUTES, REGULATIONS, AND PERMITS

STATE WATER POLLUTION CONTROL ACT

The intent of the State Water Pollution Control Act is to “maintain the highest possible control standards to ensure the purity of all waters of the state consistent with public health and the enjoyment the propagation and protection of wildlife, birds, game, fish and other aquatic life, and the industrial development of the state.” Under the Revised Code of Washington (RCW) 90.48 and the Washington Administrative Code (WAC) 173-240, Ecology issues permits for wastewater treatment facilities.

Submission of Plans and Reports for Construction of Wastewater Facilities, WAC 173-240

Prior to construction or modification of domestic wastewater facilities, engineering reports, plans, and specifications must be submitted to and approved by Ecology. This regulation outlines procedures and requirements for the development of an engineering report that thoroughly examines the engineering and administrative aspects of a domestic wastewater facility project.

Key provisions of WAC 173-240 are provided below:

- An engineering report for a wastewater facility project must contain everything required for a general sewer plan unless an up-to-date general sewer plan is on file with Ecology.

- An engineering report shall be sufficiently complete so that plans and specifications can be developed from it without substantial changes.

- A wastewater facility engineering report must be prepared under the supervision of a professional engineer.

Criteria for Sewage Works Design, Washington State Department of Ecology

Ecology has published design criteria for collection systems and wastewater treatment plants. While these criteria are not legally binding, their use is strongly encouraged by Ecology since the criteria are used by the agency to review engineering reports for upgrading wastewater treatment systems. Commonly referred to as the "Orange Book," these design criteria primarily emphasize unit processes through secondary treatment, and also include criteria for planning and design of wastewater collection systems. Any expansion or modification of the District's collection system and/or WWTF will require conformance with Ecology criteria unless the District demonstrates that alternate standards provide similar reliability and efficacy.

Ecology Reliability Requirements

The Orange Book also presents guidelines for the wastewater treatment component design. Including the number of units required for operation during peak flows. These requirements are derived from federal standards developed by the EPA and published in a 1974 document entitled Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability. Table 2-16 presents Ecology criteria for designation of WWTFs into three reliability classes based on the nature or their receiving water. Per the NPDES Permit and fact sheet, the District's WWTF has a reliability classification of Class II. Reliability criteria for WWTF in Class II are presented in Table 2-17.

TABLE 2-16

Reliability Classifications from the Orange Book

Reliability Class	Guideline
I	These are works whose discharge or potential discharge: (1) is into public water supply, shellfish, or primary contact recreation waters; or (2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted. Examples of Reliability Class I works are those with a discharge or potential discharge near drinking water intakes, into shellfish waters, near areas used for water contact sports, or in dense residential areas.
II	These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days). Examples of a Reliability Class II works are works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for water contact sports, and residential areas.
III	These are works not otherwise classified as Reliability Class I or Class II.

Source: The Orange Book (Ecology, 2008), Paragraph G2-8.

TABLE 2-17

Reliability Requirements for Class II WWTFs

WWTF Component	Class II Requirements
Mechanically Cleaned Bar Screens	A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.
Pumps	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow
Comminution Facility	If comminution of the total wastewater flow is provided, an overflow bypass with a manually installed or mechanically cleaned bar screen shall be provided. The hydraulic capacity of the comminutor overflow bypass should be sufficient to pass the peak flow with all comminution units out of service.

TABLE 2-17 – (continued)

Reliability Requirements for Class II WWTFs

WWTF Component	Class II Requirements
Primary Sedimentation Basins	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
Final Sedimentation Basins and Trickling Filters	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
Activated Sludge Process Components.	1. Aeration Basin. A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.) 2. Aeration Blowers or Mechanical Aerators. There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed. 3. Air Diffusers. The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.
Disinfectant Contact Basins	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow.
Electrical Power Supply	Sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Except that the vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but shall be sufficient to maintain the biota.

Source: The Orange Book (Ecology, 2008), Paragraph G2-9 and G2-10.

Certification of Operators of Wastewater Treatment Plants, WAC 173-230

Wastewater treatment plant operators are certified by the State Water and Wastewater Operators Certification Board. The operator assigned overall responsibility for operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." As noted in the NPDES Permit, "this permitted facility must be operated by an operator certified by the state of Washington for at least a Class III plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class II plant must be in charge during all regularly scheduled shifts."

SURFACE WATER QUALITY STANDARDS (WAC 173-201A)

The Washington State surface water quality standards (Chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide TMDL.

The State adopted revised water quality standards in 2019. The standards are based on two objectives: protection of public health and enjoyment, and protection of fish, shellfish, and wildlife. For each surface water body in the State, the standards assign specific uses, such as aquatic life, recreation, or water supply. Water quality standards have been developed for each use for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, and deleterious substances. The surface water criteria include 29 toxic substances, including ammonia, residual chlorine, several heavy metals, polychlorinated biphenyls (PCBs), and pesticides.

Discharging to surface water requires an NPDES permit issued by Ecology under WAC 173-220. Wastewater treatment plants must generally, at a minimum, meet technology-based limits that include 30 mg/L total suspended solids (TSS) and 30 mg/L 5-day biochemical oxygen demand (BOD_5) (typically termed "30-30 limits"). Additionally, under WAC 173-201A-320, Ecology is authorized to condition NPDES permits so that the discharge meets water quality standards. Therefore, other permit conditions in addition to or more stringent than the 30-30 limits could be added to ensure that the water quality of the receiving water is not degraded.

It is the policy of the State of Washington to maintain existing beneficial uses of surface water by preventing degradation of existing water quality. However, certain allowances are made by Ecology for discharging treated wastewater into a surface water that enable a temporary or mitigated degradation to occur. These allowances are made by establishing mixing zones and determining the assimilative capacity of the receiving water. Ecology uses modeling to estimate the amount of mixing within the mixing zone. A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with the receiving water. Within mixing zones, the pollutant concentrations may exceed water quality numeric standards, so long as the discharge does not interfere with the designated uses of the receiving water body. The pollutant concentrations outside of the mixing zones must meet water quality numeric standards. The Water Quality Standards (WAC 173-201A-400) allow the Washington State Department of Ecology to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone.

Through modeling, Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derives any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses.

The District prepared the Outfall Evaluation and Mixing Zone Study in 2002 and updated in 2005 and 2018. Ecology determined the dilution factors that occur within these zones at the critical conditions using these modeling studies. The dilution factors are listed in Table 2-18.

TABLE 2-18

Mixing Zone Dilution Factors, Lake Stevens Sewer District WWTF

Criteria	Acute	Chronic
Current NPDES Permit (2002 Study)		
Aquatic Life	6.4	15
Human Health, Carcinogen	-	239
Human Health, Non-carcinogen	-	15
2018 Mixing Zone Study Update		
Aquatic Life	12.4	29.1
Human Health, Carcinogen	-	32.8

The State's anti-degradation policy, under WAC 173-201A-300 through 173-201A-330, aims to maintain the highest possible quality of water in the State by preventing the deterioration of water bodies that currently have higher quality than the water quality standards require. The revised water quality standards define three tiers of waters in the anti-degradation policy:

- Tier I water bodies are those with violations of water quality standards from natural or human-caused conditions. The focus of water quality management is on maintaining or improving current uses and preventing any further human-caused degradation.

- Tier II water bodies are those of higher quality than required by the water quality standards. The focus of the policy is on preventing degradation of the water quality and to preserve the excellent natural qualities of the water body. New or expanded actions are not allowed to cause a "measurable change" in the water quality unless they are demonstrated to be "necessary and in the overriding public interest."

- Tier III are the highest quality "outstanding resource waters." Tier III(A) prohibits any and all future degradation, or Tier III(B) which allows for de minimis (below measurable amounts) degradation from well-controlled activities.

Per the Fact Sheet of the District's NPDES Permit, the WWTF discharges to Ebey Slough, part of the Snohomish River Estuary. Based on its designations in WAC-173-201a and the Fact Sheet, the LSSD WWTF must meet Tier I requirements:

- Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.

- For waters that do not meet assigned criteria, or protect existing or designated uses, Ecology will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.

- Whenever the natural conditions of a water body are of a lower quality than the assigned criteria, the natural conditions constitute the water quality criteria. Where water quality criteria are not met because of natural conditions, human actions are not allowed to further lower the water quality, except where explicitly allowed in Chapter 173-201A WAC.

The applicable criteria noted in the Fact Sheet are summarized in Table 2-19.

TABLE 2-19

Aquatic Water Quality Criteria

Parameter	Value
Fresh Water Aquatic Life, Salmonid Spawning, Rearing & Migration	
Temperature Criteria – Highest 7-DADMax (7-day average of the daily maximum)	17.5 degrees C (63.5 degrees F)
Dissolved Oxygen Criteria – Water Column (1-Day Minimum)	10 mg/L or 90 percent saturation
Turbidity Criteria	5 NTU over background when the background is 50 NTU or less; or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

TABLE 2-19 – (continued)

Aquatic Water Quality Criteria

Parameter	Value
Total Dissolved Gas Criteria	Total dissolved gas must not exceed 110 percent of saturation at any point of sample collection.
pH Criteria	pH must be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Marine Aquatic Life Uses – Excellent Quality	
Temperature Criteria – Highest 7-DADMax (7-day average of the daily maximum)	16 degrees C (60.8 degrees F)
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	6.0 mg/L
Turbidity Criteria	5 NTU over background when the background is 50 NTU or less; or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
pH Criteria	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Recreations Uses – Primary Contact Recreation	
E. coli (Fresh Water)	E. coli organism levels within an averaging period must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than 10 sample points exist) obtained within the averaging period exceeding 320 CFU or MPN per 100 mL.
Enterococci (Marine Water)	Enterococci organism levels within an averaging period must not exceed a geometric mean value of 30 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample values exist) obtained within the averaging period exceeding 110 CFU or MPN per 100 mL.

The miscellaneous marine water uses for the receiving water for the LSSD WWTF outfall are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

Additional discussion of the water quality implications of wastewater treatment alternatives is provided in Chapter 7 and 8.

RECLAIMED WATER STANDARDS

Reclaimed water is the effluent derived from a wastewater treatment system that has been adequately and reliably treated, such that it is no longer considered sewage and is suitable for a beneficial use or a controlled use that would not otherwise occur. The legislature has declared that "the utilization of reclaimed water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife habitat creation and enhancement purposes (including wetland enhancement) will contribute to the peace, health, safety, and welfare of the people of the State of Washington." Consideration of the feasibility of reclaimed water is required in General Sewer Plans.

The legislature approved the Reclaimed Water Use Act in 1992 and codified it as chapter 90.46 Revised Code of Washington (RCW). This act initially envisioned treated sanitary wastewater as the source of supply for reclaimed water, and encouraged using reclaimed water for land application and industrial and commercial uses. Legislative amendments to Chapter 90.46 RCW in 2006 required the development of a new Washington Administrative Code (WAC) chapter for reclaimed water. On January 23, 2018, the Department of Ecology adopted a new rule, Chapter 173-219 WAC, Reclaimed Water. The Departments of Ecology and Health cooperatively developed this Rule with significant input from stakeholders and technical advisory groups. The Rule sets forth minimum standards for reclaimed water projects. The agencies may incorporate additional enforceable conditions into a reclaimed water permit issued under the Rule as needed to protect public health and the environment.

The *Reclaimed Water Facilities Manual* defines the water quality standards for reclaimed water. The Reclaimed Water Regulations define three classes of reclaimed water: Class A+, Class A, and Class B. The beneficial use of reclaimed water is limited by its classification. Classes of reclaimed water are defined as follows:

> "Class A+ reclaimed water" is the highest quality of reclaimed water and can be used for Class A and Class B uses. Class A can be used for Class A and Class B beneficial uses. Class B water can be used only for Class B beneficial uses. "Class A+ reclaimed water" means a water resource that meets the treatment requirements for Class A reclaimed water and any additional criteria determined necessary on a case-by-case basis by Washington State Department of Health (WDOH) for direct potable reuse. Class A+ reclaimed water is required for direct potable reuse.

"Class A reclaimed water" means a water resource that meets the treatment requirements of this chapter, including, at a minimum, oxidation, coagulation, filtration, and disinfection. Membrane Filtration is acceptable in lieu of coagulation and filtration. Class A reclaimed water may be used for: commercial, industrial, or institutional toilet and urinal flushing, laundry, public water features where public contact may occur; landscape irrigation with direct or indirect public access; irrigation of food crops, trees, and fodder in pastures accessed by milking animals; discharge to Category II wetlands without characteristics provided application rate and supplemental performance standards are met, Category III or IV wetlands, constructed wetlands with public access; direct groundwater recharge; or recovery of reclaimed water stored in an aquifer.

"Class B reclaimed water" means a water resource that meets the treatment requirements of this chapter, including, at a minimum, oxidation, and disinfection. Class B Reclaimed water may be used for: commercial, industrial, and institutional uses with environmental contact or where there is restricted access; landscape irrigation with restricted access and no human contact; frost protection of orchard crops; irrigation of non-food crops, irrigation of orchards, vineyards, process food crops, trees or seed crops in pastures not accessed by milking animals.

The salient performance standards for Class A and Class B reclaimed water are defined in Tables 2-20 and 2-21. Class A+ reclaimed water requirements must be established by jurisdictional health department on a case-by-case basis, and must have approval of the WDOH before reclaimed water can be beneficially used for direct potable reuse.

TABLE 2-20

Minimum Biological Oxidation Performance Standards

Biological Oxidation		
Parameter	**Minimum Biological Oxidation Performance Standard**	
Dissolved Oxygen	Must be measurably present	
Parameter	**Month Average**	**Weekly Average**
BOD_5	30 mg/L	45 mg/L
$CBOD_5$	25 mg/L	40 mg/L
TSS	30 mg/L	45 mg/L
Parameter	**Minimum**	**Maximum**
pH	6 s.u.	9 s.u.
pH (groundwater recharge)	6.5 s.u.	8.5 s.u.

TABLE 2-21

Class A and B Performance Standards

Parameter	Class A Reclaimed Water		Class B Reclaimed Water	
	Monthly Average	**Sample Maximum**	**Monthly Average**	**Sample Maximum**
Coagulation/Filtration				
Turbidity	2 NTU	5 NTU	Not Applicable	Not Applicable
Membrane Filtration				
Turbidity	0.2 NTU	0.5 NTU	Not Applicable	Not Applicable
Disinfection				
Total Coliform	2.2 MPN/100 mL or CFU/100 mL(1)	23 MPN/100 mL or CFU/100 mL	23 MPN/100 mL or CFU/100 mL(1)	240 MPN/100 mL or CFU/100 mL
Virus Removal	See disinfection process standards in WAC 173-219-340		Not Applicable	Not Applicable
Denitrification				
Total Nitrogen	10 mg/L	15 mg/L (Weekly Average)	Not Applicable	Not Applicable

(1) 7-day median value.
Note: Numerical values for parameter represent maximum values for monthly average and single sample results.

STATE ENVIRONMENTAL POLICY ACT

WAC 173-240-050 requires a statement in all wastewater comprehensive plans regarding proposed projects in compliance with the State Environmental Policy Act (SEPA), if applicable. The capital improvements proposed in this plan will fall under SEPA regulations. A SEPA checklist and the Determination of Non-Significance that was issued on August 4, 2022 are included in Appendix A of this plan for use in the environmental review for the project. In most cases, a Determination of Non-Significance (DNS) is issued; however, if a project will have a probable significant adverse environmental impact, an Environmental Impact Statement (EIS) will be required.

ACCREDITATION OF ENVIRONMENTAL LABORATORIES (WAC 173-050)

The State of Washington established a requirement that all laboratories reporting data to comply with NPDES permits must be generated by an accredited laboratory. This accreditation program establishes specific tasks for quality control and quality assurance (QA/QC) that are intended to ensure the integrity of laboratory procedures. Accreditation requirements must be met for any on-site laboratory or outside laboratory used to analyze samples. Only accredited laboratories may be used for analyses reported for compliance with NPDES permits. In planning for an on-site laboratory, staffing must be sufficient to allow for QA/QC procedures to be performed. The LSSD WWTF laboratory is currently accredited for testing the following parameters for TSS, VSS, BOD_5, CBOD, pH, ammonia, nitrite, orthophosphate, total phosphorus, turbidity, and fecal coliform.

MINIMAL STANDARDS FOR SOLID WASTE HANDLING (WAC 173-304)

Grit and screenings are not subject to the sludge regulations in WAC 173-308, but their disposal is regulated under the State solid waste regulations, WAC 173-304. Waste placed in a municipal solid waste landfill must not contain free liquids, nor exhibit any of the criteria of a hazardous waste as defined by WAC 173-303. To be placed in a municipal solid waste landfill, grit, screenings, and incinerator ash must pass the paint filter test. This test determines the amount of free liquids associated within the solids and includes the toxic characteristic leachate procedure (TCLP) test, which determines if the waste has hazardous characteristics.

SHORELINE MANAGEMENT ACT

The Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to shoreline uses that protect water quality and the natural environment, depend on proximity to the water, and preserve or enhance public access to the water. The Shoreline Management Act jurisdiction extends to lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cubic feet per second (cfs) or greater, marine waters, and any area inland 200 feet from the ordinary high-water mark. Projects are reviewed by local governments according to State guidelines.

Although the LSSD WWTF is not located within the shoreline area, portions of the collection systems are located within shoreline areas.

FLOODPLAIN DEVELOPMENT PERMIT

Local governments that participate in the National Flood Insurance Program are required to review projects in a mapped floodplain and impose conditions to reduce potential flood damage from floodwater. A Floodplain Development Permit is required prior to construction, including projects involving wastewater collection facilities.

HYDRAULIC PROJECT APPROVAL

Under the Washington State Hydraulic Code (WAC 220-110), the WDFW requires a hydraulic project approval (HPA) for activities that will "use, divert, obstruct, or change the natural flow or bed" of any waters of the State. For District activities, such as pipeline crossings of streams or WWTF outfall modifications, an HPA will be required. The HPA will include provisions necessary to minimize project-specific and cumulative impacts to fish.

CHAPTER 3

SERVICE AREA CHARACTERISTICS, LAND USE AND POPULATION PROJECTIONS

SEWER SERVICE AREAS

The Sewer District's service area includes the entirety of Lake Stevens Urban Growth Area (LSUGA) as well as small areas within the Marysville UGA and rurally designated Snohomish County. The LSUGA currently has three land use jurisdictions. Although most of the LSUGA is within the City of Lake Stevens, a portion of the area has not yet been annexed and is under Snohomish County jurisdiction. A very small portion is within the City of Marysville UGA. The Interlocal Agreements that dictate the terms of sewer service within these municipalities are provided in Appendix C.

The portion of the District's current service area that is within the Marysville UGA will be transferred to the City of Maryville upon annexation of that area to that City. Accordingly, that area is not included in the District's buildout service area.

The portion of the District's service area that has a rural designation is not assumed to re-develop for the buildout condition.

The Sewer District has not yet annexed the entirety of its service area into the District. Accordingly, the Sewer District Boundary is a portion of the District's service area.

Figure 3-1 shows the location of the jurisdictional boundaries within the District's service area. Table 3-1 summarizes the area within each jurisdiction.

TABLE 3-1

Current Service Area Jurisdictions

Jurisdiction	Area (acres)
City of Lake Stevens	7,501
Unincorporated Snohomish County(1)	652
City of Marysville	10
Total Service Area	**8,163**

(1) Includes 1,013 acres of lake surface area. These areas reflect completion of the City's SE Annexation as of August 2021.

The land uses that have been adopted by each jurisdiction are identified in their respective Comprehensive Plans.

Because the LSSD provides service only to urban areas, the Sewer Plan will not consider sewer service to any areas that are outside the LSUGA. Snohomish County has designated land around the LSUGA (north, south and east) as rural-urban transition area (RUTA). These are areas of potential future expansion of the LSUGA. Development of these areas will not be used to size any capital facilities.

The District's collection system currently includes 30 lift stations and approximately 126 miles of sanitary sewer mains, ranging in size from 8 to 36 inches in diameter. An additional lift station is currently under construction by a developer. The WWTF provides secondary treatment and has a maximum-month design capacity of 5.01 million gallons per day (mgd) and a peak hour design capacity of 11.52 mgd.

NATURAL ENVIRONMENT

The physical characteristics of the natural environment are essential elements for considering the locations of future sewer systems and facilities. The relevant components discussed below include topography, soils and geology and climate.

Topography

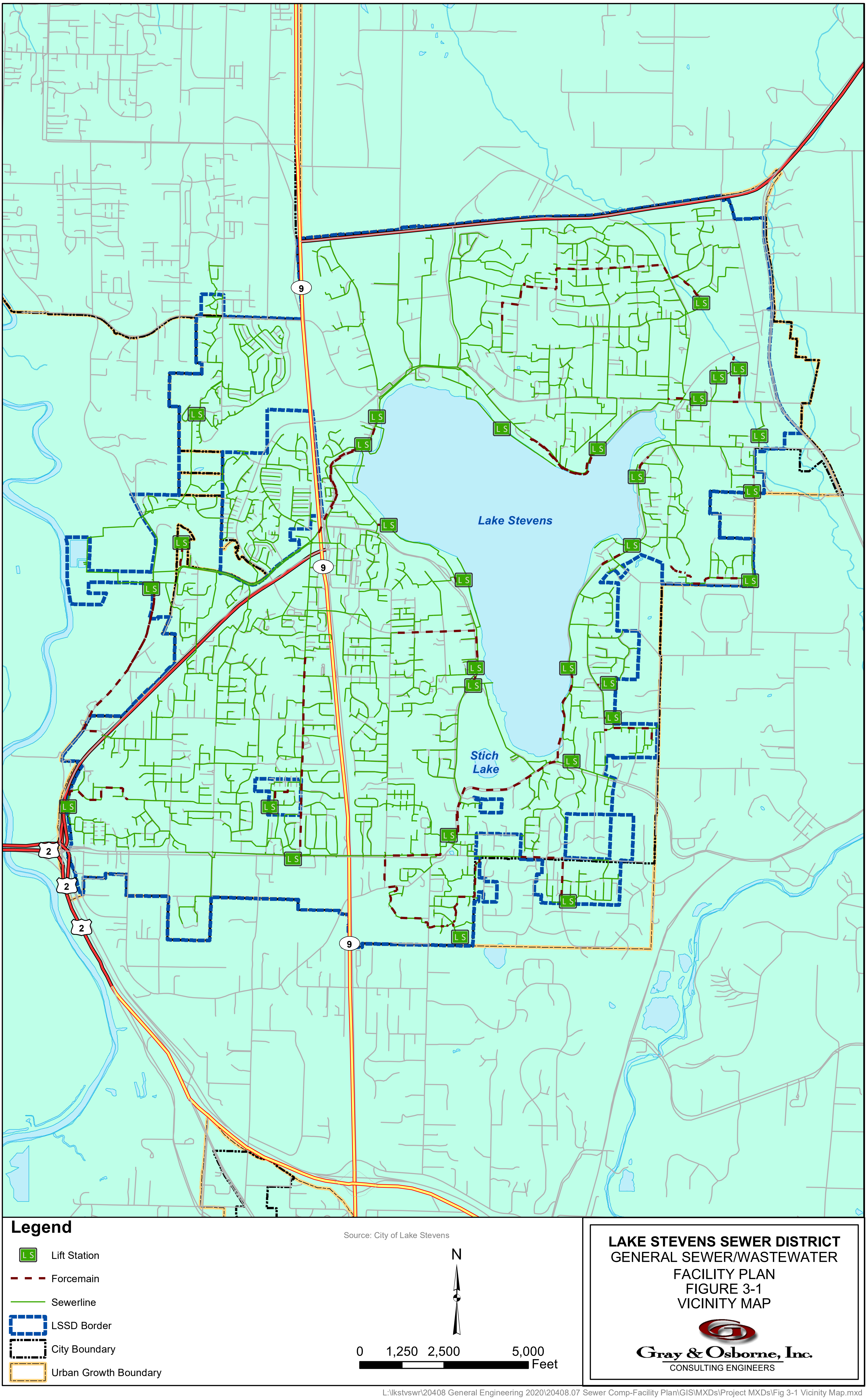
Topography for the District is shown in Figure 3-2. Ground elevation in the District's sewer service area ranges from 20 to 460 feet above sea level. The highest elevations are on the District's northern border, along SR 9. The lowest elevations are on the District's western border, along Sunnyside Boulevard.

The topography is rolling. The center and northern portions of the District's service area generally slope toward Lake Stevens. The eastern, western and southern portions generally slope in those respective directions.

Soils and Geology

Major historic ice flows covered the Lake Stevens area. The most recent of these is the Vashon ice flow that receded approximately 16,000 years ago. These ice flows compacted soils beneath, leaving large areas of till, a compact unoxidized silty-sand material.

Figure 3-3 shows the soils classifications as identified by the United States Department of Agriculture Soil Conservation Service (SCS) within the District. The predominant soil type within the District is Tokul gravelly loam, a moderately deep, moderately well drained soil formed in glacial till and volcanic ash. The subsoil is brown and dark yellowish brown gravelly loam about 18-inches thick and the substratum is light olive brown gravely fine sandy loam about 9-inches thick. A hardpan exists at the depth of about 20 to 40 inches. Permeability of this soil is moderate to the hardpan and very slow through the hardpan itself. The available water capacity is moderate. The main


Lake Stevens
Stich Lake
Legend
Lift Station
Forcemain
Sewerline
LSSD Border
City Boundary
Urban Growth Boundary
Source: City of Lake Stevens
N
0 1,250 2,500 5,000
Feet
LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-1
VICINITY MAP
Gray & Osborne, Inc.
CONSULTING ENGINEERS
L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-1 Vicinity Map.mxd

Legend

Contours - LiDAR Generated

100'

20'

Lift Station

LSSD Border

City Boundary

Urban Growth Boundary

Source: WA DNR, City of Lake Stevens

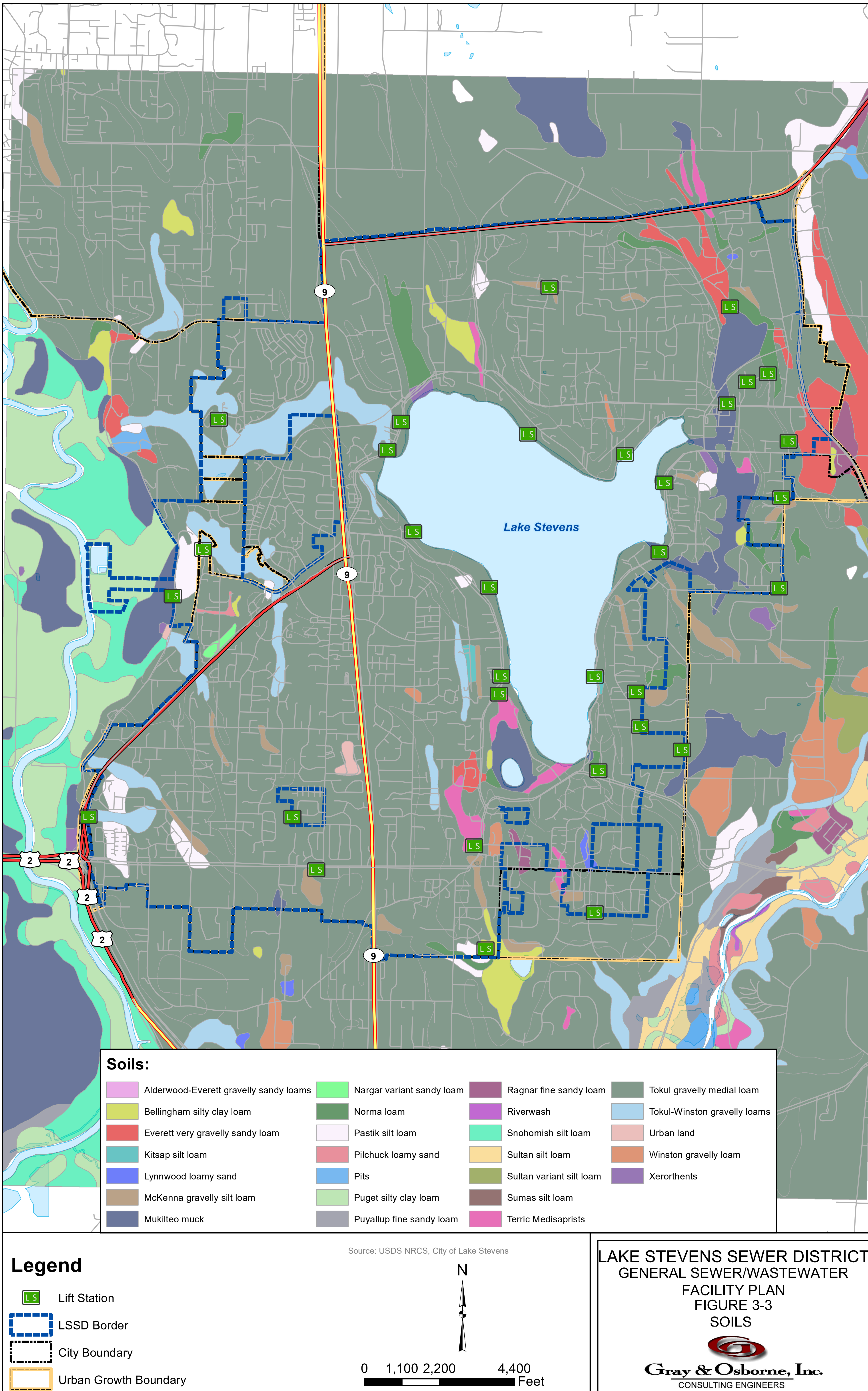
N

0 1,250 2,500 5,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-2
TOPOGRAPHIC MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-2 Topography.mxd



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-3
SOILS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-3 Soils.mxd limitations for residential use are the seasonal perched water table and the shallow depth hardpan which limits the potential for on-site sewer systems (septic tank/drainfield).

Climate

The local climate is greatly tempered by the influence of Puget Sound, typical of areas surrounding the Sound. Winters are wet and relatively mild. In general, the prevailing direction of the wind is south or southeasterly in the winter and west or northwesterly in the summer. Normal wind movement is moderate, in the range of 2 to 20 mph. Local temperatures range from 30 degrees F to 50 degrees F in the winter with brief dips below 30 degrees F. Summers are characteristically cool and relatively dry with temperatures rarely exceeding 80 degrees F. The normal frost-free season ranges from 180 to 200 days.

Table 3-2 provides precipitation and temperature data measured at the National Oceanic and Atmospheric Administration (NOAA) weather station (USC00452675) adjacent to the Snohomish River in Everett.

TABLE 3-2

Everett Weather Station Summary

Month	Mean Total Precipitation (Inches)	Mean Maximum Temperature (°F)	Mean Minimum Temperature(°F)
Jan	5.1	48.0	34.4
Feb	3.1	50.7	34.1
Mar	3.7	54.9	37.2
Apr	3.0	59.7	41.0
May	2.7	65.2	46.1
Jun	2.3	69.9	51.1
Jul	1.2	74.6	54.4
Aug	1.2	75.5	54.0
Sep	2.0	70.0	48.6
Oct	3.6	60.7	42.4
Nov	5.6	52.1	37.6
Dec	5.2	46.0	33.2
Annual Average	**38.4**	**60.6**	**42.8**

SOURCE: NOAA, National Virtual Data System.

CRITICAL AREAS

Critical areas impact the development potential within the District's service area. The following section summarizes information regarding critical areas presented in the City of Lake Stevens and Snohomish County Comprehensive Plans. Critical areas within the sewer service area include those classified as fish and wildlife habitat conservation areas (streams and waterbodies), wetlands, flood hazard areas, and geologically hazardous areas.

The City of Lake Stevens administers critical areas regulations through Chapter 14.88 of the Lake Stevens Municipal Code (LSMC). Snohomish County administers critical areas regulations through Chapters 30.62 and 30.65 of the Snohomish County Code (SCC).

Fish & Wildlife Conservation Areas (Surface Water)

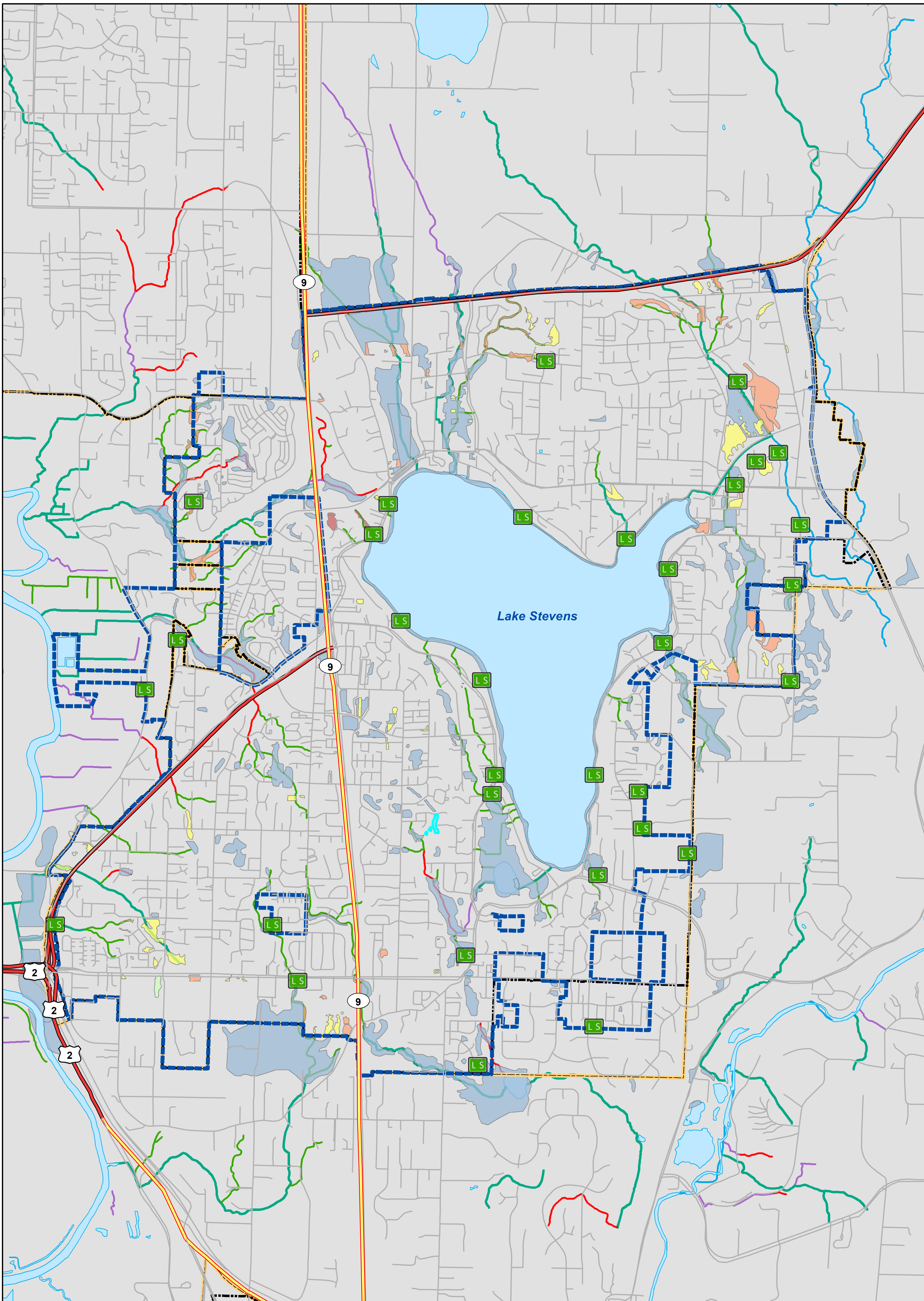
The major surface waters are shown in Figure 3-1. Lake Stevens is the major water body in the Lake Stevens UGA. The lake covers 1,040 acres and provides important habitat for species including Chinook, Coho Salmon, Bull Trout, Steelhead, the Northern Spotted Owl, and Marbled Murrelet. Sensitive fish and wildlife habitat is defined as areas that are essential for maintaining specifically listed species in suitable habitats. Buffers have been established by the City of Lake Stevens Shoreline Master Program for activities adjacent to surface waters as necessary to protect the integrity, functions and values of the resource.

Lake Stevens and Stich Lake and their associated shoreline-associated wetlands are subject to the Shoreline Management Act (SMA) and considered flood hazard zones. The Lake Stevens drainage basin encompasses a number of streams and creeks, including the Kokanee (Mitchell) Creek, Stevens Creek, Lundeen Creek, Catherine Creek, and the Little Pilchuck Creek.

Wetlands

The Growth Management Act defines wetlands as areas that have surface or ground water that supports vegetation typically adapted in saturated soil conditions. Wetlands support valuable and complex ecosystems, and, consequently, development is severely restricted if not prohibited in most wetlands and buffer areas around the wetland. There are approximately 740 acres within the City that are classified as wetlands.

The major wetlands within the District are located along the lakes and creeks. The intent of the wetland standard in Sections 14.100.200 through 14.100.263 of the City's municipal code is to prevent adverse effects to wetlands and wetland buffers from development effects. Figure 3-4 shows wetland areas within the City.



Legend

L S Lift Station

LSSD Border

City Boundary

Urban Growth Boundary

Wetland Category

- Cat I
- Cat II
- Cat III
- Cat IV
- Unclassified

Stream Type

- Fish habitat
- Perennial non-fish bearing
- Seasonal non-fish bearing
- Shoreline
- Unknown

Source: City of Lake Stevens - Wetlands, Snohomish County - Streams

N

0 1,250 2,500 5,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-4
WETLANDS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Flood Hazard Areas

Flood hazard areas are areas adjacent to lakes, rivers, streams and the ocean that are prone to flooding during peak runoff periods. Construction of buildings and other development in these areas are regulated in accordance with flood hazard construction standards. Significant portions of the District, including several collection system pumps stations and the treatment plant, are located within the 100-year floodplain map (land that has a one percent chance of flooding each year) as mapped by the Federal Emergency Management Agency (FEMA). These areas are mainly adjacent to Catherine Creek and Lake Stevens. Flood protection will be considered in the planning of the facilities upgrades. The floodplain map is shown in Figure 3-5.

Geologically Hazardous Areas

The District's service area contains many steep hillsides that are susceptible to naturally occurring landslides, earthquakes, erosion and other geological events. Steep slopes are present along the western boundary and northwest portion of the service area. Proposed developments that are located within 200 feet of any area that is designated as geologically hazardous are required to prepare a geological assessment that analyzes the potential impacts of the development. The geologically hazardous areas are shown in Figure 3-6.

WATER SYSTEM

Snohomish PUD No. 1 (PUD) provides drinking water service to the Lake Stevens UGA. The water supplied by PUD is purchased from the City of Everett after treatment at the City of Everett's water treatment plant for water supplied by Spada Lake.

The PUD owns and operates 12 separate public water systems and serves approximately 20,000 customers, with approximately 17,000 of those within Lake Stevens. The PUD distribution system includes approximately 400 miles of pipelines, 15.3 million gallons of storage, two water treatment plants, 11 booster stations, six water supply pump stations, 12 wells and 41 pressure zones.

OTHER WASTEWATER SYSTEMS

CITY OF MARYSVILLE

The City of Marysville's wastewater collection system is northwest of and adjacent to the District's. There is an interlocal agreement for sewer service between the City of Marysville and the District that provides for assumption of the District's collection system once the areas are annexed into the City of Marysville. That agreement, as well as the other Interlocal Agreements, is provided in Appendix C. Marysville maintains a wastewater treatment facility that is located approximately 3 miles northwest of the District's WWTF.

CITY OF EVERETT

The City of Everett operates its wastewater collection system east of the District, on the opposite side of Ebey, Steamboat and Union Sloughs. Everett's wastewater treatment facility is located approximately 1.5 miles west of the District's WWTF,

CITY OF SNOHOMISH

The City of Snohomish operates a wastewater collection system located south of the District's service area. Snohomish's wastewater treatment facility is located approximately 6 miles south of the District's treatment facility.

CITY OF GRANITE FALLS

The City of Granite Falls operates a wastewater collection system located along SR 92, northeast of the District's service area. Granite Falls' wastewater treatment facility is located approximately 9 miles northeast of the District's treatment facility.

ON-SITE SEWER SYSTEMS

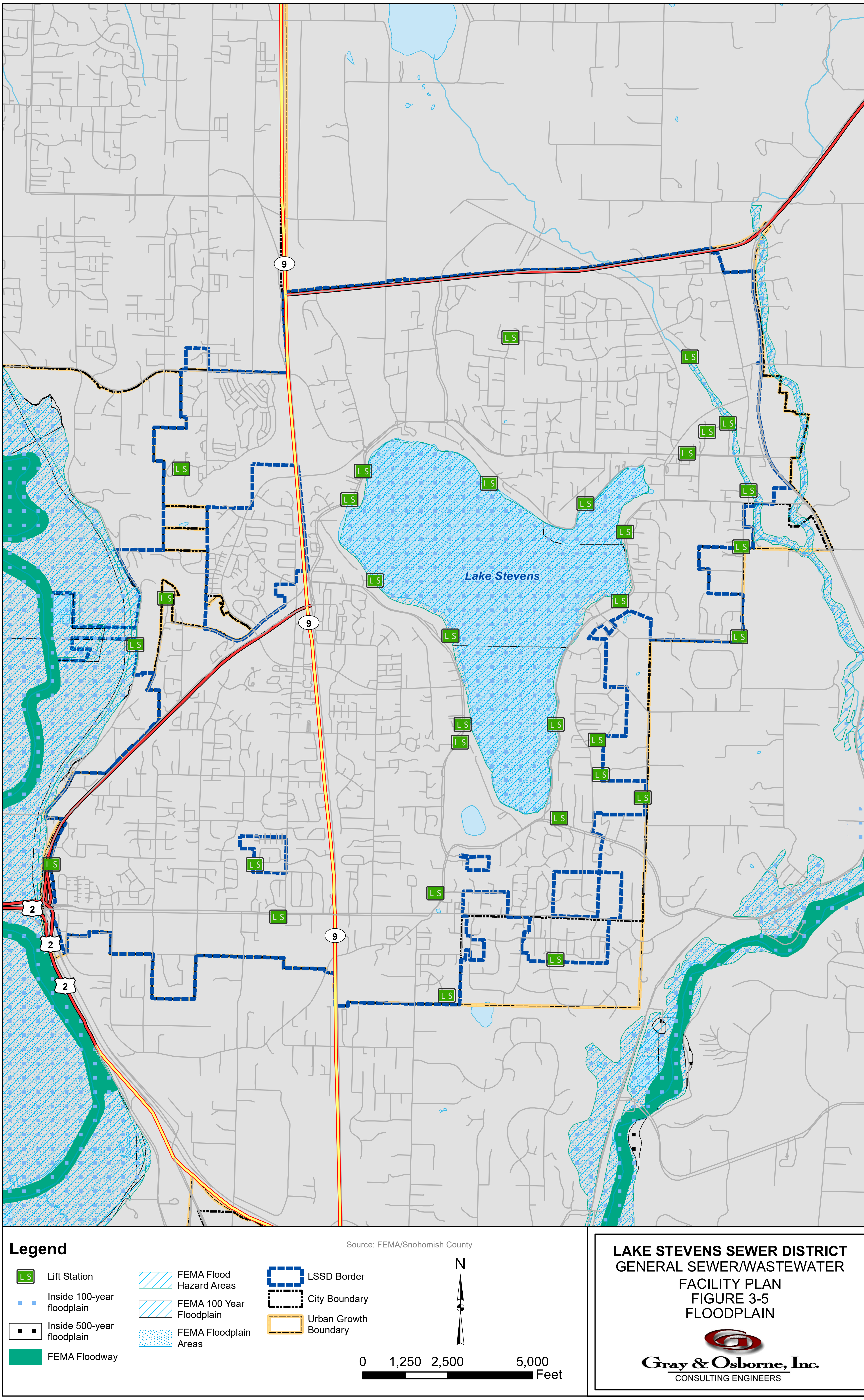
There are an estimated 1,800 properties served by on-site sewer systems within the District's service area. Figure 3-7 shows those properties as developed parcels that are not connected to the District's sewer system. On-site sewer systems are regulated by the Snohomish Health District. Per WAC 246-272A, the minimum land area required for an on-site sewer system is determined based on soil type. In general, the soil types found in the District's service area require a minimum of approximately 20,000 square feet for a property that is connected to the public water system and approximately 2 acres for those that have an on-site water supply.

Approximately 1,000 of these properties are within 200 feet of an existing sewer main and could be served by a sewer to the existing collection system or by a minimal (less than 200 feet) extension of the system. The Snohomish Health District requires connection of failing sewer systems if repair is not possible and the property is near an existing sewer system connection.

PLANNING PERIOD

In order to provide wastewater services for future growth, the wastewater system is in need of frequent evaluation and improvement. To accomplish this planning effort, sewer flows and loads are estimated for the following conditions: existing (2021), buildout and 6 (2027), 10 (2031) and 20 (2041) years.

Typically, buildout flow projections are used to size below-grade capital improvements such as conveyance pipes and wet wells. 20-year flow and load projections are used to



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-5
FLOODPLAIN

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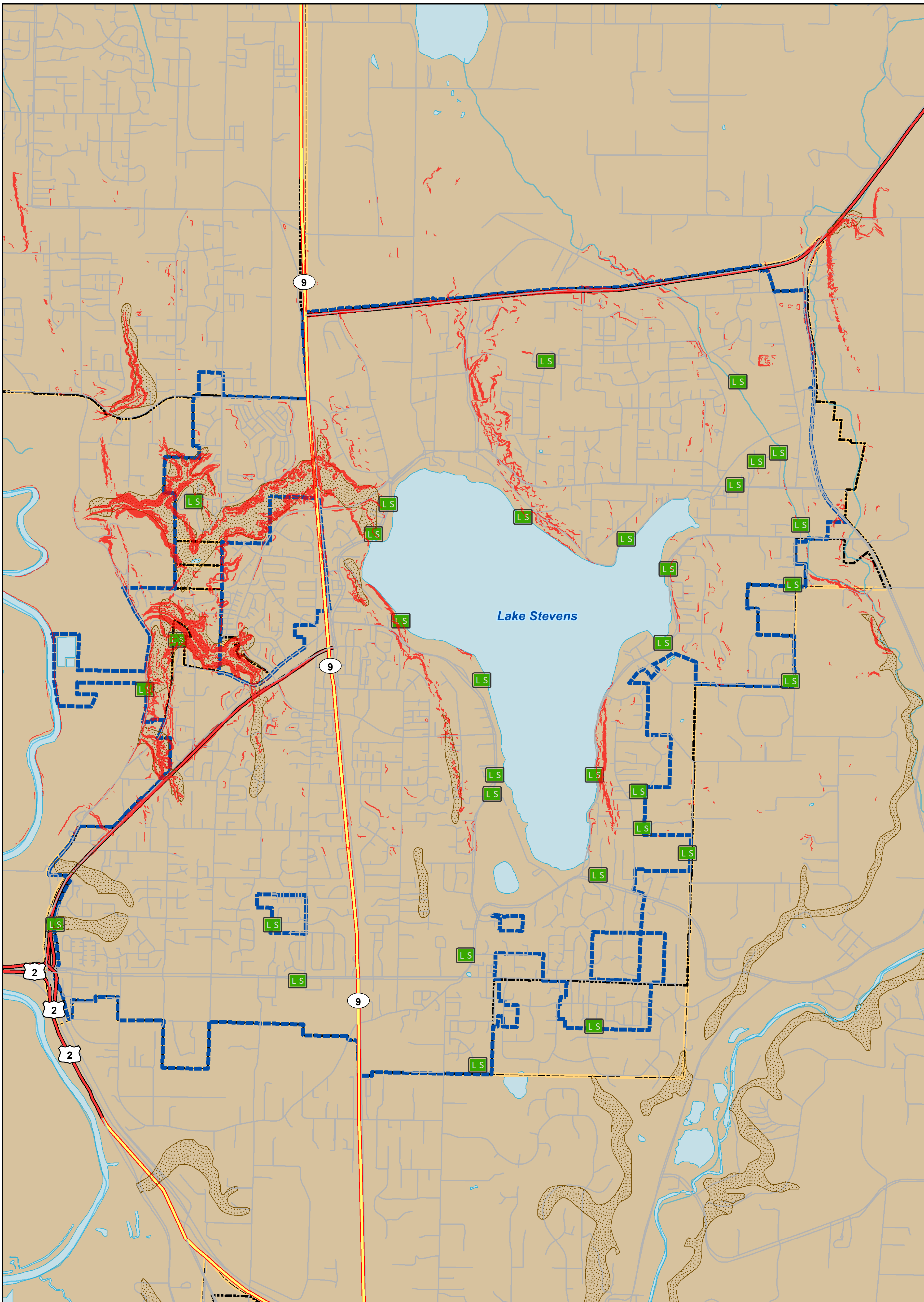
L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-5 Floodplain.mxd



Legend

Source: Snohomish County

- Lift Station
- LSSD Border
- City Boundary
- Urban Growth Boundary
- Steep Slopes (greater than 33 percent)
- Soil Erosion Hazard Areas

N

0 1,250 2,500 5,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-6
GEOLOGIC HAZARDS

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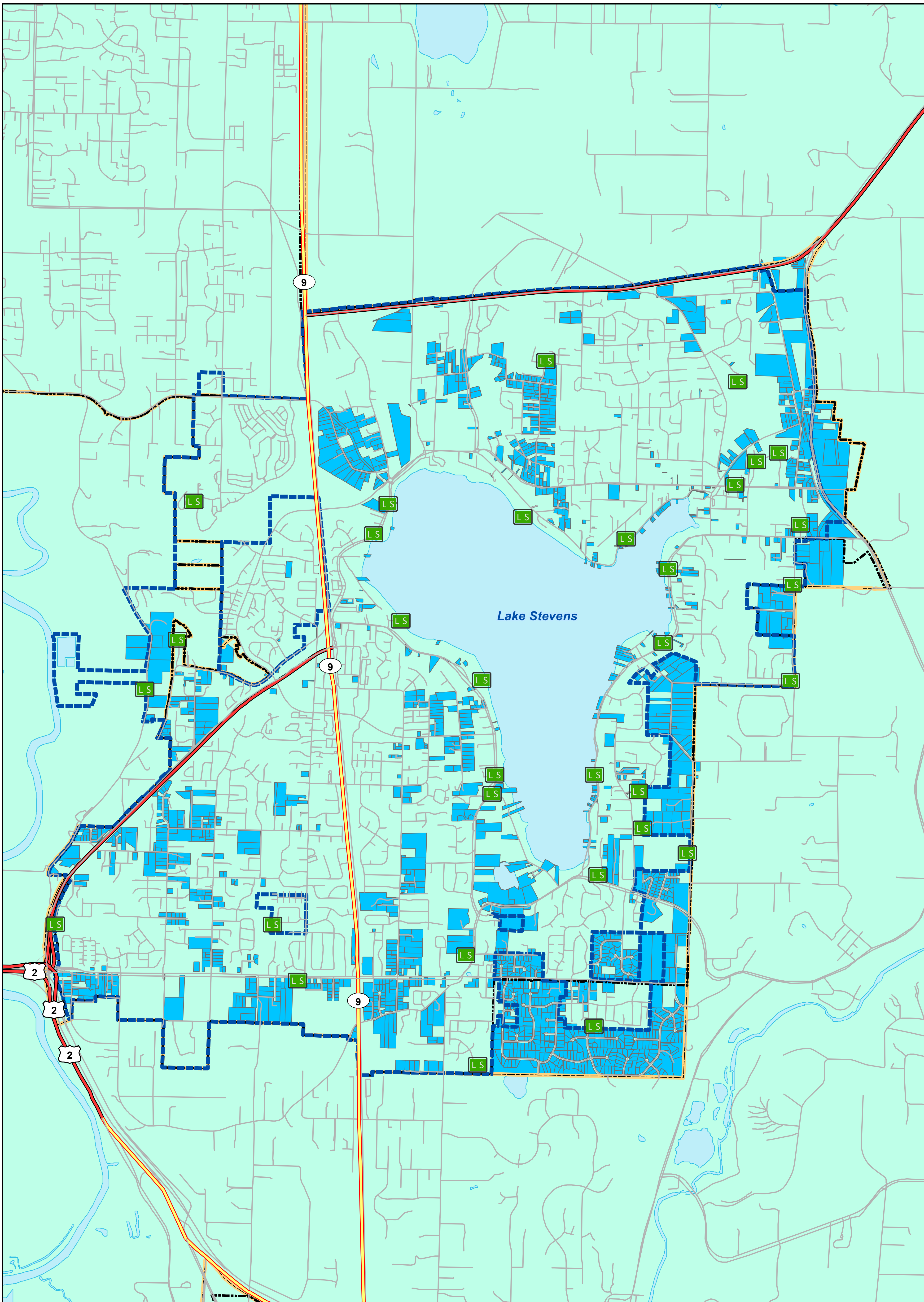
L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-6 Geologic.mxd



Legend

Source: City of Lake Stevens

- LS Lift Station
- LSSD Border
- City Boundary
- Urban Growth Boundary
- Developed Parcels without Side Sewers to Estimate Existing Septic

N

0 1,250 2,500 5,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-7
ESTIMATED EXISTING SEPTIC PARCELS

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L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-7 Existing Septic.mxd size above-grade and mechanical capital improvements. The 6- and 10-year projections are used to determine the Capital Improvement Plan (CIP) schedule.

Planning data such as land use and anticipated development, available as of March 2021, was used in the preparation of this Plan.

LAND USE

The adopted land use is used to calculate the buildout flows and loads throughout the LSUGA. This buildout condition is often referred to as "zoning capacity" because it is the maximum amount of development that would be allowable under applicable land use regulations.

The land use categories that have been adopted by the City of Lake Stevens and Snohomish County, as of March 2021, are shown in Figure 3-8 and summarized in Table 3-3.

TABLE 3-3

Land Use

Land Use Designation	Total Acres (ac)
City of Lake Stevens	
High Density Residential (HDR)	502
Medium Density Residential (MDR)	3,899
Waterfront Residential (WR)	246
Downtown/Local Commercial (D/LC or LC)	39
Commercial (COM)	400
Mixed Use (MU)	71
Planned Business District (PBD)	44
General Industrial (GI)	112
General Industrial w/ Development Agreement (GIDA)	9
Light Industrial (LI)	40
Public/Semi-Public (P/SP)	468
Total City of Lake Stevens	*5,830*
Snohomish County	
Urban Medium Density Residential (UMDR)	4
Urban Low Density Residential - 4 (ULDR-4)	449
Urban Low Density Residential - 6 (ULDR-6)	694
Urban Industrial (UI)	82
Total Snohomish County	*1,229*
Total Area	**7,059**

POPULATION AND SEWER CONNECTIONS

EXISTING POPULATION

The Washington State Office of Financial Management (OFM) provided a history of population for Lake Stevens from 2010 to 2020, as shown in Table 3-4. The UGA's population has grown by 6,081 people during that 10-year period.

TABLE 3-4

City of Lake Stevens Population 2010-2020

Year	Population(1)	Annual Growth Rate
2010	28,069	
2011	28,210	0.50%
2012	28,510	1.06%
2013	28,960	1.58%
2014	29,170	0.73%
2015	29,900	2.50%
2016	30,900	3.34%
2017	31,740	2.72%
2018	32,570	2.61%
2019	33,080	1.57%
2020	34,150	3.23%
Average Annual Growth	608	1.98%

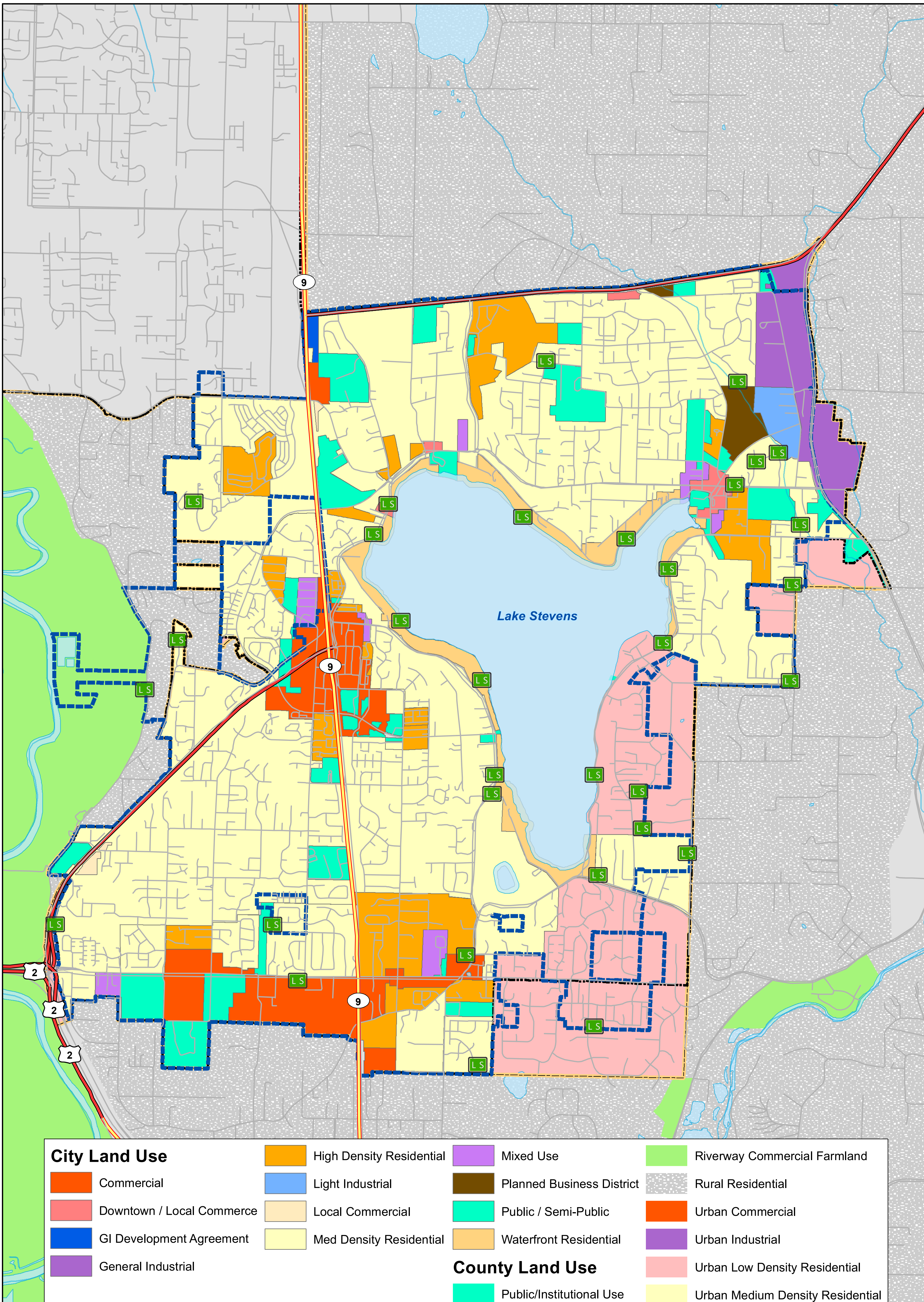
SOURCE: Washington State Office of Financial Management (OFM).

These populations and growth rates are specific to the City's municipal boundary on April 1 each year. As such, they do not correct for growth due solely to annexations to the City and do not directly correspond to growth in connections to the District's sewer system.

The OFM states that the average household size in the Lake Stevens UGA is 2.89 persons. This household size will be used throughout this Plan.

HISTORIC ERUs

Table 3-5 shows the District average residential and commercial equivalent residential units (ERUs) for each year from 2010 to 2020 based on the District's billing records.



Legend

- Lift Station
- LSSD Border
- City Boundary
- Urban Growth Boundary

Source: City of Lake Stevens

N

0 1,250 2,500 5,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 3-8
LAND USE

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L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-8 Land Use.mxd

TABLE 3-5

LSSD Sewer ERUs 2010-2020

	Average Annual ERUs				
	Residential	**Commercial(1)**	**School(1)**	**Total**	**Annual Growth**
2010	10,288	686	87	11,061	
2011	10,471	685	108	11,265	1.80%
2012	10,647	759	90	11,496	2.00%
2013	10,894	744	119	11,755	2.30%
2014	11,059	757	97	11,913	1.30%
2015	11,237	729	104	12,069	1.30%
2016	11,649	687	102	12,438	3.10%
2017	11,878	746	109	12,733	2.40%
2018	12,072	756	135	12,963	1.80%
2019	12,378	812	146	13,336	2.90%
2020	12,767	770	76	13,613	2.10%
Average					2.10%

(1) Commercial and School connections are flow-based where 750 cubic feet of water per month is one Equivalent Residential Unit (ERU).

FUTURE ERUS

The Lake Stevens Comprehensive Plan shows an annual growth rate of approximately 3.9 percent between 2010 and 2015 and projects an annual residential growth rate of 1.43 percent between 2014 and 2035. The Plan will use this growth rate for residential and school connections. Between 2035 and 2041, residential and school growth will be extrapolated at the annual growth rate of 1.43 percent.

Additionally, it is assumed that half of the 1,000 properties with on-site sewer systems that are currently within 200 feet of a connection point will connect to the sewer system at a linear rate within the 20-year period (25 annual connections).

The Lake Steven Comprehensive Plan projects an annual jobs growth of 3.5 percent between 2014 and 2035 and a projected number of jobs within the LSUGA of 7,821 in 2035. This 3.5 percent growth rate will be applied to commercial connections to the District for the 20-year planning period.

The average number of school and commercial connections from 2019 will be used as the basis for the growth rate in this analysis due to the influence of the COVID-19 pandemic on the 2020 data points.

Table 3-6 shows the resulting number of ERUs for each of the planning conditions.

TABLE 3-6

Future LSSD ERUs

	Equivalent Residential Units (ERUs)			
	Residential	**Commercial**	**School**	**Total**
Existing(1)	12,767	812	146	13,725
2021	12,949	870	150	13,969
2027	14,251	1,069	164	15,484
2031	15,175	1,227	173	16,575
2041	17,702	1,731	200	19,632

(1) Existing year for Residential ERUs is 2020 and for Commercial and School connections is 2019.

The collection system hydraulic model is discussed in detail in Chapter 6. For the purposes of the hydraulic model, connections from all active Developer Extension Agreements have been included in the Existing condition. By executing the Developer Extension Agreement with a property, the District has guaranteed sewer capacity for the number of connections listed in the Agreement for that property for a period of 3 years. The active Developer Extension Agreements (as of March 2021) are listed below in Table 3-7.

TABLE 3-7

Active Developer Extension Agreements (DEAs)

DEA	Residential ERUs	Commercial ERUs
Hillcrest Estates	12	
Nourse 3 and 4	113	
A and J	2	
Lewandowski	4	
Pellerin II	104	
StorQuest		1
Lake Drive	48	
Hewitt Ave Development	14	
Soper Hill Commercial		8
Hintz DEA	10	
Weinberg SP DEA	2	
Mountain View Phase 1 DEA	100	
Mountain View Phase 2 DEA	82	
Sedona DEA	38	
Costco DEA		12.7
Toll Estate DEA	31	
Centennial SP DEA	9	
Total	**569**	**21.7**

BUILDOUT ERUs

This buildout condition is often referred to as "zoning capacity" because it is the maximum amount of development that would be allowable under applicable land use regulations.

The City of Lake Stevens and Snohomish County have analyzed the remaining "Buildable Lands" located within the LSUGA. That data, last updated in 2019 by the City of Lake Stevens, will be used to proportionally distribute new sewer connections throughout the LSUGA.

Undevelopable areas, including critical areas (wetland, steep slopes, etc.) and easement corridors, are identified as unbuildable in the City and County Buildable Lands Inventory. No future development will be projected within these unbuildable areas.

Properties that have public/semi-public uses will be evaluated on a property-specific basis. These include mainly educational properties and parks. Growth for educational properties will be assumed proportional to the residential growth between the existing and buildout conditions. Parks are assumed to have no growth.

Figure 3-9 shows the buildable area within each land use. The District has active Developer Extension Agreements (DEAs) with a number of properties shown as the buildable areas. The number of units proposed in the active DEAs are assumed for these properties.

Table 3-8 provides a summary of the remaining buildable areas and the resulting number of new sewer connections for the buildout condition.

TABLE 3-8

Buildable Areas and Connections[1]

Land Use Designation	Assumed Gross Density for Sewer Projections (Equivalent Residential Unit/acre)	Buildable Acres (ac)	Residential ERUs	Commercial ERUs
High Density Residential	12	56.6	679.0	
Medium Density Residential	8	559.3	4474.3	
Low Density Residential	4	398.2	1592.6	
Waterfront Residential	4	51.5	205.9	
Downtown/Local Commercial	4	9.8		39.4
Commercial	8	27.4		219.0
Mixed Use	12	0.8		10.1
Planned Business District	4	1.0		3.9
Industrial	4	74.3		297.1
Total		1,179	**6,952**	**569**

(1) Land use designations in place as of March 2021.

The growth of the connections associated with Schools is assumed to be directly proportional to the residential growth rate.

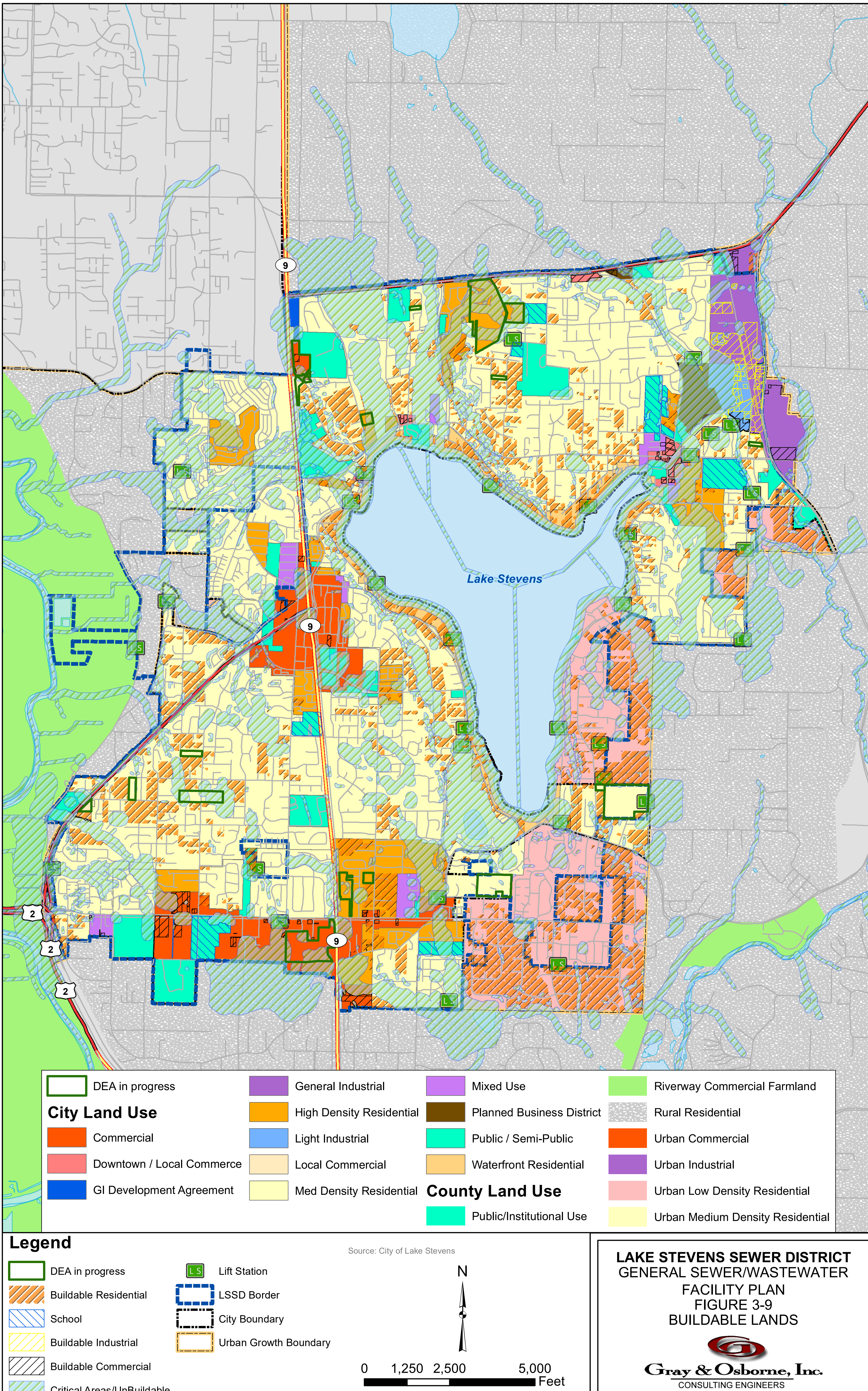
Table 3-9 shows the total Buildout Equivalent Residential Units (ERUs) in the District.

TABLE 3-9

Buildout ERUs

	ERUs			
	Residential	**Commercial**	**School**	**Total**
Existing[1]	12,767	812	146	13,725
Active DEAs	569	21.7		591
Buildable	6,952	569	86	7,607
Total	**20,288**	**1,403**	**232**	**21,923**

(1) Existing year for Residential ERUs is 2020 and for Commercial and School connections is 2019.



L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 3-9 Buildable Lands.mxd

CHAPTER 4

EXISTING COLLECTION SYSTEM

INTRODUCTION

This chapter describes the existing facilities that comprise the Lake Stevens Sewer District's wastewater collection system, and describes the condition of these facilities.

The Lake Stevens Sewer District owns, operates, and maintains a wastewater collection and treatment system consisting of approximately 126 miles of sewer pipes, 29 sewage lift stations, and a 5 million gallons per day (mgd) capacity Wastewater Treatment Facility (WWTF) with submerged outfall discharging to Ebey Slough in the Snohomish River Estuary.

The current condition of the existing sewer pipes and lift stations is summarized. The focus is on assessing the condition and developing a list to identify and develop a cost effective repair and replacement plan in order to provide for future expansion within the District's service area.

OVERVIEW

Lake Stevens Sewer District was originally formed because of poorly functioning septic systems due to the till soils in the Lake Stevens area that have low infiltration rates. Pipe trenches constructed in till soils have a tendency to "funnel" water within the trench, resulting in a high rate of infiltration into the pipe systems that are not completely watertight. The District has maintained an ongoing effort to minimize inflow and infiltration (I/I), such as manhole rehabilitation through grouting and epoxy lining and replacement of damaged sewer sections. Infiltration often strongly correlates with aging pipes. The portions of the collection system that are constructed of concrete tend to have defects such as misaligned joints, cracks, fractures, and holes.

The first portions of the District's sanitary sewer collection system were constructed in the late 1960s. The majority of the pipes installed at that time were concrete. Since that time, improved sewer system construction methods and pipe materials have been used, including nonporous piping materials and rubber-gasket joints to reduce infiltration.

The collection system conveys wastewater from around Lake Stevens, west to the District's WWTF. Because the collection system extends around the entirety of Lake Stevens and through the Lake Stevens UGA, lift stations are required to convey flow through the hilly topography. The current system consists of 30 lift stations and 8- to 36-inch diameter pipes. Wastewater is discharged to the District's Wastewater Treatment Plant, which has an outfall to Ebey Slough in the Snohomish Estuary.

COLLECTION SYSTEM PIPING

A breakdown of the size, material and age of the pipes in the District's collection system is shown in Figures 4-1, 4-2 and 4-3 and pipe lengths summarized in Tables 4-1, 4-2 and 4-3.

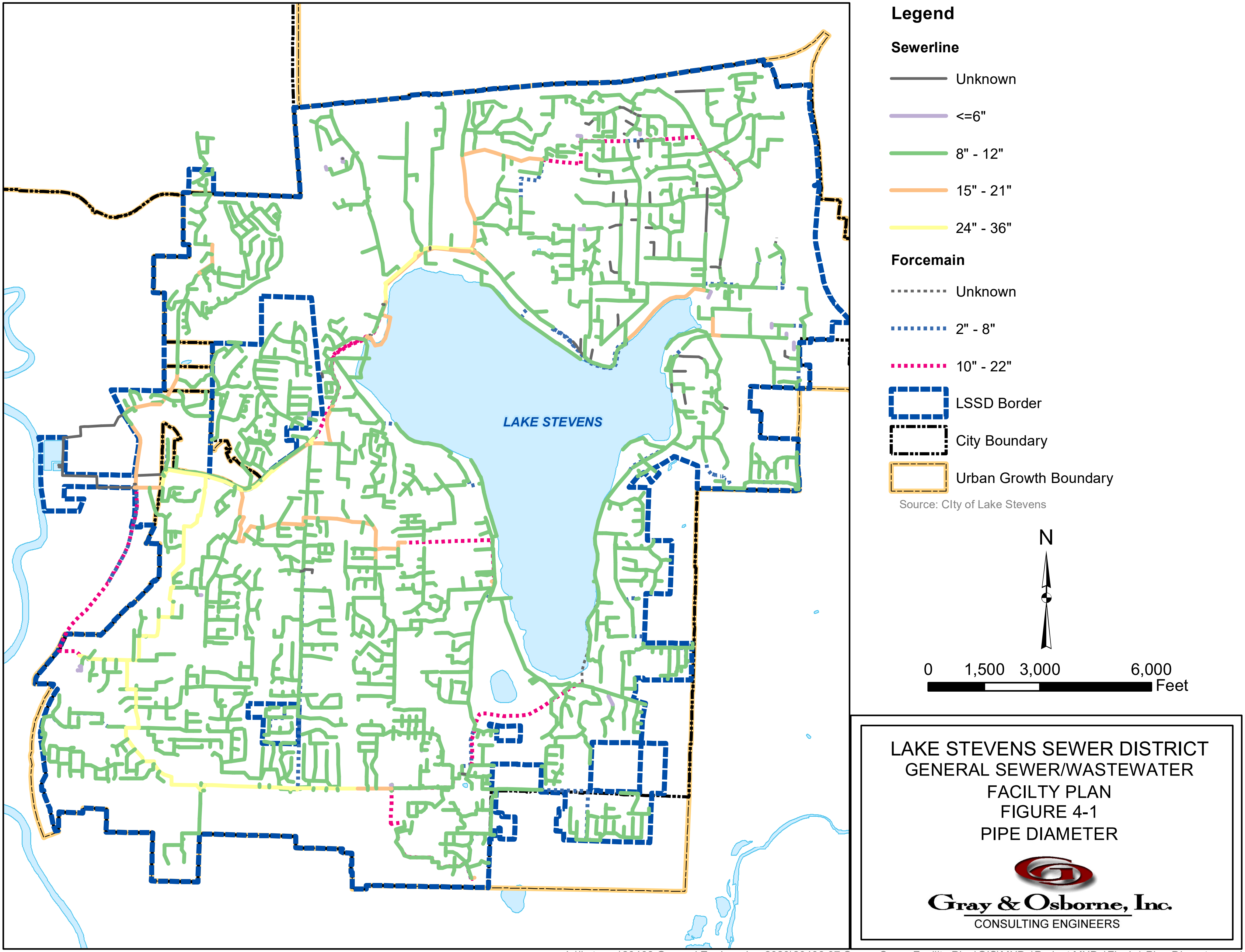
This summary is based on the District's GIS data, review of as-built drawings and previous inspections. Figure 4-1 shows the sewer system with sewer pipe diameters identified.

The District's sanitary sewer system contains approximately 3,750 manholes. Many of the District's manholes, even those precast structures with gasketed joints, show signs of infiltration.

TABLE 4-1

Sewer Pipe Size Summary

Gravity		Force Main	
Pipe Diameter (in)	**Pipe Length (ft)**	**Pipe Diameter (in)**	**Pipe Length (ft)**
<8	2,020	2	596
8	553,125	4	7,700
10	28,716	6	16,839
12	24,819	8	16,190
15-16	12,380	10	11,886
18-21	18,211	12	9,088
24	13,053	14	1,881
30	4,706	16	2,480
36	7,918	22	4,531
Total	**664,948**		**71,191**



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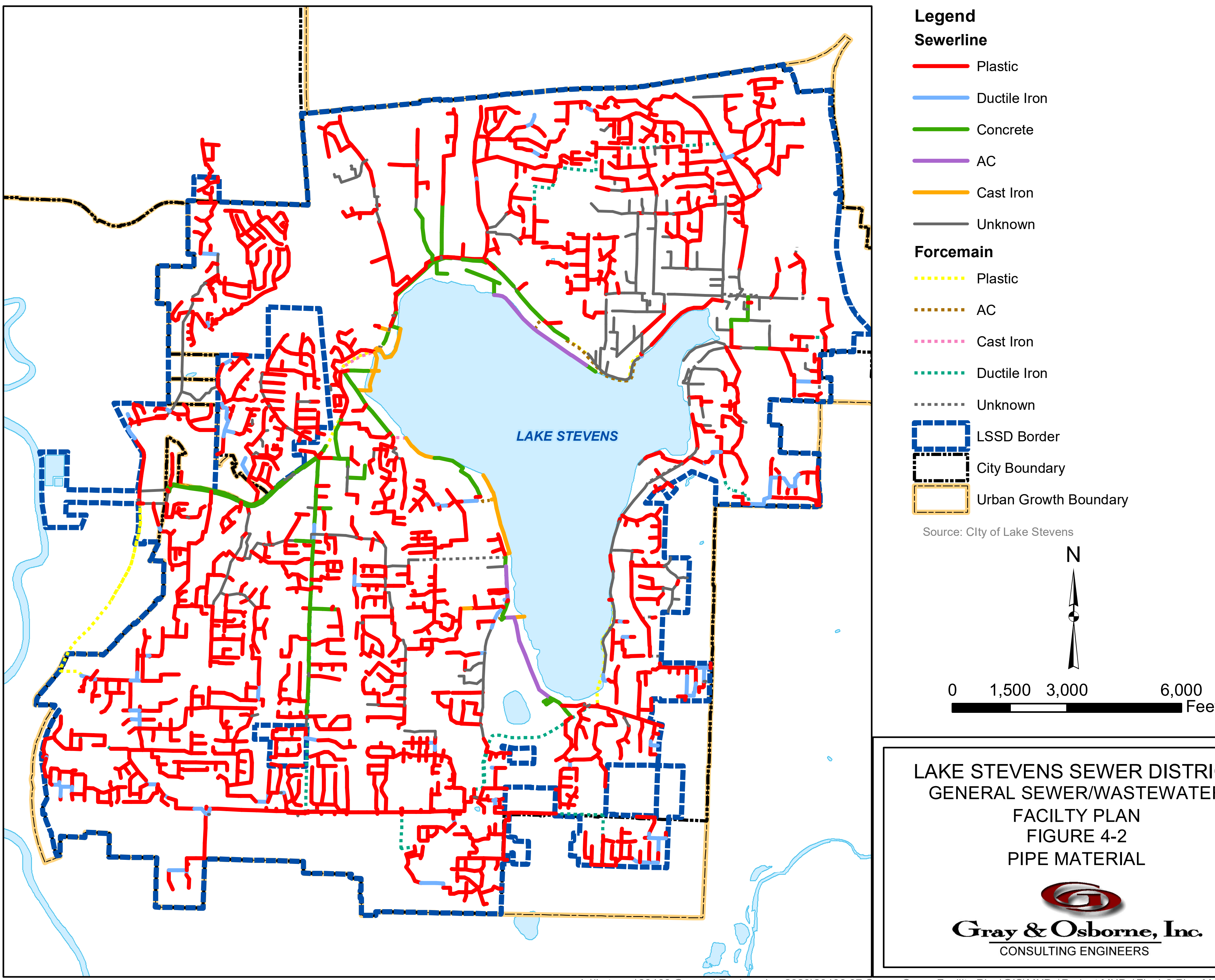

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILTY PLAN
FIGURE 4-2
PIPE MATERIAL

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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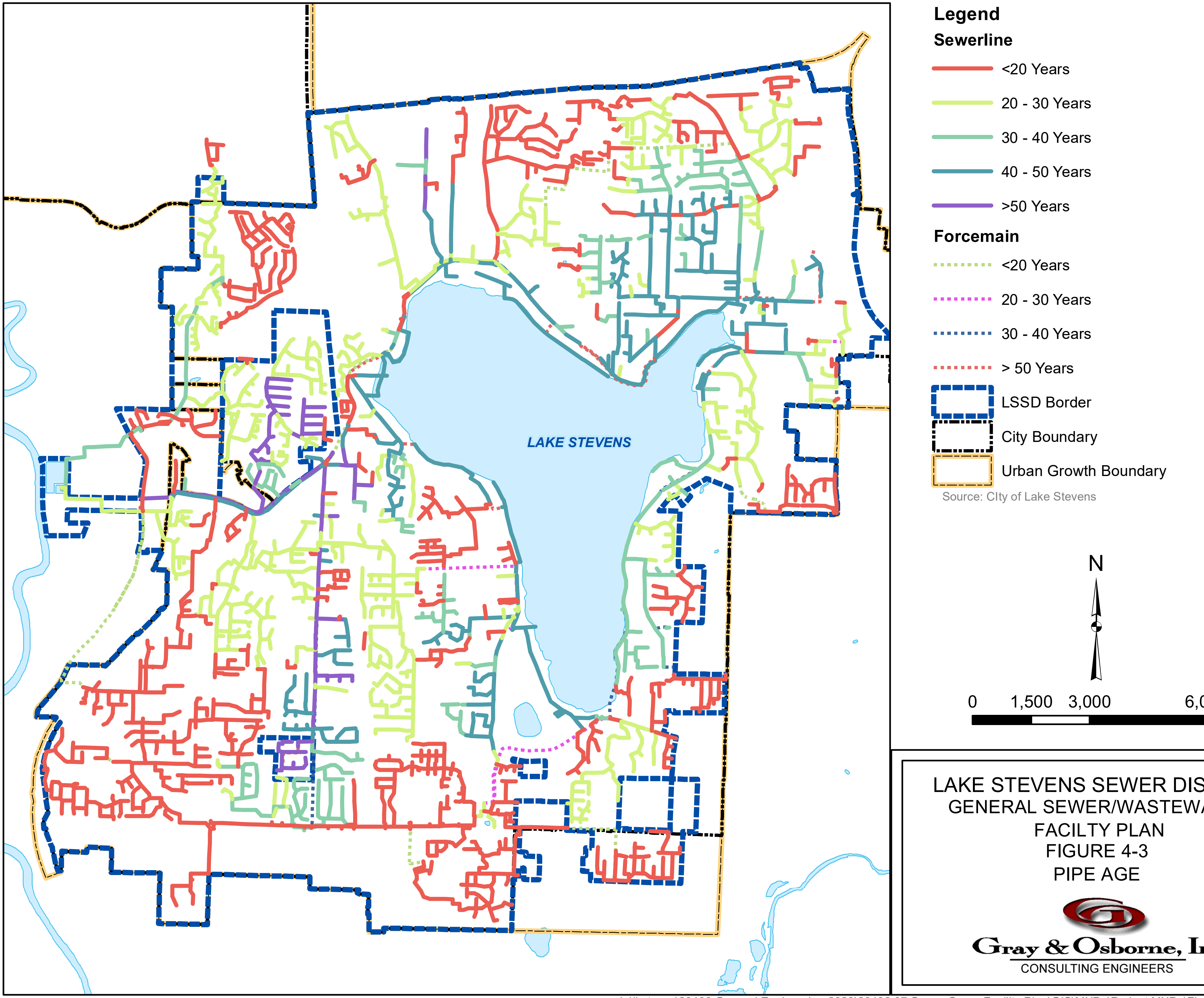


LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILTY PLAN
FIGURE 4-3
PIPE AGE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 4-3 Pipe Age.mxd

TABLE 4-2

Sewer Pipe Material Summary

Pipe Material	Gravity		Force Main	
	Pipe Length (ft)	**Percent of Total**	**Pipe Length (ft)**	**Percent of Total**
Asbestos Concrete	6,751	1.0%	4,853	6.8%
Cast Iron	7,569	1.1%	3,811	5.4%
Concrete	38,496	5.8%		
Ductile Iron	21,323	3.2%	48,108	67.6%
HDPE	3,268	0.5%	4,806	6.8%
PVC	499,536	75.1%	9,612	13.5%
Unknown	88,005	13.2%		
Total	**664,948**		**71,190**	

TABLE 4-3

Sewer Pipe Age Summary

Pipe Age	Gravity			Force Main	
	Pipe Length (ft)	**Percent of Total**	**Number of Manholes**	**Pipe Length (ft)**	**Percent of Total**
>50 Years	32,069	5%	145	9,829	14%
40-50 Years	108,956	16%	508	3,349	5%
30-40 Years	76,036	11%	384	11,421	15%
20-30 Years	178,212	27%	1,071	9,693	13%
<20 Years	269,675	41%	1,641	36,898	54%
Total	**664,948**		**3,749**	**71,190**	

District video inspection efforts have been used to identify areas of the collection system that will be prioritized in their upcoming smoke testing efforts. These areas are primarily in the oldest sections of the gravity sewer system that were constructed of asbestos concrete, reinforced concrete and cast iron. Often in older pipes constructed of these materials, there is evidence of infiltration at pipe defects such as misaligned joints, cracks, fractures and holes.

It is recommended that an annual gravity sewer repair and replacement program be established to identify and correct deficieincies in the oldest sections of collection system. The plan will assume that 20 percent of the manholes and 15 percent of the pipes that are currently more than 40 years old will be repaired or replaced as part of an annual replacement program over the next 10 years.

DOSING STATION

In the northwest portion of the Distrist, the District operates a flush/dosing tank that was installed in 1985 to prevent solids from setting by regularly passing high velocity flows. Downstream of the tank, a pair of parallel 8-inch and 12-inch diameter pipes were constructed as a siphon to cross under a creek. The flow during the "flush" is approximately 700 gpm to prevent clogs within the pipe "bellies."

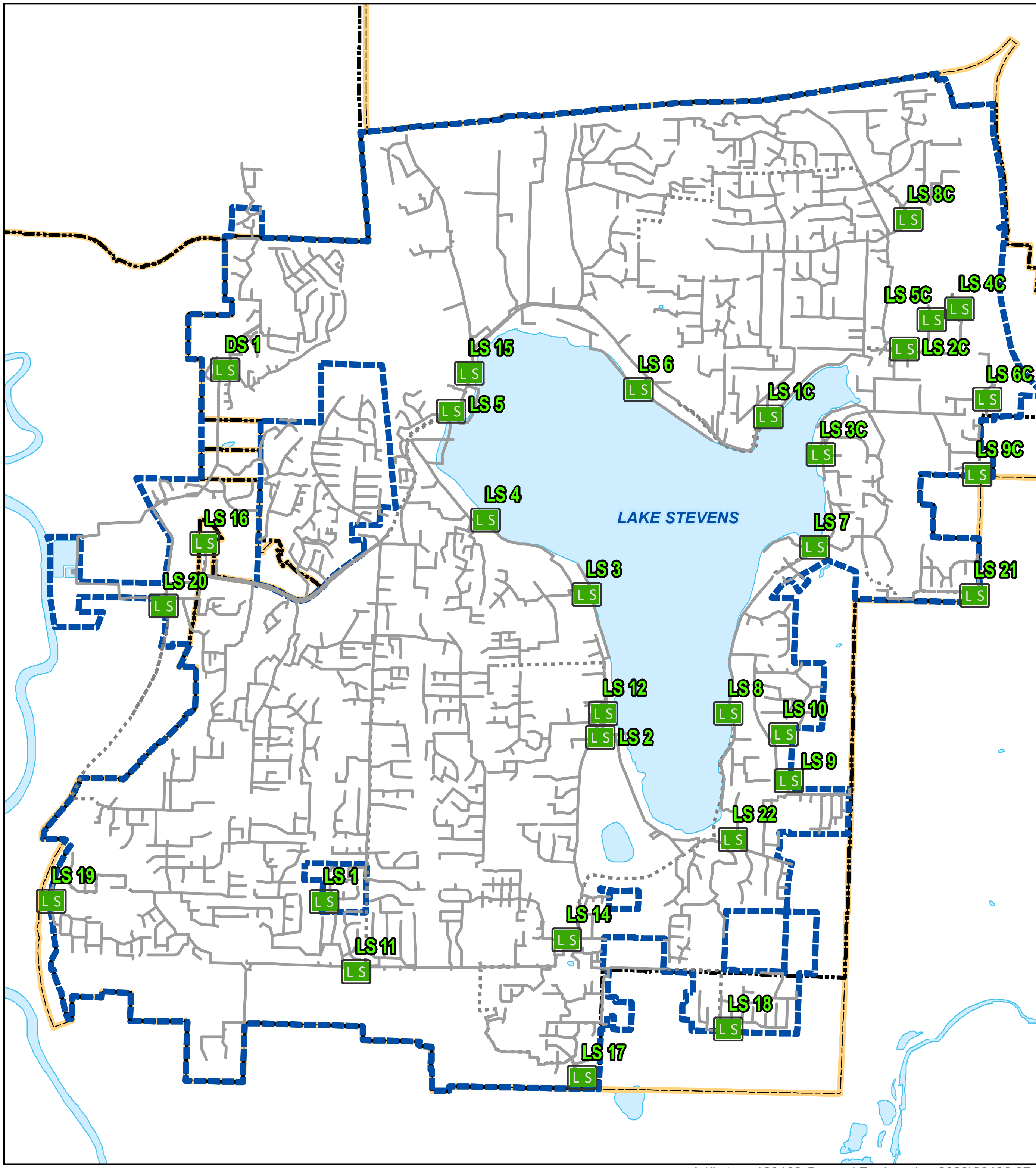
Much of the pipeline that this station flushes has limited accessibility making failures of this system difficult to detect and costly to repair.

Because of the age of this critical facility, it is recommended that it be rehabilitated and access improved within the next 10 years. The equipment and controls should be modernized and commication systems replaced with those meeting current standards.

LIFT STATIONS

The Lake Stevens Sewer District has 30 lift stations within its collection system. The locations of these lift stations are shown in Figure 4-4.

Basic information about the lift stations is included in Table 4-4. The capacity listed is the total flow able to be pumped with the largest pump out of service.



Legend

- Lift Station
- Sewerline
- Forcemain
- LSSD Border
- City Boundary
- Urban Growth Boundary

Source: CIty of Lake Stevens

N

0 1,500 3,000 6,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILTY PLAN
FIGURE 4-4
LIFT STATIONS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 4-4 Lift Stations.mxd

TABLE 4-4

Lift Stations

Station Information				Pump Information			Design Capacity		Force Main Information			Other		
Lift Station ID No.	Year Online	Station Type[(1)]	Manufacturer	No. of Pumps	Pump Model	Motor (hp)	TDH (ft)	Confirmed Capacity (gpm)	Size[(2)] (in)	Length (ft)	Material[(3)]	Discharge Manhole	Generator Data	Telemetry[(4)]
LS1	1969	W/D	Smith & Loveless	2	4B3	7.5	56	59	4	1,120	AC	58-2	None	Yes
LS2	1970/Modified 1998	W/D	Fairbanks Morse	2	5432K	7.5	48	239	6	364	AC	LS12	15 kW, 18.75 KVA, LP Gas, Kohler 15R72	Yes
LS3	1970	W/D	Fairbanks Morse	2	5432K	7.5	40.5	307	6	448	AC	23T	20kW, 18.75 KVA, LP Gas, Kohler 15R72	Yes
LS4	1970	W/D	Fairbanks Morse	2	5432K	20	76.5	580	8	123	AC	35	30 kW, 31.25 KVA, LP Gas, Kohler 30R72	Yes
LS5	1970/Modified 2004	W/D	Smith & Loveless	2	4B2A	15	50	800	9.5	1,050	HDPE	LS15	200kW, 156 KVA, Diesel, Chrysler-Nissan Surge Tank	Yes
LS6	1982	W/D	Fairbanks Morse	2	5432K	7.5	77.5	312	6	200	AC	77	30kW, 31.25 KVA, LP Gas, Kohler 30R72	Yes
LS7	1982	VP	Hydronix 181V	2	40MPC	7.5	43	200	6	1,240	PVC	801A	40kW, 28 KVA, Diesel, Lima Ser R 360	Yes
LS8	1982/Modified 2000	VP	Smith & Loveless	2	4C3B	30		Unknown	8 / 10	810/2265	HDPE/DI	753D	100 kW, Diesel, Cummins/Onan 100 DGDB	Yes
LS9	1982	GP	Myers	1	WG20-21	2	40	30	2	305	PVC	815	None	No
LS10	1982	GP	Myers	2	WG20-21	2	40	30	2	560	PVC	811	None	Yes
LS11	1983	Recessed VP	Hydronix/Paco	2	NCVU-412-11-12	25	30	400	6	65	PVC	3947	60 kW, Cummins/Onan DGDB	Yes
LS12	1998	W/D	Cornell	3	4x4x14T – VC18DR	75	193	2,000	12	3,520	DI	2535	250 kW, Diesel, Caterpillar 3306 DITA	Yes
LS14	2000	VP	Smith & Loveless	2	4B2D	10	38	480	6	980	DI	2825	35 kW, Diesel, Cummins/ Onan 35 DGBB	Yes
LS15	2004	W/D	Smith & Loveless	4	8D4C	125	170	5,250	19.4	3360	HDPE	91B	350 kW, Diesel, Cummins/ Onan 350 DFCC	Yes
LS16	2003	VP	Smith & Loveless	2	4B2D	7.5	62	155	4	717	DI	3027	25 kW, Diesel, Cummins/ Onan 25 DKAF	Yes
LS17	2006/Modified 2018	VP	Smith & Loveless	2	4D4B	75	184	800	10	3200	DI / HDPE	3345	250 kW, Diesel, Cummins/ Onan 250 DQDAA	Yes
LS18	2006	VP	Smith & Loveless	2	4D4B	25	113	290	6	1386	DI	3342	80 kW, Diesel, Cummins/ Onan 80 DGDA	Yes
LS19	2007	VP	Smith & Loveless	2	4D4B	75	226	290	6	2865	DI	3476	200 kW, 250 KVA, Diesel, Cummins 200 DSHAC	Yes
LS20	2008	VP	Smith & Loveless	2	8D4V	100	140	1650	12	5588	PVC	3411	400 kW, 500 KVA, Diesel, Cummins 400 DFEH	Yes
LS21	2006	VP	Smith & Loveless	2	4B2D	10	66	130	4	3027	DI	C82	35 kW, Diesel, Cummins DGBB	Yes
LS22	2020	W/D	Cornell	2	4NHTB	200	288	1,544	10 /14	7,660	DI / HDPE	3921	Cummins / Onan	Yes
Future LS23	2021	Submersible	Flygt	2	NP 3153	23	137	237	6	1,850	DI	3586	75 kW, Diesel, Cummins / Onan	Yes

TABLE 4-4 – (continued)

Lift Stations

Station Information				Pump Information			Design Capacity		Force Main Information			Other		
Lift Station ID No.	Year Online	Station Type(1)	Manufacturer	No. of Pumps	Pump Model	Motor (hp)	TDH (ft)	Confirmed Capacity (gpm)	Size(2) (in)	Length (ft)	Material(3)	Discharge Manhole	Generator Data	Telemetry(4)
Future LS24	2022	Submersible	Flygt	2	DP N80-3600	5.5	70	160	4	1,460	HDPE	3932	25 kW, Diesel, Cummins / Onan	Yes
LS1C	1971	W/D	Smith & Loveless	3	4C2	30	112	650	Two - 8	2870	AC/AC	79	125 kW, Diesel, Kohler 135ROZJ	Yes
LS2C	1971/Modified 2004	W/D	Smith & Loveless	2	4B28	15	40	700	8	920	DI	B14	50kW, LP Gas, Cummins	Yes
LS3C	1971	W/D	Smith & Loveless	2	4B2A	10	43	200	4	660	DI	C32	37.5 KVA, Diesel, Cummins	Yes
LS4C	1978	Submersible	Flygt	2	3085	3	27	100	6	1137	PVC	D36	None	Yes
LS5C	1993	Submersible	Meyers	2	4VX 50 M4-23	5	30	200	4	145	PVC	D34	None	Yes
LS6C	1992	W/D	Smith & Loveless	2	4B3A	5	55	100	4	337	Unknown	C36	37.5 KVA, Diesel, Cummins	Yes
LS8C	2000	W/D	Smith & Loveless	2	6D5	100	260	670	10	5300	DI	1182	230 kW, Diesel, Kohler	Yes
LS9C	1999	Vacuum Prime	Smith & Loveless	2	4B2B	3	33	150	4	480	Unknown	C102	35 kW, Diesel, Cummins	Yes

(1) W/D = Wet Pit/Dry Pit; W = Wet Well; GP = Grinder Pump; VP = Vacuum Prime.
(2) All force mains are inside diameter.
(3) AC = Asbestos Cement; HDPE = High Density Polyethylene; PVC = Polyvinyl Chloride; DI = Ductile Iron.
(4) All stations equipped with alarm auto-dialers, except as noted.
(5) The force main was recently modified to reduce TDH at the station. The resulting increase in capacity has not yet been confirmed.

LIFT STATION FACILITIES

There are four types of lift stations within the collection system: self-priming vaccum, wetpit/dry pit, submersible, and grinder.

Eleven of the stations are vacuum prime lift stations, most of which have above-grade pumps and motors located on top of the wet well. Other components include electrical, instrumentation and ancillary equipment.

Fourteen of the stations are wet pit/dry pit lift stations that have cylindrical, cast-in-place concrete or steel structures. The above-grade structure houses the electrical, instrumentation, and ancillary equipment. The wet pit and dry pit make up the below-grade portion of the structure. The dry pit and above-grade structures are pressure ventilated. The dry pit houses two vertical dry pit centrifugal pumps or dry pit submersible pumps, or a combination thereof.

Four of the station are submersible lift stations that include below-grade wet wells and valve vaults. The electrical and controls components are located above grade in their respective panel-mounted enclosures. Each wet well typically houses two submersible pumps.

CONDITION OF LIFT STATIONS

Past reports and inspections provided by the District have been reviewed to assign a condition value for the components of each lift station based on the percentage of the value of the facility that would be required to restore each station to its original physical condition and useful life, as well as an importance rating that indicates the relative consequence of specific facility failure with regard to the overall wastewater treatment process. The 2016 *Lift Station Condition Assessment* is included as Appendix E.

Site visits in inspections were performed in 2021 for the lift stations that are recommended for rehabilitation in the 10-Year Capital Improvement Plan. Photographs from that site visit are included in Appendix E.

The condition ranking scale and ratings for importance and age are shown in Tables 4-5 and 4-6.

TABLE 4-5

Facility Condition Ranking Scale

Ranking	Description	Percentage of Facility Requiring Repair
1	Very Good Condition	<5
2	Minor Defects	5 to 10
3	Maintenance Required to Return to Acceptable Level of Service	10 to 20
4	Requires Rehabilitation	20 to 40
5	Facility Unserviceable	>50

TABLE 4-6

Lift Station Rating for Importance and Age

Rating	Importance	Age (of Construction or Major Rehabilitation)
1	None - Failure would have negligible impact, such as process with adequate backup/redundancy.	<20 Years
2	Low - Failure would likely not result in interruption to the sewer service. These lift sations pump flow from 20 units or less.	20 – 30 Years
3	Moderate - Failure would result in moderate impacts, such as causing minor risk of overflow.	30 – 40 Years
4	High - Failure would have significant impacts, such as causing risk of overflow or possible risk to staff or the public health/safety.	40 – 50 Years
5	Very High - Failure would cause impacts throughout the collection system. These lift stations pump flow from multiple upstream lift stations or have a high risk of overflow to surface waters or risk to staff or public health/safety at multiple locations.	>50 Years

The condition rankings were compiled into one average component condition rating for each lift station. To calculate the overall weighted rating, the importance rating was multiplied by the facility average condition rating.

Table 4-7 summarizes the condition assessment of the lift stations. Several of the lift stations are approaching the end of their useful life and/or require upgrades in the near future.

Deficiencies to the following lift station components were used to rank the condition of each lift station and compare necessity of rehabilitation for each lift station:

- Age: Several stations have been in operation for nearly 50 years with minimal rehabilitation. Some of the mechanical components at these stations are nearing the end of their useful life.
- Site Security: Many stations are not adequately fenced and do not have intrusion sensors and do not have adequate lighting.
- Corrosion: The corrosive lift station environment has resulted in damage of many of the metal surfaces in the lift stations and deficiencies to the coatings of the concrete structures.
- Electrical: Electrical systems at many stations are nearing the end of their useful life and are not up to current standards. Station may not be NFPA 820 compliant.
- Bypass Pumping: Many stations do not have either a temporary flow bypass of the wet well or a bypass pump connection on the force main to allow pumping during power outages, pump failures or wet well maintenance.
- Backup Power: Several stations do not have a standby power generator. Others have generators that are nearing the end of their useful lives.
- Odor Control: Although sewer flow from many areas within the District is pumped through multiple lift stations, few of the District's stations have odor control mitigation. Although odor complaints have only been reported at two of the lift stations (LS 15 and LS 22), it is recommended that any station that receives flow from two or more upstream lift stations, or contributes flow to an existing odor problem, consider adding odor control mitigation.

The 2016 *Lift Station Assessment* identifies telemetry needs at many of the lift stations. The District has since implemented improvements to the telemetry systems. Per discussion with District staff, it is assumed here that the existing telemetry at all stations is adequate.

As shown in Table 4-7, the lift stations with the highest weighted ratings, those above 10, include the following: Lift Stations 1, 1C, 2, 2C, 3, 3C, 4, 6, 7. The design of projects to provide rehabilitation of Lift Stations 1C and 2C is currently in process, so no additional project will be provided. Rehabilitation of the other lift stations with the highest weighted ratings (over 10) will be planned within the 6-year CIP. Gray & Osborne staff inspected each of these lift stations that will be included in the 6-Year CIP. The findings of these inspections are summarized in the discussion of each lift station rehabilitation project in Chapter 6.

Projects to rehabilitate the the following lift stations with weighted ratings at or above 6 will be provided in the 10-Year CIP: Lift Stations 5, 8, 10, 11, 12, 14 and 15. Additionally, Lift Stations 4C, 5C, 8C and 9 have weighted ratings at or above 6. The design of a project for the rehabilitation of LS 4C and 6C and removal of LS 5C is in process and projects to increase the capacity of LS 8C and decommission LS 9 will be included in the 6-Year CIP, so no additional rehabilitation of those lift stations will be provided in the 10-Year CIP.

A summary of the components of the rehabilitation project for each of these lift stations is provided in Table 6-8. A preliminary cost estimate for the rehabilitation project for each of these lift stations is provided in Appendix F.

TABLE 4-7

Collection System Lift Stations Condition and Weighted Ratings

Lift Station	*Importance*	Age	Site Security	Corrosion	Electrical	Bypass Pumping	Backup Power	Odor Control	Average Rating	Weighted Rating
LS1	*3*	5	2	4	4	4	4	1	3.4	10.3
LS2	*4*	2	2	4	3	4	3	1	2.7	10.9
LS3	*4*	5	2	4	3	4	2	1	3.0	12.0
LS4	*4*	5	2	4	4	4	3	1	3.3	13.1
LS5	*4*	1	1	3	3	2	1	2	1.9	7.4
LS6	*4*	3	2	4	4	4	3	1	3.0	12.0
LS7	*4*	3	2	3	3	4	3	1	2.7	10.9
LS8	*4*	3	2	3	3	2	1	2	2.3	9.1
LS9	*2*	3	2	3	4	4	4	1	3.0	6.0
LS10	*2*	3	2	3	4	4	4	1	3.0	6.0
LS11	*3*	3	2	3	4	4	2	1	2.7	8.1
LS12	*4*	3	1	4	1	2	1	2	2.0	8.0
LS14	*3*	2	2	3	3	4	1	1	2.3	6.9
LS15	*5*	1	1	3	3	2	1	3	2.0	10.0
LS16	*3*	1	2	1	3	4	1	1	1.9	5.6
LS17	*3*	1	2	1	1	2	1	1	1.3	3.9
LS18	*3*	1	2	1	1	2	1	1	1.3	3.9
LS19	*3*	1	2	1	1	2	1	1	1.3	3.9
LS20	*5*	1	1	1	1	2	1	1	1.1	5.7
LS21	*3*	1	2	1	1	2	1	1	1.3	3.9
LS22	*5*	1	2	1	1	1	1	1	1.1	5.7
LS1C	*5*	5	2	4	4	4	3	2	3.4	17.1
LS2C	*5*	5	2	4	4	4	3	2	3.4	17.1
LS3C	*4*	5	2	4	4	4	3	1	3.3	13.1

TABLE 4-7 – (continued)

Collection System Lift Stations Condition and Weighted Ratings

Lift Station	*Importance*	Age	Site Security	Corrosion	Electrical	Bypass Pumping	Backup Power	Odor Control	Average Rating	Weighted Rating
LS4C	*3*	3	2	4	4	4	4	1	3.1	9.4
LS5C	*2*	2	2	4	4	4	4	1	3.0	6.0
LS6C	*3*	2	2	4	4	4	3	1	2.9	8.6
LS8C	*3*	2	1	4	3	2	1	1	2.0	6.0
LS9C	*2*	1	2	2	3	4	1	1	2.0	4.0

CHAPTER 5

WASTEWATER FLOW AND LOADING PROJECTIONS

INTRODUCTION

Proper design of wastewater treatment and conveyance facilities require the determination of the quantity and quality of wastewater generated by the users of the District's sanitary sewage collection system.

In this chapter, the existing wastewater characteristics for the service area are analyzed and projections are made for future conditions.

DEFINITIONS OF TERMS

The terms and abbreviations used in the analysis are described below, listed in alphabetical order.

Ammonia

Ammonia (NH_3) is a colorless, pungent gaseous compound of hydrogen and nitrogen that is highly soluble in water. It is a biologically active compound found in wastewater and most waters as a normal biological degradation product of nitrogenous organic matter (protein). Ammonia in water exists in pH–dependent equilibrium with ammonium ion (NH_4^+). Ammonia is toxic to aquatic biota at moderate concentrations.

Average Annual Flow

Average Annual Flow (AAF) is the average daily flow over a calendar year. This flow parameter is used to estimate annual operation and maintenance costs for treatment and lift station facilities.

Average Dry Weather Flow

Average Dry Weather Flow (ADWF) is wastewater flow during periods when the groundwater table is low and precipitation is at its lowest of the year. The dry weather flow period in western Washington normally occurs during June through September. During this time, the wastewater strength is highest, due to the lack of dilution with the ground and surface water components of infiltration and inflow. The higher strength coupled with higher temperatures and longer detention times in the sewer system create the greatest potential for system odors during this time. The average dry weather flow is the average daily flow during the three lowest consecutive flow months of the year. For this study, average flows for July, August, and September are used.

Biochemical Oxygen Demand

Biochemical Oxygen Demand (BOD) is a measure of the oxygen required by microorganisms in the biochemical oxidation (digestion) of organic matter. BOD is an indicator of the organic strength of the wastewater. If BOD is discharged untreated to the environment, biodegradable organics will deplete natural oxygen resources and result in the development of septic (anaerobic) conditions. BOD data together with other parameters are used in the sizing of the treatment facilities and provide a measurement for determining the effectiveness of the treatment process. BOD is typically expressed as a concentration in terms of milligrams per liter (mg/L) and as a load in terms of pounds per day (lb/d). The term BOD_5 refers to a 5-day BOD, often written BOD_5, since the BOD test protocol requires five days for completion. BOD_5 of a wastewater is composed of two components – a carbonaceous oxygen demand ($CBOD_5$) and a nitrogenous oxygen demand ($NBOD_5$). The use of $CBOD_5$ as a parameter for evaluating wastewater strength removes the influence of nitrogenous components, including ammonia and organic nitrogen.

Equivalent Residential Unit

An Equivalent Residential Unit (ERU) is a baseline wastewater generator that represents the average single-family residential household. An ERU can also express the average annual flow contributed by a single-family household, in units of gallons per day, or an annual average loading (of 5-day biochemical oxygen demand or total suspended solids) contributed by a single-family household, in units of pounds per day.

Infiltration

Infiltration is groundwater entering a sewer system by means of defective pipes, pipe joints or manhole walls. Infiltration quantities exhibit seasonal variation in response to groundwater levels. Storm events or irrigation trigger a rise in the groundwater levels and increase infiltration. The greatest infiltration is observed following significant storm events after prolonged periods of precipitation. Since infiltration is related to the total amount of piping and appurtenances in the ground and not to any specific water use component, it is generally expressed in terms of the total land area being served. The unit quantity generally used is gallons per acre per day.

Inflow

Inflow is surface water entering the sewer system from yard, roof and footing drains, from cross connections with storm drains and through holes in manhole covers. Peak inflow occurs during heavy storm events when stormwater systems are taxed beyond their capacity, resulting in hydraulic backups and local ponding. Inflow, like infiltration, can be expressed in terms of gallons per capita day or gallons per acre per day.

WWTF flow records are utilized to characterize infiltration and inflow (I/I) in the District system in terms of peak hour, peak day, maximum month, and average annual I/I.

Loading

Loading is the mass of a constituent in wastewater conveyed per unit time. Loading is usually expressed in pounds per day, which in water is equal to the concentration (mg/L) times the flow (in mgd) times 8.34.

Maximum Month Flow (Treatment Design Flow)

Maximum Month Flow (MMF) is the highest monthly flow during a calendar year. It typically occurs in months with maximum rainfall. In western Washington, the maximum month flow normally occurs in the winter due to the presence of more I/I. This wintertime flow is composed of the normal domestic, commercial and public use flows with significant contributions from inflow and infiltration. The predicted maximum month flow at the end of the design period is used as the design flow for sizing treatment processes and selecting treatment equipment.

Peak Hour Flow

Peak Hour Flow (PHF) is the highest hourly flow during a calendar year. The peak hour flow in western Washington usually occurs in response to a significant storm event preceded by prolonged periods of rainfall which have previously developed a high groundwater table in the service area. Peak hour flows are used in sizing the hydraulic capacity of wastewater collection, treatment and pumping components. Peak hour flow is typically determined from treatment facility flow records and projected future flows.

Total Suspended Solids

Total Suspended Solids (TSS) is a measure of the solid matter carried in the waste stream. The Total Suspended Solids in a wastewater sample is determined by filtering a known volume of the sample, drying the filter paper and measuring the increase in weight of the filter paper. TSS is expressed in the same terms as BOD; milligrams per liter (mg/L) for concentration and pounds per day (lb/day) for mass load. The amount of TSS in the wastewater is used in the sizing of treatment facilities and provides another measure of the treatment effectiveness. The concentration of TSS in wastewater affects the treatment facility biosolids production rate, treatment and storage requirements, and ultimate disposal requirements.

Wastewater

Wastewater is water-carried waste from residential, business, industry and public use facilities, together with quantities of groundwater and surface water which enter the sewer system through defective piping and direct surface water inlets. The total wastewater flow is quantitatively expressed in millions of gallons per day (mgd).

EXISTING WASTEWATER FLOWS

WWTF records for the 9-year period from 2013 through March 2021 were reviewed and analyzed to determine current wastewater characteristics and influent loadings. Current wastewater flows and loadings were then used in conjunction with projected population and ERU data in Chapter 3 to determine projected future wastewater flows and loadings.

INFLUENT WASTEWATER FLOWS AT WWTF

Table 5-1 summarizes reported WWTF influent flows for the 9-year period of 2012 to 2021. The average dry weather flow was relatively stable over the first few years of that period and has increased during the last 3 years. The monthly average WWTF flows ranged from 1.58 mgd to 3.75 mgd. The peak day flow (PDF) typically occurs between December and March.

TABLE 5-1

Historical WWTF Influent Flows (mgd, 2013 to 2021)

Flow Type	Average Dry Weather Flow (1)	Annual Average Flow	Maximum Monthly Flow	Peak Day Flow	Peak Hour Flow(2)	Annual Rainfall (in)
2013	2.13	2.51	3.23	5.90	7.07	42.7
2014	2.09	2.61	3.36	5.26	6.72	62.9
2015	2.01	2.46	3.54	5.05	7.08	47.5
2016	2.13	2.65	3.43	5.11	7.33	64.7
2017	2.13	2.75	3.55	5.15	6.20	56.8
2018	2.25	2.84	3.74	5.99	7.89	47.3
2019	2.24	2.57	2.94	5.60	7.76	41.0
2020	2.37	2.87	3.64	6.91	9.11	57.5
2021 (Jan-Mar)	-	-	3.75	5.61	6.61	-

(1) Average of July, August, September.
(2) 2021 PHF is not available and is estimated based on the flow monitoring and lift station data.

The comparison of plant influent and rainfall in Figure 5-1 shows that wastewater flow is strongly influenced by rainfall. The historic rainfall data was derived from the local Everett Airport weather station (WBAN 24222) records obtained through the NOAA website. This weather station is located approximately 10 miles southwest of the WWTF. The peak day flow of 6.91 mgd occurred during a major storm event on February 5, 2020. A peak hour flow of 9.91 mgd was reported on the same date. Historical peaking factors are presented in Table 5-2.

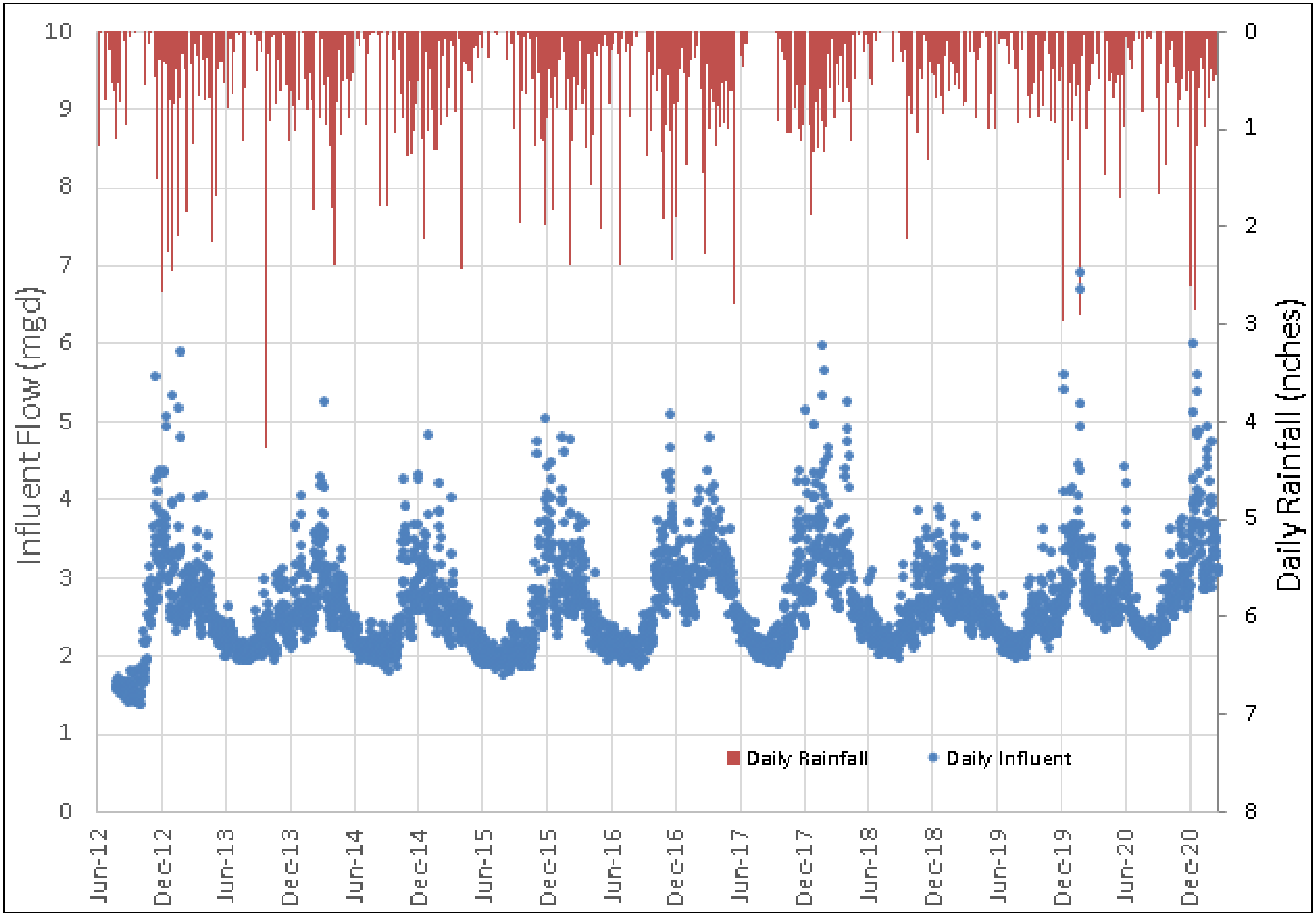


FIGURE 5-1

WWTF Daily Influent Flow

TABLE 5-2

WWTF Influent Flow Historical Peaking Factors (2013 to 2020)

Flow Type(1)	2013	2014	2015	2016	2017	2018	2019	2020	Selected PF
Average Dry Weather Flow	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Annual Average Flow	1.2	1.3	1.2	1.2	1.3	1.3	1.1	1.2	1.2
Maximum Monthly Flow	1.5	1.6	1.8	1.6	1.7	1.7	1.3	1.5	1.6
Peak Day Flow	2.8	2.5	2.5	2.4	2.4	2.7	2.5	2.9	2.9
Peak Hour Flow	3.3	3.2	3.5	3.4	2.9	3.5	3.5	3.8	3.8

(1) Peak Factors are based on average dry weather flow.

Monthly discharge monitoring reports (DMR) data for this period are provided in Appendix B and summarized in Table 5-3. Graphical representations of daily, average month, and peak day monthly WWTF flows for the period from August 2012 through March 2021 are shown in Figures 5-2 through 5-3. As shown in Figure 5-3, the data indicate that the existing permit limit of 5.01 mgd has not been exceeded as a monthly average since the WWTF was put into service in August 2012.

TABLE 5-3

Summary of Discharge Monitoring Reports (DMRs) WWTF Influent Monthly Averages

Year	Avg. Monthly Flow (mgd)	Max. Daily Flow (mgd)	Avg. Monthly BOD_5 (mg/L)	Avg. Monthly BOD_5 (lb/d)	Avg. Monthly TSS (mg/L)	Avg. Monthly TSS (lb/d)	Avg. Monthly NH3 (mg/L)	Avg. Monthly NH3 (lb/d)
Aug-12	1.59	1.73	340	4,535	294	3,916	32	420
Sep-12	1.58	1.82	391	5,163	377	5,007	33	418
Oct-12	1.79	2.90	404	5,660	334	4,693	30	450
Nov-12	3.09	5.58	211	5,233	180	4,443	19	384
Dec-12	3.61	5.09	172	5,138	154	4,630	17	508
Jan-13	3.23	5.90	196	5,124	181	4,835	19	530
Feb-13	2.83	3.40	313	6,898	261	5,750	25	554
Mar-13	2.89	4.02	350	8,513	227	5,525	24	621
Apr-13	2.81	4.06	265	5,688	227	4,948	22	498
May-13 (1)	2.32	2.55	370	7,199	303	5,891	29	571
Jun-13	2.25	2.64	375	7,027	333	6,182	28	495
Jul-13	2.07	2.25	381	6,411	310	5,263	29	495
Aug-13	2.03	2.21	394	6,547	321	5,353	33	557
Sep-13	2.29	2.98	333	6,221	292	5,469	31	600
Oct-13	2.25	2.66	365	6,725	288	5,384	31	571
Nov-13	2.58	3.13	326	6,880	263	5,559	25	527

TABLE 5-3 – (continued)

Summary of Discharge Monitoring Reports (DMRs)
WWTF Influent Monthly Averages

Year	Avg. Monthly Flow (mgd)	Max. Daily Flow (mgd)	Avg. Monthly BOD_5 (mg/L)	Avg. Monthly BOD_5 (lb/d)	Avg. Monthly TSS (mg/L)	Avg. Monthly TSS (lb/d)	Avg. Monthly NH3 (mg/L)	Avg. Monthly NH3 (lb/d)
Dec-13	2.53	3.68	306	6,089	260	5,222	28	557
Jan-14	2.78	4.05	332	7,453	238	5,389	25	577
Feb-14	2.84	3.57	347	8,325	214	5,046	21	517
Mar-14	3.36	5.26	236	6,477	175	4,780	20	547
Apr-14	2.71	3.15	316	7,121	260	5,851	26	567
May-14	2.57	3.36	288	6,013	254	5,273	27	573
Jun-14	2.22	2.50	337	6,053	298	5,362	33	582
Jul-14	2.10	2.44	319	5,500	285	4,927	33	569
Aug-14	2.06	2.43	319	5,490	299	5,125	33	571
Sep-14	2.10	2.41	352	6,209	312	5,435	33	579
Oct-14	2.52	4.28	328	7,111	267	5,566	26	562
Nov-14	2.96	3.94	282	6,438	224	5,366	24	555
Dec-14	3.11	4.34	241	6,147	194	4,959	22	549
Jan-15	2.85	4.85	287	6,476	215	4,809	27	606
Feb-15	2.87	4.22	277	6,068	220	4,935	25	563
Mar-15	2.60	4.04	342	7,001	252	5,216	28	563
Apr-15	2.40	2.69	270	5,298	205	4,030	31	606
May-15	2.20	2.65	293	5,315	246	4,465	36	647
Jun-15	2.06	2.31	297	5,027	245	4,181	37	632
Jul-15	1.97	2.17	311	5,031	263	4,261	38	613
Aug-15	1.98	2.39	297	4,803	260	4,198	40	643
Sep-15	2.10	2.41	293	4,989	232	3,993	38	625
Oct-15	2.09	2.67	306	5,275	256	4,410	37	640
Nov-15	2.87	4.75	213	4,967	189	4,327	26	583
Dec-15	3.54	5.05	186	5,316	158	4,467	21	579
Jan-16	3.12	4.81	180	4,743	178	4,549	23	571
Feb-16	2.98	4.79	189	4,553	176	4,169	25	583
Mar-16	3.08	3.80	196	4,882	183	4,611	24	603
Apr-16	2.44	3.07	244	4,874	220	4,390	32	626
May-16	2.23	2.58	285	5,335	246	4,584	36	667
Jun-16	2.16	2.39	288	5,087	254	4,505	34	601
Jul-16	2.09	2.30	295	5,076	261	4,494	36	627
Aug-16	2.06	2.23	332	5,653	280	4,771	37	635
Sep-16	2.25	2.55	290	5,387	298	5,578	39	728
Oct-16	2.81	3.75	241	5,428	222	4,935	32	701
Nov-16	3.43	5.11	170	4,734	165	4,586	21	591
Dec-16	3.18	3.81	192	4,887	185	4,727	25	650
Jan-17	2.84	3.72	220	5,221	199	4,748	28	663

TABLE 5-3 – (continued)

Summary of Discharge Monitoring Reports (DMRs)
WWTF Influent Monthly Averages

Year	Avg. Monthly Flow (mgd)	Max. Daily Flow (mgd)	Avg. Monthly BOD_5 (mg/L)	Avg. Monthly BOD_5 (lb/d)	Avg. Monthly TSS (mg/L)	Avg. Monthly TSS (lb/d)	Avg. Monthly NH3 (mg/L)	Avg. Monthly NH3 (lb/d)
Feb-17	3.23	4.13	188	4,926	172	4,555	23	610
Mar-17	3.55	4.82	159	4,664	159	4,676	21	599
Apr-17	3.27	3.86	180	4,885	177	4,834	23	616
May-17	2.93	3.63	234	5,674	218	5,283	31	739
Jun-17	2.41	2.64	327	6,594	305	6,146	36	734
Jul-17	2.21	2.45	340	6,378	281	5,266	39	754
Aug-17	2.09	2.23	328	5,748	278	4,867	38	673
Sep-17	2.09	2.36	316	5,523	291	5,091	40	693
Oct-17	2.29	2.88	289	5,338	265	4,871	41	703
Nov-17	3.00	4.38	237	5,650	232	5,561	27	640
Dec-17	3.13	5.15	242	5,620	203	4,875	26	617
Jan-18	3.62	4.96	173	5,133	173	5,143	20	598
Feb-18	3.74	5.99	169	4,719	161	4,493	21	600
Mar-18	3.08	3.73	207	5,198	199	5,027	25	631
Apr-18	3.52	5.27	176	4,923	168	4,876	21	599
May-18	2.55	2.79	254	5,453	232	5,001	35	755
Jun-18	2.47	3.09	266	5,575	239	5,006	35	731
Jul-18	2.23	2.53	315	5,777	272	5,022	35	655
Aug-18	2.15	2.37	311	5,512	267	4,750	38	682
Sep-18	2.37	3.17	288	5,516	252	4,806	37	689
Oct-18	2.46	3.17	273	5,611	255	5,211	33	696
Nov-18	2.95	3.87	211	4,930	209	4,888	29	674
Dec-18	2.94	3.91	228	5,122	220	5,068	29	659
Jan-19	2.88	3.80	222	5,169	200	4,676	28	650
Feb-19	2.93	3.70	234	5,572	194	4,645	26	638
Mar-19	2.68	3.53	256	5,724	224	4,993	31	689
Apr-19	2.76	3.80	238	5,254	217	4,799	31	695
May-19	2.47	2.73	298	6,029	272	5,503	37	760
Jun-19	2.35	2.65	320	6,182	272	5,266	39	760
Jul-19	2.17	2.77	335	6,153	295	5,416	39	723
Aug-19	2.12	2.27	333	5,847	300	5,305	40	701
Sep-19	2.44	3.01	283	5,706	264	5,283	35	703
Oct-19	2.58	3.64	271	5,709	228	4,845	33	703
Nov-19	2.52	3.34	258	5,291	234	4,869	34	708
Dec-19	2.94	5.60	289	6,655	229	5,175	31	682
Jan-20	3.42	4.16	200	5,624	189	5,325	23	650
Feb-20	3.64	6.91	208	5,608	176	4,754	24	641
Mar-20	2.83	3.54	253	5,852	210	4,894	31	723

TABLE 5-3 – (continued)

Summary of Discharge Monitoring Reports (DMRs)
WWTF Influent Monthly Averages

Year	Avg. Monthly Flow (mgd)	Max. Daily Flow (mgd)	Avg. Monthly BOD_5 (mg/L)	Avg. Monthly BOD_5 (lb/d)	Avg. Monthly TSS (mg/L)	Avg. Monthly TSS (lb/d)	Avg. Monthly NH3 (mg/L)	Avg. Monthly NH3 (lb/d)
Apr-20	2.60	2.90	302	6,533	240	5,187	36	781
May-20	2.72	3.38	294	6,559	248	5,516	34	767
Jun-20	3.04	4.45	241	5,863	216	5,259	30	736
Jul-20	2.45	2.74	327	6,706	269	5,527	38	774
Aug-20	2.30	2.48	335	6,365	289	5,501	41	763
Sep-20	2.37	2.86	302	5,969	296	5,845	41	816
Oct-20	2.68	3.63	271	6,069	237	5,348	37	775
Nov-20	3.05	3.77	218	5,975	207	5,288	29	753
Dec-20	3.39	6.01	217	6,088	197	5,630	27	767
Jan-21	3.75	5.61	205	6,215	177	5,331	25	747
Feb-21	3.72	4.93	183	5,695	167	5,180	24	745
Mar-21	3.17	3.34	218	5,638	198	5,131	30	779
Ave.	**2.67**	**3.54**	**274**	**5,763**	**238**	**5,009**	**30**	**635**
Max.	**3.75**	**6.91**	**404**	**8,513**	**377**	**6,182**	**41**	**816**
Min.	**1.58**	**1.73**	**159**	**4,535**	**154**	**3,916**	**17**	**384**

(1) The unusually high loading on 5/22/2015: 1,995 mg/l and 38,767 lb/d BOD, 832 mg/l TSS and 16,168 lb/d TSS, is exclude from this analysis since they are unrepresentative.

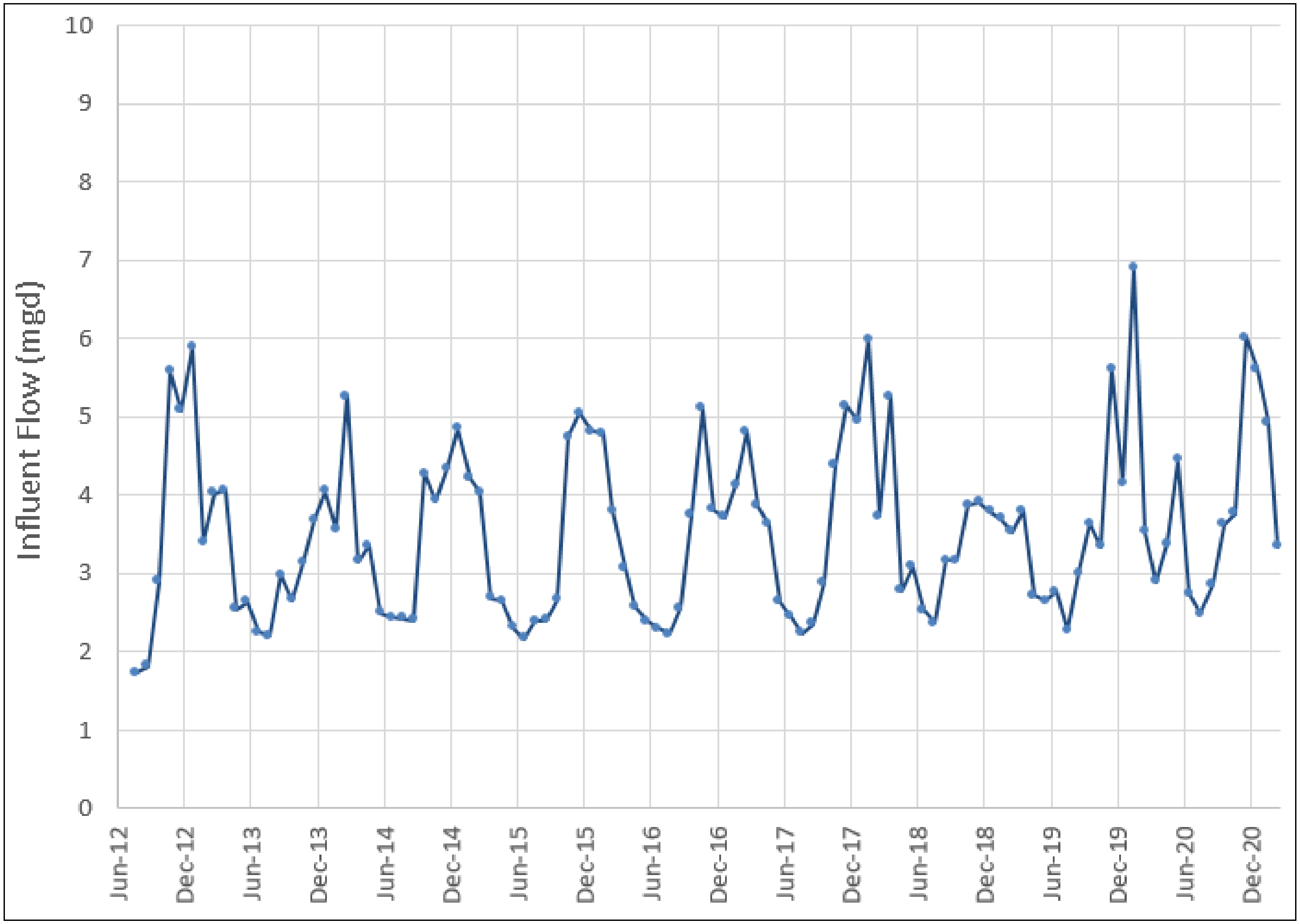


FIGURE 5-2

WWTF Monthly Peak Day Influent Flow

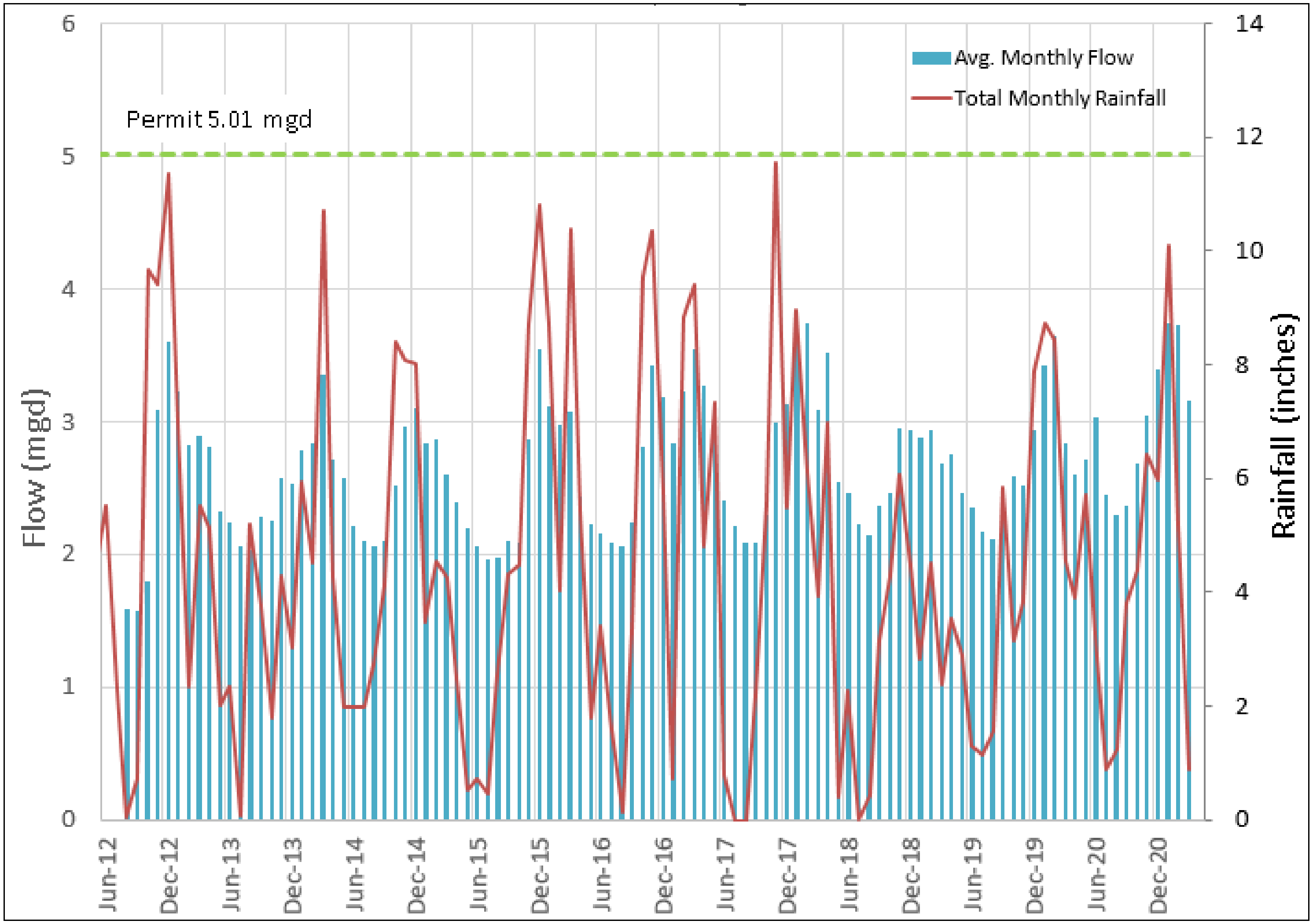


FIGURE 5-3

WWTF Monthly Average Influent Flow

EQUIVALENT RESIDENTIAL UNITS

Use of Equivalent Residential Units (ERUs) is a way to express the amount of sewer use by residential customers as well as non-residential customers as an equivalent number of residential customers.

The average water use per ERU can be determined a number of ways. Below we compare the average water use estimate by two sets of available data: the average inflow to the WWTF and winter water use drinking.

Winter water use is used to determine base flow because there are fewer water demands that are not tributary to the sanitary sewer system, such as irrigation, vehicle washing or outdoor residential recreation during the winter. An estimated 95 percent of winter water consumption is discharged to the sanitary sewer.

WWTF FLOWS

Dividing the 2020 Average Dry Weather Flow (ADWF) at the WWTF (2.37 mgd) by the total number of sewer ERUs in the service area (13,725 ERUs, from Table 3-6) yields an average flow of 173 gallons per day per ERU (gpd/ERU). This flow factor represents the base sanitary flow and likely a small amount of infiltration flow.

This flow will be used to project future flows within the District's service area.

WATER CONSUMPTION DATA

To assist in the determination of the number of residential units with sewer service, the water consumption data between 2016 and 2020, as provided by Snohomish PUD, was reviewed. (Note: water consumption data strictly for Lake Stevens Sewer District customers was not available – only for the entire Snohomish PUD service area.) Approximately 65 percent of the Snohomish PUD water customers are within the Lake Stevens UGA. As such, the water use of these customers is representative of the water use of LSSD sewer connections.

The residential winter water consumption (November through February) was used to estimate the average base flow. One single-family residential connection is equivalent to one ERU. The data shows an average of 2,594,315 gpd winter water use across 18,367 single-family residential connections. This translates to 141 gpd/ERU (= 2,594,315 gpd/ 18,367 single-family ERUs).

Winter water consumption is typically used to estimate wastewater volumes entering the collection system. Assuming 95 percent of the water usage enters the wastewater system (typically it is assumed that 90 to 95 percent does), the ERU sewage flow is 134 gpd/ERU (= 141 gpd/ERU water usage x 95 percent).

The winter water consumption derived ERU unit flow is at the low end of the range of values across the Puget Sound region, as shown in Table 5-4.

TABLE 5-4

Comparable Wastewater Flows in Western Washington

City/District	Unit Flow Per ERU	Capita/ERU
City of Burlington	138	3.36
Southwest Suburban Sewer District (in Burien, King County)	147	2.45
Alderwood Water and Wastewater District	191	2.9
City of Puyallup	182	2.43
City of Monroe	195	2.9
City of Lynnwood	175	2.5
City of Edmonds	150	2.36

Due to the relatively low value of unit flow estimated using winter water use compared to the base flow estimated based on WWTF influent, and the fact that water use data strictly for the District's sewer service area was not available, the latter (173 gpd/ERU) will be used to project future flows within the LSSD service area.

EXISTING WASTEWATER LOADING

Influent BOD_5, TSS and ammonia loadings as sampled for the period from August 2012 through March 2021 are shown in Figures 5-4 through 5-9. The annual average, maximum month, and peak day BOD_5, TSS and ammonia loadings for 2012 through 2021 are summarized in Table 5-5. The BOD_5 and TSS loadings have been fairly constant while ammonia loading has tended to increase as shown from the reported data.

TABLE 5-5

WWTF Influent Loadings (2013-2021)

Year	Annual Average			Max. Month			Peak Day		
	BOD_5 (lb/d)	TSS (lb/d)	NH3 (lb/d)	BOD_5 (lb/d)	TSS (lb/d)	NH3 (lb/d)	BOD_5 (lb/d)	TSS (lb/d)	NH3 (lb/d)
2013	6,610	5,448	548	8,513	6,182	621	15,652	10,011	920
2014	6,528	5,257	562	8,325	5,851	582	11,497	10,883	660
2015	5,464	4,441	608	7,001	5,216	647	14,339	8,444	824
2016	5,053	4,658	632	5,653	5,578	728	7,580	11,424	811
2017	5,518	5,064	670	6,594	6,146	754	8,519	9,614	882
2018	5,289	4,941	664	5,777	5,211	755	7,495	7,257	1,150
2019	5,774	5,065	701	6,655	5,503	760	9,977	7,479	1,008
2020	6,101	5,339	746	6,706	5,845	816	10,224	9,602	916
2021 (Jan-Mar)	-	-	-	6,215	5,331	779	8,185	5,960	868
Average	**5,792**	**5,027**	**641**	**6,826**	**5,651**	**716**	**10,385**	**8,964**	**893**

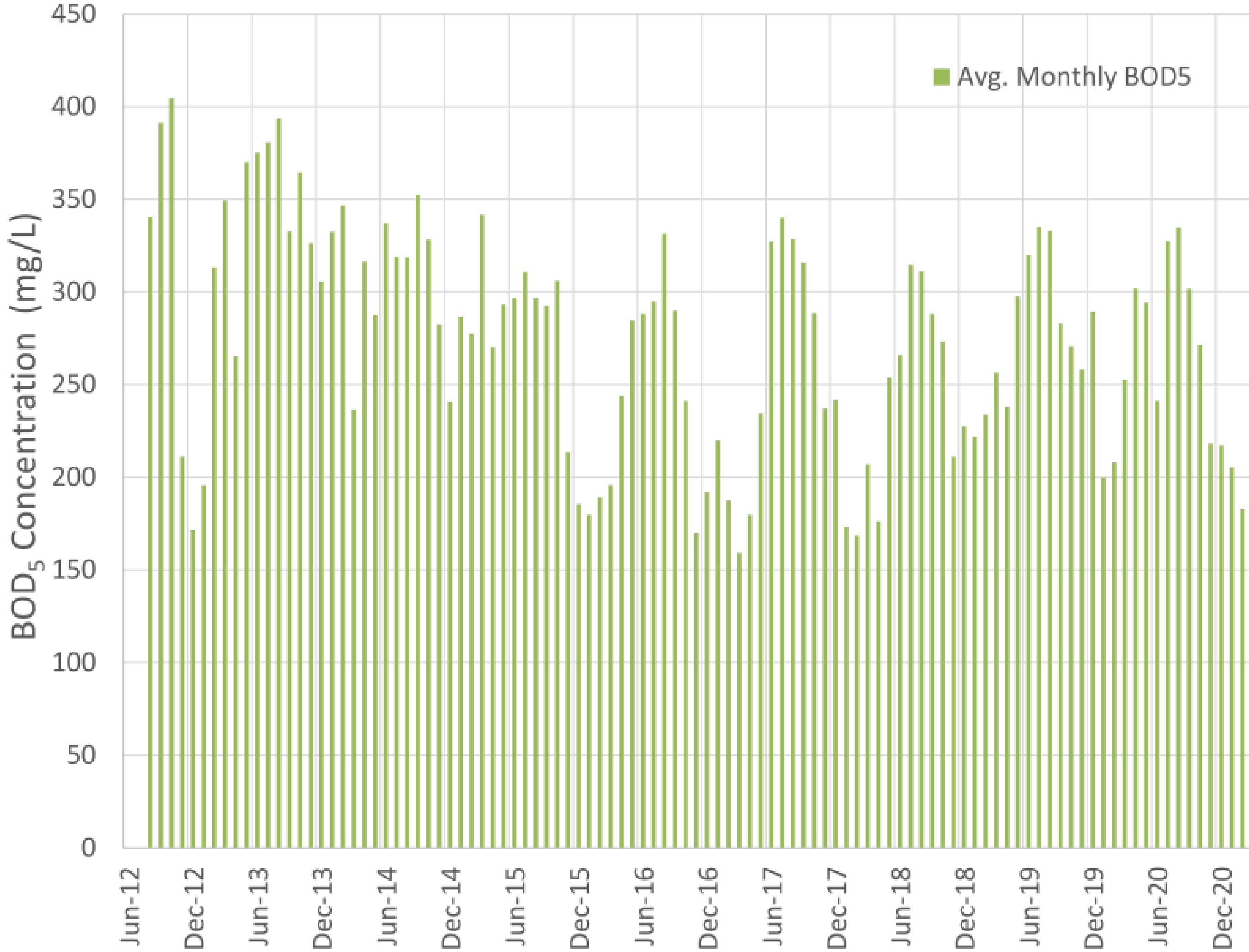


FIGURE 5-4

Monthly Average WWTF Influent BOD_5 Concentrations

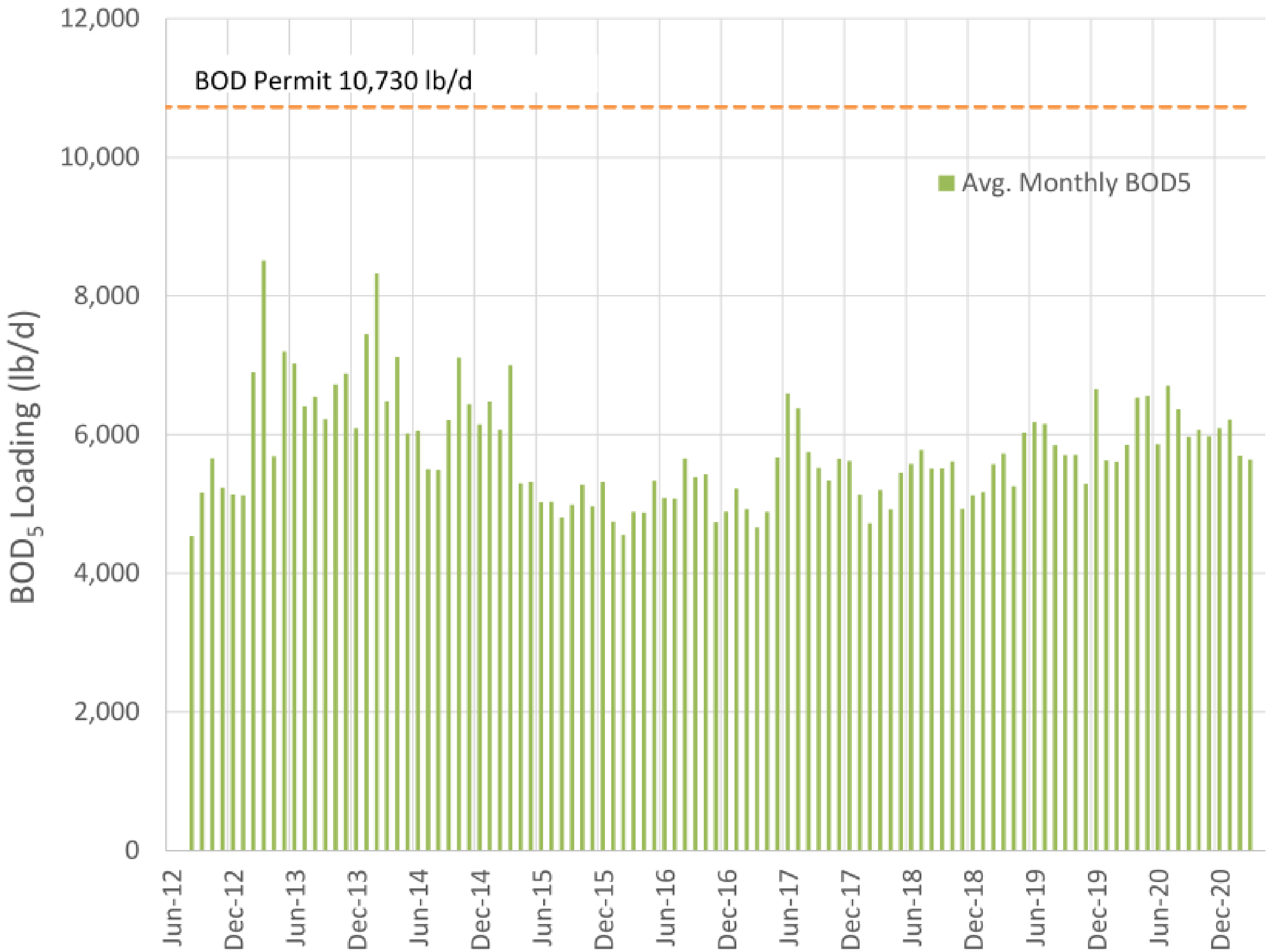


FIGURE 5-5

Monthly Average WWTF Influent BOD_5 Loadings

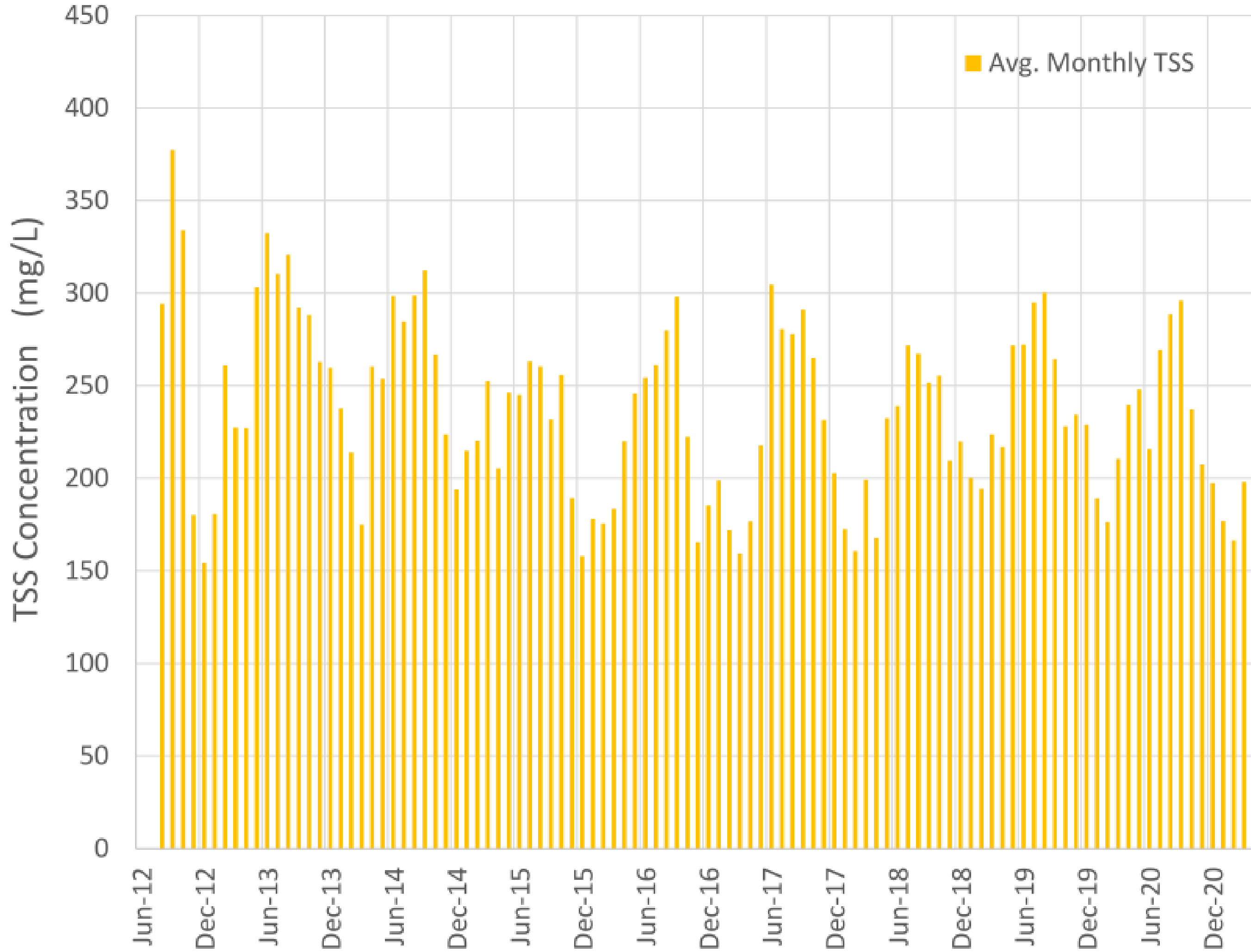


FIGURE 5-6

Monthly Average WWTF Influent TSS Concentrations

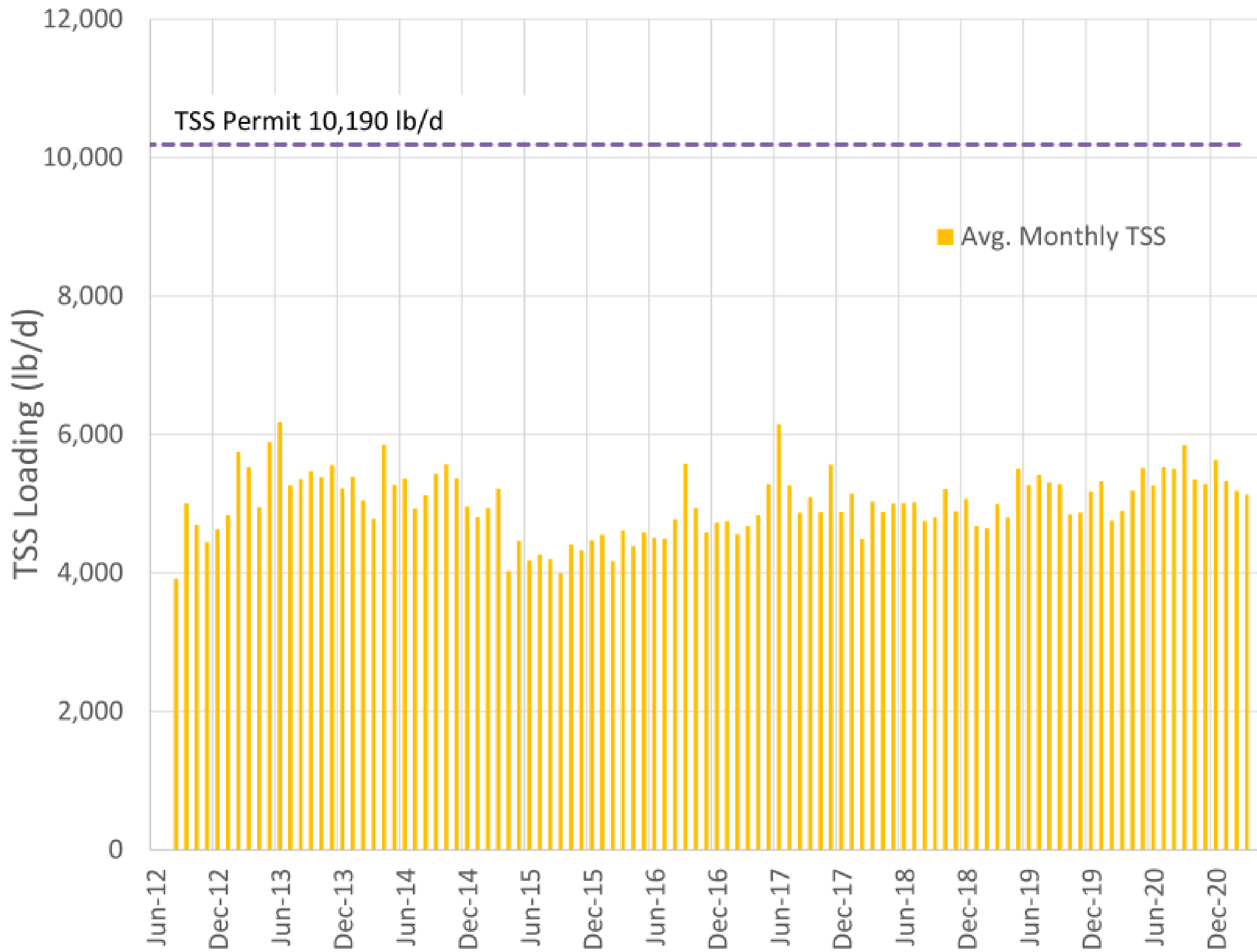


FIGURE 5-7

Monthly Average WWTF Influent TSS Loadings

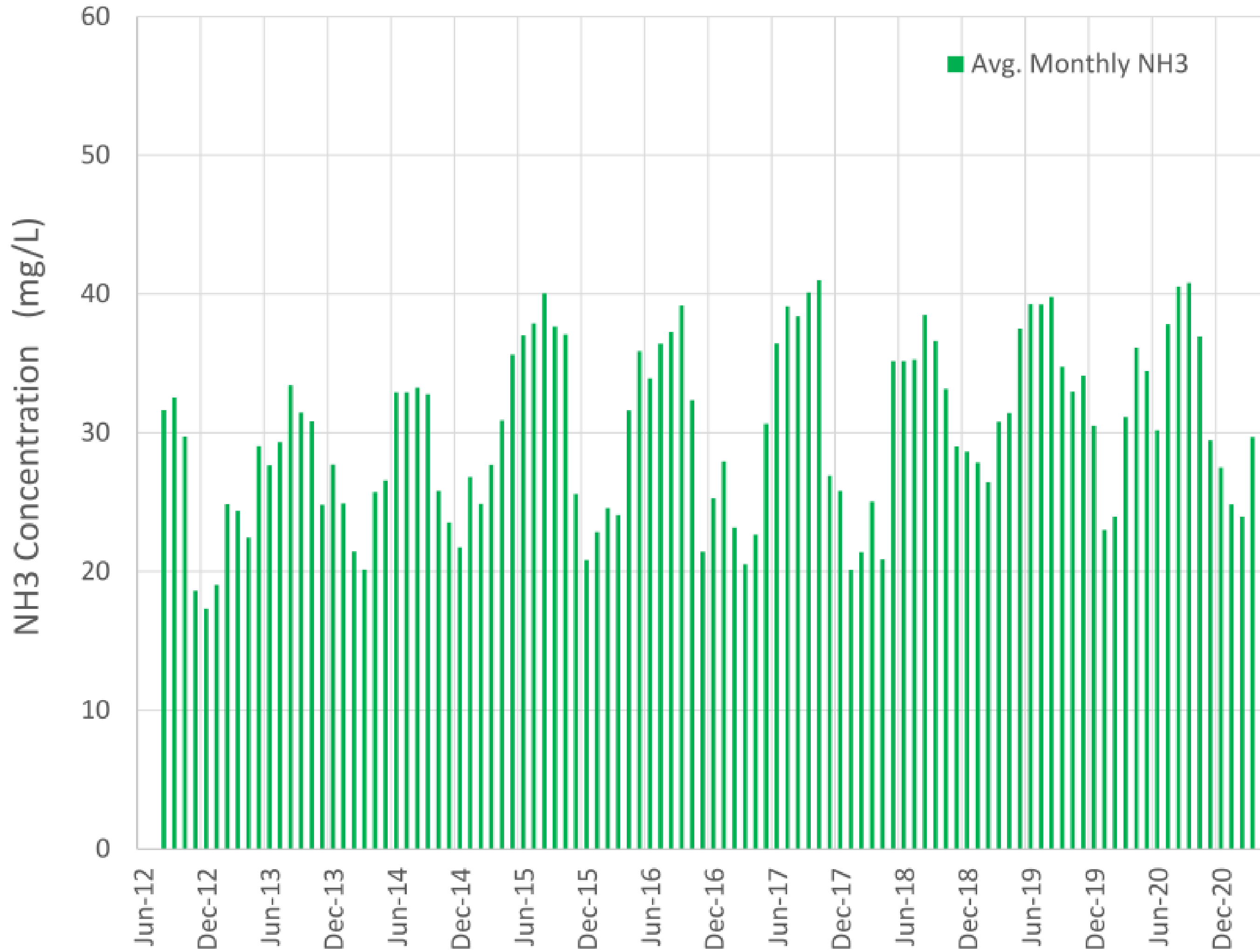


FIGURE 5-8

Monthly Average WWTF Influent NH3 Concentrations

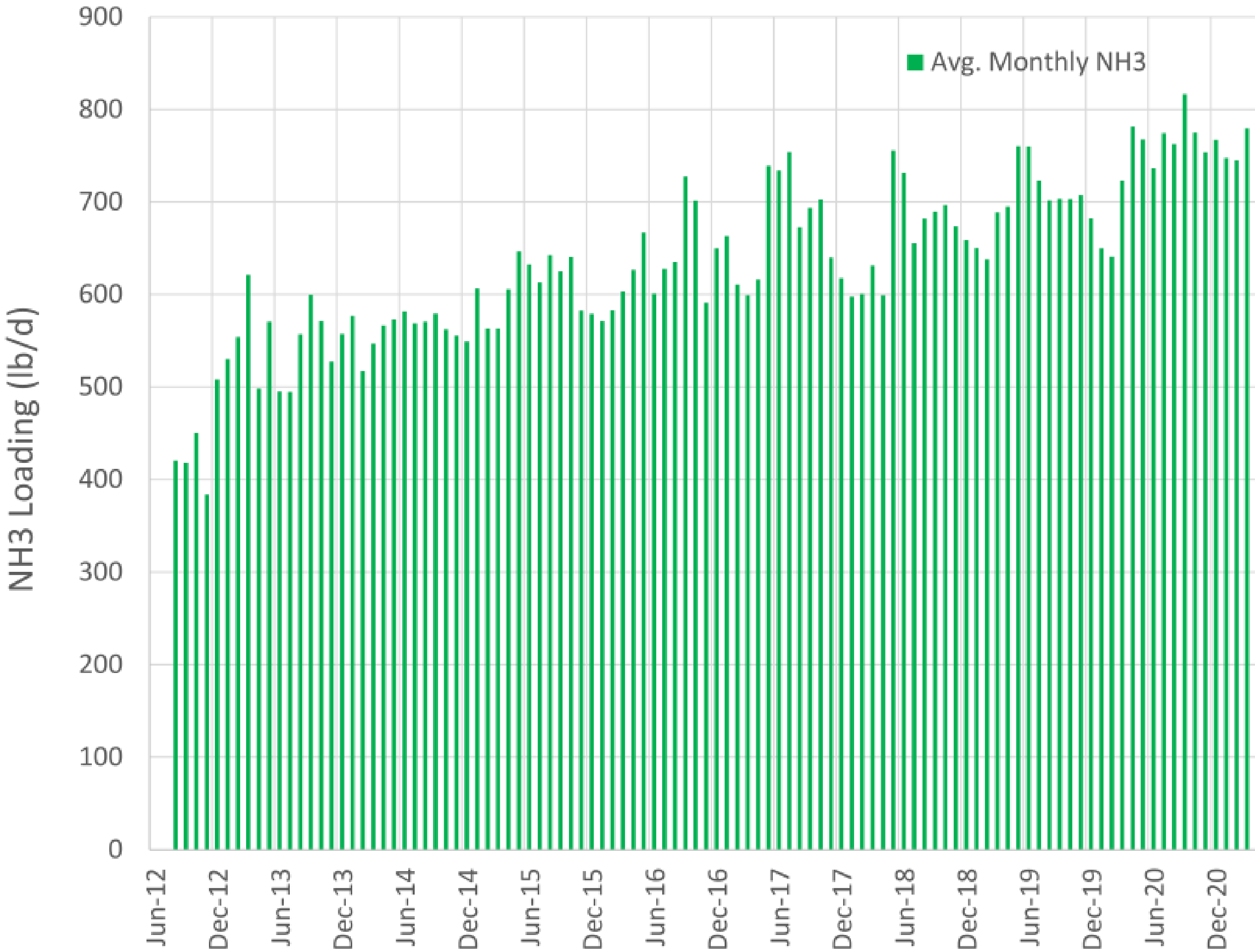


FIGURE 5-9

Monthly Average WWTF Influent NH3 Loadings

Historical peaking factors are presented in Table 5-6. The peaking factors for year 2020 are used to determine future loadings, since they are considered representative of current loading conditions.

TABLE 5-6

WWTF Influent Loading Historical Peaking Factors (2013 to 2020)

Loading Type	2013	2014	2015	2016	2017	2018	2019	2020	Selected Peak Factor
BOD5 Loading									
Annual Average	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max. Month	1.3	1.3	1.3	1.1	1.2	1.1	1.2	1.1	1.1
Peak Day	2.4	1.8	2.6	1.5	1.5	1.4	1.7	1.7	1.7
TSS Loading									
Annual Average	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max. Month	1.1	1.1	1.2	1.2	1.2	1.1	1.1	1.1	1.1
Peak Day	1.8	2.1	1.9	2.5	1.9	1.5	1.5	1.8	1.8
NH3 Loading									
Annual Average	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max. Month	1.1	1.0	1.1	1.2	1.1	1.1	1.1	1.1	1.1
Peak Day	1.7	1.2	1.4	1.3	1.3	1.7	1.4	1.2	1.2

BOD_5 LOADING TO THE WWTF

There is a high degree of variability in the concentrations of BOD_5 in the influent wastewater. Influent BOD_5 concentrations ranged from 97 mg/L to 960 mg/L. As illustrated in Figure 5-4, the average monthly BOD_5 concentration appears to correlate inversely with rainfall. This provides further evidence of inflow and infiltration (I/I) in the District's wastewater collection system. Note that an unrepresentative concentration of 1,995 mg/L was listed for May 22, 2015. This outlier has not been included in the further analysis.

As would be expected with a system with infiltration and inflow, the historical record indicates that the BOD_5 loading to the wastewater treatment facility has been more consistent than the concentration. Monthly average influent BOD_5 loadings ranged from 4,535 lb/d to 8,513 lb/d for the period of analysis, with no apparent correlation with season or rainfall, as shown in Figure 5-5. Since January 2016, reported influent loadings have been less variable, ranging from 4,553 lb/d to 6,559 lb/d. As such, the peak loadings from 2012 to 2015 are not used further in this analysis, as they are considered to be unrepresentative of current loadings.

The current NPDES monthly average influent BOD_5 loading of 10,730 lb/d was not exceeded during the period of analysis.

The average influent BOD_5 concentration for the 9-year period is 274 mg/L, which would be considered moderate to strong domestic wastewater. The average BOD_5 loading between 2012 and 2021, is summarized in Table 5-5 and was 5,763 lb/d.

TOTAL SUSPENDED SOLIDS LOADING TO THE WWTF

Similar to BOD_5, there is a high degree of variability in the concentration of total suspended solids (TSS) in the influent wastewater. Daily influent TSS concentrations from August 2012 through March 2021 ranged from 84 mg/L to 784 mg/L. As shown in Figure 5-6, the average monthly concentration of TSS, like that of BOD_5, appears to correlate inversely with rainfall.

The monthly average TSS loadings ranged from 3,916 lb/d to 6,182 lb/d. Similar to BOD_5, the mass loading of TSS appears to be more consistent than concentrations on a monthly basis. There have been no exceedances of the plant loading limit of 10,190 lb/d during the period of analysis, as shown in Figure 5-7.

The average influent TSS concentration is 238 mg/L, which would be considered moderate to strong domestic wastewater. There were not the anomalous high values of influent TSS in the 2012 to 2015 period, as there were with BOD. As summarized in Table 5-5, the average TSS loading during 2012 to 2021 was 5,009 lb/d.

AMMONIA LOADING TO THE WWTF

Daily influent ammonia concentrations from 2013 through March 2021 ranged from 17 mg/L to 41 mg/L. As shown in Figure 5-8, the average monthly concentration of ammonia, like that of BOD_5, appears to correlate inversely with rainfall.

The monthly average ammonia loadings ranged from 384 lb/d to 816 lb/d. The average influent ammonia concentration is 30 mg/L, which would be considered moderate to strong domestic wastewater. As summarized in Table 5-5, the average ammonia loading during 2013 to 2021 was 641 lb/d.

Currently, there is no ammonia loading capacity limit specified in the WWTF permit.

UNIT LOADING FACTORS

Unit loading factors were developed using existing loading data to provide a basis for projecting future BOD, TSS and ammonia loadings in the service area. The unit loading factors were established on an ERU basis and calculated by dividing the 2020 average annual (AA) loading by the 2020 service area ERUs. The resulting WWTF related unit loading factors are 0.44 pounds per ERU per day (lbs/ERU/day) for BOD, 0.39 lbs/ERU/day for TSS and 0.05 lbs/ERU/day for ammonia.

NPDES PERMIT LOADING LIMITS

Table 5-7 presents a summary of current flows and loadings compared to the flow and loading limits listed in the current NPDES permit for the WWTF.

The most recent year with complete data (2020) was used for comparisons of influent loadings. BOD loading was 62 percent of the NPDES limit. TSS loading was 57 percent of the NPDES limit. The year 2021 influent flow was used for flow comparisons with the maximum month flow limit. The 5.01 mgd monthly flow rate was approximately 75 percent of the NPDES limit.

TABLE 5-7

WWTF Influent Flow and Loading Limits

Parameter	Units	Current Influent Value	NPDES Permit Limit	Percent of NPDES Permit Limit
Max. Month Flow	mgd	3.75(1)	5.01	75%
Max. Month BOD	lb/d	6,706(2)	10,730	62%
Max. Month TSS	lb/d	5,845(2)	10,190	57%

(1) Includes data from January to March 2021.
(2) Includes data from January to December 2020.

INFILTRATION AND INFLOW

The amount of I/I can be estimated on an annual average, maximum month, and maximum day basis by subtracting the base flow at the WWTF from the annual average, maximum month, and maximum day flows at the WWTF.

For this report, I/I is expressed in units of gallons per acre per day (gpad). The total collection area of the District is estimated to be approximately 3,731 acres.

Table 5-8 summarizes the I/I analysis for current conditions. With several significant storm events, the winter of 2020/2021 was chosen to be the wet season for the I/I evaluation. The peak day and peak hour flows were derived from a February 5, 2020 storm event, which was determined to be similar in intensity to a 20-year storm event for the region.

The data contained in this table is useful as a baseline for evaluating changes in infiltration and inflow in the future. I/I flows are further broken down by basin using the available flow monitoring data in Appendix D.

TABLE 5-8

Estimated WWTF I/I

Flow Type	Influent Flow at WWTF (mgd)	Base Flow (mgd)	I/I (mgd)	Service Area (acre)	I/I (gpad)
Annual Average(1)	2.87	2.37	0.505	3,731	135
Max. Month(2)	3.75	2.37	1.378	3,731	369
Peak Day(3)	6.91	2.37	4.542	3,731	1,217
Peak Hour(3)	9.11	3.08(4)	6.030	3,731	1,616

(1) Annual average and base flow derived from 2020 data.
(2) Maximum month flow derived from Jan, 2021 data.
(3) Peak day and peak hour flow derived from February 5, 2020 data.
(4) Peak hour base flow, with a peaking factor of 1.3 at 8:00 p.m. was used to represent the base flow during the peak hour flow event occurred at 8:00 p.m. on February 5, 2020.

I/I Analysis Using EPA Criteria

The U.S. EPA manual entitled *I/I Analysis and Project Certification* provides recommended guidelines for determining if infiltration and/or inflow is excessive.

1. To determine if excessive *infiltration* is occurring, a threshold value of 120 gallons per capita per day (gpcd) is used. This includes domestic wastewater flow, infiltration and nominal industrial and commercial flows. This infiltration value is based on an average daily flow over a 7- to 14-day non-rainfall period during seasonal high ground water conditions.

2. To determine if excessive *inflow* is present in a collection system, the USEPA uses a threshold value of 275 gpcd. If the average daily flow (excluding major commercial and industrial flows greater than 50,000 gpd each) during periods of significant rainfall exceeds 275 gpcd, the amount of inflow is considered excessive. This calculation should exclude major commercial and industrial flows (greater than 50,000 gpd each).

Analysis of I/I was performed to compare estimates of per capita I/I to EPA criteria. These I/I rates are summarized in Table 5-9.

TABLE 5-9

Per Capita WWTF Infiltration and Inflow Based on EPA Criteria

Parameter	EPA Criteria for Excessive I/I (gpcd)	Estimated LSSD I/I Value (gpcd)
EPA Excessive Infiltration Criteria	120	82
EPA Excessive Inflow Criteria	275	202

Infiltration

Rainfall records from the District WWTF DMR data show a 7-day period (December 1 – 7, 2020) during which only trace amounts of rainfall were measured. This would also be a period of relatively high groundwater. The average daily flow recorded during this time period was 2.80 mgd. With a total population of sewer users in 2020 of 34,150, the "EPA I/I Infiltration Value" for the District is estimated at 82 gpcd which is less than the EPA guideline of 120 gpcd and; therefore, indicates that infiltration is not excessive based on EPA criteria.

Inflow

The maximum day influent flow at the WWTF was 6.91 mgd (recorded on February 5, 2020). With a total population of sewer users in 2020 of 34,150, the "EPA I/I Inflow Value" for the District is estimated at 202 gpcd. Because this value, even including the major commercial and industrial flows, is lower than the EPA guideline of 275 gpcd, inflow within the District is not considered to be excessive based on EPA criteria.

FLOW AND LOADING PROJECTIONS

PROJECTED AVERAGE DRY WEATHER FLOW (ADWF)

The projected future ADWF is summarized in Table 5-11. Total residential and non-residential dry weather flows in the District's collection system discharging to WWTF, were projected by multiplying the projected number of ERUs (from Table 3-6) by 173 gallons per ERU per day (gal/ERU/day).

TABLE 5-10

Projected Future ERUs and ADWF

Year	ERUs	WWTF ADWF (mgd) (1)
2021	13,969	2.42
2027	15,484	2.68
2031	16,575	2.87
2036	18,041	3.12
2041	19,632	3.40
Buildout	21,923	3.79

(1) Based on 173 gpd/ERU.

PROJECTED I/I

For this plan, infiltration and inflow for the *existing* service area is assumed to be constant throughout the 20-year planning period. (In other words, ongoing I/I rehabilitation efforts are assumed to compensate for the increase in new I/I due to deterioration of infrastructure). Projected I/I flow is summarized in Table 5-11. Based on I/I rates observed in areas with PVC sewers in other similar communities. Estimated I/I rates of 100, 200, 500 and 1,000 gpad were used for all *new* service area under the AAF, MMF, PDF, and PHF condition, respectively. New service areas for the next 6, 10, 15 and 20 years are estimated assuming the growth indicated in Table 3-6. These I/I rates reflect the significant (20 year) storms that occurred in the winter of 2019-2020.

TABLE 5-11

Current and Projected Future I/I

Year	Existing Service Area(1) (acres)	I/I Flow (mgd) Annual Average	Max. Month	Peak Day	Peak Hour
2021	3,731	0.50	1.38	4.54	6.03
		I/I Rates for New Service Areas (gpad)(2)			
		100	200	500	1000
Year	New Service Areas (acres)	Total I/I Flow (mgd)			
2027	224	0.53	1.42	4.65	6.25
2031	386	0.54	1.45	4.73	6.42
2036	603	0.56	1.50	4.84	6.63
2041	839	0.59	1.55	4.96	6.87
Buildout	1,178 (3)	0.62	1.61	5.13	7.21

(1) Existing Service Area reflects sum of currently served parcels and rights-of-way.
(2) The estimated I/I rates are the typical rates for newer collection systems.
(3) Total buildable area indicated in Table 3-8.

SUMMARY OF PROJECTED FLOWS

Table 5-12 and Figure 5-10 summarize projected total flows to the WWTF. To estimate future annual average, maximum month, and peak day flows, the I/I flow rates were added to the ADWF derived from the ERU projections to obtain the respective future WWTF influent flowrates.

In addition to the permit limits, 85 percent of the permit limits are shown in the figures, since, per the permit, the District will need to submit a plan to maintain adequate capacity if flow or loading exceed 85 percent of the permitted capacity for 3 consecutive months.

TABLE 5-12

Current and Projected Future WWTF Influent Flows

Projected Flows (mgd)								
Flow Type	**NPDES Permit Limit**	**85 Percent NPDES Permit Limit**	**2021**	**2027**	**2031**	**2036**	**2041**	**Buildout**
Average Dry Weather	--		2.42	2.68	2.87	3.12	3.40	3.79
Average Annual(1)	--		2.92	3.21	3.41	3.69	3.98	4.42
Maximum Month(1)	5.01	4.26	3.79	4.10	4.32	4.62	4.94	**5.41**
Peak Day(1)	--		6.96	7.33	7.60	7.96	8.36	8.92
Peak Hour(1)	--		9.17(3)	9.74(3)	10.14(3)	10.69(3)	11.28(3)	12.14(3)

(1) AAF, MMF, and PDF are the sum of ADWF in Table 5-10 and I/I flow in Table 5-11. Flows are reflective of the 20-year storm event that occurred in the winter of 2019-2020.

(2) BOLD values exceed anticipated NPDES Permit Limits (current design limits).

(3) PHF is the sum of the peak hour base flow and I/I flow in Table 5-11. A peaking factor of 1.3 was used to calculate the peak hour base flow; refer to Table 5-8 Note 4 for data source.

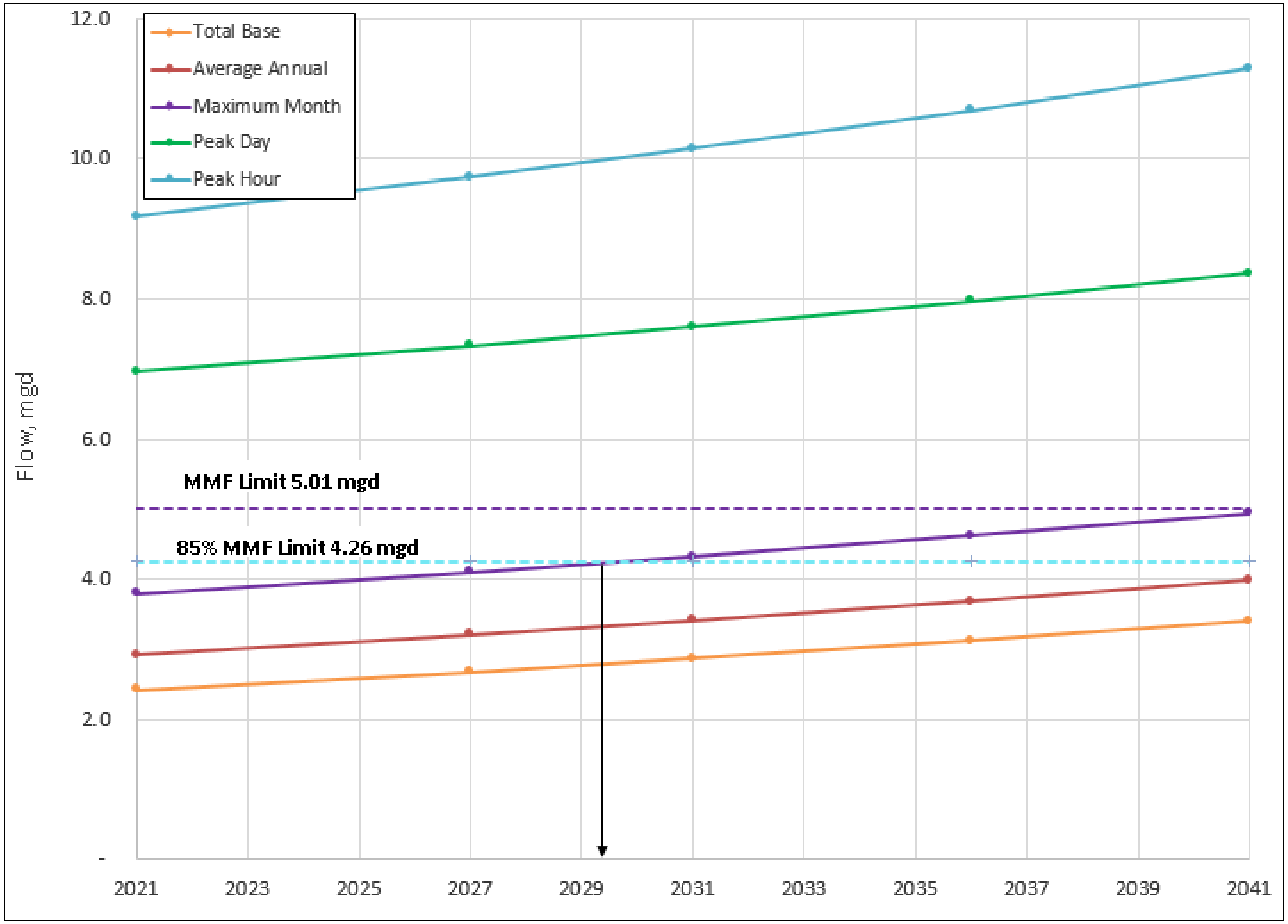


FIGURE 5-10

WWTF Influent Flow Projections

PROJECTED WASTEWATER LOADING

Future BOD_5, TSS and ammonia annual average WWTF loadings are estimated by multiplying the projected number of ERUs in the District collection system by the respective ERU-based loadings calculated in previous sections. The maximum month and peak day loadings were calculated using the peaking factors calculated in Table 5-5.

The strength of the combined industrial/commercial wastewater with regard to loadings for the industrial ERUs is assumed to be the same as that of domestic wastewater for this analysis.

Table 5-14, as well as Figures 5-11 through 5-13, provide a summary of projected future influent loadings at the WWTF.

TABLE 5-13

Current and Projected WWTF Influent Loadings

ERUs and Loadings (lb/d)	NPDES Permit	85% NPDES Permit	2021	2027	2031	2036	2041	Buildout
Total ERUs	--		13,969	15,484	16,575	18,041	19,632	21,923
Annual Average BOD_5	--		6,210	6,883	7,368	8,020	8,727	9,745
Max Month BOD_5	10,730	9,121	6,825	7,565	8,098	8,815	9,592	10,711
Peak Day BOD_5	--		10,406	11,534	12,347	13,439	14,625	16,331
Annual Average TSS	--		5,435	6,024	6,448	7,019	7,638	8,529
Max Month TSS	10,190	8,662	5,950	6,595	7,059	7,684	8,361	9,337
Peak Day TSS	--		9,773	10,832	11,596	12,621	13,734	15,337
Annual Average NH3-N			759	841	900	980	1,066	1,191
Max Month NH3-N			831	921	986	1,073	1,168	1,304
Peak Day NH3-N			932	1,033	1,106	1,204	1,310	1,463

FIGURE 5-11

Projected WWTF BOD_5 Loading

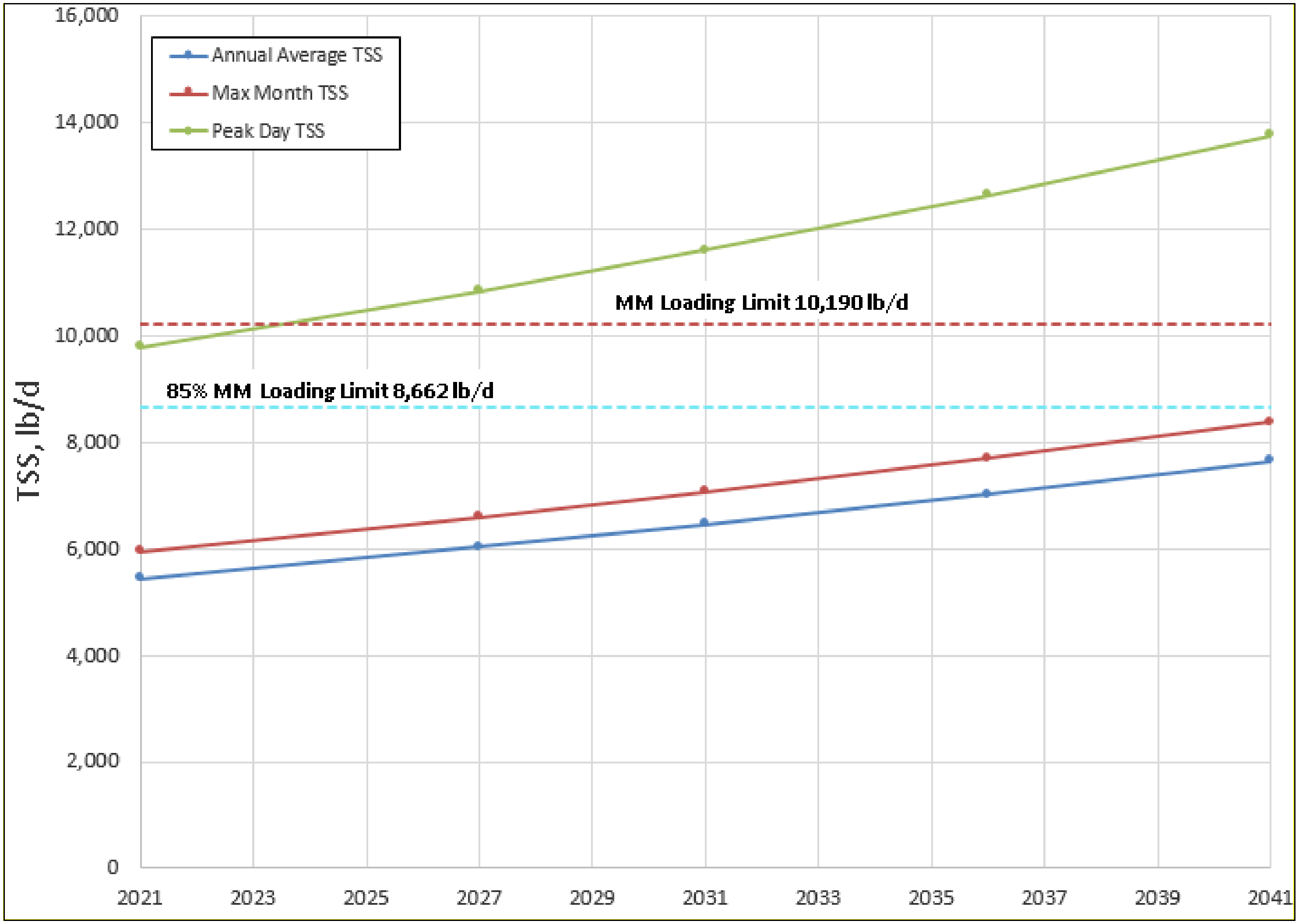


FIGURE 5-12

Projected WWTF TSS Loading

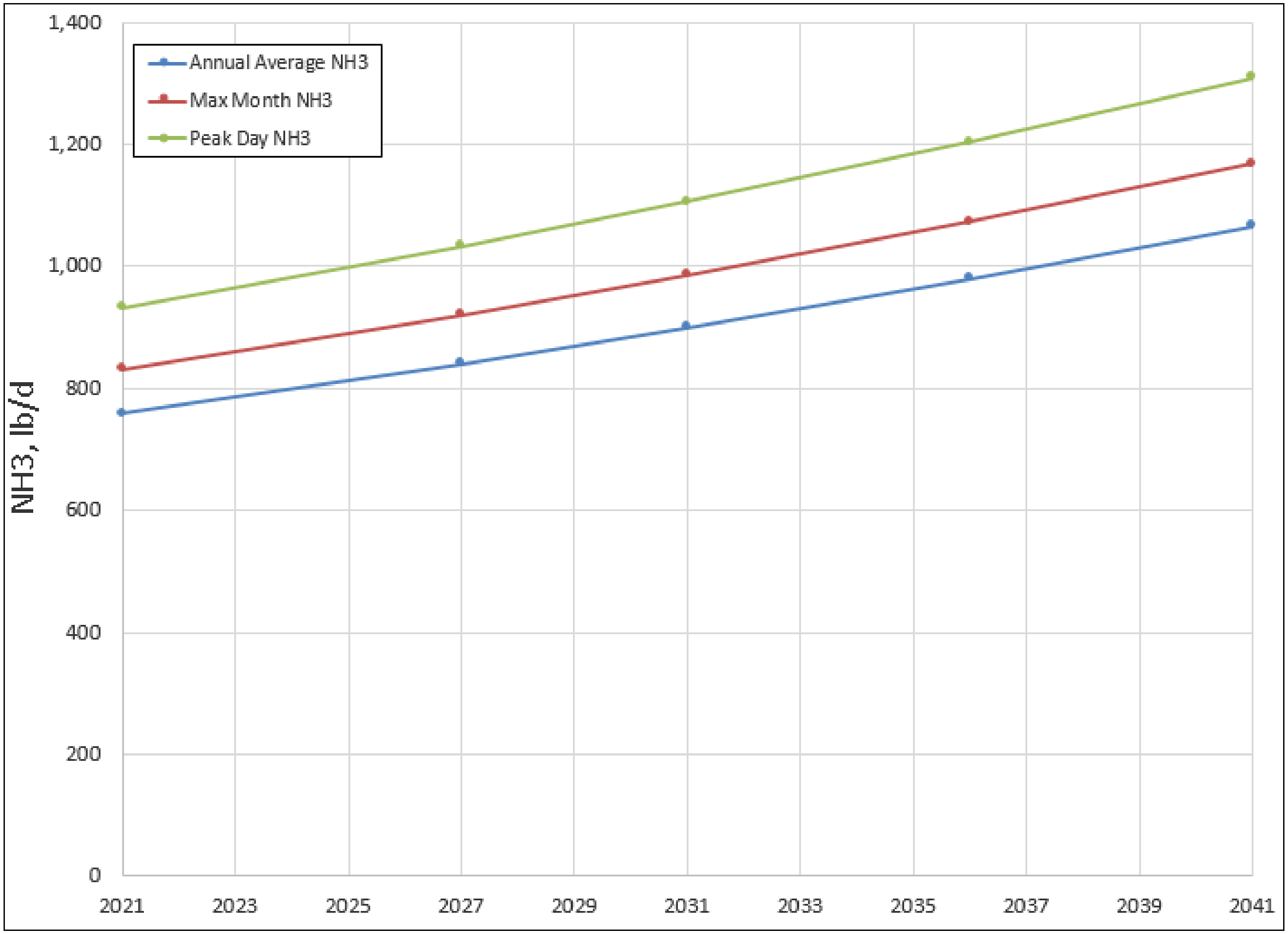


FIGURE 5-13

Projected WWTF Ammonia Loading

SUMMARY

Table 5-14 indicates when the capacity of the WWTF will be exceeded for flow, BOD and TSS, based on the flow and loading projections.

TABLE 5-14

Current and Projected WWTF Influent Flow and Loadings

Parameter	NPDES Permitted Capacity	Year Reaching Capacity	Year Reaching 85 Percent of Capacity
MM Flow	5.01 mgd	Beyond 2041	2029
MM BOD Loading	10,730 ppd	Beyond 2041	2038
MM TSS Loading	10,190 ppd	Beyond 2041	Beyond 2041

CHAPTER 6

COLLECTION SYSTEM EVALUATION

INTRODUCTION

This chapter presents an evaluation of the District's wastewater collection system. Following the evaluation, potential improvements necessary to serve the District are considered, recommended improvements are provided based on the evaluation of capacity, condition, operation and maintenance, and reliability. Existing and future population, land use, and wastewater flows presented in Chapters 3 and 4 of this Plan are utilized to develop data for use in the hydraulic model. Total area population and wastewater flows are allocated to individual subareas to identify current and future deficiencies in the collection system.

The components of the District's sewer system are organized into three categories for capacity evaluation:

- Major Gravity Lines
- Lift Stations
- Force Mains

The purpose of the hydraulic/hydrologic analysis is to evaluate the District's sewer collection system based on existing and future conditions. The hydraulic model software, InfoSewer developed by Innvoyze, has been used to analyze the major gravity lines within the collection system for current conditions (2021), and 20-year anticipated development, and buildout. For the capacity analysis for the force mains and sewage lift stations, peak wet weather flows were estimated and compared to existing lift capacity.

In this chapter, the development of the hydraulic model is described and the assumptions used to develop the model are presented. The output from this model is used to evaluate the capacity of the existing collection system and to identify improvements that will be required to accommodate the wastewater flows. The model can be updated and maintained for use as a tool to aid in future planning and design.

HYDRAULIC MODELING

HYDRAULIC MODELING SCENARIOS

Three scenarios of projected flows are modeled for the purpose of analyzing the District's collection system.

1. Existing Scenario: A hydraulic model was first developed for the year 2021 to represent the existing wastewater collection system. This approach

is used to identify any existing pipeline deficiencies. The existing scenario includes flows from all DEAs that are currently in progress.

2. Buildout Scenario: An additional hydraulic model was prepared for future conditions at buildout to reflect anticipated growth within the District. This growth is distributed to undeveloped or underdeveloped parcels within each basin. A conceptual plan of future sewer pipes used in the buildout modeling was developed for the previous Comprehensive Plan.

3. Interim 20-Year Scenario: A 20-year (2041) flow scenario was modeled using the future sewer system to establish a schedule for deficiencies identified in the buildout scenario.

The locations of each of the basins may be seen on Figure 6-1. The location of each project listed below is shown on Figure 6-2. Figures 6-3 through 6-6 show the hydraulic modeling results that are described below.

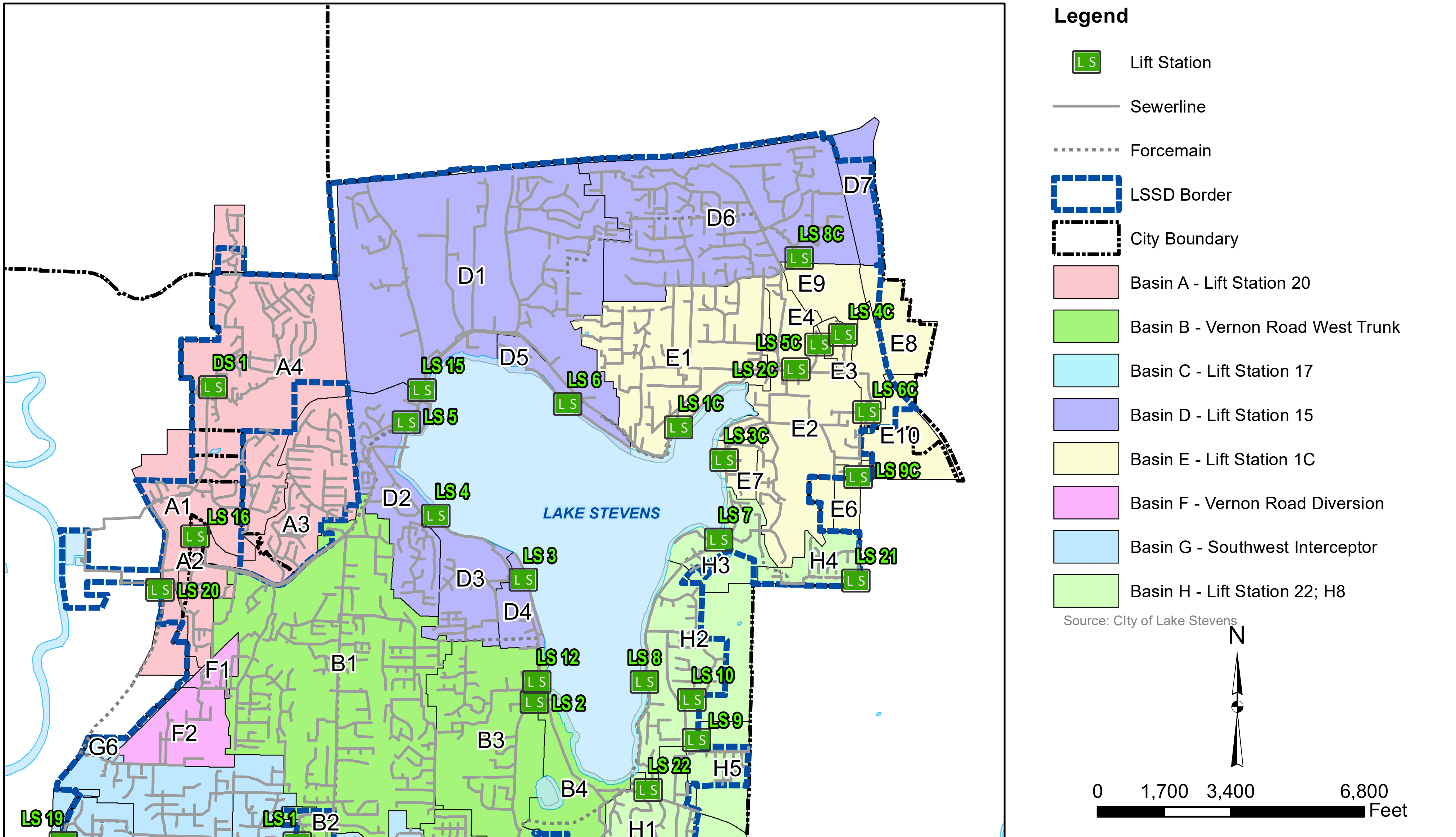
LIFT STATION CAPACITY ANALYSIS

The District operates and maintains 29 lift stations, 27 of which were evaluated with the model. A future lift station, LS 23, was also included in the modeling as it is currently under construction.

A summary of the Existing and Buildout flows to the lift stations are compared to each of the lift stations' existing capacities in Table 6-1. LS 9 and LS 10 were not explicitly modeled as their basin areas are very small, and the flows tributary to these lift stations were instead assigned to the basins downstream.

Each of the lift stations was modeled with a constant flow rate and was analyzed for capacity. The flow of the lift station was then injected downstream at the location of the force main discharge.

The results of Table 6-1 show that most of the District's lift stations, except 1, 7, 1C, 2C, and 8C currently have adequate capacity under existing conditions.



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILTY PLAN
FIGURE 6-1
MAJOR SEWER BASINS

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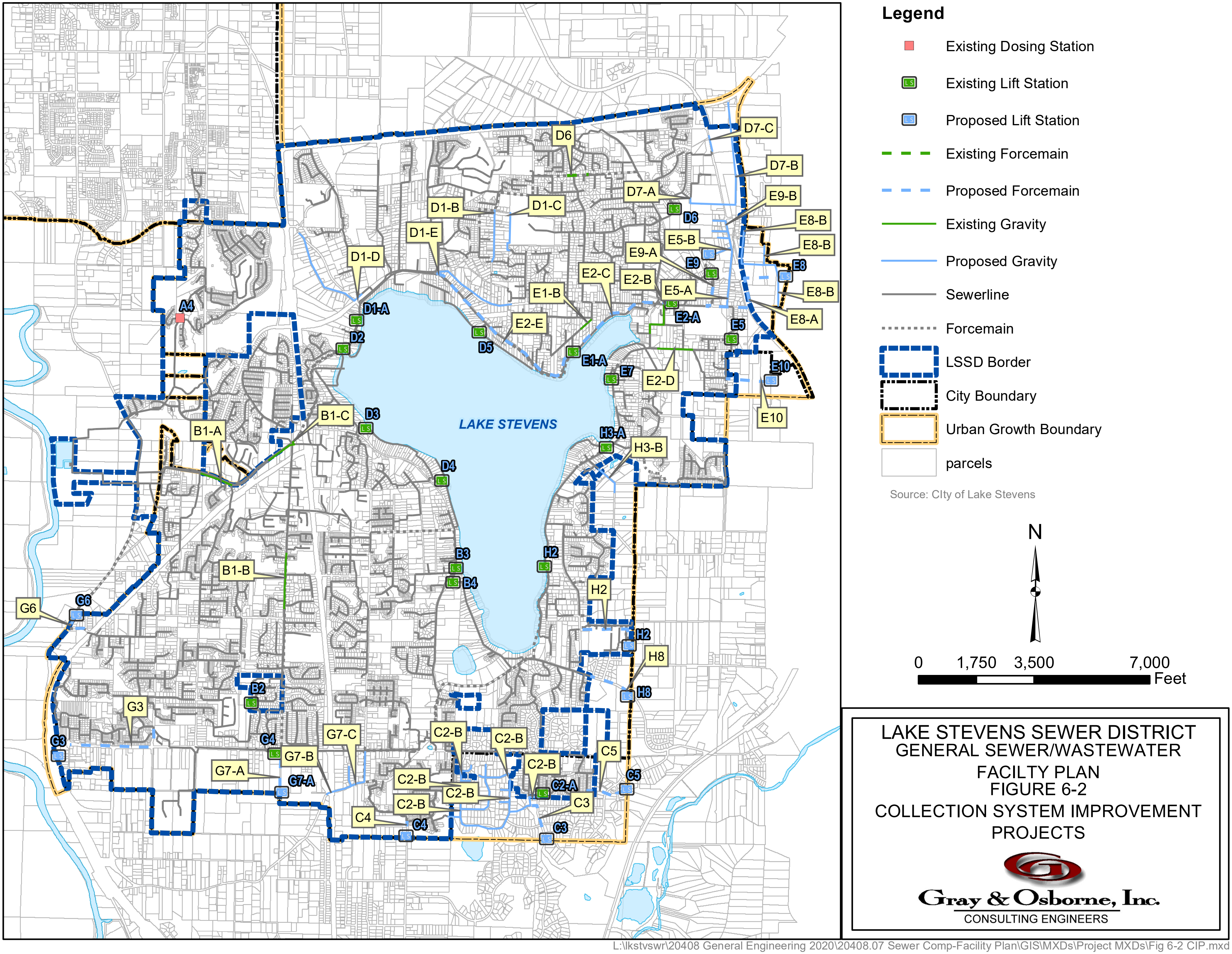
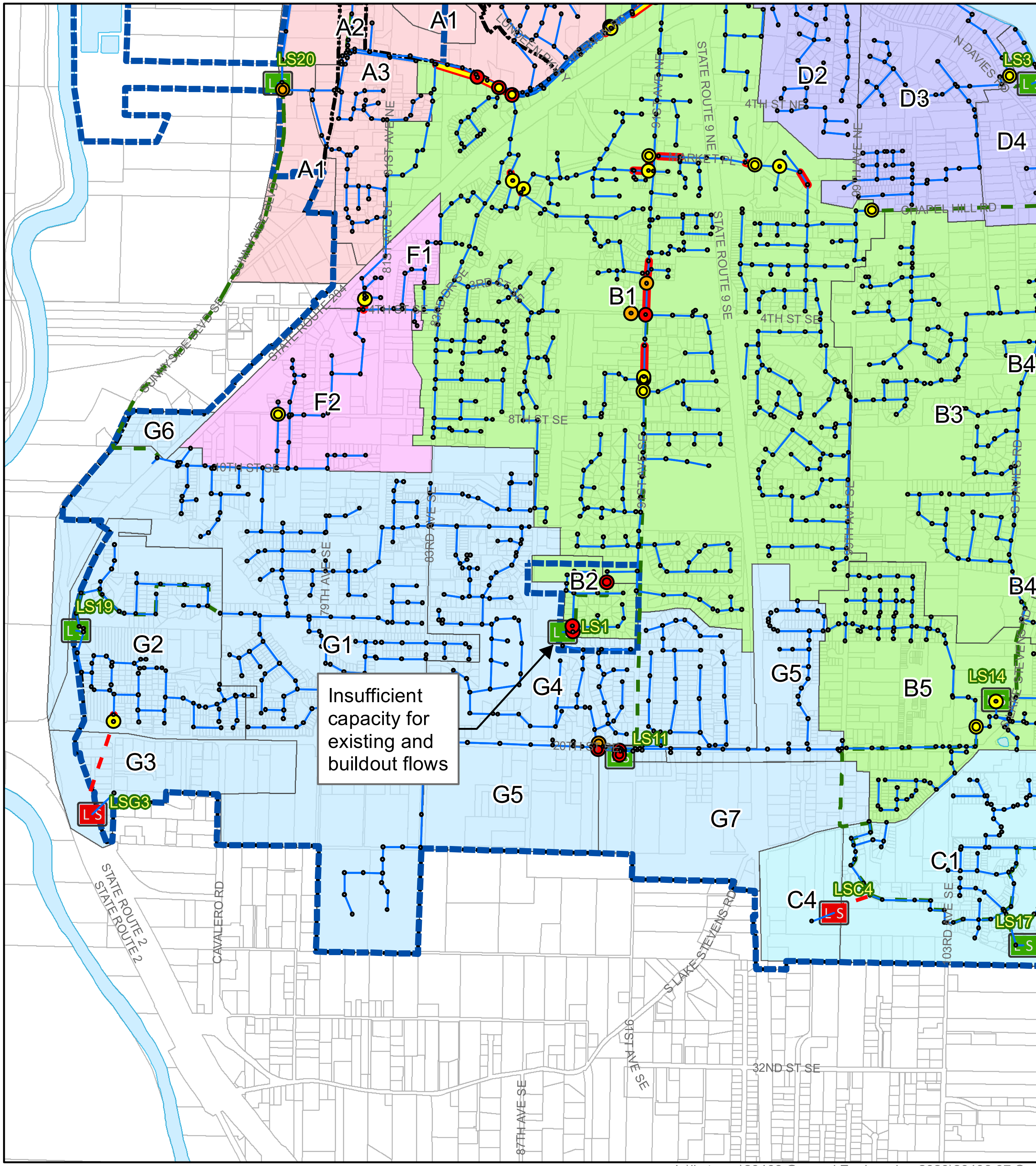
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig 6-1 Basins.mxd



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILTY PLAN
FIGURE 6-2
COLLECTION SYSTEM IMPROVEMENT
PROJECTS



Legend

Existing Surcharging

- < 0 ft
- 0 - 0.5 ft
- 0.501 - 1 ft
- >1 ft

Buildout Surcharging

- < 0 ft
- 0 - 0.5 ft
- 0.501 - 1 ft
- >1 ft

Existing Pipe Capacity

- Sufficient Capacity
- Over Capacity

Buildout Pipe Capacity

- Sufficient Capacity
- Over Capacity

- LS Existing Lift Station
- LS Future Lift Station
- Existing Force main
- Future Force Main
- LSSD Border
- City Boundary

Source: City of Lake Stevens

N

0 850 1,700 3,400 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILTY PLAN
FIGURE 6-3
MODEL RESULTS: SOUTHWEST

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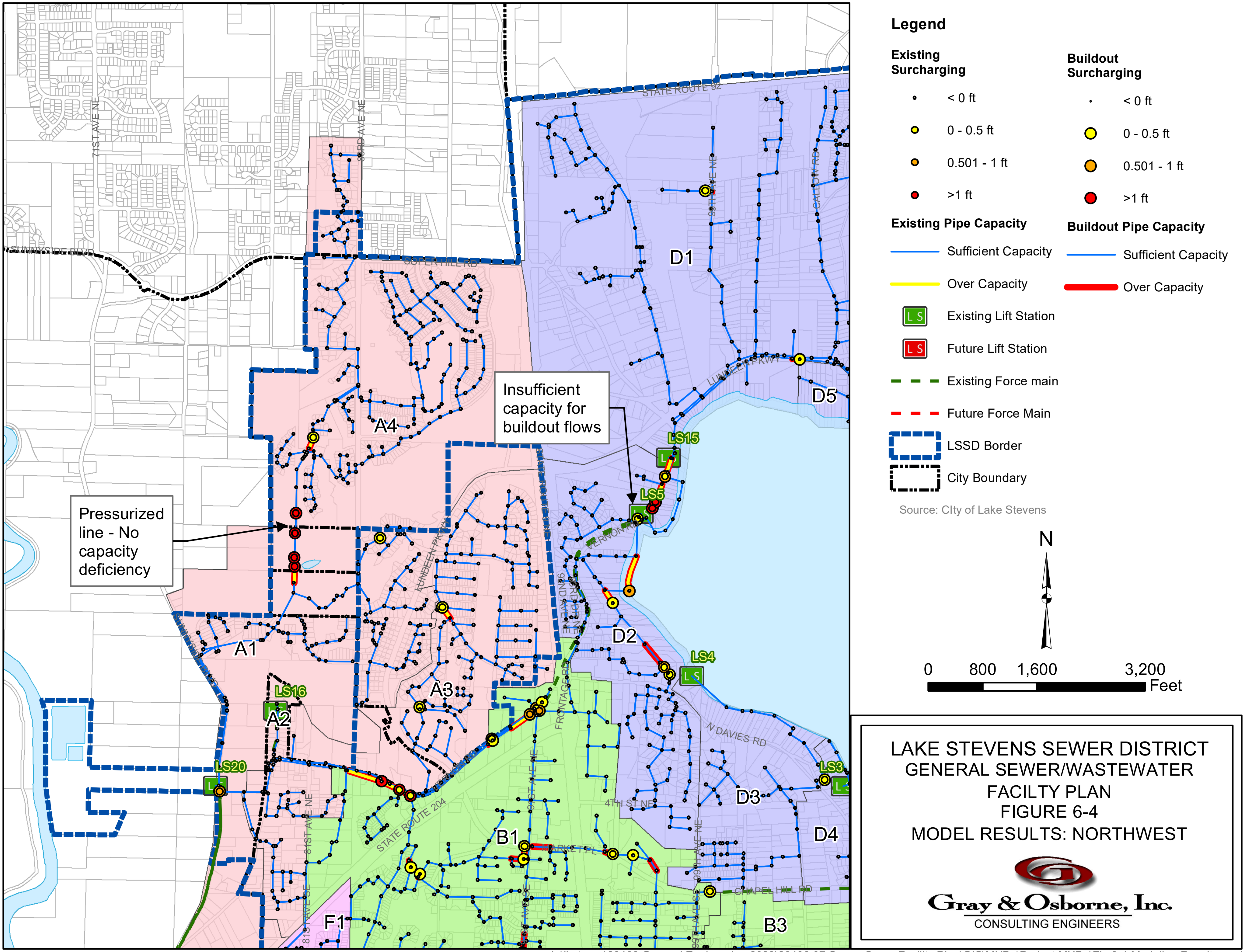

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILTY PLAN
FIGURE 6-4
MODEL RESULTS: NORTHWEST

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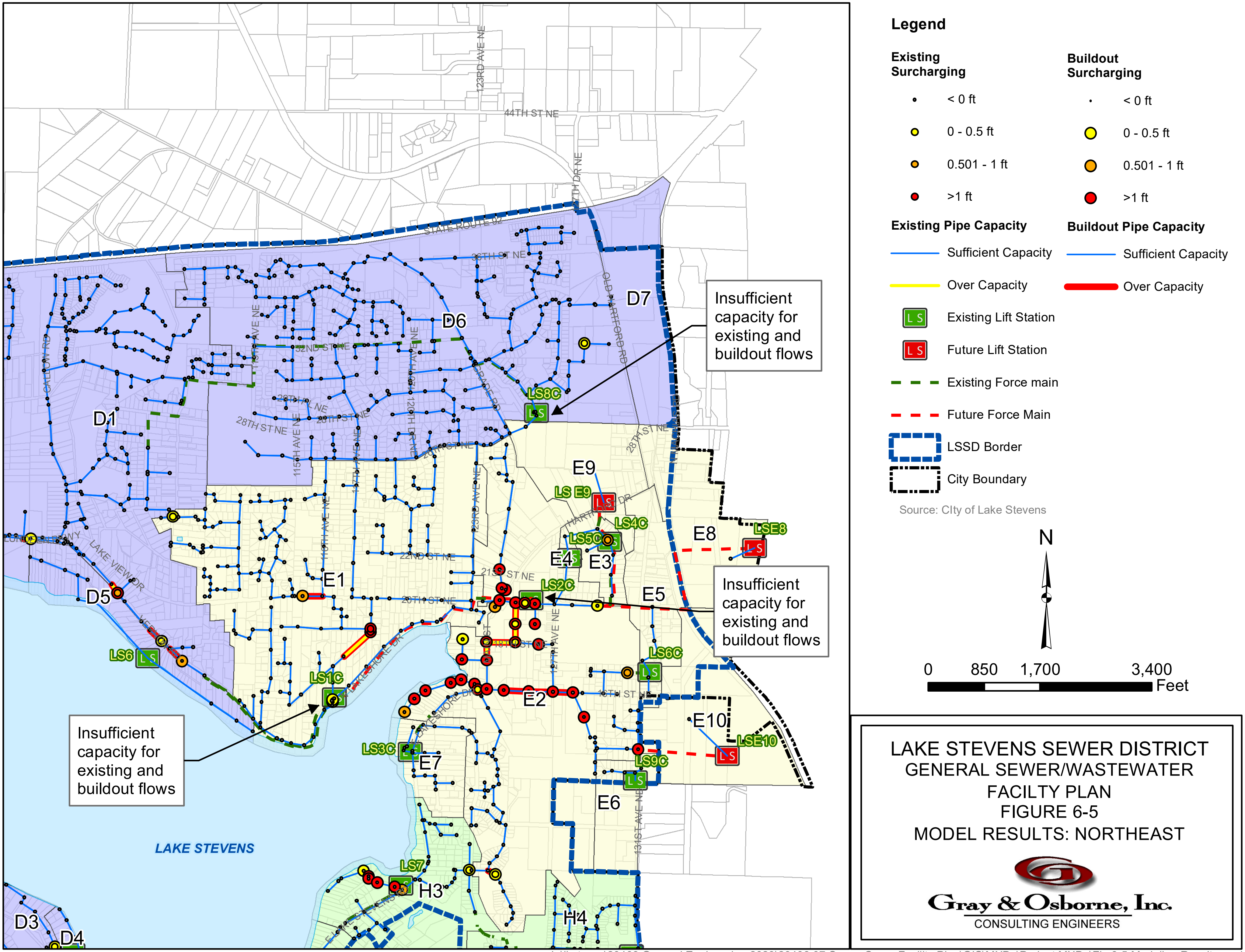

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILTY PLAN
FIGURE 6-5
MODEL RESULTS: NORTHEAST

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CONSULTING ENGINEERS

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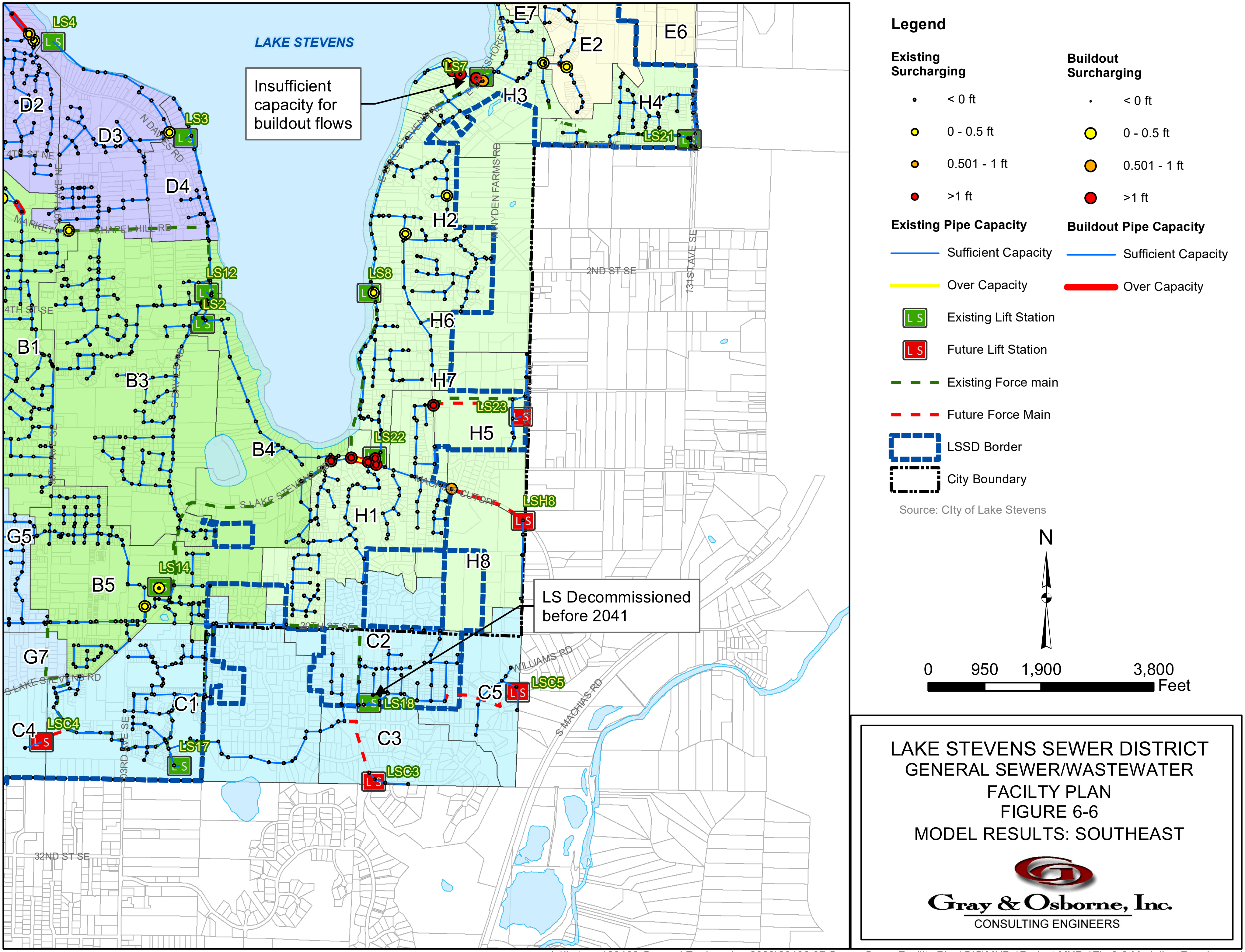

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILTY PLAN
FIGURE 6-6
MODEL RESULTS: SOUTHEAST

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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TABLE 6-1

Lift Station Capacity Summary (Existing and 20 Year)

Lift Station ID	Lift Station Capacity (gpm)	Existing ERUs(1)	Existing Service Area(1) (acre)	Existing Peak Flow(2) (gpm)	Existing Surplus (+)/ Def (-) (gpm)	20-Year ERUs(1)	20-Year Service Area (acre)(1)	20-Year Peak Flow (gpm)	20-Year Surplus (+)/ Def (-) (gpm)
LS 1	59	123	20.5	**84**	**-25**	123	20.5	**95**	**-36**
LS 2	239	131	57.7	108	131	169	65.2	135	104
LS 3	307	64	27.5	71	236	116	35.3	98	209
LS 4	580	212	62.7	304	276	337	80.0	356	224
LS 5	800	643	147.6	661	139	704	157.0	**803**	**-3**
LS 6	312	66	45.4	130	182	88	51.9	160	152
LS 7	200	149	55.8	**249**	**-49**	226	70.9	**295**	**-95**
LS 8	540	414	144.9	530	10	591	190.0	**649**	**-109**
LS 9	30	5	1.0			11	2.3		
LS 10	30	5	1.6			8	2.5		
LS 11	400	525	129.3	304	96	570	138.1	355	45
LS 12	2,000	599	165.4	936	1,064	800	190.6	1,101	899
LS 14	480	677	71.3	215	265	872	89.2	282	198
LS 15	5,250	1,092	366.0	2,969	2,281	1,731	446.4	3,316	1,934
LS 16	155	23	6.0	13	142	23	6.0	14	141
LS 17	800	358	80.5	344	456	1,119	255.5	627	173
LS 18	290	263	54.6	142	148	Temporary LS			
LS 19	290	336	72.4	184	106	420	82.8	282	8
LS 20	1,650	1,785	346.6	1,000	650	1,871	356.3	1,139	511
LS 21	130	157	27.6	76	54	168	29.0	88	42
LS 22	1,544	388	97.7	837	707	628	158.2	1,162	382
LS 1C	650	795	300.0	**1,578**	**-928**	1,124	346.5	**1,834**	**-1,184**

TABLE 6-1 – (continued)

Lift Station Capacity Summary (Existing and 20 Year)

Lift Station ID	Lift Station Capacity (gpm)	Existing ERUs[1]	Existing Service Area[1] (acre)	Existing Peak Flow[2] (gpm)	Existing Surplus (+)/ Def (-) (gpm)	20-Year ERUs[1]	20-Year Service Area (acre)[1]	20-Year Peak Flow (gpm)	20-Year Surplus (+)/ Def (-) (gpm)
LS 2C	700	959	188.2	**810**	**-110**	1,315	267.4	**1,017**	**-317**
LS 3C	200	65	26.2	69	131	107	31.8	91	109
LS 4C	100	42	15.0	47	53	58	17.8	58	42
LS 5C	200	10	2.5	6	194	Temporary LS			
LS 6C	100	47	8.2	23	77	118	22.4	50	50
LS 8C	670	1,026	338.3	**730**	**-60**	1,199	370.3	**900**	**-230**
LS 9C	150	21	8.6	19	131	59	18.2	36	114

(1) Does not include upstream basins.
(2) Determined through hydraulic modeling.

The results of Table 6-1 show that LS 5, 8, and 19 may not have adequate capacity for buildout flows, along with the other lift stations that currently have inadequate capacity under existing conditions. The peak flow to LS 15 is slightly over the lift station's capacity, but the model indicates that there is sufficient volume in the wet well to accommodate this flow.

TABLE 6-2

Lift Station Capacity Summary (Buildout and Buildout with CIPs)

Lift Station ID	Lift Station Capacity (gpm)	Buildout ERUs(1)	Buildout Service Area (acre)(1)	Buildout Peak Flow (gpm)	Buildout Surplus (+)/ Def (-) (gpm)
LS 1	59	123	20.5	**100**	**-41**
LS 2	239	185	68.4	147	92
LS 3	307	138	38.7	109	198
LS 4	580	391	87.5	380	0
LS 5	800	730	161.1	**879**	**-79**
LS 6	312	98	54.7	173	139
LS 7	200	260	77.4	**314**	**-114**
LS 8	540	667	209.4	**786**	**-246**
LS 9	30	Temporary LS			
LS 10	30	Temporary LS			
LS 11	400	585	141.9	378	22
LS 12	2,000	886	201.5	1,193	807
LS 14	480	957	96.9	311	169
LS 15	5,250	2,007	481.0	**5,259**	**-9**
LS 16	155	23	6.0	15	140
LS 17	800	1,508	331.0	746	54
LS 18	290	Temporary LS			
LS 19	290	457	87.3	**304**	**-14**
LS 20	1,650	1,908	360.5	1,199	451
LS 21	130	173	29.6	93	37
LS 22	1,544	979	184.3	1,409	334
LS 1C	650	1,265	366.6	**1,236**	**-586**
LS 2C	700	1,221	301.6	**1,283**	**-570**
LS 3C	200	126	34.2	101	99

TABLE 6-2 – (continued)

Lift Station Capacity Summary (Buildout and Buildout with CIPs)

Lift Station ID	Lift Station Capacity (gpm)	Buildout ERUs(1)	Buildout Service Area (acre)(1)	Buildout Peak Flow (gpm)	Buildout Surplus (+)/ Def (-) (gpm)
LS 4C	100	104	19.1	67	33
LS 5C	200	Temporary LS			
LS 6C	100	149	28.5	62	38
LS 8C	670	1,337	384.1	**973**	**-303**
LS 9C	150	76	22.3	43	107

(1) Does not include upstream basins.
(2) Determined through hydraulic modeling.

FORCE MAIN CAPACITY EVALUATION

The capacity evaluation for the District's force mains is tied directly to the lift station capacity evaluation. The capacity of each force main is based on a maximum design velocity of 8 feet per second (fps). This capacity is compared to the existing lift station capacity and the predicted peak flow at buildout.

TABLE 6-3

Force Main Capacity Evaluation

	FM Diameter (in)	FM Capacity (gpm)	Existing Peak Flow(1) (gpm)	Buildout Peak Flow (gpm)
LS 1	4	313	84	100
LS 2	6	705	239	239
LS 3	6	705	307	307
LS 4	8	1,253	580	580
LS 5	9.5	1,767	800	852
LS 6	6	705	312	312
LS 7	6	705	249	314
LS 8	8/10	1,253/1,958	540	786
LS 9	2	78	30	Temporary LS
LS 10	2	78	30	Temporary LS
LS 11	6	705	400	400
LS 12	12	2820	2,000	2,000
LS 14	6	705	480	480
LS 15	19.4	7,370	5,250	5,259
LS 16	4	313	155	155
LS 17	10	1,958	800	800
LS 18	6	705	290	Temporary LS
LS 19	6	705	290	304
LS 20	12	2,820	1,650	1,650
LS 21	4	313	130	130
LS 22	10	1958	1,544	1,544
LS 1C	8	1,253	1,578	1,236
LS 2C	8	1,253	810	1,283
LS 3C	4	313	200	200
LS 4C	6	705	100	100
LS 5C	4	313	200	Temporary LS
LS 6C	4	313	100	100
LS 8C	8/10	1,253/1,958	730	973
LS 9C	4	313	150	150

(1) Capacity listed is the greater of the modeled peak flow in the lift station or the rated capacity of the lift station.
(2) Assumes LS2C force main discharge is routed past LS1C.

COLLECTION SYSTEM CAPACITY ANALYSIS

The following summarizes the deficiencies identified in the model and proposed improvements for each of the major basins.

The system was modeled under the scenarios discussed above: existing, 20-year, and buildout. Where surcharging of less than 1 foot is indicated in gravity sewer systems in the buildout scenario, replacement of the system is not recommended. Where pipe replacement is recommended, it is assumed that the new pipe will be installed at the same slope as the existing pipe.

Basin A1

The major trunk within this basin is known as the Campus Park (Hewlett-Packard) Trunk. This trunk ends at a pressure system leading to LS 20. According to buildable land information, this basin does not have developable or redevelopable land available, so increased flow due to development is not anticipated in this basin.

The infrastructure in this basin appears to be adequate for the projected buildout flows.

Basin A2

This basin is served by a local lift station, LS 16, which pumps to the gravity system tributary to LS 20.

According to buildable land information, this basin does not have developable or redevelopable land available, so increased flow due to development is not anticipated in this basin.

The infrastructure in this basin appears to be adequate for the projected buildout flows.

Basin A3

Wastewater from this basin flows by gravity to LS 20 via the 10-inch diameter pipe along Vernon Road. One pipe (PIP-692) is shown to have insufficient capacity in this basin at buildout due to its flat slope, but surcharging at the manholes connected to this pipe is less than 5 inches. Therefore, the pipe is not in need of replacement.

Basin A4

Basin A4 is located upstream of Basin A1 and contains the Campus Park (Hewlett-Packard) Trunk, which flows via a pressure system to LS 20. Because the trunk has a "belly" in order to pass beneath a stream, a dosing tank was installed, which periodically flushes the line and prevents debris from settling and clogging the pipe.

According to buildable land information, this basin does not have developable or redevelopable land available, so increased flow due to development is not anticipated in this basin.

The infrastructure in this basin appears to have adequate hydraulic capacity for the projected buildout flows.

Project A4: As discussed in Chapter 4, the Dosing/Flush Station that the District is aging. It operates this station to maintain adequate flushing velocity though a sewer system siphon. This project will modernize the equipment at the station and will improve access to the pipeline system downstream of the station.

Basin B1

This basin flows by gravity to the existing wastewater treatment facility through the Vernon Road Diversion. The major trunks in this basin include the Frontier Heights Trunk, the Vernon Road West Trunk, the Glenacres/Meridian Trunk and the 91st Avenue SE Trunk.

Project B1-A: A 968-foot portion of the 24-inch Vernon Road West trunk between MH 99 and MH 101 does not have adequate capacity for current or projected future flows. Under the Existing scenario, the modeling shows the flow along this portion causes surcharging of approximately 0.4 feet. The surcharging reaches 1.1 feet above the pipe crown by 2041 and is up to 3.6 feet above the pipe crown under buildout flows. 30-to 36-inch-diameter pipe can convey flows for the Buildout scenario at the existing pipe slope without surcharging. It is recommended that this pipe be replaced with 30- to 36-inch-diameter pipe.

Project B1-B: Three segments of the 8-inch diameter main along 91st Avenue SE between 7th Street SE and 1st Place SE are shown to have insufficient capacity at buildout. Surcharging along the main reaches 0.3 feet above the pipe crown under existing peak flows, 0.8 feet above the pipe crown by 2041, and 1.4 feet above the pipe crown during times of peak flow at buildout. It is recommended that a total of 1,208 feet of 8-inch pipe be replaced with 12-inch pipe to provide capacity in this location.

Project B1-C: A 902-foot-long section of 21-inch-diameter pipe immediately downstream of the LS 15 discharge along the Vernon Road West Trunk has insufficient capacity. Surcharging under existing and 20-year peak flows is 0.9 feet, but this increases to 1 foot at buildout. 24-inch diameter replacement pipe would be required to eliminate surcharging under the buildout scenario.

Several isolated 18-inch pipes along Market Place, between 91st Avenue NE and 97th Avenue SE are shown in the modeling to have inadequate capacity due to discharges from the LS12 force main. These pipes are nearly flat with slopes of less than 0.2 percent.

Surcharging along this main is less than 0.3 feet under existing peak flow conditions. Surcharging at buildout reaches 0.4 feet in the vicinity of the intersection of Market Place and 95th Drive NE (MH 2526 and MH 2527) due to a pipe at a reverse slope. Replacement of these pipes is not recommended as surcharging is less than 0.5 feet and occurs briefly only at peak flow.

Two isolated 18-inch diameter pipes in the vicinity of the intersection of 1st Street SE and 86th Drive SE are also shown to surcharge up to 0.1 feet during times of peak flow at buildout. Accordingly, replacement of these pipes is not recommended.

Basin B2

LS 1, a small local lift station, serves this basin. LS 1 discharges to the 91st Avenue SE Trunk. No development is projected to occur in this basin, but I/I flows are anticipated to increase in the future. In both scenarios, the conveyance facilities have adequate capacity, however, the lift station itself is undersized for the existing and buildout peak flow.

Project B2: Although this lift station had previously been intended to be a temporary lift station, able to flow by gravity to LS 11, construction of that gravity connection has been found to be infeasible. This project will upgrade the lift station to 100 gpm and rehabilitate this lift station. This project is discussed in more detail below.

Basin B3

LS 12, a regional lift station, serves this basin, which discharges to the 97th Avenue SE trunk in Basin B1. This lift station has sufficient capacity for the flows projected under all scenarios. The major trunk in this basin is the Davies Road Trunk, which conveys flow from LS 14 to LS 12. There are no deficiencies identified for this basin under any of the scenarios.

Basin B4

This basin is located at the south end of Lake Stevens. The basin is served by LS 2. The major trunk within this basin is the Stitch Road (UCT) Trunk. The capacity of LS 2 and the gravity pipes in this basin are adequate for both the existing and Buildout scenarios.

Basin B5

This basin is located to the south of Lake Stevens. The basin is served by LS 14. This lift station currently discharges into the Davies Road Trunk, tributary to LS 12.

The only deficiency within the gravity system in this basin is in the 8-inch-diameter pipe between MH 2830 and LS 14. Under the buildout scenario, the maximum surcharge is less than 1 inch. Because this portion of pipe is directly upstream of the wet well, it has effectively increased wet well storage. Although 10-inch pipe would be required to provide capacity in this section, replacement of the existing pipe is not recommended at this time.

Basin C1

This basin is located to the south of Lake Stevens, at the southern boundary of the service area. The basin is served by LS 17, which discharges to the Southwest Interceptor.

There are no deficiencies identified for the gravity system within this basin under the existing or buildout scenarios.

The current capacity of LS 17 is projected to be sufficient for the buildout flows of 746 gpm.

Basin C2

This basin is located to the southeast of Lake Stevens. Currently the basin is served by a temporary lift station, LS 18. The station will be decommissioned and a gravity line will be extended to the LS 17 system, as a donated facility from the developer or ULID that builds the gravity line. There are no identified capacity deficiencies for the gravity system in this basin under either the existing or buildout scenarios.

Project C2-B: Under the buildout scenario, LS 18 is decommissioned. Flow from this basin will be conveyed via a new 10-inch-diameter gravity pipe to the LS 17. The 10-inch gravity pipe will be constructed to provide sewer service within the White Oaks Subdivision.

Project C2-A: This project will decommission LS 18 following completion of the gravity pipe to LS 17.

Flows from future LS C3 and LS C5 will be routed through this basin to LS 17. Construction of these projects is contingent upon completion of Projects C2-A and C2-B.

Basin C3

This basin is located south of existing LS 18, in the southeast corner of the service area. Currently, this basin has no sanitary sewer service.

Project C3: Under the buildout scenario, this basin is served by LS C3. The projected peak flow to LS C3 is approximately 70 gpm. The proposed 4-inch force main from this lift station will be approximately 1,250 feet long and will discharge to the gravity basin of LS 17 (Basin C2, currently served by LS 18). This project is contingent upon completion of Project C2-A, the decommissioning of LS 18.

Basin C4

This basin is located in the southeast corner of the service area, west of Basin C1. This basin currently has no sanitary sewer service.

Project C4: Under the buildout scenario, this basin is served by LS C4. The projected peak flow to LS C4 is approximately 20 gpm. The proposed 4-inch force main from this lift station will discharge to the gravity basin of LS 17.

Basin C5

This basin is located east of existing LS 18, in the southeast corner of the service area, north of Basin C3. Currently, this basin has no sanitary sewer service.

Project C5: Under the buildout scenario, this basin is served by LS C5. The projected buildout peak flow to LS C5 is 60 gpm. The 4-inch force main from this lift station will be approximately 1,600 feet long, and will discharge to the gravity basin of LS 17 (Basin C2, currently served by LS 18). This project is contingent upon completion of Project C2-A, the decommissioning of LS 18.

Basin D1

This basin is located to the northwest of Lake Stevens. Currently the basin is served by LS 15. Several lift stations contribute flow to LS 15, including LS 5, LS 1C and LS 8C. There are several major trunks in this basin including the Vernon/Lundeen Trunk, the Callow Road Trunk, 99th Avenue NE Trunk, and the Lake Drive Trunk. The manhole adjacent to LS 15, MH 53A, can be modified to divert up to 2,000 gpm to LS 5.

The peak flow to LS 15 under the existing scenario is approximately 2,970 gpm, which is within the capacity of the lift station (5,250 gpm).

Currently, there are several sections of pipe that do not have adequate capacity within the gravity portion of this basin. These include a single pipe at the intersection of 31st Place NE and 99th Avenue NE that is laid flat, and a flat 12-inch pipe along Vernon Road near the Anglin site. Surcharging is less than 2 inches under existing flows. Additionally, the 8-inch pipes downstream of the LS 5 discharge, along Vernon Road south of LS 15 do not have adequate capacity. Surcharging of up to 3 feet above the crown of the pipe occurs due to the force main discharge, within 5 feet of the ground elevation. Because this surcharge is eliminated between the LS 5 pump cycles, replacement of this pipe is not recommended.

Project D1-A: Projected flow to LS 15 in the buildout scenario is 5,259 gpm, slightly above the existing capacity of the lift station of 5,250 gpm. The LS 15 wet well volume is adequate to handle this flow, as it lasts for less than 15 minutes. This project will include improvements to LS 15 to increase capacity. Lift station rehabilitation, with the components shown in Table 6-4, should be included in this project.

Projected buildout flows in the 12-inch gravity main along Vernon Road downstream of the LS 1C (and future LS 2C) discharge exceed the main's capacity. The force main extension in Project E2-E will convey flows around this section of gravity main. The feasibility of this system is outlined in the *Lift Station 2C Upgrade Predesign Report* dated May 2015 and included as Appendix H.

The single, flat 12-inch pipe along Vernon Road near the Anglin site showed some surcharging under buildout flows of up to 2 inches. The modeling also shows surcharging under buildout flows of 3 inches at a single, flat 15-inch pipe at the intersection of Lundeen Parkway and Sandy Beach Drive. These pipes are not recommended for replacement at this time.

Basin D2

This basin is located to the west of Lake Stevens, east of SR 9. Currently the basin is served by LS 5.

Project D2: Flow to LS 5 is 661 gpm under the existing scenario, which is within the capacity of LS 5 of 800 gpm, but flow is projected to reach 879 gpm by buildout. This project will include improvements to LS 5 to increase capacity. Lift station rehabilitation, with the components shown in Table 6-4, should be included in this project.

Two gravity pipes downstream of the LS 4 discharge along Springbrook Road are shown to have insufficient capacity due to their flat slopes, totaling 700 feet of existing 10-inch diameter pipe. Surcharging under buildout flows is shown to reach about 0.3 feet above the crown of the pipe. These pipes are not recommended for replacement as the surcharging is less than 1 foot and happens only at peak flows.

A single pipe located along the west lakeshore south of 15th Street NE is shown to have insufficient capacity at buildout, and surcharging at the upstream manhole reaches about 0.8 feet above the crown of the pipe due to the steep slope of the upstream pipe. A 10-inch pipe just upstream of the LS 5 wet well is laid at a nearly flat slope, and surcharging at buildout is shown to reach less than 1 inch. Replacing these pipes is not recommended as they are isolated problem areas, and surcharging only occurs at peak flow times.

Basin D3

This basin is located along the west edge of Lake Stevens. Currently the basin is served by LS 4, which pumps to LS 5. Flow to LS 4 is 304 gpm under the existing scenario and is projected to reach 380 gpm at buildout. The capacity of LS 4 is 580 gpm.

There are no identified capacity deficiencies for the gravity system in this basin under either the existing or buildout scenarios.

Basin D4

LS 3, a small local lift station, serves this basin. LS 3 discharges to the gravity basin of LS 4. Existing and buildout flows to LS 3 are within the capacity of the lift station, and there are no gravity deficiencies indicated.

Basin D5

LS 6, a small local lift station, serves this basin. LS 6 discharges to the Lundeen/Vernon Road Trunk near the intersection of Vernon Road and 18th Street NE. Flows are projected to increase only slightly by buildout, and the lift station has adequate capacity for this flow. There are no gravity deficiencies identified for this basin. The capacity of LS 6 is 312 gpm, and flow to the lift station is expected to reach 173 gpm at buildout.

Basin D6

This basin is located to the northeast of Lake Stevens. Currently the basin is served by LS 8C, which discharges to Basin D1. The major trunks in this basin are the 26th Street NE Trunk and the Grade Road Trunk.

Project D6: Under the existing scenario, flow to LS 8C is 730 gpm. The capacity of LS 8C is 670 gpm. Projected flow to LS 8C at buildout is 973 gpm, which exceeds the capacity of the lift station. This project will include improvements to the lift station to increase capacity. Lift station rehabilitation, with the components shown in Table 6-4, should be included in this project.

There are no identified capacity deficiencies in the gravity system in this basin under this scenario or the buildout scenario.

Basin D7

This basin is located in the northeast corner of the City of Lake Stevens. A portion of the basin is currently served by a temporary lift station owned and maintained by Snohomish PUD. Projects D7-A and D7-B, as discussed below, would provide service to this basin and would allow for decommissioning of the temporary lift station.

Basin E1

This basin is located along the eastern half of the north shore of Lake Stevens. It is served by LS 1C which discharges to the Vernon/Lundeen Trunk. The major trunk within this basin is the Vernon Road East Trunk.

Currently, LS 2C, as well as several small lift stations are routed through this lift station. Flow to LS 1C is approximately 1,578 gpm under the existing scenario, which exceeds the LS 1C capacity of 650 gpm. After Projects E2-A and E2-C are complete, flow from LS 2C will no longer by pumped by LS 1C. These projects are discussed in the Lift Station 2C Predesign Report and provided in Appendix H.

Project E1-A: LS 1C was placed into service in 1971 and has since had partial upgrades to the motors, impellers, and miscellaneous electrical components. This project will rehabilitate this lift station and increase the capacity of LS 1C to the projected flow at buildout of 1,236 gpm (with the LS 2C diversion).

The capacity of a single section of 8-inch pipe just upstream of the wet well near 116th Drive NE and North Lakeshore Drive is shown to be exceeded at buildout, though surcharging reaches approximately 2 inches at peak flow times. An 8-inch pipe at the intersection of 116th Avenue NE and 20th Street NE has insufficient capacity for buildout flows, and peak surcharging reaches approximately 0.5 feet above the crown of the pipe. These pipes are not recommended to be replaced as the surcharging is less than 0.5 feet and occurs only at peak times.

Project E1-B: A 444-foot-long, 8-inch pipe located along Mitchell Road between 118th Avenue NE and 116th Drive NE has insufficient capacity. Surcharging of up to 1.5 feet above the crown of the pipe is noted at peak flow in the existing scenario, and up to 4.3 feet above the crown of the pipe is noted at peak flow. It is recommended that this pipe be replaced with a 12-inch diameter pipe to provide sufficient capacity.

Basin E2

This basin is located to the northeast of Lake Stevens. It is served by LS 2C, which currently flows to LS 1C. The major trunk in this basin is the East Lake Shore Drive Trunk.

The flow to LS 2C is 959 gpm under the existing scenario, and the lift station is currently at capacity. This station receives flow from several upstream lift stations including LS 3C, LS 4C, LS 5C, LS 6C, and LS 9C.

Projects E2-A and E2-C: The projected flow to LS 2C is 1,283 gpm under the buildout scenario. As discussed in the Lift Station 2C Predesign Report included in Appendix H, the District is currently planning to reroute the LS 2C force main through an extension of a new 12-inch force main in order to bypass LS 1C, as flows to the lift station currently exceed the lift station's capacity. This diversion was included in the buildout modeling. The upgrade of LS 2C and force main extensions are included in this project**.**

Project E2-E: When LS 2C is upgraded, the 12-inch-diameter force main that connects to the existing 8-inch-diameter PVC force main will be extended approximately

4,700 feet to MH 67-B, bypassing MH 79 and several low-capacity gravity sections on the Vernon Road East Trunk, as discussed above in Basin D1.

Project E2-B: The 6-segment, 10-inch diameter, 1,580-foot portion of the East Lakeshore Drive Trunk, from LS 2C to MH C7, has insufficient capacity for the buildout scenario. An 18-inch-diameter main is required to eliminate all surcharging and provide capacity.

Project E2-D: A 1,050-foot long, three-section portion of 8-inch-diameter pipe in 16th Street NE has insufficient capacity for the buildout scenario. 10-inch diameter pipe is required to eliminate surcharging.

Basin E3

LS 4C, a small local lift station, serves this basin. LS 4C discharges to the gravity sewer system tributary to LS 2C. Flows to this lift station are anticipated to increase slightly by buildout due to development, but will be within the capacity of the lift station. There are no gravity deficiencies identified for this basin.

Basin E4

LS 5C, a temporary lift station, serves this basin. LS 5C discharges to the gravity sewer system tributary to LS 4C and then LS 2C. There are no deficiencies identified for this basin under existing flows.

Project E4: LS 5C will be abandoned and flow from Basin E4 will be routed to Basin E3 and LS 4C to the east via a 12-inch diameter main.

Basin E5

This basin is served by LS 6C. LS 6C discharges to the gravity sewer system tributary to LS 2C.

The flow to LS 6C is 23 gpm under this scenario, reaching 62 gpm under the buildout scenario. This flow is within the lift station's current capacity. There are no gravity deficiencies in this basin.

Basin E6

LS 9C, a small local lift station, serves this basin. LS 9C discharges to the gravity sewer system tributary to LS 2C. The lift station capacity is currently 150 gpm. Under the buildout scenario, a peak flow of 43 gpm is projected for LS 9C. It should be noted that it is possible for some of the area in this basin to flow by gravity to LS 2C in the future. There are no gravity deficiencies noted in this basin.

Basin E7

LS 3C, a small local lift station, serves this basin. LS 3C discharges to the gravity sewer system tributary to LS 2C. Flow is anticipated to increase slightly by buildout, but the LS has adequate capacity for the projected 101 gpm peak flow. There are no deficiencies identified for this basin.

Basin E8

This basin is not currently sewered and is located to the east of the City of Lake Stevens.

Project E8: Under the buildout scenario, a future small, local lift station, LS E8, is constructed to serve this basin. Projected flow to LS E8 is approximately 30 gpm. The 4-inch force main for LS E8 will convey flow west in Machias Cutoff and 20th Street NE to MH D36 in the gravity basin of LS 2C. Completion of this project may be contingent upon completion of Projects E2-C or E2-E.

Basin E9

This basin is not currently sewered and is located in the eastern portion of the City of Lake Stevens.

Project E9: Under the buildout scenario, a future small, local lift station, LS E9, is constructed to serve this basin. Projected flow to LS E9 is approximately 20 gpm. The force main for LS E9 will convey flow south through easement area and 130th Place NE to MH D36 in the gravity basin of LS 2C. Completion of this project may be contingent upon completion of Projects E2-C or E2-E.

Basin E10

This basin is not currently sewered and is located in the eastern portion of the City of Lake Stevens.

Project E10: Under the buildout scenario, a future small, local lift station, LS E10, is constructed to serve this basin. Projected flow to LS E10 is approximately 60 gpm. The 4-inch force main for LS E10 will convey flow west across private property to MH C102 in the gravity basin of LS 2C. Completion of this project may be contingent upon completion of Projects E2-C or E2-E.

Basin F1

This basin flows by gravity to the Vernon Road Diversion and WWTF, as the lift station previously serving this basin was decommissioned. Very little area in this basin is eligible for new development or redevelopment, and projected flows are only slightly higher under the buildout scenario. The conveyance facilities have adequate capacity for this flow. There are no deficiencies identified for this basin.

Basin F2

This basin flows by gravity to the Vernon Road Diversion and WWTF. There are no identified capacity deficiencies in this basin.

Basin G1

This basin flow by gravity to the Southwest Interceptor and WWTF and is located in the southwestern portion of the City of Lake Stevens. There are no identified capacity deficiencies in this basin.

Basin G2

LS 19, a small local lift station, serves this basin. LS 19 discharges to the gravity sewer system in Basin G1. Flow is anticipated to increase to 304 gpm by buildout, but the LS has adequate capacity. There are no deficiencies identified for this basin.

Basin G3

This basin is located in the southwest corner of the District. Currently, this basin has no sanitary sewer service.

Project G3: Flow from this basin is assumed to be routed to Basin G2 and LS 19 via a new lift station, LS G3, for the buildout scenario. The projected peak flow from this basin is approximately 20 gpm.

Basin G4

LS 11 currently serves this basin, and flow is pumped to the Southwest Interceptor.

Project G4: The lift station capacity is currently 400 gpm and peak flow at buildout is projected to be 378 gpm. The length of the force main for this lift station was substantially reduced after completion of the Southwest Interceptor. This reduction resulted in increased pumping capacity at the lift station. Lift station rehabilitation, with the components shown in Table 6-4, should be included in this project.

Basin G5

This basin is located in the southwest portion of the UGA, south and east of Basin G4. The major trunk within this basin is the Southwest Interceptor, which flows west to the WWTF. There are no deficiencies noted in either scenario in this basin.

Basin G6

This basin is located to the north of and adjacent to the WWTF site. Currently this basin has no sanitary sewer service.

Project G6: Flow from this basin will be directed to the WWTF via a new lift station, G6 for the buildout scenario. The projected peak flow from this basin is approximately 10 gpm.

Basin G7

This basin is not currently sewered and is located in the south portion of the City of Lake Stevens.

Project G7: This basin will flow by gravity to the LS 24 located near a new intersection of 91st Avenue and 24th Street. This lift station is currently in design and expected to be completed in 2022. The proposed 160 gpm lift station will have capacity for the peak flow at buildout.

Basin H1

This basin is located at the south end of Lake Stevens, east of Basin B7. The basin is served by LS 22. The capacity of LS 22 and the gravity pipes in this basin are adequate for the existing scenario.

Improvements to upstream LS 7 and LS 8 may be necessary to provide adequate capacity for buildout flows in those basins. LS 22 appears to have sufficient capacity to accommodate the increased flows associated with those improvements without needing additional upsizing.

Several pipes from the lift station wet well to South Lake Stevens Road along Machias Cutoff are undersized for the buildout flows. A 303-foot section of 8-inch pipe between South Lake Stevens Road and 115th Drive SE should be replaced with a 12-inch pipe, and the two pipes leading to the wet well from Machias Cutoff may need to be replaced with 15-inch pipes to accommodate the tributary flow to the lift station.

Basin H2

This basin is located along the southeast side of Lake Stevens. The basin is served by LS 8. The major trunk within this basin is the South Lake Stevens Road Trunk. Flows tributary to this trunk include LS 7, LS 9, LS 10, and LS 21.

With a modeled incoming peak flow at 444 gpm, LS 8 appears to have sufficient capacity for existing flow. A single 8-inch pipe located near the intersection of Rhodora Heights Road and Meridian Place SE has a reverse slope causing surcharging of less than 1 inch.

Project H2: Peak buildout flow to LS 8 is 700 gpm, exceeding the existing rated capacity of this lift station. This project will upgrade the station to 700 gpm. Lift station rehabilitation, with the components shown in Table 6-4, should be included in this project.

Basin H3

This basin is located along the east side of Lake Stevens. The basin is served by LS 7, which is currently in moratorium per District Resolutions 772 and 782, included as Appendix I.

With incoming existing peak flow of 249 gpm, LS 7 has insufficient capacity. The capacity of the downstream system (LS 8) may limit the ability to upgrade this station. There are no capacity deficiencies in the gravity conveyance within this basin.

Project H3: The projected peak flow to LS 7 is 314 gpm under the buildout scenario. An upgrade of LS 7 will be required to increase capacity. LS 7 has not been substantially rehabilitated since its construction in 1982. The upgrade requires the installation of new motors and impellers. Lift station rehabilitation is discussed in more detail below.

Basin H4

LS 21, a small local lift station with a pumping rate of 130 gpm, serves this basin, discharging to the LS 7 gravity basin. A small amount of redevelopment could occur in this basin by buildout, but the conveyance facilities and the lift station have adequate capacity. There are no deficiencies identified for this basin in either scenario.

Basin H5

This basin is located on the eastern border of the service area, primarily to the north of Machias Cutoff.

Currently this basin has no sanitary sewer service. LS 23 is currently under construction to provide sewer service to this basin.

Under the buildout scenario, this basin is served by LS 23. Projected buildout peak flow to LS 23 is approximately 70 gpm.

Basin H6

LS 10, a small lift station, serves this basin. LS 10 discharges to the gravity sewer system tributary to LS 8. Very little development is projected to occur in this basin, and though the lift station was not explicitly modeled at this time, it is anticipated that the lift station and conveyance facilities have adequate capacity. There are no deficiencies identified for this basin.

Basin H7

LS 9, a small temporary lift station, serves this basin. LS 9 discharges to the gravity sewer system tributary to LS 8. Very little development is projected to occur in this basin, and though the lift station was not explicitly modeled at this time, it is anticipated that the lift station and conveyance facilities have adequate capacity. There are no deficiencies identified for this basin.

Project H7: LS 9 is located within 200 feet of sewer main that is currently under construction by the Hintz DEA. A sewer main extension of approximately 170 LF across private property would allow this lift station to be eliminated.

Basin H8

This basin is located in the southeast portion of the service area, primarily to the south of Machias Cutoff. Currently this basin has no sanitary sewer service.

Project H8: Flow from this basin is assumed to be routed to Basin H1 and LS 22 via a new lift station, LS H8, for the buildout scenario. The projected peak flow from this basin is approximately 52 gpm.

OTHER PIPELINE DEFICIENCIES

The hydraulic model can provide some, but not all, information about current pipeline deficiencies. Where "sagging" has occurred, offset joints developed, or manholes have been improperly installed, the hydraulic model most likely will not reflect these problems.

UNSEWERED URBAN AREAS

The District's sewer collection system has historically been funded either by private entities as connection to the sewer system was necessary in order to develop land more densely than allowed by the use of septic systems or by property owners with failing septic systems. This has resulted in relatively small pockets within the District that do not yet have sanitary sewer service but could be served by sewer main extensions.

The following projects extend sewer main to the unsewered areas north of Lake Stevens:

Project D1-B: Construct 1,550 feet of 8-inch gravity main along Cedar Road, north of Willow Road to serve the areas immediately adjacent to Cedar Road.

Project D1-C: Construct 1,250 feet of 8-inch gravity main along the western property boundary of the Lake Stevens High School property to serve those areas immediately west of the high school and east of Cedar Road.

Project D1-D: Construct 3,600 feet of 8-inch gravity main along Soper Hill Road, from Lundeen Parkway to the road's northernmost terminus to serve this area.

Project D1-E: Construct 5,300 feet of 8-inch gravity main along Lakeview Drive, Willow Road and Cherry Road to serve the areas immediately adjacent to those roads.

The following projects extend sewer main to the unsewered areas in the Industrial Area, with the northeast corner of the District's service area:

Project D7-A: Construct 840 LF of 8-inch diameter gravity main to Hartford Road.

Project D7-B: Construct 3,160 LF of 8-inch-diameter gravity main from upstream end of Project D6-A to the east, across Hartford Road and then north parallel to Hartford Road across private property.

Project E5-A: Construct 400 LF of 10-inch diameter gravity main in 131st Avenue NE, north of 20th Street NE.

Project E5-B: Construct 1,400 LF of 8-inch diameter gravity main in 131st Avenue north of Project E5-A to Old Hartford Road. This project is contingent upon completion of Project E5-A.

Project E8-B: Construct 4,000 LF of 8-inch-diameter gravity sewer main in North Machias Road and private properties to the east of the road. This project is contingent upon completion of Project E8-A, the lift station that will provide service to the sewer basin.

Project E9-B: Construct 2,650 LF of 8-inch-diameter gravity sewer main to provide in Hartford Drive, Old Hartford Road and in 26th, 27th and 28th Places NE. This project is contingent upon completion of Project E9-A, the lift station that will provide service to the sewer basin.

LIFT STATION REHABILITATION PROJECTS

LIFT STATION CONDITION EVALUATION

As discussed in Chapter 4 and shown in Appendix E, many of the District's lift stations require rehabilitation. Table 6-4 identifies which of the following major components that should be considered for each station that are recommended for rehabilitation within the 10-year CIP:

- Site Improvements: Most of the lift stations have inadequate lighting to allow for night work. Site drainage issues that should be addressed were noted at LS 7. It is recommended that additional parking be provided at LS 14.

- Water Service: Water service is necessary for efficient lift station maintenance. It is recommended that water service be added to all lift stations that currently lack it.

- Bypass Connection: Many of the stations do not have a force main bypass connection. It is recommended that this be added to all lift stations that currently lack it.

- Replace Pumps: The pumps at many of the stations have reached the end of their useful lives and should be replaced. This should include replacing the pumps, piping and associated valves.

- Dry Well Recoating and Vent: Many of the dry wells have significant corrosion. Where this is the case, it is recommended that the existing coating be removed and dry well recoated. The following stations have dry well ventilation systems that should be upgraded: LS 2, 3, 4, 5, 6, 3C and 6C.

- Cathodic Protection: It is recommended that cathodic protection be added to some of the District's lift stations.

- Wet Well Improvements: Many of the metal surfaces within the lift stations have significant corrosion. Where this is observed, it is recommended that hatches, steps, ladders, grating and rails be replaced. Additionally, the following lift stations have inlet sewer valves in the wet well that are not used and should be removed: LS 3, 4, 5 and 6.

- Power Service: It is recommended that the power service pole and service feeder be replaced at many lift stations.

- Generator: Many lift stations either have no standby power or have a generator that has reached the end of its useful life. It is recommended that a new generator be provided at each of these stations.

- Odor Control: LS 15 is the only lift station where odor complaints were noted in the 2016 Lift Station Assessment. Additional odor control mitigation for the lift station site should be included during the lift station rehabilitation.

- Electrical: The electrical systems at many stations do not meet current code requirements. Where electrical systems are recommended for improvement, the following systems should be replaced: conduit and wiring, intrusion sensors, control panel, motor starter panel, level sensors (including cable splice boxes) and check valve limit switches.

  The electrical installations of each lift station should be evaluated during the design of each rehabilitation project. Each should be evaluated on the condition of the equipment, the size of the electrical service, and compliance with current codes.

  When discussing the electrical loads, the connected loads should be used to evaluate the electrical capacity of the system rather than the alternative "bill demand" method allowed by the National Electrical Code (NEC) as it is the more conservative approach.

  The term "code compliance considerations" are based on the NEC and WAC requirements. The facilities are existing, and thus, are considered to be grandfathered in. Any modifications to the systems will require the modified portions to be brought to current code standards.

  The term "classified area(s)" or "hazardous area(s)" refer to those areas deemed as Class I, div 1 or Class I, div 2 under NFPA 820. These areas require special electrical methods such as seal-off fittings and intrinsically safe barriers to make the installation "explosion proof."

TABLE 6-4

Lift Station Rehabilitation Project Components

Lift Station	Rehab Project ID	Site Work	Water Service	Bypass Cxn	Replace Pumps	Dry Well Recoat and Vent	Cathodic Protection	Wet Well	Power Service	New Generator	Odor Control	Electrical
1	B2	X	X	X	X	X		X	X	X		X
2	B4	X		X	X	X	X	X	X	X		X
3	D4	X		X	X	X	X	X	X			X
4	D3	X		X	X	X	X	X	X	X		X
5	D2	X				X		X	X			X
6	D5	X			X	X	X	X	X	X		X
7	H3	X		X	X			X	X	X		X
8	H2	X		X	X			X	X			X
10	H6	X	X	X	X			X	X	X		X
11	G4			X	X			X	X			X
12	B3	X			X		X	X				X
14	B5	X		X	X							X
15	D1-A	X			X		X	X			X	X
3C	E7	X		X	X	X	X	X	X	X		X
6C	E5	X		X	X	X	X	X	X	X		X

LIFT STATION CAPACITY EVALUATION

For each of the lift stations in the 6-year CIP, hydraulic calculations were completed to evaluate the capability of various components of the existing lift station to convey the projected future flow. The components of the lift station most significantly impacted by the increased flow are the pumps, wet well, force main and electrical system.

It is recommended that a predesign evaluation be provided as part of each lift station rehabilitation to confirm the scope of each project.

A site visit was made to each of the lift stations included for rehabilitation in the 6-Year CIP. Photographs from that site visit are included in Appendix E.

Pump Evaluation

The existing pumps were evaluated by comparing the pumping capacity of each pump determined by drawdown tests and rated capacity with the projected future flows. Tables 6-1 and 6-2 summarize the results of this evaluation.

Wet Well Evaluation

Lift station wet wells are typically sized to avoid frequent starting and stopping of the pumps during filling and pumping. Although the recommended time between pump starts varies with the particular pump, as a general rule, most wet wells are designed for pumps to start no more than every 5 minutes, or 12 starts per hours, in worst case conditions. The worst cast occurs when influent flow is one-half of the capacity of the lift station with one pump out of service.

For each lift station equipped with constant speed pumps, the maximum starts per hour was calculated using the following equation:

$$T = (4V/Q)(n-1)$$

where,

V = Wet Well Operating Volume (gallons)
Q = Projected Peak Hour Flow (gallons per minute)
T = Time between Starts (minutes)
n = Number of Pumps

If it is determined that the time between pump starts for a particular lift station wet well is less than 5 minutes, replacement was considered. For stations with larger pumps, installation of VFDs was considered to reduce starting frequency.

Force Main Evaluation

The capacity of the force mains associated with each lift station were evaluated. Table 6-3 summarized the results of this evaluation.

The recommended minimum velocity in force mains is 2 feet per second to maintain solids in suspension.

PROJECT B2 – LIFT STATION 1 REHABILITATION

LS 1 is a wet well/dry well station that is in a residential area and located on an easement located between two single-family houses. The lift station site is approximately 400 square feet and is located approximately 100 feet from the nearest right-of-way. The station is surrounded by chain link fence. Information about LS 1 is shown in Table 6-5 below. Figures 6-7 through 6-10 include photographs of LS 1.

TABLE 6-5

Lift Station 1

Parameter	Value
Year Built	1969
Capacity	59 gpm
Flows (Existing/Buildout)	84/100 gpm
Type	Wet well/dry well
Pump Manufacturer	Smith & Loveless (4B3)
Number of Pumps	2
Horsepower	7.5
Backup Power	None
Wet Well Diameter	6 feet
Operating Depth	2 feet
Time Between Pump Starts (Existing/Buildout)	20/17 minutes
Force Main	1,120 LF 4" diameter
Force Main Velocity (Existing/Buildout)	2.1/2.6 feet per second

FIGURE 6-7

Lift Station 1 Site

FIGURE 6-8

Lift Station 1 Dry Well

FIGURE 6-9

Lift Station 1 Wet Well

FIGURE 6-10

Lift Station 1 Control Panel

This lift station has significant corrosion and no on-site power generation capability. The lift station has insufficient capacity to pump the estimated current and future flows. The lift station wet well and force main are adequately sized for the projected flows.

It is recommended that the coatings in the wet and dry wells at this station be replaced and pumps be replaced with those that have capacity to pump the projected flows. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment.

Because of the long residence time in the wet well, odor control should be considered as part of the wet well modifications.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

It appears that the site does not have adequate space to accommodate an emergency generator. This should be confirmed during the design of the rehabilitation project. It may be necessary to either obtain more property to site a generator and fuel storage or improve access to the site to improve the ability to move a portable generator to and from the site.

Site lighting should be added to improve the efficiency of night work at the lift station.

The site currently has no water service. A hose bib should be added to facilitate cleaning.

PROJECT B4 – LIFT STATION 2 REHABILITATION

LS 2 is a wet well/dry well station that is situated in a residential area and located on an easement adjacent to South Davies Road. The station is surrounded by chain link fence. Information about LS 2 is shown in Table 6-6 below. Figures 6-11 through 6-14 include photographs of LS 2.

TABLE 6-6

Lift Station 2

Parameter	Value
Year Built/Upgraded	1970/1995
Capacity	239 gpm
Flows (Existing/Buildout)	108/147 gpm
Type	Wet well/dry well
Pump Manufacturer	Fairbanks Morse (5432K)
Number of Pumps	2
Horsepower	7.5
Backup Power	15 kW LP Gas Generator
Wet Well Diameter	6 feet
Operating Depth	3 feet
Time Between Pump Starts (Existing/Buildout)	23/17 minutes
Force Main	364 LF 6" diameter
Force Main Velocity (Capacity/Buildout)	2.7/1.7 feet per second

FIGURE 6-11

Lift Station 2 Site

FIGURE 6-12

Lift Station 2 Wet Well

FIGURE 6-13

Lift Station 2 Generator

FIGURE 6-14

Lift Station 2 Fuel Storage

This lift station has significant corrosion. The lift station has sufficient capacity to pump the estimated current and future flows. The lift station has relatively low flows compared to the size of the wet well and force main.

It is recommended that the coatings in the wet and dry wells at this station be replaced and pumps be replaced. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment. Additionally, the Condition Assessment recommends that cathodic protection be provided at the station.

Because of the long residence time in the wet well, odor control should be considered as part of the wet well modifications.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

Site lighting should be added to improve the efficiency of night work at the lift station.

The Condition Assessment indicates that the existing generator should be replaced. It is assumed that it will be replaced with a diesel generator and fuel tank.

PROJECT D4 – LIFT STATION 3 REHABILITATION

LS 3 is a wet well/dry well station that is situated in a residential area and located on an easement, east of North Davies Road and adjacent to Lake Stevens. Information about LS 3 is shown in Table 6-7 below.

TABLE 6-7

Lift Station 3

Parameter	Value
Year Built	1970
Capacity	307 gpm
Flows (Existing/Buildout)	71/109 gpm
Type	Wet well/dry well
Pump Manufacturer	Fairbanks Morse (5432K)
Number of Pumps	2
Horsepower	7.5
Backup Power	20 kW LP Gas Generator
Wet Well Diameter	6 feet
Operating Depth	2 feet
Time Between Pump Starts (Existing/Buildout)	24/16 minutes
Force Main	448 LF 6" diameter
Force Main Velocity (Capacity/Buildout)	3.5/1.2 feet per second

This lift station has significant corrosion. The lift station has sufficient capacity to pump the estimated current and future flows. The lift station has relatively low flows compared to the size of the wet well and force main.

It is recommended that the coatings in the wet and dry wells at this station be replaced and pumps be replaced. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment. Additionally, the Condition Assessment recommends that cathodic protection be provided at the station.

Because of the long residence time in the wet well, odor control should be considered as part of the wet well modifications.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

Site lighting should be added to improve the efficiency of night work at the lift station.

The site currently has no water service. A hose bib should be added to facilitate cleaning.

PROJECT D3 – LIFT STATION 4 REHABILITATION

LS 4 is a wet well/dry well station that is situated in a residential area and located on an easement, northeast of North Davies Road and adjacent to Lake Stevens. Information about LS 4 is shown in Table 6-8 below. Figures 6-15 through 6-18 include photographs of LS 4.

TABLE 6-8

Lift Station 4

Parameter	Value
Year Built	1970
Capacity	580 gpm
Flows (Existing/Buildout)	304/380 gpm
Type	Wet well/dry well
Pump Manufacturer	Fairbanks Morse (5432K)
Number of Pumps	2
Horsepower	20
Backup Power	30 kW LP Gas Generator
Wet Well Diameter	6 feet
Operating Depth	2.8 feet
Time Between Pump Starts (Existing/Buildout)	8/6 minutes
Force Main	123 LF 8" diameter
Force Main Velocity (Capacity/Buildout)	3.7/2.4 feet per second

FIGURE 6-15

Lift Station 4 Site

FIGURE 6-16

Lift Station 4 Wet Well

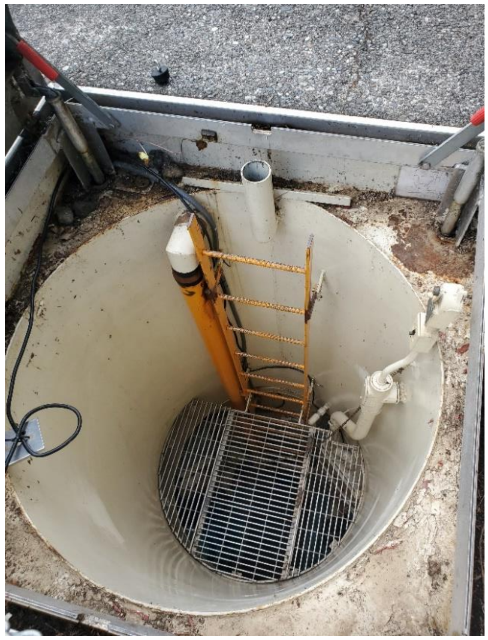


FIGURE 6-17

Lift Station 4 Dry Well

FIGURE 6-18

Lift Station 4 Valve

This lift station has significant corrosion. The lift station has sufficient capacity to pump the estimated current and future flows. The lift station wet well and force main are adequately sized for the projected flows.

It is recommended that the coatings in the wet and dry wells at this station be replaced and pumps be replaced. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment. Additionally, the Condition Assessment recommends that cathodic protection be provided at the station.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

The Condition Assessment indicates that the existing generator should be replaced. It is assumed that it will be replaced with a diesel generator and fuel tank

Site lighting should be added to improve the efficiency of night work at the lift station.

The site currently has no water service. A hose bib should be added to facilitate cleaning.

PROJECT D5 – LIFT STATION 6 REHABILITATION

LS 6 is a wet well/dry well station that is situated in a residential area and located on an easement, south of Vernon Road and adjacent to Lake Stevens. Information about LS 6 is shown in Table 6-9 below. Figures 6-19 through 6-22 include photographs of LS 6.

TABLE 6-9

Lift Station 6

Parameter	Value
Year Built/Upgraded	1970/1982
Capacity	312 gpm
Flows (Existing/Buildout)	130/173 gpm
Type	Wet well/dry well
Pump Manufacturer	Fairbanks Morse (5432K)
Number of Pumps	2
Horsepower	7.5
Backup Power	30 kW LP Gas Generator
Wet Well Diameter	6 feet
Operating Depth	2 feet
Time Between Pump Starts (Existing/Buildout)	13/10 minutes
Force Main	200 LF 6" diameter
Force Main Velocity (Capacity/Buildout)	3.5/2.0 feet per second

FIGURE 6-19

Lift Station 6 Site

FIGURE 6-20

Lift Station 6 Wet Well

FIGURE 6-21

Lift Station 6 Dry Well

FIGURE 6-22

Lift Station 6 Valve

This lift station has significant corrosion. The lift station has sufficient capacity to pump the estimated current and future flows. The lift station wet well and force main are adequately sized for the projected flows.

It is recommended that the coatings in the wet and dry wells at this station be replaced and pumps be replaced. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment. Additionally, the Condition Assessment recommends that cathodic protection be provided at the station.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

The Condition Assessment indicates that the existing generator should be replaced. It is assumed that it will be replaced with a diesel generator and fuel tank

Site lighting should be added to improve the efficiency of night work at the lift station.

The site currently has no water service. A hose bib should be added to facilitate cleaning.

PROJECT H3 – LIFT STATION 7 REHABILITATION

Lift Station LS 7 is a vacuum prime station that is situated in a residential area and located on an easement, west of E Lakeshore Drive. Information about LS 7 is shown in Table 6-10 below. Figures 6-23 through 6-26 include photographs of LS 7.

TABLE 6-10

Lift Station 7

Parameter	Value
Year Built	1982
Capacity	200 gpm
Flows (Existing/Buildout)	249/314 gpm
Type	Vacuum prime
Pump Manufacturer	Hydronix (181V)
Number of Pumps	2
Horsepower	7.5
Backup Power	40 kW Diesel Generator
Wet Well Diameter	6 feet
Operating Depth	2 feet
Time Between Pump Starts (Existing/Buildout)	7/5 minutes
Force Main	1,240 LF 6" diameter
Force Main Velocity (Existing/Buildout)	2.8/3.6 feet per second

FIGURE 6-23

Lift Station 7 Site

FIGURE 6-24

Lift Station 7 Wet Well

FIGURE 6-25

Lift Station 7 Controls

FIGURE 6-26

Lift Station 3C Site

This lift station has significant corrosion. The lift station has insufficient capacity to pump the estimated current and future flows. The force main is adequately sized for the projected flows.

It is recommended that the coating in the wet well at this station be replaced and pumps be replaced. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

The Condition Assessment indicates that the existing generator should be replaced. It is assumed that it will be replaced with a diesel generator.

Site lighting should be added to improve the efficiency of night work at the lift station.

PROJECT E7 – LIFT STATION 3C REHABILITATION

LS 3C is a vacuum prime station that is situated in a residential area and located on an easement, east of North Davies Road and adjacent to Lake Stevens. Information about LS 3 is shown in Table 6-11 below. Figures 6-27 through 6-29 include photographs of LS 3C.

TABLE 6-11

Lift Station 3C

Parameter	Value
Year Built	1971
Capacity	200 gpm
Flows (Existing/Buildout)	69/101 gpm
Type	Wet Pit/Dry Pit
Pump Manufacturer	Smith & Loveless (4B2A)
Number of Pumps	2
Horsepower	10
Backup Power	37.5 kW Diesel Generator
Wet Well Diameter	8-foot diameter
Operating Depth	1 feet
Time Between Pump Starts (Existing/Buildout)	22/15 minutes
Force Main	660 LF 4" diameter
Force Main Velocity (Capacity/Buildout)	2.3/1.1 feet per second

FIGURE 6-27

Lift Station Wet Well

FIGURE 6-28

Lift Station Dry Well

FIGURE 6-29

Lift Station Dry Well

This lift station has significant corrosion. The lift station has sufficient capacity to pump the estimated current and future flows. The lift station wet well and force main are adequately sized for the projected flows.

It is recommended that the coating in the wet well at this station be replaced and pumps be replaced. All corroded components within the wet well should be replaced with those that have protection to withstand the corrosive environment. Additionally, the Condition Assessment recommends that cathodic protection be provided at the station.

Because of the long residence time in the wet well, odor control should be considered as part of the wet well modifications.

The lift station currently has no location to connect a bypass pump. This should be installed as part of the rehabilitation.

The electrical system that was installed when this lift station was constructed has reached the end of its useful lift. All electrical components, including controls and telemetry, should be replaced.

Site lighting should be added to improve the efficiency of night work at the lift station.

CHAPTER 7

WASTEWATER TREATMENT PLANT EVALUATION

INTRODUCTION

This chapter provides an evaluation of the District's existing WWTF and identifies improvements needed to address deficiencies to ensure reliable service through the 6-year, 10-year, and 20-year planning periods as well as through buildout. The chapter is focused on the mainstream treatments processes and includes:

1. Discussion of anticipated future NPDES and General Nutrient permit limits
2. A comparison of WWTF NPDES permit limits and design criteria to projected flows and loads
3. Evaluation of the hydraulic capacity of the WWTF
4. Evaluation of the WWTF treatment processes, including capacity of each treatment process system/component
5. Description and condition assessment of each treatment system of the WWTF
6. Recommended improvements

Hydraulic capacity is the ability of each unit of the treatment plant to pass the process flow. Process capacity is each unit's ability to effectively treat the flows passing through it. The capacity, performance, and reliability of each process within the WWTF are reviewed for consistency with current state and federal design standards and codes, including the reliability classification of the plant. The WWTF site and site location are shown in Figure 7-1, and the existing site plan is shown on Figure 7-2. The WWTF unit processes of the WWTF are shown in Figure 7-3. The unit processes that are evaluated in this chapter include the following systems:

- Mainstream Treatment System
    - Influent Flow Measurement
    - Influent Screening and Pretreatment
    - Primary Clarification and Primary Effluent (Secondary) Screening
    - Membrane Bioreactor Activated Sludge Process
        - Aeration Basins
        - Membrane Basins
        - Deoxygenation Basin

- Ultraviolet Disinfection
- Effluent Flow Measurement
- Outfall

- Facility Support Systems
    - Plant Compressed Air System
    - Non-Potable Water System
    - Chemical Addition Systems
    - Plant Drain Pump Station
    - Centrate Storage and Pumping
    - Sampling Systems
    - On-Site Stormwater Collection/Disposal
    - Auxiliary Power System
    - Odor Control
    - Buildings, Laboratory, and Security

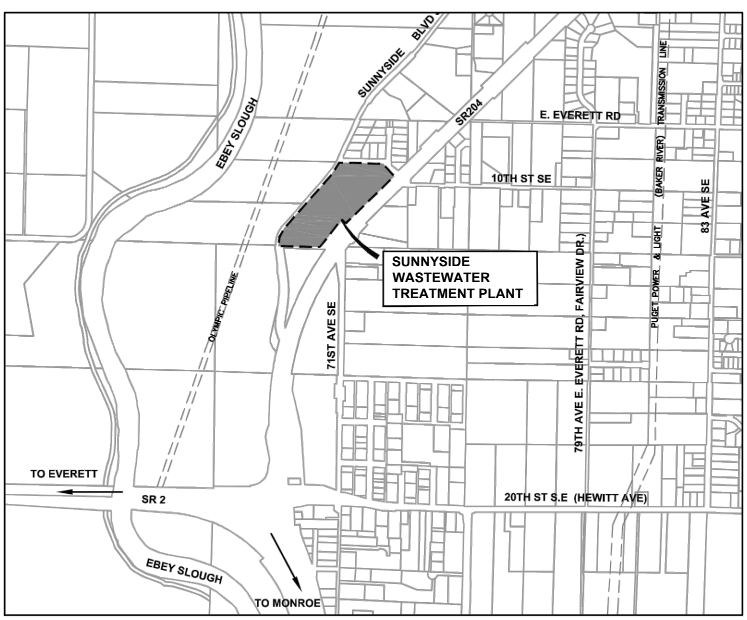
This chapter includes some processes related to solids handling and treatment. However, these processes are predominantly covered in Chapter 8.

Discussion of the improvements or process modifications needed to provide the capacity necessary to treat future projected flows and loads, improve performance or operational efficiency, and extend service life is provided at the end of this chapter.

ANTICIPATED FUTURE NPDES AND GENERAL NUTRIENT PERMIT LIMITS

It is anticipated that new permit requirements most significantly impacting the WWTF will come from the Puget Sound Nutrient General Permit (PSNGP). The PSNGP is summarized in Chapter 2 and in greater detail in Appendix K, Nutrient General Permit Compliance Road Map. This chapter (and Chapter 8) provide discussions of the PSNGP in the context of WWTF capital and operating impacts from the new standards. As mentioned in Chapter 2, the PSNGP will require the WWTF to reduce effluent loads of total inorganic nitrogen (TIN) such that the annual effluent load is no more than 127,000 lbs/year. If this level is exceeded, the District must submit for review a proposed approach to reduce the annual effluent load below 127,000 lbs/year. If this level is exceeded for two consecutive years or three times during the permit term, the District must implement the proposed approach to reduce nitrogen loads.

At the time of the development of this plan, there is limited information regarding the level of TIN reduction that will be required beyond the first permit cycle of the PSNGP. One indication of the magnitude of future treatment is in the Nutrient Reduction Evaluation requirements described in the PSNGP. At the end of 2025, the District must submit the Nutrient Reduction Evaluation which must evaluate alternatives to meet an effluent TIN concentration of 3 mg/L on a seasonal (April – October) average basis; this must consist of an AKART (All Known And Reasonable means of prevention control and Treatment) analysis. Significant improvements would likely be required to meet a



LOCATION MAP
SCALE 1'=1000'

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 7-1
WWTF SITE

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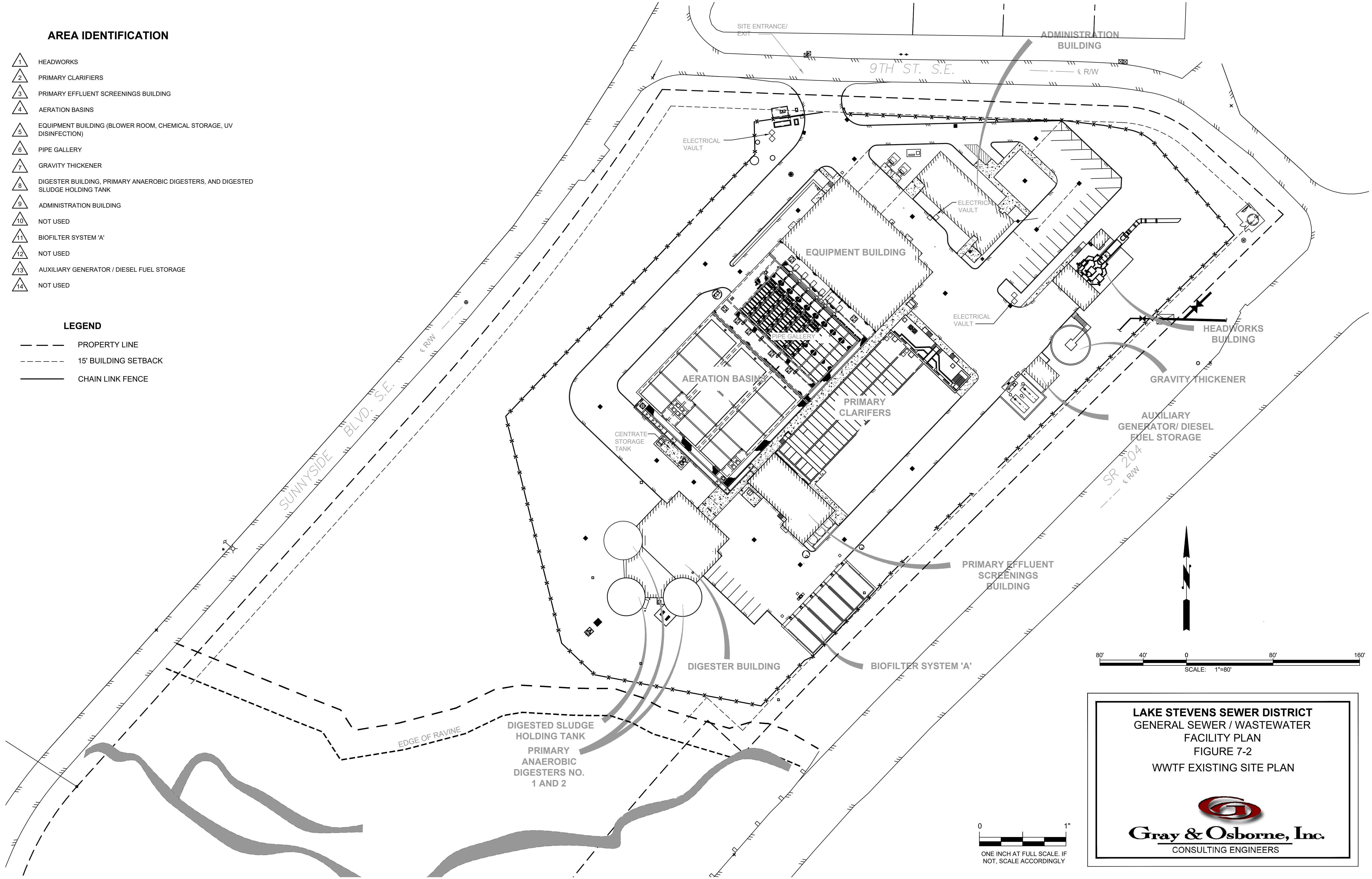
AREA IDENTIFICATION

1. HEADWORKS
2. PRIMARY CLARIFIERS
3. PRIMARY EFFLUENT SCREENINGS BUILDING
4. AERATION BASINS
5. EQUIPMENT BUILDING (BLOWER ROOM, CHEMICAL STORAGE, UV DISINFECTION)
6. PIPE GALLERY
7. GRAVITY THICKENER
8. DIGESTER BUILDING, PRIMARY ANAEROBIC DIGESTERS, AND DIGESTED SLUDGE HOLDING TANK
9. ADMINISTRATION BUILDING
10. NOT USED
11. BIOFILTER SYSTEM 'A'
12. NOT USED
13. AUXILIARY GENERATOR / DIESEL FUEL STORAGE
14. NOT USED

LEGEND

PROPERTY LINE
15' BUILDING SETBACK
CHAIN LINK FENCE

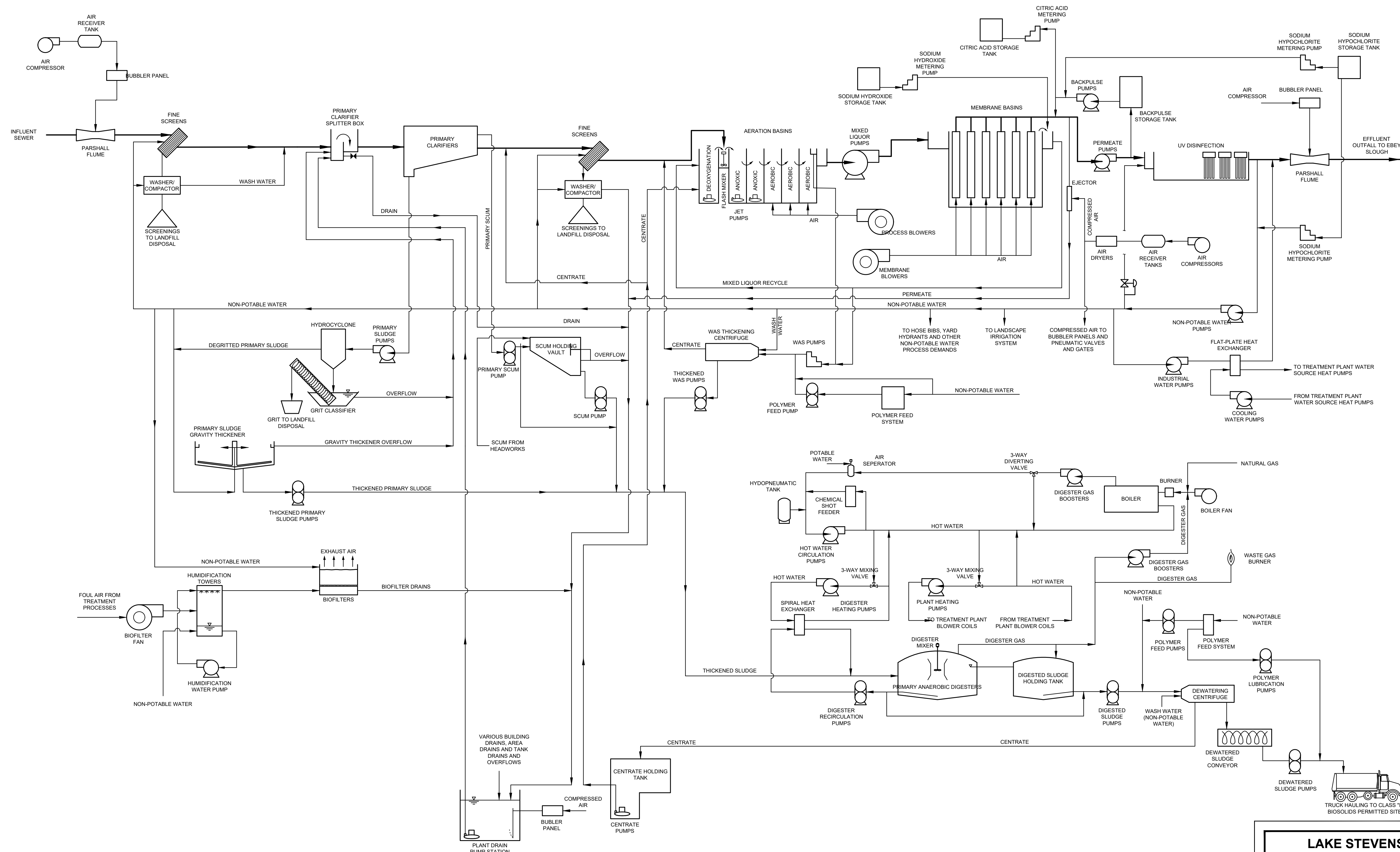


0 1"
ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER / WASTEWATER FACILITY PLAN
FIGURE 7-2
WWTF EXISTING SITE PLAN

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\06 Plan\Figures\Working Files\Drafting Request_101321KN\Figures\Fig 7,8-##.dwg, 2/3/2022 2:08 PM, KOTA NISHIGUCHI



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER / WASTEWATER FACILITY PLAN
FIGURE 7-3
EXISTING WWTF PROCESS FLOW DIAGRAM

Gray & Osborne, Inc.
CONSULTING ENGINEERS

3 mg/L effluent TIN concentration. However, since the AKART analysis includes an economic (rate) analysis, implementing the capital and operating improvements to achieve compliance with the 3 mg/L TIN limit may not be considered feasible. Thus, it is not certain that the District will be required to meet the 3 mg/L seasonal average limit. Given the uncertainties of the future limit and that the alternatives analysis required for the limit must be conducted in the Nutrient Reduction Evaluation, this Plan is limited to providing qualitative discussion of and expectations for the facility-wide impact of meeting a future seasonal average limit of 3 mg/L TIN.

In addition to effluent TIN limits, it is possible that the WWTF may face other permit limits in the future. The level of treatment that the WWTF must currently achieve is regulated by the existing NPDES permit, which is set to expire in October 31, 2022. As discussed in Chapter 2, the District conducted a mixing zone study in 2018. The study provides updates for the WWTF mixing zone dilution factors, whose importance is also described in Chapter 2. Given that the majority of the dilution factors are greater than those used to derived the effluent limits in the existing NPDES permit, future permit limits are largely expected to be no more stringent than those in the existing permit.

There is a possibility that EPA and Ecology may develop water quality standards (which may lead to effluent permit limits) in the future for trace organic “emerging constituents” such as pharmaceuticals, personal care products, or PFAS (per- and polyfluoralkyl substances). However, such limits are not anticipated in the near future, and the District’s MBR treatment technology is known to provide robust removal of a wide range of trace organics.

ANALYSIS OF WWTF FLOW AND LOAD PROJECTIONS

Chapter 5 presents a detailed analysis of the existing and projected future flows and loads. The WWTF NPDES Permit stipulates that when influent flow, BOD_5 load, or TSS load exceed 85 percent of the plant design criteria for 3 consecutive months, or if the projected plant flow or loads would reach design capacity within five years, a plan to maintain adequate capacity must be developed and submitted within 1 year. As shown in Table 7-1 and discussed in Chapter 5, this permit requirement has not yet been triggered, but is projected to be triggered before buildout.

TABLE 7-1

Current and Projected WWTF Influent Flows and Loads

Projected Flows (mgd)								
Flow Type	**NPDES Permit Limit**	**85% NPDES Permit Limit**	**2021**	**2027**	**2031**	**2036**	**2041**	**Buildout**
Average Dry Weather	--	--	2.42	2.68	2.87	3.12	3.40	3.79
Average Annual(1)	--	--	2.92	3.21	3.41	3.69	3.98	4.42
Maximum Month(1)	5.01	4.26	3.79	4.10	4.32	4.62	4.94	**5.41**
Peak Day(1)	--	--	6.96	7.33	7.60	7.96	8.36	8.92
Peak Hour(1)	--	--	9.17(3)	9.74(3)	10.14(3)	10.69(3)	11.28(3)	12.14(3)
ERUs								
Total ERUs	--		13,969	15,484	16,575	18,041	19,632	21,923
Loadings (lb/d)								
Annual Average BOD_5	--		6,210	6,883	7,368	8,020	8,727	9,745
Max Month BOD_5	10,730	9,121	6,825	7,565	8,098	8,815	9,592	10,711
Annual Average TSS	--		5,435	6,024	6,448	7,019	7,638	8,529
Max Month TSS	10,190	8,662	5,950	6,595	7,059	7,684	8,361	9,337
Annual Average NH_3			759	841	900	980	1,066	1,191
Max Month NH_3			831	921	986	1,073	1,168	1,304

(1) AAF, MMF, PDF and PHF are the sum of ADWF in Table 5-10 and I/I flow in Table 5-11. Flows are reflective of the 20-year storm event that occurred in the winter of 2019-2020.

(2) **BOLD** values exceed anticipated NPDES Permit Limits (current design limits).

(3) A peaking factor of 1.3 was used to calculate the peak hour base flow; refer to Table 5-8 Note 4 for data source.

HYDRAULIC CAPACITY EVALUATION

A spreadsheet-based mathematical model was developed to evaluate the ability of the WWTF to hydraulically convey the projected flows. The analysis starts with establishing the 100-year flood level of the receiving water and then proceeds upstream through the each unit process in the plant. When the hydraulic capacity of the conveyance system or unit process is exceeded, flow can be restricted causing the water level in upstream facilities to increase, impacting their performance and potentially causing overflows.

METHOD OF EVALUATION

The hydraulic profile represents the water surface elevation as wastewater flows through each unit process of the treatment plant. Water surface elevation changes from unit process to unit process because of frictional losses, changes in unit process elevation, hydraulic control structure losses, and mechanical energy added to the system by pumping. The projected flows were evaluated in a spreadsheet model assuming a specific number of process units are in operation. The flows and number of unit processes in operation are presented in Table 7-2.

TABLE 7-2

Hydraulic Capacity Evaluation Parameters

Parameter	Year 2027	Year 2031	Year 2036	Year 2041	Buildout
Max Month (mgd)	4.10	4.32	4.62	4.94	5.41
Peak Day Flow (mgd)	7.33	7.60	7.96	8.36	8.92
Peak Hour Flow (mgd)	9.74	10.14	10.69	11.28	12.14
Mixed Liquor Return Flow (mgd)	12.30	12.96	13.86	14.82	16.23
Influent Screens In-Service	1	1	1	1	2
Primary Clarifiers In-Service	2	2	2	2	2
Primary Effluent Screens In-Service	2	2	2	2	2
Aeration Basins In-Service	3	3	3	3	3
Membrane Basins In-Service	6	6	6	6	6

The hydraulic profile for the treatment facility was developed based on the equipment, structures, locations, piping configuration and piping sizes shown on the record drawings. The water surface elevation through the treatment plant was calculated using Bernoulli's equation for conservation of energy. Hydraulic head losses in piping systems were determined using the Hazen-Williams equation. Losses in open channels were calculated using Manning's equation. Calculations of head conditions for critical flow at other submerged and free discharged control structures, such as weirs, are conformed to methodologies set forth by Benefield, Judkins & Parr (1984). Minor head losses through pipe fittings and valves were calculated using fitting-specific minor loss constants. Lastly, hydraulic profiles were determined with the Ebey Slough high water elevation of

8.5 (NAVD 88). The following hydraulic profile evaluation details only year 2031, 2041 and buildout flow conditions.

This evaluation includes assessment of the hydraulic capacity of mechanical equipment in the mainstream treatment process. Design capacities for mechanical process equipment were derived from Operation & Maintenance and Equipment manuals. Equipment hydraulic capacities were also evaluated for compliance with the reliability requirements detailed in Ecology's Criteria for Sewage Works Design (2008) (Orange Book).

RESULTS OF HYDRAULIC PROFILE EVALUATION

The hydraulic profiles at the projected peak hour flows depict the water surface elevations at each stage of the treatment process. The capacity of a unit process or portion of the conveyance system is considered to be inadequate when the water surface elevation at that location is less than 2 feet from the top of the wall for the structure or when the hydraulic drop at weirs is less than 3 inches. A hydraulic drop of at least 3 inches at weirs is required to ensure that free discharge is maintained and upstream water levels are not affected. This can also potentially result in uneven flow distribution or short circuiting. Other flow metering points, such as Parshall flumes, have been evaluated to ensure that free discharge is maintained and the downstream water level does not cause a submerged condition at the Parshall flume.

As shown in Figures 7-4, 7-5, and 7-6, water surface elevations through the planning period and at buildout flows are projected to meet the minimum freeboard requirement at each location in the treatment process. The figures present the top of wall (TOW) elevation of each structure along with the water surface elevations at both the normal and the maximum water level (MWL) conditions. The MWL represents the projected water surface elevations when the flow equalization storage volume is being fully utilized during peak flows. As discussed later in this hydraulic capacity evaluation, projected peak day and peak hour flows are not expected to require flow equalization until year 2036 because until that point the updated flow projections are lower than the WWTF design capacity.

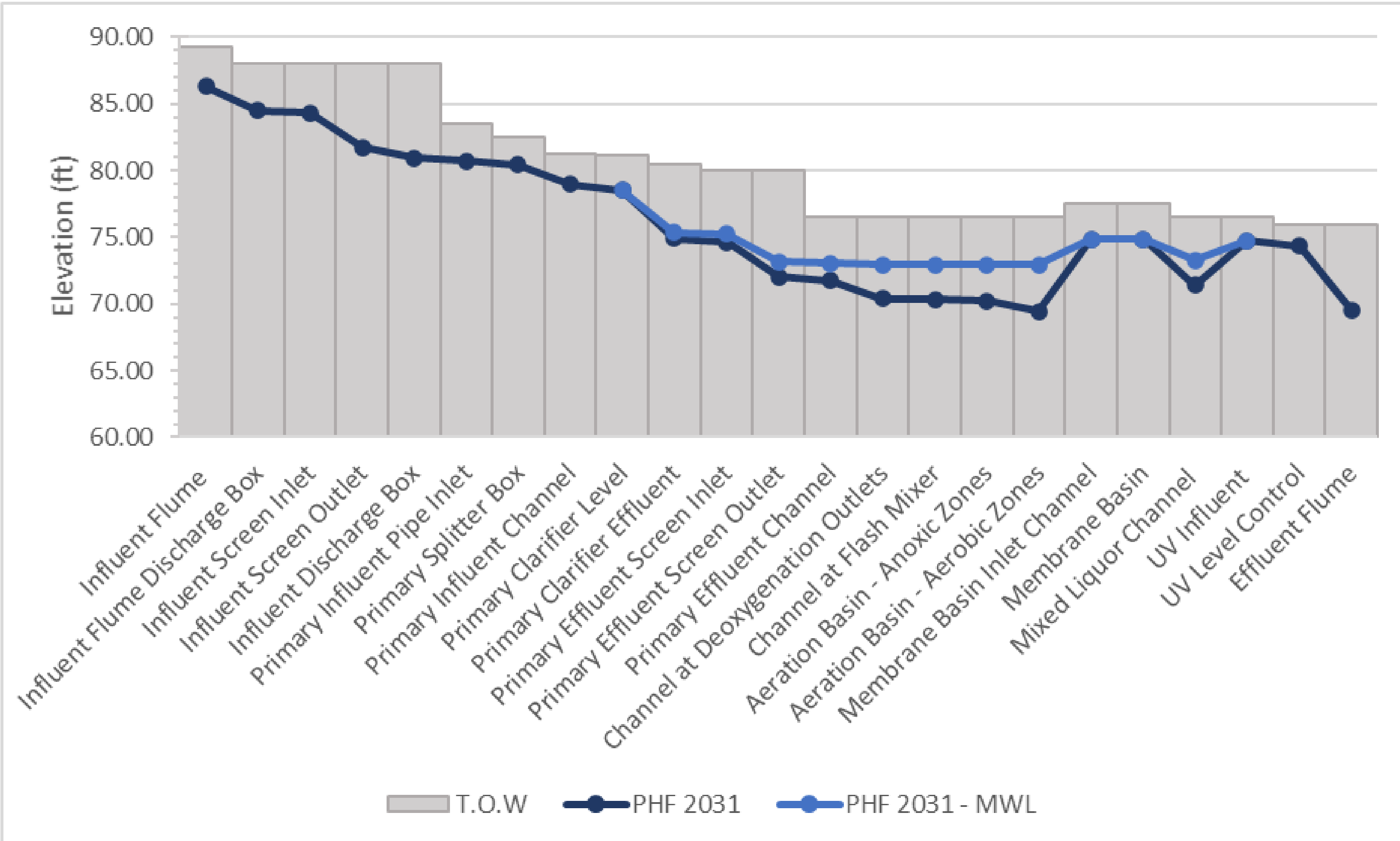


FIGURE 7-4

Hydraulic Profile at 2031 Peak Flow

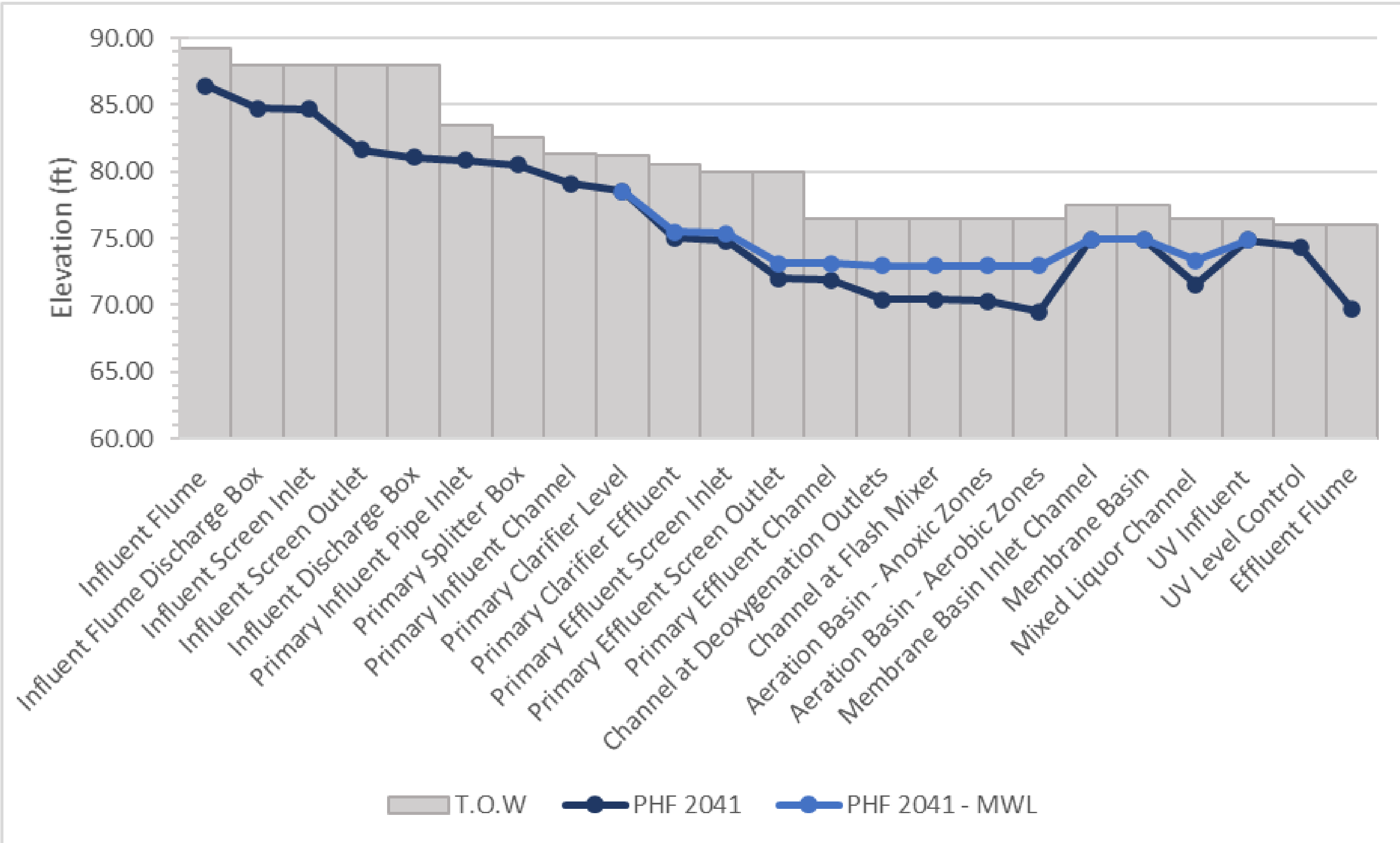


FIGURE 7-5

Hydraulic Profile at 2041 Peak Flow

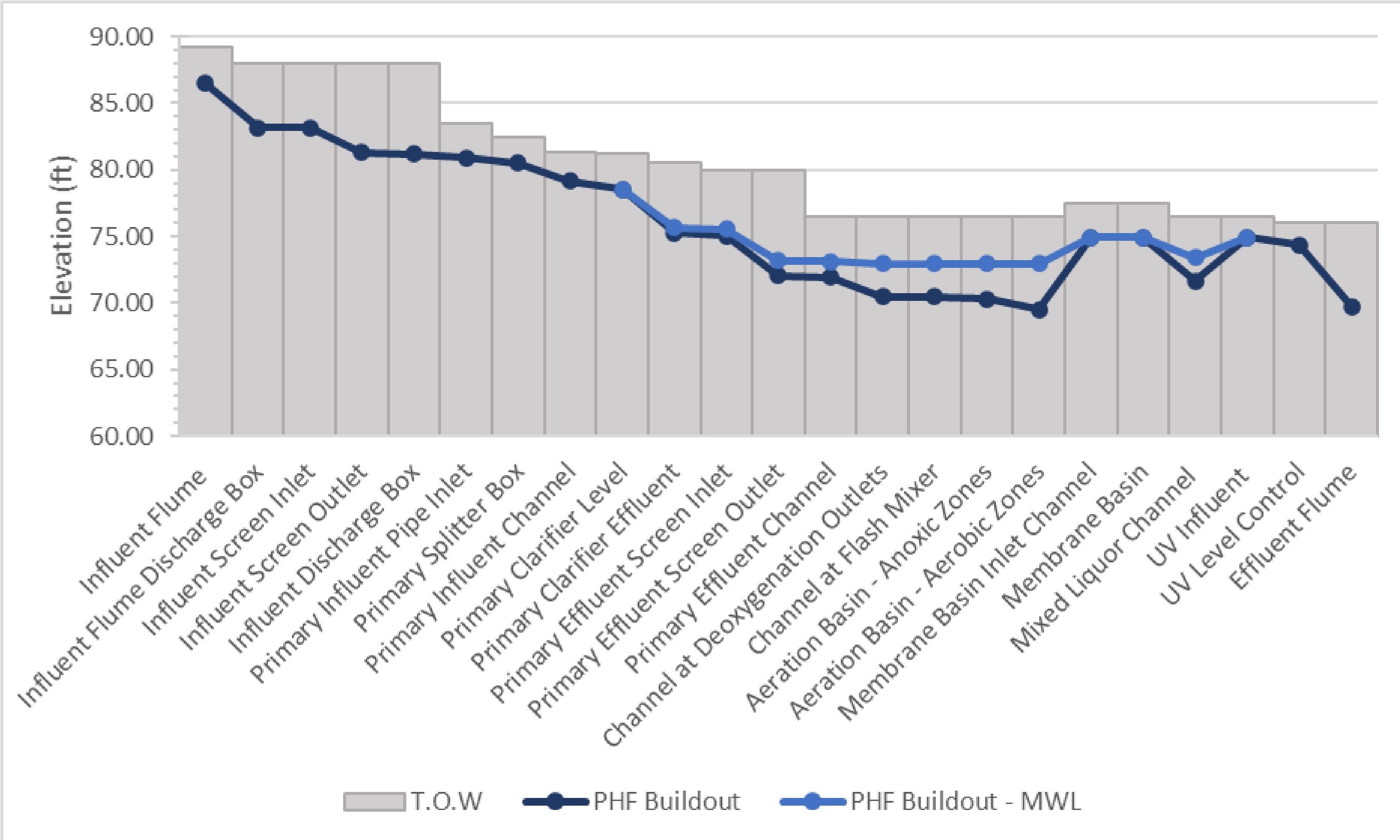


FIGURE 7-6

Hydraulic Profile at Buildout Peak Flow

As shown in Table 7-3, this analysis suggests that projected peak hour flows will not reduce freeboard to less than 2 feet or interfere with proper function of flow control points across the WWTF at any of the projected flow scenarios. Notably, the freeboard value for the influent flume discharge box is projected to be minimal and would likely result in submerged flow for the influent flume for peak hour flow in 2041. This value is partially dependent on the number of influent screens, and it is assumed that only one influent screen would need to be in operation for peak hour flow in 2041. While this strategy of operation may cause submerged flow of the influent flume, the flume is expected to accommodate a downstream depth of up to 70 percent of the upstream depth before flow measurements must be corrected for accuracy. Given this, the influent flume is expected to accurately measure peak hour flow in 2041 with only one influent screen in operation. Water depths for higher buildout peak flows were calculated with assumed two influent screens in service, which would provide free discharge into the influent flume discharge box, as presented in Table 7-3. Therefore, the hydraulic capacity of the existing WWTF is sufficient for the projected peak flows through buildout.

TABLE 7-3

Assessment of Flow Control Freeboard with Projected Flows

Location	Freeboard at Peak Hour Flow, in.		
	2031	2041	Buildout
Influent Flume Discharge	3.0	0.3(1)	> 12 (2)
Primary Splitter Box Weir	8.4	7.5	6.6
Primary Clarifier Launder	5.6	5.3	4.9
Membrane Basin Outlet Weir	> 12	> 12	> 12
UV Level Control Gate Outlet	> 12	> 12	> 12
Effluent Flume Discharge	> 12	> 12	> 12

(1) Flume outlet results in submerged flow, but is not likely to affect flow measurement accuracy.
(2) Assumes two influent screens in service.

RESULTS OF UNIT PROCESS HYDRAULIC CAPACITY EVALUATION

The following mainstream unit processes are projected to be at or beyond hydraulic capacity for projected peak flows within the planning period or by buildout.

Influent Screening

Reliability criteria for influent screening requires a redundant screen to be installed. Each of the existing influent screens has sufficient capacity to pass the projected flow through the planning period, which satisfies Ecology's reliability and redundancy criteria with one unit out of service. The projected peak hour flow for buildout will necessitate simultaneous operation of both existing screens. In turn, the screens can no longer be considered as backup units for one another. Therefore, buildout flows will require a third screen to be installed to fulfill reliability requirements. The headworks area was constructed with a third channel to provide space for a future third influent screen. By buildout, it will be necessary to install a third influent screen unit into this channel and support the system with a screenings washer-compactor.

Primary Clarifier Weir Loading

Ecology's Orange Book recommends limiting weir loading to 40,000 gpd/lf for primary sedimentation. The existing two primary clarifiers provide approximately 282 linear feet or effluent weir length. Peak hour flows at buildout will exceed this recommendation by approximately 8 percent (3,000 gpd/lf) of the recommend capacity, however, the surface loading rate of 2,020 gpd/ft^2 is well below the recommended peak surface loading rate of 3,000 gpd/ft^2. Consequently, the slight exceedance in weir loading in not expected to reduce primary clarifier performance. For this reason, it would be more prudent to re-evaluate the need to construct additional primary clarifier capacity after the 20-year planning period based on the actual performance as flows increase.

Aeration Basin Aerobic Detention Time

According to Water Environmental Foundation (WEF) Manual of Practice No. 8 (2010) and Orange Book guidelines, the aerobic zones in a secondary treatment system designed for nitrogen removal should have a minimum detention time of approximately 6 hours. However, this criteria applies to conventional activated sludge systems that are typically designed to operate at mixed liquor suspended solids (MLSS) concentrations of around 3,500 mg/L and is not directly applicable to membrane bioreactor treatment systems such as Lake Stevens WWTF. The membrane bioreactor system here is designed for an MLSS concentration of 5,400 mg/L and is ultimately capable of operating at MLSS concentrations of 7,000 mg/L and above. In treatment systems such as this there is more biomass composed of nitrifying and denitrifying microorganisms for nitrogen removal than in a conventional activated sludge system, which reduces the detention time required to achieve the same level of treatment. Regardless, the aerobic zone volume of the existing aeration basins will satisfy this requirement at projected maximum month flows through 2041. Projected buildout flow will result in an aerobic detention time of 5.8 hours in the existing three aeration basins, which is slightly lower than the criteria, but given the higher operating mixed liquor concentration this detention time is adequate. In addition, the membrane basins downstream of the aerobic zones provide aeration through the air scouring system. Anecdotal data shows that dissolved oxygen (DO) concentrations in the membrane basins are as high as 6 mg/L, which is greater than the DO setpoints within the aerobic zones. This suggests that the required aerobic detention time would be fulfilled by the combined aerated tank volumes of the aeration basins and membrane basins. In fact, the membrane basins provide an additional 1.25 hours of aerobic detention time at buildout maximum month flow. Therefore, the recommended aerobic detention time for nitrogen removal will be fulfilled through buildout.

Membrane Flux, Permeate Pumping. and Storage Volume

The membrane system was evaluated based on equipment capacity. Ecology's reliability criteria require the membrane basins to be sized with the capacity to process 50 percent of peak flow with one train out of service. With only five of the six total membrane basins in operation, the existing hollow fiber membranes and permeate pumps have the capacity for at least 50 percent of the projected peak flows through buildout. Thus, the membrane basins meet this reliability criterion.

For the WWTF to manage the entire projected peak flows, the existing equalization storage volume will be necessary to account for the capacity of the hollow fiber membranes. The flow capacity provided by the existing membranes is less than the projected peak hour flows for 2036 and beyond, without the use of equalization storage. The existing hollow-fiber membranes have a design flux of 18 gpd/ft^2 and a total membrane area of 587,520 ft^2, resulting in a peak hour flow capacity of about 10.6 mgd. Therefore, projected flows will require the use of the 462,000 gallons of equalization storage volume that is currently available at the WWTF.

The original design of the WWTF was based on a diurnal flow pattern for a typical storm event in Lake Stevens. This diurnal flow pattern was scaled to the projected peak day and peak hour flows to simulate the use of equalization storage volume at the WWTF. The existing equalization storage volume is sufficient to attenuate peak flows within the 20-year planning period. However, buildout peak day and peak hour flows are projected to require over 450,000 gallons of storage volume to be reduced with all six membrane basins operating at the maximum instantaneous flux rate over the course of about 15.5 hours. In practice, the design flux rate cannot be continuously sustained to reduce the consumed storage volume for this period of time. Therefore, the capacity of the membrane system will need to be expanded prior to buildout so that the stored volume can be reduced over a shorter period of time or to reduce the overall need to store excess flow. As discussed later in this chapter, newer generations of membranes have higher capacities by way of greater surface areas per module and higher design flux rates. These membranes would effectively expand the capacity of the system to account for projected peak flows.

SUMMARY OF HYDRAULIC CAPACITY EVALUATION

The hydraulic evaluation revealed no limitations from water levels resulting from peak flows during the planning period. However, the capacity of some unit processes in the liquid stream treatment process will be exceeded at the projected buildout flows. These unit processes and capacity limitations are summarized in Table 7-4.

TABLE 7-4

Summary of Hydraulic Capacity Evaluation

Equipment/Location	Hydraulic Limitation from Projected Flows
Primary Clarifiers	Effluent weir loading capacity at peak hour flow exceeded for buildout flows.(1)
Membrane Flux/Storage Volume	Peak flux rate duration above recommendation for buildout flows.

(1) Weir capacity exceedance not expected to have deleterious effects on treatment process.
(2) Requisite aerobic detention time expected to be provided by membrane basins downstream.

MAINSTREAM TREATMENT PROCESS CAPACITY EVALUATION

Mainstream treatment processes were evaluated based on accepted design criteria, such as those published in the Ecology's Criteria for Sewage Works Design (Orange Book, 2008), WEF Design of Water Resource Recovery Facilities, Manual of Practice No. 8 (2019) and Wastewater Engineering (Metcalf and Eddy, 2014). The following subsections contain evaluations organized by process area.

HEADWORKS, PRIMARY TREATMENT, AND PRIMARY EFFLUENT SCREENING

Treatment processes in these areas, including influent screening, primary sedimentation, and primary effluent screening, are expected to meet treatment performance criteria based on the design capacities of these systems.

The two existing influent screens each have a capacity of 11.53 mgd, which is greater than the projected peak hour flow during the planning period. The primary effluent screens each have a capacity of 12.25 mgd, which will not be surpassed during the planning period.

Projected flows and loads to the primary clarifiers are below the original design criteria. Therefore, the two existing primary clarifiers have sufficient capacity for the projected flows through the planning period. Furthermore, projected overflow rates are well below Ecology's guidelines for maximum month overflow rate (1,200 gpd/sf) and peak hour overflow rate (3,000 gpd/sf), including the reliability requirement for the peak hour overflow rate.

SECONDARY TREATMENT (ACTIVATED SLUDGE SYSTEM)

Method of Evaluation

The mainstream treatment process was modelled using GPS-X software. The model simulates the performance of primary clarification, aeration basins, and secondary clarification, as well as the solids handling processes discussed in later sections. To ensure that the GPS-X model was representative of WWTF performance, the model was calibrated using plant data for average dry weather conditions between 2013 and 2020. Historically, plant staff have utilized the primary sludge gravity thickener bypass line to bypass a portion of the primary sludge as a means of providing supplementing organic carbon to the secondary treatment process. The primary sludge bypass line has only been in operation during certain periods and during those periods the percentage of flow being bypassed has been variable with no accurate means of estimating flow. Consequently, the available records for the level of primary sludge bypass flow are only qualitative in nature. Therefore, the model was calibrated using data from a dry-weather period when no primary sludge was bypassed (July – September 2020). Model calibration was verified against primary effluent as well as plant effluent data and is further detailed in a memorandum attached as Appendix J.

Projected maximum month flows and loads were used in the model to assess the WWTF capacity to treat wastewater and meet NPDES limits on CBOD, TSS, and CBOD+NBOD. In addition, the model was used to project effluent total inorganic nitrogen (TIN) loads to the receiving water at the projected average annual and average dry weather flows and loads. These values are necessary to compare projected treatment performance against the proposed limits in the Puget Sound Nutrient General Permit (PSNGP). The method for calculating annual TIN loads consists of using ADWF model output effluent TIN to estimate daily loads for July through September, maximum month effluent TIN to estimate loads for December through February, and average annual effluent TIN for all other months. These daily loads were summed to derive an estimate of the projected annual effluent TIN loads. Notably, average dry weather loads, summarized in Table 7-5, were projected using the same methods in Chapter 5 with existing dry-weather loading being extrapolated based on projected equivalent residential units.

TABLE 7-5

ADWF Load Projections for Modeling

Projected Parameters[(1)]	2027	2031	2036	2041	Buildout
Total ERUs	15,484	16,575	18,041	19,632	21,923
ADWF Flow, mgd	2.68	2.87	3.13	3.40	3.80
ADWF BOD_5, lb/d	7,171	7,677	8,356	9,092	10,153
ADWF TSS, lb/d	6,342	6,789	7,389	8,041	8,979
ADWF NH_3, lb/d	883	946	1,029	1,120	1,251

(1) ADWF condition loads have been calculated using methods in Chapter 5.

Operational primary clarifiers, number of aeration basins in service, number of membrane basins in service, aeration, and mixed liquor pumped flow were adjusted as necessary to demonstrate treatment performance capacity. These operational parameters are detailed as part of the modeling results. For maximum month flows and loads, it was assumed that the aeration basin MLSS concentration was 5,450 mg/L at a liquid temperature of 12 degrees C. For the average annual flow and load conditions, the MLSS concentration was assumed to be 4,100 mg/L; this value is lower than the historical average at the WWTF and is meant to provide conservative results for nitrogen removal. The average annual condition used a liquid temperature of 15 degrees C. For projected average dry weather flows and loads, it was assumed that the MLSS concentration was 3,800 mg/L, which was typical for dry-weather conditions according to plant process data. Liquid temperature for these conditions was assumed to be 20 degrees C.

Finally, model results were processed to compute projections of required airflow for the aeration basins. Model results provide actual oxygen transfer rates (AOTRs). However, diffused aeration requirements are based upon standard oxygen transfer rate (SOTR), the oxygen transfer rate in clean 20°C water with no suspended solids. The SOTR is calculated for the aeration basins using an oxygen transfer correction factor, or alpha value. Alpha is the correction factor used to estimate the actual oxygen mass transfer coefficient of wastewater to the oxygen mass transfer coefficient of clean water. Alpha is especially important because it varies with the physical features of the aeration system, the geometry of the reactor, and the characteristics of the wastewater. Metcalf & Eddy (2014) state that typical alpha values range from 0.4 to 0.8; values vary by treatment facility. Based on observed values at operating treatment plants, the following calculation assumes varying alpha values for fine bubble diffused aeration occurring in each of the three aerobic zones of the aeration basins. The following is the equation to determine the SOTR:

$$SOTR = \frac{AOTR}{(\alpha)(F)}\left[\frac{C_{s20}\left(1 + d_e\left(\frac{D_t}{P_s}\right)\right)}{\tau\Omega\beta C_{s20}\left(1 + d_e\left(\frac{D_t}{P_s}\right)\right) - C}\right](\theta^{20-T})$$

Where:

$SOTR$	= Standard Oxygen Transfer Rate, lb/d
$AOTR$	= Actual Oxygen Transfer Rate, lb/d (from above)
α	= Oxygen transfer correction factor,
	= 0.40 for Aerobic Zone 1
	= 0.50 for Aerobic Zone 2
	= 0.55 for Aerobic Zone 3
F	= Fouling factor (0.89 for membrane diffusers)
τ	= Temperature correction factor, C_{sT}/C_{s20}
C_{sT}	= DO saturation at operating temperature (12 degrees C) at site elevation (10.693 mg/L, tabulated in Metcalf & Eddy, 2014)
C_{s20}	= DO saturation at 20 degrees C at site elevation (9.020 mg/L, tabulated in Metcalf & Eddy, 2014)
Ω	= Pressure correction factor, P_b/P_s
β	= DO saturation relative to clean water (0.96, typical from Metcalf & Eddy, 2014)
P_b	= Barometric pressure at site elevation (14.66 psi at 76 ft elevation)
P_s	= Standard barometric pressure (14.70 psi)
D_t	= Diffuser submergence depth (22 feet)
d_e	= mid-depth correction factor (0.4)
C	= Operating DO in aerobic zones (2.0 mg/L)

The following calculation is then used to determine the airflow and blower capacity needed to meet the aeration demands under maximum month conditions:

Fine Bubble Diffuser Efficiency	=	1.86% / foot submergence
Depth of Submergence	=	22 ft
Diffuser Efficiency	=	41 %
Air Flow for Aeration	=	(SOTR)(1 scf/0.0173 lb O2)/(41%)

Results and Discussion from Modeling

Projected loads and flows were modeled using the calibrated GPS-X model with the operational parameters summarized in Table 7-6, which were adjusted within the capacity range of the existing equipment.

TABLE 7-6

Projected Operational Parameters

Operating Parameters	Existing Capacity	MM 2027	AA 2027	ADWF 2027
Primary Clarifiers In-Service	2	2	2	2
Aeration Basins In-Service	3	3	2	2
Membrane Basins In-Service	6	6	6	6
Mixed Liquor Pumping, gpm(1)	23,550	14,241	11,129	9,314
Required WAS Flow, MGD(2)	0.084	0.048	0.056	0.056
Aerobic DO Setpoint, ppm(3)	-	2.0	2.0	2.0
Aeration AOTR, lb-O_2/d(4)	-	5,809	4,866	5,345
Total Airflow, scfm(4)	4,590	1,977	1,629	1,789
Operating Parameters	**Existing Capacity**	**MM 2031**	**AA 2031**	**ADWF 2031**
Primary Clarifiers In-Service	2	2	2	2
Aeration Basins In-Service	3	3	2	2
Membrane Basins In-Service	6	6	6	6
Mixed Liquor Pumping, gpm(1)	23,550	15,000	11,840	9,970
Required WAS Flow, MGD(2)	0.084	0.052	0.061	0.062
Aerobic DO Setpoint, ppm(3)	-	2.0	2.0	2.0
Aeration AOTR, lb-O_2/d(4)	-	6,185	5,158	5,693
Total Airflow, scfm(4)	4,590	2,046	1,720	1,948
Operating Parameters	**Existing Capacity**	**MM 2036**	**AA 2036**	**ADWF 2036**
Primary Clarifiers In-Service	2	2	2	2
Aeration Basins In-Service	3	3	2	2
Membrane Basins In-Service	6	6	6	6
Mixed Liquor Pumping, gpm(1)	23,550	16,041	12,797	10,852
Required WAS Flow, MGD(2)	0.084	0.058	0.069	0.070
Aerobic DO Setpoint, ppm(3)	-	2.0	2.0	2.0
Aeration AOTR, lb-O_2/d(4)	-	6,682	5,551	6,160
Total Airflow, scfm(4)	4,590	2,202	1,843	2,094
Operating Parameters	**Existing Capacity**	**MM 2041**	**AA 2041**	**ADWF 2041**
Primary Clarifiers In-Service	2	2	2	2
Aeration Basins In-Service	3	3	2	2
Membrane Basins In-Service	6	6	6	6
Mixed Liquor Pumping, gpm(1)	23,550	17,160	13,836	11,809
Required WAS Flow, MGD(2)	0.084	0.065	0.078	0.079
Aerobic DO Setpoint, ppm(3)	-	2.0	2.0	2.0
Aeration AOTR, lb-O_2/d(4)	-	7,204	5,933	6,624
Total Airflow, scfm(4)	4,590	2,365	1,963	2,239

TABLE 7-6 – (continued)

Projected Operational Parameters

Operating Parameters	Existing Capacity	MM Buildout	AA Buildout	ADWF Buildout
Primary Clarifiers In-Service	2	2	2	2
Aeration Basins In-Service	3	3	2	2
Membrane Basins In-Service	6	6	6	6
Mixed Liquor Pumping, gpm(1)	23,550	18,772	15,331	13,187
Required WAS Flow, MGD(2)	0.084	0.075	0.091	0.094
Aerobic DO Setpoint, ppm(3)	-	2.0	2.0	2.0
Aeration AOTR, lb-O_2/d(4)	-	7,957	6,482	7,285
Total Airflow, scfm(4)	4,590	2,601	2,135	2,446

(1) Mixed liquor pumping capacity consists of three out of four pumps each with the capacity to pump 7.850 gpm.

(2) WAS flow capacity based on 7.2 hour runtime (7 days/week) of the thickening centrifuge (requires 1,000 lb/hr loading); existing WAS pump capacity is 250 gpm.

(3) Aerobic Zone 3 was set to provide a constant of 50 cfm per aeration basin in-service.

(4) Standard cubic feet per minute, AOTR includes aeration from Aerobic Zones 1 and 2; total airflow adds Aerobic Zone 3. The total airflow capacity consists of three of four process blowers each with a capacity of 1,530 scfm.

Using the operational parameters above, the GPS-X model was used to simulate the WWTF process performance and project effluent quality for future flows and loads. Notably, the mixed liquor pump flow was set to four times the influent flow to maximize denitrification. In addition, the aeration controller for third aerobic zone was set to maintain a constant airflow rate of 50 cfm per aeration basin in-service. The reduced aeration rate lowered the dissolved oxygen concentration in this zone to allow some simultaneous nitrification/denitrification to occur and promote a net reduction of TIN.

The calibrated process model was then used to project primary and waste activated sludge production, that were used to evaluated the capacity of the biosolids treatment and management facilities presented later in Chapter 8. As shown in Table 7-6, WAS flow required to load the thickening centrifuge was sufficient for an operating schedule of 7.8 hours each day, 5 days per week. This schedule is detailed in the original design criteria for the WWTF. However, as discussed in Chapter 8, a new rotary screen thickener would allow the existing WAS pumps to load the thickening system at a lower flow rate. With the existing centrifuge or a new rotary screen thickener, the existing WAS pumps are sufficient for future flows and loads.

Projected WWTF effluent concentrations are compared against the existing NPDES permit limits in Table 7-7. Based on this evaluation, the existing WWTF is capable of complying with all of the existing permit limits through the planning period, as well as at the projected buildout flows and loads. In addition, Table 7-7 shows that the estimated net alkalinity consumption for all future flow and load scenarios is lower than the capacity of the existing alkalinity addition system, which was designed to provide 13,000 lb-$CaCO_3$/d of alkalinity.

TABLE 7-7

Projected WWTF Effluent Parameters

Effluent Parameters	**NPDES Permit Limit(1)**	**MM 2027**	**AA 2027**	**ADWF 2027**
$CBOD_5$, mg/L	25	0.65	0.55	0.42
$CBOD_5$, lb/d	1,045(2)	22.4	14.8	9.29
TSS, mg/L	30	0.20	0.15	0.14
TSS, lb/d	1,254(3)	6.98	4.11	3.18
NH_3, mg/L	-	0.52	0.39	0.21
NBOD + $CBOD_5$, lb/d	235(4)	59.4	36.8	19.3
Nitrate/Nitrite, mg/L	-	11.3	14.5	18.0
Net Alkalinity Consumption, lb-$CaCO_3$/d	-	4,816	4,571	4,879
Effluent Parameters	**NPDES Permit Limit(1)**	**MM 2031**	**AA 2031**	**ADWF 2031**
$CBOD_5$, mg/L	25	0.66	0.56	0.42
$CBOD_5$, lb/d	1,045(2)	23.9	16.0	10.1
TSS, mg/L	30	0.20	0.15	0.14
TSS, lb/d	1,254(3)	7.35	4.37	3.41
NH_3, mg/L	-	0.57	0.43	0.23
NBOD + $CBOD_5$, lb/d	235(4)	66.8	41.8	21.5
Nitrate/Nitrite, mg/L	-	11.0	15.5	17.7
Net Alkalinity Consumption, lb-$CaCO_3$/d	-	5,080	4,840	5,178
Effluent Parameters	**NPDES Permit Limit(1)**	**MM 2036**	**AA 2036**	**ADWF 2036**
$CBOD_5$, mg/L	25	0.67	0.57	0.43
$CBOD_5$, lb/d	1,045(2)	26.0	17.6	11.3
TSS, mg/L	30	0.20	0.15	0.14
TSS, lb/d	1,254(3)	7.86	4.72	3.71
NH_3, mg/L	-	0.63	0.49	0.25
NBOD + $CBOD_5$, lb/d	235(4)	77.2	49.6	24.8
Nitrate/Nitrite, mg/L	-	10.6	13.8	17.2
Net Alkalinity Consumption, lb-$CaCO_3$/d	-	5,421	5,182	5,576

TABLE 7-7 – (continued)

Projected WWTF Effluent Parameters

Effluent Parameters	NPDES Permit Limit(1)	MM 2041	AA 2041	ADWF 2041
$CBOD_5$, mg/L	25	0.69	0.59	0.44
$CBOD_5$, lb/d	1,045(2)	28.3	19.5	12.5
TSS, mg/L	30	0.20	0.15	0.14
TSS, lb/d	1,254(3)	8.41	5.10	4.04
NH_3, mg/L	-	0.72	0.58	0.27
NBOD + $CBOD_5$, lb/d	235(4)	90.4	59.8	28.8
Nitrate/Nitrite, mg/L	-	10.2	13.3	16.8
Net Alkalinity Consumption, lb-$CaCO_3$/d	-	5,795	5,540	5,993
Effluent Parameters	**NPDES Permit Limit(1)**	**MM Buildout**	**AA Buildout**	**ADWF Buildout**
$CBOD_5$, mg/L	25	0.70	0.61	0.46
$CBOD_5$, lb/d	1,045(2)	31.8	22.3	14.4
TSS, mg/L	30	0.20	0.15	0.14
TSS, lb/d	1,254(3)	9.21	5.66	4.51
NH_3, mg/L	-	0.87	0.75	0.32
NBOD + $CBOD_5$, lb/d	235(4)	114.6	80.0	35.8
Nitrate/Nitrite, mg/L	-	9.649	12.6	16.2
Net Alkalinity Consumption, lb-$CaCO_3$/d	-	6,295	6,024	6,583

(1) Average monthly limits.
(2) $CBOD_5$ effluent load is limited from November through June.
(3) TSS effluent load is limited from November through June.
(4) Combined NBOD and CBOD limited from July through October; NBOD = 2.1*NH_3.

As previously discussed, the District anticipates limits on annual effluent TIN from the PSNGP. The PSNGP proposes a limit of 127,000 lb-N/year, which translates to approximately 348 lb-N/day. Effluent annual TIN loads were projected using projected flow and load conditions with modeled effluent ammonia and nitrate/nitrite values. These values are summarized in Table 7-8. Projections of effluent TIN exceed the proposed limit from the PSNGP in every year for which performance was evaluated. The magnitude by which the projections exceed the limit suggest that available optimization methods without external carbon addition, like increasing mixed liquor return flow or decreasing aeration in the third aerobic zones, will not be sufficient to provide the level of denitrification necessary to achieve an annual loading of less than 127,000 lb-N. The denitrification capacity of existing system and its ability to meet the total nitrogen limit in the PSNGP is limited by the carbon:nitrogen (C:N) ratio in the primary effluent. While the primary clarifiers remove a significant portion of the organic carbon entering the treatment facility, the influent nitrogen remains more or less unchanged as flow passes through the primary clarifiers. This, coupled with the high ammonia loads in the centrate return stream from dewatering anaerobically digested waste biosolids, results in an unfavorable C:N ratio. Therefore, improving denitrification at this facility to the level required to meet the proposed limits in the PSNGP will require the addition of an external carbon source to increase the ratio between readily biodegradable carbon and nitrogen entering the anoxic zones in the aeration basins.

In addition, the PSNGP suggests that the PSNGP may ask treatment plants to target an effluent TIN concentration of 3 mg-N/L or less after the first permit cycle. As a result, the PSNGP will require the District to submit a nutrient reduction evaluation by the end of 2025. This evaluation will need to include an AKART analysis, economic evaluation, and environmental justice review of alternatives to reduce effluent TIN to a level that is as close to 3 mg/L as feasible. Based on the results of the WWTF modeling effort that was performed as part of the Plan, the existing WWTF is not capable of achieving an effluent TIN concentration of 3 mg/L without significant improvements and additional infrastructure. Therefore, if the 3 mg/L effluent TIN limits are put into effect within the planning period, significant improvements to the WWTF will be required.

TABLE 7-8

Projected Effluent TIN Loads

Condition	Effluent TIN by Flow Condition, lb/d		
	MM	**AA**	**ADWF**
2027	402	398	407
2031	415	453	428
2036	431	439	456
2041	451	461	483
Buildout	475	492	522
Condition	**Annual Effluent TIN, lb/yr**		
2027	146,600		
2031	159,577		
2036	161,051		
2041	169,435		
Buildout	180,743		

Summary of Secondary Treatment System Evaluation

Results from GPS-X modeling show that the existing secondary treatment system is capable of meeting the *existing* NPDES permit limits through the planning period and buildout. However, the annual effluent TIN limit in the PSNGP will likely not be met throughout the planning period by the existing secondary treatment system, due to carbon limitation. All projected influent flow and loading conditions resulted in annual effluent TIN values that exceeded the proposed limit. System modeling demonstrated that optimizing operational parameters resulted in only a minor increase in denitrification performance, suggesting that the existing system is carbon limited. At minimum, improvements that will allow the addition of an external carbon source to the secondary treatment system within the first permit cycle of the PSNGP to achieve the level of denitrification required.

DISINFECTION AND FINAL EFFLUENT

As mentioned in this chapter, the design peak day flow capacity of the UV disinfection system is projected to be exceeded prior to 2031. However, it is apparent that the membrane system greatly reduces fecal coliforms upstream of the UV system. Consequently, the combined pathogen removal provided by the existing membrane bioreactor and UV system is likely more than necessary to meet the NPDES permit limit. Historical UV transmittance data shows that the original design transmittance of 65 percent was reasonable given that existing transmittance has a 10th percentile value of 63 percent, but averages at about 68 percent (with values ranging between 54 percent to 80 percent transmittance). Due to the fact that the fecal coliform level in the permeate is lower than in typical secondary effluent, the required log removal for pathogens that must be achieved by the UV system is lower, resulting in a lower required UV dose to satisfy the effluent discharge criteria. The existing UV system is likely performing as designed, but is providing a dose beyond what is necessary to meet NPDES permit limits. UV systems have a typical service life of between 17 and 20 years and the current system has been in operation for approximately 10 years. Consequently, the existing UV system will reach the end of its useful life and need to be replaced within the planning period. Given the historical performance of the existing system at the current design dose of 30 mJ/cm^2, collimated beam testing should be conducted during the design phase of the replacement system to establish the minimum design dose that will be used as the basis of design. If this testing substantiates a lower minimum design dose, the replacement system may potentially be smaller than the existing system, while still meeting NPDES permit limits at the projected peak hour flow. The design of the replacement system would also need to consider the potential of membrane failure.

As a safeguard against effluent pH excursions below the permit limit, the District has expressed a desire for a secondary alkalinity dosing point just prior to final effluent discharge. The existing alkalinity addition system injects sodium hydroxide into the mixed liquor return channel just downstream of the overflow from the membrane bioreactors. From this point the buffered mixed liquor is recirculated through the secondary treatment process, creating a significant delay between when a dose adjustment is made and when the effluent pH effect is observed. As a result, if the system is operated near the lower end of the pH range stipulated in the effluent permit, there would be a significant delay between when a pH excursion is observed and when the resulting dose adjustment brings the effluent back into compliance. Consequently, the District has requested an additional dose point downstream of the permeate pumps that would provide more immediate control over final effluent alkalinity and pH. It should be noted that for treatment process stability, it is not recommended that membrane treatment system not be operated at a pH below around 6.6 or 6.7, which is well above the effluent permit limit. If the system is operated in this range, the risk of an effluent violation is greatly reduced.

To potentially improve floc formation and effluent filterability, it was previously suggested that the District trial an alternative alkalinity source such as magnesium hydroxide to provide favorable monovalent/divalent cation ratio in the mixed liquor. During the development of the Plan, the District was conducting a pilot study evaluating the addition of magnesium hydroxide to the membrane bioreactor system for alkalinity addition and pH control. The preliminary results of the pilot were promising, showing the potential for long-term cost savings in addition to apparent improvement in mixed liquor filterability. King County's Brightwater Treatment Plant, another hollow fiber membrane bioreactor activated sludge plant, has also recently observed similar promising results using magnesium hydroxide for alkalinity control. If the study continues to yield positive results, it is recommended that the District install a more permanent magnesium hydroxide alkalinity addition system. It would be possible to convert the existing sodium hydroxide alkalinity addition system into one that can also utilize magnesium hydroxide. These modifications would likely include the installation of mechanical mixing in one of the existing storage tanks and the installation of new metering pumps that are capable of pumping the magnesium hydroxide slurry. The District is also planning to conduct additional pilot testing using calcium carbonate as an alternative source of alkalinity. The mixing and pumping requirements will ultimately depend on the alkalinity source selected by the District, although both options involve storage and pumping a slurry. The magnesium hydroxide and calcium carbonate based slurries will both likely require more operation and maintenance than the current alkalinity addition system, because slurries require prevention and removal of scaling and plugging in the system. The alkalinity addition system modifications could also include the secondary injection point discussed earlier, however, it should be noted that the both slurries require time to dissolve into solution so they may not be as suitable for application just upstream of the effluent discharge.

MAINSTREAM TREATMENT DESCRIPTION AND CONDITION

INFLUENT FLOW MEASUREMENT

Influent Flow Measurement

Influent flow to the WWTF is measured by a 24-inch Parshall Flume with a capacity of 21.4 mgd. The Parshall flume is equipped with redundant level sensors for redundancy and reliability. The primary level measuring device is a pressure transmitter located in the headworks bubbler panel that monitors the backpressure on the bubbler tube that continuously discharges air at the base of the flume. The secondary level measuring device is an ultrasonic level sensor. Both instruments continuously monitor the depth of flow in the Parshall flume and this depth is converted to a flow rate by the Headworks PLC. The influent flow rate is also used as an input to control other processes at the treatment plant, including being used in conjunction with the aeration basin equalization storage volume by the control algorithm for permeate pumping. Influent flow meter equipment data is summarized in Table 7-9.

TABLE 7-9

Influent Flow Meter Equipment Data

Parameter	Equipment Data
Quantity	1
Type	Parshall flume
Throat Width	24"
Capacity	21.4 mgd

Under normal circumstances, the level signal (4-20 mA) from the bubbler system pressure transmitter is monitored by the Headworks PLC, which calculates the real-time flow base on the following equation.

$$Q = 3{,}591 \times H^{1.55}$$

Where: Q = flow in gpm.
H= depth of flow in feet.

Headworks Compressed Air System

Compressed air for the Headworks bubbler system is provided by a stand-alone compressor system, consisting of redundant oil-less piston compressors mounted on a common 30-gallon air receiver tank that is installed in a sound attenuating enclosure. The compressed air system supplies air to the Headworks bubbler system control panel that not only monitors the level in the Parshall flume, but also upstream and downstream of each influent screen. The equipment data for the headworks compressed air system is presented in Table 7-10.

TABLE 7-10

Headworks Compressed Air System Equipment Data

Parameter	Equipment Data
Compressors	
Quantity	2
Type	Oil-less piston
Capacity and discharge pressure	2.4 cfm @ 40 psig
Motor size	1/2 hp
Receiver Tank	
Quantity	1
Capacity	30 gallons

INFLUENT SCREENING

After the influent flow leaves the Parshall Flume, it passes through two 36-inch mechanically-cleaned band screens with 6-mm perforations, each with a capacity of 11.54 mgd. The purpose of the band screens is to remove rags, plastics, cans and fibrous materials from the wastewater so they will not clog or otherwise adversely affect downstream equipment. The band screens are installed in two parallel channels and influent flows are split equally between the two channels. A third channel is available for a future screen, but currently serves as an emergency bypass of the influent screens. Flow passes through the face of the influent screen perforated panels, where screenings are captured. The band screen periodically rotates and deposits screenings into a hydraulic flume that conveys the material to the screenings washer/compactor inlet hopper, where primary washing of the screenings occurs. The combination of the sluice water and spray bars in the inlet hopper and initial compaction zone separates fecal matter and organics from the screenings. The fecal matter and organics re-enter the treatment process via the perforated drainage plate along the bottom of the hopper. After washing, the screenings enter the press zone where they are compacted and discharged to a dumpster located in the Headworks Building. Screened influent is discharged to a common basin and enters the 36-inch primary influent line that conveys flow to the primary clarifier. Table 7-11 summarizes the band screen equipment data.

TABLE 7-11

Mechanically Cleaned Band Screen System Equipment Data

Parameter	**Equipment Data**
Influent Band Screens	
Quantity	2
Type	Mechanically cleaned band screen
Channel Width	36"
Band Screen Panel Perforation Size	6 mm
Capacity, ea.	11.54 mgd
Screen Drive Motor Size	2 hp
Screenings Washer/Compactor	
Quantity	2
Capacity (wet screenings)	150 ft^3/hr
Drive Size	3 hp

Influent Screening Area Condition

There are no notable structural or equipment related condition issues at the influent screening area. The District recently completed a full rebuild of the influent screens. This maintenance is expected to allow the screens to continue to function as designed though their service life. Influent screens and washer/compactors typically have a useful life of about 20 years. Therefore, these units will likely need to be replaced in the second half of the planning period (after 2031). The stand-alone headworks compressor system may need to be replaced at a similar interval due to age.

PRIMARY CLARIFICATION AND PRIMARY EFFLUENT SCREENING

Primary Clarifier Splitter Box

Screened influent wastewater flows by gravity from the Headworks to the primary clarifier splitter box, which also receives flow from the plant drain pump station. The splitter box is equipped with four slide gates, allowing each clarifier to isolated and taken offline. A horizontal fixed weir plate is installed on the downstream face of the wall at each slide gate and these weirs ensure that flow is split equally between the in-service clarifiers. Currently, there are only two primary clarifiers, but the splitter box was originally constructed to allow for the installation of two additional clarifiers at a future date.

Primary Clarifiers

Screened influent wastewater passes over the splitter box weirs and is distributed evenly across the north end of each clarifier by a network of distribution channels. The main objective of primary sedimentation is to remove both floatable and settleable solids, including grit, from the influent wastewater. Primary sedimentation also removes a portion of the influent BOD_5, reducing the load on the secondary treatment process. By lowering the BOD_5 load to the secondary process, both the required aeration basin volume and air demand are reduced. At this facility, each rectangular clarifiers has a length of 150 feet, width of 20 feet, and a side water depth of 9 feet. The primary clarifier design criteria are summarized in Table 7-12.

TABLE 7-12

Primary Clarifier Dimensions and Design Criteria

Parameter	Equipment Data
Quantity	2
Length, ea.	150 feet
Width, ea.	20 feet
Effective Settling Area, ea.	3,000 ft^2
Effective Side Water Depth, ea.	9 feet
Volume, ea.	27,000 ft^3
Surface Loading Rate at Design MMF	835 gpd/ft^2
Surface Loading Rate at Design PHF	1,920 gpd/ft^2
Detention Time at Design MMF	1.9 hr
Detention Time at Design PHF	0.84 hr
Weir Length, ea.	141 feet
Scrapper Mechanism Drive Motor	0.5 hp
Cross Collector Drive Motor	0.5 hp

The settled solids accumulate on the bottom of the clarifier and are transported by chain and flight collectors along the floor to a trough at the inlet end of the clarifier. A screw cross-collector located at the bottom of the trough then conveys the sludge to the sludge sump. The sludge is then pumped from this hopper to the grit removal system by the primary sludge pumps, with on pump being dedicated to each clarifier. The primary sludge pumping and grit removal systems are discussed in more detail in later sections. The same system of chains and flights that transport solids along the bottom of the clarifiers also move floating solids along the surface of the primary clarifiers towards the scum trough. On a timed basis, the scum trough periodically rotates allowing accumulated scum to enter the trough and flow by gravity to the common scum box on the west side of the clarifier structure. The scum trough also acts as a barrier, preventing scum from entering the effluent weirs. Clarified primary effluent spills over the clarifier effluent weirs and flows to the primary effluent screening area.

Primary Clarifier Performance

Primary clarifier performance is summarized in Table 7-13. TSS removal across the primary clarifiers has historically averaged around 66 percent, but is only representative of about 4 years of data. This is related to the ongoing practice of bypassing a portion of the primary solids around the gravity thickener and discharging these solids to the primary effluent channel to provide some carbon to the aeration basins for improved denitrification and enhanced floc formation. In 2016, the gravity thickener was damaged in a traffic accident and taken off-line for an extended period to allow repairs to be completed; after these repairs, additional time was spent studying the potential benefits of the bypass on the membrane system downstream. Since 2016, the primary effluent samples have not provided an accurate representation of the performance of the primary clarifiers because they represent the combination of primary effluent and variable quantities of primary sludge. A review of the data prior to this occurrence indicates that the primary clarifiers can operate well above the normally accepted BOD and TSS removal rates of 30 and 60 percent, respectively. Clarifier overflow rates were calculated assuming both clarifiers in operation. The maximum 30-day average overflow rate was 697 gpd/sf, which is below the design overflow rate (835 gpd/sf at maximum month flow) for the clarifiers. BOD removal, TSS removal, and overflow rates are presented in Figure 7-7. BOD and TSS removal efficiencies versus overflow rate for the periods during which the gravity thickener bypass was not in operation are presented in Figure 7-8.

TABLE 7-13

Primary Clarifier Performance Data (2013 – 2021)

Condition/Year	BOD Removal(1)	TSS Removal(1)
2013 Average	53%	71%
2014 Average(2)	55%	69%
2015 Average(2)	46%	70%
2016 Average	-	-
2017 Average	-	-
2018 Average	-	-
2019 Average	-	-
2020 Average(3)	-	-
2021 Average(4)	32%	58%
Average(1)	46%	66%
Maximum(1)	91%	85%
Minimum(1)	13%	15%

(1) Data during periods of sludge bypassing were removed due to inaccurate representation.
(2) WWTF process data in September 2014 was limited.
(3) Most 2020 data includes variable periods of sludge bypassing.
(4) Data available for 2021 averages were limited to January through March.

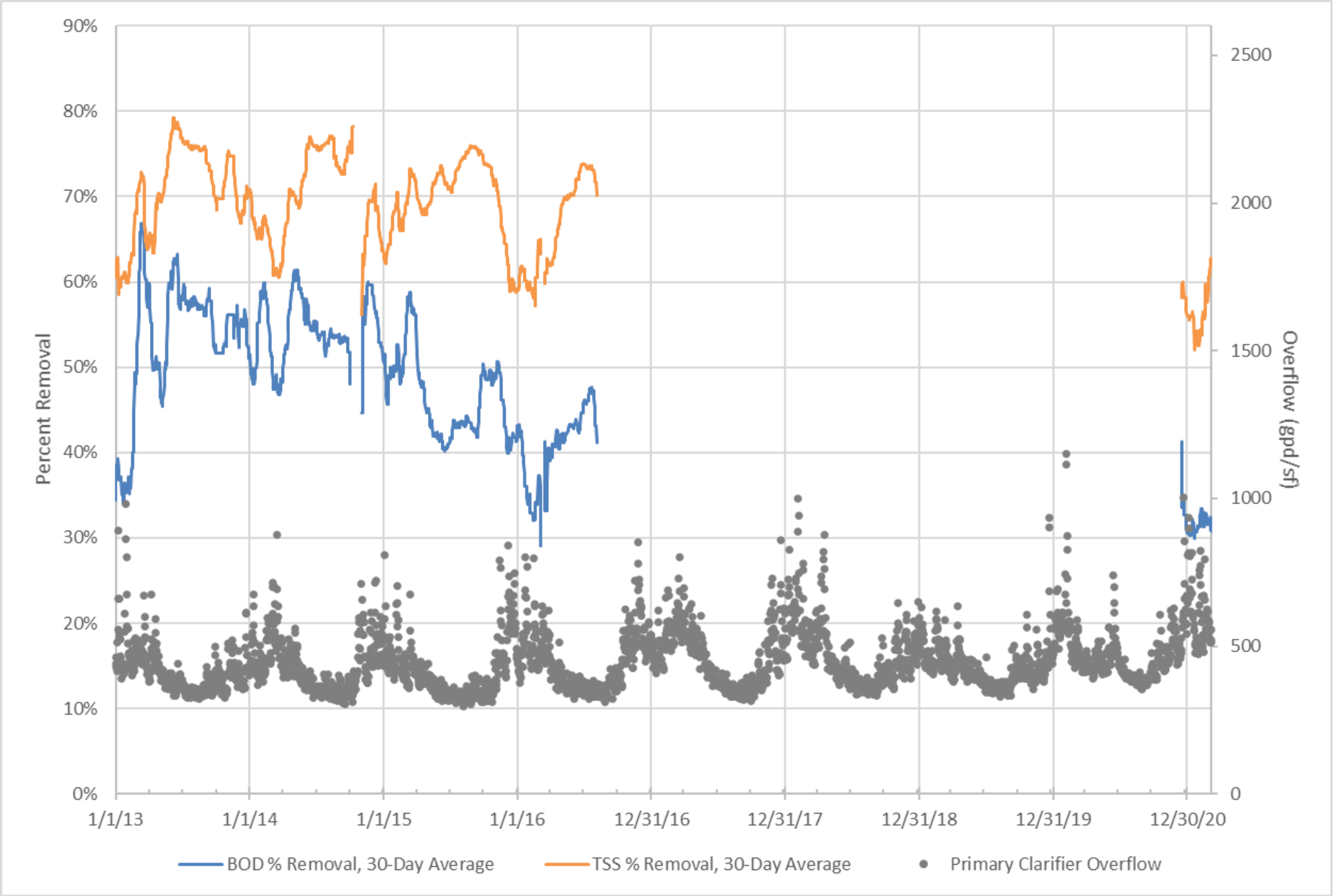


FIGURE 7-7

Primary Clarifier BOD Removal, TSS Removal, and Overflow Rate (2013-2021)

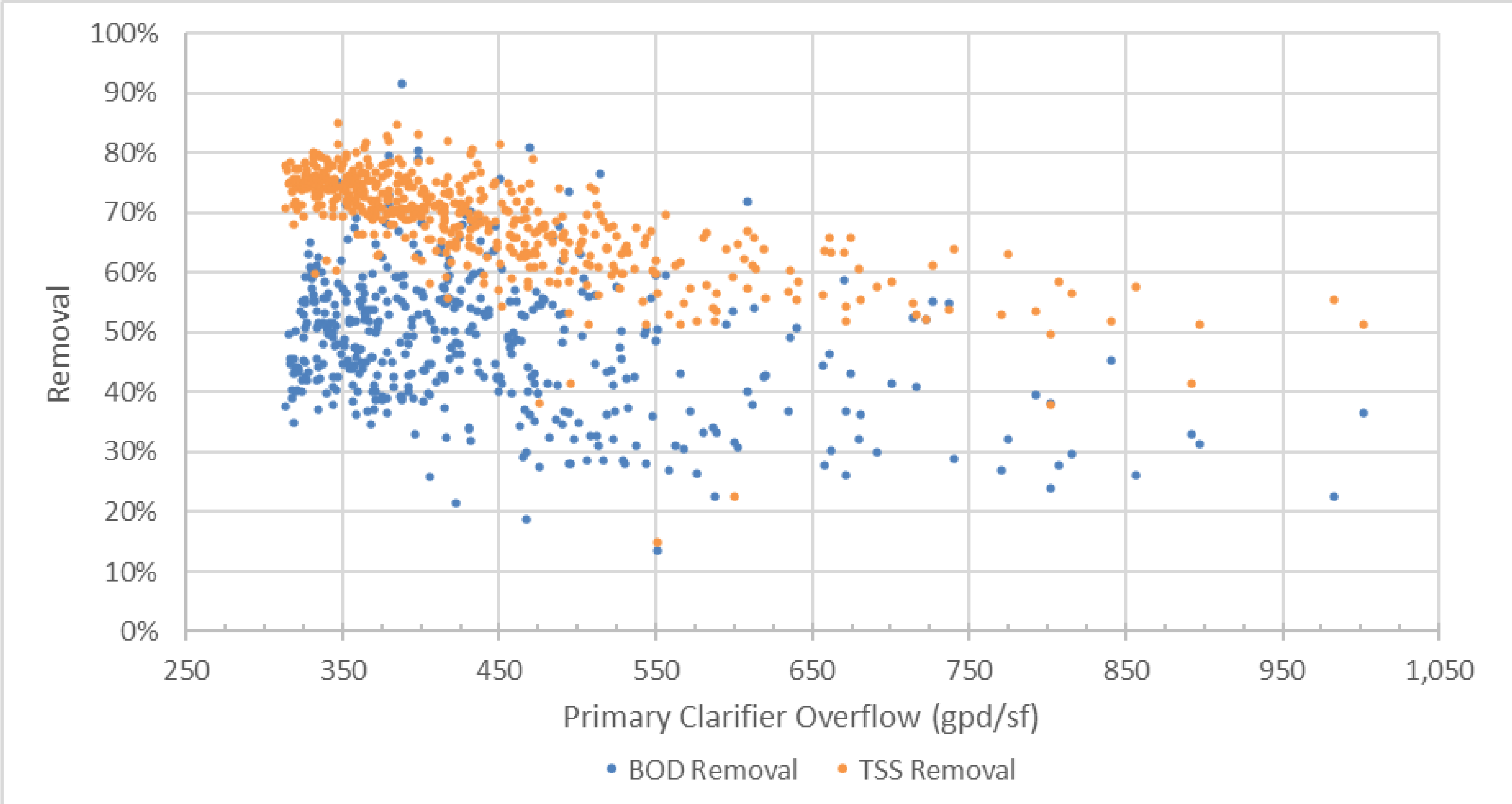


FIGURE 7-8

Primary Clarifier Overflow vs. BOD and TSS Removal Without Sludge Bypass

Primary Clarifier Effluent Screening

Screening of the primary effluent removes any additional fibrous or stringy material from the wastewater before it enters the aeration basins and more importantly before it gets passed on to the membrane basins. The primary effluent screens have smaller perforations (2mm) than the influent screens and are necessary to minimize clogging of and damage to the hollow-fiber membranes downstream.

Primary effluent flows from the common primary clarifier effluent channel and is split into two parallel channels that each contain a primary effluent band screen. There are motor operated slide gates at the inlet and outlet of each screen channel that allow a channel to be taken out of service for maintenance. A third parallel channel is available as an emergency bypass and provides space for installation of a third screen in the future. Similar to the influent screens, the primary effluent band screens capture solids on the face of their perforated panels, and screenings are washed and compacted prior to being discharged to a dumpster. Each screen has a dedicated washer/compactor unit. Screened primary effluent from both channels discharges to a common channel that then conveys the screened primary effluent by gravity to the aeration basins.

Table 7-14 summarizes the primary effluent band screen system equipment data.

TABLE 7-14

Primary Effluent Band Screen System Equipment Data

Parameter	Equipment Data
Primary Effluent Band Screens	
Quantity	2
Type	Mechanically cleaned band screen
Manufacturer and Model	JWC Environmental MBS-85
Channel Width	30"
Band Screen Panel Perforation Size	2 mm
Capacity, ea.	12.25 mgd
Screen Drive Motor Size	2 hp
Screenings Washer/Compactor	
Quantity	2
Manufacturer and Model	JWC Environmental SMW0018
Capacity (wet screenings)	25 ft^3/hr
Drive Size	3 hp

Primary Clarifier and Primary Effluent Screening Area Condition

A recent safety inspection revealed excessive movement in a number of the guardrails around the primary clarifiers, aeration basins, and gravity thickener area. From this inspection, it was noted that some portions of horizontal rails were installed with expansion connections that do not have rivets. While these are needed to accommodate expansion and contraction, some of these expansion connections near corner posts allow excessive movement of the guardrails. Figure 7-9 shows one of these expansion connections in the primary clarifier area. The repairs require installation of new rivets near corner posts and removal of some existing rivets on the straight runs to allow for adequate expansion and contraction. The District has indicated that these repairs would be made in coordination with the guardrail manufacturer; therefore, discussion of this issue is limited for the remainder of this Plan.

The primary clarifier mechanisms, including the chain and flight collectors, have been in operation for approximately 10 years. A typical useful life for primary clarifier mechanisms is between 20 and 25 years. It is expected that this equipment will need to be replaced within the planning period, likely after 2031.

During the development of this Plan, the District initiated an major maintenance overhaul of the existing primary effluent screens. It is expected that this maintenance will allow these screens to continue function properly through their useful life. Similar to the influent screens, the primary effluent screens and their washer/compactor units are expected to reach the end of useful life within the planning period. These should be planned to be replaced in approximately 10 years, as were the influent screens.

FIGURE 7-9

Guardrail Expansion Connection near Primary Clarifier 1

MEMBRANE BIOREACTOR ACTIVATED SLUDGE PROCESS

Deoxygenation Zone

The deoxygenation zone receives mixed liquor returned from the membrane basins and centrate from the dewatering system. Mixed liquor from the membrane basins is heavily aerated due to the air-scouring required to clean the membranes. This raises the dissolve oxygen concentration in the mixed liquor effluent from the membrane basins to above 4 mg/L. As a result, the deoxygenation zone is necessary to reduce dissolved oxygen concentration in the mixed liquor before mixed liquor enters the anoxic zones to attain the low dissolved oxygen concentrations that are needed for denitrification, in which heterotrophic bacteria utilize nitrate in lieu of oxygen to oxidize the organic matter in the wastewater. If the dissolved oxygen concentration is too high the bacteria will utilize oxygen preferentially over nitrate and denitrification will not occur. During the development of this Plan, a set of grab sample measurements showed that the flow out of the deoxygenation zone had a dissolved oxygen (DO) concentration of about 0.3 mg/L, whereas flow into the deoxygenation zone had a DO concentration of 5.4 mg/L. This demonstrates that the deoxygenation zone is reducing the DO concentration of returned mixed liquor as intended.

The deoxygenation zone has working volume of approximately 18,500 ft^3 and is mixed by a jet mixing system that consists of one jet motive pump and a jet header with nine nozzles positioned along the north wall of the basin. Three large openings at the bottom of the screened primary effluent channel connect the deoxygenation zone to primary effluent flow. Slide gates along the primary effluent channel walls allow primary effluent and mixed liquor to be diverted around the deoxygenation zone so that it can be isolated and taken off line for maintenance. Deoxygenation zone equipment data and design criteria are summarized in Table 7-15.

TABLE 7-15

Deoxygenation Zone Equipment Data and Design Criteria

Parameter	Equipment Data
Deoxygenation Zone	
Quantity	1
Capacity, ea.	18,500 ft^3
Mixing System	
Quantity	1
Type	Submersible Centrifugal
Capacity	1,100 gpm @ 18ft
Motor	10 hp

Flash Mixer

To ensure that the mixed liquor return from the deoxygenation zone and the primary effluent are thoroughly mixed prior to entering the aeration basins, these two flow streams are combined prior to passing through the flash mix structure. The flash mixer is equipped with a single turbine mixer and a series of baffle plates that extend out from the basin walls. Combined the flash mixer and baffle plates provide the mixing energy that is required. Aeration basin flash mix equipment data are summarized in Table 7-16.

TABLE 7-16

Aeration Basin Flash Mix Equipment Data

Parameter	Equipment Data
Flash Mixer	
Quantity	1
Type of Mixers	Vertical turbine
Mixer Speed	84 rpm
Impeller Diameter	40"
Drive Size	15 hp
Mixing Chamber Volume	920 ft^3

Aeration Basins

Secondary biological wastewater treatment is provided by three aeration basins arranged in parallel. The basins are designed to remove carbon and nitrogen compounds from the wastewater. Each aeration basin is separated into several compartments in series, including two anoxic zones and three aerobic (oxic) zones. The anoxic zones carry out partial oxidation of the organic matter, and conversion of nitrate to nitrogen gas (denitrification). The aerobic zones oxidize the remainder of the organic matter and accomplish oxidation of ammonia (nitrification).

After primary effluent, mixed liquor and centrate are mixed in the flash mixing chamber. The combined mixed liquor then flows through a channel that distributes flow to the aeration basins There is a motor operated slide gate at the inlet to each aeration basin that allows each basin to be taken out of service for maintenance. The flow to each aeration basin is regulated by the mixed liquor pumps, which lift mixed liquor out of the aeration basins and discharge to the common membrane basin inlet channel.

Aeration basin equipment data and design criteria are summarized in Table 7-17.

TABLE 7-17

Aeration Basin Equipment Data and Design Criteria

Parameter	**Equipment Data/Design Criteria**
General	
Quantity	3
Volume, ea.	80,500 ft^3
Side Water Depth	22.75 ft
Detention Time at Design Flow	8.2 hrs
MLSS Concentration	5,450 mg/L
Design Aerobic Solids Retention Time	12 d
Anoxic Zones	
Quantity per Basin	2
Total Volume (all basins)	67,000 ft^3
Detention time at Design Flow	2.3 hrs
Anoxic Zone Jet Mixing System	
Quantity per Anoxic Zone	1
Type	Submersible centrifugal
Primary Flow	550 gpm @ 18ft
Motor	5 hp
Aerobic Zones	
Quantity per Basin	3
Total Volume (all basins)	174,500 ft^3
Detention time at Design Flow	5.9 hrs

<u>Anoxic Zones</u>

The anoxic zones associated with each aeration basin have been designed to provide a low DO environment suitable for denitrification. In these zones, the nitrate nitrogen, recirculated in the nitrified mixed liquor from the membrane basins, is utilized by heterotrophic microorganisms to oxidize the organic material (BOD) in the wastewater. By utilizing nitrate as an electron acceptor instead of oxygen, the aeration requirements and the resulting electrical power requirements can be significantly reduced. The nitrate is primarily converted to nitrogen gas, which is released to the atmosphere. Other process benefits resulting from the anoxic zones include increased process stability, alkalinity recovery, and selective pressure against filamentous and foam-causing bacteria.

A jet mixing system was installed in each of the six anoxic zones to ensure adequate mixing in these zones. The mixing system operates continuously for in-service basins, while maintaining negligible DO in zones.

Aerobic Zones

The aerobic zones of each aeration basin train were designed to provide oxidation of the remaining organic matter and partial oxidation (nitrification) of ammonia. Each aerobic zone is divided into four reactors. Compartmentalization reduces back mixing and short-circuiting, creating a situation that more closely resembles plug flow that improves process kinetics and overall treatment efficiency. Oxygen is transferred to the mixed liquor by discharging compressed air through a network of fine-bubble diffusers installed on the floor of the aerobic zones. The diffuser density is highest in the first aerobic zone and decreases in each successive zone based on the projected decline in oxygen demand.

Single Stage Centrifugal Process Blowers and Air Distribution System

Low-pressure, compressed air is introduced at depth to the aeration basins through fine bubble membrane disc diffusers installed just above the floor of the basins. Compressed air is supplied by four (three duty and one standby) 100-hp, single-stage centrifugal high-speed turbo blowers, all of which are located in the Equipment Building along with the membrane blowers.

Table 7-18 summarizes the process blowers equipment data.

TABLE 7-18

Process Blowers Equipment Data

Parameter	Equipment Data/Design Criteria
Process Blowers	
Quantity	4
Type	Single-stage, high speed turbo centrifugal
Capacity @ Discharge Pressure	1,530 scfm @ 13 psi
Motor	100 hp

Control loops meet aeration basin air requirements by iteratively adjusting valve position, air header pressure setpoint, and blower speed. When the DO setpoint of aerobic zones or airflow setpoints in the aerobic zones are not met, valve positions are adjusted to change airflow. If the most open valve position must move beyond the preset minimum or maximum position, the blower Master Control Panel (MCP) will adjust the air header pressure. Blower speeds change to meet the new air head pressure setpoint. In turn, valve positions are adjusted in response to the change in airflow and may require the air header pressure setpoint to adjust again. This control loop serves to minimize the air header pressure setpoint, minimizing the operating blower speeds and power requirements, while meeting the set aeration requirements of each zone.

Mixed Liquor Pumps and Mixed Liquor Recycle

The mixed liquor pumps have multiple purposes, including splitting flow equally between the aeration basins, conveying mixed liquor to membrane basin inlet channel and returning mixed liquor flow to the anoxic zones to enable denitrification. Mixed liquor does not flow by gravity from the aeration basins to the membrane basins and instead is pumped from the third oxic zone of each aeration basin. The pumps dictate the flow through the aeration basins and the membrane basins. The majority of flow through the membrane basins returns to the head of the aeration basins by way of the mixed liquor channel and deoxygenation zone.

Table 7-19 summarizes the mixed liquor pump equipment data.

TABLE 7-19

Mixed Liquor Pump Equipment Data

Parameter	Equipment Data
Mixed Liquor Pumps	
Quantity	4
Type	Screw centrifugal
Motor	50 hp
Maximum Capacity per Pump	7,850 gpm at 17 TDH

The pumps lift mixed liquor individually from each in service aeration basin and discharge flow to the membrane basin inlet channel that is common to all membrane basins. There are four mixed liquor pumps (three duty and one standby) each with a magnetic flow meter on the pump discharge. The three duty pumps were designed to pump up to five times the design influent flow, which provides and internal recycle flow rate of four times the influent back to the anoxic zones. The pumps are typically controlled based on an operator adjustable multiple of influent flow.

Foam Control and WAS/Scum Surface Wasting

Foam accumulation is expected for aeration basins with submerged outlets. In addition, membrane treatment systems are known for allowing accumulation of foam-causing bacteria. To safeguard against excessive foam accumulation at this facility, the aeration basins were designed to allow for surface wasting of WAS with WAS/scum boxes installed in each of the aeration basins. Each of the WAS/scum boxes is equipped with a downward opening weir gate with a modulating electric motor operator. Each 4-foot long weir was designed to provide 1 to 3 centimeters of flow depth over the weir and drains to the WAS/scum box in Aeration Basin 2. This WAS/scum box is equipped with a spray nozzle that allows a concentrated sodium hypochlorite solution to be applied to foam in the box to target foaming organisms. In lieu of wasting from the WAS/Scum box, WAS can also be wasted directly from the mixed liquor return channel. WAS and Scum handling are further detailed in Chapter 8.

Peak Flow Equalization Storage and Aeration Basin Level Measurement

Peak flows to the membrane basins must be limited due to the membrane capacity. For peak flow conditions, the aeration basins were designed to allow a 3'-2" water level rise above the normal water level for design flow. This rise provides approximately 84,000 gallons per aeration basin (252,000 gallons total) that aids in flow equalization. The rise in the aeration basin results in a similar level rise in the primary clarifier effluent and mixed liquor return channels, providing an additional 70,000 gallons of equalization volume. Finally, the unequipped, empty membrane basins each provide approximately 47,000 gallons (140,000 gallons total) of equalization volume that can be accessed by opening the sluice gates at the outlet of these basins, allowing flow from the mixed liquor return channel to enter the empty basins. Available equalization storage volume is fed into the permeate pump control algorithm. This storage volume is monitored by the two separate level sensors (pressure transmitter and radar level with float-mounted plate) that are installed in each aeration basin. These level sensors provide continuous redundant level monitoring to the membrane system PLC, which uses this information to calculate the available equalization volume.

Centrate Storage Tank

Centrate from the mechanical dewatering of anaerobically digested sludge is stored in the centrate storage tank, allowing centrate to be return to this treatment system during late night and early morning hours, reducing peak ammonia loads to the treatment process. The centrate storage tank is equipped with two submersible centrifugal centrate pumps (one duty and one standby) that can discharge centrate to either the primary effluent channel or the mixed liquor return channel upstream of the deoxygenation zone. The latter discharge location is advantageous because it provides additional oxygen demand to consume the relatively high concentration of dissolved oxygen in returned mixed liquor, reducing the dissolved oxygen introduced into the anoxic zones and providing additional ammonia oxidation. A magnetic flow meter is installed on the common discharge header from the centrate pumps allowing the speed of the centrate pumps to be modulated to maintain the flow setpoint value. The flow setpoint value is calculated based on the volume of centrate in the storage tank (based on elevation) at the end of each day and the desired return period. The return period is operator adjustable, but is typically set to return centrate to the treatment process during the hours between 2:00 a.m. and 6:00 a.m., when influent ammonia loads are lowest.

Table 7-20 summarizes the centrate storage tank and pump equipment data.

TABLE 7-20

Centrate Storage Tank and Pump Equipment Data

Parameter	Equipment Data
Centrate Storage Tank	
Quantity	1
Working Volume	7,500 ft^3
Centrate Pumps	
Quantity	2
Type	Submersible centrifugal
Capacity per Pump @ TDH	250 gpm @ 42 ft
Motor	5 hp

Membrane Basins

Mixed liquor from the aeration basins is lifted by the mixed liquor pumps and discharged to the membrane basin inlet channel that is common to all nine membrane basins. Motor operated downward-opening weir gates control flow to on- and off-line basins. Each equipped basin (six basins equipped, three unequipped for flow equalization) contains six membrane cassettes; each consisting of 48 membrane modules. As mixed liquor flows through the on-line membrane basins, permeate pumps draw permeate through the hollow fiber membranes. Each membrane consists of a reinforced hollow fiber membrane with a pore size of 0.04 µm, which filters out the suspended solids. This process retains suspended solids in the membrane basins, while the permeate pumps draw permeate through the membranes and discharge treated effluent to a common force main that the flow to the common UV system inlet distribution channel. Mixed liquor flows through the membrane basins and passes over effluent weirs, which discharge to the common mixed liquor return channel. The membrane basin effluent weirs maintain a constant level in the membrane basins and also ensures that the mixed liquor flow is split equally between the in-service basins.

The membrane filtration system is supported by the scouring air blowers, which periodically provide pulsed air to each model at a frequency and rate that varies based on the flow through the system and the transmembrane pressure. The scour air helps lift particles away from the membrane surfaces controlling fouling and maintaining membrane capacity. In addition, the membrane filtration system can periodically call the back-pulse pumps to reverse flow through each membrane train individually as needed to remove solids blocking membrane pores and reduce transmembrane pressure. Occasionally, the membrane basins must undergo chemical cleaning with dilute sodium hypochlorite and citric acid solutions. The membrane filtration system consists of numerous subsystems provided by the membrane manufacturer (GE/Zenon, now a part of Suez) and includes the membrane cassettes, permeate headers and pneumatic control valves, the air distribution headers and the multi-stage centrifugal souring air blowers, the staging pump, and a host of instrumentation (pressure switches, pressure transmitters, flow switches, flow meters, pressure transmitters, level switches, and turbidimeters) in addition to the SCADA system for this equipment.

Table 7-21 summarizes the membrane system equipment data and design criteria.

TABLE 7-21

Membrane System Equipment Data and Design Criteria

Parameter	Equipment Data
Membranes	
Quantity of Membrane Tanks	6
Quantity of Cassettes per Tank	6
Total Quantity of Cassettes	36
Membrane Pore Size	0.04 µm
Membrane Flux @ Design AAF (gallons/sf-day, gfd)	7.8 gfd
Membrane Flux @ Design MMF	9.0 gfd
Membrane Flux @ Design PDF	12.6 gfd
Membrane Flux @ Design PHF	15.2 gfd
Membrane Surface Area per Cassette	16,320 ft^2
Membrane Surface Area per Module	340 ft^2
Total Membrane Surface Area	587,520 ft^2
Permeate Pumps	
Quantity	6
Type	Self-priming centrifugal
Capacity, each	1,530 gpm @ 32.5 ft
Motor, each	20 hp
Backpulse Pumps	
Quantity	2
Type	Self-priming centrifugal
Capacity, each	1,980 gpm @ 47 ft
Motor, each	40 hp
Staging Pumps	
Quantity	1
Type	Centrifugal
Capacity, each	170 gpm @ 25 ft
Motor, each	3 hp

TABLE 7-21 – (continued)

Membrane System Equipment Data and Design Criteria

Parameter	Equipment Data
Scouring Air Blowers	
Quantity of Blowers	4
Blower Type	Multi-stage centrifugal
Capacity, each	4,600 scfm
Discharge Pressure	4.35 psig
Motor, each	150 hp
Future Membrane Basins (7, 8, and 9) Equalization Storage	
Quantity of Membrane Basins	3
Equalization Storage Volume, each	47,000 gallons

The membrane basins are also supported by the membrane basin drain pumps, sodium hypochlorite storage and metering system, citric acid storage and metering system, and alkalinity addition system.

Membrane Basin Drain Pumps

Two membrane basin drain pumps are located in the basement of the Equipment Building. These pumps are necessary to drain basins in preparation for a membrane recovery clean and to drain the unequipped basins after a peak flow event when they are longer required for flow equalization storage. All of the membrane basins include drainage sumps and individual drain lines that are connected to the common membrane drain pump suction header. Each of the membrane basin drain lines is equipped with a motor operated plug-valve. The membrane basin drain pumps discharge to the mixed liquor return channel.

Table 7-22 summarizes the membrane basin drain pump equipment data and design criteria.

TABLE 7-22

Membrane Basin Drain Pump Equipment Data and Design Criteria

Parameter	Equipment Data
Membrane Drain Pumps	
Quantity	2
Type	Self-priming centrifugal
Capacity, each	1,500 gpm @ 18.5 ft
Motor, each	10 hp

Sodium Hypochlorite Storage and Metering System

Sodium hypochlorite is used for periodic chemical cleaning of the hollow fiber membranes. In addition, solidum hypochlorite solution is added to the non-potable water system to minimize regrowth within this distribution system by maintaining a chlorine residual within this system. The sodium hypochlorite system consists of a 4,000-gallon, double-wall, polyethylene storage tank and four sodium hypochlorite metering pumps. The metering pumps that are associated with membrane system maintenance and recover cleans are hose pumps that each have a capacity of 26.3 gallons per minute, while the non-potable water system metering pumps have a maximum capacity of 0.6 gallons per minute. Table 7-23 summarizes the sodium hypochlorite storage and metering system equipment data.

TABLE 7-23

Sodium Hypochlorite Storage and Metering System Equipment Data

Parameter	Equipment Data
Sodium Hypochlorite Storage Tank	
Quantity	1
Volume	4,000 gallons
Membrane Maintenance and Recovery Clean Hose Pump	
Quantity	2
Type	Hose
Capacity, each	26.3 gpm @ 30 psi
Motor, each	3 hp
Non-Potable Water System Metering Pumps	
Quantity	2
Type	Peristaltic
Capacity, each	0.003 – 0.6 gpm

Citric Acid Storage and Metering System

Citric acid is used for periodic chemical cleaning of membranes. The citric acid system consists of a 1,350-gallon polyethylene storage tank and two citric acid hose pumps, which each have a capacity of 26.3 gallons per minute. The storage tank is equipped with a turbine mixer mounted on the cover of the tank. The citric acid storage and metering system equipment data are presented in Table 7-24.

TABLE 7-24

Citric Acid Storage and Metering System Equipment Data

Parameter	**Equipment Data**
Citric Acid Storage Tank	
Quantity	1
Volume	1,350 gallons
Citric Acid Metering Pumps	
Quantity	2
Type	Hose
Capacity, each	11.8 gpm @ 30 psi
Motor, each	2 hp
Citric Acid Tank Mixer	
Quantity	1
Type	Vertical Propeller
Speed	350 rpm
Motor, each	0.75 hp

Alkalinity Addition System

Although some alkalinity recovery is accomplished through denitrification, additional alkalinity is needed due to the low alkalinity of the influent wastewater. The alkalinity addition system ensures that pH within the system remains within the optimal range for biological treatment and to ensure the District meets its discharge permit limits. The system consists of two polyethylene storage tanks and two peristaltic metering pumps, which help deliver sodium hydroxide to the mixed liquor return channel. The system uses plant influent flow and effluent pH measurements to call the pumps to deliver an operator adjustable sodium hydroxide dose when the effluent pH falls below a setpoint value (e.g., pH < 6.4).

Equipment data for the alkalinity addition system is summarized in Table 7-25.

TABLE 7-25

Alkalinity Addition System Equipment Data

Parameter	Equipment Data
Sodium Hydroxide Storage Tanks	
Quantity	2
Volume	16,500 gallons
Sodium Hydroxide Metering Pumps	
Quantity	2
Type	Peristaltic
Capacity, each	0.2 – 4 gpm
System Capacity (Alkalinity as $CaCO_3$)	13,000 ppd

Membrane Bioreactor Activated Sludge Performance

The Mixed Liquor Suspended Solids (MLSS) concentration is the concentration of suspended solids in the mixed liquor, which serves as a surrogate for the active biomass in the aeration and membrane basins. If the MLSS concentration is too high, the process is prone to increased membrane fouling and reduced membrane system permeate capacity. Conversely, at lower MLSSs the treatment capacity and ability of the process to achieve the desired level of BOD and nutrient removal is reduced. At the WWTF, the MLSS averaged 4,620 mg/L in the aeration basins from 2013 through March of 2021. For the same period, the membrane basins have had an average MLSS of 7,025 mg/L. In recent years, the membrane basin MLSS has increased in variability and also shows a moderate increasing trend. It should also be noted that the membrane basin MLSS varies with the internal recycle rate (mixed liquor pumping rate). Higher internal recycle rates will reduce the membrane basin MLSS and conversely, lower internal recycle rates will increase the membrane basin MLSS.

Solids Retention Time (SRT) is the average time the activated-sludge solids are in the system. It is an important factor affecting the performance of nutrient removal and sludge characteristics. At the WWTF, nitrification is required to meet effluent NBOD limits; a typical value range for complete nitrification is between 3 and 18 days, depending on mixed-liquor temperature. Including residence time in the membrane basin, the total SRT at the WWTF has historically averaged at 18 days, with the membrane manufacturer preferring an aerobic SRT in the aeration basins of at least 12 days.

Another key parameter in the performance of the membrane bioreactor activated sludge system is Time-To-Filter (TTF). This parameter characterizes the filterability of the activated sludge, quantifying how quickly sampled mixed liquor can be filtered. The WWTF records TTF values in seconds per 100 mL. Measurements are limited to a maximum of 1,000 seconds due to time limitations and the usefulness of data beyond this. Historically, the WWTF has annually experienced low filterability beginning in early January and extending into June. Throughout this period, the TTF regularly exceeds the 1,000 second limit. In general, for a 100 mL sample, a TTFof around 100 seconds represents good filterability, while measurements greater than 300 seconds are considered low or bad filterability, although these guidelines are plant specific. As evidenced by the extended periods of poor TTFs, the filterability of the mixed liquor has been poor at the WWTF.

More recent research has indicated the mixed liquor soluble COD concentration is a more reliable indicator of mixed liquor filterability than TTF. As a result, the District began regular collection of filtered COD measurements from the mixed liquor in 2018. These COD measurements are taken by filtering each mixed liquor sample through a 0.45 µm filter and measuring the COD of the filtered sample. The filtered COD measurements are used to estimate the concentration of large organic molecules produced by bacteria that are believed to contribute to fouling of membranes; the 0.45 µm filter separates these organic molecules from the suspended solids. Two broad groups of organic molecules, extracellular polymeric substances (EPS) and soluble microbial products (SMP), have been associated with lowering mixed liquor filterability. These substances do not pass through the 0.45 µm hollow fiber membranes and form a cake layer on the membrane that decreases filterability. When District staff first began collecting filtered COD data, values could range as high as 200 to 300 mg/L. This was during a period of significant fouling and reduced membrane capacity. More recently, filtered COD concentrations have generally ranged between 10 mg/L to 30 mg/L. In March and April of 2021, measurements greater than 40 mg/L occurred when peak flow TMP values suggested low filterability. However, high magnitude peak flow TMP values have also occurred during periods with filtered COD less than 30 mg/L. However, based on experience at Lake Stevens and other similar membrane treatment plants, soluble COD values of 30 mg/L and below generally correlate to good filterability, while values between 30 and 60 mg/L represent moderate filterability, and concentrations in excess of 60 mg/L correlate to poor filterability and reduced system permeate capacity. It is understood that EPS and SMP represented in filtered COD measurements may be part of multiple factors affecting filterability.

The poor filterability is believed to be affected by floc structure similar to how poor floc structures impact settleability in clarifiers. For membrane systems, healthy floc structures are believed trap colloidal particles and EPS within the floc structure limiting the amount of these substances that are present in the bulk liquid and reducing membrane fouling. In general, low F/M ratios are known to provide favorable conditions for microorganisms responsible for mixed liquor with poor floc structures; Figure 7-10 shows a microscopic observation of poor floc structure at the WWTF, where growth of filamentous (string-like) bacteria change the quality of floc that can result in membrane fouling. While some filamentous bacteria are helpful for building healthy floc structures, those in Figure 7-10 are disperse yet abundant. The filamentous bacteria produce EPS, increase sludge viscosity, and help bridge molecules on the membrane surface. Figure 7-10 is provided as an example of how the underlying biology of the system may be affecting filterability. The example is not representative of all possible causes of poor filterability. However, at the WWTF, increasing the F/M ratio through addition of external carbon may favor microorganisms that create better floc structures. In addition, alkalinity sources with multivalent cations, such as those provided in magnesium hydroxide or calcium carbonate (as opposed to sodium-based alkalis, which are monovalent), are known to help promote flocculation. Therefore, improvements that address other needs of the membrane bioreactor activated sludge system may help address the causes of poor filterability.

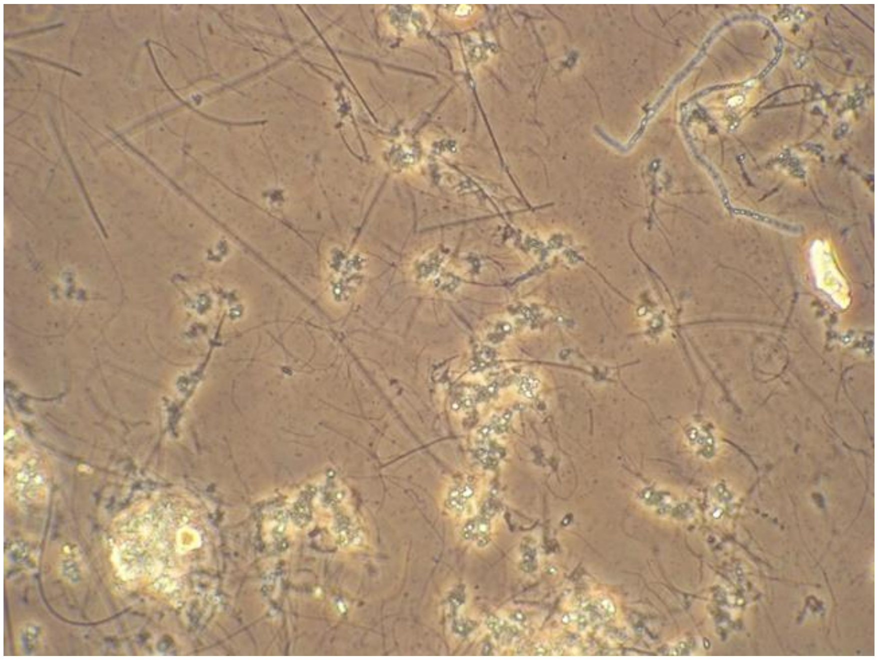


FIGURE 7-10

Microscopic Observation of Poor Floc Structure of WWTF Mixed Liquor, June 2015, 200x

MLSS, SRT, and TTF history is presented in Figures 7-11, 7-12, and 7-13, respectively, and in Table 7-26.

TABLE 7-26

Activated Sludge Performance Data (2013 – 2021)

Condition/Year	Aeration Basin MLSS (mg/L)	Membrane Basin MLSS (mg/L)	SRT, Total (days)
2013 Average	3,961	5,306	17
2014 Average(1)	3,132	4,389	-
2015 Average(1)	3,122	4,084	-
2016 Average	4,049	5,207	16
2017 Average	4,545	6,294	17
2018 Average	4,501	6,731	13
2019 Average	4,087	6,031	15
2020 Average	4,568	6,960	17
2021 Average(2)	4,920	8,046	17
Average	4,620	7,025	18
Maximum	6,744	11,568	48(3)
Minimum	1,969	2,552	6(3)

(1) WWTF process data in 2014 and 2015 was limited.
(2) Data available for 2021 averages were limited to January through March.
(3) Maximum and minimum 7-d moving average.

In 2016, the WWTF staff began collecting performance data from peak flow testing to help provide a more direct means of monitoring mixed liquor filterability and, more importantly, a means of monitoring the peak flow capacity of the treatment plant. Peak flow testing consists of permeating one membrane train at as near as possible to its rated capacity of approximately 19 gfd (gallons per feet per day), which corresponds to about 1,500 gpm per membrane train. Transmembrane pressure (TMP) is monitored and recorded during peak flow tests, with higher TMPs corresponding to lower filterability. From October 2016 to October 2017, when filterability at the WWTF was considered good, peak flow TMP values were between -1 psi and -2 psi. Since this period, TMP values have seasonally fluctuated, but have often been between -5 psi and -6 psi, which suggests poor filterability. During the development of this Plan, TMP values have again dropped back down to between -1 psi and -2 psi. There have been periods during when a membrane train cannot permeate the peak design flow when operating at the maximum design TMP of -7psi. During these periods the plant is not capable of permeating the WWTF design flows.

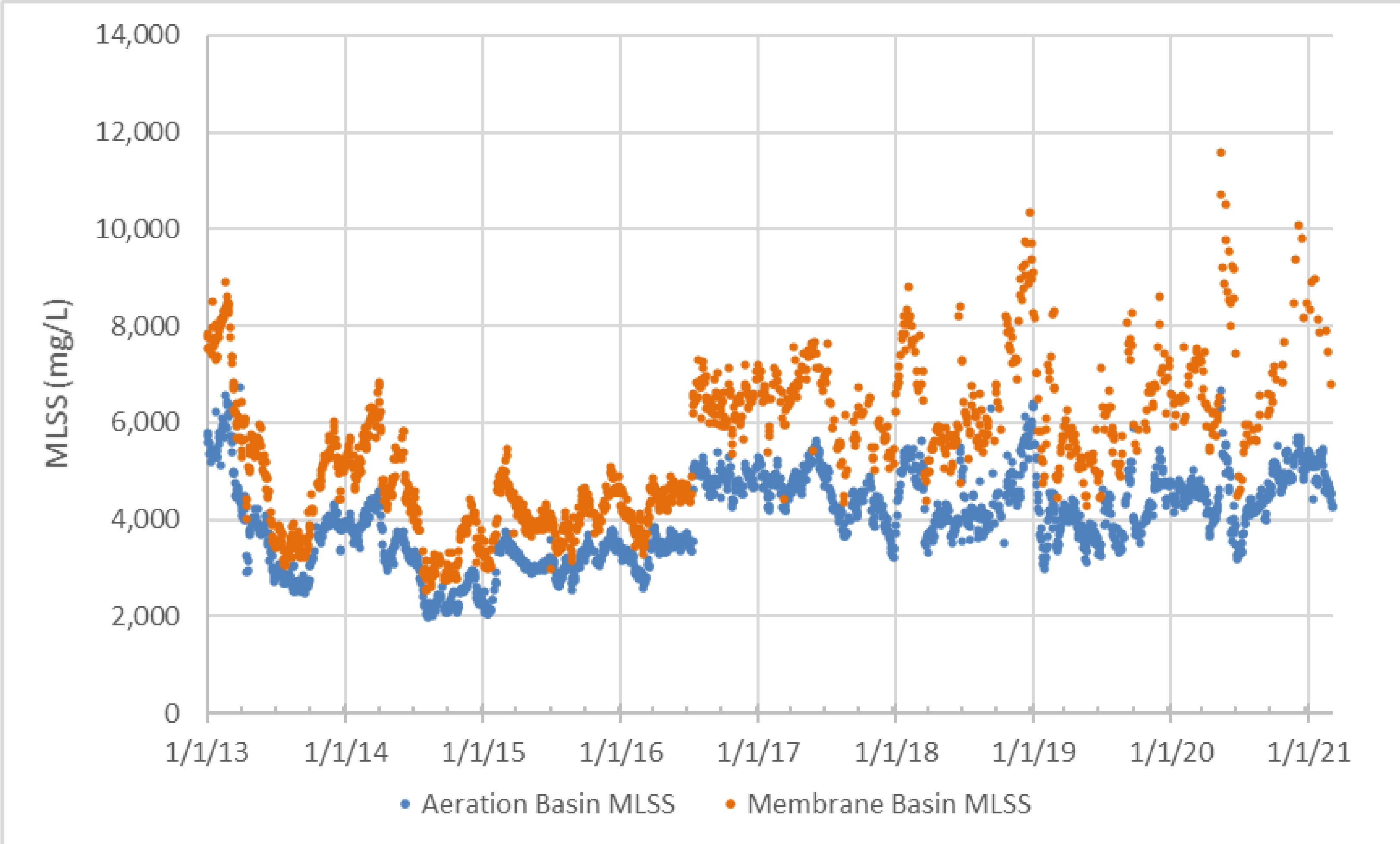


FIGURE 7-11

Aeration Basin and Membrane Basin MLSS Concentration (2013-2020)

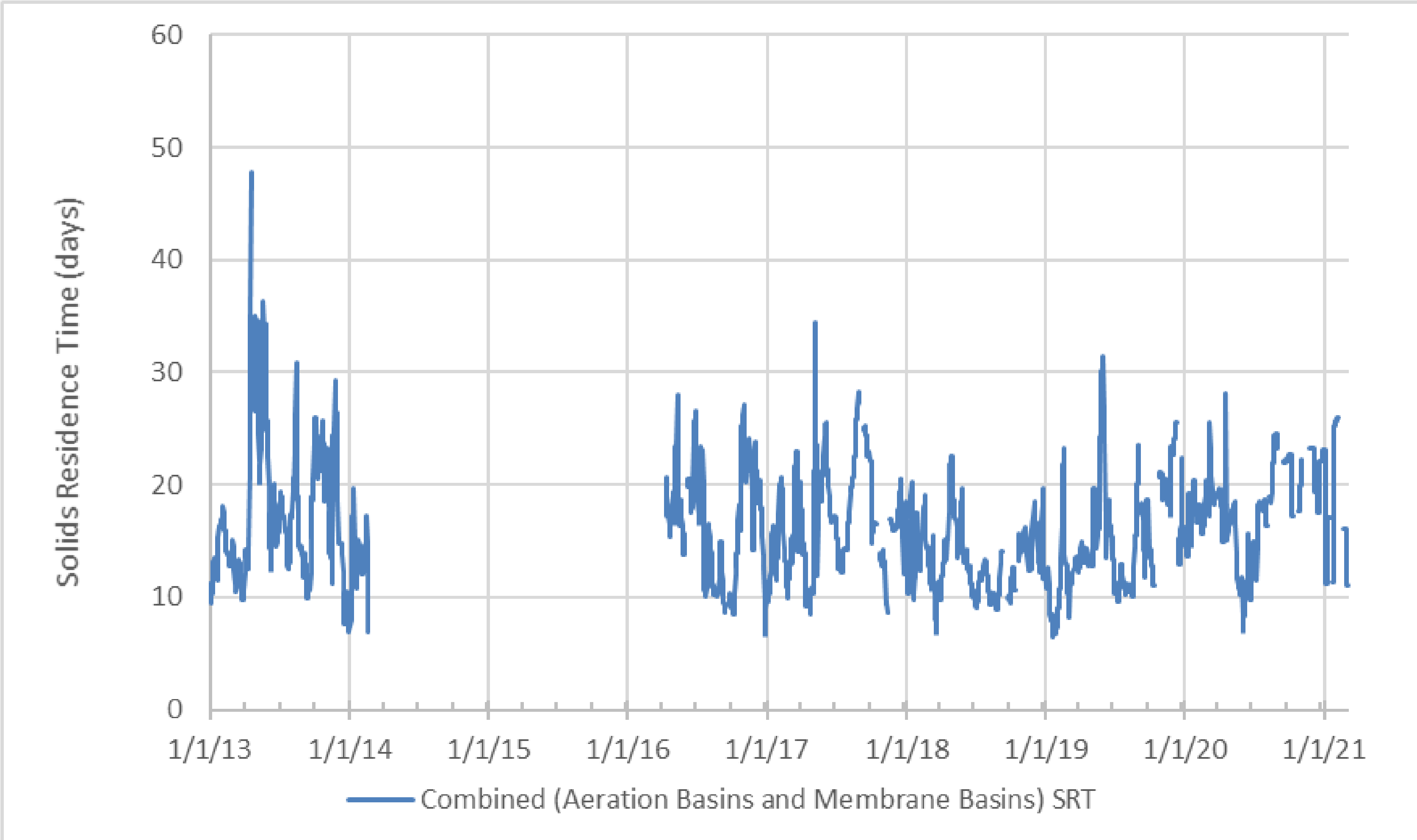


FIGURE 7-12

Aeration Basin and Membrane Basin SRT (2013-2020)

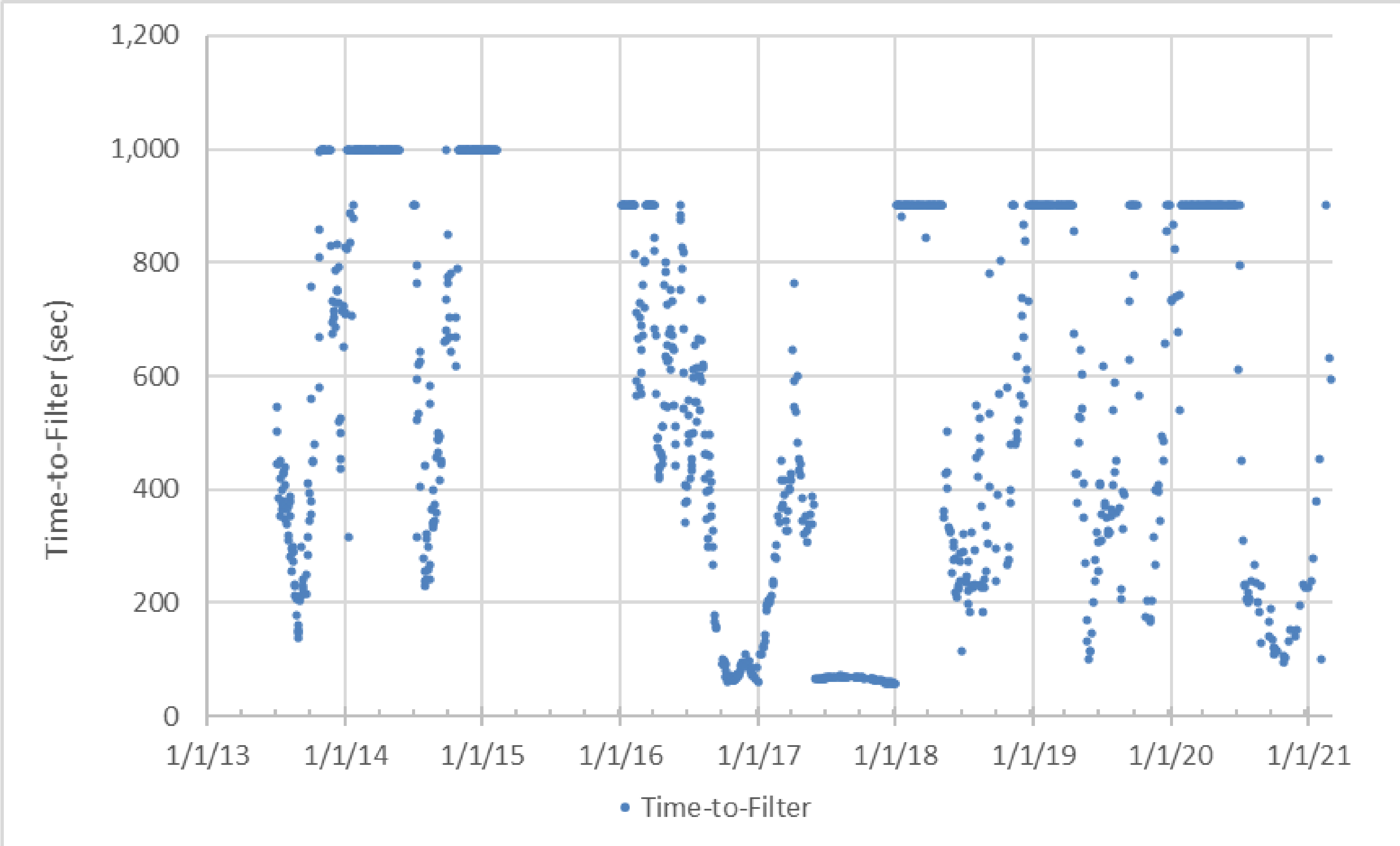


FIGURE 7-13

Activated Sludge Time-To-Filter (2013-2020)

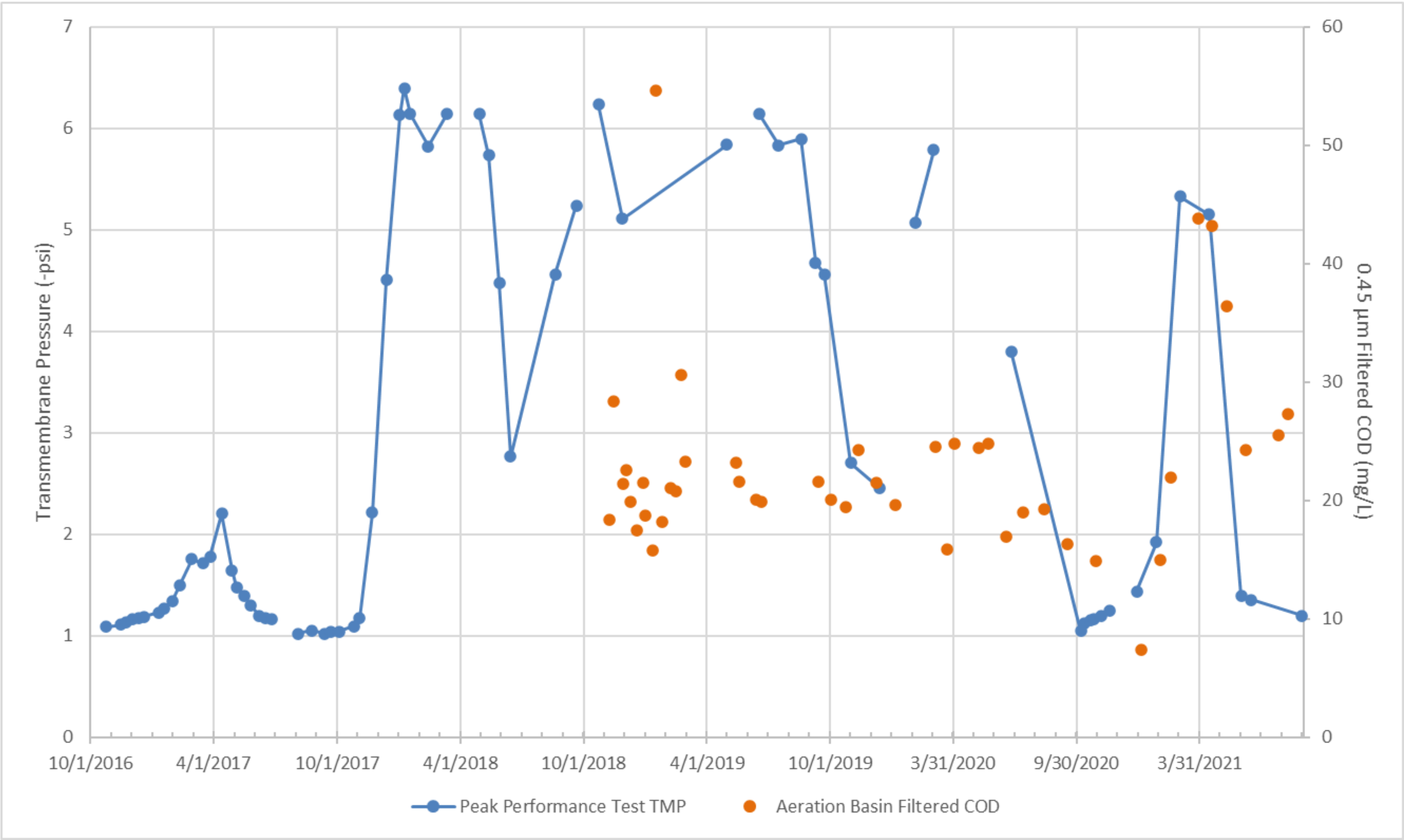


FIGURE 7-14

Peak Performance Test Transmembrane Pressure and Filtered COD (2016-2021)

NPDES Permit Compliance

According to the NPDES permit effluent limits, the WWTF treatment process is responsible for maintaining at least 85 percent BOD_5 and TSS removal, limiting monthly average CBOD to 25 mg/L, and limiting monthly average TSS to 30 mg/L. Past compliance with these permit conditions are demonstrated in Figures 7-15, 7-16, and 7-17. In addition, the WWTF has maintained compliance with the permit condition that effluent TSS load does not exceed 971 lb/day from July through October and 1,254 lb/day from November through June; the WWTF effluent loads in relation to these permit limits are shown in Figure 7-18.

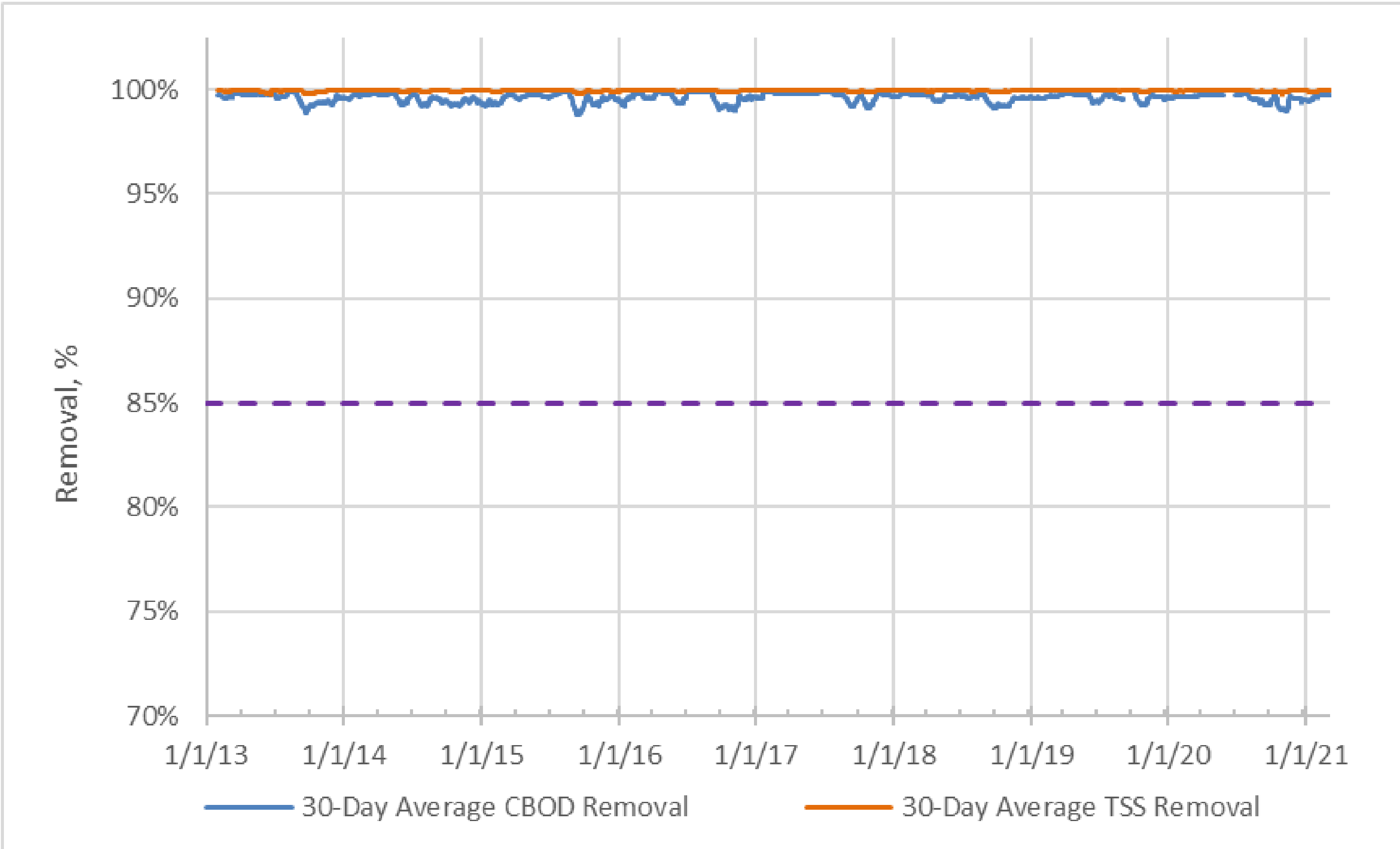


FIGURE 7-15

WWTF Percent Removal of CBOD and TSS (2013-2020)

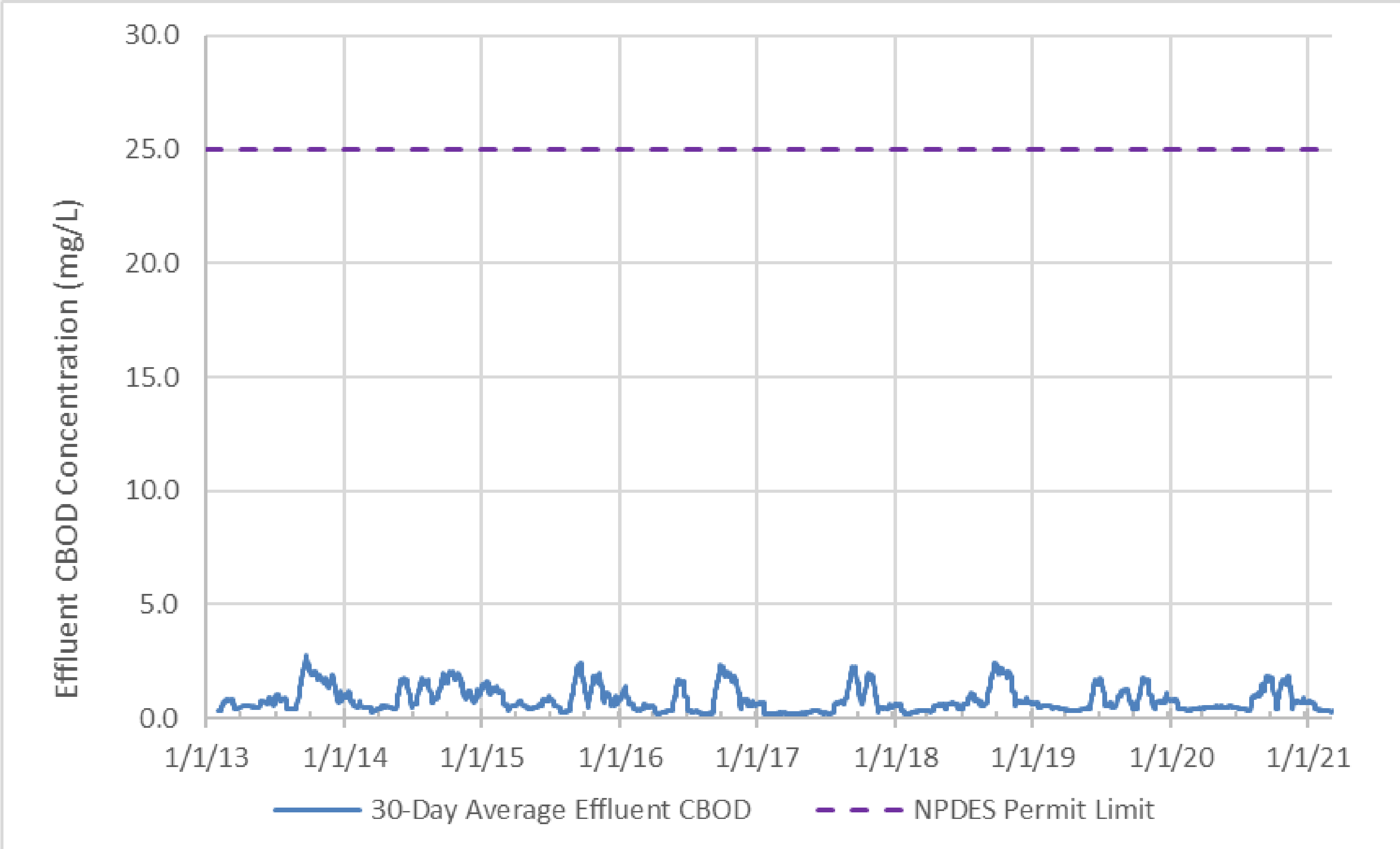


FIGURE 7-16

WWTF Effluent CBOD Concentration (2013-2020)

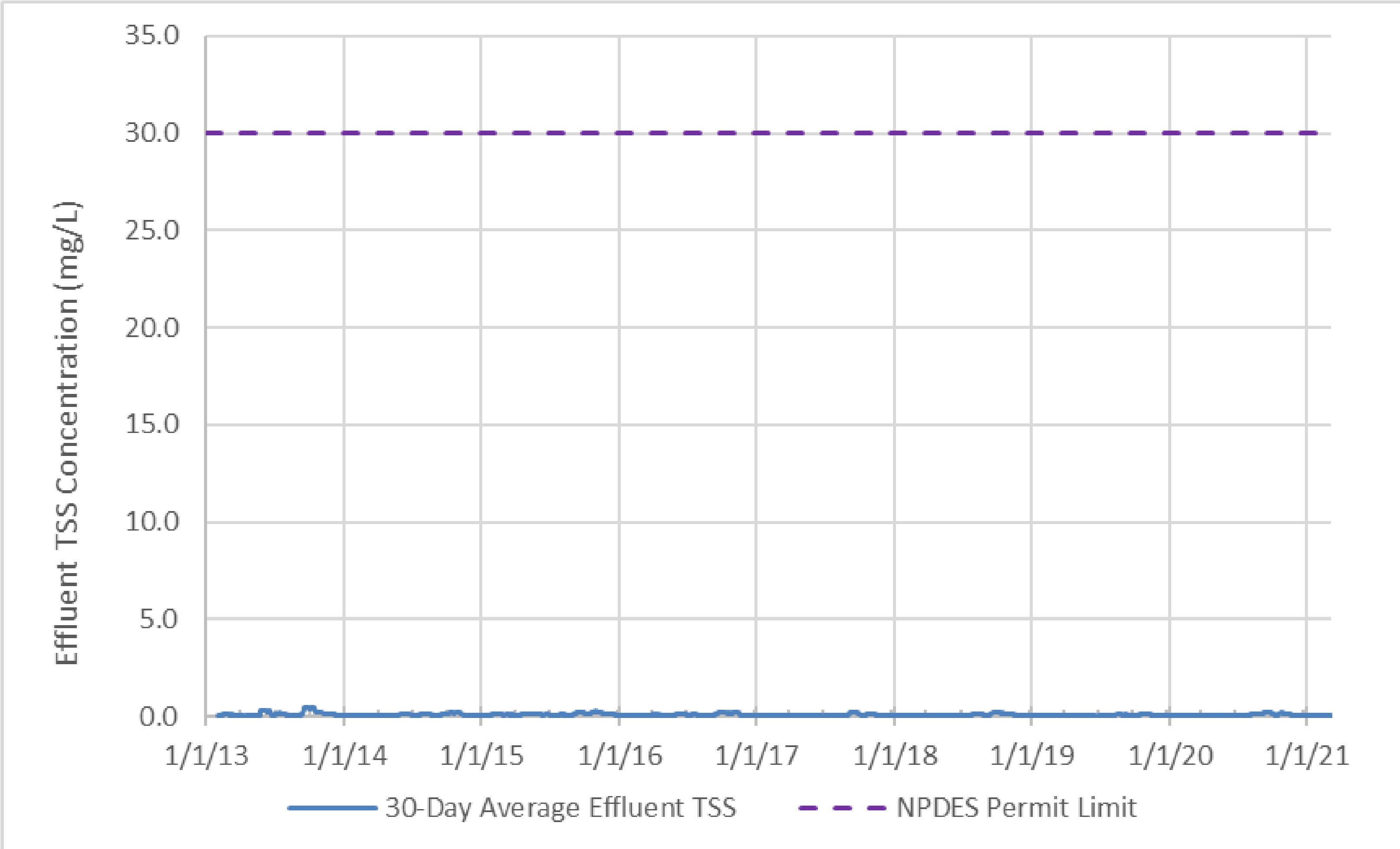


FIGURE 7-17

WWTF Effluent TSS Concentration (2013-2020)

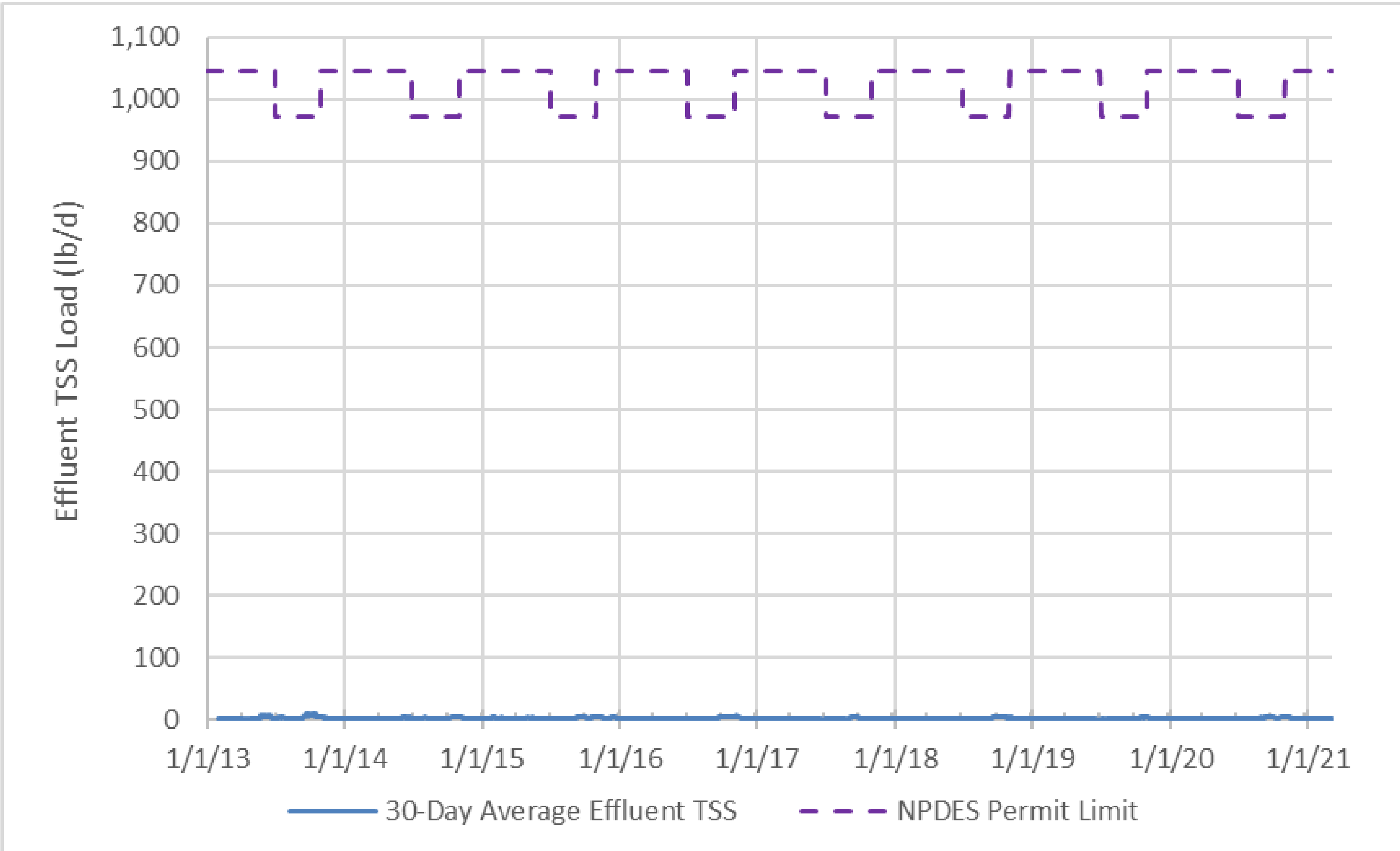


FIGURE 7-18

WWTF Effluent TSS Load (2013-2020)

The NPDES permit also requires the combined CBOD and NBOD effluent load to be less than 235 lb/day on an average monthly basis from July through October. The WWTF effluent has complied with this limit, as shown in Figure 7-19. Additionally, the permit limits the maximum daily combined CBOD and NBOD to 747 lb/day; the maximum daily combined effluent CBOD and NBOD load since 2013 was 39 lb/day. Because effluent NBOD is primarily due to effluent ammonia, historical effluent ammonia concentrations and loads are provided in Figure 7-20 to provide additional context.

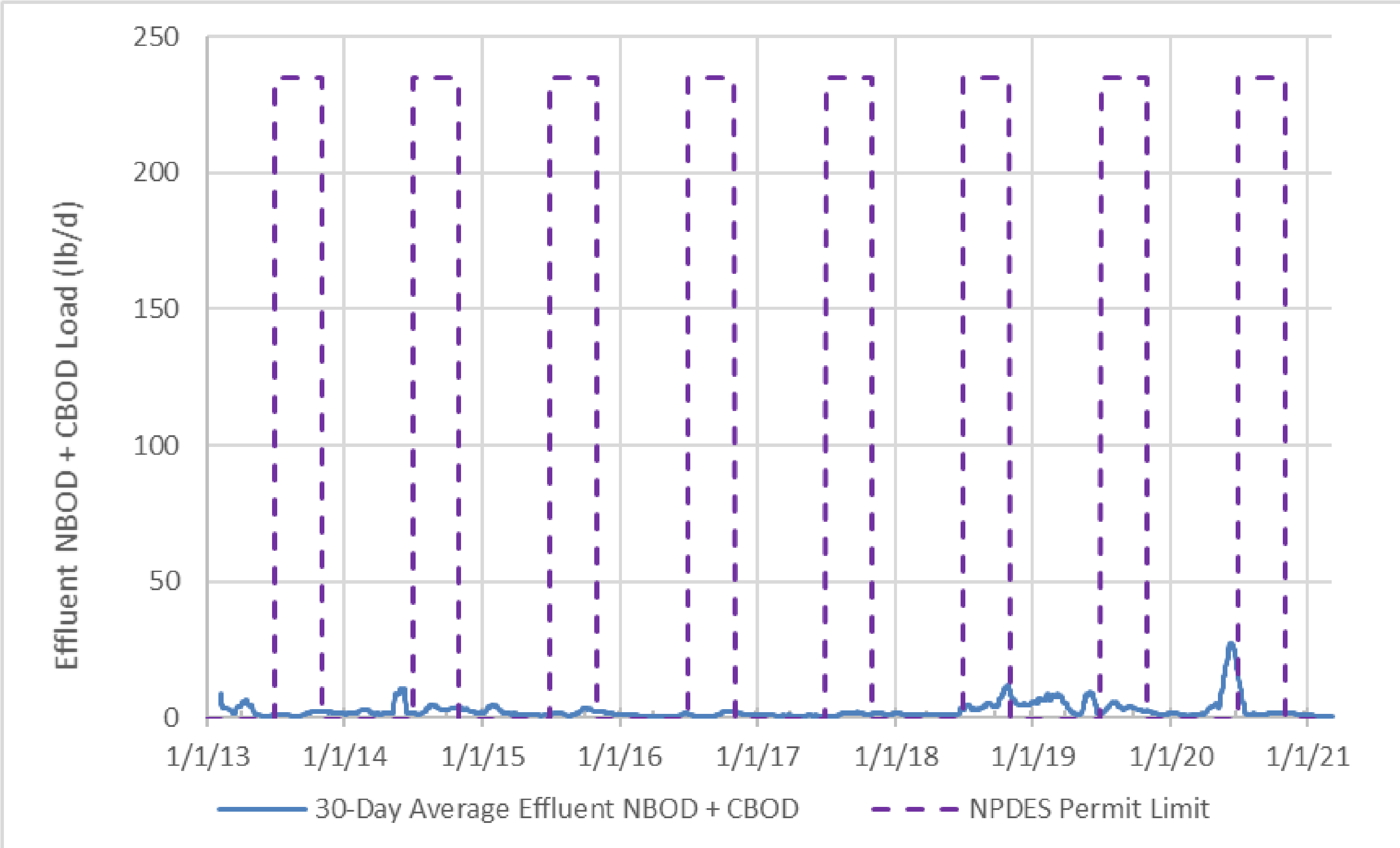


FIGURE 7-19

WWTF Effluent Combined CBOD and NBOD Load (2013-2020)

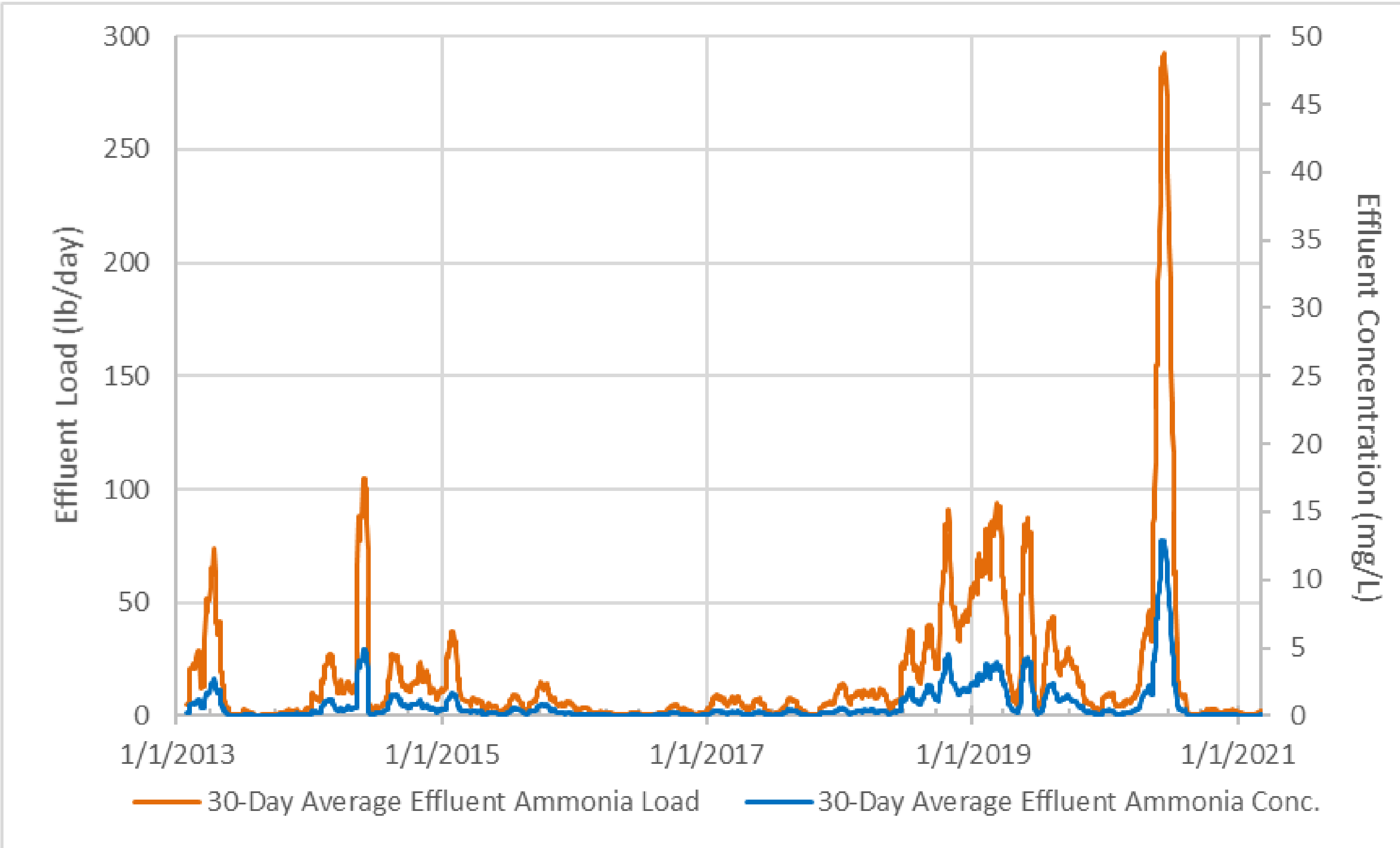


FIGURE 7-20

WWTF Effluent Ammonia (2013-2020)

The membrane basins provide the last opportunity for copper removal from the mainstream treatment process. Therefore, plant copper removal performance is discussed here. The NPDES permit limits average monthly effluent copper concentrations to 12.1 µg/L from July through October. The District began collecting and reporting copper measurements in November 2017. Since then, there has only been one reported value that exceeded the average monthly effluent copper limit when the limit was active (October 2019). The District only reports one measurement per month. Therefore, each reported value effectively represents the average for the month.

As previously mentioned, the mixing zone study in 2018 resulted in higher acute and chronic aquatic life dilution factors. These factors are used in Ecology's determination of effluent copper limits. Although the calculated copper limits in the next NPDES permit using the higher dilution factors in the 2018 study could potentially be less stringent, relaxation of the limits is unlikely due to the anti-backsliding provisions in state and federal regulations discussed in Chapter 2. Other plants, including the City of Puyallup Water Pollution Control Plant, have been able to comply with stringent NPDES effluent copper limits with the addition of specialized precipitants. Since only one exceedance has occurred in the last 3 years, it is expected that the WWTF will be able to continue to comply with copper limits without additional process modifications. If necessary, the District could consider the addition of specialized precipitants. However, pilot testing and consideration of the long-term impact on the membranes is recommended before implementation.

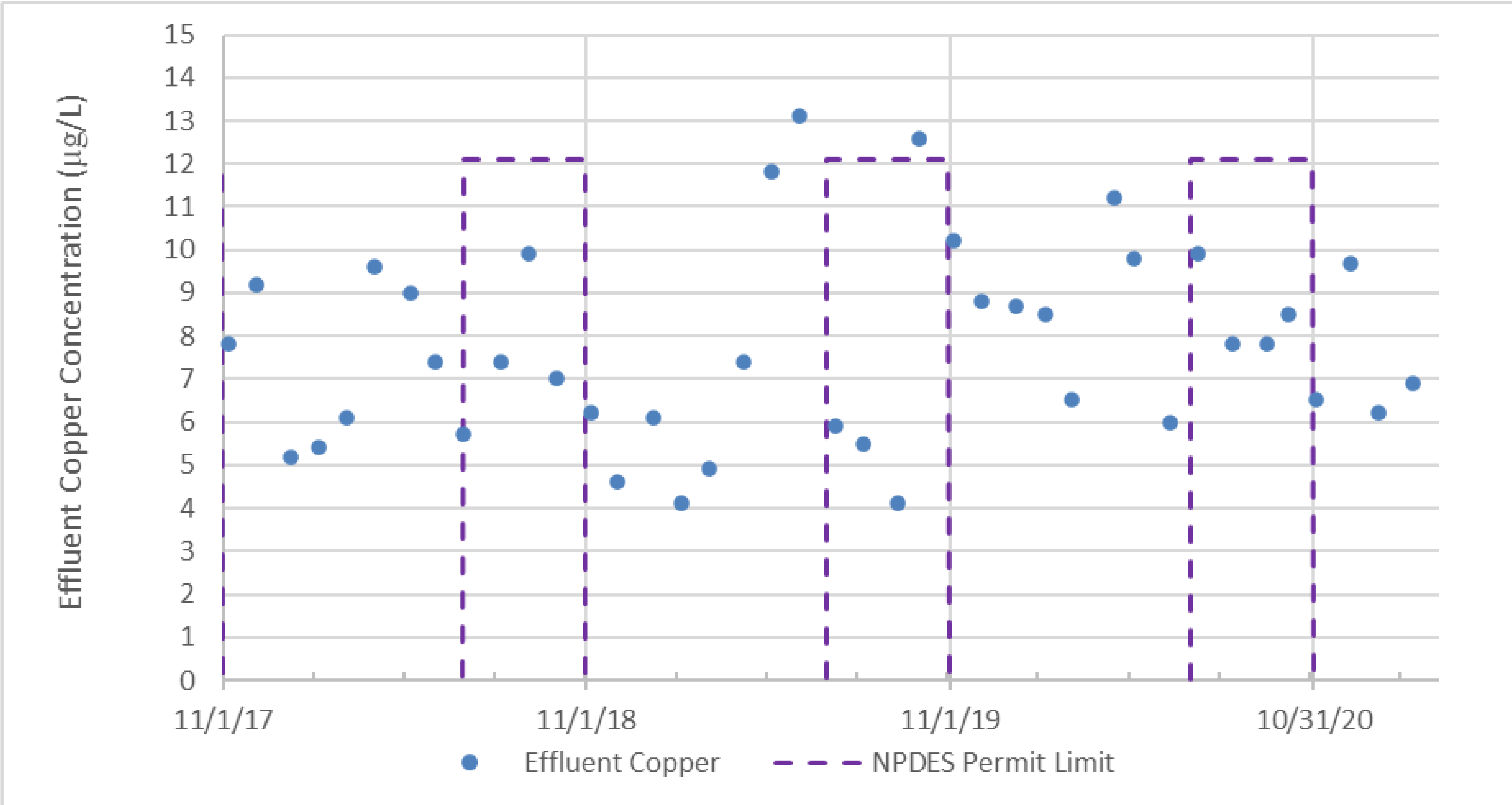


FIGURE 7-21

WWTF Daily Effluent Copper (2013-2020)

Future Nutrient Limits

The PSNGP set the WWTF effluent TIN at a limit of 127,000 lb/yr. The District has reported effluent nitrate/nitrite values since 2017. Table 7-27 summarizes the effluent TIN loading calculated from the combined loads of ammonia, nitrate, and nitrite. The intent of the TIN limit in the PSNGP is to represent historical WWTF effluent TIN loads to allow the District to optimize to meet the TIN load limit. However, the District has exceeded this baseline limit three times (2017, 2019, and 2020) in the past 4 years. Therefore, as currently operated, the existing treatment process is likely to experience future exceedances of the proposed TIN limit. Consequently, the District would be required to implement small-scale modifications to improve nitrogen removal. Given the historical magnitude and frequency at which the proposed limit has been exceeded, improvements to the denitrification process is expected to be necessary during the planning period.

TABLE 7-27

WWTF Effluent Total Inorganic Nitrogen Loads

Year	Effluent TIN Load	
	Total Annual (lb/yr)(1)	**Average Daily (lb/d)**
2017	**136,891**	**330**
2018	115,320	292
2019	**129,513**	**309**
2020	**136,969**	**354**

(1) Values in **bold** would have exceeded the annual TIN load limit set in the Puget Sound Nutrient General Permit.

Membrane Bioreactor Activated Sludge System Area Condition

Issues with the condition of aeration basin guardrails are discussed in the discussion of the primary clarifier area condition. In addition, one area with signs of corrosion is the backpulse line in the membrane system area; specifically, the welds on the stainless-steel components appear to be corroded on piping between the back-pulse pumps and the connection to the back pulse header between the connections to membrane basins 5 and 6. The apparent corrosion likely is due to the membrane cleaning chemicals, such as sodium hypochlorite. Consequently, it is recommended that these pipes and fittings be replaced with a more chemically resistant material such as Schedule 80 PVC and that this work is completed within the planning period.

Another notable issue in this area is the blower room, where WWTF staff identified recent issues with process blower high temperature alarms on hot days. This primarily occurs in the afternoons on extremely hot summer days. Potential remedies include installation of individual air conditioners on each of the process blower enclosures and installing a cooling system on the inlet louver to cool the makeup air at the source.

While future improvements to treatment processes are evaluated at the end of this chapter, it is recommended that a modification is made to the anoxic zones to potentially provide marginal improvement to the function of these zones. Presently, a small portion of the flow passes over the baffle wall between anoxic zones 1 and 2, while the majority of the flow passes through rectangular openings at the base of the wall. This ensures that scum is able to pass from anoxic zone 1 to 2 so that it is not trapped in anoxic zone 1. However, visual observation of these zones suggests that some short-circuiting of flow may be occurring over these walls. Figure 7-22 shows one of the submerged anoxic zone baffle walls, where the depth of flow appears to be larger than necessary to allow scum to pass over the wall. Though it is not clear if this amount of flow results in significant short-circuiting, it is recommended that the District raise the effective height of these anoxic zone walls with small (4" x 1") stainless steel angles to ensure that short-circuiting does not reduce the denitrification performance of the anoxic zones.

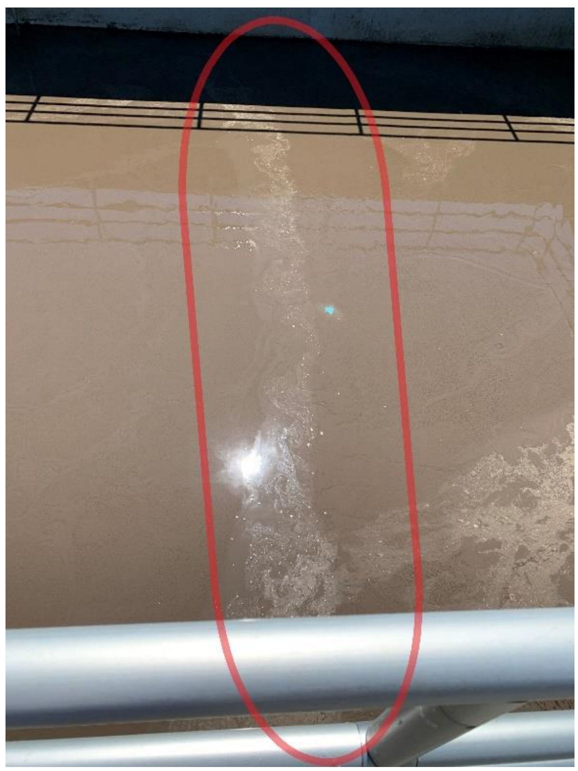


FIGURE 7-22

Flow Over Submerged Anoxic Zone Wall

Over time, membranes in membrane bioreactor systems diminish in performance due to an irreversible accumulation of material in the membrane pores. The hollow fiber membranes at the WWTF have a typical service life between 8 to 10 years and the existing membrane bioreactor system has now been in operation for over 9 years. Given that the existing membranes are approaching the end of their service life, the District should plan to replace the existing membranes within 1 to 2 years. Once the membranes have been replaced, it is anticipated that the District will need to replace the membranes 1 to 2 more times within the planning period.

Similarly, several equipment items are expected to reach the end of their useful lives within the planning period. To begin with, the deoxygenation zone and anoxic zone jet mixing pumps have a typical service life of between 20 and 25 years. Therefore, the District should plan to replace these pumps before 2036.

The flash mixer also has a typical service life of between 20 and 25 years. However, the continuous operation of this unit produces wear on the 100,000-hour rated gearbox. Consequently, it is recommended that the District plan to replace the gearbox on the flash mixing unit. Given that the unit has been in operation for nearly 100,000 hours, this work is recommended to occur at the beginning of the planning period. Replacement of the gearbox would allow the unit to operate until it is time for the entire unit to be replaced, likely after 2031.

In general, membranes for fine bubble diffusers need to be replaced every 10 years. Because the WWTF aeration basins have been in operation for nearly 10 years, the diffuser membranes in the aeration basins are due for replacement at the beginning of the planning period. Membrane replacement is expected to occur at least once more during the planning period.

The process blowers are critical components to the activated sludge system. High-speed turbo blowers, such as those installed at the WWTF, were not widely utilized until the last decade. Therefore, it is difficult to project the long-term maintenance and the expected service life of these units. Assuming similar equipment ageing as other blower types, the process blowers would need replacement toward the end of the planning period. It is recommended that the District plan for this replacement to occur after 2037.

Like many other equipment items, the centrate pumps have an expected service life of between 20 and 25 years. Therefore, these pumps may reach the end of their service life within the planning period. These pumps should be planned to be replaced prior to 2036.

Lasty, the peristaltic metering pumps for delivering sodium hypochlorite to the non-potable water system have an expected service life of 15 to 20 years. These pumps could be replaced after 2027.

ULTRAVIOLET DISINFECTION

The hollow fiber membrane filtration system removes nearly all bacteria and most viruses from the effluent flow stream (permeate). However, regulations still require this flow to undergo disinfection prior to discharge to the receiving water. At this facility, the ultraviolet disinfection system ensures that the final effluent meets the NPDES permit limits for pathogenic organisms under all conditions.

Ultraviolet radiation inactivates bacteria and other pathogens by modifying their genetic material (DNA or RNA) and modifying cellular proteins so that they die or cannot reproduce. Ultraviolet disinfection performance is expressed in terms of log reduction of reproducing bacteria, or inactivation. (A 10-fold reduction is 1 log removal; a 100-fold reduction is 2 log removal, etc.) The dose of UV light available to inactivate bacteria is measured in milliwatt-seconds/cm^2 (equivalent to mJ/cm^2), which is essentially the product of the light intensity and duration of exposure. The amount of UV radiation available to inactivate pathogens depends on the amount of radiation not absorbed (transmittance) by suspended and/or dissolved matter present in the effluent stream. Transmittance is an indicator of the amount of UV light available for disinfection within a given wastewater sample and will dictate the relative efficiency of bacterial inactivation. The UV transmittance is the percentage of UV light at 254 nm not absorbed after passing through 1 cm of effluent sample. Transmittance is reduced with increasing concentrations of suspended matter (and some dissolved constituents) in the wastewater stream. Reduced transmittance decreases the intensity of the light in the liquid, and will therefore require longer retention/exposure times or higher lamp intensities to deliver the necessary UV dose.

The WWTF uses UV light generated by low-pressure, high-output mercury amalgam lamps. The Ozonia Aquaray 3X HO VLS system consists of three separate modules of vertically-oriented UV lamps arranged in series in a single channel. Each module contains 36 lamps for a total of 108 installed lamps. The UV disinfection system was designed with the ability to expand to a total of 12 modules with six modules in each of two parallel channels, though currently only one channel is equipped with 3 modules. Each channel is equipped with an inlet slide gates to allow each channel to be isolated. Flow through the UV channel is regulated by an effluent counter-weighted flap gate that self-modulates to maintain an effectively constant depth of flow in the channel; this is necessary to ensure that flow depth submerges the UV lamps and all flow receives adequate UV dosage.

Each UV module contains an automated mechanical wiping and cleaning system. A 1-ton capacity bridge crane in the effluent disinfection room provides the ability to pull UV modules out of the UV channel for maintenance.

Table 7-28 summarizes the UV disinfection system equipment data and design criteria.

TABLE 7-28

UV Disinfection System Equipment Data and Design Criteria

Parameter	Equipment Data
UV Disinfection System	
Manufacturer and Model	Ozonia Aquaray 3X HO VLS
Design Peak Day Flow	7.40 mgd
Design Peak Hour flow	12.28 mgd
Minimum Flow	1.0 mgd
TSS	<5 mg/L
Disinfection Standard, 30-Day Mean	200 mpn/100mL
UV Transmittance @ 253.7 nm	65%
UV Lamp Type	Low Pressure-Medium Intensity
Orientation	Vertical
Minimum UV Dose @ Peak Day Flow	30,000 µw/sec^2
Number of Equipped Channels	1
Channel Length	44 ft
Channel Width	28 in.
Channel Depth	84 in.
Quantity of Modules per Channel	3
Quantity of Lamps per Module	36
Total Quantity of Lamps	108
Level Control	Counter-balanced flap gate

Ultraviolet Disinfection Performance

The membrane system filters out virtually all fecal coliform prior to UV disinfection. Consequently, the UV disinfection system is easily able to meet the NPDES permit limit, and likely provides a dose in excess of what is required. While the permit limit is a monthly geometric mean of 200 cfu/100 mL, the WWTF effluent has not exceeded the detection limit of 1 cfu/100 mL

As noted in Chapter 2, Section 200 of Chapter 172-201A of the Washington Administrative Code (WAC) set fecal coliform level limits to expire on 12/31/2020. The bacterial indicator is instead *Escherichia coli* (*E. coli*). Counts of *E. coli* will be lower than those of fecal coliforms, as *E. coli* represent a single species of fecal coliforms. Furthermore, a study titled "Comparison of *Escherichia coli*, Total Coliform, and Fecal Coliform Populations as Indicators of Wastewater Treatment Efficiency" (Elmund, Allen, & Rice, 1999) observed that *E. coli* accounted for about 49 percent of fecal coliform counts in wastewater treatment final effluent after UV disinfection. Data from sampling and measurements of final effluent is necessary to determine the proportion of *E. coli* to fecal coliforms at the WWTF, as this proportion is site-specific. However, since the existing WWTF effluent has not exceeded the detection limit of 1 cfu/100 mL of fecal coliforms, it is likely that the existing combination of membrane filtration and UV disinfection would result in similarly low counts of *E. coli*. Therefore, the existing treatment processes are expected to provide sufficient removal of *E. coli* through the planning period.

Ultraviolet Disinfection Area Condition

There are no notable issues with the UV disinfection area condition. However, the existing UV system will approach the end of its service life within the planning period. The typical service life of a UV system is from 17 to 22 years. Therefore, the District should expect to replace the existing UV system between 2027 and 2033.

EFFLUENT FLOW MEASUREMENT

After passing through the UV effluent disinfection system, a small portion of the effluent flows towards the non-potable water system sump, while the other portion flows towards the effluent flow meter. The effluent flow meter consists of a 24-inch Parshall flume with redundant level sensors. As is the case with the influent flow meter, the depth of flow through the effluent Parshall flume is continuously monitored by the bubbler system pressure transmitter and an ultrasonic level sensor.

Table 7-29 summarizes the effluent flow meter equipment data.

TABLE 7-29

Effluent Flow Meter Equipment Data

Parameter	**Equipment Data**
Quantity	1
Type	Parshall flume
Throat Width	24"

The Equipment Building PLC continuously calculates and records effluent flow based on the following equations:

$$Q = 3{,}591 \text{ x } H^{1.5}$$

Where: Q = flow in gpm.
H= depth of flow in feet.

Effluent Area Condition

The effluent flow measurement area only expected to require regular maintenance during the planning period.

OUTFALL

After passing through the effluent Parshall flume, final effluent is conveyed by gravity through the 3,000 foot, 30-inch diameter effluent pipeline to the outfall in Ebey Slough. The outfall diffuser consists of two 14-inch duckbill diffuser ports with a total capacity of 21.4 mgd.

Outfall Condition

As previously mentioned, a mixing zone study was conducted in 2018. As part of this effort, divers inspected the condition of the outfall. The divers noted that the outfall was in good condition except for one diffuser that was missing a nut on one of the bolts. The nut has since been replaced, and all bolts on the diffusers and couplings were tightened by the divers. The inspection noted that there was no sediment accumulation near the diffusers, no obstructions to flow from the diffusers, and the diffusers themselves and anchors used to secure the outfall line are in good condition.

FACILITY SUPPORT SYSTEMS DESCRIPTION AND CONDITION

Facility systems that do not directly contribute to the liquid stream or solids handling processes are described and evaluated in this section. These systems were evaluated based predominantly on discussions with WWTF staff.

PLANT COMPRESSED AIR SYSTEM

Compressed air is used for a number of different applications around the treatment plant. The bubbler panels at the headworks, primary effluent screenings building, and effluent flow meter require instrument air. The membrane system requires air for its pneumatically actuated automated valves as well as the permeate ejector systems needed to prime the permeate pump suction piping prior to bringing a membrane basin back on line. Compressed air at the headworks is provided by a small, localized system that is described in the influent flow measurement section. All other compressed air needs are provided by the plant compressed air system, which consists of three compressors, three receiver tanks, and three air dryers. Each compressor is associated with a receiver tank and air dryer and is capable of meeting the WWTF compressed air needs. The compressors are controlled by the Equipment Building PLC and operate in lead-lag configuration to maintain a minimum of system pressure of 80 psig. A humidity sensor monitors the moisture content of the common discharge of the air compressors.

Equipment data for the plant compressed air system is summarized in Table 7-30.

TABLE 7-30

Plant Compressed Air System Equipment Data

Parameter	Equipment Data
Air Compressors	
Quantity	3
Type	Pressure lubricated, reciprocating
Capacity, ea.	52.5 acfm
Discharge Pressure	100 psig
Motor, each	15 hp
Air Receiver Tanks	
Quantity	3
Capacity, ea.	120 gallons
Air Dryers	
Quantity	3
Type	Refrigerated
Capacity	75 acfm

Plant Compressed Air System Condition

At present, there are no notable issues with the condition of the plant compressed air system. The plant compressors and dryers have a typical service life of between 25 and 30 years. Given the system has been in operation for about 10 years, the compressors and dryers should be planned to be replaced at some point after 2037.

NON-POTABLE WATER SYSTEM

Non-potable water needs at the plant are met by three vertical turbine pumps, all of which are connected to a common 6-inch suction pipe that draws treated effluent out of a sump just downstream of the UV effluent disinfection channel. Each pump discharges to a common 6-inch discharge header. The system normally operates at a pressure between 80 and 100 psi. Non-potable water flow is monitored by a 6-inch magnetic flow meter installed on the discharge header and system pressure is monitored by two pressure sensors installed downstream of the three pumps. There is also a tee on the discharge header and there is a pressure sustaining valve on the branch from this tee that continuously modulates to maintain a maximum system pressure of 100 psig and recirculates excess flow to the inlet of the UV effluent disinfection channels. The system demand is met by the two duty pumps, while the third pump serves as a redundant unit. The two pumps operate in lead-lag arrangement through the Equipment Building PLC, configured to maintain 80 psi in the force main. The pressure relief valve allows non-potable water to flow back into the UV system inlet channel when pressure in the force main rises over 100 psi.

Equipment data for the non-potable water pumps is provided in Table 7-31.

TABLE 7-31

Non-Potable Water Pump Equipment Data

Parameter	Equipment Data
Quantity	3
Type	Vertical, multistage centrifugal
Capacity at TDH, ea.	250 gpm @ 230 ft
Motor	25 hp

Non-Potable Water System Condition

Currently, the non-potable water pumps appear to be in good condition. Based on a typical service life, the non-potable water pumps can be expected to operate for a total of 25-30 years with normal maintenance. As these pumps have been operational for nearly 10 years, the District should plan to replace these pumps at some point after 2037.

PLANT DRAIN PUMP STATION

The Plant Drain Pump Station is an 8-foot diameter wet well containing three submersible pumps, that operates in a lead-lag configuration based on the level the wet well. The pump station receives flow from drains across the WWTF, in addition to overflows and tank drains and convey these flows back to the primary clarifier splitter box via a 6-inch force main. The level in the wet well is monitored by a submersible pressure transmitter that transmits a level proportional 4-20 mA signal to the Equipment Building PLC. There are also three float switches installed in the wet well above the high-level alarm setpoint elevation for the submersible pressure transmitter. One float switch is directly wired into the control circuit for a specific pump, allowing the pumps to continue to function in the event that either the submersible pressure transmitter or the PLC fails.

Plant drain pump station equipment data are summarized in Table 7-32.

TABLE 7-32

Plant Drain Pump Station Equipment Data

Parameter	Equipment Data
Quantity	3
Type	Submersible centrifugal
Capacity at TDH, ea.	500 gpm @ 42 ft
Motor	10 hp

Plant Drain Pump Station Condition

The Plant Drain Pump Station is not expected to require any improvements beyond regular maintenance during the planning period. The plant drain pumps can be expected to function for approximately 30 years, based on typical service life. Therefore, these pumps should be planned for replacement towards the end of the planning period (before 2041).

PLANT COMPOSITE SAMPLERS

Composite samplers collect wastewater samples downstream of the influent band screens, upstream of the primary effluent band screens, and downstream of the UV disinfection system. Each of these sample locations has a composite sampler consisting of a peristaltic pump and refrigerated chamber that are contained in all-weather enclosures. The samplers at the influent band screen and primary effluent band screen are capable of collecting flow-paced composite samples based on influent flow measurements. Flow pacing of the effluent sampler at the UV disinfection system is based on effluent flow.

Equipment data for the plant composite samplers is summarized in Table 7-33.

TABLE 7-33

Plant Composite Samplers Equipment Data

Parameter	Equipment Data
Influent Sampler	
Quantity	1
Maximum Sample Lift	22'
Primary Effluent Sampler	
Quantity	1
Maximum Sample Lift	22'
Effluent Sampler	
Quantity	1
Maximum Sample Lift	22'

Plant Composite Sampler Condition

The existing plant composite samplers had no notable issues for this evaluation and are not expected to require any additional work beyond regular maintenance and replacement of parts.

ON-SITE STORMWATER COLLECTION AND FLOOD PROTECTION

The WWTF stormwater is regulated under the NPDES Industrial Stormwater General Permit, whose current iteration is effective until December 31, 2024. Under this permit, the District is required to collect quarterly samples of stormwater discharge at minimum. Measurements derived from these samples are required to fall below the following benchmark values in Table 7-34.

TABLE 7-34

Stormwater Limits

Parameter	Benchmark Value
Turbidity (NTU)	25
pH	5.0 – 9.0
Oil Sheen (Visible, Yes/No)	No Visible Oil Sheen
Total Copper, Western WA (µg/L)	14
Total Zinc (µg/L)	32

Stormwater at the WWTF is collected by a network of catch basins distributed across the impervious surfaces on-site. Flows across the site eventually combine into a 12-inch line that discharges through a 12-inch duckbill elastomeric diffuser check valve into Ebey Slough. Upstream of conveyance to Ebey Slough, stormwater typically flows through three stormfilter manholes, which contain 8 stormfilter cartridges. The stormfilter manhole controls water quality and has a capacity of 0.19 cfs. Stormwater flows beyond the stormfilter capacity are bypassed and combined with treated flow at a downstream manhole. Samples for permit compliance are collected from stormwater flow before it travels offsite towards Ebey Slough. The current WWTF was designed and positioned to be out of the Ebey Slough floodplain. In addition, the WWTF is separated from the slough by a levee that is not owned by the District.

The WWTF stormwater discharge exceeded benchmarks (Table 7-34) in 2013 and 2015, but has not had exceedances since then. Thus, there is no apparent need for improvements to the WWTF stormwater collection system or flood protection measures. Typical maintenance of the stormfilter cartridges is expected to be required throughout the planning period. This includes annual inspection of the cartridges during the dry season. Maintenance, which typically should occur every 1 to 5 years, includes removal of accumulated sediment and replacement of filter cartridges.

AUXILIARY POWER SYSTEM

The auxiliary power generators provide an alternate source of electrical power in the event of a failure of both of the utility services. The system includes two generators, each rated for 1.0 MW of power, and two 4,000-gallon diesel fuel storage tanks. Each of the two generators is capable of meeting the power needs of the critical process systems.

There is an automatic transfer switch that monitors the normal utility power source and automatically initiates generator startup and load transfer when the utility power fails or falls below normal. The load is automatically transferred back to normal operation and the generator is shut down when utility power is restored.

Table 7-35 summarizes equipment data for the auxiliary generators.

TABLE 7-35

Auxiliary Generator Equipment Data

Parameter	Equipment Data
Quantity	2
Rating	1.0 MW, 277/480 V, 3-phase, 4-wire
Power Factor	0.8

Auxiliary Power System Condition

The existing auxiliary power system has one functional issue related to the utility services. The WWTF is served by two separate utility services. Historically, when the primary utility service failed, the utility transfer switch transferred to the redundant utility service. During this transfer period, the standby generators' automatic transfer switches would register a loss-of-power and call the standby generators. By the time the generators were in operation, the utility power transferred to the live utility service, removing the need for the generators to run. The programming in the vendor-provided PLC in both sets of switchgear needs to be modified so that the delays in the switchgear accommodate the transition period between the two utility services. This modification will essentially involve delaying the call to start the generators upon detection of power failure of the primary utility service. During the development of this plan, the District began working to address this issue.

ODOR CONTROL SYSTEM

Air containing odorous gases such as hydrogen sulfide, ammonia, and organic gases is produced across various facilities at the WWTF. The odor control system and biofilter is responsible for collection and treatment of foul air. The following facilities are served by the odor control system:

- Headworks (including influent channels, screens, flume, screenings washer/compactor, grit classifier and building)
- Primary Clarifier Splitter Box
- Primary Clarifiers
- Primary Effluent Screenings Building
- Gravity Thickener
- Plant Drain Pump Station

- Centrate Storage Tank
- Digester Building

Two biofilter fans are installed in the Primary Effluent Screenings Building. Only one biofilter fan runs at any given time with the other fan available as a standby unit. The foul air travels through fiberglass reinforced pipe across the WWTF until it reaches the 36-inch intake duct to the biofilter fans. The fans distribute flow across three humidification towers, which spray non-potable water into the passing air to increase its moisture and maintain a minimum air temperature for proper function of the biofilters. Two immersion heaters in each humidification tower help maintain minimum foul air temperature. The six biofilters each consist of three-sided concrete basins designed to allow air to flow up through a layer of coarse limestone prior to passing through coarse wood media, which provides area for adsorption of gas molecules. The gas molecules are metabolized and oxidized by bacteria living in the media. Due to the humidity of collected foul air and air discharged from the humidification towers, the odor control system is supported by a drain manhole that collects water accumulated from low points in the system.

Table 7-36 summarizes the odor control system equipment data.

TABLE 7-36

Odor Control System Equipment Data

Parameter	**Equipment Data**
Biofilter Fans	
Quantity	2
Type	Centrifugal
Capacity	16,400 cfm @ 14" W.C.
Motor Size	50 hp
Motor Speed	1,800 rpm
Biofilter Humidification Tower Equipment	
Humidifier Tower	
Quantity	3
Diameter	10 feet
Height	12 feet
Immersion Heaters	
Quantity, ea. Tank	6
Type	Immersion
Output, ea.	12 kW
Recirculation Pump	
Quantity	3
Type	Centrifugal
Capacity at TDH	75 gpm @ 60 psi
Motor Size	7.5 hp

TABLE 7-36 – (continued)

Odor Control System Equipment Data

Parameter	Equipment Data
Biofilter Equipment	
Quantity	6
Type	Coarse Wood Media Biofilter
Design Airflow Rate, ea.	2,730 cfm
Area, ea.	474 ft^3
Volume, ea.	2,370 ft^3
Media Depth	66"
Design Detention Time	57 sec
Odor System Drain Manhole Submersible Pump	
Quantity	1
Type	Submersible centrifugal
Capacity	75 gpm @ 30 feet
Motor Size	1.7 hp

Odor Control System Condition

The existing odor control system had no notable issues for this evaluation. However, during the planning period, the biofilter media should be regularly replaced (every 4 to 6 years) and was last replaced in 2019. In addition, the drain pump can be expected to have a service life of about 20 years. Therefore, the drain pump may need to be replaced in about 10 years, which would be 2032 or after.

A larger set of equipment that may require replacement is the biofilter fan system. The two fans can be expected to have a service life of about 30 years. Therefore, the District should plan for the need to replace these fans towards the end of the planning period (before 2041).

BUILDING, LABORATORY, AND SECURITY

The WWTF was constructed within the past decade and its buildings appear to be in good condition. These buildings provide adequate noise control for the equipment running inside. Given the topography and landscaping of the site, which provide cover from nearby traffic and residents, the existing security measures are also satisfactory.

Across the site, heaters have been provided to keep equipment from freezing. In addition, the plant heating pumps (covered in Chapter 8) help provide heat to the buildings. Where cooling is necessary, temperature control is facilitated by either ventilation systems or the ductless hydronic loop system. For example, the blower room is serviced by a ventilation system. Various electrical rooms are serviced by the ductless cooling system to sufficiently cool the motor control centers. The ductless cooling system, or the plant hydronic loop system, uses non-potable water (pumped from the industrial water pumps) and a heat exchanger to the water sent to cool the electrical rooms.

Table 7-37 summarizes equipment data for the plant hydronic loop system.

TABLE 7-37

Plant Hydronic Loop System Equipment Data

Parameter	Equipment Data
Industrial Water Pump	
Quantity	2
Type	Vertical Centrifugal
Capacity	150 gpm @ 26 ft
Motor Size	2 hp
Heat Exchanger	
Quantity	1
Type	Flat-Plate
Capacity	1,080 MBH
Cooling Water Pumps	
Quantity	2
Type	Vertical Centrifugal
Capacity	200 gpm @ 70 ft
Motor Size	7.5 hp

Most laboratory analyses are performed on site. The treatment plant's lab is state-certified for general chemistry and microbiology, including BOD, CBOD, TSS, turbidity, pH, ammonia, nitrite, orthophosphate, total phosphorus, fecal coliforms, as well as total, fixed, and volatile solids. Other analyses are sent to offsite laboratories; these analyses include metals, priority pollutant volatiles and semi-volatile organic compounds and the required biosolids tests.

Building, Laboratory, and Security Condition

As noted above, there are no notable issues with these systems. However, it is noted that the pumps for the hydronic loop system (industrial water and cooling water) can be expected to function for about 30 years with normal maintenance. By the end of the planning period (2041), these pumps may need to be replaced.

DISCUSSION OF ANTICIPATED EQUIPMENT REPLACEMENT COSTS

In the evaluation of condition of the mainstream treatment and facility support systems, several equipment items are expected to reach the end of their service lives within the planning period. Given that most major equipment at the WWTF have typical service lives of between 15 and 30 years, while the WWTF has been in operation for nearly 10 years, the WWTF will enter a period of potential high frequency of equipment overhaul and replacement. Therefore, based on the assessments in the above sections and in condition assessments in Chapter 8, planning level estimates of equipment replacement costs are provided in Table 7-38 to help the District prepare for anticipated increases in facility O&M costs. These equipment replacement costs would add to existing O&M costs.

TABLE 7-38

Anticipated Major Equipment Replacement Costs

Years	Anticipated Major Replacement Items	Estimated Cost
2021-2026	• Flash mixer gearbox • Aeration basin fine bubble diffuser membranes • Anaerobic digester clean and inspection	$450,000 ($90,000/year)
2027-2031	• Sodium hypochlorite (NPW) metering pumps • Primary sludge pumps • Gravity thickener mechanisms • Thickening centrifuge • Digester draft tube mixers • Boiler tubes • Dewatering centrifuge	$1,330,000 ($266,000/year)
2032-2036	• Influent band screens and washer/compactors • Headworks compressor • Primary clarifier mechanisms • Primary effluent band screens and washer/compactors • Deoxygenation zone jet mixer • Flash mixer • Anoxic zone jet mixer • Aeration basin fine bubble diffuser membranes • Centrate pumps • Odor system drain MH pump • Grit declassifiers • Anaerobic digester clean and inspection	$2,832,000 ($566,300/year)

TABLE 7-38 – (continued)

Anticipated Major Equipment Replacement Costs

Years	Anticipated Major Replacement Items	Estimated Cost
2037-2041	• Process blowers • Plant compressors and dryers • Non-potable water pumps • Biofilter fans • Industrial water pumps • Cooling water pumps • Boilers • Digester heat exchangers • Waste gas burner	$3,102,000 ($620,400/year)

WATER REUSE ANALYSIS

An evaluation of water reuse is presented in Appendix L. As described in the appendix, the District does not have the usual drivers for water reuse such as a need for water rights, nearby golf courses or agriculture that required additional irrigation, industrial demand for reclaimed water, etc. The evaluation does note that there are several parks and schools that might benefit from summer irrigation; however, they are spread around the District, requiring an expensive distribution network with demand for only about 0.25 mgd of reclaimed water in the summer only. The combined total project cost of a reclaimed water pump station, distribution system, irrigation systems, and WWTF improvements is approximately $40 to $50 million. The majority (over 80 percent) of the cost is in the distribution system, so if a high demand user closer to the WWTF could be identified, water reuse could be closer to feasible. Based on the analysis, given the high costs and limited demand, a reclaimed water project is not recommended at this time.

RECOMMENDED IMPROVEMENTS

This section develops improvements to address the deficiencies identified in this chapter. Recommended improvements are presented at a preliminary planning level, including preliminary layout, sizing, and general design criteria. The following sections provide the recommended improvements with planning-level cost estimates to create an improvement plan for the WWTF with exception to biosolids management, which is provided in Chapter 8.

The following recommended improvements are organized in relative order of need based on projected flows and loads to the WWTF.

6-YEAR INTERVAL IMPROVEMENT PROJECTS

Current Minor Improvements

Discussions with treatment plant staff and site visits identified several minor, non-routine repair and replacement/improvement projects that should be completed in the near term. For all of these improvements, the projects are small in scope and can be incorporated into a larger project or independently addressed by the District. Each of these projects are described in the condition assessments of this chapter and are listed below.

Table 7-39 provides a list of current minor improvements.

TABLE 7-39

Current Minor Improvements List

Area	Project Description
Aeration Basins	Raise anoxic zone walls with small (4" x 1") stainless steel angles
	Estimated Cost: $6,000
Equipment Building	Replace corroded membrane backpulse water pipe sections
	Estimated Cost: $50,000
Blower Room	Install stand-alone cooling units for each process blower enclosure
	Estimated Cost: $25,000

Alkalinity Addition Improvements

WWTF staff are pilot testing alternatives to sodium hydroxide for alkalinity addition. As discussed in this chapter, the alternatives would consist of magnesium hydroxide-based or calcium carbonate-based slurries in addition to continuing with sodium hydroxide. Because the District has not yet concluded its studies on both alternatives, the improvements described here assume that magnesium hydroxide will be utilized, and consist of modifying one of the existing sodium hydroxide tanks so that it could utilize magnesium hydroxide. This includes the installation of mechanical mixing in one of the existing storage tanks and the installation of a new metering pump that is capable of pumping the slurry. Due to the size of the existing sodium hydroxide tank, a top-down mixer would require a support frame. The existing radar level sensor may be used to monitor the magnesium hydroxide tank. Notably, through discussions with the magnesium hydroxide solution supplier used in the pilot study, it is only advisable to have a single metering pump installed; the additional piping for redundantly installed pumps create opportunities for the slurry to clog the pipes. Therefore, it is recommended that an uninstalled spare pump is provided instead.

Due to the clogging and scaling issues, significantly more frequent maintenance of conveyance lines is anticipated for either the magnesium hydroxide-based or calcium carbonate-based slurries. However, the use of these slurries may improve floc structure and filterability and reduce the safety risks associated with sodium hydroxide.

As previously discussed, this set of improvements can include an additional dose point for alkalinity to the final effluent. However, this would consist of a separate alkalinity dosing system due to the potential clogging issues described above. Also, modifications to pH monitoring will be necessary. Because the existing alkalinity addition system relies on the final effluent pH to control alkalinity into the mixed liquor, an additional measuring point for pH will be necessary to decouple mixed liquor pH from final effluent pH. The additional pH probe and transmitter can be positioned in the UV disinfection area and would make measurements prior to the additional alkalinity dose point; this probe would serve the control of alkalinity addition to the mixed liquor. The existing pH probe could then be used as a reference point for control of alkalinity addition to the final effluent.

Because usage of this system should be infrequent, the recommended alkalinity source is sodium hydroxide (liquid caustic) for ease of operation and the lack of mixing requirements for storage. A 275-gallon tote of sodium hydroxide may be purchased and housed within the UV disinfection area, where a metering pump would deliver alkalinity upstream of the UV channel. This dose point would provide mixing through the UV system prior to the final effluent pH probe. Implementation of a final effluent alkalinity addition system is recommended after at least one full year of use of the new mixed liquor alkalinity addition system and new supplemental carbon addition system (discussed in the following section). Although formation of nuisance precipitates will increase, control of pH with alkalinity sourced from magnesium hydroxide and calcium carbonate is known to be easier than control with caustic, as the former (divalent) alkalinity sources result in more stable in pH. With this benefit from the new mixed liquor alkalinity system, the WWTF staff may have less need for a final effluent alkalinity control system. In addition, the supplemental carbon addition system should reduce the overall alkalinity consumption. Both of the new chemical addition systems affect the pH and alkalinity upstream of a potential final effluent alkalinity addition system such that pH control for the final effluent may not be necessary.

Table 7-40 and 7-41 summarize design criteria for the alkalinity systems.

TABLE 7-40

Mixed Liquor Alkalinity Addition System Design Criteria

Parameter	Equipment Data
Magnesium Hydroxide Storage Tanks	
Quantity	1
Volume	16,500 gallons
Magnesium Hydroxide Tank Mixing	
Quantity	1
Type	Vertical Shaft Mixer
Power	7.5 hp, 460 V, 3-phase
No. of Impellers	2
Impeller Size/Diameter, ea.	60 inches
Magnesium Hydroxide Metering Pumps	
Quantity(1)	1
Type	Peristaltic
Capacity, each (gallons per hour)	0.001 gph – 31.7 gph
Max Operating Pressure	100 psi
Solution Concentration	60% $Mg(OH)_2$
System Capacity (Alkalinity as $CaCO_3$)	7,100 ppd

(1) WWTF to have one uninstalled standby pump for reliability.

TABLE 7-41

Final Effluent Alkalinity Addition System Design Criteria

Parameter	Equipment Data
Sodium Hydroxide Storage	
Quantity	1
Tote Size	275 gallons
Magnesium Hydroxide Metering Pumps	
Quantity(1)	1
Type	Peristaltic
Capacity, each	0.001 gph – 31.7 gph
Max Operating Pressure	100 psi
Solution Concentration	50% NaOH
System Capacity (Alkalinity as $CaCO_3$)(1)	2,200 lb

(1) Consumption rate is dependent on situation; capacity represents total alkalinity stored in the tote.

TABLE 7-42

Alkalinity Addition Systems - Capital Cost Estimate

Improvement Project	Estimated Cost
Mixed Liquor Alkalinity Addition System(1)	$130,300
Final Alkalinity Addition System	$79,600

(1) Includes structural modification costs needed to accommodate supplemental carbon addition system.

Supplemental Carbon Addition Improvements

Based on process modeling, external carbon will be necessary to meet the annual TIN limits and exceedance actions proposed in the PSNGP. A supplemental carbon addition system would be comprised of storage and peristaltic metering pumps with small diameter feed piping. The initial assumption is that the external carbon source would be MicroC-2000, but the carbon addition system would also be capable of utilizing other external carbon sources, such as locally-sourced glycerin or acetate. The external carbon source would be injected into the primary clarifier effluent channel upstream of the anoxic zones, ensuring that it is thoroughly mixed into the mixed liquor return stream prior to entering the anoxic zones. The calibrated GPS-X model was used to develop preliminary sizing of this system and estimate the external carbon required to reliably meet the effluent permit limits at the projected year 2027 flows and loads, approximating conditions near the end of the proposed permit cycle.

If a glycerin-based MicroC-2000 (1,100,000 mg-COD/L) carbon source were used, a storage volume of about 1,500 gallons would be required to fulfill the supplemental carbon demand within the first cycle of the PSNGP. This storage would provide over a 30-day supply at the maximum month demand with a 1.35 safety factor. A fairly conservative approach to the sizing for supplemental carbon was used because denitrification rates vary between different sources of carbon. One of the existing 16,500-gallon sodium hydroxide storage tanks could be repurposed for carbon source storage. Given the size of the projected chemical demand and the available storage at the WWTF, a storage volume of between 3,500 and 3,600 gallons is recommended because it would be more economical to receive deliveries of that size. Furthermore, this volume provides a 30-day supply sufficient for the projected external carbon demand at the end of the planning period.

To deliver external carbon from this location, a new set of metering pumps will be installed near the existing sodium hydroxide metering pumps. Design criteria as well as a cost estimate for this improvement are provided below in Tables 7-43 and 7-44, respectively.

TABLE 7-43

Supplemental Carbon Addition System Design Criteria

Parameter	Equipment Data
Storage Tank	
Quantity	1
Minimum Required Volume(1)	3,600 gallons
Available Volume	16,500 gallons
MicroC Metering Pumps	
Quantity	2
Type	Peristaltic
Capacity, each	0.001 gph – 31.7 gph
Max Operating Pressure	100 psi
Carbon Source	MicroC-2000
System Capacity (as COD)(1)	1,320 ppd

(1) Minimum required volume and system capacity represent 30-day supply for projected 2041 maximum month consumption.

TABLE 7-44

Supplement Carbon Addition System Capital Cost Estimate

Improvement Project	Estimated Cost
Supplemental Carbon Addition System	$231,100

Membrane Replacement and System Improvement

The membranes in the MBR modules are due for replacement as they have been in operation for nearly 10 years. Since the installation of these membranes, the membrane system manufacturer has developed membranes with higher module surface areas (430 ft^2/module) than the original membrane surface areas (340 ft^2/module). Additionally, the newer membranes have higher rated peak flux capacities. The existing membranes are designed for a flux rate of 18 gpd/ft that could be sustained for 12 hours. The new membranes can sustain a flux rate of 23 gpd/ft for 12 hours. As discussed earlier in this chapter, projected flows in the planning period exceed the peak flux capacity of the existing membrane system, which would result in full utilization of the existing equalization storage volume. Due to the higher membrane area in conjunction with higher potential flux rates, if the existing membrane modules are replaced with the latest modules the membranes would no longer be the limiting factor in the capacity of the membrane basins. As a result, projected flows would not require use of the existing equalization volume provided the system has the requisite permeate pumping capacity.

To accommodate the greater flow capacity provided by the additional membrane area, the permeate pump capacity should be increased. This will require replacing the existing pump impellers with larger diameter impellers, but should not require any other changes to the existing permeate pumps. The increased membrane area and replacing the permeate pump impellers would provide the required capacity for the projected peak hour flow through buildout. Consequently, the membrane system would no longer require the use of any of any of the existing equalization storage volume to treat the projected buildout peak flows.

The membrane replacement project would consist of replacing the membrane modules in the existing cassettes. Due to the higher module surface area, it is only necessary to install 42 modules per cassette instead of the existing 48 modules per cassette. These new membranes can directly replace those that are currently installed. The replacement project would also involve refurbishment of the existing membrane cassettes. This would require the manufacturer's service technicians to replace any worn plastic parts and update the hardware. In addition, the impellers on the permeate pumps would be replaced with new larger diameter impellers that will increase the capacity of each permeate pump from 1,530 gpm to 1,664 gpm, and this work could be completed by District staff. Design criteria as well as a cost estimate for these improvements are shown below in Tables 7-45 and 7-46, respectively.

TABLE 7-45

Membrane System Equipment Data and Design Criteria

Parameter	Equipment Data
Membranes	
Quantity of Membrane Tanks	6
Quantity of Cassettes per Tank	6
Total Quantity of Cassettes	36
Membrane Pore Size	0.04 μm
Membrane Surface Area per Cassette	18,060 ft^2
Membrane Surface Area per Module	430 ft^2
Total Membrane Surface Area	650,160 ft^2
Permeate Pumps	
Quantity	6
Type	Self-priming centrifugal
Capacity, each(1)	1,664 gpm @ 32.5 ft
Motor, each	20 hp

(1) Existing 10-5/8" dia. impellers would be replaced with 11-1/8" dia. impellers.

TABLE 7-46

Membrane Replacement and System Improvement Cost Estimate

Improvement Project	Estimated Cost
Membrane Replacement and System Improvement Project	$3,411,000

Static Fermenter-Thickener Trial

Primary sludge thickening is discussed and evaluated in Chapter 8. However, the existing gravity thickener also provides the opportunity to generate additional readily biodegradable carbon from the WWTF influent through an on-site fermentation process that could decrease the cost of external carbon addition. Specifically, static primary sludge can undergo fermentation to yield readily biodegradable carbon in the form of volatile fatty acids (VFAs). This may be achieved by converting the existing gravity thickener into a fermenter - thickener, which would involve increasing the SRT of the thickener to between 3 and 5 days by increasing the sludge blanket depth and decreasing the sludge flow out of the thickener.

The following results are key considerations for conducting a trial of the existing gravity thickener as a fermenter-thickener in comparison to only using external carbon to promote denitrification:

- A typical fermenter-thickener provides about 0.1 g VFA/g VSS applied while about 20 percent to 50 percent of VFAs produced are returned to the mainstream. Depending on these performance parameters and the composition of VFAs produced, the fermenter-thickener could reduce supplemental carbon demand by up to 25 percent.

- The fermenter-thickener would require alkalinity control not only to prevent inhibition of fermentation, which occurs when pH falls below 4, but also to ensure that anaerobic digester feed sludge has adequate alkalinity. With the low alkalinity in WWTF influent, this alkalinity requirement might diminish chemical cost savings.

- Fermentation may have downstream effects such as increased loads through WAS, digester feed sludge, and digested sludge.

It is recommended that the District trial the production of VFAs in the existing gravity thickener because of the potential savings in chemical costs. Data collected from the trial would allow an accurate lifecycle cost analysis that would demonstrate whether the savings in external carbon consumption would exceed the cost of alkalinity control, as well as demonstrate ancillary operational benefits and drawbacks. For the trial study, provisions for a temporary alkalinity control system are paramount. Because the plant influent is low in alkalinity, primary sludge will not have enough alkalinity to buffer the pH during the production of VFAs. As noted above, decreases in pH would have deleterious effects on the fermentation process itself as well as the anaerobic digestion process downstream. In addition, the trial must include additional monitoring of sludge blanket levels as well as testing of baseline and trial rbCOD in the overflow of the fermenter-thickener. The existing gravity thickener is presently covered and is served by an 8-inch odor control duct, which should suffice for the trial study. Lastly, an ideal trial period would occur during the wet weather season. Lower temperatures will allow for more flexibility with longer SRTs to induce fermentation. Lower temperatures would also mitigate the risk of accidental alkalinity depletion or production of methane gas. Estimated costs associated with a 3-month trial, including estimated chemical and additional labor costs, are provided below in Table 7-47.

TABLE 7-47

Static Fermenter-Thickener Trial Study Cost Estimate

Improvement Project	Estimated Cost
3-Month Fermenter-Thickener Trial Study	$110,000

10-YEAR INTERVAL IMPROVEMENT PROJECTS

UV Disinfection System Improvements

The peak day flows projected beyond 2027 exceed the design capacity of the UV disinfection system. The projected exceedance coincides with the end of the system's useful life. While it is possible to extend the life of the existing system with replacement of key electrical components (i.e., power distribution center and system controls) of the system, the system would still carry the risk of failure due to the age of the electrical components throughout the system and would, therefore, have diminished reliability. It is instead recommended that the District plan for the system to be replaced between 2027 and 2031.

A replacement UV system would consist of two duty modules and one standby module, in addition to a new power distribution center (PDC). For ease of construction, it is assumed that the second UV channel is equipped with the new system to prevent any lapse in disinfection (or need for a temporary disinfection system) during construction. Furthermore, this configuration would provide the District with future flexibility to expand capacity through rehabilitation or upgrade of the UV system in the existing channel. If the existing spare channel is equipped, a temporary bulkhead in the existing influent channel is also recommended to divert flow directly into the south channel and eliminate the quiescent portion of this channel that would be created by using the south channel exclusively for disinfection.

Based on historical transmittance data and a design dose of 30 mJ/cm^2, the UV system manufacturer Ozonia determined that the new UV system would have a design capacity to meet the projected peak day flow (8.36 mgd) at the end of the planning period. To meet peak flows through buildout, a fourth module is recommended such that there are three duty modules and one standby module. The design criteria and associated cost of this system is provided in Tables 7-48 and 7-49.

TABLE 7-48

UV Disinfection System Design Criteria

Parameter	Equipment Data
UV Disinfection System	
Design Peak Day Flow	8.36 mgd
Design Peak Hour flow	12.28 mgd
Minimum Flow	1.0 mgd
TSS	<5 mg/L
Disinfection Standard, 30-Day Mean	200 mpn/100mL
UV Transmittance @ 253.7 nm	65%
UV Lamp Type	Low Pressure-Medium Intensity
Orientation	Vertical
Minimum UV Dose @ Peak Day Flow	30 mJ/cm^2
Number of Equipped Channels	1
Channel Length	44 ft
Channel Width	28 in.
Channel Depth	84 in.
Quantity of Modules per Channel	3
Quantity of Lamps per Module	36
Total Quantity of Lamps	108
Level Control	Counter-balanced flap gate

TABLE 7-49

UV Disinfection System Improvement Cost Estimate

Improvement Project	Estimated Cost
UV Disinfection System Improvement	$986,000

Notably, it is discussed in this chapter that the design dose may be reassessed for this project because it is understood that the membrane basins are removing a nearly all fecal coliform counts prior to disinfection. For the design of the new system, an assessment of the design dose might include testing of the existing UV influent samples. Specifically, collimated beam tests are bench-scale tests that use range of UV doses to determine the dose necessary to meet specified target microorganism levels. During the design of the new system, having third-party labs conduct a set of collimated beam tests would provide the contextual data necessary to reevaluate the current design dose of 30 mJ/cm^2, which might result in a smaller UV system design or demonstrate that the system proposed above has greater treatment capacity. In addition, collimated beam tests could be conducted to specifically account for E. coli as the new bacterial indicator to provide additional confidence behind a revision of the UV system design criteria.

20-YEAR INTERVAL AND BUILDOUT IMPROVEMENT PROJECTS

For projected flows between 2031 and 2041, the mainstream treatment process is expected to have adequate capacity provided that the above improvements are implemented. Through buildout, the District will have to address reliability of the influent screening system.

Influent Screen Reliability Improvement

The existing two influent band screens each have a capacity of 11.53 mgd. By buildout, projected peak hour flow exceeds the capacity of a single influent screen. Therefore, the influent screening system will require two duty screens and one standby screen to meet the reliability requirements for buildout flows. The headworks area includes a third channel to host an additional influent band screen. Installing a third screen into this channel would fulfill reliability requirements. To provide redundancy for the influent screening system, a third screenings washer-compactor unit should be installed to process the screenings from the third influent screen.

To accomplish this, a third influent band screen, equal in capacity to the existing screens, would be installed in the existing empty channel. The screenings transport flume from the new influent screen would need to be angled away from the stem of the slide gate at the channel outlet. The flume would enter the Headworks Building, where a new screenings water compactor would be installed. The unit would require the existing platform to be extended to create space between the existing washer compactor and grit classifier; currently, there is an opening in the platform surrounded by guard railing. Non-potable water and drain piping in this area would need to be installed to support the new washer compactor unit. The design criteria and associated cost estimate for this system are provided below in Tables 7-50 and 7-51, respectively.

TABLE 7-50

Influent Screening System Design Criteria

Parameter	Equipment Data
Influent Band Screens	
Quantity	3
Type	Mechanically cleaned band screen
Channel Width	36"
Band Screen Panel Perforation Size	6 mm
Capacity, ea.	11.54 mgd
Screen Drive Motor Size	2 hp
Screenings Washer/Compactor	
Quantity	3
Capacity (wet screenings)	150 ft^3/hr
Drive Size	3 hp

TABLE 7-51

Influent Screening System Cost Estimate

Improvement Project	Estimated Cost
Influent Screenings System Improvement	$996,000

OVERVIEW OF IMPROVEMENT PROJECTS

Recommended improvements to the WWTF, excluding the biosolids management and treatment processes that are covered in Chapter 8, are organized in the proposed mainstream improvements layout in Figure 7-23.

AREA IDENTIFICATION

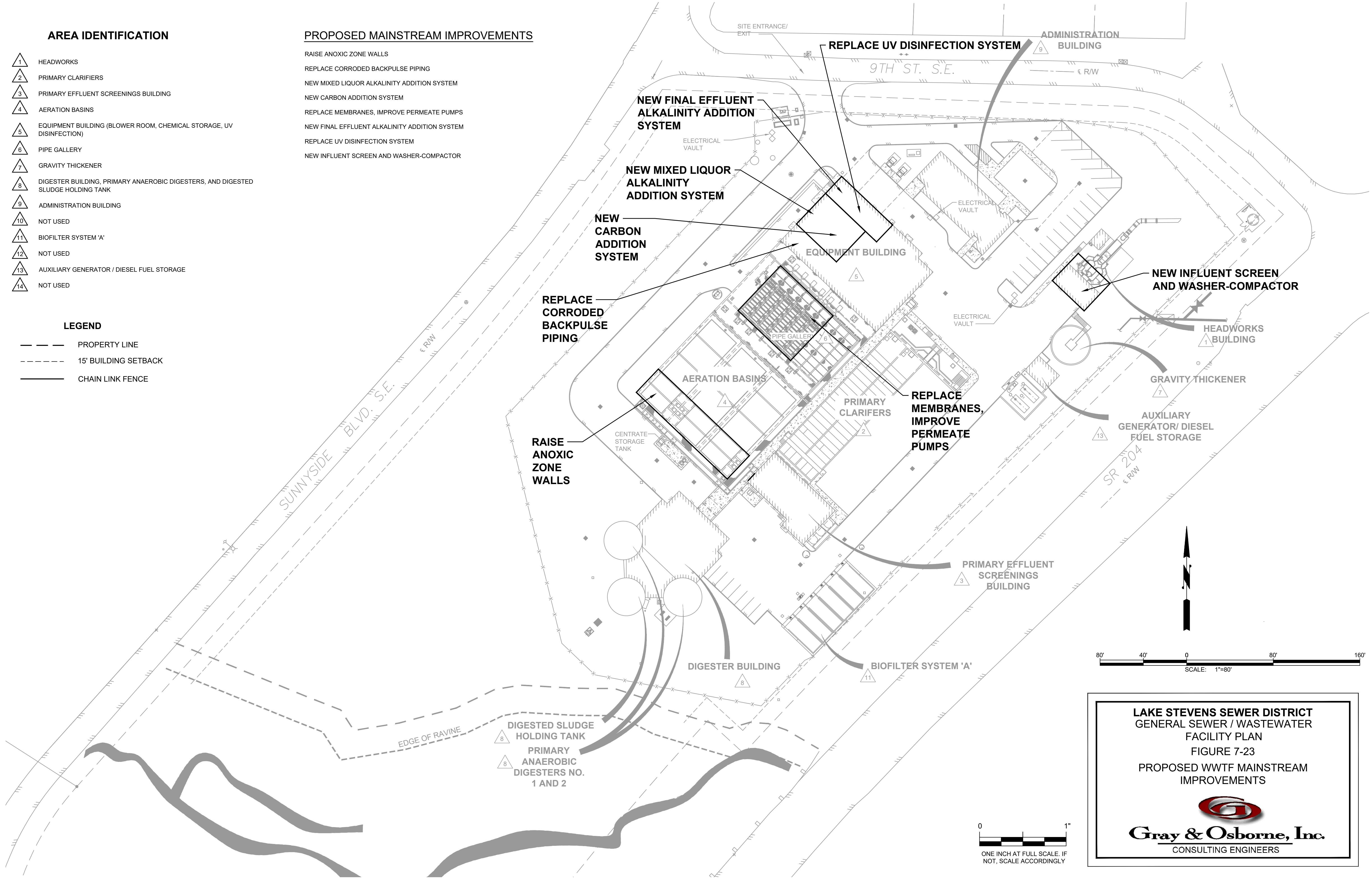
1. HEADWORKS
2. PRIMARY CLARIFIERS
3. PRIMARY EFFLUENT SCREENINGS BUILDING
4. AERATION BASINS
5. EQUIPMENT BUILDING (BLOWER ROOM, CHEMICAL STORAGE, UV DISINFECTION)
6. PIPE GALLERY
7. GRAVITY THICKENER
8. DIGESTER BUILDING, PRIMARY ANAEROBIC DIGESTERS, AND DIGESTED SLUDGE HOLDING TANK
9. ADMINISTRATION BUILDING
10. NOT USED
11. BIOFILTER SYSTEM 'A'
12. NOT USED
13. AUXILIARY GENERATOR / DIESEL FUEL STORAGE
14. NOT USED

LEGEND

— — —	PROPERTY LINE
– – – – – –	15' BUILDING SETBACK
———	CHAIN LINK FENCE

PROPOSED MAINSTREAM IMPROVEMENTS

- RAISE ANOXIC ZONE WALLS
- REPLACE CORRODED BACKPULSE PIPING
- NEW MIXED LIQUOR ALKALINITY ADDITION SYSTEM
- NEW CARBON ADDITION SYSTEM
- REPLACE MEMBRANES, IMPROVE PERMEATE PUMPS
- NEW FINAL EFFLUENT ALKALINITY ADDITION SYSTEM
- REPLACE UV DISINFECTION SYSTEM
- NEW INFLUENT SCREEN AND WASHER-COMPACTOR



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER / WASTEWATER FACILITY PLAN
FIGURE 7-23
PROPOSED WWTF MAINSTREAM IMPROVEMENTS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CHAPTER 8

BIOSOLIDS TREATMENT AND MANAGEMENT

INTRODUCTION

This chapter provides an evaluation of the District's existing WWTF biosolids treatment and management and provides recommendations to ensure reliable service through the 6-year, 10-year, and 20-year planning periods as well as through buildout. The chapter includes:

- Assessment of existing capacity against projections of future solids production.
- Assessment of the condition of the existing District treatment facilities for biosolids, scum, and screenings.
- Evaluation of their existing performance, condition, and reliability based on current solids production.
- Evaluation of alternatives for, and development of recommendations for, future biosolids treatment and management.

The processes that are evaluated include the following systems:

- Primary Sludge Pumping and Grit Removal
- Primary Sludge Thickening and Thickened Sludge Pumping
- Primary Scum Removal and Pumping
- Waste Activated Sludge Pumping
- Waste Activated Sludge Thickening and Thickened Sludge Pumping
- Anaerobic Digestion and Gas Handling
- Polymer Systems
- Biosolids Dewatering
- Dewatered Biosolids Conveyance and Sludge Haul Truck Loading

Discussion of the improvements and facility modifications needed to provide the necessary treatment capacity, improve performance or operational efficiency, and extend service life are provided at the end of this chapter. Note, Chapter 7 includes a discussion of anticipated increases in facility O&M costs due to expected needs for equipment replacement across the facility, including equipment for biosolids treatment and management. Thus, these costs are not further discussed in this chapter.

SOLIDS TREATMENT CAPACITY EVALUATION

Projected solids production is based on the results from the GPS-X modeling, as detailed in Chapter 7. Operation of the mainstream processes are described in Chapter 7, as well as in the memorandum detailing model calibration provided in Appendix J. In the following sections, solids treatment and management processes are evaluated against projected sludge quantities to determine which processes will require improvements within the planning period and through buildout. Modeling scenarios included the maximum month, average annual, and average dry weather conditions presented in Chapter 7. The maximum projected sludge production from each of these scenarios are presented in this capacity evaluation.

As discussed in Chapter 7, it is recommended that the WWTF install an external carbon addition system. The carbon addition system would increase sludge produced in the activated sludge system and, therefore, sludge loads to the biosolids treatment and management system. Projected sludge production with external carbon addition was also estimated using GPS-X at the year 2027 and 2041 projected flows and loads. The 2027 condition was necessary to determine sludge production during the first permit cycle of the Puget Sound Nutrient General Permit (PSNGP), when external carbon addition will be necessary to meet the requirements detailed in the PSNGP. As noted in Chapter 7, it is unlikely that external carbon addition will be the only improvement necessary to meet the requirements of the PSNGP beyond the first permit cycle. Because these requirements are not yet known, sludge production in 2041 with external carbon addition is provided in this chapter as the basis for increased sludge production driven by the improvements needed to meet the nitrogen load limits in the PSNGP. The maximum projected sludge loads and flows produced from the mainstream are presented in Table 8-1 below.

TABLE 8-1

Projected Maximum Primary Sludge and Waste Activated Sludge

Year/Condition	Primary Sludge Load, lb/day	Primary Sludge Flow, gpm	WAS Load, lb/day	WAS Flow, gpd
2027	3,760	440	2,710	55,990
2031	3,940	440	2,960	61,890
2036	4,180	440	3,300	70,350
2041	4,410	440	3,690	79,480
Buildout	4,740	440	4,280	93,750
With External Carbon Addition				
2027	3,760	440	2,760	57,650
2041	4,410	440	3,810	83,900

PRIMARY SLUDGE PUMPING AND THICKENING CAPACITY

Grit removal at this facility is accomplished by pumping a dilute slurry of primary sludge through two hydrocyclones that separate the grit from the primary sludge. The grit drops into the grit classifier where it is settled and dewatered before being conveyed to a dumpster for transport and disposal at a landfill. The overflow from the hydrocyclones flows by gravity to the gravity thickener where the primary solids are thickened prior to being pumped to the anaerobic digesters. In order to function optimally, each hydrocyclone requires a consistent primary sludge flow rate of 220 gpm. There is one primary clarifier and one primary sludge pump dedicated to each hydrocyclone and the primary sludge pumps are controlled to maintain a constant flow rate of 220 gpm to the associated hydrocyclone. Since the primary sludge flow is dictated by the operating requirements of the hydrocyclones, the hydraulic capacity of these systems is expected to remain the same throughout the planning period.

The existing gravity thickener has a design solid loading rate of 10.1 lb/ft^2/day. At the projected influent flows and loads the solids load to the gravity thickener will not reach this solids loading rate within the planning period or at buildout. Furthermore, the design solids loading rate of 10.1 lb/ft^2/day is well below typical design values of between 20 and 30 lb/ft^2/day based on the WEF Design of Wastewater Treatment Plants, Manual of Practice No. 8 (2010) and Wastewater Engineering (Metcalf and Eddy, 2014). At the WWTF, the solids loading rate is below typical values because the primary sludge flow to gravity thickener is very dilute; thus, the hydraulic loading rate is the governing design criteria. With both hydrocyclones in operation the flow rate to the gravity thickener is about 410 gpm, which corresponds to an overflow rate of 615 gpd/ft^2. This is within the range of overflow rates of 380 to 760 gpd/ft^2 recommended in Wastewater Engineering (Metcalf and Eddy, 2014). Given both the solids loading rate and overflow rates are projected to remain within recommended criteria, the existing gravity thickener is expected to continue to perform well through buildout. Notably, external carbon addition does not directly affect primary sludge production.

Table 8-2 summarizes the projected gravity thickener primary sludge loads.

TABLE 8-2

Projected Gravity Thickener Primary Sludge Loads

Year/Condition	Maximum Month Solids Load, lb/day	Maximum Month Solids Loading Rate, lb/ft^2/day
2027	3,760	3.9
2031	3,940	4.1
2036	4,180	4.3
2041	4,410	4.6
Buildout	4,740	4.9

As discussed in Chapter 7, the demand for readily biodegradable carbon in the mainstream treatment process provides the opportunity to convert the existing gravity thickener into a fermenter/thickener system. These systems also have design loading rates between 20 to 30 lb/ft^2/day, but are designed to provide solids retention times (SRTs) of at least 5 days to promote production of volatility fatty acids (VFAs). The existing gravity thickener has most of the equipment necessary to be operated as a fermenter/thickener. Modifications to operation would include higher attention to the sludge blanket level to provide accurate representations of SRTs. This would involve installation of a sludge interface analyzer to allow continuous monitoring of the blanket depth and sludge densities. Based on this information the solids inventory within the thickener can be calculated and tracked. The primary sludge flow rate can then be modulated to maintain the desired SRT in the gravity thickener/fermenter. A trial for modifying the operation for the existing gravity thickener is further discussed in Chapter 7, but it is noted here given the additional context of projected loading rates to the existing gravity thickener.

WASTE ACTIVATED PUMPING AND THICKENING CAPACITY

Projected waste activated sludge (WAS) flows are dependent on projected flows and loads in addition to assumptions for secondary treatment operation, which are detailed in Chapter 7. Based on the projected flows and loads to the secondary treatment process, the existing WAS pumps have sufficient capacity.

The existing thickening centrifuge was evaluated at the projected WAS flows. The hydraulic capacity of 250 gpm and solids loading capacity of 1,000 lb/hr were used to determine the requisite runtimes for maximum WAS sludge production. Notably, this system was originally designed to allow daily WAS loads to be thickened within 7.8 hours for 5 days each week and alternatively 7.2 hours for 7 days each week; these schedules, which are detailed in the design criteria, limit operation to one 8-hour shift.

As shown in Table 8-3, projected WAS flow in 2041 will require a runtime of 7.4 hours. For WAS flows in 2041 and beyond, longer runtimes may require split shifts to complete or operate the thickening centrifuge 7 days per week.

TABLE 8-3

Projected Waste Activated Sludge and Thickening

Year/Condition	WAS Flow, gpd	WAS Solids Loads, lb/d	WAS Centrifuge Runtime(1)(2), hr
2027	55,990	2,710	5.2 (5 d/wk)
2031	61,890	2,960	5.8 (5 d/wk)
2036	70,350	3,300	6.6 (5 d/wk)
2041	79,480	3,690	7.4 (5d/wk)
Buildout	93,750	4,280	6.3 (7d/wk)
With External Carbon Addition			
2027	57,650	2,760	5.4 (5d/wk)
2041	83,900	3,810	5.6 (7d/wk)

(1) Centrifuge runtimes calculated from projected WAS flows with hydraulic capacity of 250 gpm because these values are larger than those calculated from solids loading capacity (1,000 lb/hr).

(2) Operating schedules were adjusted between 5 days per week (5d/wk) and 7 days per week (7d/wk) to limit runtimes within one 8-hour shift.

The modeling results predict that WAS sludge production with external carbon addition in 2027 and 2041 are greater than the sludge production without external carbon addition for the same years. The additional sludge produced with carbon addition in 2027 is still within the capacity of the existing thickening centrifuge, assuming the operation is limited to 8-hour per day. With carbon addition, the projected year 2041 WAS production will require runtimes that necessitate split shifts to complete or operation to increase to 7 days per week.

ANAEROBIC DIGESTER AND SLUDGE HOLDING TANK CAPACITY

The GPS-X model was used to determine the thickened sludge flows and loads to the anaerobic digestion system. Based on these projected sludge loads, the existing anaerobic digestion system will have sufficient capacity to continue to produce Class B biosolids through buildout. The existing system has a design organic loading rate of 0.153 lb-VS/ft^3/day; the maximum organic solids loading rate at buildout is projected to be 0.157 lb-VS/ft^3/day for loading to the lead digester. While this loading rate is greater than the original design capacity, mesophilic anaerobic digesters typically can be loaded up to about 0.2 lb-VS/ft^3/day. Given this, the existing digesters are expected to be sufficient for the projected organic solids loading rate. In addition, the digestion system will have the volume to provide the minimum retention time of 15 days, as required for Class B biosolids, as well as the design retention time of 20 days. Through buildout, the minimum retention time projected for sludge loads to the lead digester is 21.3 days. Thus, the combined retention times provided by both digesters have ample capacity for buildout sludge flows. The maximum sludge flows and loads to the anaerobic digestion system as well as the resultant parameter values above are shown in Table 8-4.

TABLE 8-4

Projected Anaerobic Digestion System and Sludge Holding Tank Parameters

	Anaerobic Digester					Sludge Holding Tank
Year/Condition	**Influent Flow, gpd**	**Residence Time[(1)], d**	**Total Solids Load, lb/d**	**Volatile Solids Load, lb/d**	**Organic Loading Rate[(1)], $lb/ft^3/d$**	**Residence Time, d**
2027	9,930	29.4	5,210	4,330	0.111	15.1
2031	10,580	27.6	5,580	4,620	0.119	14.2
2036	11,450	25.5	6,080	5,030	0.129	13.1
2041	12,360	23.6	6,610	5,460	0.140	12.2
Buildout	13,700	21.3	7,400	6,110	0.157	11.0
With External Carbon Addition						
2027	10,020	29.1	5,270	4,390	0.112	15.0
2041	12,580	23.2	6,770	5,620	0.144	12.0

(1) Residence time and organic loading rates calculated for flows and loads to the first (lead) digester.

The holding tank for anaerobically digested sludge was designed to allow WWTF staff flexibility with maintenance and runtimes of the dewatering system by providing additional storage volume for digested sludge. As shown in Table 8-4, the existing sludge holding tank is projected to be able to provide a minimum of 11 days of sludge storage, which should provide the District with enough flexibility in dewatering operations through buildout.

The increased WAS production with external carbon addition in the aeration basins will lead to higher loads to the anaerobic digesters. However, the additional sludge flows and loads are projected to still be within the capacity of the digestion system as well as the sludge holding tank.

SLUDGE DEWATERING CAPACITY

For solids loaded to the sludge dewatering system, the solid loads shown in Table 8-3 were used to develop projections of digested sludge loads with the equation shown below.

$$TS_{Dig} = \frac{(1 - VSR) * VSS_{Inf} + iTSS}{TSS/TS}$$

Where:

TS_{Dig} = Digested Sludge Total Solids Load, lb/d

TSS/TS = Total Suspended Solids fraction of Total Solids, assumed 0.83
VSR = Volatile Solids Reduction, assumed 45%
VSS_{Inf} = Influent Volatile Solids Load, lb/d

The calculations are necessary to provide a more conservative estimate of digester sludge loads than provided by the GPS-X model. As detailed in the memorandum regarding model calibration in Appendix J, the model predicts a higher than observed Volatile Solids Reduction (VSR). The calculation shown above uses a VSR of 45 percent, which is appropriate for the historically observed VSR of 48 percent at the WWTF; this assumed VSR is also appropriate because the anaerobic digestion system is projected to have ample capacity for organic loads. The projections resulting from the above calculation were used to assess the capacity of the dewatering centrifuge. Similar to the thickening centrifuge for WAS, the required capacity of the dewatering centrifuge is governed by the allowable runtime to stay within the desired number of operating hours. The dewatering centrifuge was originally designed for a maximum runtime of 6.2 hours per day, assuming centrifuge operation 5 days per week. The capacity of the dewatering centrifuge partially reflects the original design for this unit to be equal in capacity to the thickening centrifuge so that both centrifuges may serve as redundant units for one another, as described later in this chapter. At most, the projected digested sludge loads will require a runtime of 2.6 hours per day during maximum month loads at buildout. Therefore, the existing dewatering system is expected to satisfy future sludge loads through buildout. Projected flows, loads, and runtimes for the dewatering system are shown on Table 8-5.

TABLE 8-5

Projected Digested Sludge Parameters

Year/Condition	Digested Sludge Flow, gpd	Digested Sludge Solids Loads, lb/d	Dewatering Centrifuge Runtime(1)(2), hr
2027	9,930	3,930	1.8
2031	10,580	4,210	2.0
2036	11,450	4,600	2.1
2041	12,360	5,000	2.3
Buildout	13,700	5,600	2.6
With External Carbon Addition			
2027	10,020	3,970	2.2
2041	12,580	5,110	2.9

(1) Centrifuge runtimes calculated from projected digested sludge flows based on the centrifuge solids loading capacity of 2500 lb/hr, because these values are larger than those calculated based on the centrifuge hydraulic capacity (150 gpm).
(2) Runtimes assume that dewatering centrifuge is operated 5 days per week.

Similar to the above treatment processes, external carbon addition in the aeration basins will lead to increased sludge loads to the dewatering system. However, the additional loads will still result in digested sludge loads that are within the capacity of the existing dewatering system.

SUMMARY OF PROJECTED SOLIDS QUANTITY CAPACITY EVALUATION

Projections of sludge loads to the biosolids treatment and management system showed the design capacities that may be met or exceeded at the end of the planning period in 2041; specifically, the WAS thickening centrifuge will require a higher runtime than that noted in the original design and the anaerobic digesters will be loaded above their design organic solids loading rate. However, both of these unit processes are expected to have sufficient capacity through buildout. The thickening centrifuge may require split shifts to complete the WAS thickening for each day or increase to operation of the centrifuge to 7 days per week. Through this change in operation, the existing equipment has the capacity to accommodate future loads. The addition of external carbon in the mainstream treatment system will increase WAS production, accelerating the schedule at which split shifts will be needed for thickening centrifuge operation. For the anaerobic digesters, the existing digestion system can accommodate the higher organic solids loading rate (0.157 lb-VS/ft^3/day) because the digesters are expected to be capable of loading rates closer to 0.2 lb-VS/ft^3/day and the digesters will provide a retention time well above the time required to continue to produce Class B biosolids.

BIOSOLIDS TREATMENT AND MANAGEMENT SYSTEM DESCRIPTION AND CONDITION

PRIMARY SLUDGE PUMPING AND GRIT REMOVAL

Primary Sludge Pumping

Primary clarifiers remove a large portion of the suspended solids from the screened influent wastewater. The suspended solids that are removed by settling in the primary clarifiers are termed primary sludge. These settled solids are usually fairly coarse and fibrous, have densities greater than that of water, and are typically composed of 70 to 80 percent volatile (organic) matter. The remaining 20 to 30 percent of the primary sludge is classified as nonvolatile (inorganic) matter. The settled primary sludge is continuously transported to the inlet end of the primary clarifiers by the clarifier chains and flights and is then pumped to the grit removal system by primary sludge pumps located in the clarifier pump room. There are three primary sludge pumps, one dedicated to each primary clarifier, while the third pump is redundant. There are parallel 6-inch force mains, one dedicated to each of the two grit hydrocyclones. Each in-service primary clarifier/primary sludge pump combination is associated with one grit hydrocyclone. Because the hydrocylones require a flowrate of 220 gpm for optimal performance, the speed of each primary sludge pump is modulated to maintain the setpoint flow rate of 220 gpm to each hydrocyclone. If one of the hydrocyclones is out of service for maintenance and two clarifiers are still in operation, each control setpoint for each primary sludge pump would be reduced to 110 gpm, so that their combined flow is 220 gpm.

Equipment data for the primary sludge pumps is summarized in Table 8-6.

TABLE 8-6

Primary Sludge Pump Equipment Data

Parameter	Equipment Data
Quantity	3
Type	Recessed Submersible Impeller Centrifugal
Capacity per Pump @ TDH	220 gpm @ 35'
Motor	15 hp
Motor Speed	1,155 rpm, VFD

Primary Sludge Grit Removal System

Grit settles in the primary clarifiers and becomes part of the primary sludge. Grit is heavy mineral matter, including sand, eggshells, and cinders, found in wastewater that will not decompose in the wastewater treatment process. This material causes excessive wear in pumps and other process equipment, including the membranes. The mixture of grit, sand and grease can form a solid mass in pipes and digesters. For these reasons, grit is continuously removed from primary sludge by the hydrocyclones and grit classifiers.

The primary sludge is pumped as a dilute slurry through the hydrocyclone degritter. The cyclonic forces in the hydrocyclone separates the grit from the lighter organic solids and discharges it into the grit classifier where it is washed and dewatered prior to being discharged to a dumpster for disposal at a landfill. The degritted overflow from the hydrocyclone flows by gravity to the gravity thickener where the waste primary solids are thickened prior to being pumped to the anaerobic digesters and the classifier overflow drains to the plant drain pump. Degritted sludge flows by gravity to the gravity thickener.

Equipment data for the grit removal system is summarized in Table 8-7.

TABLE 8-7

Grit Removal System Equipment Data

Parameter	Equipment Data
Grit Cyclones	
Quantity	2
Size	10-inch diameter feed chamber
Capacity at Design Flow	220 gpm @ 5.0 psi
Cyclone Underflow	5 – 15 gpm
Grit Classifier	
Quantity	2
Screw Diameter	12"
Classifier Underflow	15 gpm
Motor	1 hp

Primary Sludge Pumping and Grit Removal Systems Condition

From site observations and discussions with WWTF staff, there are no notable issues with the conditions of the primary sludge pumping and grit removal systems. The primary sludge pumps can be expected to have a typical service life between 10 to 15 years. Given that these pumps have been in operation for nearly 10 years, these pumps should be planned for replacement within the first 10 years of the planning period, likely around 2027.

The grit removal system consists of the cyclones and the classifiers. While the cyclones should remain functional through the planning period, the classifiers have more wear components and are more likely to require replacement within the planning period. The classifiers are expected to require replacement at some point after the first ten years (2031) of the planning period.

PRIMARY SLUDGE THICKENING AND THICKENED SLUDGE PUMPING

Gravity Thickener

As noted above, degritted waste primary sludge flows by gravity to the gravity thickener. Here, waste primary solids settle to the bottom of the thickener and are then compacted by the weight of the overlying solids. Thickening these solids reduces the primary sludge volume pumped to the anaerobic digester, ultimately improving digester performance and reducing the digester volume required for treatment.

The gravity thickener is a center feed unit in which the primary sludge is conveyed via a 6-inch pipe into circular feed well located at the center of the tank. It then flows downward under the feed well towards the effluent weirs at the perimeter of the tank allowing the solids settle to the bottom. The thickener mechanism transports settled solids along the bottom of the tank towards the sludge hopper at the center of the tank. The scrapper arms are also equipped with pickets to help densify the sludge prior to pumping it to the anaerobic digesters. Overflow from the gravity thickener flows over the effluent weir and then by gravity back to the primary clarifier splitter box so that the thickener overflow can once again pass through the primary clarifiers to improve solids removal. There is also a flat aluminum cover on the gravity thickener and the head space is vented to the odor control system for treatment.

There is also a gravity thickener bypass line that allows overflow from the hydrocyclones to flow by gravity to the primary clarifier effluent trough, in the event that the gravity thickener needs to be taken out of service for maintenance. Operations staff have been using this bypass line periodically since the gravity thickener mechanism was damaged in 2016 to bypass a portion of the primary solids to the aeration basins.

Equipment data for the gravity thickener are summarized in Table 8-8.

TABLE 8-8

Gravity Thickener Equipment Data

Parameter	Equipment Data
Gravity Thickener	
Diameter	35'
Side Water Depth	12'
Design Overflow Rate	614 gpd/ft^2
Feed Solids	<1%
Thickened Solids	6%
Design Solids Loading Rate	10.1 lbs/ft^2/d
Drive Motor	0.5 hp

Thickened Primary Sludge Pumping

Thickened primary sludge is pumped from the gravity thickener to the anaerobic digesters by two (one duty and one standby) progressing cavity pumps located in the primary sludge pump room. Each pump has sufficient capacity to convey the projected buildout thickened primary sludge flow. Equipment data for the thickened primary sludge pumps are summarized in Table 8-9.

TABLE 8-9

Thickened Primary Sludge Pump Equipment Data

Parameter	Equipment Data
Thickened Primary Sludge Pumps	
Quantity	2
Type	Progressive cavity
Capacity	80 gpm @ 60 psi
Motor	10 hp

Primary Sludge Thickening Performance

The gravity thickener has historically thickened waste primary sludge to a concentration of about 5.9 percent solids, which is consistent with the design for the gravity thickener; the historical thickened primary sludge concentrations are presented in Figure 8-1. It should be noted that the gravity thickener was taken out of operation in July of 2016 due to a traffic accident that damaged the thickener mechanism. This required degritted primary sludge to bypass the gravity thickener and discharge directly to the primary effluent channel. Since this incident in July 2016, the WWTF has gone through periods of in which a portion of the primary sludge continued to be bypassed around the gravity thickener to improve denitrification and floc formation in the aeration basins. Therefore, the thickened primary sludge quantities subsequent to the July 2016 incident are not representative of the what the primary sludge quantities would have been if all primary sludge was sent to the gravity thickener. Prior to this period, the gravity thickener was producing between 1,500 lb/day to 3,500 lb/day of thickener primary sludge, as shown in Figure 8-2. The shift in primary sludge mass after July 2016 is apparent in the thickened primary sludge data Figure 8-2, which shows typical thickened primary sludge loads of less than 2,200 lb/day during this period.

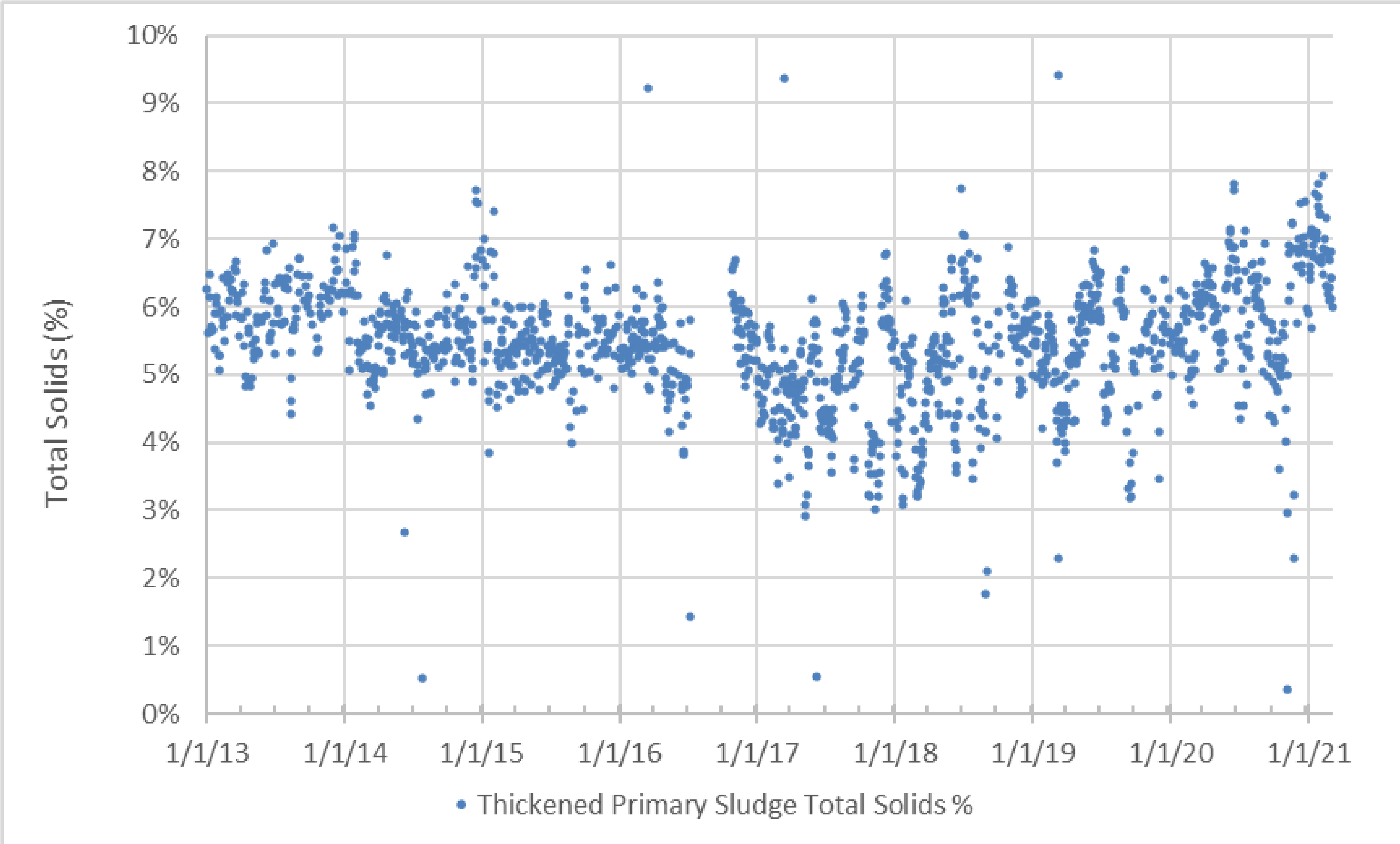


FIGURE 8-1

Thickened Primary Sludge Concentration (2013-2020)

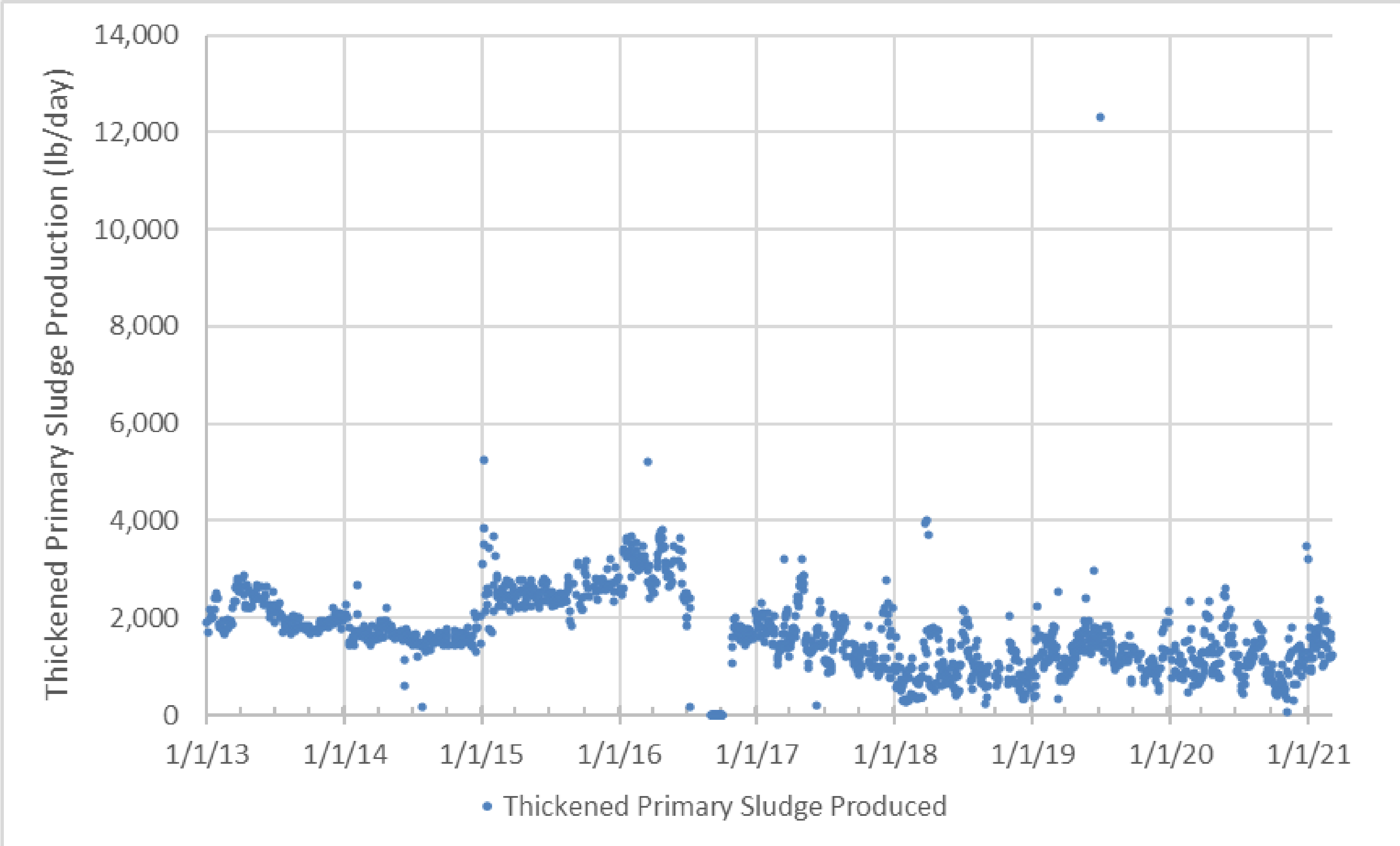


FIGURE 8-2

Thickened Primary Sludge Production (2013-2020)

Primary Sludge Thickening System Condition

Issues with expansion connections for the guardrails, as discussed in Chapter 7, are also present for a portion of guard rail atop the gravity thickener. During the development of this plan, the District indicated that repairs for this issue will be made.

Beyond regular maintenance, the primary sludge gravity thickening system is expected to remain functional through its respective service lives. Notably, the gravity thickener mechanisms can be expected to have a service life between 20 to 25 years. Given the system has been in operation for nearly 10 years, the gravity thickener mechanisms may require replacement around 2031.

PRIMARY SCUM REMOVAL AND PUMPING

Scum is periodically removed from the surface of the primary clarifiers by the rotating scum trough assemblies, which are typically rotated based on time. Scum then flows by gravity to the primary clarifier scum box, from where it is pumped to the scum holding vault by one of the scum pumps. The telescoping valve downstream of the influent screens at the headworks also allows the operators to periodically remove scum from the surface of the headworks outlet box and scum from this location flows by gravity along with carrier water to the scum holding vault. The scum holding vault separates scum from the carrier water and thickens the scum. The operators then periodically drain the carrier water from the scum holding vault before pumping the thickened scum to the digesters. There are two scum pumps located in the primary effluent screenings building, and the scum piping is configured to allow either pump to pump either from the primary clarifier scum box to the scum holding vault or from the scum holding vault to the anaerobic digesters. Under normal operations, Scum Pump 1 will pump from the primary clarifier scum box to the scum holding vault, while Scum Pump 2 pumps scum from the scum holding vault into thickened primary sludge line prior to discharging both to the anaerobic digesters. Scum flow is monitored by a magnetic flow meter.

Equipment data for the primary scum pumps is summarized in Table 8-10.

TABLE 8-10

Primary Scum Pump Equipment Data

Parameter	Equipment Data
Scum Holding Vault	
Length	14 feet
Width	8 feet
Working Volume	520 ft^3
Primary Scum Pumps	
Quantity	2
Type	Rotary Lobe
Capacity, ea.	30 gpm @ 30 psi
Pump Speed	175 rpm
Motor, ea.	5 hp

Primary Scum Removal and Pumping System Condition

Beyond regular maintenance, the primary scum removal and pumping system is not expected to require additional work during the planning period.

WASTE ACTIVATED SLUDGE PUMPING

Waste activated sludge (WAS) is the portion of the mixed liquor that is wasted either from the aeration basins or the mixed liquor return channel. The WAS flow rate is adjusted to maintain the desired solids residence time (SRT) in the activated sludge system. The design aerobic SRT for this system is approximately 12 days. As previously discussed, activated sludge can be wasted either from the surface of the aeration basins via the WAS/foam boxes installed in the aeration basins, from the aeration basins at depth, or from the mixed liquor return channel. The source and volume of WAS to be wasted along with the WAS flow rate are operator adjustable via the HMI. When using the aeration basin WAS/scum boxes, the operators must choose which aeration basins to waste from. This method of wasting involves a compound loop control algorithm in which one control loop modulates the WAS pump speed to maintain the desired WAS flow rate, while a second control loop modulates the selected WAS/foam weir gate to maintain a setpoint level in the WAS/foam box.

The volume of sludge in a wasting cycle may be sourced from a single basin, equally from all in-service basins, or from the mixed liquor return channel. Regardless of the source of the WAS, a real time flowmeter totalizes the WAS volume for each day and each wasting cycle. The WAS pumps only run when the WAS thickening system and all associated equipment are available to receive flow.

Table 8-11 summarizes equipment data for the WAS pumps.

TABLE 8-11

WAS Pump Equipment Data

Parameter	Equipment Data
WAS Pumps	
Quantity	2
Type	Rotary Lobe
Capacity, ea.	250 gpm @ 30 psi
Pump Speed	175 rpm
Motor, ea.	10 hp

Waste Activated Sludge Pumping System Condition

Beyond regular maintenance, the WAS pumping system is not expected to require additional work during the planning period.

WASTE ACTIVATED SLUDGE THICKENING AND THICKENED SLUDGE PUMPING

Waste Activated Sludge Thickening Centrifuge

The WAS pumps convey sludge to the solid bowl centrifuge for thickening. The objective of centrifuge thickening is to concentrate WAS from <1 percent solids to a thickened sludge concentration between 6 percent and 8 percent solids. The centrifuge uses centrifugal forces to accumulate solids along the walls of a spinning conical bowl. Solids along the wall are collected and transported to the solids discharge end of the centrifuge by a helical scroll conveyor, operating at a different speed than the bowl. Polymer feed points are installed at two locations on the sludge feed piping to the centrifuge for performance optimization. The role of polymer addition is detailed in a later section that discusses the polymer systems.

Thickened sludge is discharged into the thickened sludge hopper before being pumped to the anaerobic digesters, while the centrate from the thickening centrifuge flows by gravity back to the primary effluent channel. Valve positions within the Digester Building can also be reconfigured to send digested sludge to this centrifuge allowing it to serve as a backup for the dewatering centrifuge. The thickening centrifuge has adequate capacity for the projected buildout waste activated sludge flow.

Equipment data for the thickening centrifuge is summarized in Table 8-12.

TABLE 8-12

Thickening Centrifuge Equipment Data

Parameter	Equipment Data
Thickening Centrifuge Equipment Data	
Quantity	1
Type	Bowl
Hydraulic Capacity	250 gpm
Solids Feed Concentration	5,450 mg/L
Solids Loading	1,000 lbs/hr
Minimum thickened solids concentration	6-8%
Minimum solids capture	90%
Water flush rate	52 – 105 gpm
Polymer dosage	3 – 4 lb/dry ton
Working bowl speed	3,000 rpm
Maximum bowl speed	3,200 rpm
Main drive horsepower	100 hp
Back drive horsepower	20 hp

Thickened Waste Activated Sludge (WAS) Pumps

There are two thickened WAS pumps installed beneath the thickened WAS hopper that convey solids from the thickened WAS hopper to the anaerobic digesters. The thickened WAS are progressing cavity pumps each have a capacity of 50 gpm with one pump typically serving as the duty pump, while the second pump is as a standby unit. The duty pump is paced to maintain the sludge level setpoint in the TWAS hopper. There is a magnetic flow meter installed on the common discharge header from the two pumps that provides a real-time flow and pulse output to the PLC for daily TWAS flow totalization.

Table 8-13 summarizes equipment data for the thickened WAS pumps.

TABLE 8-13

Thickened WAS Pump Equipment Data

Parameter	Equipment Data
Thickened WAS Pump	
Quantity	2
Type	Progressing Cavity
Capacity, ea.	50 gpm @ 60 psi
Motor, ea.	7.5 hp

Waste Activated Sludge Thickening Performance

Figures 8-3 and 8-4 summarize thickened WAS concentrations and production, respectively. The waste activated sludge thickening system has yielded sludge with an average concentration of 8.8 percent solids. Thickened WAS production data shows that there was an apparent high-wasting period that occurred between July and October of 2016. This corresponds to the period when the gravity thickener off-line, which resulted in primary sludge being bypassed to the aeration basins increasing the loads to the aeration basins and waste activated sludge production. While the solids load to the thickening centrifuge during period required longer operating periods, solids production during the remaining 8 years of operating data indicates the loads to the centrifuge and hours of operation were withing the original design parameters. During this period the thickened WAS production was typically between 1,500 and 6,500 lb/day. At these loads the WAS centrifuge capacity of 1,000 lb/hr appears to be adequate for allowing WWTF staff to complete the requisite thickening within a typical 8-hour day.

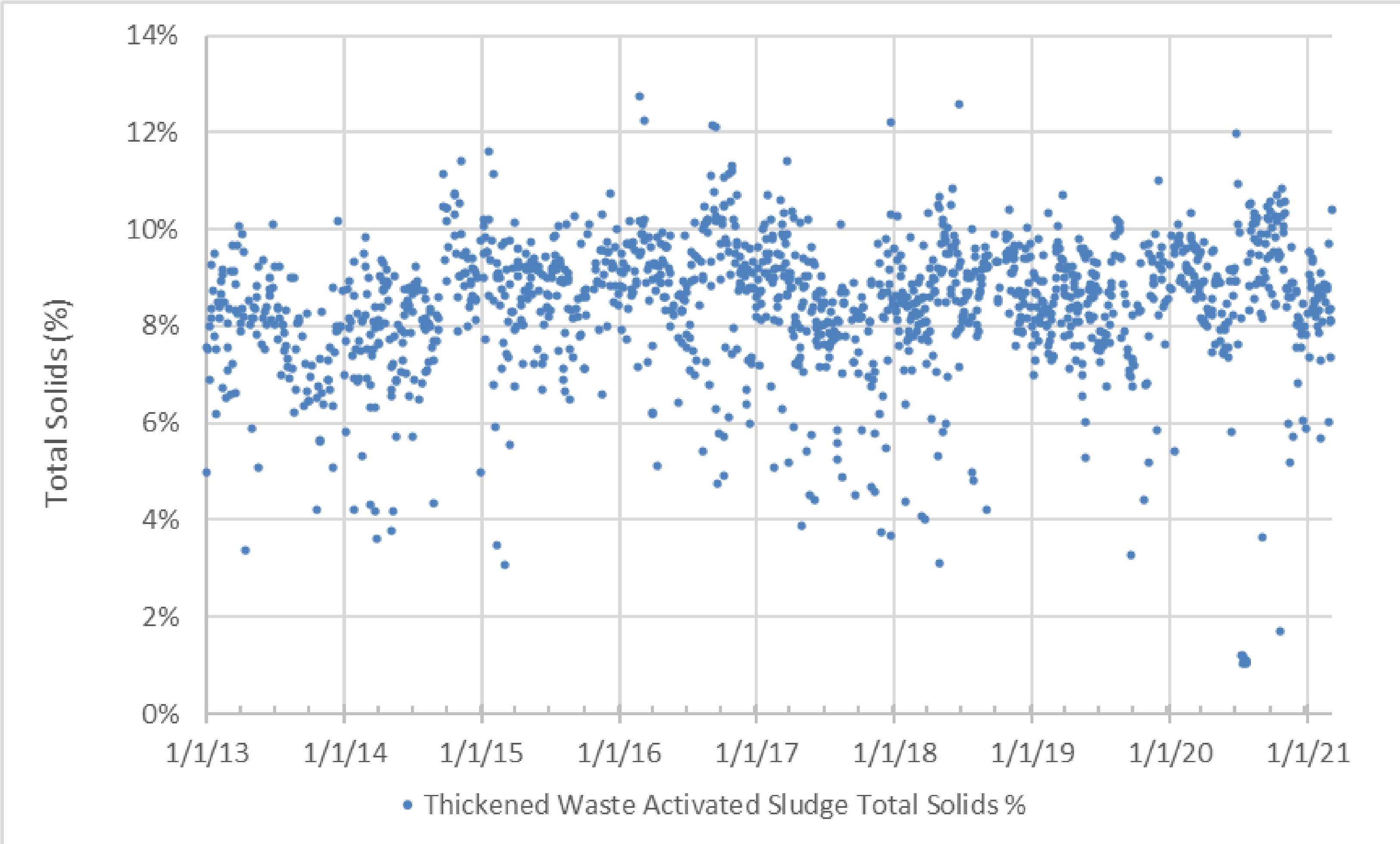


FIGURE 8-3

Thickened WAS Concentration (2013-2020)

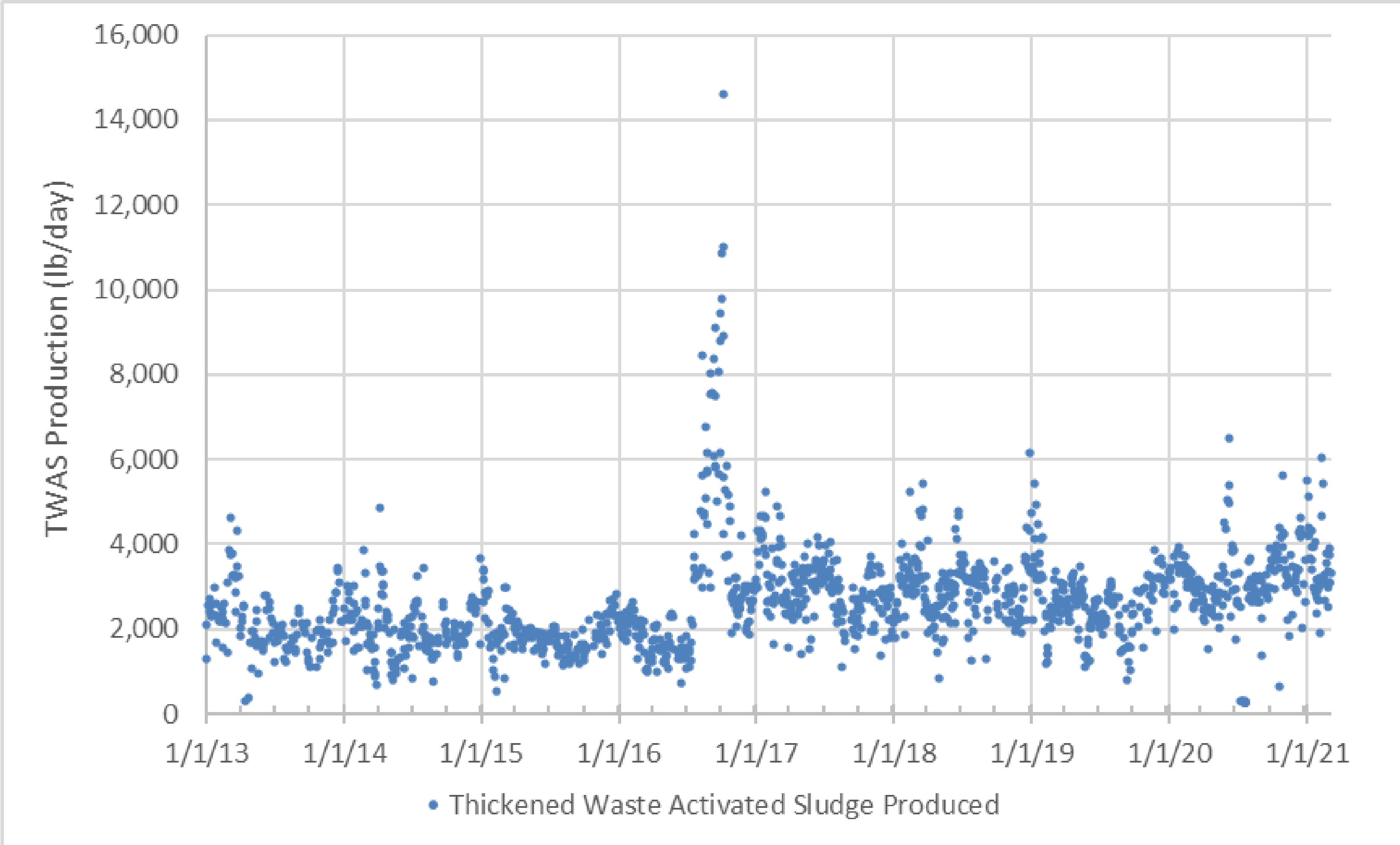


FIGURE 8-4

Thickened WAS Production (2013-2020)

Waste Activated Sludge Thickening System Condition

From site observations and discussions with WWTF staff, there are no notable issues with the conditions of the waste activated sludge thickening system. The thickening centrifuge can be expected to have a service life of about 20 years. Since the equipment has been in operation for nearly 10 years, the centrifuge may require replacement about 10 years into the planning period, likely around 2032.

ANAEROBIC DIGESTION AND GAS HANDLING

The goals of anaerobic digestion include reduction of the mass of biosolids requiring disposal, stabilization of the vector attraction nature of sludge, pathogen reduction, conversion of biomass into methane, minimization of the organic content of the return streams and improved the residual sludge dewaterability. At the same time, anaerobic digestion provides products of possible value, such as biosolids containing useful nutrients and methane gas that can be used to heat the facilities. Anaerobic digestion consists of four major processes:

1. Hydrolysis – Larger, more complex organic molecules degrade into smaller molecules that can be utilized by fermenting microorganisms. However, microorganisms are not necessarily aiding this process as it is a chemical reaction with water that is affected by environmental conditions (e.g., temperature).

2. Acidogenesis – Anaerobic bacteria, or fermenters, convert small organic molecules to simpler short-chain volatile fatty acids (VFAs) in the absence of oxygen.

3. Acetogenesis – A select group of fermenters convert volatile fatty acids and other small organic molecules into acetic acid, which is a highly processible VFA by methanogenic organisms.

4. Methanogenesis – Acetic acid and other VFAs are converted to gaseous methane and carbon dioxide by anerobic microbes, known as methanogens.

Of these processes, methanogenesis requires the most attention because methanogens have the slowest growth rate and are the most sensitive to environmental conditions. Furthermore, methanogens are susceptible to a cascading decline in which an overload of organic molecules decreases the performance of methanogenesis. This condition is typically accompanied by a decline in pH, imbalance between VFA concentration and alkalinity, and inconsistent gas production. The anaerobic digesters were designed to provide enough retention time for the methanogenic population needed to handle the design organic loading and prevent imbalance.

Primary Anaerobic Digesters

There are three waste streams produced at this plant. These waste streams are primary sludge, WAS, and scum and all are thickened prior to being pumped to the anaerobic digesters. Thickened solids from these three sources are combined in a single pipe before being discharged to the primary digesters. The thickened solids are then utilized as a food source for the anaerobic bacteria present in the digesters. The existing anaerobic digester system consists of two primary digesters and one unmixed digested sludge holding tank along with digester recirculation pumps, digester mixers and a digester heating system. The primary digesters are continuously fed and configured to be operated either in parallel or in series; however, the digesters are typically operated in series. The lead primary digester is periodically alternated between the two primary digesters. Digested sludge is flows sequentially by gravity from the lead primary digester to the lag primary digester and then to the sludge holding tank.

Equipment data and design criteria for the anaerobic digestion system is summarized in Table 8-14. As previously detailed, the original design of this anaerobic digestion system consisted of an organic loading rate of about 0.153 lb VS/ft^3/d with a retention time of 17.6 days. These design parameters are based on the projected flows and loads to the digester during the original design and not necessarily the absolute capacity of the system. Typical mesophilic digesters can accommodate loads of about 0.2 lb VS/ft^3/d, and the minimum retention time is 15 days. Given these typical design standards, the design criteria for this system were updated in Table 8-14 to reflect the flows and loads expected for buildout.

TABLE 8-14

Anaerobic Digestion System Equipment Data and Design Criteria

Parameter	**Equipment Data/Design Criteria**
Primary Anaerobic Digester	
Quantity	2
Diameter	32'
Side Water Depth	48'
Volume each	39,000 ft^3
Design Hydraulic Retention Time	21.3 days
Design Volumetric Solids Loading	0.157 lb VS/ft^3/d
Digester Operating Temperature	95°F - 100°F (35°C - 38°C)

Each of the two digesters and the sludge holding tank are equipped with a pressure/level transmitter to monitor liquid level. The primary digesters are hydraulically connected by an 8-inch pipe that ensures that both digesters operate at the same level and digested sludge passes from the lead digester to the lag digester when being operated in series. The operating level in the primary digesters is constant and controlled by separate overflow lines that run from each primary digester to the sludge holding tank. When being operated in series only one of the valves on these two overflow lines is open. The level in the sludge holding tank varies with the sludge feed flow rate and digested sludge flow rate, which is discussed in a later section.

During digestion, the anaerobic bacteria produce methane gas and carbon dioxide. There is only limited gas storage volume in the headspace of each primary digester and sludge holding tank. As a result, gas is continuously discharged to either the boiler system, where it is utilized to for digester and building heating, or the waste gas burner. Flow to the waste gas burner is controlled by a backpressure regulator that opens when the gas pressure in the digesters rises above 12 inches water column. Both primary digester covers are also equipped with dual vacuum and pressure relief valve/flame arrester assemblies. In addition, one of the three manhole covers on each of the digesters and the storage tank is an emergency pressure relief manhole that provides a secondary means of pressure relief should the primary relief valve fail or become plugged with foam.

<u>Digester Mixing System</u>

Each primary anaerobic digester is equipped with one draft-tube type mixer. These mechanical sludge mixers minimize the formation of scum as well as distribute heat, digested material, and incoming nutrients and organic loads evenly throughout the digester. The installed mixing system provides an approximate turn over time of about 0.5 hours.

Table 8-15 summarizes equipment data for the digester mixing system.

TABLE 8-15

Digester Mixing System Equipment Data

Parameter	Equipment Data
Digester Mixing System	
Quantity of Mixers per Digester	1
Type	Draft Tube
Digester Turnover Time	0.5 hrs
Mixer Capacity	10,200 gpm
Motor	10 hp

<u>Digester Heating System</u>

The primary digesters are kept at a constant temperature between 95 degrees F and 100 degrees F (35 degrees C and 38 degrees C) using water to sludge spiral heat exchangers. Gas produced by the digestion process provides the fuel for the boilers, which heats the water that is pumped through one side of the heat exchangers. There are two fire tube boilers that operate in a lead-lag scenario to provide hot water for digester heating as well as to heat the conditioned building spaces at the WWTF. Each of these boilers is equipped with an ultra-low NOx burner that requires the digester gas pressure to be boosted from the 4 to 12 inches of water column present in the digesters to 2 psi. This is achieved using two multi-stage centrifugal digester gas boosters, each of which has sufficient capacity to meet the demand of both boilers. When there is not enough digester gas available, the boilers are fueled by commercial natural gas.

The digester recirculation pumps continuously withdrawal sludge from the associated digester and pump the sludge through the one side of the spiral heat exchangers before the sludge is returned to the digester. Temperature probes on the digester recirculation piping continuously monitor the digester temperature and when the temperature drops below the setpoint value the digester heating pumps pump hot water through the other side of the heat exchanger until the digester temperature rises to the desired temperature setpoint.

There are a number of pumps that work in tandem to provide hot water to the digester heating system as well as the plant heating system. The two (one duty, one standby) hot water circulation pumps continuously circulate hot water and provide a source of hot water to both the digester heating pumps and plant heating pumps. The two boiler water pumps, one associated with each boiler, circulate hot water from the boilers to the hot water circulation loop as required to maintain the setpoint temperature in this loop. The digester heating pumps and plant heating pumps simultaneously circulate hot water from the hot water circulation loop as required to meet the heating needs of the digesters and plant heating system.

Table 8-16 summarizes equipment data and design criteria for the digester and plant heating system.

TABLE 8-16

Digester Heating System Equipment Data and Design Criteria

Parameter	Equipment Data
Digester Recirculation Pump	
Type	Rotary lobe
Quantity	3
Capacity per Pump @ TDH	200 gpm @ 23 feet
Motor	10 hp
Boiler	
Quantity	2
Type	Gas Fired Tube
Boiler Capacity	3,348 MBH
Boiler Water Pumps	
Quantity	2
Type	Centrifugal
Pump Capacity @ TDH	210 gpm @ 16feet
Motor	1.5 hp

TABLE 8-16 – (continued)

Digester Heating System Equipment Data and Design Criteria

Parameter	Equipment Data
Hot Water Circulation Pumps	
Quantity	2
Type	Centrifugal
Pump Capacity @ TDH	475 gpm @ 21 feet
Motor	5 hp
Plant Heating Pumps	
Quantity	2
Type	Centrifugal
Pump Capacity @ TDH	400 gpm @ 52 feet
Motor	10 hp
Digester Heating Pumps	
Quantity	2
Type	Centrifugal
Pump Capacity @ TDH	105 gpm @ 7 feet
Motor	0.5 hp
Digested Sludge Heat Exchangers	
Quantity	2
Type	Spiral
Capacity	750,000 BTU/hr

<u>Digester Gas Handling System</u>

The digester gas handling system consists of 6-inch digester gas lines that are connected to each of the two primary digesters and the sludge holding tank. Each of these 6-inch digester gas lines is equipped with a sediment trap that removes moisture and particulates from the digester gas flow from each source before they combine into a common 6-inch line. Each sediment trap is equipped with an automatic drip trap that periodically drains the accumulated moisture. There are two pressure transmitters mounted on this 6-inch digester gas line that continually monitor the digester gas pressure in the digesters. This 6-inch digester gas line branches into two separate 3-inch lines. One of these lines is equipped with a back pressure regulator and is connected to the waste gas burner. The other 3-inch line is equipped with a coalescing filter that provides additional moisture removal prior to being burned in the boilers. This 3-inch branch is connected to the suction side of the two digester gas boosters. As noted above, the digester gas boosters raise the pressure of the digester gas from a range of approximately 4 to 12 inches W.C. to approximately 2 psi, which is the minimum pressure required for the operation of the boilers. Only one digester gas booster operates at a time. Digester gas flow through the digester gas boosters is constant. To satisfy the variable boiler digester gas demand, there is a digester gas recirculation loop that recirculates the portion of the boosted digester gas that is not utilized in the boilers back through the gas boosters. If left unchecked, this recirculation loop would raise the temperature of the boosted digester gas to an unsafe level. As a result, the digester gas is cooled by a water-to-gas heat exchanger that is installed on the recirculation loop. As previously discussed, excess digester gas that is not utilized in the boilers is flared in waste gas burner. The waste gas burner is equipped with a natural gas-fueled pilot that continuously burns to ensure that the waste gas burner remains lit under varying digester gas flows and quality.

Table 8-17 summarizes equipment data for the waste gas burner.

TABLE 8-17

Waste Gas Burner Equipment Data

Parameter	Equipment Data
Waste Gas Burner	
Quantity	1
Pilot Type	Continuous, low-pressure natural gas
Diameter	3-inches
Capacity	7,500 ft^3/hr

Digested Sludge Holding Tank

Digested sludge flows by gravity from the two primary anaerobic digesters to the Digested Sludge Holding Tank. This tank is necessary to maintain a constant liquid level in the primary digesters because the feed to the digesters does not coincide with the digested sludge dewatering operations. While the digested sludge pumps can pump digested sludge from either primary digester to the dewatering centrifuge, digested sludge is typically pumped from the sludge holding tank to the centrifuge. This tank was also designed to provide at least 7 days of sludge storage in the event that the dewatering centrifuge is taken off line for repair or maintenance.

Table 8-18 summarizes equipment data for the Digested Sludge Holding Tank.

TABLE 8-18

Digested Sludge Holding Tank Equipment Data

Parameter	Equipment Data
Digested Sludge Holding Tank	
Quantity	1
Diameter	32 ft
Side Water Depth	25 ft
Volume	20,100 ft^3

Digested Sludge Pumps

Digested sludge is pumped from the Digested Sludge Holding Tank to the dewatering centrifuge by two progressing cavity pumps, one duty and one standby. Both pumps discharge to a common force main that is equipped with a magnetic flow meter that transmits both a flow proportional signal and a pulse output to the PLC to monitor digested sludge flow and volume.

Equipment data for the digested sludge pumps is summarized in Table 8-19.

TABLE 8-19

Digested Sludge Pump Equipment Data

Parameter	**Equipment Data**
Digested Sludge Pump	
Quantity	2
Type	Progressing Cavity
Capacity	180 gpm @ 60 psi
Motor	20 hp

Anaerobic Digestion Performance

Anaerobic digester process data available between January 2013 and January 2021 were evaluated for conformance with Washington State regulations on biosolids under Chapter 70.95J of the RCW. The state requirements in Chapter 173-308 of the Washington Administrative Code (WAC) dictate that the anaerobically digested Class B biosolids must comply with the following requirements: (1.) Biosolids pollutant limits, (2.) Pathogen reduction requirements, and (3.) Vector attraction reduction requirements. Each of these is discussed in greater detail below.

1) *WAC 173-308-160, Biosolids pollutant limits*

   WAC-173-308 Table 1 and 3 set, respectively, *(1) the maximum allowable concentration (ceiling limit) of pollutants in biosolids that are applied to the land, (2) the lower pollutant concentration threshold which, when achieved, relieves the person who prepares biosolids and the person who applies biosolids, from certain requirements related to recordkeeping, reporting, and labeling.*

2) *WAC 173-308-170, Pathogen reduction*

   Anaerobic digestion. The biosolids must be treated in the absence of air for a specific mean cell residence time at a specific temperature. Values *for the mean cell residence time and temperature must be between fifteen days at 35 to 55°C (95 to 131°F) and sixty days at 20°C (68°F).*

3) *WAC 173-308-180, Vector attraction reduction*

Volatile Solids Reduction: The mass of volatile solids in the biosolids must be reduced by a minimum of thirty-eight percent. Bench-scale test for anaerobically digested solids: When the thirty-eight percent volatile solids reduction requirement in this subsection cannot be met for anaerobically digested biosolids, vector attraction reduction can be demonstrated by digesting a portion of the previously digested biosolids anaerobically in the laboratory in a bench-scale unit for forty additional days at a temperature between 30 and 37°C (86 and 98.6°F). After the forty-day period, the vector attraction reduction requirement is met if the volatile solids in the biosolids at the beginning of that period are reduced by less than seventeen percent.

The District reports pollutant analyses of biosolids on a quarterly basis. Based on analyses conducted between 2013 and 2020, biosolids produced from the anaerobic digestion process have met the pollutant requirements described above. This included both the ceiling limit and the lower pollutant concentration, as shown in Table 8-20.

TABLE 8-20

Biosolids Pollutant Concentrations

Pollutant	Limit[1], mg/kg	Measured Concentration, mg/kg							
		Mar. 2013	**May 2013**	**July 2013**	**Oct. 2013**	**Jan. 2014**	**April 2014**	**July 2014**	**Oct. 2014**
Arsenic	41	ND	ND	ND	ND	ND	ND	1.87	4.45
Cadmium	39	2.19	1.99	2.09	ND	1.86	3.3	ND	ND
Copper	1500	306	378	324	114	297	137	351	383
Lead	300	14.3	16.2	14.5	6.99	16	28.1	13.1	11.6
Mercury	17	0.3502	0.374	0.503	0.282	0.168	0.106	0.28	0.832
Molybdenum	75[2]	6.00	5.96	6.53	2.51	8.5	2.07	6.17	5.93
Nickel	420	13.8	14.8	14.4	4.51	13.2	7.38	14.7	13.5
Selenium	100	ND	5.83	6.51	ND	ND	ND	ND	2.22
Zinc	2800	795	934	774	259	738	427	830	932
		Feb. 2015	**April 2015**	**July 2015**	**Nov. 2015**	**Feb. 2016**	**April 2016**	**July 2016**	**Nov. 2016**
Arsenic	41	3.22	ND	ND	ND	ND	ND	1.71	1.50
Cadmium	39	1.97	1.32	ND	ND	1.41	1.16	ND	1.23
Copper	1500	461	445	414	198	371	466	478	475
Lead	300	13.8	10.5	9.06	3.41	7.28	6.82	9.15	8.33
Mercury	17	0.410	0.504	0.548	0.453	0.466	0.377	0.4021	0.4076
Molybdenum	75[2]	5.76	5.4	6.23	3.58	6.59	7.55	6.57	6.44

TABLE 8-20 – (continued)

Biosolids Pollutant Concentrations

Pollutant	Limit(1), mg/kg	Measured Concentration, mg/kg							
		Feb. 2015	April 2015	July 2015	Nov. 2015	Feb. 2016	April 2016	July 2016	Nov. 2016
Nickel	420	18.4	18.7	19.5	6.47	17.5	16.8	13.4	16.4
Selenium	100	ND	ND	5.12	5.03	8.41	10.3	10	7.19
Zinc	2800	815	865	931	366	762	854	942	826
		Jan. 2017	**April 2017**	**July 2017**	**Nov. 2017**	**Jan. 2018**	**April 2018**	**July 2018**	**Nov. 2018**
Arsenic	41	1.51	3.09	ND	ND	ND	ND	ND	ND
Cadmium	39	ND	ND	ND	ND	1.14	ND	2.05	1.09
Copper	1500	417	368	316	364	475	468	411	397
Lead	300	7.00	7.80	8.70	8.06	11.6	8.96	ND	7.80
Mercury	17	0.310	1.05	0.310	0.60	0.73	5.98	0.709	0.463
Molybdenum	75(2)	6.02	6.24	5.60	6.42	6.20	2.94	ND	2.38
Nickel	420	17.1	18.9	18.4	15.0	17.9	20.3	15.5	16.7
Selenium	100	7.89	11.3	ND	ND	ND	ND	ND	ND
Zinc	2800	600	660	682	731	838	780	692	779
		Jan. 2019	**April 2019**	**Sept. 2019**	**Oct. 2019**	**Jan. 2020**	**May. 2020**	**July 2020**	**Oct. 2020**
Arsenic	41	ND	ND	ND	ND	3.9	ND	ND	ND
Cadmium	39	1.74	ND	ND	ND	ND	ND	ND	ND
Copper	1500	374	77.0	166	395	334	374	327	302
Lead	300	8.86	1.67	11.6	14	8.1	13.0	10	9.6
Mercury	17	0.435	0.512	0.4165	0.301	0.40	0.58	0.363	0.263
Molybdenum	75(2)	3.29	ND	ND	13.4	4.6	4.2	5.5	5.8
Nickel	420	19.1	4.03	6.99	13.8	15.0	20.0	13	14
Selenium	100	ND	ND	11.1	4.95	4.2	11	ND	ND
Zinc	2800	834	153	381	733	656	703	667	741

(1) Limit represents lower pollutant concentration unless otherwise noted.
(2) Concentration represents ceiling limit due to lack of lower pollutant limit.

As discussed in Chapter 2, a possible future issue regarding biosolids quality is the emerging concern for trace organic compounds in biosolids, in particular PFAS (perfluoroalkyl substances). At present, it is expected that future regulations on PFAS would focus on source control for commercial discharges and for consumer products. It is uncertain if future regulation will necessitate additional treatment of biosolids at the WWTF. Furthermore, there are limited available treatment solutions for PFAS in biosolids. Only combustion and oxidation processes like incineration and pyrolysis have been shown to remove PFAS, and those treatment processes produce products with vastly reduced nutrients, are very expensive, and difficult to permit (incineration) and/or not in common use in the U.S. (pyrolysis). For these reasons, potential treatment of PFAS is not discussed further in this Plan. Analysis of the presence and potential treatment of

PFAS at the WWTF is recommended when there is increased likelihood and clarity on potential regulations for biosolids.

Figures 8-5, 8-6 and 8-7 show historical digester HRT/VSR, temperature, and digested solids concentrations, respectively. The anaerobic digestion system at the WWTF has historically achieved an average residence time of 46 days in the lead digester and 92 days across both digesters. From digester data available between 2017 and 2020, temperatures within the digesters averaged 35.6 degrees C in Digester 1 and 35.7 degrees C in Digester 2. The minimum 10-day average temperatures for Digester 1 and Digester 2 were 33.6 degrees C and 32.7 degrees C, respectively. These events are believed to be related to periodic feed valve issues in the hot water loop. Though these temperature values were lower than 35 degrees C, they occurred when total residence times were above 60 days (Figure 8-5) and at a temperature above 20 degrees C (Figure 8-6); therefore, the biosolids pathogen reduction requirements were still met.

At the WWTF, the anaerobic digestion system yielded an average volatile solids reduction (VSR) of 48 percent from 2013 and 2020. Staff at the WWTF conduct sampling such that VSR values can be determined once or twice a week. There have been instances when the VSR was below 38 percent. Typically, when there was a VSR measurement below 38 percent, the subsequent VSR measurement was greater than 38 percent. Given the long residence times of the system, these instances of low VSR are likely outliers because VSR values should not vary significantly from day to day in a system with detention times in the range of those present here. However, there have been periods during which VSR measurements were consistently below 38 percent. These periods include September of 2016, September of 2018, December of 2018, and August of 2019 (Figure 8-5). The low VSRs during these periods are believed to be related to the inconsistent loading that might have resulted from the primary sludge bypassing that occurred between 2016 and 2020. Thickened primary sludge provides more easily digestible organic loads to the digesters and greater VSR. When the primary sludge gravity thickener is bypassed, these loads are shifted to the activated sludge system, which metabolizes these organic loads to yield less digestible waste activated sludge. Given that anaerobic digesters typically operate best under consistent loads, it is hypothesized that the shift in loads to the digesters may have resulted in temporary decreases in apparent VSRs.

Historically, the total and volatile solids concentrations of digested sludge have averaged 3.2 percent and 2.6 percent, respectively. It is apparent in Figure 8-7 that these measurements have been increasing over time. Given that total and volatile solids concentrations appear to be increasing proportionally, there is no evidence of a buildup of inert solids within the digesters, and the increasing solids concentrations could simply be related to increased feed solids concentrations. Figure 8-8 presents the limited volumetric gas production data that is available. This data shows that the anaerobic digestion system has yielded an average of about 21,000 ft^3/day of digester gas.

Lastly, organic loading rates to the lead digester have averaged 0.098 lb/ft^3-d. According to Metcalf and Eddy (2014), a typical mesophilic anaerobic digester may be designed for organic loading rates between 0.1 lb/ft^3-d and 0.3 lb/ft^3-d. Thus, the existing anaerobic digestion system has the loading capacity needed for existing loads and projected loads, as previously detailed.

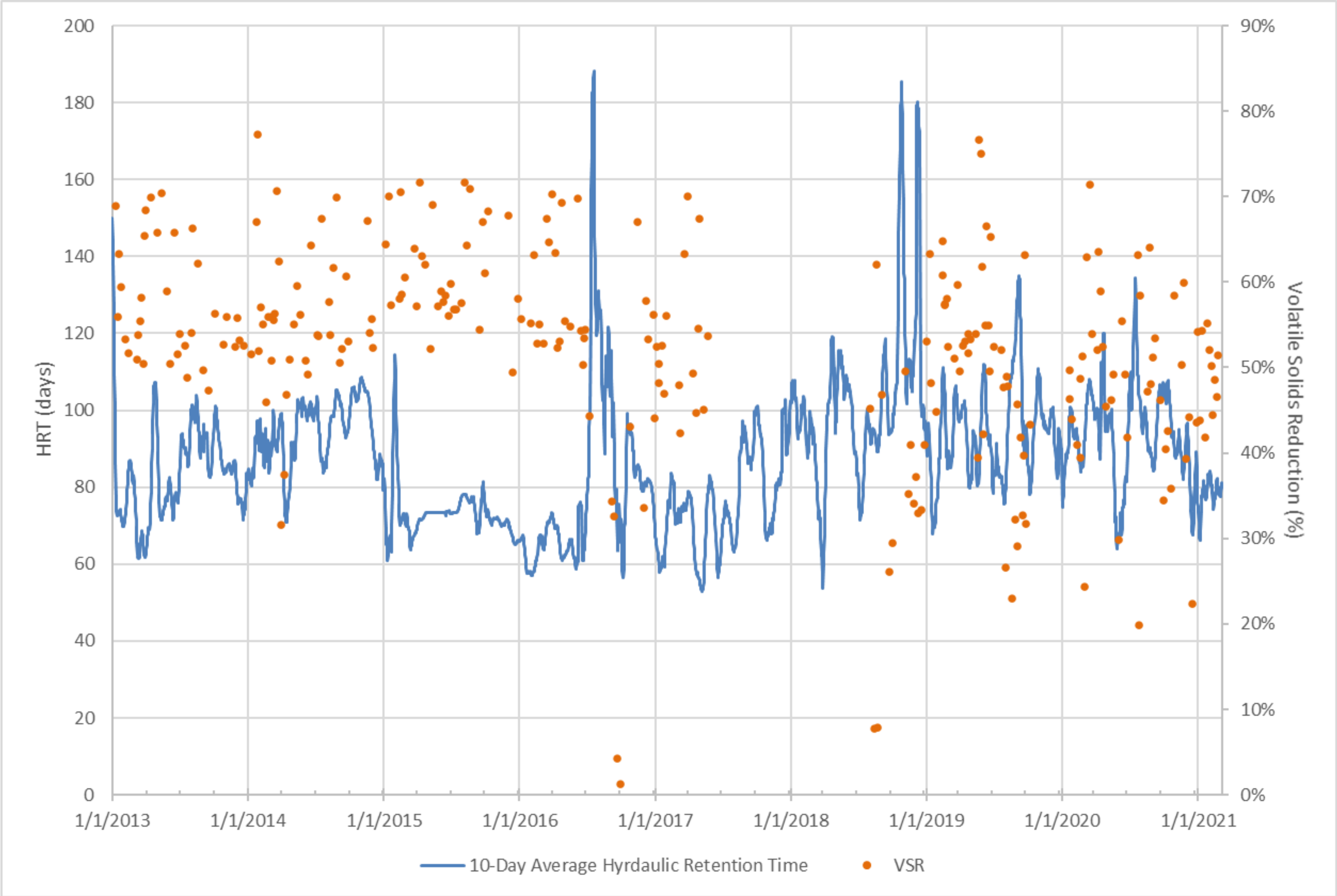


FIGURE 8-5

Anaerobic Digester System Hydraulic Retention Time and Volatile Solids Reduction (2013-2020)

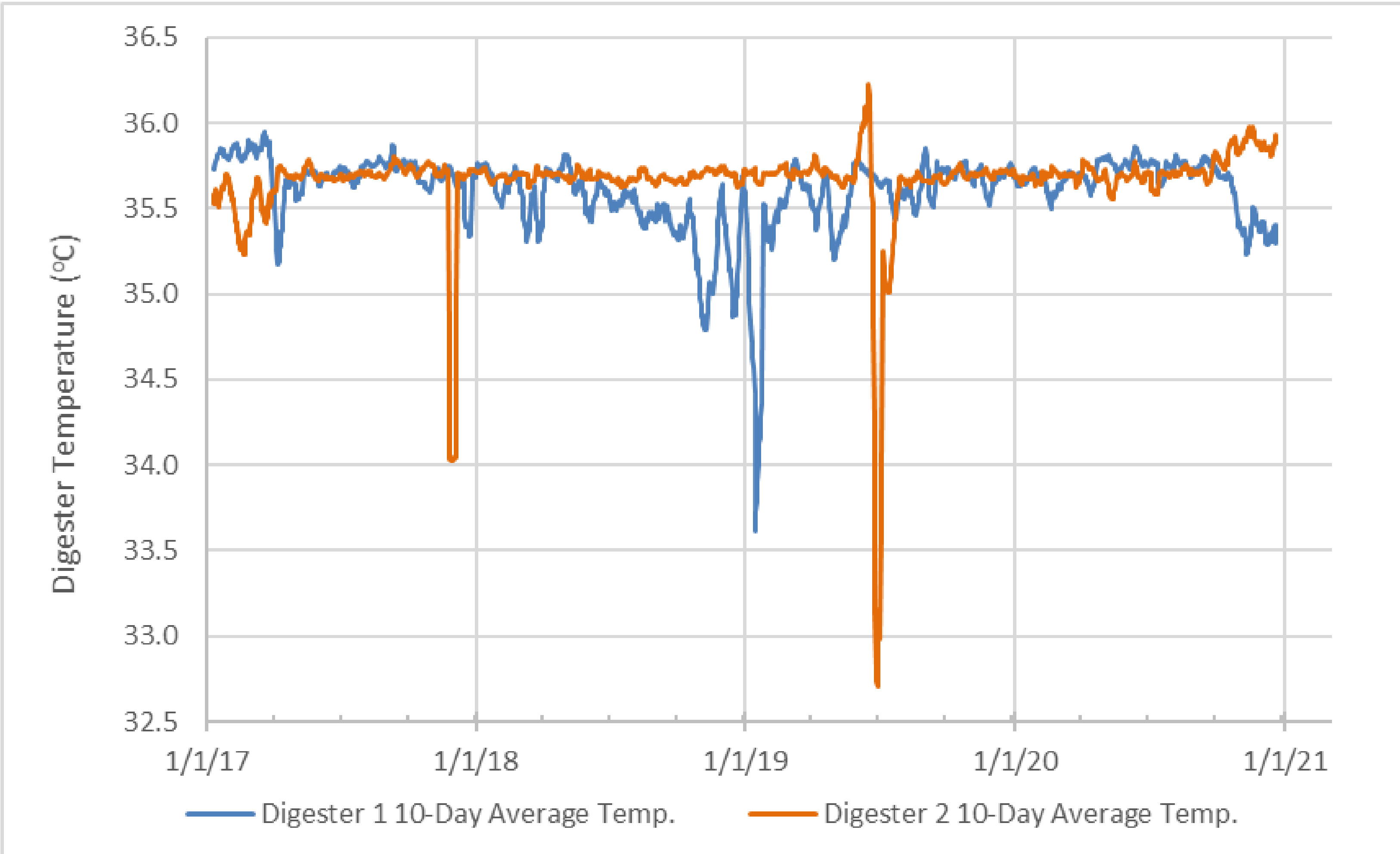


FIGURE 8-6

Anaerobic Digester Temperature (2013-2020)

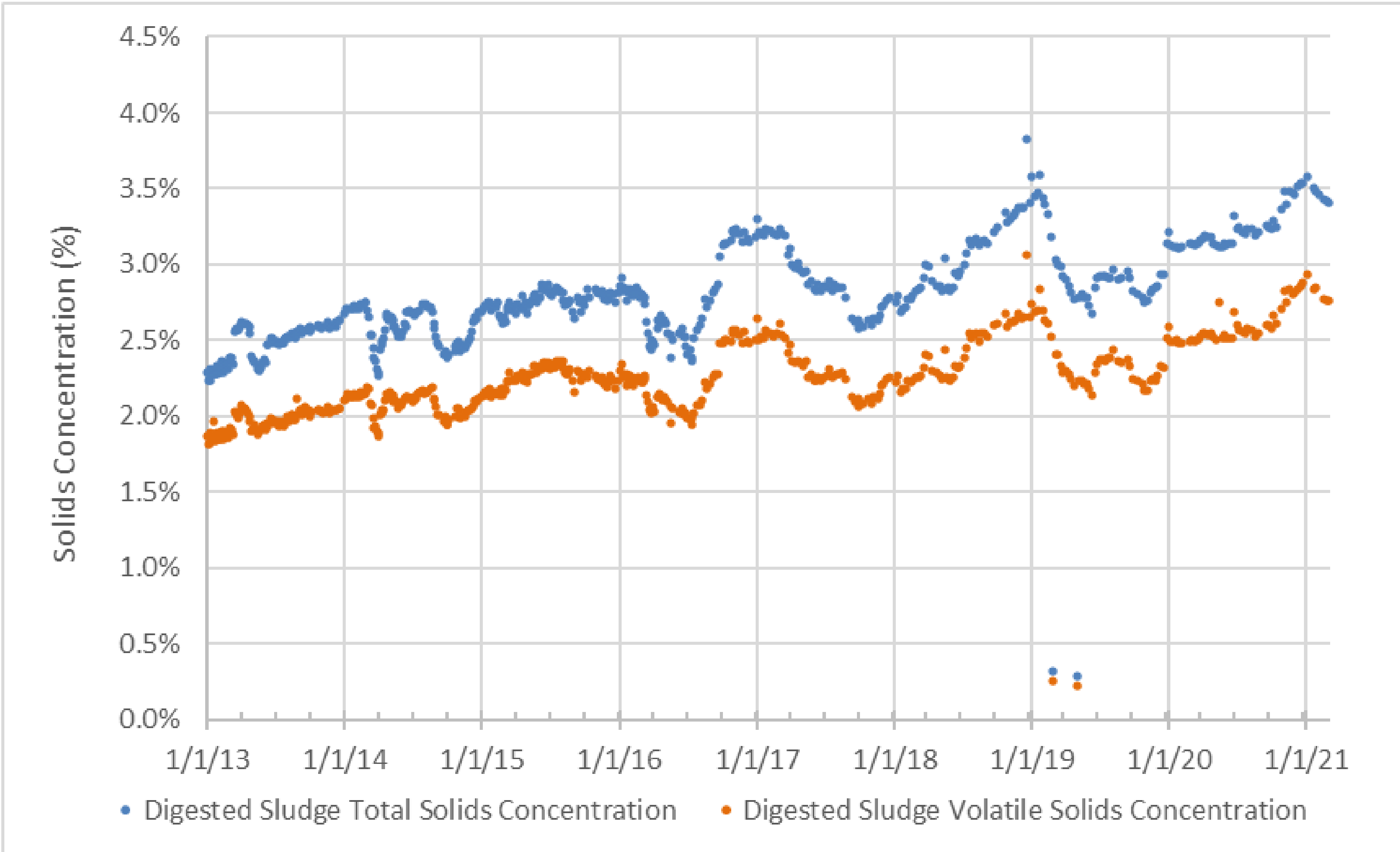


FIGURE 8-7

Digested Sludge Solids Concentrations (2013-2020)

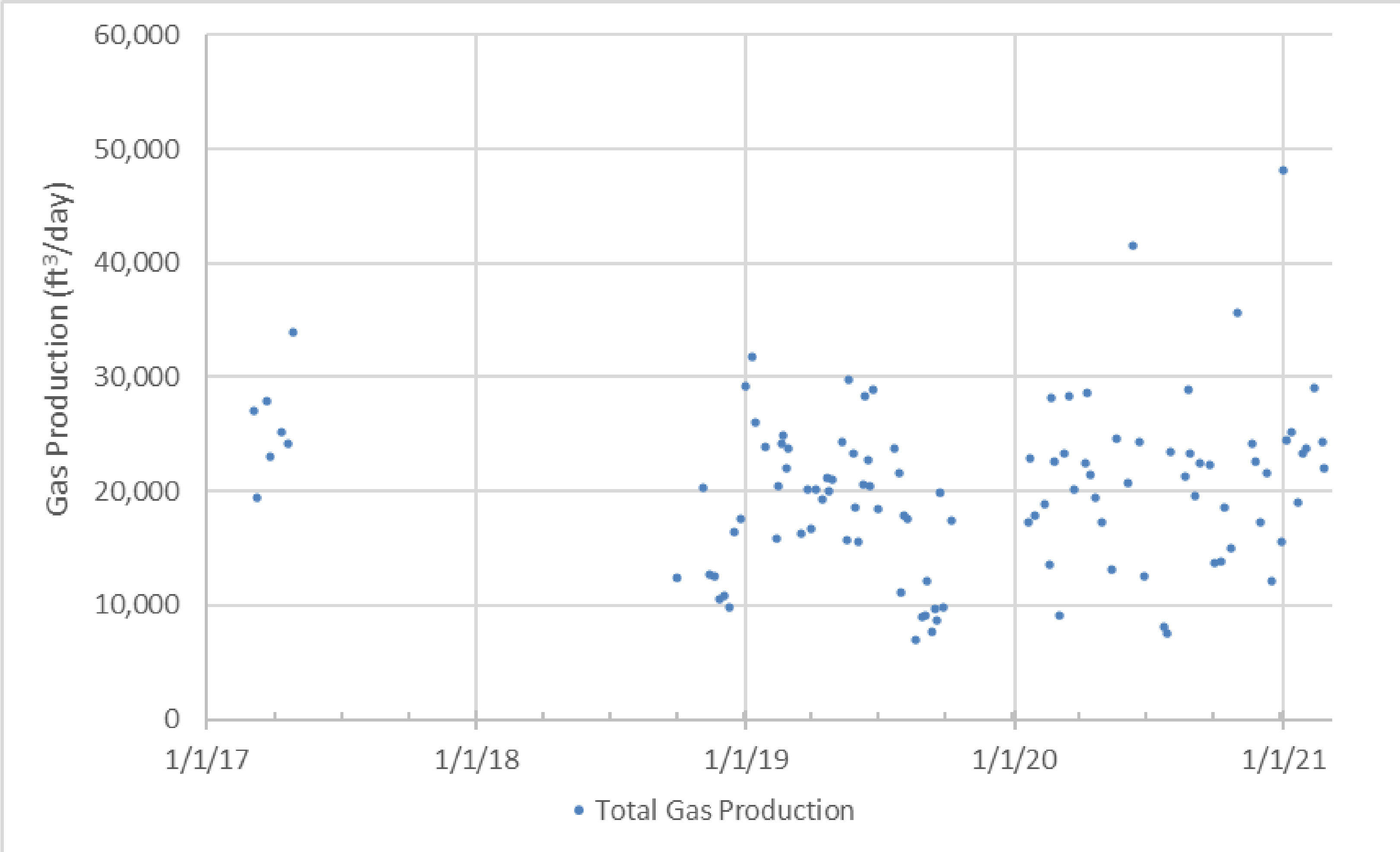


FIGURE 8-8

Digested Gas Production (2017-2020)

Anaerobic Digestion and Gas Handling Systems Condition

The anaerobic digesters and associated process equipment had no apparent condition issues during the development of the Plan. However, several components of the system are likely to require equipment replacement and significant maintenance efforts.

The anaerobic digesters and the sludge holding tank should be drained on an interval between 3 and 8 years to be cleaned, inspected, and repaired as needed. The anaerobic digesters have been in operation for more than 8 years and, therefore, would benefit from cleaning and inspection at the beginning of the planning period (around 2022). This would repeat at least once more during the planning period. The effort required to clean and inspect the digesters (and sludge holding tank) can be significant due to the need to drain, dewater and land apply the large volume of sludge from each digester. Since the existing digesters are underloaded, it should be possible to take one digester out of service at a time, allowing the other digester to remain in service and continue to produce Class B biosolids.

The digester draft tube mixers can be expected to have a service life of about 20 years. Given that these mixers have been in service for nearly 10 years, these mixers may require replacement within the first 10 years of the planning period (prior to 2031).

Boilers typically have a service life of about 30 years. However, to operate boilers for this long, it is expected that the boilers would need to have their tubes replaced at some point during the planning period. Boiler tube replacement may be necessary within the first 10 years of the planning period (prior to 2031). At the end of the planning period (2041), the boilers may need to be replaced.

The waste gas burner will near the end of its service life at the end of the planning period (2041). Though most equipment needing replacement can be replaced in kind, a significant upgrade may be required when the existing waste gas burner is replaced due to more stringent air quality standards. This will likely require the existing waste gas burner to be replaced with an enclosed flare. In addition, other design standards have changed since the existing waste gas burner was installed. Specifically, the American National Standards Institute (ANSI) B149.6 Code for Digester Gas and Landfill Gas Installations, which was originally published in 2015, applies to digester gas systems for newly constructed wastewater treatment plants. The most recent edition (3rd edition, 2020) includes requirements for minimum distances between waste gas burners and adjacent structures and property lines that were not in effect when the WWTF was constructed. According to ANSI B149.6, the waste gas burner must be at least 50 feet from the digester and digested sludge holding tank. In addition, it must be at least 25 feet from the property line. For an enclosed flare, this property line limit is reduced to 10 feet. Therefore, when the existing waste gas burner is replaced, an enclosed flare is recommended not only because of trends in emissions regulations that could not be met by an open flare, but also because it allows the flare to be positioned west of Anaerobic Digester 1 and still more than 10 feet from the property line. Other viable locations would utilize space that would be better reserved for future improvements, given the limited footprint of the site. Digester and natural gas lines can be easily extended from the existing waste gas burner location. The new waste gas burner assembly will require drain piping to be installed and routed to the nearest 4-inch drain line, which is located near Anaerobic Digester 1.

Finally, at the end of the planning period (2041), the digester heat exchangers may require replacement. While there are no mechanical parts associated with the spiral heat exchangers, sludge passing through the equipment can eventually wear down the interior chambers. Thus, it is recommended that the District plan for the replacement of the heat exchangers towards the end of the planning period.

POLYMER SYSTEMS

There are two polymer systems at the WWTF, one system is dedicated to WAS thickening while the other system is dedicated primarily to digested sludge dewatering. The dewatering polymer system also provides polymer for the polymer lubrication pumps that discharge polymer through an injection ring into the discharge of the dewatered cake pumps to provide the lubrication necessary to pump dewatered cake to the sludge haul truck. Injecting polymer into the waste activated and digested sludge feed to the centrifuges enhances flocculation, solids capture and dewaterability of the sludge in both applications. Polymers typically used in municipal wastewater treatment are long chain macromolecules that carry localized positive charge. Suspended particles in sludge predominantly have negatively charged surfaces and the introduction of cationic polymers reduces the repulsion between sludge particles and aids in binding multiple particles together, which is known as “polymer bridging.” In this way, polymer addition promotes better floc formation to improve the efficiency of separating liquid from the solids.

The thickening and dewatering polymer systems are similar and both are designed to activate either dry or liquid polymer. To some extent, each polymer system is comprised of two separate system; the polymer preparation system and the final dilution/feed system. The polymer preparation systems each consist of a dry polymer blower and liquid polymer feed pump that deliver dyr or liquid polymer to the polymer mix tank, where polymer is combined with dilution water and aged so that the polymer is properly activated. The dewatering polymer system includes a polymer transfer pump that transfers the polymer solution to the polymer feed tank once it has been aged, while the polymer mix tank is stacked on top of the feed tank in the thickening polymer system and transfer from the mix tank to the feed tank simply involves opening a motor operated valve. These systems essentially operate independently of the centrifuges, with the focus on maintaining a minimum volume of activated polymer in the polymer feed/storage tanks.

Both polymer final dilution/feed system include a progressing cavity metering pump and a polymer post-dilution system. The progressing cavity pumps draw polymer from their respective polymer feed/storage tanks and the polymer solution is then diluted further with non-potable water by the post-dilution systems. Each post-dilution system consists of a rotameter and control valve on the non-potable waterline and a static mixer where the polymer solution and non-potable water are mixed prior to use. The polymer final dilution/feed systems are activated in conjunction with their respective centrifuges to inject activated polymer into the sludge feed prior to entering the centrifuge. There are magnetic flow meters installed on the discharge of both progressing cavity pumps to monitor polymer flow and control pump speed.

The thickening polymer system is controlled through the Thickening Polymer System PLC in the Thickening Polymer System Control Panel. Similarly, the dewatering polymer system is controlled through the Dewatering Polymer Control Panel. Both system controls target maintaining the level in the polymer feed tanks.

Tables 8-21 and 8-22 summarize equipment data and design criteria for the Polymer System.

TABLE 8-21

Thickening Polymer Feed System Equipment Data and Design Criteria

Parameter	Equipment Data
Thickening Polymer Feed System	
Quantity	1
Type	2-Tank Automatic
Polymer Type	Liquid or Dry
System Capacity (Active Polymer)	3 lb/hr @ 0.5%
Dry Polymer Volumetric Screw Feeder Motor Size	0.25 hp
Dry Polymer Feed Blower Type	Regenerative
Dry Polymer Feed Blower Capacity	90 scfm @ 40" W.C.
Dry Polymer Feed Blower Size	2.5 hp
Liquid Polymer Feed Pump Type	Progressing Cavity
Liquid Polymer Feed Pump Capacity	58 gpm
Liquid Polymer Motor	0.5 hp
Nominal Mix Tank Volume	500 gallons
Polymer Solution Feed Pump Type	Progressing Cavity
Polymer Solution Feed Pump Capacity	60 gph @ 30 psi
Polymer Solution Feed Pump Size	0.5 hp
Post-Dilution Rotameter Capacity	0.2-2 gpm

TABLE 8-22

Dewatering Polymer Feed System Equipment Data and Design Criteria

Parameter	Equipment Data
Dewatering Polymer Feed System	
Quantity	1
Type	2-Tank Automatic
Polymer Type	Liquid or Dry
System Capacity (Active Polymer)	4 lb/hr @ 0.5%
Dry Polymer Volumetric Screw Feeder Motor Size	0.25 hp
Dry Polymer Feed Blower Type	Regenerative
Dry Polymer Feed Blower Capacity	90 scfm @ 40" W.C.
Dry Polymer Feed Blower Size	2.5 hp
Liquid Polymer Feed Pump Type	Progressing Cavity
Liquid Polymer Feed Pump Capacity	58 gpm
Liquid Polymer Motor	0.5 hp
Nominal Mix Tank Volume	1,500 gallons
Mix Tank Mixer Motor	2 hp
Solution Transfer Pump Type	Progressing Cavity
Solution Transfer Pump Capacity	100 gpm
Solution Transfer Pump Motor	7.5 hp
Nominal Solution Tank Volume	1,500 gallons
Polymer Solution Feed Pump Type	Progressing Cavity
Polymer Solution Feed Pump Capacity	60 gph @ 30 psi
Polymer Solution Feed Pump Size	0.5 hp
Post-Dilution Rotameter Capacity	1.5-15 gpm

BIOSOLIDS DEWATERING

Digested sludge is dewatered by a solid bowl centrifuge. The digested sludge is normally pumped from the Sludge Holding Tank to the dewatering centrifuge by the digested sludge pumps, but can also be pumped from either primary anaerobic digester. The dewatering centrifuge was designed and sized to concentrate solids from an approximate concentration of 3.6 percent to approximately 20-23 percent solids. Like the WAS thickening centrifuge, this centrifuge uses centrifugal forces to accumulate the solids along the walls of a spinning conical bowl, where solids are then collected and transported to the discharge end of the centrifuge by a helical scroll conveyor. Polymer feed points are installed at two locations on the sludge feed piping to the centrifuge for performance optimization. The role of polymer addition was discussed in the preceding section.

Dewatered biosolids are then discharged through a chute and conveyed to the inlet hoppers of the dewatered sludge cake pumps for discharge to sludge haul trucks. With adjustments to valve positions and operation modes, the dewatering centrifuge can be used to thicken waste activated sludge in the event that the thickening centrifuge is out of service.

Table 8-23 summarizes the equipment data for the dewatering centrifuge.

TABLE 8-23

Dewatering Centrifuge Equipment Data

Parameter	Equipment Data
Dewatering Centrifuge Equipment Data	
Quantity	1
Type	Bowl
Influent Flow Rate	150 gpm
Design Solids Feed Concentration	3.6%
Design Discharge Solids Concentration	20-23%
Solids Processing Rate	2,500 lbs/hr
Polymer dosage	20 – 30 lb/dry ton
Working bowl speed	3,000 rpm
Maximum bowl speed	3,200 rpm
Main drive horsepower	100 hp
Back drive horsepower	20 hp

Biosolids Dewatering Performance

Figures 8-9 and 8-10 present dewatered cake solids concentrations and total monthly wet tons of dewatered sludge processed, respectively. The dewatering centrifuge has produced relatively consistent dewatered cake concentrations, as shown in Figure 8-9. However, the average dewatered cake solids concentration for the period from 2013 through 2021was 16.6 percent, which is well below the target range of 20-23 percent. One factor that likely contributes to the lower apparent cake concentration to the need to inject polymer downstream of the dewatered sludge cake pumps to reduce friction in the conveyance piping. As a result, the samples collected and represented in Figure 8-9 likely reflect dewatered sludge that has been partially diluted by polymer. The need for polymer injection for dewatered cake pumping is described in more detail in the following section. During the same period, an average of 165 wet tons of dewatered cake was produced per month, but there is no discernable trend, as evidenced by the data depicted in Figure 8-10.

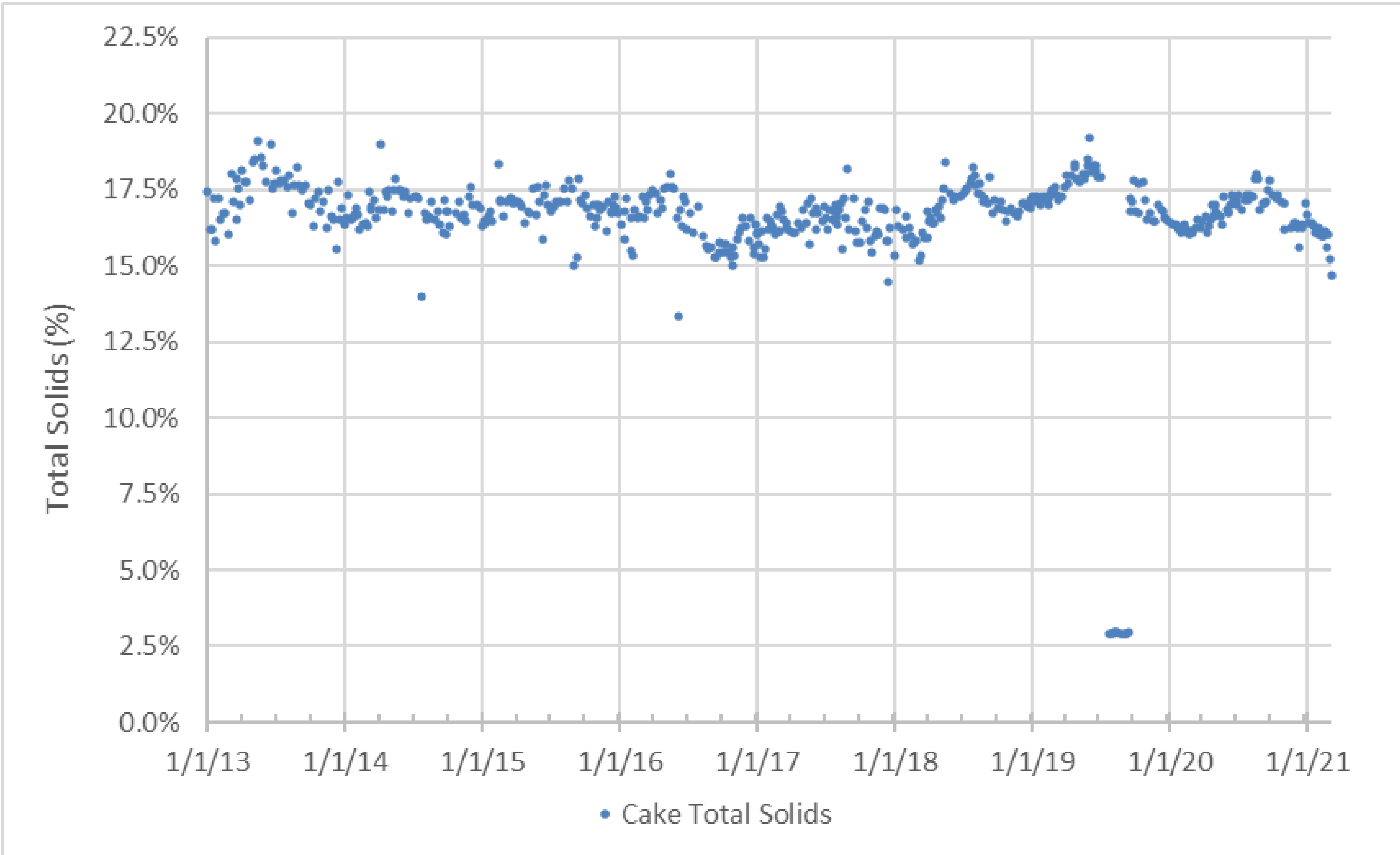


FIGURE 8-9

Dewatered Cake Solids Concentrations (2013-2020)

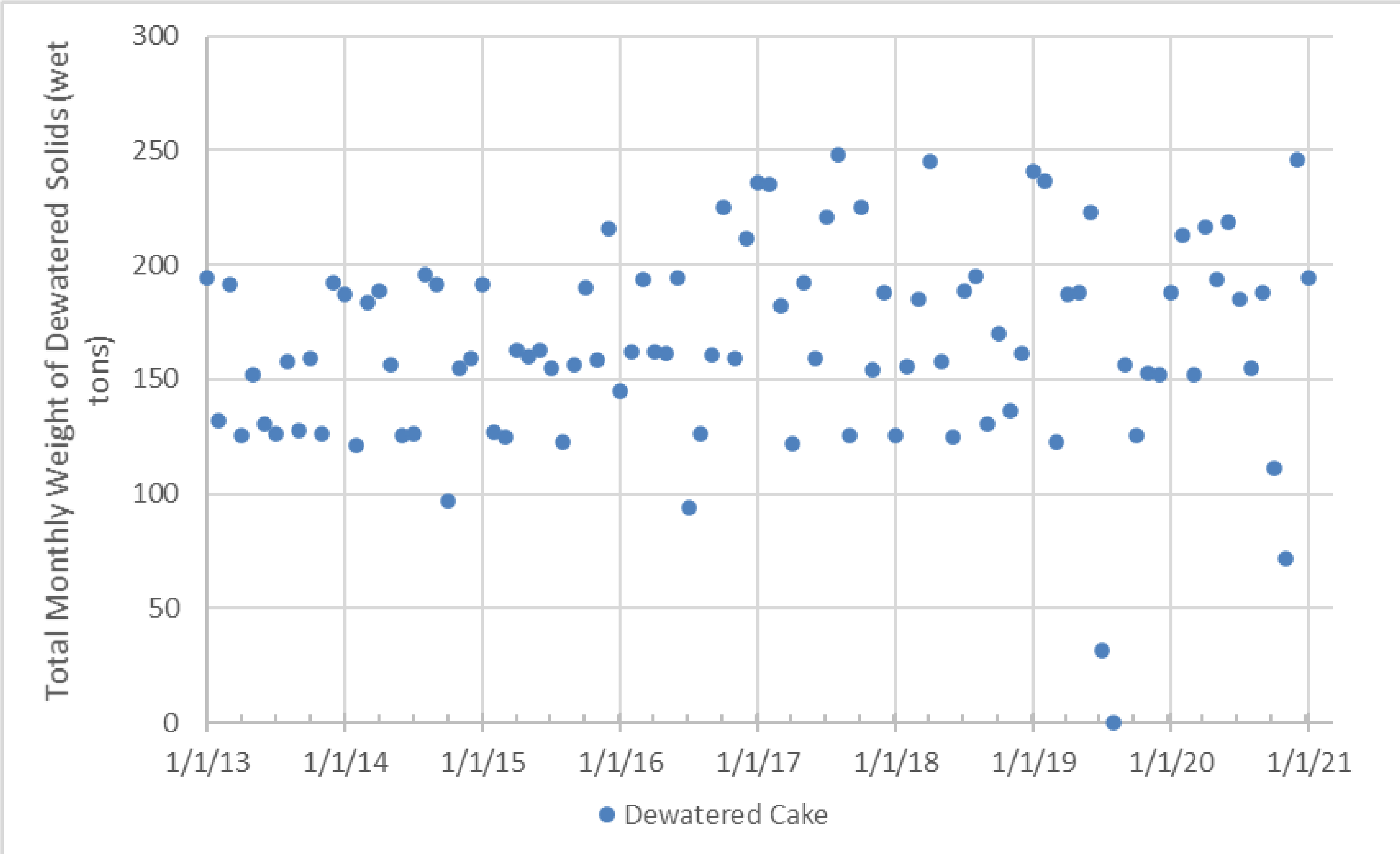


FIGURE 8-10

Monthly Dewatered Cake Solids Production (2013-2020)

Biosolids Dewatering Condition

Similar to the thickening centrifuge, the dewatering centrifuge has an expected service life of between 20 and 25 years. Therefore, it may be necessary to replace the centrifuge about 10 years into the planning period (2031). Because the dewatering centrifuge operates for fewer hours than the thickening centrifuge on average, it is likely that the dewatering centrifuge does not need to be replaced as soon as the thickening centrifuge.

DEWATERED BIOSOLIDS CONVEYANCE AND SLUDGE HAUL TRUCK LOADING

Conveying dewatered biosolids from the discharge of the dewatering centrifuge to sludge haul trucks involves both a shaftless screw conveyor and two dewatered sludge cake pumps. Dewatered cake from the centrifuge first drops into a 21-foot long, horizontal,, shaftless screw conveyor that transports dewatered sludge from the centrifuge discharge chute to either of the dewatered cake pump inlet hoppers. The Dewatered Sludge Cake Pumps then transfer the sludge from the dewatered cake hopper to the one of three discharge points in the sludge truck loading bay. Polymer lubrication pumps inject polymer solution through an injection into the dewatered cake pump discharge piping, which effectively provides a thin layer of polymer between the dewatered cake and the wall of the piping, reducing friction between the dewatering cake and the pipe wall and maintaining a discharge pressure that is within the acceptable range.

The sludge truck loading bay is a partially enclosed, odor-controlled structure that includes three discharge points for dewatered sludge, allowing even distribution of sludge into the sludge haul truck. Each of the discharge points is equipped with a motor-operated ball valve that is used to control the distribution of dewatered cake.

Table 8-24 summarizes equipment data for the dewatered biosolids conveyance and pumping equipment.

TABLE 8-24

Dewatered Biosolids Conveyance and Pumping Equipment Data

Parameter	**Equipment Data**
Dewatered Sludge Conveyor	
Type	Shaftless Screw
Spiral Diameter	14 inches
Transport Length	21 feet, 7 inches
Conveyor Incline	0^{o} (Horizontal)
Conveyor Operating Speed	28 rpm
Transport Rate	500 ft^3/hr
Motor Size	5 hp
Motor Speed	1,750 rpm

TABLE 8-24 – (continued)

Dewatered Biosolids Conveyance and Pumping Equipment Data

Parameter	Equipment Data
Dewatered Sludge Pumps	
Quantity	2
Type	Progressing Cavity
Capacity	25 gpm @ 300 psi
Motor	30 hp
Polymer Lubrication Pumps	
Quantity	2
Type	Progressing Cavity
Capacity	5 gpm @ 300 psi
Motor	5 hp

Dewatered Biosolids Conveyance and Sludge Haul Truck Loading Condition

During the development of the Plan, WWTF staff were in the process of replacing wear parts and repairing the dewatered sludge pumps. Continued overhaul and repair of the equipment in this system is expected to allow the equipment to function through the planning period.

ALTERNATIVE EVALUATION AND RECOMMENDED IMPROVEMENTS

This section provides an evaluation of alternatives for future biosolids management and recommends improvements to address the deficiencies identified in this chapter. Where applicable, alternatives are evaluated in terms of capital cost, annual operation and maintenance cost, east of operations and maintenance, reliability, and complexity. Recommended improvements are presented at a planning level, including preliminary layout, sizing, and general design criteria. The following sections provide the recommended improvements with planning-level cost estimates to create an improvement plan for the WWTF with the exception of mainstream treatment processes, facility support systems, and water reuse considerations, as these are discussed in Chapter 7 and Appendix L. In addition, these improvements do not include routine equipment repair/replacement, such as the needed replacement of the rotors and stators on the dewatered cake pumps and other progressing cavity pumps.

BIOSOLIDS ALTERNATIVES ANALYSIS

The following alternatives analysis compares the continued production and hauling of Class B biosolids with the potential production of Class A biosolids. The alternatives are sized based on the projected the maximum month dewatered cake production at the end of the planning period, which is 5,840 wet tons per year or 5,340 dry lb per day. The annual costs needed for the net present worth determination in this analysis were calculated based on 4,570 wet tons per year, which represents the estimated average dewatered cake production at the middle of the planning period.

Alternative 1 – Class A Biosolids Production

Preliminary Screening of Class A Biosolids Technologies

Preliminary screening of Class A biosolids technologies ensures that the most suitable method for Class A biosolids production is used for comparison. As detailed in WAC 173-308-170, biosolids may be treated using lime stabilization, composting, or thermal drying to meet Class A pathogen reduction criteria. These technologies are briefly described and preliminarily screened on the basis of feasibility for this application.

Lime Stabilization – Class A biosolids may be produced through a combination of lime stabilization and heat pasteurization. Both steps in the process create inhospitable conditions for pathogenic organisms. However, lime stabilization is typically more suitable for aerobically digested sludge than anaerobically digested sludge. The ammonia concentration in anaerobically digested sludge is quite high, whereas with aerobic digestion the ammonia is typically fully nitrified resulting in very low ammonia concentrations. This is problematic for lime stabilization of anaerobically digested sludge because the ammonia will volatilize under high pH conditions (pH greater than 10 to 11). As a result, gaseous ammonia would be released creating foul odors. The nitrogen content of the biosolids will also be reduced, lowering the fertilizer value. Malodorous conditions would be exacerbated by the pasteurization of the biosolids, which causes further decomposition of proteins and volatilization of ammonia as well as reduced sulfur compounds. Adapting lime stabilization for this application would require a sophisticated and costly odor control system that is prohibitive, as well as necessitate finding users that are comfortable with the odors. Consequently, this alternative is not recommended for further consideration.

Composting – Class A biosolids can be produced through composting by allowing aerobic microbes to promote decomposition of organics and generation of heat to reduce pathogens. For this application, composting is not expected to be feasible. Due to the reduction of organic carbon through anaerobic digestion, there is not enough organic material remaining to provide enough biological activity to generate heat during the composting process. For this reason, composting of anaerobically digested sludge at the WWTF is likely not feasible.

Thermal Drying – The time and temperature requirements for Class A biosolids are accomplished by thermal drying, as the process uses heat to evaporate dewatered sludge until it is in excess of 90 percent dry solids by weight. There are several options to consider in selecting dryers:

- Operational mode (batch vs. continuous)
- Conveyance/mixing means (e.g., paddle, belt, drum, fluidized bed)
- Convective (direct) versus conductive (indirect). Convective dryers include a vessel or conveyance in which the wet solids are directly exposed to a stream of hot air or gas. In conductive dryers, the heating process is separate from the drying process. In the conductive heat-transfer process, the solids are dried by contact with the heated metal.

Indirect, continuous flow, paddle dryers were chosen for this analysis because of the opportunity for a small footprint relative to direct dryers. An indirect dryer applies heat to an oil, water, or steam medium that is passed in a closed loop through discs or paddles in a sludge heater. Heating the paddles requires a boiler to support the closed loop for the heated medium. At the scale of biosolids production at the WWTF, it would be reasonable to run the system continuously while periodically attended by an operator.

Given that neither composting nor lime stabilization are considered feasible alternatives, thermal drying is the preferred Class A treatment alternative. Several treatment plants in Washington State successfully combine anaerobic digestion and thermal drying, including those at the Cities of Camas, Sumner, and Burlington. A generic process flow diagram for a paddle dryer system is provided below.

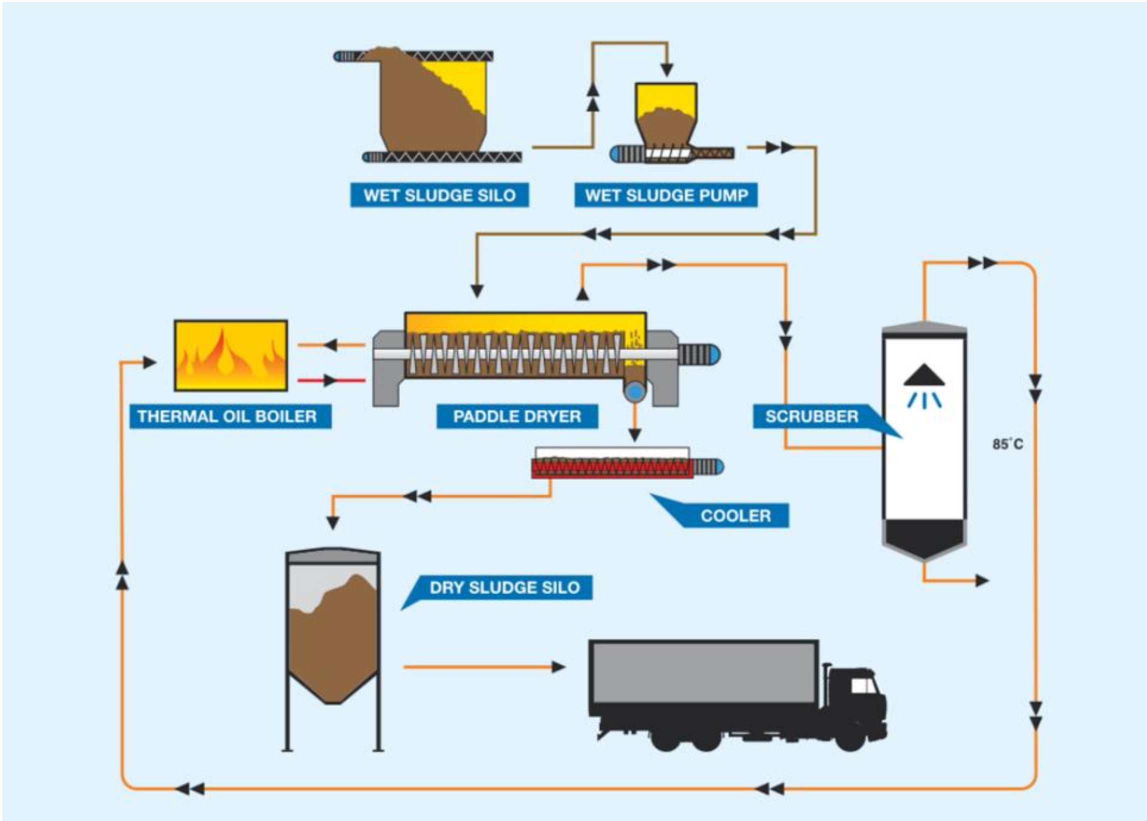


FIGURE 8-11

Process Flow Diagram of Komline-Sanderson Paddle Dryer

<u>Preferred Class A Biosolids Alternative – Thermal Drying</u>

As introduced above, thermal drying is a process capable of achieving the pathogen reduction required to produce Class A biosolids. With this alternative, biosolids are expected to be heated above 80 degrees C to meet Class A requirements. In addition, thermal drying must reduce the moisture content of the solids to 10 percent or less, meaning the solids concentration of the final product must be 90 percent or greater. Finally, the final product must also have a fecal coliform concentration of less than 1,000 MPN per gram total solids, or a Salmonella concentration of less than 3 MPN per 4 grams of total solids. Both of these requirements are attainable through the pasteurization provided by the heat applied to the biosolids in thermal drying.

For this application, the paddle dryer system would consist of a wet cake hopper where dewatered sludge cake would be collected and then pumped into the paddle dryer by progressive cavity pumps. The paddle dryer must be supported by a thermal fluid heating system that is responsible for heating and pumping the fluid that heats the paddles in the dryer. For an application of this size, it is likely that the thermal fluid heating system would utilize natural gas as the energy source. The dryer would also be supported by an off-gas dryer that cools and condenses the off-gas, prior to receiving additional treatment in an odor control system. Biosolids that have passed through the paddle dryers would be discharged onto a specialized conveyor that also cools these solids. Given all of the equipment required for the paddle dryer system, an annex to the digester building would be necessary to house the system. The unused area northwest of the digester building appears suitable for the annex, as shown in Figure 8-12. Finally, it is assumed for this analysis that all Class A biosolids would be given away to the public. Regional examples of this model for Class A biosolids distribution include the Cities of Sumner and Burlington. The City of Burlington also provides their Class A biosolids to the local dike district to be used as a field fertilizer. To provide public access to the finished Class A Biosolids, the WWTF would need to develop an area for users to pick up composted solids. For this, it is proposed that an area within the property line and along Sunnyside Blvd. would be developed with a covered dried biosolids storage area that is roughly 48 feet by 48 feet and a separate small canopy or shed to provide public access to dried biosolids.

Assuming demand for the biosolids is developed, the production of Class A biosolids and its availability for public use effectively removes the cost of hauling biosolids offsite. However, the additional treatment also increases operational and maintenance costs, including power, natural gas, regular repair, and labor. Based on preliminary estimates of operation, the additional power requirements would consist of an additional annual electricity consumption of about 128,000 kWh and annual natural gas consumption of about 6,450,000 cf. The estimated capital cost, annual operational and maintenance cost, as well as the resultant 20-year net present worth have been calculated based on the system described above. These costs are presented in Table 8-25.

TABLE 8-25

Alternative 1 – Class A Solids Thermal Drying System Cost Estimates

Improvement Project	Estimated Value
Thermal Drying System Preliminary Capital Cost	$12,048,000
Thermal Drying System Preliminary Annual O&M Cost[(1)]	$273,300
Thermal Drying System 20-Year Net Present Worth[(2)]	$15,346,000

(1) Costs in addition to existing dewatered digested sludge production in 2021 dollars.
(2) Assumed 3 percent inflation rate and 6 percent discount rate.

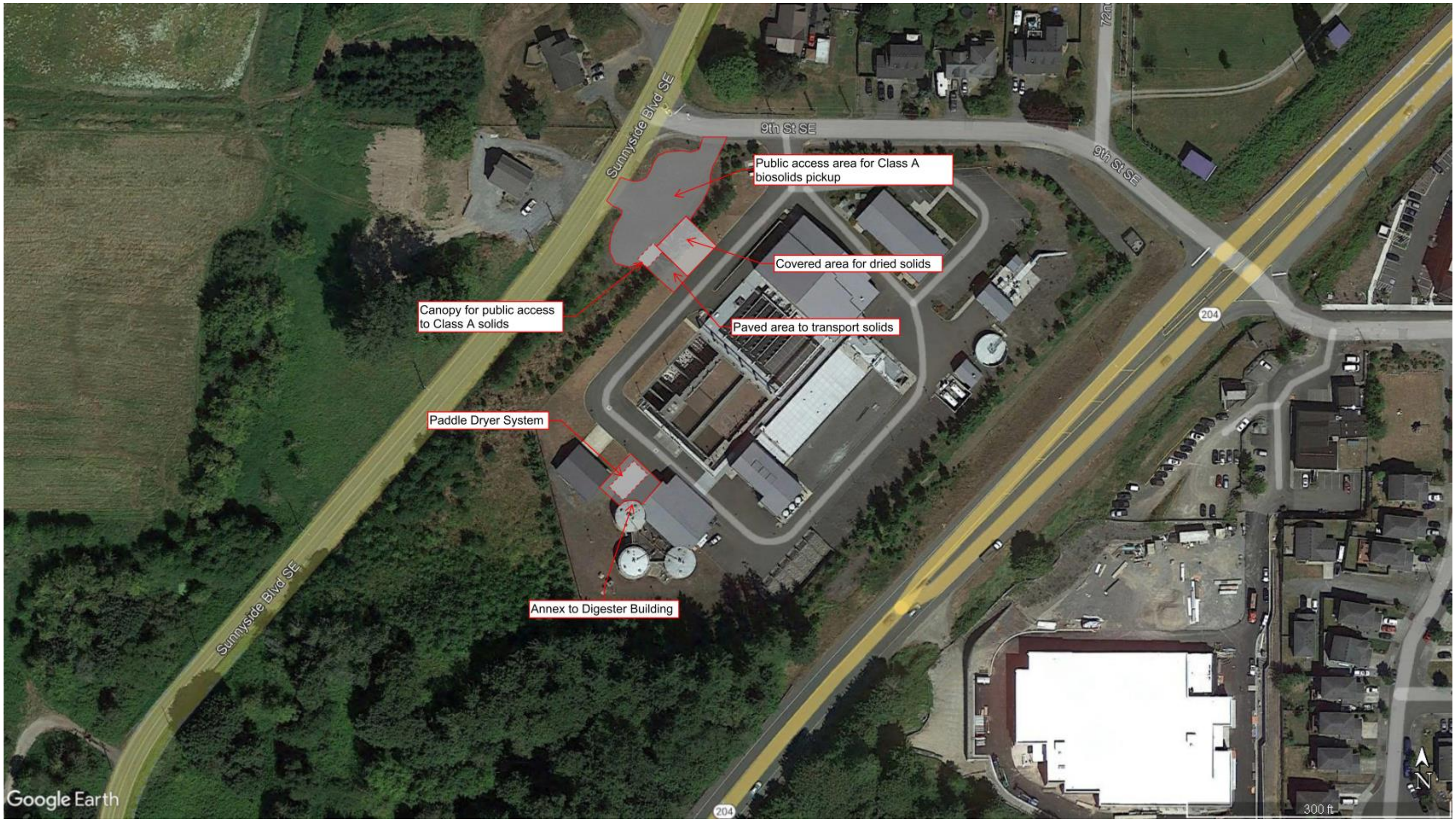


FIGURE 8-12

Alternative 1 Class A Thermal Drying Preliminary Layout

Alternative 2 – Class B Biosolids Production

Class B biosolids production would consist of continued hauling of dewatered anaerobically digested sludge. There are no capital costs associated with continuing this operation. Regarding operation and maintenance costs, the continued production of Class B biosolids would require of the ongoing costs of contracted biosolids hauling, which a Class A alternative would not, assuming public demand is developed. The existing cost of hauling Class B biosolids is approximately $58 per wet ton. This figure was used to calculate the annual costs for this alternative. Relative to Alternative 1, there are no additional costs for labor, power, and consumables. The estimated capital cost, annual operational and maintenance cost, as well as the resultant 20-year net present worth have been calculated based on the above. These costs are presented in Table 8-26 below.

TABLE 8-26

Alternative 2 – Class B Continued Contracted Hauling Cost Estimates

Improvement Project	Estimated Value
Capital Cost	$0
Contracted Hauling Annual O&M Cost(1)	$249,400
Contracted Hauling 20-Year Net Present Worth(2)	$3,632,000

(1) Costs in addition to existing dewatered digested sludge production in 2021 dollars.
(2) Assumed 3 percent inflation rate and 6 percent discount rate.

Recommended Alternative – Biosolids Classification

Estimates of the costs associated with the alternatives show that continued production of Class B biosolids would result in lower costs by a significant margin. For Class B biosolids, there are no additional capital costs. In addition, there are lower annual costs. As a result, the 20-year net present worth ($3,632,000) is significantly lower than the preferred Class A alternative ($14,419,000). The dryer alternative not only has much higher capital costs, but also higher annual O&M costs, which is reflected in the 20-year net present worth comparison. There are additional non-monetary factors that might affect a decision on whether to continue with Class B biosolids or pursue Class A biosolids production.

The production of Class A biosolids would provide a benefit to the community. Thermally dried biosolids are considered desirable and would likely be welcomed by the residential, developer, and agricultural communities. In addition, the lack of hauling would provide some benefit the community directly neighboring the WWTF due to the lower traffic and noise from trucks. Though, some additional noise would be produced from the consistent moving of solids across the site. In addition, an on-site public distribution center would also increase vehicle traffic. Because of the costs associated with Class A biosolids production, higher sewer rates may further diminish the net benefit to the community.

For the District and WWTF staff, the production of Class A biosolids largely provides challenges. To produce Class A biosolids, the thermal dryer system would add on to existing biosolids management and treatment processes. This inherently increases the level of effort required from WWTF staff through the need for operator attention and periodic repair. Furthermore, the thermal dryer system and dried biosolids storage area would occupy currently unused WWTF footprint. Though projected flows, loads, and solids quantities are not expected to require major improvements that would require space, the thermal dryer system would occupy space that may be needed for other future purposes, such as nutrient removal.

Another qualitative factor in this analysis is the long-term reliability of Class B biosolids application. Currently, a limited number of sites in this region will accept Class B biosolids for permitted land application. If fewer sites can accept Class B biosolids for land application or further treatment, contracted hauling costs would likely increase. Thus, part of the benefit of pursuing Class A biosolids production would be relative independence from the uncertainties of contracted hauling costs.

The above discussion is quantified through a decision matrix in Table 8-27, which shows that the recommended alternative is continued contracted hauling of Class B biosolids. The 20-year net present worth of Class B biosolids production is significantly lower than that of Class A biosolids production. It is estimated that the annual costs of the Class A alternative prevent the realization of a payback period until the costs of Class B hauling increase at a rate significantly above inflation. Class B biosolids production is also recommended because this alternative maintains the District's flexibility with site footprint for improvements beyond this planning period due to the limited available footprint at the WWTF. Additionally, Class B biosolids production maintains the existing level of operation and maintenance for biosolids treatment and management. The combined benefits of continued Class B biosolids production outweigh the benefits of adding Class A biosolids treatment.

TABLE 8-27

Biosolids Classification Decision Matrix

Criteria	Weighting Factor	Alternative 1 - Class A Thermal Drying		Alternative 2 - Class B Contracted Hauling	
		Rating(1)	Score	Rating(1)	Score
Capital Cost	15	1	15	5	75
Lifecycle Cost	20	1	20	4	80
Community Benefit	20	3	60	1	20
Operability and Safety	15	2	30	4	60
Site Footprint	15	1	15	5	75
Future Flexibility	15	3	45	2	30
Total Score	**100**		**185**		**340**

(1) Five is the best rating and one is the worst rating.

RECOMMENDED IMPROVEMENTS

The following sections provide the recommended improvements organized in relative order of need based on projections for the WWTF and the resultant biosolids loads.

6-Year and 10-Year Interval Improvement Projects

As described in Chapter 7, as conversion to a fermenter-thickener presents potential benefits to the mainstream treatment process. The existing gravity thickener is expected to continue to adequately perform through the planning period regardless of the outcome of this study.

There are no other recommended solids treatment improvement projects within the 6-year and 10-year planning period. However, it is noted that equipment across the WWTF may require replacement within the planning period. As detailed in Chapter 7, the cost of replacing the major components of the treatment process can begin to represent a substantial portion of costs within the planning period, and these costs may arrive within the first 10 years of the period.

20-Year Interval and Buildout Improvement Projects

For projected flows between 2031 and 2041, increased WAS production due to efforts to increase denitrification, as discussed in Chapter 7, will increase operation of the centrifuge system for WAS thickening. However, through buildout, there is no projected need for improvements to the biosolids management and treatment process based on either capacity or existing or anticipated regulations.

<u>Waste Activated Sludge Thickening Improvements</u>

Towards the end of the 20-year planning period, projected increases in WAS loads to the thickening centrifuge will begin to necessitate split shifts or additional days of centrifuge operation, as loads exceed what can be processed within an 8-hour shift for 5 days of operation per week. Notably, both the WAS thickening and dewatering centrifuges may reach the end of service life during this planning period. Both units could then undergo replacement or significant overhaul. After this effort, it is possible to continue using the WAS thickening centrifuge within the planning period and run this equipment beyond the original design runtime by splitting shifts on the requisite daily thickening operation or extending weekly centrifuge operation to 7 days per week. However, a potential alternative that could reduce the operation and maintenance associated with the thickening process would involve adding a rotary drum thickening (RDT) system. Anecdotal reports from WWTF staff suggest that sludge filterability has improved as a result of the pilot testing of the magnesium hydroxide alkalinity addition system. This would open an RDT as a potentially viable and preferable option for WAS thickening. In the past, the poor mixed liquor floc-structure would not have proved challenging for an RDT and initial bench testing indicated that thickened sludge concentrations above about

3.5 percent would be difficult to achieve. However, if the characteristics of the mixed liquor have changed and remain consistently better over time, thickened waste activated sludge concentrations in the 6 to 6.5 percent range would make an RDT a viable alternative to a centrifuge for waste activated sludge thickening. The benefit of an RDT system is that it can be run nearly 24 hours a day with significantly less operator attention. RDTs are also significantly more energy efficient when compared to a centrifuge. However, it is important to note that this option is entirely contingent upon the characteristics of the mixed liquor. Additional testing should be conducted after installation of the new alkalinity addition and demonstration of sustained improvement in sludge filterability.

After verification of viability through sludge testing, an RDT system could be installed in the basement level of the Digester Building. Originally, a portion of the Digester Building basement was allocated for installation of the equipment associated with a third anaerobic digester. As the anerobic digestion system appears to have sufficient capacity through buildout, this space may no longer need to be reserved for an additional digester heating and recirculation equipment. As such, the basement of the Digester Building would provide a convenient location for the installation of an RDT system to thicken WAS. In order to install an RDT in this location, the unit would need to be disassembled to allow it to fit through the access hatch to the basement level. Figure 8-13 depicts an RDT system from FKC Co., LTD (which is known as a rotary screen thickener or “RST” under their terminology) to illustrate the need to partially disassemble the system. The general design criteria for such a system and its associated cost are presented below. For the cost estimate, it is assumed that the existing thickening polymer system may be used for this application and only the polymer injection location would be modified.

Tables 8-28 and 8-29 summarize design criteria and estimated project costs for the WAS Thickening Rotary Drum Thickener System.

TABLE 8-28

WAS Thickening Rotary Drum Thickener System Design Criteria

Parameter	Equipment Data
WAS Thickening Rotary Drum Thickener	
Quantity	1
Hydraulic Capacity	150 gpm
Solids Feed Concentration	5,450 mg/L
Estimated Polymer Dosage	8-12 per ton of sludge
Drive Motor	2 hp
Flocculation Tank Size	285 gallon
Flocculation Tank Mixer Motor	1.5 hp
Target Discharge Concentration	4.5% - 6%
Minimum Solids Capture Rate	95%

TABLE 8-28 – (continued)

WAS Thickening Rotary Drum Thickener System Design Criteria

Parameter	Equipment Data
Thickened Waste Activated Sludge Pumps	
Quantity	2
Type	Progressing Cavity
Capacity, each	50 gpm @ 60 psi
Motor	10 hp

TABLE 8-29

WAS Thickening Rotary Drum Thickener Project Cost Estimate

Improvement Project	Estimated Cost
WAS Thickening Rotary Drum Thickening System	$669,000

FIGURE 8-13

Rotary Drum Thickening System from FKC Co., Ltd.

Because the existing WAS centrifuge system was designed to serve as a redundant dewatering centrifuge, the project described above can be designed such that the existing centrifuge remains in place and continues to serve as a redundant unit for both the thickening and dewatering systems.

Overview of Improvement Projects

Recommended improvements to the biosolids management and treatment process are organized in the preliminary site layout in Figure 8-14.

AREA IDENTIFICATION

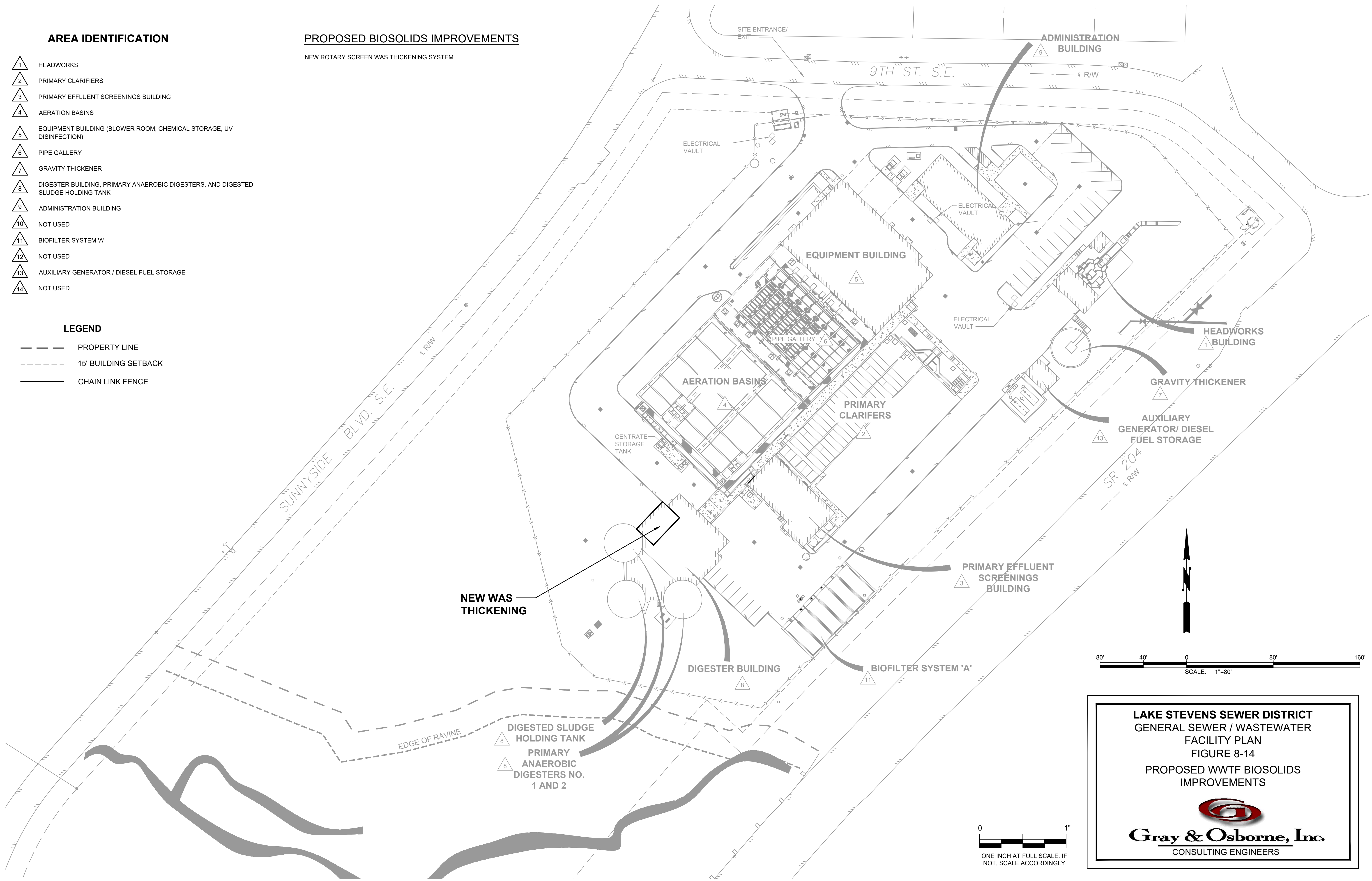
1. HEADWORKS
2. PRIMARY CLARIFIERS
3. PRIMARY EFFLUENT SCREENINGS BUILDING
4. AERATION BASINS
5. EQUIPMENT BUILDING (BLOWER ROOM, CHEMICAL STORAGE, UV DISINFECTION)
6. PIPE GALLERY
7. GRAVITY THICKENER
8. DIGESTER BUILDING, PRIMARY ANAEROBIC DIGESTERS, AND DIGESTED SLUDGE HOLDING TANK
9. ADMINISTRATION BUILDING
10. NOT USED
11. BIOFILTER SYSTEM 'A'
12. NOT USED
13. AUXILIARY GENERATOR / DIESEL FUEL STORAGE
14. NOT USED

LEGEND

- — — PROPERTY LINE
- - - - - 15' BUILDING SETBACK
- ——— CHAIN LINK FENCE

PROPOSED BIOSOLIDS IMPROVEMENTS

NEW ROTARY SCREEN WAS THICKENING SYSTEM



LAKE STEVENS SEWER DISTRICT
GENERAL SEWER / WASTEWATER FACILITY PLAN
FIGURE 8-14
PROPOSED WWTF BIOSOLIDS IMPROVEMENTS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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CHAPTER 9

CAPITAL IMPROVEMENT PLAN AND FINANCIAL ANALYSIS

INTRODUCTION

This chapter summarizes the Lake Stevens Sewer District's Capital Improvement Plan (CIP) and provides a financial program that supports the completion of the recommended capital improvements while continuing to fund ongoing operation and maintenance.

CAPITAL IMPROVEMENT PLAN

Wastewater capital improvements have been identified and prioritized based on hydraulic analyses of the District's collection system and treatment plant, regulatory requirements, a condition assessment, operation and maintenance considerations, system benefit, and costs. For all proposed projects identified in this chapter, detailed preliminary project cost estimates are presented in Appendix F. Figures illustrating the conceptual locations of the proposed improvement projects are included in Chapters 6 (for the collection system) and 8 (for the WWTF).

Other capital improvement projects may arise in the future that are not identified as part of the District's CIP presented in this chapter. Such projects may be deemed necessary for remedying an emergency situation, assessing growth in other areas, accommodating improvements proposed by other agencies or land development, or addressing unforeseen problems with the District's wastewater system. Due to budgetary constraints and/or addressing growth scenarios that differ from that which was modeled in this Plan, the construction of these projects may require changes in the proposed completion date for projects in the CIP. When new information becomes available, the Plan should remain flexible to allow rescheduling, addition to, or deletion of proposed projects or to expand or reduce the scope of the projects, as best determined by the District. Additionally, future planning efforts may affect land use zoning and service requirements within the District. Developments may create streets or provide alignments and locations of facilities that are different than shown on the Plan. Each capital improvement project should be reevaluated to consider the most recent planning efforts as the proposed completion date for the project approaches.

PROPOSED SYSTEM IMPROVEMENTS

The proposed system improvements in the CIP are shown below in Tables 9-1. Each project cost estimate includes sales tax, construction contingency, and design, engineering, and permitting. All project costs are based on 2021 dollars and the date and Engineering New Record Construction Cost Index (ENR CCI) is listed in each detailed estimate. This allows a benchmark for adjustments to be made for inflation in future years.

TABLE 9-1

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contribution	Description
Years 1-6 (2022-2027)						
Gravity Sewer System Repair and Replacement			Annual	$1,500,000	$1,500,000	Replace 2,300 LF of pipe and 13 MHs annually. 20 percent of MHs and 15 percent pipes over 40 years old over 10 year CIP
Anoxic Zone Wall Improvements	WWTF	Capital	2022	$6,000	$6,000	Raise Anoxic Zone Walls to prevent short-circuiting
New LS 23 and FM	H5	Donated	2021 (Completed)	$1,580,000	$ -	Construct 401 gpm LS and 2,150 LF 6" FM
TIN Optimization Report	WWTF	Capital	2022	$30,000	$30,000	WWTF Process Performance Assessment and Initial Selection of Optimization Strategy per requirements of Nutrient Permit – currently due in March 2023
Backpulse Pipe Replacement	WWTF	Capital	2022 (Completed)	$25,000	$25,000	Replace corroded membrane backpulse water pipe sections
20th St NE and Bus. Loop Rd to LS 2C	E2-B	Capital	2022	$1,150,000	$1,150,000	Replace 1,560 LF 10" with 15" gravity
Sewer System Comprehensive Plan/Facility Plan Update	Comp	Capital	2022	$345,000	$345,000	Evaluate existing WWTF in context of actual operation data to support increased capacity within same footprint
SR 9 Gravity Crossing	G7-B	Capital	2022 (Under Construction)	$500,000	$500,000	Extend 8" gravity sewer in 16" casing across SR 9 to allow gravity sewer service from Basin C2-2 to Basin G1-8 and to proposed LS G1
LS 2C Upgrade	E2-A	Capital	2022	$2,700,000	$2,700,000	Upgrade LS 2C from 700 gpm to 1,250 gpm
LS 2C Force Main	E2-C	Capital	2022	$2,730,000	$2,730,000	Construct 3,800 LF 10" FM; bypass LS 1C via existing 8" PVC FM
LS 5C Decommission and LSs 4C and 6C Rehabilitation	E4	Capital	2022	$1,710,000	$1,710,000	Construct up to 641 LF 8" to LS 4C and decommision LS 5C; Rehab of LS 6C

TABLE 9-1 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contribution	Description
LS 8C Upgrade and Rehabilitation	D6	Donated	2022	$1,040,000	$ -	Increase Capacity from 600 to 1,050 gpm; Includes Replacing 360 LF of 8" FM with 10" FM
Lift Station 11 Rehabilitation	G4	Capital	2022	$590,000	$590,000	Lift Station Rehabilitation per general condition assessment - LS 11
New LS G7 and FM	G7-A	Donated	2022 (Under Construction)	$1,410,000	$ -	Construct 140 gpm LS and 1,300 LF 4" FM
Process Blower Enclosure Cooling	WWTF	Capital	2022	$87,200	$87,200	Repair and improve Blower Room HVAC
Mixed Liquor Alkalinity Addition System Improvements	WWTF	Capital	2022	$130,300	$130,300	Install magnesium hydroxide/calcium carbonate storage and dosage system
Carbon Addition System	WWTF	Capital	2022	$231,100	$231,100	Pilot and install supplemental COD addition storage and dosage system
District Office Upgrades - Generator	VBC-A	Capital	2022	$250,000	$250,000	Install Emergency Generator and Electrical system upgrade to District office
WWTF Membrane Replacement	WWTF	Capital	2023	$3,858,000	$3,858,000	Replace WWTF membranes per Manufacturer's Recommendations - Paid $482,250 annualy 2023 - 2030
LS 1C Rehabilitation	E1-A	Capital	2023	$740,000	$740,000	Rehabilitate existing structures and pumping, electrical, contol and instrumentation systems, including repalcement generator. Increase capacity to 821 gpm
Lift Station 3C Rehabilitation	E7	Capital	2023	$550,000	$550,000	Lift Station Rehabilitation per general condition assessment - LS 3C
Centennial Townhomes DEA	E5-A	Donated	2023	$340,000	$ -	Construct 400 LF 10" gravity
LS 1 Rehabilitation	B2	Capital	2024	$779,000	$779,000	Rehabilitate LS 1 to increase capacity to 100 gpm and add Generator

TABLE 9-1 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contribution	Description
Lift Station 6 Rehabilitation	D5	Capital	2024	$793,000	$793,000	Lift Station Rehabilitation per general condition assessment - LS 6
New LS H8 and FM	H8	75% Donated/ 25% Capital	2024	$1,790,000	$447,500	Construct 140 gpm LS and 1,200 LF 4" FM; Hisey Project
New Gravity Line - Industrial Area	D7-A	Capital	2024	$520,000	$520,000	Construct 840 LF 8" Grav in Easement Area in NE Corner of UGA
District Office Upgrades - 2nd Floor	VBC-B	Capital	2024	$250,000	$250,000	Allowance for upgrade of District office including accessibility improvements and 2nd Floor Remodel - full scope and budget to be determined
Nutrient Reduction Evaluation	WWTF	Capital	2025	$200,000	$200,000	Evaluate alternatives to meet 3 mg/L TIN per requirements of Nutrient Permit
131st Avenue NE	E5-B	Capital	2025	$1,020,000	$1,020,000	Construct 1,400 LF 8" gravity
Lift Station 4 Rehabilitation	D3	Capital	2025	$902,000	$902,000	Lift Station Rehabilitation per general condition assessment - LS 4
Lift Station 3 Rehabilitation	D4	Capital	2025	$624,000	$624,000	Lift Station Rehabilitation per general condition assessment - LS 3
Lift Station 2 Rehabilitation	B4	Capital	2026	$780,000	$780,000	Lift Station Rehabilitation per general condition assessment - LS 2
New Gravity Line - Industrial Area	D7-B	Capital	2026	$970,000	$970,000	Construct 3,160 LF 8" gravity in Easement Area in NE Corner of UGA
LS 9 Decommissioning	H7	Capital	2026	$180,000	$180,000	Construct 170 LF 8" gravity
Vactor and CCTV Truck Replacement		Capital	2027	$650,000	$650,000	Replace existing vactor and CCTV equipment at end of useful life
New LS E8 and FM	E8-A	Capital	2027	$2,360,000	$2,360,000	Construct 140 gpm LS and 3,800 LF 4" FM
Basin E8 Collection System (North Machias Road)	E8-B	Capital	2027	$2,200,000	$2,200,000	Construct 4,000 LF 8" gravity
New LS E9 and FM	E9-A	Capital	2027	$1,710,000	$1,710,000	Construct 140 gpm LS and 1,700 LF 4" FM

TABLE 9-1 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contribution	Description
26th, 27th and 28th Places NE	E9-B	Capital	2027	$1,590,000	$1,590,000	Construct 2,650 LF 8" gravity
New LS C4 and FM	C4	75% Donated/ 25% Capital	2027	$1,340,000	$335,000	Construct 140 gpm LS and 900 LF 4" FM
Lift Station 7 Rehabilitation and Upgrade	H3-A	50% Donated/ 50% Capital	2027	$752,000	$376,000	Lift Station Rehabilitation per general condition assessment - LS 7 and Increase capacity to 310 gpm
Years 7-10 (2028-2031)						
Comprehensive Plan Update		Capital	2028	$200,000	$200,000	Full 6-year update to Comprehensive Sewer Plan
Mitchell Road Main Replacement	E1-B	Capital	2028	$560,000	$560,000	Replace 444 LF 8" with 12" gravity
97th Drive SE and 99th Avenue SE	G7-C	Capital	2028	$1,490,000	$1,490,000	Construct 1,150 LS 8" gravity
Lift Station 8 Rehabilitation	H2	Capital	2028	$554,000	$554,000	Lift Station Rehabilitation per general condition assessment - LS 8 and Increase capacity to 866 gpm
LS 15 Upgrade and Rehabilitation	D1-A	Capital	2028	$1,033,000	$1,033,000	Increase capacity to 5,430 gpm and rehabilitate per condition assessment. 10- to 20-Year CIP
LS 2C FM Extension	E2-E	Donated	2028	$1,680,000	$ -	Construct 4,700 LF 10" FM from LS 1C to MH 701. Replaces 50 Year Old FM.
Hartford Road	D7-C	Capital	2029	$280,000	$280,000	Construct 450 LF 8" gravity
Dosing Station Reconstruction	A4	Capital	2029	$1,080,000	$1,080,000	Modernize Dosing Station, Upgrade commication system and improve pipeline access
WAS Thickener	WWTF	Capital	2030	$668,800	$668,800	Install WAS rotary drum thickener system in Digester Building
UV System Addition	WWTF	Capital	2030	$986,000	$986,000	Install additional UV banks to existing UV channel.

TABLE 9-1 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contribution	Description
Lift Station 12 Rehabilitation	B3	Capital	2030	$760,000	$760,000	Lift Station Rehabilitation per general condition assessment - LS 12
New LS E10 and FM	E10	75% Donated/ 25% Capital	2030	$1,600,000	$400,000	Construct 140 gpm LS and 1,300 LF 4" FM
New LS G6 and FM	G6	75% Donated/ 25% Capital	2030	$1,390,000	$347,500	Construct 140 gpm LS and 1,050 LF 4" FM
Lift Station 5 Rehabilitation and Upgrade	D2	Capital	2031	$536,000	$536,000	Lift Station Rehabilitation per general condition assessment and upgrade to 880 gpm
Lift Station 14 Rehabilitation	B5	Capital	2031	$386,000	$386,000	Lift Station Rehabilitation per general condition assessment - LS 14
Lift Station 10 Rehabilitation	H6	Capital	2031	$585,000	$585,000	Rehabilitation of LS 10, Year 2031
Years 11-20 (2032-2041)						
Lift Station 20 Rehabilitation	A1	Capital	2032	$397,000	$397,000	Lift Station Rehabilitation per general condition assessment - LS 20
New LS C3 & FM	C3	75% Donated/ 25% Capital	2032	$1,560,000	$390,000	Construct 182 gpm LS and 1400 LF 4" FM
New LS C5 & FM	C5	75% Donated/ 25% Capital	2032	$1,730,000	$432,500	Construct 140 gpm LS and 1,250 LF 4" FM
Lift Station 16 Rehabilitation	A2	Capital	2033	$423,000	$423,000	Lift Station Rehabilitation per general condition assessment - LS 16
Lift Station 9C Rehabilitation	E6	Capital	2033	$401,000	$401,000	Lift Station Rehabilitation per general condition assessment - 9C
Purple Pennet and Nyden Farms Roads	H3-B	Capital	2034	$760,000	$760,000	Construct 1,050 LF 8" gravity
Lift Station 19 Rehabilitation	G2	Capital	2035	$465,000	$465,000	Lift Station Rehabilitation per general condition assessment - LS 19

TABLE 9-1 – (continued)

Capital Improvement Plan

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contribution	Description
New LS G3 and FM	G3	75% Donated/ 25% Capital	2035	$1,420,000	$355,000	Construct 140 gpm LS, 800 LF 4" FM
Lakeview Drive Sewers	D1-E	Donated	2035	$2,710,000	$ -	Construct 5,300 LF 8" gravity (ULID?)
Cedar Road Sewers - West Side	D1-B	Donated	2035	$1,130,000	$ -	Construct 1,550 LF 8" gravity (ULID?)
Cedar Road Sewers - East Side	D1-C	Donated	2035	$930,000	$ -	Construct 1,250 LF 8" gravity (ULID?)
Soper Hill Sewers	D1-D	Donated	2035	$1,980,000	$ -	Construct 2,800 LF 8" gravity
Decommission LS 18	C2-A	Capital	2035	$130,000	$130,000	Decommission LS 18 after Project C2-B
White Oaks Sewer Extension	C2-B	Donated	2035	$6,450,000	$ -	Construct 3,600 LF 10" gravity and 6,800 LF 8" gravity
Lift Station 21 Rehabilitation	H4	Capital	2035	$317,000	$317,000	Lift Station Rehabilitation per general condition assessment - LS 21
Lift Station 17 Rehabilitation	C1	Capital	2037	$456,000	$456,000	Lift Station Rehabilitation per general condition assessment - LS 17
Vernon Road West @ VRD	B1-A	Capital	2037	$1,280,000	$1,280,000	Replace 473 LF 24" with 30" gravity and 550 LF 24" with 36" gravity
Vernon Road West Trunk @ LS 15 Discharge	B1-C	Capital	2039	$1,040,000	$1,040,000	Replace 902 LF 21" gravity with 24" gravity
Lift Station 22 Rehabilitation	H1	Capital	2040	$453,000	$453,000	Rehabilitation of LS 22
91st Avenue SE	B1-B	Capital	2041	$1,370,000	$1,370,000	Replace 1,700 LF 8" with 12" gravity in 91st Avenue SE.

GENERAL FACILITY CHARGE

Under the authority of Section 57.08.005 (11), the District imposes a General Facilities Charge (GFC) on new development and redevelopment that results in a net increase in capacity requirements. The current GFC is $10,400 per equivalent residential unit (ERU).

The GFC intends to recover a proportionate share of the cost of system infrastructure from development, providing a source of funding for capital costs. In broad conceptual terms, the GFC is generally calculated by dividing an allocable "cost of the system" by the applicable ERU capacity of the system to arrive at a cost per unit of capacity. The key components of the GFC calculation are discussed in further detail below.

Existing Cost Basis

The GFC cost basis includes costs associated with existing assets to recognize that those assets will provide benefit to new customers. In addition, RCW 57.08.005 (11) allows the District to recover a provision for up to ten years of interest accrual on assets. Conceptually, this interest provision attempts to account for opportunity costs that the District's customers incurred by supporting investments in infrastructure rather than having the money available for investment or other uses. The existing cost basis is adjusted to:

- Include construction work in progress, reflecting infrastructure investments that the District has not yet booked as completed fixed assets.

- Include historical investments in the Southwest Interceptor (SWI). Though the District originally intended to fund the SWI through latecomer agreements, actual latecomer revenues have been inadequate to fully recover the cost.

- Exclude assets not funded by the District (e.g., ULIDs, developer extensions). This adjustment includes a deduction for latecomer fees that the District has received for the SWI as well as other basin charges.

- Deduct a provision for asset retirements. Because the CIP includes projects that involve replacing existing assets, the cost basis is reduced to account for the estimated value of the assets being replaced in order to avoid double charging customers for an asset and its replacement.

- Deduct outstanding debt principal net of available cash balances to recognize that new customers connecting to the District's system will pay for a proportionate share of the assets funded by District's currently outstanding debt as ratepayers.

Future Cost Basis

RCW 57.08.005 (11) allows the District to recover costs associated with future capital projects which plan to undertake within the next 10 years and are part of an adopted comprehensive plan. The future cost basis is generally based on the capital projects summarized in Table 9-1, but is adjusted to exclude projects that are anticipated to be funded by grants, developer extensions, ULIDs, or other outside sources. In addition, the updated costs of the District's comprehensive plan is also excluded, as Governmental Accounting Standards Board (GASB) Rule No. 51 states that intangible assets should not be capitalized unless attributable to a specific facility.

System Capacity

Table 5-12 indicates that the District's Wastewater Treatment Facility (WWTF) currently receives a maximum-month influent flow of 3.79 mgd. The District's maximum-month flow is projected to grow to 4.94 mgd over the next 20 years, representing relative growth of about 30 percent over existing flows. Customer records provided by the District indicate that the District currently serves approximately 13,794 ERUs, which with 30 percent growth would increase to a total of 17,980 ERUs.

The District's GFC calculation is based on an "average cost" methodology, which computes a charge per ERU by divding allocable costs by the applicable number of ERUs. Table 9-2 summarizes the updated sewer GFC calculation and shows that the District could adopt a maximum GFC of $13,687 per ERU, reflecting the addition of assets and accrual of interest on system assets since the District last reviewed its GFC calculation. With the passing of Resolution No. 1024 at its meeting on March 24, 2022, the District's Board of Commissioners adopted an updated GFC of $13,500 effective May 1, 2022.

TABLE 9-2

Updated Sewer GFC Calculation

GFC Calculation	
Existing Cost Basis ($1,000s)	
Capital Assets	$ 230,824
less: Donated Plant	(59,393)
plus: Construction Work In Progress	1,158
less: Provision for the Retirement of Existing Assets	(11,884)
plus: Interest Accrued on Utility Funded Assets	63,301
less: ULID Assessments	(19)
less: Latecomer Payments	(2,032)
less: Net Outstanding Debt Principal	(42,624)
Total Existing Cost Basis	**$ 179,332**
Future Cost Basis ($1,000s)	
Total Utility-Funded Capital Improvement Program (2021 Dollars)	$ 67,647
less: Non-Capitalizable Utility-Funded Projects	(893)
Total Future Cost Basis	**$ 66,755**
Total GFC Cost Basis ($1,000s)	**$ 246,086**
System Capacity (mgd)	
Design Capacity	4.94 mgd
Probable Existing Utilization	3.79 mgd
Percent of Capacity Available for Growth	**30.34%**
Existing ERUs as of Mid-Year 2021	13,794
Additional ERUs Capacity	4,186
Future Available Capacity (ERUs)	**17,980**
Total GFC Per ERU	**$ 13,687**
Existing GFC	*$ 10,400*
Difference	*$ 3,287*

FINANCIAL STATUS

HISTORICAL FINANCIAL OPERATIONS

Table 9-3 summarizes the District's resources and uses arising from cash transactions for the 5-year period spanning from 2016 to 2020.

TABLE 9-3

Summary of Historical Fund Resources and Uses Arising from Cash Transactions (in $1,000s)

	2016	2017	2018	2019	2020
Operating Revenue					
Utility Revenue	$ 12,731	$ 13,411	$ 13,710	$ 14,117	$ 14,464
Total Operating Revenue	**$ 12,731**	**$ 13,411**	**$ 13,710**	**$ 14,117**	**$ 14,464**
Operating Expenses					
General Operations	$ 3,959	$ 4,208	$ 4,136	$ 4,561	$ 4,770
Maintenance Expense	555	645	634	610	697
Depreciation Expense	6,050	6,122	6,231	6,344	6,549
Taxes	497	459	554	584	605
Total Operating Expenses	**$ 11,061**	**$ 11,435**	**$ 11,555**	**$ 12,099**	**$ 12,622**
Operating Income (Loss)	**$ 1,671**	**$ 1,977**	**$ 2,155**	**$ 2,018**	**$ 1,842**
Nonoperating Revenues (Expenses)					
Interest Revenue	$ 182	$ 289	$ 532	$ 725	$ 308
Interest on Long-Term Debt	(2,777)	(2,762)	(2,650)	(2,548)	(1,786)
Grant Revenue	-	45	-	-	-
Gain (Losses) on Insurance Claim	-	58	-	-	-
Gain (Losses) on Capital Asset Disposition	(1,211)	1	(23)	-	(1)
FOG Grant Expenditures	-	-	-	(6)	(9)
Reduction in STP #1 Remediation Costs Liability	-	-	-	881	-
Net Rental Income	21	20	28	28	29
Total Nonoperating Revenues (Expenses)	**$ (3,785)**	**$ (2,349)**	**$ (2,112)**	**$ (921)**	**$ (1,458)**
Income Before Capital Contributions	**$ (2,114)**	**$ (372)**	**$ 43**	**$ 1,097**	**$ 384**
Capital Contributions:					
Developer Donated Facility	$ 713	$ 3,044	$ 3,340	$ 3,233	$ 3,650
Connection Fees	3,171	1,070	3,389	3,461	2,945
SWI Phase II Basin Fee	-	144	263	215	355
Other Capital Revenue	-	-	265	83	82
Total Capital Contributions	**$ 3,884**	**$ 4,258**	**$ 7,257**	**$ 6,992**	**$ 7,033**
Change in Net Assets	$ 1,770	$ 3,886	$ 7,300	$ 8,089	$ 7,416
Total Net Assets at Beginning of Year	82,853	84,623	88,881	96,180	104,269
Prior Period Adjustment	-	372	-	-	-
Total Net Assets at End of Year	**$ 84,623**	**$ 88,881**	**$ 96,180**	**$ 104,269**	**$ 111,685**
Operating Coverage Ratio					
Excluding Depreciation	2.5	2.5	2.6	2.5	2.4
Including Depreciation	1.2	1.2	1.2	1.2	1.1
NOI Before Depreciation as % of Op. Revenue	60.6%	60.4%	61.2%	59.2%	58.0%

The District's operating revenue increased 13.6 percent from 2016 to 2020, primarily due to (1) a $3.00 per month, per ERU sewer rate increase that took effect January 1, 2017 and (2) 10.9 percent overall growth of the District's customer base. Operating expenses increased 21.2 percent over the 5-year period, excluding depreciation. The operating coverage ratio, calculated as total operating revenue divided by total operating expense, indicates the operating efficiency of the District. A ratio of 1.00 or greater suggests that revenue is adequate to cover expenses – Table 9-1 shows that the District's revenues were adequate to cover operating expenses and depreciation from 2016 – 2020.

The net operating income before depreciation as a percent of operating revenue is another common indicator of how well revenues are covering expenses. Higher positive numbers suggest healthier performance while lower and/or negative numbers imply a need for improvement. The District maintained positive ratios throughout the 5-year period, ranging from a low of 58.0 percent in 2020 to a high of 61.2 percent in 2018.

Table 9-4 summarizes the net operating revenue (operating revenue minus operating expenses) from 2016 to 2020. Key takeaways include:

- Calculated as unrestricted current assets (excluding prepaid items) divided by current liabilities, the *current ratio* measures the District's short-term liquidity. A ratio of 1.0 indicates that the District is able to pay its short-term obligations. Higher values are desirable as they suggest a greater ability to pay large and/or unanticipated bills. Table 9-4 shows that the District performed well from 2016 to 2020, ranging from a low of 4.1 in 2016 to a high of 5.0 in 2018.

- Measuring financial security in terms of how long the District would be able to fund daily operations if it received no additional revenue, the *days of cash on hand* is calculated by dividing unrestricted cash by the average daily cost of operations (excluding depreciation). Table 9-4 shows the District maintaining 831 – 1,108 days of cash on hand since 2016. While there is no firm minimum standard for this metric, bond rating agencies prefer a minimum of 180 days of cash on hand for utilities seeking the highest bond ratings.

- The *debt-to-asset ratio* provides a measure of how leveraged a utility is. A ratio above 0.6 is indicative of a relatively high debt burden that can reduce a utility's flexibility to manage rate increases and execute the capital plan in a timely manner. Table 9-4 indicates that the District reduced its debt-to-asset ratio from 0.5 in 2016 to 0.3 by 2020 by making payments on its existing bonds and loans.

- Generally computed by dividing net revenue available for debt service by annual debt service, *debt service coverage* is a measure of annual financial performance. The District's bond covenants require a minimum coverage ratio of 1.2 on revenue-bond debt service; the District increased its coverage ratio on parity debt from 3.6 in 2016 to 6.5 in 2020. The bond rating agencies prefer a minimum coverage ratio of 2.0; the District has consistently exceeded that standard.

TABLE 9-4

Summary of Historical Comparative Statements of Net Position (in $1,000s)

	2016	2017	2018	2019	2020
Assets					
Current Assets:					
Cash and cash equivalents	$ 11,487	$ 12,098	$ 15,440	$ 17,474	$ 15,800
Restricted cash and cash equivalents	15,805	15,568	15,942	9,976	9,390
Receivables, net	358	415	511	510	510
Assessments Receivable	48	41	31	24	18
Prepayments	134	167	146	162	147
Total Current Assets	**$ 27,834**	**$ 28,290**	**$ 32,069**	**$ 28,146**	**$ 25,865**
Noncurrent Assets					
Capital Assets:					
Land	$ 1,052	$ 1,052	$ 1,052	$ 1,052	$ 1,052
Construction Works in Progress	68	108	105	1,625	1,158
Plant and Buildings	179,537	183,115	186,396	189,776	200,107
Machinery, Equipment and Furniture	28,271	28,503	29,102	29,458	29,664
Total Capital Assets	**$ 208,929**	**$ 212,778**	**$ 216,655**	**$ 221,912**	**$ 231,981**
Less accumulated depreciation	(45,487)	(51,329)	(57,495)	(63,823)	(70,330)
Total Noncurrent Assets	**$ 163,443**	**$ 161,449**	**$ 159,160**	**$ 158,089**	**$ 161,652**
Deferred Outflow of Resources	316	260	221	1,616	1,651
Total Assets and Deferred Outflows	**$ 191,592**	**$ 189,999**	**$ 191,451**	**$ 187,851**	**$ 189,168**
Liabilities					
Current Liabilities:					
Accounts Payable	$ 859	$ 203	$ 207	$ 276	$ 376
Compensated Absences	144	148	156	174	184
Developer Extension Deposits	98	127	137	132	113
Interest Accrued	410	400	384	247	341
Current Portion of Bonds, Notes and Loans Payable	5,245	5,507	5,526	5,790	5,537
Total Current Liabilities	**$ 6,756**	**$ 6,385**	**$ 6,410**	**$ 6,618**	**$ 6,551**
	2016	**2017**	**2018**	**2019**	**2020**
Noncurrent Liabilities:					
Bonds, Notes and Loans Payable, net of current portion	$ 97,373	$ 92,013	$ 86,406	$ 72,370	$ 66,833
Accrued STP #1 Remediation Costs	1,028	1,013	1,013	-	-
Net Pension Liability	1,736	1,439	1,021	774	785
Total Noncurrent Liabilities	**$ 100,137**	**$ 94,465**	**$ 88,439**	**$ 73,145**	**$ 67,618**
Deferred Inflows of Resources	76	268	422	3,819	3,313
Total Liabilities and Deferred Inflows	**$ 106,969**	**$ 101,118**	**$ 95,271**	**$ 83,582**	**$ 77,482**
Net Position					
Invested in Capital Assets, Net of Related Debt	$ 60,824	$ 63,929	$ 67,229	$ 79,928	$ 89,281
Restricted for Debt Service & Construction	15,805	15,568	15,942	9,976	9,390
Unrestricted	7,993	9,384	13,010	14,364	13,014
Total Net Position	**$ 84,623**	**$ 88,881**	**$ 96,180**	**$ 104,269**	**$ 111,685**
Total Liabilities and Net Position	**$ 191,592**	**$ 189,999**	**$ 191,451**	**$ 187,851**	**$ 189,168**
Current Ratio	4.1	4.4	5.0	4.2	3.9
Days of Cash On Hand	837	831	1,059	1,108	950
Debt-to-Asset Ratio	0.5	0.5	0.4	0.4	0.3
Debt Service Coverage - Parity Debt	3.6	3.3	4.4	5.9	6.5
Debt Service Coverage - All Debt	1.2	1.1	1.4	1.5	1.6

CUSTOMER GROWTH

Projecting future revenues requires a forecast of the number of ERUs that the District will serve. The District currently serves 13,794 ERUs; District staff estimate that the system can serve 14,868 ERUs with the current constraints attributable to limitations in the amount of buildable land available in the District's service area. The annual ERU growth projections provided by District staff indicate the anticipated addition of 300 ERUs in 2021 and 130 – 150 ERUs per year from 2022 – 2026; growth is expected to slow down after 2026, with the system reaching its capacity by 2028.

BUDGET FORECAST

The budget forecast for the District covers the 2022 – 2027 planning period. It includes revenue and expense projections for the District's operating and capital centers.

FINANCIAL POLICIES

The financial plan reflects the following policy assumptions:

- The District maintains a minimum operating reserve balance equal to 90 days (24.7 percent) of budgeted operating expenses. Based on the 2022 operating expense projections, this policy results in a target operating reserve balance of approximately $1.9 million.

- The District maintains a minimum capital reserve balance of $1.5 million.

- The District sets its sewer rates at a level adequate to fund system operations and maintenance, repay outstanding debt obligations, and achieve the target reserve balances.

PROJECTED OPERATING REVENUES AND EXPENSES

Operating Revenues

Table 9-5 summarizes the District's projected operating revenues under its existing rates.

TABLE 9-5

Projected Operating Revenues at Existing Rates (in $1,000s)

Operating Revenues	2022	2023	2024	2025	2026	2027
Rate Revenue	$ 14,507	$ 14,660	$ 14,792	$ 14,924	$ 15,057	$ 15,108
Other Operating Revenue	508	456	457	428	428	429
Total Operating Revenues	**$ 15,015**	**$ 15,116**	**$ 15,249**	**$ 15,352**	**$ 15,485**	**$ 15,537**

Sewer rate revenue currently represents almost 97 percent of the District's annual operating revenue; with projected growth, this share is projected to increase to 97.2 percent by 2027. With the exception of interest earnings (which are computed based on projected reserve balances assuming an annual interest rate of 1.0 percent), the other operating revenues are generally projected based on the District's Budget and are assumed to remain largely consistent over the 2022 – 2027 planning horizon. As another notable exception, the District's rental income from the Vernon Business Center (approximately $30,000 per year) is projected to drop off after 2024.

Operating Expenses

The gradual increases of operating expenses over time is a result of cost inflation, customer growth, and changes in capital infrastructure. In this analysis, future expenses are projected based on the District's Budget and increased to reflect the customer growth and inflationary impacts. Most expenses are increased at rates based on planning assumptions confirmed with District staff:

- General Cost Inflation: 5.0 percent per year from 2022 to 2024; 2.0 percent per year thereafter.
- Administrative Salaries, Benefits, and Other Administrative Costs: 4.0 percent in 2022, 2.0 percent per year thereafter.
- Operating Salaries, Benefits, and Other Operating Costs: 3.5 percent in 2022, 2.0 percent per year thereafter.
- Property Taxes and Insurance: 2.8 percent per year.
- Labor and Industries Taxes: 10.0 percent per year.
- Public Employee Reitrement System (PERS): 3.0 percent per year.
- Medical, Dental, and Vision Benefits: 12.0 percent per year.

Debt Service

The District's rates are set to cover payments on outstanding debt in addition to operating expenses. The District currently receives approximately $3,000 per year in utility local improvement district (ULID) assessments that it dedicates toward debt repayment, which decreases the net amount required from rates. However, the District's most recent financial forecast suggests that this income will end after 2024. Table 9-6 summarizes the District's existing debt obligations, net of the offsetting ULID assessment income.

TABLE 9-6

Projected Annual Debt Expenses Less ULID Assessment Revenue (in $1,000)

Existing Debt Service	2022	2023	2024	2025	2026	2027
2019 Refunding Bonds	$ 2,039	$ 2,042	$ 2,037	$ 2,039	$ 2,037	$ 2,037
Other Loans	5,341	4,893	4,884	4,875	4,708	4,291
Less: Offsetting ULID Assessment Income	(3)	(3)	(3)	-	-	-
Net Existing Debt Service	**$ 7,377**	**$ 6,932**	**$ 6,918**	**$ 6,914**	**$ 6,744**	**$ 6,327**

PROJECTED CAPITAL REVENUES AND EXPENSES

Capital Expenses

The forecast of capital expenses is based on the costs outlined in Table 9-1 with adjustments for construction cost inflation (assumed to be 5.0 percent per year from 2022 – 2024 and 2.0 percent per year thereafter. Table 9-7 summarizes the capital cost forecast.

Capital Revenues

Aside from cash generated through rates, GFCs represent the District's primary source of capital revenue. Other sources of funding include:

- Loan/Grant Programs: There are various grant and loan programs that can be used to fund a portion of the District's CIP. These funding sources are listed and described in Appendix M. It is important to note that these sources do not necessarily provide full funding for construction projects and may require supplementary funding from the District's cash resources to fully fund the planned projects. Nevertheless, the District should monitor future opportunities to obtain these potential funding sources.

- Revenue Bonds: Revenue bonds are another external source of funding for capital projects and are the most common source of funds for construction of major utility improvements. A key benefit of revenue bonds is the exemption of federal income tax – however, they are generally seen as less desirable than low-cost loans and grants due to their relatively higher interest rates. Revenue bonds also come with coverage requirements, where the utility has to generate a certain amount of "net revenue" (operating revenue net of operating expenses) to protect bondholders against repayment risk. District bond covenants define this amount as 120 percent of annual debt service. Similar to revenue bonds, other bond financing approaches include ULIDs, special assessment districts (SADs), and other funding for projects that benefit a limited subset of the District's service area. The costs of those improvements are shared only by those customers benefiting from those improvements. The District has historically funded some capital improvements through ULIDs.

- Developer Contributions: Some of the CIP projects are identified as being funded through developers. Where possible, the District attempts to use developer extension agreements (DEAs) to construct facilities in order to avoid charging its other customers for development-related projects of localized benefit.

Table 9-7 also summarizes the anticipated 2022 – 2027 capital funding strategy.

TABLE 9-7

Projected Capital Funding Strategy (in $1,000s)

Capital Funding Strategy	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**Total**
Capital Projects per Table 9-1 (2021 Dollars)	$ 14,429	$ 3,612	$ 6,114	$ 4,728	$ 3,912	$ 12,584	$ 45,380
Plus: Adjustment for Inflation	721	370	964	909	892	3,334	7,192
Total Projected Capital Expenditures	**$ 15,150**	**$ 3,983**	**$ 7,078**	**$ 5,638**	**$ 4,805**	**$ 15,919**	**$ 52,572**
Planned Funding Sources:							
Grants	$ 2,573	$ 375	$ 1,554	$ -	$ -	$ 1,747	$ 6,248
Revenue Bond Proceeds	-	-	-	-	-	14,172	14,172
District Cash Resources (Including GFCs)	12,578	3,608	5,524	5,638	4,805	-	32,152
Total Capital Funding	**$ 15,150**	**$ 3,983**	**$ 7,078**	**$ 5,638**	**$ 4,805**	**$ 15,919**	**$ 52,572**

Table 9-7 suggests that the District will need to issue new debt in order to fully cover the projected capital costs. The financial plan envisions the District issuing revenue bonds to obtain $19.5 million in net proceeds, with $14.1 million being spent in 2027 and the remaining $5.4 million being spent in 2028. Assuming a 20-year repayment term, an interest rate of 4.0 percent, issuance costs equal to 1.5 percent of the amount issued, and a reserve requirement equal to one year's principal and interest payment, the financial plan projects a total 2027 bond issue of $21.4 million to generate the $19.5 in net proceeds needed. This bond is projected to increase the District's annual debt service by approximately $1.6 million starting in 2027.

PROPOSED FINANCIAL PLAN

Table 9-8 summarizes the 2022 – 2027 financial forecast. The detailed model may be seen in Appendix N. It shows a 2022 monthly sewer rate of $99.00 per ERU, which is $13.00 more than the existing rate of $86.00 per ERU – this increase is needed to generate cash to fund the capital plan. The Board of Commissioners adopted this increase effective June 1, 2022 with the passing of Resolution No. 1025 at its meeting on March 24, 2022.

Table 9-8 shows an additional increase of $11.00 in the monthly rate beginning in 2027 – this increase is needed to cover the annual debt service on the $21.4-million bond issued to fund the capital plan.

TABLE 9-8

Projected Cash Flows and Reserves at Existing Rates (in $1,000s)

	2022	2023	2024	2025	2026	2027
Monthly Sewer Rate per ERU	$99.00	$99.00	$99.00	$99.00	$99.00	$110.00

Total Cash Flows	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sewer Rate Revenue at Proposed Rates	$ 15,969	$ 16,876	$ 17,028	$ 17,180	$ 17,333	$ 19,324
Other Operating Revenue	508	456	457	428	428	429
Total Revenue	$ 16,477	$ 17,332	$ 17,485	$ 17,608	$ 17,761	$ 19,753
Expenses						
Operating Expenses	$ 7,794	$ 8,246	$ 8,294	$ 8,586	$ 8,874	$ 9,221
Debt Service	7,380	6,935	6,921	6,914	6,744	7,902
Use of GFCs/Assessments for Debt Service	(783)	(1,016)	(881)	(439)	(439)	(169)
Rate-Funded Capital	-	-	-	-	-	-
Total Expenses	$ 14,391	$ 14,166	$ 14,334	$ 15,061	$ 15,180	$ 16,954
Net Cash Flow	**$ 2,086**	**$ 3,166**	**$ 3,151**	**$ 2,547**	**$ 2,581**	**$ 2,799**
Coverage Ratio - Parity Debt	**5.09**	**5.49**	**5.43**	**5.33**	**5.26**	**3.12**

Summary of Reserve Activity	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Operating Reserve						
Beginning Balance	$ 7,120	$ 1,915	$ 2,023	$ 2,034	$ 2,106	$ 2,177
Net Cash Flow	2,086	3,166	3,151	2,547	2,581	2,799
Transfers to Capital Reserve for Projects	(7,291)	(3,058)	(3,139)	(2,475)	(2,511)	(2,723)
Ending Balance	**$ 1,915**	**$ 2,023**	**$ 2,034**	**$ 2,106**	**$ 2,177**	**$ 2,253**
Minimum Balance	*$ 1,915*	*$ 2,023*	*$ 2,034*	*$ 2,106*	*$ 2,177*	*$ 2,253*
Capital Reserve						
Beginning Balance	$ 13,992	$ 9,625	$ 10,185	$ 8,779	$ 7,021	$ 6,113
Transfers From Operating Reserve	7,291	3,058	3,139	2,475	2,511	2,723
Transfers From Rate Stabilization Reserve	-	-	-	-	-	-
Grants/Developer Extensions	2,573	375	1,554	-	-	1,747
GFCs (Net of Use for Debt Service)	780	1,013	878	1,316	1,316	506
Interest Earnings	140	96	102	88	70	61
Revenue Bond Proceeds	-	-	-	-	-	19,500
Direct Rate Funding for Capital Projects	-	-	-	-	-	-
Less: Capital Projects	(15,150)	(3,983)	(7,078)	(5,638)	(4,805)	(15,919)
Ending Balance	**$ 9,625**	**$10,185**	**$ 8,779**	**$ 7,021**	**$ 6,113**	**$14,731**
Minimum Balance	*$ 1,500*	*$ 1,500*	*$ 1,500*	*$ 1,500*	*$ 1,500*	*$ 1,500*
Combined Operating/Capital Balance as Days of O&M	***540***	***540***	***476***	***388***	***341***	***672***

Table 9-8 also shows the District maintaining a combined operating/capital cash balance ranging from 341 to 672 days of operating expenses during the study period. The bond rating agencies have expressed a preference that utilities seeking high bond ratings maintain unrestricted cash reserves of at least 180 days of operating expenses. Because the financial plan shows the District issuing revenue bonds during the 6-year planning period, it incorporates the policy assumption that the District will meet this standard. Though Table 9-8 shows the District exceeding this standard by a comfortable margin, the longer-term financial forecast shows the District reaching a minimum balance of 188 days of operating expenses by 2031.

AFFORDABILITY EVALUATION

A key objective of this chapter is to evaluate the District's ability to execute the capital improvement plan while maintaining affordable sewer rates. While the term "affordable" is relatively susbjective in its definition, agencies that offer low-cost loans to utilities often use an "affordability index" based on median household income to define a threshold beyond which utility rates impose financial hardship on ratepayers. The benchmark most often used in this evaluation is 2.0 percent of the median household income in the relevant demographic area. The United States Census Bureau estimates that the 2019 median income for households in the City of Lake Stevens was $93,381. Assuming 3.0 percent annual cost-of-living adjustments, the equivalent 2022 median household income level would be approximately $102,040. Table 9-9 presents the affordability evaluation of the residential sewer utility rates through 2022 to 2027.

TABLE 9-9

Affordability Evaluation

	2022	2023	2024	2025	2026	2027
Monthly Sewer Rate per ERU	$99.00	$99.00	$99.00	$99.00	$99.00	$110.00
Annual Median Household Income **[1]**	$102,040	$105,101	$108,254	$111,502	$114,847	$118,292
Monthly MHI	$ 8,503	$ 8,758	$ 9,021	$ 9,292	$ 9,571	$ 9,858
Sewer Bill as % of MHI	1.2%	1.1%	1.1%	1.1%	1.0%	1.1%

[1] Assumes annual cost-of-living increases of 3.0%.

Table 9-9 suggests that the District's sewer rate is and will remain affordable based on the industry definition discussed above, remaining at 1.0 – 1.1 percent of the median household income in the City of Lake Stevens. It is important to note that a definition of "affordability" based on median household income does not necessarily reflect the relative burden placed on customers earning significantly less than the median income level. The District has a low-income rate reduction program that offers a 10 percent discount on the monthly sewer rate for low-income senior and/or disabled customers.

SUMMARY AND RECOMMENDATIONS

As shown in Table 9-8, the District will be able to fund the needed capital improvements with an increase in the monthly rate from $86.00 to $99.00 per ERU (effective June 2022) and an increase to $110.00 per month per ERU in 2027.

It is important to note that the analysis performed in this chapter relies on a number of assumptions including inflation rates, growth rates, future revenues, and future expenses. The District regularly reviews rates and GFCs, and tracks development in order to provide up-to-date financial projections with which to assess the need for rate increases. By doing this, the District can adapt to changing economic and financial conditions.

APPENDIX A

SEPA CHECKLIST AND DETERMINATION

DETERMINATION OF NON-SIGNIFICANCE

DESCRIPTION OF PROPOSAL:	**General Sewer / Wastewater Facility Plan**
PROPONENT:	Lake Stevens Sewer District 1106 Vernon Road, Suite A Lake Stevens, WA 98258 (425) 334-8588
LOCATION OF PROPOSAL:	Lake Stevens Urban Growth Area
LEAD AGENCY:	Lake Stevens Sewer District 1106 Vernon Road, Suite A Lake Stevens, WA 98258 (425) 334-8588

THRESHOLD DETERMINATION:
The lead agency for this proposal has determined that it does not have a probable, significant adverse impact on the environment. An environmental impact statement (EIS) is NOT required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with this agency. This information is available to the public on request.

☐ There is no comment period for this DNS.

☐ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

☒ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Written comments must be received by August 22, 2022 or within 14 days after publication, whichever date is later.

RESPONSIBLE OFFICIAL:	Mariah Low
POSITION/TITLE:	General Manager
ADDRESS:	Lake Stevens Sewer District 1106 Vernon Road, Suite A Lake Stevens, WA 98258

For further information contact John Dix, Lake Stevens Sewer District, 425-334-8588.

Signature: Mariah Low
Mariah Low

Date: 08/04/2022

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

1. Name of proposed project, if applicable:

    Lake Stevens Sewer District General Sewer/Wastewater Facility Plan

2. Name of applicant:

Lake Stevens Sewer District

3. Address and phone number of applicant and contact person:

Mariah Low, General Manager
1106 Vernon Road, Suite A
Lake Stevens, WA 98258
(425) 334-8588

4. Date checklist prepared:

September 2021

5. Agency requesting checklist:

Lake Stevens Sewer District

6. Proposed timing or schedule (including phasing, if applicable):

The General Sewer/Wastewater Facility Plan is expected to be adopted in 2022.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

This SEPA review for the Plan is a non-project action. This Plan provides a six-year, 10-year and 20-year capital improvement plan (CIP). These projects would be implemented based on need and available financing.

Specific projects or actions identified through the CIP would be reviewed under separate project and site-specific SEPA processes as they are proposed for design and implementation.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

None directly related to the General Sewer/Wastewater Facility Plan. However there has been environmental information prepared related to documents used as a basis for this Update, including:

Snohomish County County Comprehensive Plan
City of Lake Stevens Comprehensive Plan

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

No

10. List any government approvals or permits that will be needed for your proposal, if known.

This Plan will require approval by the District Board of Commissioners, Washington Department of Ecology, Snohomish County Council and Cities of Lake Stevens and Marysville. Government approval and permits will be obtained for each capital project implemented.

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 Plan is a compilation of planning data, sewage generation projections, future sewer plan layout and related information for the service area. The goal is to identify projects and improvements that would be required to provide sewer service to the District's sewer service area. To that end the Plan identifies a conceptual layout of sewer lines and lift stations to extend service beyond the existing sewer system. The Plan further considers upgrades required to the District Wastewater Treatment Facility (WWTF) required to treat th sewer from this service area. An estimated schedule is provided for projects that are expected to be implemented in the next six years.

The scope of the Plan is organized into the following chapters covering the Description of Sewer System, Planning Data and Sewer Flow Projections, System Analysis, Service Strategy, Operations and Maintenance Program, Sewer System Policies, Capital Improvement Plan and Financial Summary.

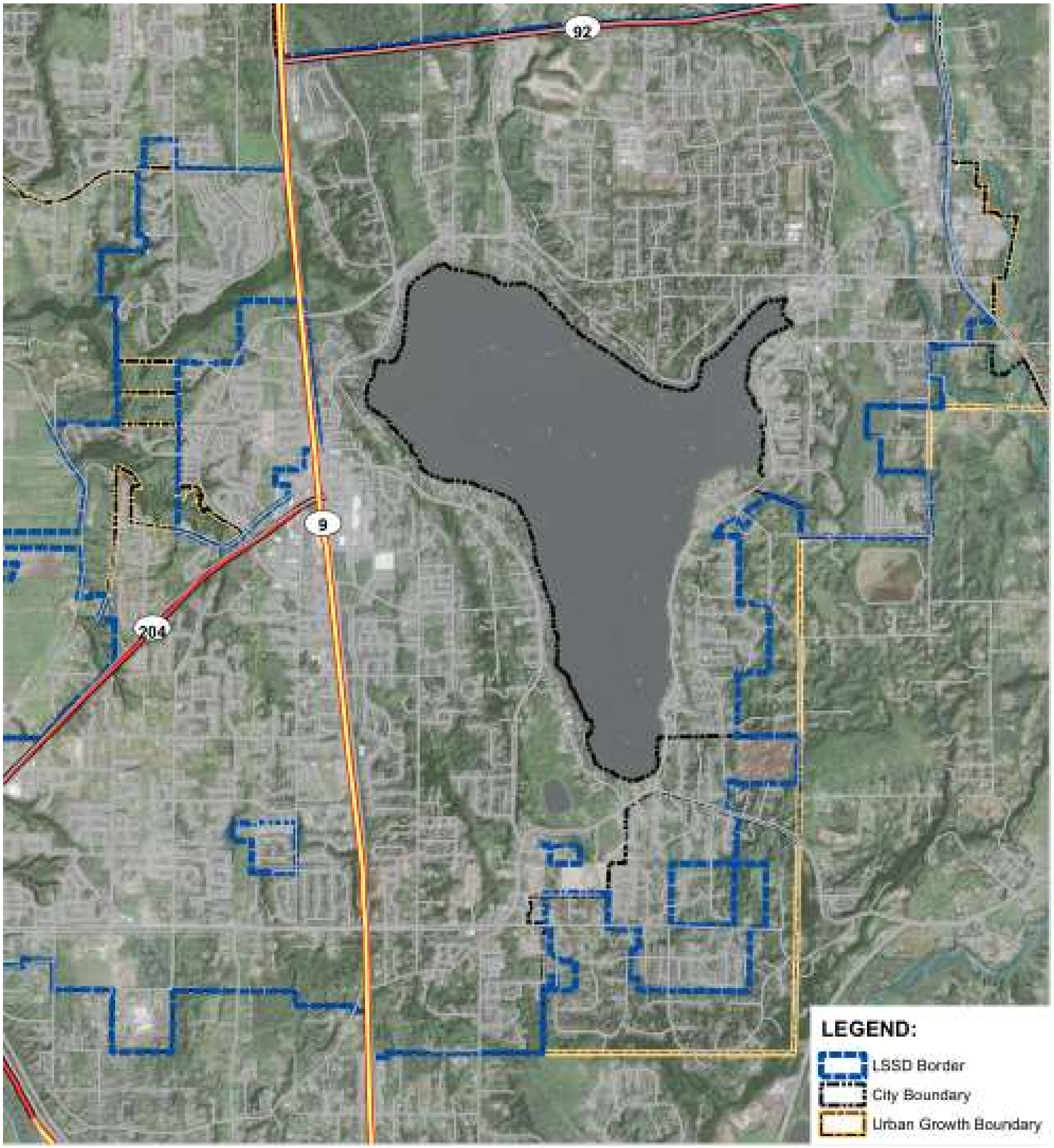
The Plan is a "non-project action" in that no specific project identified in the Plan would be implemented or constructed without appropriate project and site specific SEPA review.

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 study area for this Plan covers approximately 13 square miles or 8,200 acres within the Lake Stevens Urban Growth Area.

The project area is located within Sections 1, 12-14 and 23-26 of Township 29N, Range 5E and within Sections 5-9, 16-21, and 29-30 of Township 29N, Range 6E.

Vicinity Map



B. Environmental Elements [HELP]

1. *Earth* [help]

a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____________

b. What is the steepest slope on the site (approximate percent slope)?

The District's topography ranges from flat, wetland-type areas to steep slopes. The elevation generally varies from sea level to 450 feet. Detailed topographic

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 majority of the soils in the Lake Stevens UGA are glacial soils, mainly Tokul gravelly loams (Group C). Other soils found in Lynnwood include McKenna (Group D), Norma (Group C/D), Winston (Group A), and Pastik (Group C). Overall, the soils are poorly draining. The classification of soils will be determined on a project specific basis.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

The only known indications of unstable soils within the District sewer service area are located in the steeper slope areas. Soil characteristics would be identified on a project specific basis.

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.

Changes in surface grades are not generally anticipated with the installation of the projects identified in the Plan. Installation of new or upgrading existing facilities would require excavation for construction . The contractor of each project would determine the source of backfill.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Underground utilities, such as those identified in the Plan, are not likely to cause erosion once constructed. Erosion potential for future projects would be determined on a project specific basis.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Construction of underground utilities generally does not increase the amount of impervious surface. Increases in impervious surface would occur as a result of the construction of new lift stations and access roads associated with sewer facilities constructed in areas other than rights-of-way. These improvements would likely account for only a very small increase in impervious surface. Specific measurements of changes in impervious area would be evaluated on a project specific basis.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Measures to control erosion would be determined on a project specific basis considering the local conditions and anticipated construction activities.

2. Air [help]

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.

Projects proposed by the Plan may have associated dust from construction activities, and exhaust associated with construction equipment.

The sewer system itself may be a source of odors. Gravity collection systems do not usually produce noticeable odors, but lift stations and flows existing force mains may be a source of odors. Future project proposals would consider odor emissions as part of their design process.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None known.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Odor control measures associated with future projects would be determined on a project specific basis.

3. Water [help]

a. Surface Water: [help]

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 Lake Stevens UGA contains various types of surface water including creeks, lakes and wetlands. Lake Stevens, with over 1,000 acres of surface area, is the dominant largest surface water formation within the UGA. Stich Lake is a much smaller lake located near the southern extension of Lake Stevens. Three creeks are tributary to Lake Stevens: Lundeen, Stevens and Kokanee. Stich Creek is tributary to Stich Lake. Catherine Creek is fed by the Lake Stevens outlet.

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.

Some projects identified in the Plan would be located in the vicinity of a surface water body. These would be determined on a project specific basis as they are proposed for implementation.

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.

Specific sewer facility routes for projects identified in the Plan would be selected to minimize the impact to wetlands or surface waters, and if possible routes would be placed in established right-of-ways. Filling and dredging of wetland and/or surface water features may be necessary for certain individual projects. Quantities, locations, and mitigation measures would be determined under each individual project design and would be determined on a project specific basis.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

None of the projects proposed in the Plan anticipate a surface water withdrawal or diversion. However, any would be determined on a project specific basis, and covered under a project specific SEPA process.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Sections of the District's service area lie within the 100-year floodplain. These areas are generally limited to areas abutting streams and lakes. Historically, there has been flooding along some of the District's roads. Potential for work in a floodplain would be determined on a project specific basis.

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.

None of the projects identified in the Plan are expected to discharge waste materials to surface waters. The potential for discharges would be determined on a project specific basis.

b. Ground Water: [help]

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.

Ground water withdrawals or discharges to ground water are not expected to occur with the projects identified as part of the Plan. However, high ground water tables in the vicinity of a project may require dewatering activities during construction. Future projects would consider potential dewatering requirements on a project specific basis.

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.

The Plan does not include any projects that anticipate discharging waste materials into the ground. The Plan does include projects that would allow transition of houses in the urban area that currently use septic tanks and on-site systems to transition to sanitary sewer. There are approximately 1,000 septic systems in use in the District's sewer service area.

c. Water runoff (including stormwater):

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.

Many of the projects identified in the Plan would not result in additional runoff, as they are underground and would not change the impervious nature of the surface over the line. Lift

Station projects have the potential to generate runoff and design of the storm water control facilities would be determined on a project specific basis.

2) Could waste materials enter ground or surface waters? If so, generally describe.

It is unlikely that waste materials would be discharged to ground or surface waters from projects identified in the Plan. The potential for discharges would be determined on a project specific basis.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

It is unlikely that and drainage patterns would be affected by the projects identified in the Plan.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Measures associated with control or reduction of discharges to ground or surface water would be determined on a project specific basis.

4. Plants [help]

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
_X_ grass
_X_ pasture
____ crop or grain
____ Orchards, vineyards or other permanent crops.
_X_ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
_X_ water plants: water lily, eelgrass, milfoil, other
____ other types of vegetation

Due to the large size of the District's service area and scope of projects proposed in the Plan, all likely categories of vegetation have been noted.

b. What kind and amount of vegetation will be removed or altered?

To be determined on a project specific basis.

c. List threatened and endangered species known to be on or near the site.

To be determined on a project specific basis.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

To be determined on a project specific basis.

e. List all noxious weeds and invasive species known to be on or near the site.

To be determined on a project specific basis.

5. Animals [help]

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.

Examples include:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other ________

Due to the large size of the District's service area and scope of projects proposed in the Plan, all likely categories have been noted.

b. List any threatened and endangered species known to be on or near the site.

The proximity of threatened or endangered species would be determined on a project specific basis.

c. Is the site part of a migration route? If so, explain.

The entire Puget Sound basin is a part of the Pacific Flyway.

d. Proposed measures to preserve or enhance wildlife, if any:

Measures to preserve or enhance wildlife would be determined on a project specific basis.

e. List any invasive animal species known to be on or near the site.

To be determined on a project specific basis.

6. Energy and Natural Resources [help]

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.

Lift station projects identified in the Plan would include pumps driven by electric motors. Backup generators will likely use diesel fuel. Construction equipment at all projects would likely use either gasoline or diesel fuel. Maintenance vehicles used in the long-term maintenance of the proposed facilities would also require fuel.

Energy needs for each specific project identified in the Plan would be assessed on a project specific basis.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No. The majority of the projects identified are underground utility projects.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The District considers the use of high-efficiency pumps and motors when designing and constructing new facilities. Specific measures would be determined on a project specific basis.

7. Environmental Health [help]

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 of projects identified in the Plan may carry some risks of spills or leakage from equipment as is normal with construction activities, and would be subject to normal precautions taken in storing equipment, hazardous fuels, and other materials.

Future project and site-specific designs would address the potential for exposure to chemicals and hazardous waste on a project specific basis.

1) Describe any known or possible contamination at the site from present or past uses.

None are anticipated.

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.

District personnel are trained for safe operating and maintenance procedures. Spills may be reported to applicable agencies. Requirements for control of environmental health hazards would be considered on a project specific basis.

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.

All chemicals and hazardous wastes will be stored, used and producted in compliance with all required regulations and safety procedures.

4) Describe special emergency services that might be required.

No special emergency services will be required.

5) Proposed measures to reduce or control environmental health hazards, if any:

All chemicals and hazardous wastes will be stored, used and producted in compliance with all required regulations and safety procedures.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None are anticipated.

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 levels would be determined on a project specific basis. Short term noise would be associated with construction of projects identified in the Plan. Long term noise may result from lift station projects, associated with operation of motors and generators. Noise attenuation measures would be considered during project specific design.

3) Proposed measures to reduce or control noise impacts, if any:

To be determined on a project specific basis and would consider local noise ordinances.

8. Land and Shoreline Use [help]

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.

Land use in the area is a mixture of residential, commercial, industrial, and public facilities. Pipeline work will be located within public rights-of-way and easements.

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?

No. There are no properties in the sewer service area that are zoned for agriculture.

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 is no working farm or forest land surrounding potential project sites.

c. Describe any structures on the site.

Structures in proximity to projects included in the Plan would be determined on a project specific basis.

d. Will any structures be demolished? If so, what?

To be determined on a project specific basis.

e. What is the current zoning classification of the site?

Zoning classifications vary throughout the District's service area. The zoning associated with projects identified in the Plan would be determined on a project specific basis.

f. What is the current comprehensive plan designation of the site?

The District's sewer service area has a designation of urban.

g. If applicable, what is the current shoreline master program designation of the site?

The shoreline master program designation would be determined on a project specific basis.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

There are environmentally sensitive areas within the District's sewer service area. The designation of environmentally sensitive areas would be determined on a project specific basis as projects identified in the Plan are implemented.

i. Approximately how many people would reside or work in the completed project?

The population of the District's sewer service area at its zoning capacity is estimated to be approximately 62,900.

j. Approximately how many people would the completed project displace?

None, the Plan identifies projects required to accommodate growth.

k. Proposed measures to avoid or reduce displacement impacts, if any:

None required.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The Plan must be reviewed and approved by the Cities of Lake Stevens and Marysville and Snohomish County to ensure consistency with land use plans.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

None.

9. Housing [help]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

10. Aesthetics [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Heights of any proposed structures would be determined on a project specific basis. Proposed above-ground facilities include lift stations, which not normally exceed the height of a single family house.

b. What views in the immediate vicinity would be altered or obstructed?

The look of any proposed structures would be determined on a project specific basis. In general, District structures are designed to minimize aesthetic impacts and fit with the surrounding neighborhoods.

c. Proposed measures to reduce or control aesthetic impacts, if any:

To be determined on a project specific basis.

11. Light and Glare [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Most projects identified in the Plan will not produce light or glare. Design of lighting associated with lift station projects would be considered on a project specific basis.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

It is unlikely that lights associated with projects identified with the Plan would be a safety hazard or impact views, but these aspects would be considered on a project specific basis during implementation of the project.

c. What existing off-site sources of light or glare may affect your proposal?

None are anticipated.

d. Proposed measures to reduce or control light and glare impacts, if any:

Any proposed measures would be determined on a project specific basis.

12. Recreation [help]

a. What designated and informal recreational opportunities are in the immediate vicinity?

There are recreational areas throughout the District at designated parks, schools and trails. The location of recreational sites would be determined on a project specific basis during design.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No displacement of existing recreational uses is anticipated. However, it is possible that existing recreational uses may be displaced during construction activities and these would be identified on a project specific basis.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Proposed measures to reduce or control impacts would be determined on a project specific basis.

13. Historic and cultural preservation [help]

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.

In general, project components for projects included in the Plan would be designed to avoid impacts to historic and cultural resources whenever possible. Local preservation registers will be consulted before siting any new project identified in the Plan.

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.

None have been identified at this time.

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.

Specific measures would be identified on a project specific basis.

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.

Specific measures would be identified on a project specific basis.

14. Transportation [help]

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 sewer service area includes major arterials, arterials and residential streets. SR 9, SR 204 , SR 9 and 20th Street SE are the major highways serving the District. Access to the existing street system will be evaluated for each project.

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?

The District is served by some public transit, primarily on the major arterials, and including a Community Transit Park and Ride facility.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

Most sewer projects do not impact parking, except potentially during construction. Future impacts would be determined on a project specific basis.

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).

Sewer facilities in general do not require new roads, although they are not uncommon when associated with a new development. Lift station facilities may also require driveway entrances from existing roads. Future sewer facility requirements would be determined on a project specific basis.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Use of water, rail or air transportation is not anticipated for any projects identified in the Plan. This potential would be determined on a project specific basis.

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?

Vehicular trips for projects identified in the Plan would be determined on a project specific basis. Most projects would not generate many vehicular trips, although trips for maintenance would be required, with lift stations likely to require less than ten trips per week with the completed project.

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.

To be determined on a project specific basis.

h. Proposed measures to reduce or control transportation impacts, if any:

To be determined on a project specific basis.

15. Public Services [help]

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.

Projects identified in the Plan would improve public sewer service. It is not anticipated that these projects would result in an increased need for other public services, although this would be determined on a project specific basis.

b. Proposed measures to reduce or control direct impacts on public services, if any.

None proposed.

16. Utilities [help]

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other ___________

Available utilities would be determined on a project specific basis.

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.

Lift Station projects identified in the Plan would likely require additional electrical services. Specific requirements would be determined on a project specific basis.

C. Signature [HELP]

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: Leigh K Nelson

Name of signee Leigh K. Nelson

Position and Agency/Organization Engineeriner, Gray & Osborne, Inc.

Date Submitted: 9/22/2021

D. Supplemental sheet for nonproject actions [HELP]

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

Lake Stevens Sewer District's General Sewer/Wastewater Facility Plan recommends capital improvements to provide sanitary sewer service for the identified sewer service area including replacement of existing piping, new mains and lift stations.

All proposed projects will be completed in compliance with all state and federal regulations and City and County ordinances, with respect to stormwater runoff, air emissions and noise abatement. It is anticipated that these capital improvements will have no measurable production, storage or release of toxic or hazardous substances.

Proposed measures to avoid or reduce such increases are:

Avoidance and mitigation measures would be determined on a project specific basis.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

The projects identified in the Plan would not have a significant impact on plants, animals, fish or wildlife once constructed. All work performed in streams, lakes or wetlands will comply with all permit conditions per local, state and federal regulations.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

All specific project work would be in compliance with local, state and federal permits. Runoff and potential erosion associated with construction activities would be controlled at project-

specific construction sites. On-site restoration and mitigation activities would be implemented where appropriate.

3. How would the proposal be likely to deplete energy or natural resources?

Lift station projects proposed under the Plan would require electric power for normal operations and diesel fuel for back-up generators. Vehicles and equipment used by the District for operations and maintenance also require fuel.

Proposed measures to protect or conserve energy and natural resources are:

The use of efficient pumps and motors would be considered on a project specific basis. The District has alternative fuel and hybrid vehicles included in the current vehicle fleet, and considerations for similar vehicles will continue to be considered.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

The siting of public facilities such as collection piping or lift stations takes into account environmentally sensitive areas during the planning and design phases. Therefore, environmentally sensitive areas can either be mitigated or avoided all together. SEPA review will be provided for each specific project that cannot avoid sensitive areas.

Proposed measures to protect such resources or to avoid or reduce impacts are:

Specific measures would be determined on a project specific basis, and would be subject to environmental protection measures identified by each land use agency's regulations.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

All projects will comply with local zoning and land use codes, and are intended to support the land use agency comprehensive plan land use designations.

Proposed measures to avoid or reduce shoreline and land use impacts are:

Any projects proposed under the Plan would consider shoreline and land use impacts on a project specific basis.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

It is anticipated that the proposed capital projects would have minimal effects on transportation or public services and utilities. However, pipeline construction may have some temporary impacts to traffic flow, as collection lines are typically located within road rights-of-way.

Proposed measures to reduce or respond to such demand(s) are:

Measures to address transportation, public services and utilities would be determined on a project specific basis.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

All proposed projects will be completed in compliance with all local, state and federal regulations.

APPENDIX B

NPDES PERMIT AND FACT SHEET

Issuance Date: October 6, 2017
Effective Date: November 1, 2017
Expiration Date: October 31, 2022

National Pollutant Discharge Elimination System Waste Discharge Permit No. WA0020893

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

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 1342 et seq.

LAKE STEVENS SEWER DISTRICT
1106 Vernon Road, Suite A
Lake Stevens, WA 98258

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Location: 7110 9th Street SE Everett, WA 98205 Treatment Type: Activated sludge with membrane bioreactor (MBR) process	Receiving Water: Ebey Slough

Mark Henley, P.E.
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

Table of Contents

Summary of Permit Report Submittals

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S3.A	Discharge Monitoring Report (DMR)	Monthly	December 15, 2017
S3.A	Discharge Monitoring Report (DMR)	Quarterly in 2018 and 2021	April 15, 2018
S3.F	Reporting Permit Violations	As necessary	
S4.B	Plans for Maintaining Adequate Capacity	As necessary	
S4.D	Notification of New or Altered Sources	As necessary	
S5.F	Bypass Notification	As necessary	
S5.G	Operations and Maintenance Manual Update or Review Confirmation Letter	1/permit cycle	January 1, 2019
S6.E	Industrial User Survey Submittal	1/permit cycle	October 31, 2021
S8.A	Effluent Mixing Plan of Study	1/permit cycle	January 1, 2018
S8.A	Effluent Mixing Report	1/permit cycle	January 1, 2019
S9	Outfall Evaluation	1/permit cycle	January 1, 2019
S10	Acute Toxicity Effluent Test Results	2/permit cycle	April 15, 2021 October 15, 2021
S11	Chronic Toxicity Effluent Test Results	2/permit cycle	April 15, 2021 October 15, 2021
S12	Application for Permit Renewal	1/permit cycle	October 31, 2021
G1	Notice of Change in Authorization	As necessary	
G4	Reporting Planned Changes	As necessary	
G5	Engineering Report for Construction or Modification Activities	As necessary	
G7	Notice of Permit Transfer	As necessary	
G10	Duty to Provide Information	As necessary	
G20	Compliance Schedules	As necessary	
G21	Contract Submittal	As necessary	

Special Conditions

S1. Discharge limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit violates the terms and conditions of this permit.

S1.A. Effluent limits, Outfall 002, low river flow period (July through October)

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee may discharge treated municipal wastewater to Ebey Slough at the permitted location during **July**, **August, September, and October** subject to compliance with the following limits:

Effluent Limits: Outfall 002 **Latitude: 47.988101 Longitude: -122.139859**		
Parameter	**Average Monthly [a]**	**Average Weekly [b]**
Carbonaceous Biochemical Oxygen Demand (5-day) ($CBOD_5$)	25 milligrams/liter (mg/L) 85% removal of influent $CBOD_5$	40 mg/L
Total Suspended Solids (TSS)	30 mg/L 971 lbs/day 85% removal of influent TSS	45 mg/L 1,456 lbs/day
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean**	**7-day Geometric Mean**
Fecal Coliform Bacteria [c]	200 cfu/100 milliliter (mL)	400 cfu/100 mL
Parameter	**Average Monthly**	**Maximum Daily [d]**
NBOD+CBOD [e]	235 lbs/day	747 lbs/day
Copper	12.1 µg/L	24.2 µg/L

a	Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. See footnote c for fecal coliform calculations.
b	Average weekly discharge limitation means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. See footnote c for fecal coliform calculations.
c	Ecology provides directions to calculate the monthly and the 7-day geometric mean in publication No. 04-10-020, Information Manual for Treatment Plant Operators available at: http://www.ecy.wa.gov/pubs/0410020.pdf
d	Maximum daily effluent limit is the highest allowable daily discharge. The daily discharge is the average discharge of a pollutant measured during a calendar day. For pollutants with limits expressed in units of mass, calculate the daily discharge as the total mass of the pollutant discharged over the day. This does not apply to pH or temperature.
e	NBOD+CBOD is defined by the following equation: NBOD+CBOD (lbs/day) = (2.1 * Ammonia (lbs/day)) + $CBOD_5$ (lbs/day) Where $CBOD_5$ and total ammonia are measurements from the same daily composite sample. NBOD: nitrogeneous biochemical oxygen demand CBOD: carbonaceous biochemical oxygen demand

S1.B. Effluent limits, Outfall 002, high river flow period (November through June)

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee may discharge treated municipal wastewater to Ebey Slough at the permitted location during **November through June** subject to compliance with the following limits:

Effluent Limits: Outfall 002 Latitude: 47.988101 Longitude: -122.139859		
Parameter	**Average Monthly [a]**	**Average Weekly [b]**
Carbonaceous Biochemical Oxygen Demand (5-day) ($CBOD_5$)	25 milligrams/liter (mg/L) 1,045 lbs/day 85% removal of influent $CBOD_5$	40 mg/L 1,671 lbs/day
Total Suspended Solids (TSS)	30 mg/L 1,254 lbs/day 85% removal of influent TSS	45 mg/L 1,880 lbs/day
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean**	**7- day Geometric Mean**
Fecal Coliform Bacteria [c]	200 cfu/100 milliliter (mL)	400 cfu/100 mL
a	Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. See footnote c for fecal coliform calculations.	
b	Average weekly discharge limitation means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. See footnote c for fecal coliform calculations.	
c	Ecology provides directions to calculate the monthly and the 7-day geometric mean in publication No. 04-10-020, Information Manual for Treatment Plant Operators available at: http://www.ecy.wa.gov/pubs/0410020.pdf	

S1.C. Mixing zone authorization

Mixing zone for Outfall 002

The following paragraphs define the maximum boundaries of the mixing zones:

Chronic mixing zone

The width of the chronic mixing zone is limited to a distance of 80 feet. The length of the chronic mixing zone extends 208 feet upstream and 208 feet downstream of the outfall. The mixing zone extends from the discharge ports to the top of the water surface. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Acute mixing zone

The acute mixing zone is defined by two overlapping circles with radius of 20.8 feet measured from the center of each discharge port. The mixing zone extends from the discharge ports to the top of the water surface. The concentration of pollutants at the edge of the acute zone must meet acute aquatic life criteria.

Available Dilution (dilution factor)	
Acute Aquatic Life Criteria	6.4
Chronic Aquatic Life Criteria	15
Human Health Criteria - Carcinogen	239
Human Health Criteria - Non-carcinogen	15

S2. Monitoring requirements

S2.A. Monitoring schedule

The Permittee must monitor in accordance with the following schedule and the requirements specified in Appendix A.

Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type
(1) Wastewater influent			
Wastewater Influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.			
Biochemical Oxygen Demand (BOD_5)	mg/L	1/week	24-hour composite [1]
Biochemical Oxygen Demand (BOD_5)	lbs/day	1/week	Calculated [2]
Carbonaceous Biochemical Oxygen Demand (BOD_5)	mg/L	3/week	24-hour composite
Total Suspended Solids (TSS)	mg/L	3/week	24-hour composite
Total Suspended Solids (TSS)	lbs/day	3/week	Calculated
(2) Final wastewater effluent			
Final Wastewater Effluent means wastewater exiting the last treatment process or operation.			
Flow	MGD	Continuous [3]	Metered/recorded
$CBOD_5$	mg/L	3/week	24-hour composite
$CBOD_5$	lbs/day	3/week	Calculated
$CBOD_5$	% removal [4]	1/month	Calculated
Total Ammonia	mg/L as N	3/week (July-Oct only; see part (4) Effluent Characterization for Nov-June frequency)	24-hour composite
NBOD+CBOD [5]	lbs/day	3/week (July-Oct only)	Calculated
TSS	mg/L	3/week	24-hour composite
TSS	lbs/day	3/week	Calculated
TSS	% removal	1/month	Calculated
Fecal Coliform [6]	# /100 ml	3/week	Grab [7]
pH [8]	Standard Units	Continuous	Metered/recorded
Temperature [9]	Degrees centigrade (°C)	Continuous	Metered/recorded
7-DAD Max Temperature [10]	°C	1/day	Calculated
Ultraviolet (UV) Transmittance [11]	Percent	3/week	Grab
UV Light Intensity	MilliWatts/Cm2 (mW/Cm2)	Continuous	Metered/recorded
Copper	µg/L	1/month	24-hour composite
(3) Whole effluent toxicity testing – final wastewater effluent			
Acute Toxicity Testing	See S10.	2/year (2021 only)	24-hour composite
Chronic Toxicity Testing	See S11.	2/year (2021 only)	24-hour composite

Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type
(4) Effluent characterization – final wastewater effluent			
Total Phosphorus	mg/L as P	1/month	24-hour composite
Soluble Reactive Phosphorus	mg/L as P	1/month	24-hour composite
Total Ammonia	mg/L as N	1/month (Nov-June only)	24-hour composite
Nitrate plus Nitrite Nitrogen	mg/L as N	1/month	24-hour composite
Total Kjeldahl Nitrogen (TKN)	mg/L as N	1/month	24-hour composite
(5) Permit renewal application requirements – final wastewater effluent			
The Permittee must record and report the wastewater treatment plant flow discharged on the day it collects the sample for priority pollutant testing with the discharge monitoring report.			
Dissolved Oxygen	mg/L	1/quarter in 2021 only	24-hour composite
Oil and Grease	mg/L	1/quarter in 2021 only	Grab
Total Dissolved Solids	mg/L	1/quarter in 2021 only	24-hour composite
Total Hardness	mg/L	1/quarter in 2021 only	24-hour composite
Cyanide	micrograms/liter (µg/L)	1/quarter in 2021 only	Grab
Total Phenolic Compounds	µg/L	1/quarter in 2021 only	Grab
Priority Pollutants (PP) – Total Metals	µg/L; nanograms (ng/L) for mercury	1/quarter in 2021 only	24-hour composite Grab for mercury
PP – Volatile Organic Compounds	µg/L	1/quarter in 2021 only	Grab
PP – Acid-extractable Compounds	µg/L	1/quarter in 2021 only	24-hour composite
PP – Base-neutral Compounds	µg/L	1/quarter in 2021 only	24-hour composite [12]

1	24-hour composite means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.
2	Calculated means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day
3	Continuous means uninterrupted except for brief lengths of time for calibration, power failure, or unanticipated equipment repair or maintenance.
4	$\% \text{ removal} = \frac{\text{Influent concentration (mg/L)} - \text{Effluent concentration (mg/L)}}{\text{Influent concentration (mg/L)}} \times 100$ Calculate the percent (%) removal of BOD_5 and TSS using the above equation.
5	NBOD+CBOD (lbs/day) = (2.1 * Ammonia (lbs/day)) + $CBOD_5$ (lbs/day)
6	Report a numerical value for fecal coliforms following the procedures in Ecology's *Information Manual for Wastewater Treatment Plant Operators*, Publication Number 04-10-020 available at: http://www.ecy.wa.gov/programs/wq/permits/guidance.html . Do not report a result as too numerous to count (TNTC).
7	Grab means an individual sample collected over a fifteen (15) minute, or less, period.
8	Report the daily minimum and maximum pH.
9	The Permittee must determine and report a daily maximum from half-hour measurements in a 24-hour period. Continuous monitoring instruments must achieve an accuracy of 0.2 degrees C and the Permittee must verify accuracy annually.
10	Calculate a 7-DAD Max for each day by averaging each day's maximum temperature value with the daily maximum temperatures of the three (3) days prior and the three (3) days after that specific date.
11	Report the daily minimum UV transmittance and intensity.
12	For Bis(2-ethylhexyl phthalate use clean sampling techniques to assure that the detection is not a result of either sampling or laboratory contamination. Samples must be collected in clean glass bottles with polytetrafluoroethylene (PFTE or Teflon™) lids.

S2.B. Sampling and analytical procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapters N [Parts 400–471] or O [Parts 501-503]) unless otherwise specified in this permit . Ecology may only specify alternative methods for parameters without permit limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S2.C. Flow measurement, field measurement, and continuous monitoring devices

The Permittee must:

1. Select and use appropriate flow measurement, field measurement, and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard, the manufacturer’s recommendation, and approved O&M manual procedures for the device and the wastestream.
3. Calibrate continuous monitoring instruments weekly unless it can demonstrate a longer period is sufficient based on monitoring records. The Permittee:
    a. May calibrate apparatus for continuous monitoring of dissolved oxygen by air calibration.
    b. Must calibrate continuous pH measurement instruments using a grab sample analyzed in the lab with a pH meter calibrated with standard buffers and analyzed within 15 minutes of sampling.
4. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.
5. Establish a calibration frequency for each device or instrument in the O&M manual that conforms to the frequency recommended by the manufacturer.
6. Calibrate flow-monitoring devices at a minimum frequency of at least one calibration per year.
7. Maintain calibration records for at least three years.

S2.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*.

Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S3. Reporting and recording requirements

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

S3.A. Discharge monitoring reports

The first monitoring period begins on the effective date of the permit (unless otherwise specified). The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on the electronic discharge monitoring report (DMR) form provided by Ecology within the Water Quality Permitting Portal. Include data for each of the parameters tabulated in Special Condition S2 and as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.
2. Ensure that DMRs are electronically submitted no later than the dates specified below, unless otherwise specified in this permit.
3. The Permittee must also submit an electronic copy of the laboratory report as an attachment using WQWebDMR. The contract laboratory reports must also include information on the chain of custody, QA/QC results, and documentation of accreditation for the parameter.
4. Submit DMRs for parameters with the monitoring frequencies specified in S2 (monthly, quarterly, annual, etc.) at the reporting schedule identified below. The Permittee must:
    a. Submit **monthly** DMRs by the 15th day of the following month.
    b. Submit **quarterly** DMRs, by the 15th day of the month following the monitoring period. Quarterly sampling periods are January through March, April through June, July through September, and October through December. Submit the first quarterly DMR by April 15, 2018, for the quarter beginning on January 1, 2018.
    c. Submit permit renewal application monitoring data in WQWebDMR as required in Special Condition S2 in **quarterly** DMRs during 2021. Quarterly sampling periods are January through March, April through June, July through September, and October through December. Submit the first quarterly DMR by April 15, 2021, for the quarter beginning on January 1, 2021.

5. Enter the "No Discharge" reporting code for an entire DMR, for a specific monitoring point, or for a specific parameter as appropriate, if the Permittee did not discharge wastewater or a specific pollutant during a given monitoring period.
6. Report single analytical values below detection as "less than the detection level (DL)" by entering < followed by the numeric value of the detection level (e.g. < 2.0) on the DMR. If the method used did not meet the minimum DL and quantitation level (QL) identified in the permit, report the actual QL and DL in the comments or in the location provided.
7. Report single analytical values between the detection level (DL) and the quantitation level (QL) by entering the estimated value, the code for estimated value/below quantitation limit (j) and any additional information in the comments. Submit a copy of the laboratory report as an attachment using WQWebDMR.
8. Not report zero for bacteria monitoring. Report as required by the laboratory method.
9. Calculate and report an arithmetic average value for each day for bacteria if multiple samples were taken in one day.
10. Calculate the geometric mean values for bacteria (unless otherwise specified in the permit) using:
    a. The reported numeric value for all bacteria samples measured above the detection value except when it took multiple samples in one day. If the Permittee takes multiple samples in one day it must use the arithmetic average for the day in the geometric mean calculation.
    b. The detection value for those samples measured below detection.
11. Report the test method used for analysis in the comments if the laboratory used an alternative method not specified in the permit and as allowed in Appendix A.
12. Calculate average values and calculated total values (unless otherwise specified in the permit) using:
    a. The reported numeric value for all parameters measured between the detection value and the quantitation value for the sample analysis.
    b. One-half the detection value (for values reported below detection) if the lab detected the parameter in another sample from the same monitoring point for the reporting period.
    c. Zero (for values reported below detection) if the lab did not detect the parameter in another sample for the reporting period.

13. Report single-sample grouped parameters (for example: priority pollutants, PAHs, pulp and paper chlorophenolics, TTOs) on the WQWebDMR form and include: sample date, concentration detected, detection limit (DL) (as necessary), and laboratory quantitation level (QL) (as necessary).

S3.B. Permit submittals and schedules

The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all other written permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper (hard-copy) report, the Permittee must ensure that it is postmarked or received by Ecology no later than the dates specified by this permit. Send these paper reports to Ecology at:

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

S3.C. Records retention

The Permittee must retain records of all monitoring information for a minimum of three (3) years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S3.D. Recording of results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.
2. The individual who performed the sampling or measurement.
3. The dates the analyses were performed.
4. The individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

S3.E. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR unless otherwise specified by Special Condition S2.

S3.F. Reporting permit violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.
2. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

a. Immediate reporting

The Permittee must immediately report to Ecology and the Department of Health, Shellfish Program, and the Snohomish Health District (at the numbers listed below), all:

- Failures of the disinfection system.
- Collection system overflows.
- Plant bypasses discharging to marine surface waters.
- Any other failures of the sewage system (pipe breaks, etc.)

Northwest Regional Office	**425-649-7000**
Department of Health, Shellfish Program	**360-236-3330 (business hours)** **360-789-8962 (after business hours)**
Snohomish Health District	**425-339-5250** **425-339-5295 (after business hours)**

Additionally, for any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4), the Permittee must notify the appropriate MS4 owner or operator.

b. Twenty-four-hour reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at the telephone numbers listed above, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

1. Any noncompliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.
2. Any unanticipated bypass that causes an exceedance of an effluent limit in the permit (See Part S5.F, “Bypass Procedures”).
3. Any upset that causes an exceedance of an effluent limit in the permit (See G.15, “Upset”).
4. Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Section S1.A and S1.B of this permit.

5. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limit in the permit.

c. Report within five days

The Permittee must also submit a written report within five days of the time that the Permittee becomes aware of any reportable event under subparts a or b, above. The report must contain:

1. A description of the noncompliance and its cause.
2. The period of noncompliance, including exact dates and times.
3. The estimated time the Permittee expects the noncompliance to continue if not yet corrected.
4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
5. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

d. Waiver of written reports

Ecology may waive the written report required in subpart c, above, on a case-by-case basis upon request if the Permittee has submitted a timely oral report.

e. All other permit violation reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in subpart c, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

S3.G. Other reporting

a. Spills of oil or hazardous materials

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145.   You can obtain further instructions at the following website: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm .

b. Failure to submit relevant or correct facts

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

S3.H. Maintaining a copy of this permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. Facility loading

S4.A. Design criteria

The flows or waste loads for the permitted facility must not exceed the following design criteria:

Maximum Month Design Flow (MMDF)	**5.01 MGD**
Monthly Average Dry Weather Flow	**3.88 MGD**
BOD_5 Influent Loading for Maximum Month	**10,730 lbs/day**
TSS Influent Loading for Maximum Month	**10,190 lbs/day**

S4.B. Plans for maintaining adequate capacity

a. Conditions triggering plan submittal

The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.
2. The projected plant flow or loading would reach design capacity within five years.

b. Plan and schedule content

The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan.

1. Analysis of the present design and proposed process modifications.
2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.
3. Limits on future sewer extensions or connections or additional waste loads.
4. Modification or expansion of facilities.
5. Reduction of industrial or commercial flows or waste loads.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction.

S4.C. Duty to mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S4.D. Notification of new or altered sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the wastewater treatment plant is proposed which:
    a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
    b. Is not part of an approved general sewer plan or approved plans and specifications.
    c. Is subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.
2. This notice must include an evaluation of the wastewater treatment plant's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the treatment plant, and the anticipated impact on the Permittee's effluent [40 CFR 122.42(b)].

S5. Operation and maintenance

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Certified operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class III plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class II plant must be in charge during all regularly scheduled shifts.

S5.B. Operation and maintenance program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.
2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.
3. Make maintenance records available for inspection at all times.

S5.C. Short-term reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out according to the approved O&M manual or as otherwise approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.
2. Detail the reasons for, length of time of, and the potential effects of the reduced level of treatment.

This notification does not relieve the Permittee of its obligations under this permit.

S5.D. Electrical power failure

The Permittee must ensure that adequate safeguards 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. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes.

The Permittee must maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant. Reliability Class II requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but must be sufficient to maintain the biota.

S5.E. Prevent connection of inflow

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

S5.F. Bypass procedures

A bypass is the intentional diversion of waste streams from any portion of a treatment facility. This permit prohibits all bypasses except when the bypass is for essential maintenance, as authorized in special condition S5.F.1, or is approved by Ecology as an anticipated bypass following the procedures in S5.F.2.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   This permit allows bypasses for essential maintenance of the treatment system when necessary to ensure efficient operation of the system. The Permittee may bypass the treatment system for essential maintenance only if doing so does not cause violations of effluent limits. The Permittee is not required to notify Ecology when bypassing for essential maintenance. However the Permittee must comply with the monitoring requirements specified in special condition S2.B.

2. Anticipated bypasses for non-essential maintenance

   Ecology may approve an anticipated bypass under the conditions listed below. This permit prohibits any anticipated bypass that is not approved through the following process.

   a. If a bypass is for non-essential maintenance, the Permittee must notify Ecology, if possible, at least ten (10) days before the planned date of bypass. The notice must contain:

      - A description of the bypass and the reason the bypass is necessary.
      - An analysis of all known alternatives which would eliminate, reduce, or mitigate the potential impacts from the proposed bypass.
      - A cost-effectiveness analysis of alternatives.
      - The minimum and maximum duration of bypass under each alternative.
      - A recommendation as to the preferred alternative for conducting the bypass.
      - The projected date of bypass initiation.
      - A statement of compliance with SEPA.
      - A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
      - Details of the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

   b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during the project planning and design process. The project-specific engineering report as well as the plans and specifications must include details of probable construction bypasses to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.

   c. Ecology will determine if the Permittee has met the conditions of special condition S5.F.2 a and b and consider the following prior to issuing a determination letter, an administrative order, or a permit modification as appropriate for an anticipated bypass:

- If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.
- If the bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.
- If feasible alternatives to the bypass exist, such as:
  - The use of auxiliary treatment facilities.
  - Retention of untreated wastes.
  - Stopping production.
  - Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance.
  - Transport of untreated wastes to another treatment facility.

S5.G. Operations and maintenance (O&M) manual

a. O&M manual submittal and requirements

The Permittee must:

1. Review and update the Operations and Maintenance (O&M) Manual and confirm this review by letter to Ecology by January 1, 2019.
2. Submit to Ecology for review substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.
3. Keep the approved O&M Manual at the permitted facility.
4. Follow the instructions and procedures of this manual.

b. O&M manual components

In addition to the requirements of WAC 173-240-080(1) through (5), the O&M Manual must be consistent with the guidance in Table G1-3 in the *Criteria for Sewage Works Design* (Orange Book), 2008. The O&M Manual must include:

1. Emergency procedures for cleanup in the event of wastewater system upset or failure.
2. A review of system components which if failed could pollute surface water or could impact human health. Provide a procedure for a routine schedule of checking the function of these components.
3. Wastewater system maintenance procedures that contribute to the generation of process wastewater.

4. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
5. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).
6. The treatment plant process control monitoring schedule.
7. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. Pretreatment

S6.A. General requirements

The Permittee must work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

S6.B. Duty to enforce discharge prohibitions

1. Under federal regulations (40 CFR 403.5(a) and (b)), the Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference, or which otherwise violate general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC 173-216-060.
2. The Permittee must not authorize or knowingly allow the introduction of any of the following into their treatment works:
   a. Pollutants which create a fire or explosion hazard in the POTW (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).
   b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.
   c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.
   d. Any pollutant, including oxygen-demanding pollutants, (BOD_5, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.
   e. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.

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

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

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

i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).

3. The Permittee must also not allow the following discharges to the POTW unless approved in writing by Ecology:

   a. Noncontact cooling water in significant volumes.

   b. Stormwater and other direct inflow sources.

   c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.

4. The Permittee must notify Ecology if any industrial user violates the prohibitions listed in this section (S6.B), and initiate enforcement action to promptly curtail any such discharge.

S6.C. Wastewater discharge permit required

The Permittee must:

1. Establish a process for authorizing non-domestic wastewater discharges that ensures all SIUs in all tributary areas meet the applicable state waste discharge permit (SWDP) requirements in accordance with chapter 90.48 RCW and chapter 173-216 WAC.

2. Immediately notify Ecology of any proposed discharge of wastewater from a source, which may be a significant industrial user (SIU) [see fact sheet definitions or refer to 40 CFR 403.3(v)(i)(ii)].

3. Require all SIUs to obtain a SWDP from Ecology prior to accepting their non-domestic wastewater, or require proof that Ecology has determined they do not require a permit.

4. Require the documentation as described in S6.C.3 at the earliest practicable date as a condition of continuing to accept non-domestic wastewater discharges from a previously undiscovered, currently discharging and unpermitted SIU.

5. Require sources of non-domestic wastewater, which do not qualify as SIUs but merit a degree of oversight, to apply for a SWDP and provide it a copy of the application and any Ecology responses.
6. Keep all records documenting that its users have met the requirements of S6.C.

S6.D. Identification and reporting of existing, new, and proposed industrial users

1. The Permittee must take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging or proposing to discharge to the Permittee's sewer system (see Appendix C of the fact sheet for definitions).
2. Within 30 days of becoming aware of an unpermitted existing, new, or proposed industrial user who may be a significant industrial user (SIU), the Permittee must notify such user by registered mail that, if classified as an SIU, they must apply to Ecology and obtain a State Waste Discharge Permit. The Permittee must send a copy of this notification letter to Ecology within this same 30-day period.
3. The Permittee must also notify all Potential SIUs (PSIUs), as they are identified, that if their classification should change to an SIU, they must apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

S6.E. Industrial user survey

The Permittee must complete an industrial user survey listing all SIUs and potential significant industrial users (PSIUs) discharging to the POTW. The Permittee must submit the survey to Ecology by October 31, 2021. At a minimum, the Permittee must develop the list of SIUs and PSIUs by means of a telephone book search, a water utility billing records search, and a physical reconnaissance of the service area.

Information on PSIUs must include, at a minimum, the business name, telephone number, address, description of the industrial process(s), and the known wastewater volumes and characteristics.

S7. Solid wastes

S7.A. Solid waste handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

S7.B. Leachate

The Permittee must not allow leachate from its solid waste material to enter state waters without providing all known, available, and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC.

S8. Mixing zone study

S8.A. General requirements

The Permittee must:

1. Update the Outfall Evaluation and Mixing Zone Study (Cosmopolitan, 2002 and 2005). Submit a Plan of Study to Ecology for review by January 1, 2018, prior to initiation of the effluent mixing study.
2. Use the Guidance for Conducting Mixing Zone Analyses (Appendix C of Ecology's *Permit Writer's Manual*, 2015) and the protocols identified in S8.C.
3. Include the results of the effluent mixing study in the Effluent Mixing Report and submit it to Ecology for approval by January 1, 2019.
4. If the results of the mixing study, toxicity tests, and chemical analysis indicate that the concentration of any pollutant(s) exceeds or has a reasonable potential to exceed the state water quality standards, chapter 173-201A WAC, Ecology may modify this permit to impose effluent limits to meet the water quality standards.

S8.B. Reporting requirements

The mixing zone study must include:

1. A statement confirming that AKART has been applied to the discharge.
2. A description of the size of the mixing zone allowed under WAC 173-201A.
3. An analysis showing how mixing zones have been minimized based on using the lowest dilution from hydraulic limitation, width limitations, distance limitation and that predicted by the model.
4. A clear description of the critical conditions used for dilution factors:
   a. For ambient freshwater (unidirectional flow) use 7Q10 flows for acute, chronic and non-carcinogen pollutants, and harmonic flow for carcinogens.
   b. For ambient marine waters (and reversing flows e.g., tidally-influenced rivers) use 10th or 90th percentile current velocity for acute and 50th percentile tidal current velocity for chronic, carcinogens and non-carcinogens.
   c. Generally, use depth of outfall at 7Q10 flows (rivers) or at MLLW (marine environment). For assessing human health in freshwater, depths of outfall should be established at the applicable flow (e.g. harmonic mean flow or 30Q5 flows). For tidally influenced rivers a combination of MLLW and critical river flows should be used to establish depth of outfall.
   d. Use density profile that gives the lowest dilution. Valuate both maximum and minimum stratification. For human health, use average density profiles to estimate dilution.
   e. For unidirectional flow use centerline dilution factor for acute and chronic conditions, while flux average for human health dilution factors. For marine environment or rivers with reversing flows, use flux-average dilution factors for all conditions.

5. Diffuser information:
    a. Location, orientation, description and dimension of diffusers and ports.
    b. Port elevation above bottom and the depth of the diffuser/port below water surface based on either 7Q10 flow (for rivers) or MLLW (for marine or tidally-influenced river reaches).
    c. Plan view maps showing the mixing zone size and dimensions in relation to the diffuser.
    d. Schematic of waterbody cross-section, showing channel width, depth, and diffuser location in relation to shoreline and bottom.
    e. Report on the integrity of the diffuser and the ports being modeled.
6. Discharge characteristics:
    a. Existing and projected maximum daily, maximum monthly average, and annual average flows.
    b. Discharge density (temperature and salinity).
7. Ambient water characteristics:
    a. Critical stream flow statistics (7Q10, 30Q5, harmonic flow) or marine current velocities (10th, 90th and 50th percentiles over a neap and spring tide and directions).
    b. Velocity profile in the vicinity of the diffuser.
    c. Temporal density (temperature and salinity) profiles near the diffuser. May need to consider both seasonal and tidal variability.
    d. Manning's roughness coefficient, if used.
    e. Available information regarding background concentrations of chemical substances in the receiving water (for which there are criteria in chapter 173-201A WAC.
8. Model selection and results:
    a. Model selection and application discussion. Consider model applicability to single or multiport diffuser, opposing port configuration, submerged, surface or above-surface discharge, buoyant or non-buoyant discharge, and potential plume attachment to boundaries.
    b. Description of mixing and plume dynamics (nearfield, farfield, tidal buildup/reflux).
    c. Sensitivity analysis.
    d. Calibration to empirical data (tracer studies), if applicable.
    e. Provide model output and summary table of results.

S8.C. Protocols

The Permittee must determine the dilution ratio using protocols outlined in the following references, approved modifications thereof, or by another method approved by Ecology:

1. Doneker, R.L. and G.H. Jirka, *CORMIX User Manual: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, EPA-823-K-07-001, Dec. 2007. http://www.mixzon.com/downloads/.

   A complete list of general reference for CORMIX is at: http://www.cormix.info/references.php

2. Frick, W.E., Roberts, P.J.W., Davis, L.R., Keyes, D.J., Baumgartner, George, K.P. 2003. *Dilution Models for Effluent Discharges, 4th Edition (Visual Plumes)*. Ecosystems Research Div., USEPA, Athens, GA, USA.

3. Ecology, Water Quality Program, *Permit Writer's Manual*. 2015. Washington State Department of Ecology. Publication No. 92-109, Revised January 2015. https://fortress.wa.gov/ecy/publications/documents/92109.pdf.

4. Ecology, Guidance for conducting mixing zone analysis (Appendix C, Water Quality Program *Permit Writer's Manual*. 2015). https://fortress.wa.gov/ecy/publications/parts/92109part1.pdf#page=27.

5. Kilpatrick, F.A., and E.D. Cobb, *Measurement of Discharge Using Tracers, Chapter A16, Techniques of Water-Resources Investigations of the USGS*, Book 3, Application of Hydraulics, USGS, U.S. Department of the Interior, Reston, VA, 1985.

6. Wilson, J.F., E.D. Cobb, and F.A. Kilpatrick, *Fluorometric Procedures for Dye Tracing, Chapter A12. Techniques of Water-Resources Investigations of the USGS*, Book 3, Application of Hydraulics, USGS, U.S. Department of the Interior, Reston, VA, 1986.

S9. Outfall evaluation

The Permittee must inspect, once during the permit term, the submerged portion of the outfall line and diffuser to document its integrity and continued function. If conditions allow for a photographic verification, the Permittee must include such verification in the report. By January 1, 2019, the Permittee must submit the inspection report to Ecology through the Water Quality Permitting Portal – Permit Submittals application. The Permittee must submit hard-copies of any video files to Ecology as required by Permit Condition S3.B. The Portal does not support submittal of video files.

The inspector must, at a minimum:

- Assess the physical condition of the outfall pipe, diffuser, and associated couplings.
- Determine the extent of sediment accumulation in the vicinity of the diffuser.
- Ensure diffuser ports are free of obstructions and are allowing uniform flow.

- Confirm physical location (latitude/longitude) and depth (at MLLW) of the diffuser section of the outfall.
- Assess physical condition of the submarine line.
- Assess physical condition of anchors used to secure the submarine line.

S10. Acute toxicity

S10.A. Testing when there is no permit limit for acute toxicity

The Permittee must:

1. Conduct acute toxicity testing on final effluent during February 2021 and August 2021.
2. Conduct acute toxicity testing on a series of at least five concentrations of effluent, including 100% effluent and a control.
3. Use each of the following species and protocols for each acute toxicity test:

Acute Toxicity Tests	Species	Method
Fathead minnow 96-hour static-renewal test	*Pimephales promelas*	EPA-821-R-02-012
Daphnid 48-hour static test	*Ceriodaphnia dubia, Daphnia pulex,* or *Daphnia magna*	EPA-821-R-02-012

4. Submit the results to Ecology by April 15, 2021, and October 15, 2021.

S10.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Subsection C and the Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.

5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the acute critical effluent concentration (ACEC). The ACEC equals 16% effluent.
8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing must comply with the acute statistical power standard of 29% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S11. Chronic toxicity

S11.A. Testing when there is no permit limit for chronic toxicity

The Permittee must:

1. Conduct chronic toxicity testing on final effluent during February 2021 and August 2021.
2. Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 16% effluent. The series of dilutions should also contain the CCEC of 6.7% effluent.
3. Compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.
4. Submit the results to Ecology by April 15, 2021, and October 15, 2021.
5. Perform chronic toxicity tests with all of the following species and the most recent version of the following protocols:

Saltwater Chronic Test	Species	Method
Topsmelt survival and growth	*Atherinops affinis*	EPA/600/R-95/136
Mysid shrimp survival and growth	*Americamysis bahia* (formerly *Mysidopsis bahia*)	EPA-821-R-02-014

S11.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in

electronic format (CETIS export file preferred) for entry into Ecology's database.

2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Section C and the Ecology Publication no. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Subsection C or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the CCEC and the ACEC. The CCEC and the ACEC may either substitute for the effluent concentrations that are closest to them in the dilution series or be extra effluent concentrations. The CCEC equals 6.7% effluent. The ACEC equals 16% effluent.
8. All whole effluent toxicity tests that involve hypothesis testing must comply with the chronic statistical power standard of 39% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S12. Application for permit renewal or modification for facility changes

The Permittee must submit an application for renewal of this permit by October 31, 2021.

The Permittee must also submit a new application or addendum at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

General Conditions

G1. Signatory requirements

1. All applications submitted to Ecology must be signed and certified.

   a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

      - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or
      - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

   b. In the case of a partnership, by a general partner.

   c. In the case of sole proprietorship, by the proprietor.

   d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

   Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

2. All reports required by this permit and other information requested by Ecology must 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:

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

   b. 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.)

3. Changes to authorization. If an authorization under paragraph G1.2, 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 paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. Certification. Any person signing a document under this section must 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 inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. 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.
2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   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 determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.

   e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.

   f. Nonpayment of fees assessed pursuant to RCW 90.48.465.

   g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

   a. A material change in the condition of the waters of the state.

   b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

   c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

   d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

   e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

   f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

   g. Incorporation of an approved local pretreatment program into a municipality's permit.

3. The following are causes for modification or alternatively revocation and reissuance:

   a. When cause exists for termination for reasons listed in 1.a through 1.g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

   b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than one hundred eighty (180) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:

1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).
2. A significant change in the nature or an increase in quantity of pollutants discharged.

3. A significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification

   Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

2. Automatic Transfers

   This permit may be automatically transferred to a new Permittee if:

   a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.

   b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.

   c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must 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.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($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 may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
2. The permitted facility was being properly operated at the time of the upset.
3. The Permittee submitted notice of the upset as required in Special Condition S3.F.
4. The Permittee complied with any remedial measures required under S3.F of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

Appendix A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a quantitation limit (QL) to Ecology with appropriate laboratory documentation.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122.), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit appendix A list does not include those parameters.

CONVENTIONAL POLLUTANTS

Pollutant	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B [3]		2 mg/L
Fecal Coliform		SM 9221E,9222	N/A	Specified in method - sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
pH		SM4500-H^+ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] µg/L unless specified	Quantitation Level (QL)[2] µg/L unless specified
Alkalinity, Total		SM2320-B		5 mg/L as CaCO3
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-Cl B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 Cl G		50.0
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as CaCO3
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N_{org}B/C and SM4500NH_3-B/C/D/EF/G/H		300
NWTPH Dx [4]		Ecology NWTPH Dx	250	250
NWTPH Gx [5]		Ecology NWTPH Gx	250	250
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO_4)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S^2F/D/E/G		0.2 mg/L
Sulfite (as mg/L SO_3)		SM4500-SO3B		2 mg/L
Temperature (max. 7-day avg.)		Analog recorder or use micro-recording devices known as thermistors		0.2º C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5
Total Coliform		SM 9221B, 9222B, 9223B	N/A	Specified in method - sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total dissolved solids		SM2540 C		20 mg/L

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
METALS, CYANIDE & TOTAL PHENOLS					
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10
Phenols, Total	65		EPA 420.1		50

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
ACID COMPOUNDS					
2-Chlorophenol	24	95-57-8	625.1	3.3	9.9
2,4-Dichlorophenol	31	120-83-2	625.1	2.7	8.1
2,4-Dimethylphenol	34	105-67-9	625.1	2.7	8.1
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625.1/1625B	24	72
2,4 dinitrophenol	59	51-28-5	625.1	42	126
2-Nitrophenol	57	88-75-5	625.1	3.6	10.8
4-Nitrophenol	58	100-02-7	625.1	2.4	7.2
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625.1	3.0	9.0
Pentachlorophenol	64	87-86-5	625.1	3.6	10.8
Phenol	65	108-95-2	625.1	1.5	4.5
2,4,6-Trichlorophenol	21	88-06-2	625.1	2.7	8.1

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1]** ***µg/L unless specified***	**Quantitation Level (QL) [2]** ***µg/L unless specified***
VOLATILE COMPOUNDS					
Acrolein	2	107-02-8	624	5	10
Acrylonitrile	3	107-13-1	624	1.0	2.0
Benzene	4	71-43-2	624.1	4.4	13.2
Bromoform	47	75-25-2	624.1	4.7	14.1
Carbon tetrachloride	6	56-23-5	624.1/601 or SM6230B	2.8	8.4
Chlorobenzene	7	108-90-7	624.1	6.0	18.0
Chloroethane	16	75-00-3	624/601	1.0	2.0
2-Chloroethylvinyl Ether	19	110-75-8	624	1.0	2.0
Chloroform	23	67-66-3	624.1 or SM6210B	1.6	4.8
Dibromochloromethane (chlordibromomethane)	51	124-48-1	624.1	3.1	9.3
1,2-Dichlorobenzene	25	95-50-1	624	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624	4.4	17.6
Dichlorobromomethane	48	75-27-4	624.1	2.2	6.6
1,1-Dichloroethane	13	75-34-3	624.1	4.7	14.1
1,2-Dichloroethane	10	107-06-2	624.1	2.8	8.4
1,1-Dichloroethylene	29	75-35-4	624.1	2.8	8.4
1,2-Dichloropropane	32	78-87-5	624.1	6.0	18.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) [6]	33	542-75-6	624.1	5.0	15.0
Ethylbenzene	38	100-41-4	624.1	7.2	21.6
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0
Methyl chloride (Chloromethane)	45	74-87-3	624	1.0	2.0
Methylene chloride	44	75-09-2	624.1	2.8	8.4
1,1,2,2-Tetrachloroethane	15	79-34-5	624.1	6.9	20.7
Tetrachloroethylene	85	127-18-4	624.1	4.1	12.3
Toluene	86	108-88-3	624.1	6.0	18.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624.1	1.6	4.8
1,1,1-Trichloroethane	11	71-55-6	624.1	3.8	11.4
1,1,2-Trichloroethane	14	79-00-5	624.1	5.0	15.0
Trichloroethylene	87	79-01-6	624.1	1.9	5.7
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Acenaphthene	1	83-32-9	625.1	1.9	5.7
Acenaphthylene	77	208-96-8	625.1	3.5	10.5
Anthracene	78	120-12-7	625.1	1.9	5.7
Benzidine	5	92-87-5	625.1	44	132
Benzyl butyl phthalate	67	85-68-7	625.1	2.5	7.5
Benzo(*a*)anthracene	72	56-55-3	625.1	7.8	23.4
Benzo(b)fluoranthene (3,4-benzofluoranthene) [7]	74	205-99-2	610/625.1	4.8	14.4
Benzo(j)fluoranthene [7]		**205-82-3**	625	0.5	1.0
Benzo(k)fluoranthene (11,12-benzofluoranthene) [7]	75	207-08-9	610/625.1	2.5	7.5
Benzo(r,s,t)pentaphene		**189-55-9**	625	1.3	5.0
Benzo(*a*)pyrene	73	50-32-8	610/625.1	2.5	7.5
Benzo(*ghi*)Perylene	79	191-24-2	610/625.1	4.1	12.3
Bis(*2-chloroethoxy)*methane	43	111-91-1	625.1	5.3	15.9
Bis(*2-chloroethyl*)ether	18	111-44-4	611/625.1	5.7	17.1
Bis(*2-chloroisopropyl*)ether	42	39638-32-9	625	0.5	1.0
Bis(*2-ethylhexyl*)phthalate	66	117-81-7	625.1	2.5	7.5
4-Bromophenyl phenyl ether	41	101-55-3	625.1	1.9	5.7
2-Chloronaphthalene	20	91-58-7	625.1	1.9	5.7
4-Chlorophenyl phenyl ether	40	7005-72-3	625.1	4.2	12.6
Chrysene	76	218-01-9	610/625.1	2.5	7.5
Dibenzo (a,h)acridine		**226-36-8**	610M/625M	2.5	10.0
Dibenzo (a,j)acridine		**224-42-0**	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (1,2,5,6-dibenzanthracene)	82	53-70-3	625.1	2.5	7.5
Dibenzo(a,e)pyrene		192-65-4	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene		189-64-0	625M	2.5	10.0
3,3-Dichlorobenzidine	28	91-94-1	605/625.1	16.5	49.5
Diethyl phthalate	70	84-66-2	625.1	1.9	5.7
Dimethyl phthalate	71	131-11-3	625.1	1.6	4.8
Di-n-butyl phthalate	68	84-74-2	625.1	2.5	7.5
2,4-dinitrotoluene	35	121-14-2	609/625.1	5.7	17.1
2,6-dinitrotoluene	36	606-20-2	609/625.1	1.9	5.7
Di-n-octyl phthalate	69	117-84-0	625.1	2.5	7.5
1,2-Diphenylhydrazine (*as Azobenzene*)	37	122-66-7	1625B	5.0	20
Fluoranthene	39	206-44-0	625.1	2.2	6.6
Fluorene	80	86-73-7	625.1	1.9	5.7
Hexachlorobenzene	9	118-74-1	612/625.1	1.9	5.7
Hexachlorobutadiene	52	87-68-3	625.1	0.9	2.7
Hexachlorocyclopentadiene	53	77-47-4	1625B/625	2.0	4.0
Hexachloroethane	12	67-72-1	625.1	1.6	4.8
Indeno(*1,2,3-cd*)Pyrene	83	193-39-5	610/625.1	3.7	11.1
Isophorone	54	78-59-1	625.1	2.2	6.6
3-Methyl cholanthrene		**56-49-5**	625	2.0	8.0
Naphthalene	55	91-20-3	625.1	1.6	4.8

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Nitrobenzene	56	98-95-3	625.1	1.9	5.7
N-Nitrosodimethylamine	61	62-75-9	607/625	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625	1.0	2.0
Perylene		**198-55-0**	625	1.9	7.6
Phenanthrene	81	85-01-8	625.1	5.4	16.2
Pyrene	84	129-00-0	625.1	1.9	5.7
1,2,4-Trichlorobenzene	8	120-82-1	625.1	1.9	5.7

PRIORITY POLLUTANT	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
DIOXIN					
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
PESTICIDES/PCBs					
Aldrin	89	309-00-2	608.3	4.0 ng/L	12 ng/L
alpha-BHC	102	319-84-6	608.3	3.0 ng/L	9.0 ng/L
beta-BHC	103	319-85-7	608.3	6.0 ng/L	18 ng/L
gamma-BHC (Lindane)	104	58-89-9	608.3	4.0 ng/L	12 ng/L
delta-BHC	105	319-86-8	608.3	9.0 ng/L	27 ng/L
Chlordane [8]	91	57-74-9	608.3	14 ng/L	42 ng/L
4,4'-DDT	92	50-29-3	608.3	12 ng/L	36 ng/L
4,4'-DDE	93	72-55-9	608.3	4.0 ng/L	12 ng/L
4,4' DDD	94	72-54-8	608.3	11ng/L	33 ng/L
Dieldrin	90	60-57-1	608.3	2.0 ng/L	6.0 ng/L
alpha-Endosulfan	95	959-98-8	608.3	14 ng/L	42 ng/L
beta-Endosulfan	96	33213-65-9	608.3	4.0 ng/L	12 ng/L
Endosulfan Sulfate	97	1031-07-8	608.3	66 ng/L	198 ng/L
Endrin	98	72-20-8	608.3	6.0 ng/L	18 ng/L
Endrin Aldehyde	99	7421-93-4	608.3	23 ng/L	70 ng/L
Heptachlor	100	76-44-8	608.3	3.0 ng/L	9.0 ng/L
Heptachlor Epoxide	101	1024-57-3	608.3	83 ng/L	249 ng/L
PCB-1242 [9]	106	53469-21-9	608.3	0.065	0.095
PCB-1254	107	11097-69-1	608.3	0.065	0.095
PCB-1221	108	11104-28-2	608.3	0.065	0.095
PCB-1232	109	11141-16-5	608.3	0.065	0.095
PCB-1248	110	12672-29-6	608.3	0.065	0.095
PCB-1260	111	11096-82-5	608.3	0.065	0.095
PCB-1016 [9]	112	12674-11-2	608.3	0.065	0.095
Toxaphene	113	8001-35-2	608.3	240 ng/L	720 ng/L

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.

2. Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer. (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

3. Soluble Biochemical Oxygen Demand method note: First, filter the sample through a Millipore Nylon filter (or equivalent) - pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.

4. NWTPH Dx - Northwest Total Petroleum Hydrocarbons Diesel Extended Range – see http://www.ecy.wa.gov/biblio/97602.html

5. NWTPH Gx - Northwest Total Petroleum Hydrocarbons Gasoline Extended Range – see http://www.ecy.wa.gov/biblio/97602.html

6. 1, 3-dichloroproylene (mixed isomers) You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).

7. Total Benzofluoranthenes - Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.

8. Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 14/42 ng/L.

9. PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

Fact Sheet for NPDES Permit WA0020893

Lake Stevens Sewer District

Effective Date: November 1, 2017

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for the Lake Stevens Sewer District (the District).

This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit and accompanying fact sheet for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for Lake Stevens Sewer District, NPDES permit WA0020893, were available for public review and comment from August 11, 2017, until September 11, 2017. For more details on preparing and filing comments about these documents, please see *Appendix A - Public Involvement Information.*

The District reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, wastewater discharges, or receiving water prior to publishing this draft fact sheet for public notice.

After the public comment period closed, Ecology summarized substantive comments and provided responses to them. Ecology included the summary and responses to comments in this fact sheet as *Appendix F - Response to Comments*, and published it when issuing the final NPDES permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

Summary

The District owns, operates, and maintains an activated sludge wastewater treatment plant with a membrane bioreactor process. Ecology issued the previous permit on December 22, 2011. The proposed permit removes all limits and conditions for the now-decommissioned lagoon treatment plant. Effluent limits for $CBOD_5$, total suspended solids, fecal coliform organisms and pH are unchanged from the previous permit. The combined ammonia and $CBOD_5$ parameter called NBOD+CBOD has a lower monthly average limit, based on updated calculations using effluent data. The proposed permit includes a new limit for copper based on effluent data collected during the previous permit term.

Table of Contents

I. Introduction

The Federal Clean Water Act (FCWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the state of Washington to manage the NPDES permit program in our state. Our state legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The Legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations apply to domestic wastewater NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC).
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC).
- Water quality criteria for surface waters (chapter 173-201A WAC).
- Water quality criteria for groundwaters (chapter 173-200 WAC).
- Whole effluent toxicity testing and limits (chapter 173-205 WAC).
- Sediment management standards (chapter 173-204 WAC).
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC).

These rules require any treatment facility owner/operator to obtain an NPDES permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for requirements imposed by the permit.

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See *Appendix A - Public Involvement Information* for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft NPDES permit in response to comment(s). Ecology will summarize the responses to comments and any changes to the permit in *Appendix F*.

II. Background Information

Table 1. General Facility Information

Facility Information	
Applicant	LAKE STEVENS SEWER DISTRICT
Facility Name and Address	Sunnyside Wastewater Treatment Facility 7110 9th Street SE Lake Stevens, WA 98258
Contact at Facility	Caitlin Hubbard 425-334-8588
Responsible Official	Michael Bowers, General Manager 1106 Vernon Road, Suite A Lake Stevens, WA 98258 425-334-8588
Type of Treatment	Activated sludge with membrane bioreactor (MBR) process
Facility Location (NAD83/WGS84 reference datum)	Latitude: 47.987414 Longitude: -122.133631
Discharge Waterbody Name and Location (NAD83/WGS84 reference datum)	Ebey Slough Latitude: 47.988101 Longitude: -122.139859

Permit Status	
Issuance Date of Previous Permit	December 22, 2011
Application for Permit Renewal Submittal Date	June 27, 2016
Date of Ecology Acceptance of Application	July 21, 2016

Inspection Status	
Date of Last Non-sampling Inspection Date	July 18, 2014

Figure 1. Facility Location Map

A. Facility description

History

The Lake Stevens Sewer District (the District) formed in 1957 to address water quality problems in the Lake Stevens drainage basin. The District's first sewage collection system and treatment system served the Frontier Village complex beginning in 1965. The initial treatment facility was a 1.4-acre lagoon located about one mile north of the current treatment plant site along Sunnyside Boulevard. The District added an 8.5-acre lagoon in 1971, and continued to expand the collection system. The District upgraded the treatment facility in 1986 to provide secondary activated sludge treatment, and constructed an additional upgrade in 2002.

The District completed construction of the current wastewater treatment facility (the Sunnyside WWTF) in 2012. The lagoon treatment plant site is being decommissioned in phases. In August 2016, the District completed removal of 80% of the accumulated biosolids in the treatment lagoons.

Collection system status

The collection system is sanitary-only and serves residents in the District and the City of Lake Stevens. For District maps and additional information, see http://www.lkstevenssewer.org/index.asp. The District operates 29 lift stations, as well as over 112 miles gravity and force main sewer lines. The District has an ongoing infiltration and inflow (I/I) monitoring and repair program. The District's Sewer Comprehensive Plan estimates that peak hour I/I rate is 2,156 gallons per acre per day, or 65-70% of EPA's threshold for excessive I/I.

The City of Lake Stevens operated a separate sewer collection and conveyance system, with treatment by the District, from the late 1960s until 2005. At that time, the District and City entered into a long-term unification agreement. Per the agreement, the City transferred its sewer assets to the District to own, operate, and maintain, for a period of at least twenty years following completion of the new WWTF. The City and District have shared responsibilities for cooperation for sewer system planning and related matters.

Treatment processes

The WWTF includes a headworks facility with flow measurement and screening, primary clarifiers with grit removal capability, influent screening, aeration basins with anoxic and aerobic zones, membrane bioreactor basins and ultraviolet disinfection. A portion of the disinfected effluent is reused for on-site irrigation, while the remainder is discharged to Ebey Slough. The District has no significant industrial discharges into its treatment system. Figure 2 shows a schematic of the treatment process.

There are currently 23 full-time employees on the District staff. Eight personnel are assigned to the WWTF; one lead worker and five maintenance workers are assigned to the collection system. The WWTF requires a Group III certified operator or greater to be in responsible charge. The District currently has two Group IV operators and two Group III operators. An operator certified for at least Group II must be in charge during regularly scheduled shifts.

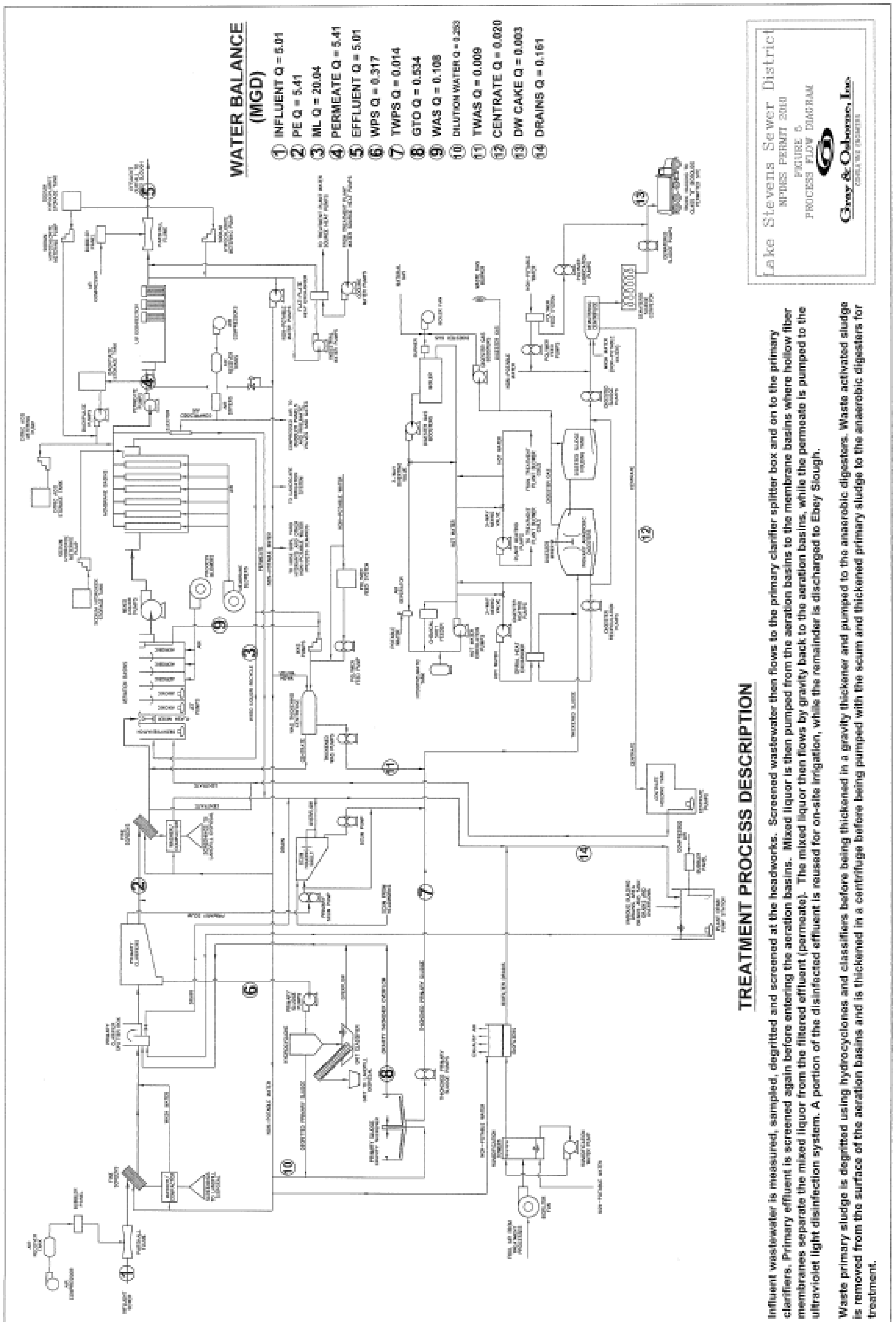
Solid wastes/residual solids

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the primary clarifiers, in addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment. The facility drains grit, rags, scum, and screenings and disposes this solid waste at the local landfill. Solids removed from the primary clarifiers and waste activated sludge from the aeration basins are thickened and treated in anaerobic digesters to meet Class B biosolids standards. Treated biosolids are dewatered and hauled to a permitted site for land application. This facility has met the solid waste requirements for screening, as required by WAC 173-308-205, by using fine screens on the influent flow.

Discharge outfall

The treated and disinfected effluent flows into Ebey Slough through a 30-inch diameter pipe, ending in a 2-port diffuser consisting of two 14-inch outlet ports.

Figure 2. Treatment Process Schematic



B. Description of the receiving water

Lake Stevens Sewer District discharges to Ebey Slough, which is part of the Snohomish River estuary. Other point source outfalls in the lower Snohomish River and the estuary include the cities of Everett, Marysville, and Snohomish. Significant nearby non-point sources of pollutants include residential and commercial development, urban and highway stormwater runoff, agricultural activities, and forestry. Section IIIE of this fact sheet describes any receiving waterbody impairments.

The ambient background data used for this permit includes the following:

Table 2. Ambient Background Data

Parameter	Value	Source
Temperature (90th percentile 1-DADMax)	21.0 °C	Receiving water temperature study (2009 & 2010 data)
Temperature (90th percentile 7-DADMax)	20.6 °C	Receiving water temperature study (2009 & 2010 data)
pH (Maximum)	7.7 standard units	TMDL study, 1997
Dissolved Oxygen (Minimum)	7.2 mg/L	Snohomish Watershed WQ Monitoring Project (2000)
Total Ammonia-N	53 µg/L	TMDL study, 1997
Fecal Coliform (geometric mean)	50/100 mL	Snohomish Watershed WQ Monitoring Project (2000)
Salinity (Min/Max)	0 / 10 ppt	TMDL study, 1997
Lead (dissolved, 90th percentile)	0.08 µg/L	Cosmopolitan, 2005
Copper (dissolved, 90th percentile)	1.41 µg/L	Cosmopolitan, 2005
Zinc (dissolved, 90th percentile)	1.30 µg/L	Cosmopolitan, 2005

C. Wastewater influent characterization

Lake Stevens Sewer District reported the concentration of influent pollutants in discharge monitoring reports. The influent wastewater from April 2012 – November 2016 is characterized as follows:

Table 3. Wastewater Influent Characterization

Parameter	Units	# of Samples	Average	Highest Monthly Average
Biochemical Oxygen Demand (BOD_5)	mg/L	224	304	495
Biochemical Oxygen Demand (BOD_5)	lbs/day	224	5954	9627
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	672	233	400
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	lbs/day	672	4553	7551
Total Suspended Solids (TSS)	mg/L	672	249	377
Total Suspended Solids (TSS)	lbs/day	672	4886	6625

D. Wastewater effluent characterization

Lake Stevens Sewer District reported the concentration of pollutants in the discharge in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater effluent discharged from April 2012 (startup of the new WWTF) through November 2016. The wastewater effluent is characterized as follows:

Table 4. Wastewater Effluent Characterization

Parameter	Units	# of Samples	Average	Maximum Monthly Average	Maximum Weekly Average
$CBOD_5$	mg/L	672	1.0	4.6	9.3
$CBOD_5$	lbs/day	672	19.1	63.8	118
TSS	mg/L	672	0.1	1.8	3.0
TSS	lbs/day	672	2.7	29	47

Parameter	Units	Average	Maximum Monthly Average	Maximum Day
Flow	MGD	2.49	3.61	5.90

Parameter	Units	# of Samples	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliforms	#/100 mL	672	< 1	< 3

Parameter	Units	# of Samples	Minimum	Maximum
pH	standard units	Continuous meter	5.1	8.4

Parameter	Units	# of Samples	Average	Maximum
Ammonia-Total (July-Oct only)	mg/L as N	240	0.35	5.04 (95^{th} %tile)
Ammonia-Total (July-Oct only)	lbs/day	240	6.1	96.8
NBOD+CBOD (July-Oct only)	lbs/day	240	33.6	212
Temperature	°C	Continuous meter	17.9	23.0 (95^{th} %tile)
Ammonia-Total (Nov-June)	mg/L as N	36	1.4	9.0
Nitrate+Nitrite Nitrogen	mg/L as N	56	14.4	23.3
Total Kjeldahl Nitrogen (TKN)	mg/L as N	56	1.6	8.9
Phosphorus-Soluble Reactive	mg/L	56	4.0	12.3
Phosphorus-Total	mg/L	56	4.2	12.6
Alkalinity	mg/L as CaCO3	5	60.8	71.7
Arsenic	µg/L	5	--	0.7
Copper	µg/L	5	--	14
Lead	µg/L	5	--	0.13
Mercury	µg/L	5	--	0.000824
Nickel	µg/L	5	--	3.0
Selenium	µg/L	5	--	0.5
Zinc	µg/L	5	--	51
Total Phenolic Compounds	µg/L	5	--	110
Chloroform	µg/L	5	--	0.6
Bis (2-ethylhexyl) phthalate	µg/L		--	13.5

E. Summary of compliance with previous permit issued December 22, 2011

The previous permit placed effluent limits on $CBOD_5$, TSS, fecal coliform bacteria, pH, and NBOD+CBOD (combined nitrogenous and carbonaceous biochemical oxygen demand).

Lake Stevens Sewer District has complied with the effluent limits and permit conditions with few violations throughout the duration of the permit issued on December 22, 2011. Ecology assessed compliance based on its review of the facility's information in the Ecology Permitting and Reporting Information System (PARIS), discharge monitoring reports (DMRs) and on inspections.

The following table summarizes the violations that occurred during the permit term.

Table 5. Permit Violations

Violation Month	Parameter	Statistical Base	Value	Limit	Violation
11/2016	pH	Minimum	5.98	6.0	Numeric effluent violation
3/2015	pH	Minimum	5.72	6.0	Numeric effluent violation
3/2013	pH	Minimum	5.14	6.0	Numeric effluent violation
7/2012	pH	Minimum	5.8	6.0	Numeric effluent violation
4/2012	Ammonia, Total	--	--	n/a	Analysis not conducted

The following table summarizes compliance with report submittal requirements over the permit term.

Table 6. Permit Submittals

Submittal Name	Due Date	Received Date
Annual Effluent Testing	11/15/2012	6/18/2013
Annual Effluent Testing	11/15/2013	9/24/2013
Annual Effluent Testing	11/15/2014	10/9/2014
Annual Effluent Testing	11/15/2015	8/12/2015
Annual Effluent Testing	11/15/2016	12/8/2016
Infiltration And Inflow Evaluation	7/1/2016	7/1/2016
Pretreatment - Industrial User Survey	7/1/2016	5/31/2016
Application For Permit Renewal	7/1/2016	6/27/2016
Outfall Evaluation	7/1/2016	7/2/2016
Toxicity - Acute Testing	4/15/2013	3/11/2013
Toxicity - Acute Testing	7/15/2013	6/7/2013
Toxicity - Acute Testing	10/15/2013	9/30/2013
Toxicity - Acute Testing	1/15/2014	12/9/2013
Toxicity - Chronic Testing	4/15/2013	3/11/2013
Toxicity - Chronic Testing	10/15/2013	9/30/2013

F. State environmental policy act (SEPA) compliance

State law exempts the issuance, reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

III. Proposed Permit Limits

Federal and state regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC).
- Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC), or the National Toxics Rule (40 CFR 131.36).
- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the state of Washington. Ecology does not develop effluent limits for all reported pollutants. Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, and do not have a reasonable potential to cause a water quality violation.

Ecology does not usually develop limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. During the five-year permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. Until Ecology modifies the permit to reflect additional discharge of pollutants, a permitted facility could be violating its permit.

A. Design criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Ecology approved design criteria for this facility's treatment plant in the facility plan dated September 2006 prepared by Gray & Osborne. The table below includes design criteria from the referenced report.

Table 7. Design Criteria for Lake Stevens Sewer District Sunnyside WWTF

Parameter	Design Quantity
Maximum Month Design Flow	5.01 MGD
Annual Average Flow	4.32 MGD
Average Dry Weather Flow	3.88 MGD
Peak Hour Design Flow	11.53 MGD
BOD_5 Loading for Maximum Month	10,730 lbs/day
BOD_5 Loading Annual Average	9,020 lbs/day
TSS Loading for Maximum Month	10,190 lbs/day
TSS Loading Annual Average	8,570 lbs/day

B. Technology-based effluent limits

Federal and state regulations define technology-based effluent limits for domestic wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). These regulations are performance standards that constitute all known, available, and reasonable methods of prevention, control, and treatment (AKART) for domestic wastewater.

The technology-based limits in the proposed permit are based on $CBOD_5$ as an alternative to BOD_5. The reason for this is consistency with the water quality-based TMDL limits (see section III.G).

The table below identifies technology-based limits for pH, fecal coliform, $CBOD_5$, and TSS, as listed in chapter 173-221 WAC. Section III.F of this fact sheet describes the potential for water quality-based limits.

Table 8. Technology-based Limits

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

Parameter	Monthly Geometric Mean Limit	Weekly Geometric Mean Limit
Fecal Coliform Bacteria	200 organisms/100 mL	400 organisms/100 mL

Parameter	Daily Minimum	Daily Maximum
pH	6.0 standard units	9.0 standard units

Technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b). Ecology calculated the monthly and weekly average mass limits for $CBOD_5$ and Total Suspended Solids as follows:

Mass Limit = CL x DF x CF

where:

CL = Technology-based concentration limits listed in the above table

DF = Maximum Monthly Average Design flow (MGD) = 5.01

CF = Conversion factor of 8.34

Table 9. Technology-based Mass Limits (November through June)

Parameter	Concentration Limit (mg/L)	Mass Limit (lbs/day)
$CBOD_5$ Monthly Average	25	1,045
CBOD5 Weekly Average	40	1,671
TSS Monthly Average	30	1,254
TSS Weekly Average	45	1,880

During the low flow season (July through October), technology-based mass limits apply to TSS only. $CBOD_5$ mass limits are based on the TMDL allocations (see section III.G). Ecology calculated the monthly and weekly average mass limits for Total Suspended Solids as follows:

Mass Limit = CL x DF x CF

where:

CL = Technology-based concentration limits listed in Table 8.

DF = Dry Weather Average Design flow (MGD) = 3.88

CF = Conversion factor of 8.34

Table 10. Technology-based Mass Limits (July through October)

Parameter	Concentration Limit (mg/L)	Mass Limit (lbs/day)
TSS Monthly Average	30	971
TSS Weekly Average	45	1,456

C. Surface water quality-based effluent limits

The Washington State surface water quality standards (chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load study (TMDL).

Numerical criteria for the protection of aquatic life and recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numerical criteria for the protection of human health

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

Narrative criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1); 2006) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2006) and of all marine waters (WAC 173-201A-210, 2006) in the state of Washington.

Antidegradation

Description--The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2006) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).
- Apply three tiers of protection (described below) for surface waters of the state.

Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities.

Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

A facility must prepare a Tier II analysis when all three of the following conditions are met:

- The facility is planning a new or expanded action.
- Ecology regulates or authorizes the action.
- The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

Facility Specific Requirements--This facility must meet Tier I requirements.

- Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.

Ecology's analysis described in this section of the fact sheet demonstrates that the proposed permit conditions will protect existing and designated uses of the receiving water.

Mixing zones

A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with receiving water. Within mixing zones the pollutant concentrations may exceed water quality numeric standards, so long as the discharge doesn't interfere with designated uses of the receiving water body (for example, recreation, water supply, and aquatic life and wildlife habitat, etc.) The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.

State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already receive all known, available, and reasonable methods of prevention, control, and treatment (AKART). Mixing zones typically require compliance with water quality criteria within a specified distance from the point of discharge and must not use more than 25% of the available width of the water body for dilution [WAC 173-201A-400 (7)(a)(ii-iii) or WAC 173-201A-400(7)(b)(ii-iii)].

Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derives any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur (see Ecology's *Permit Writer's Manual*). Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term "reasonable worst-case" applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 4 means the effluent is 25% and the receiving water is 75% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits. Water quality standards include both aquatic life-based criteria and human health-based criteria. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Most aquatic life *acute* criteria are based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years. Most aquatic life *chronic* criteria are based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic). The human health-based water quality criteria incorporate several exposure and risk assumptions. These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two liters/day for drinking water.
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

1. **Ecology must specify both the allowed size and location in a permit.**

   The proposed permit specifies the size and location of the allowed mixing zone (as specified below).

2. **The facility must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.**

   Ecology has determined that the treatment provided by Lake Stevens Sewer District meets the requirements of AKART (see "Technology-based Limits").

3. **Ecology must consider critical discharge conditions.**

   Surface water quality-based limits are derived for the water body's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-specific.

Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology uses the water depth at mean lower low water (MLLW) for marine waters. Ecology's *Permit Writer's Manual* describes additional guidance on criteria/design conditions for determining dilution factors. The manual can be obtained from Ecology's website at: https://fortress.wa.gov/ecy/publications/SummaryPages/92109.html.

Ecology used the dilution analysis prepared by Cosmopolitan Engineering Group (*Outfall Evaluation*, 2002) to evaluate acute and chronic aquatic life and human health non-carcinogen criteria. This study used ambient data at critical conditions in the vicinity of the outfall from the Snohomish Estuary TMDL study conducted in 1997.

Ecology estimated the dilution for evaluating human health carcinogen criteria based on the mean river flow and the WWTP annual average flow. The proposed permit requires a modeling study to determine a more reliable dilution factor for carcinogen criteria.

Table 11. Critical Conditions Used to Model the Discharge

Critical Condition	Value
The seven-day-average low river flow with a recurrence interval of twenty years (7Q20)	1051 cfs
Mean river flow	4400 cfs
Water depth at MLLW	7.8 feet
Density profiles	13 hourly profiles over one tide cycle
10^{th} / 90^{th} percentile current speeds for acute mixing zone	9 cm/s / 45 cm/s
50th percentile current speeds for chronic and human health mixing zones	30 cm/s
Maximum average monthly effluent flow for chronic and human health non-carcinogen (2028 projected flow)	5.5 MGD
Annual average effluent flow for human health carcinogen	2.49 MGD
Maximum daily effluent flow for acute mixing zone (2028 projected flow)	7.4 MGD

4. Supporting information must clearly indicate the mixing zone would not:

- Have a reasonable potential to cause the loss of sensitive or important habitat.
- Substantially interfere with the existing or characteristic uses.
- Result in damage to the ecosystem.
- Adversely affect public health.

Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms and set the criteria to generally protect the species tested and to fully protect all commercially and recreationally important species.

EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of discharge.

The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away. Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the effluent will not exceed 33 degrees C for more than two seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration.

Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics, and the discharge location. Based on this review, Ecology concluded that the discharge does not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in damage to the ecosystem, or adversely affect public health if the permit limits are met.

5. **The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone.**

   Ecology conducted a reasonable potential analysis, using procedures established by the EPA and by Ecology, for each pollutant and concluded the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

6. **The size of the mixing zone and the concentrations of the pollutants must be minimized.**

   At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. Because tidal currents change direction, the plume orientation within the mixing zone changes. The plume mixes as it rises through the water column therefore much of the receiving water volume at lower depths in the mixing zone is not mixed with discharge. Similarly, because the discharge may stop rising at some depth due to density stratification, waters above that depth will not mix with the discharge. Ecology determined it is impractical to specify in the permit the actual, much more limited volume in which the dilution occurs as the plume rises and moves with the current.

Ecology minimizes the size of mixing zones by requiring dischargers to install diffusers when they are appropriate to the discharge and the specific receiving waterbody. When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time. Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95th percentile pollutant concentration, the 90th percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

7. **Maximum size of mixing zone.**

   The authorized mixing zone does not exceed the maximum size restriction.

8. **Acute mixing zone.**

   - **The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.**

     Ecology determined the acute criteria will be met at 10% of the distance of the chronic mixing zone at the twenty year low flow.

   - **The pollutant concentration, duration, and frequency of exposure to the discharge will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.**

     As described above, the toxicity of any pollutant depends upon the exposure, the pollutant concentration, and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent).

   - **Comply with size restrictions.**

     The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.

9. **Overlap of mixing zones.**

   This mixing zone does not overlap another mixing zone.

D. Designated uses and surface water quality criteria

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

In brackish waters of estuaries such as Ebey Slough, where different criteria for the same use occurs for fresh and marine waters, the decision to use the fresh water or the marine water criteria must be selected and applied on the basis of vertically averaged daily maximum salinity. Fresh water criteria apply where salinity is less than or equal to 1‰ (one part per thousand). Marine water criteria apply where salinity is greater than 1‰ (see WAC 173-201A-260(3)(e)). The EPA's National Toxics Rule recommends that fresh water criteria apply to waters with salinity less than 1‰, salt water criteria apply to waters with salinity greater than 10‰, and the more stringent criteria apply to waters between 1‰ and 10‰.

The Snohomish River Estuary Dry Season TMDL – Phase I (Ecology, 1995) defined the estuary boundary for modeling purposes at a salinity of 1‰ at Mean Higher High Water and an annual average low river flow of 6,577 cfs. This line marks the upstream boundary for marine water criteria very near the Lake Stevens Sewer District discharge. Measured salinity in Ebey Slough at the discharge location varies with the tides, from zero to about 10‰.

- Aquatic life uses are designated based on the presence of, or the intent to provide protection for the key uses. All indigenous fish and non-fish aquatic species must be protected in waters of the state in addition to the key species. The fresh water aquatic life uses for this receiving water are identified below.

Table 12. Fresh Water Aquatic Life Uses and Associated Criteria

Salmonid Spawning, Rearing, and Migration	
Temperature Criteria – Highest 7-DAD MAX	17.5°C (63.5°F)
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	8.0 mg/L
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Total Dissolved Gas Criteria	Total dissolved gas must not exceed 110 percent of saturation at any point of sample collection.
pH Criteria	The pH must measure within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

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

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

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

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

  d. Fair quality salmonid and other fish migration.

The marine water aquatic life uses and the associated criteria for this receiving water are identified below.

Table 13. Marine Aquatic Life Uses and Associated Criteria

Excellent Quality	
Temperature Criteria – Highest 1D MAX	16°C (60.8°F)
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	6.0 mg/L
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
pH Criteria	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

- The Snohomish River from the mouth to the southern tip of Ebey Island, including Lake Stevens Sewer District's discharge into Ebey Slough, has a special condition for fecal coliform organism levels. The recreational uses for this receiving water are identified below.

Table 14. Recreational Uses

Recreational Use	Criteria
Primary Contact Recreation – Special Condition	Fecal coliform organism levels must not exceed a geometric mean value of 200 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 400 colonies /100 mL.

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

E. Water quality impairments

Dissolved oxygen: Ecology conducted a total maximum daily load (TMDL) study on the Snohomish River Estuary, from Possession Sound to river mile 20. The TMDL study used the WASP5 model to assess the capacity of the estuary system to assimilate oxygen consuming pollutants from point and nonpoint sources. The water quality model predicted that the wastewater treatment plants along the river would cause violations of the dissolved oxygen standards under critical conditions. The TMDL study recommended waste load allocations (WLAs) for the following point sources of carbonaceous and nitrogenous biochemical oxygen demand (CBOD and ammonia): the city of Snohomish, Lake Stevens Sewer District, the city of Marysville, and the city of Everett.

Temperature: The previous permit required Lake Stevens Sewer District to conduct temperature monitoring of the ambient water. These data show that the temperature of Ebey Slough exceeds the temperature criteria for both marine and fresh water during the summer season. Ebey Slough is not currently listed on the 303(d) list as impaired for temperature, but may be included in a future 303(d) list and subject to a TMDL.

F. Evaluation of surface water quality-based effluent limits for narrative criteria

Ecology must consider the narrative criteria described in WAC 173-201A-160 when it determines permit limits and conditions. Narrative water quality criteria limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge which have the potential to adversely affect designated uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

Ecology considers narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of treatment and prevention (AKART) as described above in the technology-based limits section. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

In addition, Ecology considers the toxicity of the wastewater discharge by requiring whole effluent toxicity (WET) testing when there is a reasonable potential for the discharge to contain toxics. Ecology's analysis of the need for WET testing for this discharge is described later in the fact sheet.

G. Evaluation of surface water quality-based effluent limits for numeric criteria

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near-field) or at a considerable distance from the point of discharge (far-field). Toxic pollutants, for example, are near-field pollutants; their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as biochemical oxygen demand (BOD_5) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

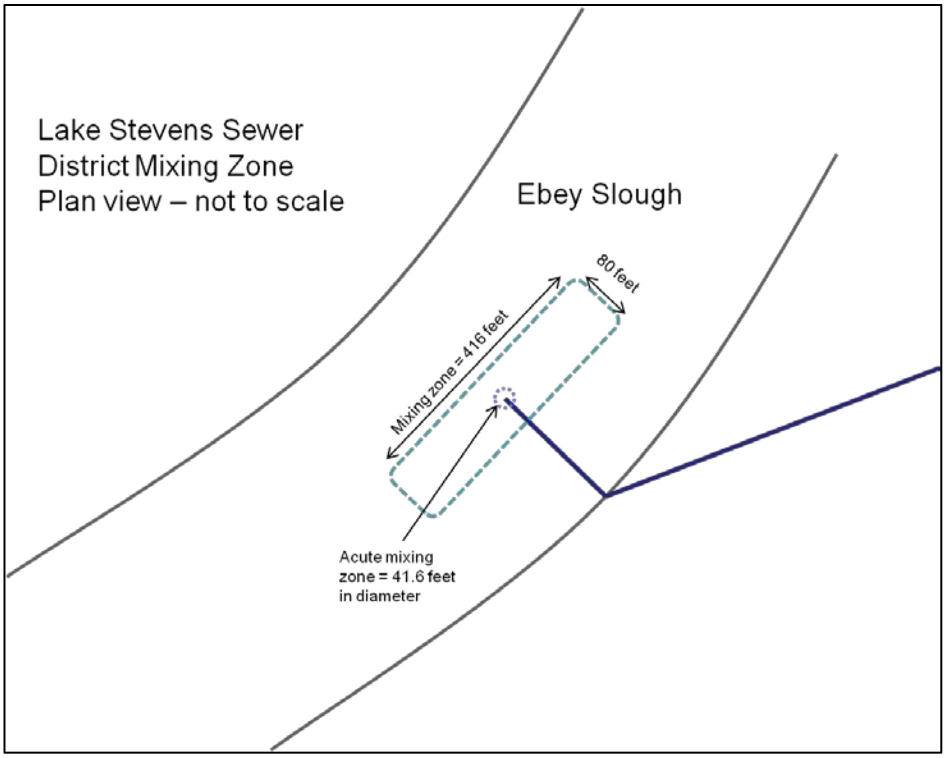
With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

The outfall line extends 200 feet from the bank and ends in a 2-port diffuser with 14- inch diameter ports. The distance between ports is 7.9 feet. The mean lower low water (MLLW) depth is 7.8 feet. Ecology obtained this information from the Outfall Evaluation report prepared by Cosmopolitan Engineering, December 2002.

Chronic Mixing Zone – WAC 173-201A-400(7)(b) specifies that mixing zones must not extend in any horizontal direction from the discharge ports for a distance greater than 200 feet plus the depth of water over the discharge ports and may not occupy more than 25% of the width of the water body as measured during MLLW. The width of the chronic mixing zone is limited to a distance of 80 feet. The length of the chronic mixing zone extends 208 feet upstream and 208 feet downstream of the outfall. The mixing zone extends from the discharge ports to the top of the water surface.

Acute Mixing Zone – WAC 173-201A-400(8)(b) specifies that in estuarine waters a zone where acute criteria may be exceeded must not extend beyond 10% of the distance established for the chronic zone. The acute mixing zone is a circle with radius of 20.8 feet measured from the center of each discharge port. The mixing zone extends from the discharge ports to the top of the water surface.

Figure 3. Mixing Zone for Outfall 002



The Outfall Evaluation report (Cosmopolitan, 2002) determined the dilution factors that occur within these zones at the critical condition using the PLUMES model. The dilution factors are listed below. The dilution factors for Outfall 002 are based on design flows for the year 2028, while the treatment plant is currently built for year 2019 flows.

Human Health Carcinogen Dilution Factor – The 2002 outfall evalutation report did not include modeling based on the harmonic mean flow, which is the critical condition for evaluation of reasonable potential for human health carcinogen pollutants. The proposed permit uses a dilution factor based on 25% percent of flow, using the mean flow of the Snohomish River (USGS Station 12150800) and the annual average effluent flow during the previous permit term. Lake Stevens Sewer District must submit an update to the mixing zone study to provide a reliable dilution factor before the next permit application.

Table 15. Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	6.4	15.0
Human Health, Carcinogen		239
Human Health, Non-carcinogen		15.0

Ecology determined the impacts of dissolved oxygen deficiency, nutrients, pH, fecal coliform, ammonia, metals, other toxics, and temperature as described below, using the dilution factors in the above table. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

Nutrients – Natural decomposition of organic material in wastewater effluent impacts dissolved oxygen in the receiving water at distances far outside of the regulated mixing zone. The 5-day Biochemical Oxygen Demand (BOD_5) of an effluent sample indicates the amount of biodegradable material in the wastewater and estimates the magnitude of oxygen consumption the wastewater will generate in the receiving water. The amount of ammonia-based nitrogen in the wastewater also provides an indication of oxygen demand potential in the receiving water.

Ecology has completed a dissolved oxygen TMDL, referenced above, and established waste load allocations (WLAs) for carbonaceous biochemical oxygen demand ($CBOD_5$) and ammonia. The proposed permit includes effluent limits for $CBOD_5$ and ammonia derived from the completed TMDL.

The WLAs for the Lake Stevens Sewer District treatment plant are:

Daily Maximum Ammonia – 283 lbs/day

Daily Maximum $CBOD_5$ – 174 lbs/day

The impact of ammonia and $CBOD_5$ on dissolved oxygen also depends on the discharge location. Because the new outfall is further upstream the impact of the discharge will slightly increase. Therefore, the WLAs will decrease by 3 percent (Cosmopolitan, 2002).

Daily Maximum Ammonia – 275 lbs/day

Daily Maximum $CBOD_5$ – 169 lbs/day

Effluent mass loading limits for $CBOD_5$ and ammonia are related because both of these substances exert an oxygen demand that affects dissolved oxygen levels in the river. Accordingly, an exchange of waste load allocations between $CBOD_5$ and ammonia is allowable if the overall daily load remains constant. River modeling indicated an exchange rate of 2.1 lbs. $CBOD_5$ for each 1 lb. of ammonia. Using this ratio, a reduction in the discharge of ammonia would allow for an increase in the discharge of $CBOD_5$.

Lake Stevens Sewer District requested an exchange of ammonia for $CBOD_5$ in their permit limits, and Ecology incorporated this change in the 2003 permit modification. In the proposed permit, the combined oxygen demand is called "NBOD+CBOD."

This is protective of water quality and allows for some flexibility in the ratio of $CBOD_5$ and ammonia in the effluent. These limits will apply during the low flow months of July through October. The technology-based limits for $CBOD_5$ will apply from November through June.

*NBOD+CBOD (lbs/day) = (2.1 * Ammonia (lbs/day)) +* $CBOD_5$ *(lbs/day)*

Where $CBOD_5$ and total ammonia are measurements from the same daily composite sample.

Using the TMDL allocations, the daily maximum limit for NBOD+CBOD (lbs/day) is (2.1 * 275 lbs/day ammonia) + 169 lbs/day $CBOD_5$ = 747 lbs/day

Equivalent monthly average limits were calculated according to the methods in EPA's *Technical Support Document for Water Quality-Based Toxics Control*. The calculations are presented in Table 16. The maximum daily limit is the same as in the previous permit. The average monthly limit is lower because the calculation includes the effluent coefficient of variation (CV). In the previous permit Ecology used an assumed CV of 0.6 because no data were available from the new treatment plant. The actual CV of the effluent NBOD+CBOD is 0.979, based on data from the most recent three years, 2014-2016.

Table 16. Calculation of Low Flow TMDL Water Quality-based Effluent Limits

NBOD+CBOD	
1.	The Daily Waste Load Allocation (WLA) = Maximum Daily Limit = MDL = 747 lbs/day NBOD+CBOD
2.	Calculate the long-term average (LTA) which will comply with this waste load allocation. $MDL = LTA * e^{(Z\sigma - 0.5\sigma^2)}$ where: $\sigma^2 = \ln[CV^2 + 1] = 0.6721$ z = 2.326 (99th percentile probability) CV = coefficient of variation = 0.979 LTA = long-term average = 155 lbs/day NBOD+CBOD
3.	Calculate the monthly average effluent limit. $AML = LTA * e^{(Z\sigma_n - 0.5\sigma_n^2)}$ where: $\sigma^2 = \ln[(CV^2/n) + 1] = 0.07684$ n = number of samples/month = 12 z = 1.645 (95th percentile probability) CV = coefficient of variation = 0.979 **AML = Average Monthly Limit = 235 lbs/day NBOD+CBOD**

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

Fecal Coliform – Ecology modeled the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 ml and a dilution factor of 15.

Under critical conditions, modeling predicts no violation of the water quality criterion for fecal coliform. Therefore, the proposed permit includes the technology-based effluent limit for fecal coliform bacteria.

Turbidity – Ecology evaluated the impact of turbidity based on the range of total suspended solids in the effluent and turbidity of the receiving water. Ecology expects no violations of the turbidity criteria outside the designated mixing zone provided the facility meets its technology-based total suspended solids permit limits.

Toxic Pollutants – Federal regulations (40 CFR 122.44) require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

The following toxic pollutants are present in the discharge: ammonia, arsenic, copper, lead, mercury, nickel, selenium, and zinc. Ecology conducted a reasonable potential analysis (See Appendix E) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature, pH, and salinity of the receiving marine water. To evaluate ammonia toxicity, Ecology used the available receiving water information from the 1997 TMDL study and Ecology spreadsheet tools.

Valid ambient background data were available for ammonia, arsenic, copper, lead, mercury, nickel, selenium, and zinc. Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards.

Ecology determined that ammonia, arsenic, lead, mercury, nickel, selenium, and zinc pose no reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991 (Appendix E) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

Ecology derived effluent limits for the toxic pollutant copper, determined to have a reasonable potential to cause a violation of the water quality standards. Ecology calculated effluent limits using methods from EPA, 1991 as shown in Appendix E.

The resultant effluent limits for copper are as follows:

Average Monthly Limit = 12.1 µg/L

Maximum Daily Limit = 24.2 µg/l

Temperature – The state temperature standards [WAC 173-201A-200-210 and 600-612] include multiple elements:

- Annual summer maximum threshold criteria (June 15 to September 15)
- Supplemental spawning and rearing season criteria (September 15 to June 15)
- Incremental warming restrictions
- Protections against acute effects

Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.

- Annual summer maximum and supplementary spawning/rearing criteria

  Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), 210(1)(c), and Table 602]. These threshold criteria (e.g., 12, 16, 17.5, 20°C) protect specific categories of aquatic life by controlling the effect of human actions on summer temperatures.

  Some waters have an additional threshold criterion to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-602, Table 602]. These criteria apply during specific date-windows.

  The threshold criteria apply at the edge of the chronic mixing zone. Criteria for most fresh waters are expressed as the highest 7-Day average of daily maximum temperature (7-DADMax). The 7-DADMax temperature is the arithmetic average of seven consecutive measures of daily maximum temperatures. Criteria for marine waters and some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

- Incremental warming criteria

  The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-200(1)(c)(i)-(ii), 210(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

  At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment. These increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

  At locations and times when a threshold criterion is being exceeded due to natural conditions, all human sources, considered cumulatively, must not warm the water more than 0.3°C above the naturally warm condition.

  When Ecology has not yet completed a TMDL, our policy allows each point source to warm water at the edge of the chronic mixing zone by 0.3°C. This is true regardless of the background temperature and even if doing so would cause the temperature at the edge of a standard mixing zone to exceed the numeric threshold criteria. Allowing a 0.3°C warming for each point source is reasonable and protective where the dilution factor is based on 25% or less of the critical flow. This is because the fully mixed effect on temperature will only be a fraction of the 0.3°C cumulative allowance (0.075°C or less) for all human sources combined.

- Protections for temperature acute effects

  Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C, unless a dilution analysis indicates ambient temperatures will not exceed 33°C two seconds after discharge.

  General lethality and migration blockage: Measurable (0.3°C) increases in temperature at the edge of a chronic mixing zone are not allowed when the receiving water temperature exceeds either a 1DMax of 23°C or a 7DADMax of 22°C.

  Lethality to incubating fish: Human actions must not cause a measurable (0.3°C) warming above 17.5°C at locations where eggs are incubating.

Reasonable Potential Analysis

Annual summer maximum and incremental warming criteria: Ecology calculated the reasonable potential for the discharge to exceed the annual summer maximum and the incremental warming criteria (See temperature calculations in Appendix E).

The discharge is only allowed to warm the water by a defined increment when the background (ambient) temperature is cooler or warmer than the assigned threshold criterion. Ecology allows warming increments only when they do not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

The incremental increase for this discharge is within the allowable amount. Therefore, the proposed permit does not include a temperature limit.

The permit requires additional monitoring of effluent temperatures. Ecology will reevaluate the reasonable potential during the next permit renewal.

General lethality and migration blockage: The receiving water conditions are listed in Table 2 of the fact sheet. Ebey Slough does not exceed a 1DMax of 23°C or a 7DADMax of 22°C.

H. Human health

Washington’s water quality standards include numeric human health-based criteria that Ecology must consider when writing NPDES permits. In accordance with the requirements of CWA section 303(c)(2)(B), EPA has finalized 144 new and revised Washington-specific human health criteria for priority toxic pollutants, to apply to waters under Washington’s jurisdiction, and has approved 45 new human health criteria submitted by Washington. For arsenic, dioxin, and thallium, the existing criteria from the National Toxics Rule (40 CFR 131.36) remain in effect.

Ecology determined the effluent may contain chemicals of concern for human health, based on data submitted during the previous permit term, including copper, mercury, nickel, selenium, zinc, phenol, chloroform, and bis(2-ethylhexyl) phthalate.

Ecology evaluated the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA/505/2-90-001) and Ecology's *Permit Writer's Manual* to make a reasonable potential determination. The evaluation showed that the discharge has no reasonable potential to cause a violation of water quality standards for copper, mercury, nickel, zinc, phenol, chloroform, or bis (2-ethylhexyl) phthalate and effluent limits are not needed.

The new criteria for bis (2-ethylhexyl) phthalate (DEHP) significantly changed from the previously adopted standard. DEHP, a known carcinogen, is frequently detected in wastewater influent and effluent. Phthalates are plasticizers that are commonly used in hundreds of common consumer and building products. The ubiquitous chemical has also been identified as a common sampling and laboratory contaminate. If phthalates are detected in a facility's effluent, permittees are required to re-sample their effluent using clean sampling techniques to confirm that the detection is not a result of either sampling or laboratory contamination.

Lake Stevens Sewer District should work with an accredited laboratory on specific clean sampling requirements. At a minimum, samples should be collected in clean glass bottles with polytetrafluoroethylene (PFTE or Teflon™) lids. Standard practice may also include an equipment rinse with a non-polar solvent to remove possible organics. Accidental sample contamination from safety equipment (e.g. gloves) is also possible. All samples must be kept from directly contacting plastics of any kind.

To help assess the sample contamination potential, permittees may opt to collect a field blank for comparison with the effluent sample so that field collection contamination may be quantified. It is the laboratory's responsibility to analyze method blanks and laboratory control samples when analyzing batches consisting of 20 or less discrete samples. These laboratory QA results must be submitted with the laboratory report.

I. Sediment quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website. http://www.ecy.wa.gov/programs/tcp/smu/sediment.html

Through a review of the discharger characteristics and of the effluent characteristics, Ecology determined that this discharge has no reasonable potential to violate the sediment management standards. Therefore, the proposed permit does not require sediment monitoring in the vicinity of the discharge outfall.

J. Whole effluent toxicity

The water quality standards for surface waters forbid discharge of effluent that has the potential to cause toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

- *Acute toxicity tests measure mortality as the significant response* to the toxicity of the effluent. Dischargers who monitor their wastewater with acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.

- *Chronic toxicity tests measure various sublethal toxic responses*, such as reduced growth or reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

Laboratories accredited by Ecology for WET testing know how to use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format. Accredited laboratory staff know about WET testing and how to calculate an NOEC, LC50, EC50, IC25, etc. Ecology gives all accredited labs the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (https://fortress.wa.gov/ecy/publications/SummaryPages/9580.html), which is referenced in the permit. Ecology recommends that Lake Stevens Sewer District send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water acute or chronic toxicity. The proposed permit will not include an acute or chronic WET limit. Lake Stevens Sewer District must retest the effluent before submitting an application for permit renewal.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization. Lake Stevens Sewer District may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing and/or chemical analyses after the process or material changes have been made. Ecology recommends that the Permittee check with it first to make sure that Ecology will consider the demonstration adequate to support a decision to not require an additional effluent characterization.
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

K. Groundwater quality limits

The groundwater quality standards (chapter 173-200 WAC) protect beneficial uses of groundwater. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100).

Lake Stevens Sewer District does not discharge wastewater to the ground. No permit limits are required to protect groundwater.

L. Comparison of effluent limits with the previous permit issued on December 22, 2011

Table 17. Comparison of Previous and Proposed Effluent Limits

		Previous Effluent Limits: Outfall 002 November-June		Proposed Effluent Limits: Outfall 002 November-June	
Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Average Weekly**
Carbonaceous Biochemical Oxygen Demand (5-day)	Technology	25 mg/L 1,045 lbs/day 85% removal	40 mg/L 1,671 lbs/day	No change	No change
Total Suspended Solids	Technology	30 mg/L 1,254 lbs/day 85% removal	45 mg/L 1,880 lbs/day	No change	No change
Parameter		**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**
Fecal Coliform Bacteria	Technology	200 /100 mL	400 /100 mL	No change	No change
Parameter		**Limit**		**Limit**	
pH	Technology	6.0 – 9.0		No change	

		Previous Effluent Limits: Outfall 002 July-October		Proposed Effluent Limits: Outfall 002 July-October	
Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Average Weekly**
Carbonaceous Biochemical Oxygen Demand (5-day)	Technology	25 mg/L 85% removal	40 mg/L	No change	No change
Total Suspended Solids	Technology	30 mg/L 971 lbs/day 85% removal	45 mg/L 1,456 lbs/day	No change	No change
Parameter		**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**
Fecal Coliform Bacteria	Technology	200 /100 mL	400 /100 mL	No change	No change
Parameter		**Limit**		**Limit**	
pH	Technology	6.0 – 9.0		No change	
Parameter		**Average Monthly**	**Maximum Daily**	**Average Monthly**	**Maximum Daily**
NBOD+CBOD	TMDL	314 lbs/day	747 lbs/day	235 lbs/day	747 lbs/day
Copper	Water Quality	--	--	12.1 µg/L	24.2 µg/L

IV. Monitoring Requirements

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, detection level (DL), and quantitation level (QL) on the discharge monitoring report or in the required report.

A. Wastewater monitoring

The monitoring schedule is detailed in the proposed permit under Special Condition S.2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (Publication Number 92-09) for activated sludge treatment plants with 2.0 - 5.0 MGD average design flow. The treatment plant has a design flow of 5.01 MGD, but current flows are below 4.0 MGD and are not likely to approach 5.0 MGD during the term of this permit.

Ecology has included some additional monitoring of nutrients in the proposed permit to establish a baseline for this discharger. It will use this data in the future as it develops TMDLs for dissolved oxygen and establishes WLAs for nutrients.

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

B. Lab accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters). Ecology accredited the laboratory (W456-16) at this facility for:

Table 18. Accredited Parameters

Parameter Name	Matrix Description	Category	Method Name
Turbidity	Non-Potable Water	General Chemistry	SM 2130 B-01
Solids, Total Suspended	Non-Potable Water	General Chemistry	SM 2540 D-97
pH	Non-Potable Water	General Chemistry	SM 4500-H+ B-00
Ammonia	Non-Potable Water	General Chemistry	SM 4500-NH3 F-97
Nitrite	Non-Potable Water	General Chemistry	SM 4500-NO2¯ B-00
Orthophosphate	Non-Potable Water	General Chemistry	SM 4500-P E-99
Phosphorus, Total	Non-Potable Water	General Chemistry	SM 4500-P E-99
Biochemical Oxygen Demand (BOD), Carbonaceous BOD (CBOD)	Non-Potable Water	General Chemistry	SM 5210 B-01
Fecal coliform-count	Non-Potable Water	Microbiology	SM 9222 D (m-FC)-97
Solids, Total, Fixed and Volatile	Solid and Chemical Materials	General Chemistry	SM 2540 G-97

V. Other Permit Conditions

A. Reporting and record keeping

Ecology based Special Condition S3 on its authority to specify any appropriate reporting and record keeping requirements to prevent and control waste discharges (WAC 173-220-210).

B. Prevention of facility overloading

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require Lake Stevens Sewer District to:

- Take the actions detailed in proposed permit Special Condition S.4.
- Design and construct expansions or modifications before the treatment plant reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

Special Condition S.4 restricts the amount of flow.

C. Operation and maintenance

The proposed permit contains Special Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, chapter 173-230 WAC, and WAC 173-240-080. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that Lake Stevens Sewer District takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

D. Pretreatment

Duty to enforce discharge prohibitions

This provision prohibits the publicly owned treatment works (POTW) from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes “pass-through” or “interference”. This general prohibition is from 40 CFR §403.5(a). Appendix C of this fact sheet defines these terms.
- The second section reinforces a number of specific state and federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:
  a. Are prohibited due to dangerous waste rules.
  b. Are explosive or flammable.
  c. Have too high or low of a pH (too corrosive, acidic or basic).
  d. May cause a blockage such as grease, sand, rocks, or viscous materials.
  e. Are hot enough to cause a problem.

f. Are of sufficient strength or volume to interfere with treatment.

g. Contain too much petroleum-based oils, mineral oil, or cutting fluid.

h. Create noxious or toxic gases at any point.

40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology. These discharges include:

  a. Cooling water in significant volumes.

  b. Stormwater and other direct inflow sources.

  c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Federal and state pretreatment program requirements

Ecology administers the Pretreatment Program under the terms of the addendum to the "Memorandum of Understanding between Washington Department of Ecology and the United States Environmental Protection Agency, Region 10" (1986) and 40 CFR, part 403. Under this delegation of authority, Ecology issues wastewater discharge permits for significant industrial users (SIUs) discharging to POTWs which have not been delegated authority to issue wastewater discharge permits. Ecology must approve, condition, or deny new discharges or a significant increase in the discharge for existing significant industrial users (SIUs) [40 CFR 403.8 (f)(1)(i) and(iii)].

Industrial dischargers must obtain a permit from Ecology before discharging waste to the Lake Stevens Sewer District [WAC 173-216-110(5)]. Industries discharging wastewater that is similar in character to domestic wastewater do not require a permit.

Routine identification and reporting of industrial users

The permit requires non-delegated POTWs to take "continuous, routine measures to identify all existing, new, and proposed significant industrial users (SIUs) and potential significant industrial users (PSIUs)" discharging to their sewer system. Examples of such routine measures include regular review of water and sewer billing records, business license and building permit applications, advertisements, and personal reconnaissance. System maintenance personnel should be trained on what to look for so they can identify and report new industrial dischargers in the course of performing their jobs. The POTW may not allow SIUs to discharge prior to receiving a permit, and must notify all industrial dischargers (significant or not) in writing of their responsibility to apply for a State Waste Discharge Permit. The POTW must send a copy of this notification to Ecology.

Requirements for performing an industrial user survey

This POTW has the potential to serve significant industrial or commercial users and must conduct an industrial user (IU) survey. The purpose of the IU Survey is to identify all facilities that may be subject to pretreatment standards or requirements so that Ecology can take appropriate measures to control these discharges. The POTW should identify each such user, and require them to apply for a permit before allowing their discharge to the POTW to commence. For SIUs, the POTW must require they actually are issued a permit prior to accepting their discharge. The steps the POTW must document in their IU Survey submittal include:

1. The POTW must develop a master list of businesses that may be subject to pretreatment standards and requirements and show their disposition. This list must be based on several sources of information including business licenses, and water and sewer billing records.
2. The POTW must canvas all the potential sources, having them either complete a survey form or ruling them out by confirming they only generate domestic wastewater.
3. The POTW must develop a list of the SIUs and potential SIUs in all areas served by the POTW. The list must contain sufficient information on each to allow Ecology to decide which discharges merit further controls such as a state waste discharge permit.

Ecology describes the information needed in IU Survey submittals to allow Ecology to make permitting decision in the manual “Performing an Industrial User Survey”. Properly completing an Industrial User Survey helps Ecology control discharges that may otherwise harm the POTW including its collection system, processes, and receiving waters. Where surveys are incomplete, Ecology may take such enforcement as appropriate and/or require the POTW to develop a fully delegated pretreatment program.

The proposed permit requires Lake Stevens Sewer District to conduct an industrial user survey to determine the extent of compliance of all industrial users of the sanitary sewer and wastewater treatment facility with federal pretreatment regulations [40 CFR Part 403 and Sections 307(b) and 308 of the Clean Water Act)], with state regulations (chapter 90.48 RCW and chapter 173-216 WAC), and with local ordinances.

E. Solid wastes

To prevent water quality problems the facility is required in permit Special Condition S7 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and state water quality standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under chapter 70.95J RCW, chapter 173-308 WAC “Biosolids Management,” and chapter 173-350 WAC “Solid Waste Handling Standards.” The disposal of other solid waste is under the jurisdiction of the Snohomish County Health Department.

F. Effluent mixing study

Ecology used the mixing zone study prepared by Cosmopolitan Engineering (2002) and updated with additional ambient monitoring in 2005 to estimate the amount of mixing of the discharge with receiving water and the potential for the mixture to violate the water quality standards for surface waters at the edge of the mixing zone (chapter 173-201A WAC). The proposed permit requires Lake Stevens Sewer District to more accurately determine the mixing characteristics of the discharge (Special Condition S.8), especially in regard to pollutants with water quality criteria for human health. The effluent mixing study must measure or model the characteristics of the discharge under conditions specified in the permit to assess whether the receiving water quality is protected outside the mixing zone boundary.

G. Outfall evaluation

The proposed permit requires Lake Stevens Sewer District to conduct an outfall inspection and submit a report detailing the findings of that inspection (Special Condition S.9). The inspection must evaluate the physical condition of the discharge pipe and diffusers, and evaluate the extent of sediment accumulations in the vicinity of the outfall.

H. General conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual domestic wastewater NPDES permits issued by Ecology.

VI. Permit Issuance Procedures

A. Permit modifications

Ecology may modify this permit to impose numerical limits, if necessary to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for groundwaters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

B. Proposed permit issuance

This proposed permit meets all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of five years.

VII. References for Text and Appendices

Cosmopolitan Engineering Group

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2002. *Lake Stevens Sewer District Outfall Evaluation*. Prepared for Gray & Osborn, Inc.

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

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

1988. *Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling*. USEPA Office of Water, Washington, D.C.

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

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2006. *Lake Stevens Sewer District Wastewater Facilities Plan*.

Tsivoglou, E.C., and J.R. Wallace.

1972. *Characterization of Stream Reaeration Capacity*. EPA-R3-72-012. (Cited in EPA 1985 op.cit.)

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

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1997. *Snohomish River Estuary Dry Season TMDL Study – Phase II*. Publication Number 97-325.

1995. *Snohomish River Estuary Dry Season TMDL Study – Phase I*. Publication Number 95-338.

Wright, R.M., and A.J. McDonnell.

1979. *In-stream Deoxygenation Rate Prediction*. Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

Appendix A – Public Involvement Information

Ecology proposes to reissue a permit to the Lake Stevens Sewer District. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Draft on August 11, 2017, in the *Everett Herald* to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Told where copies of the draft permit and fact sheet were available for public evaluation (a local public library, the closest regional or field office, posted on our website).
- Offered to provide the documents in an alternate format to accommodate special needs.
- Asked people to tell us how well the proposed permit would protect the receiving water.
- Invited people to suggest fairer conditions, limits, and requirements for the permit.
- Invited comments on Ecology's determination of compliance with antidegradation rules.
- Urged people to submit their comments, in writing, before the end of the comment period.
- Told how to request a public hearing about the proposed NPDES permit.
- Explained the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting*, which is available on our website at https://fortress.wa.gov/ecy/publications/SummaryPages/0307023.html.

You may obtain further information from Ecology by telephone, (425) 649-7201, or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

or email to tmil461@ecy.wa.gov

The primary author of this permit and fact sheet is Laura Fricke, P.E.

Appendix B – Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. “Date of receipt” is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Appendix C – Glossary

1-DMax or 1-day maximum temperature -- The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-day average of the daily maximum temperatures -- The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

Acute toxicity -- The lethal effect of a compound on an organism that occurs in a short time period, usually 48 to 96 hours.

AKART -- The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance -- An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An "early warning value" must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ambient water quality -- The existing environmental condition of the water in a receiving water body.

Ammonia -- Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Annual average design flow (AADF) -- The average of the daily flow volumes anticipated to occur over a calendar year.

Average monthly (intermittent) discharge limit -- The average of the measured values obtained over a calendar month's time taking into account zero discharge days.

Average monthly discharge limit -- The average of the measured values obtained over a calendar month's time.

Background water quality -- The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time upgradient of an activity that has not been affected by that activity [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best management practices (BMPs) -- Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD5 -- Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass -- The intentional diversion of waste streams from any portion of a treatment facility.

Categorical pretreatment standards -- National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine -- A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic toxicity -- The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean water act (CWA) -- The federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance inspection-without sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance inspection-with sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

Composite sample -- A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Construction activity -- Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

Continuous monitoring -- Uninterrupted, unless otherwise noted in the permit.

Critical condition -- The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Date of receipt -- This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Detection limit -- The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Dilution factor (DF) -- A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Distribution uniformity -- The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value -- The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit -- The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a groundwater criterion will not be exceeded and that background water quality will be protected.

Engineering report -- A document that thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal coliform bacteria -- Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab sample -- A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Groundwater -- Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Industrial user -- A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial wastewater -- Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business; from the development of any natural resource; or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated stormwater and, also, leachate from solid waste facilities.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local limits -- Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

Major facility -- A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum daily discharge limit -- The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Maximum day design flow (MDDF) -- The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum month design flow (MMDF) -- The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum week design flow (MWDF) -- The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method detection level (MDL) -- See Detection Limit.

Minor facility -- A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing zone -- An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National pollutant discharge elimination system (NPDES) -- The NPDES (Section 402 of the Clean Water Act) is the federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the state of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both state and federal laws.

pH -- The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Peak hour design flow (PHDF) -- The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak instantaneous design flow (PIDF) -- The maximum anticipated instantaneous flow.

Point of compliance -- The location in the groundwater where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential significant industrial user (PSIU) --A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day; or

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation level (QL) -- Also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and

cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1,2,or 5) x 10^n, where n is an integer (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency, December 2007).

Reasonable potential -- A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible corporate officer -- A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sample Maximum -- No sample may exceed this value.

Significant industrial user (SIU) --

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

   Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

   *The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug discharge -- Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW’s regulations and local limits.

Soil scientist -- An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5,3,or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid waste -- All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 -- Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

State waters -- Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater -- That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit -- A permit limit based on the ability of a treatment method to reduce the pollutant.

Total coliform bacteria -- A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total dissolved solids -- That portion of total solids in water or wastewater that passes through a specific filter.

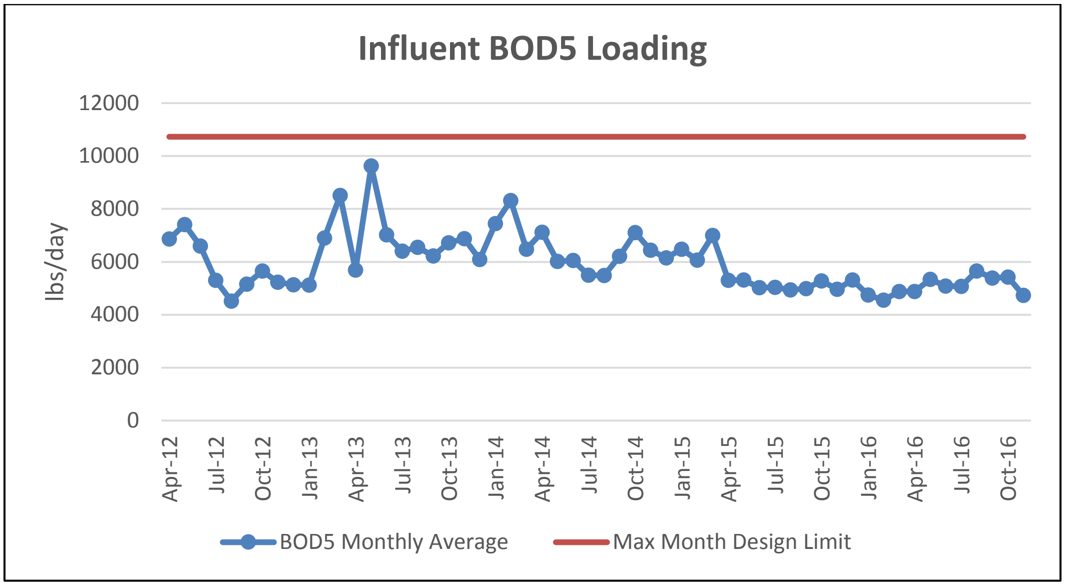
Total maximum daily load (TMDL) -- A determination of the amount of pollutant that a water body can receive and still meet water quality standards.

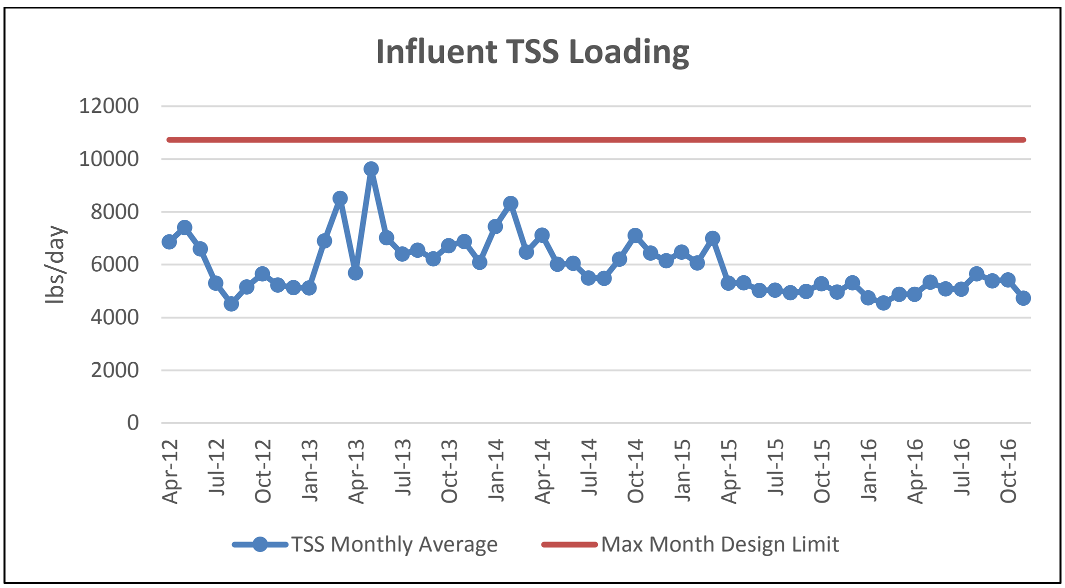
Total suspended solids (TSS) -- Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

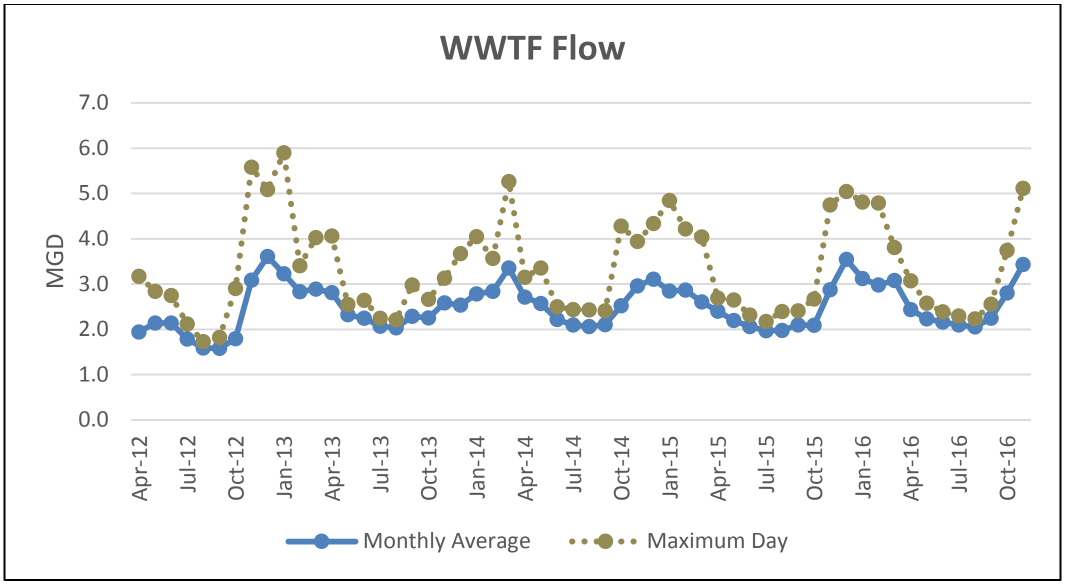
Upset -- An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water quality-based effluent limit -- A limit imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D – Influent and Effluent Data






WWTF Flow
MGD
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
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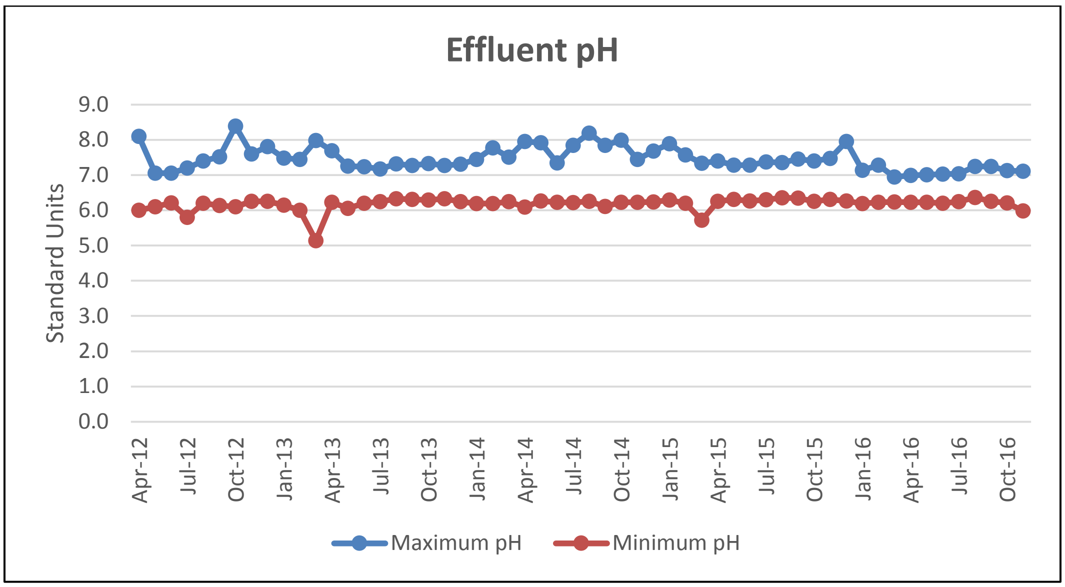
Jul-16
Oct-16
Monthly Average
Maximum Day


Effluent pH
Standard Units
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
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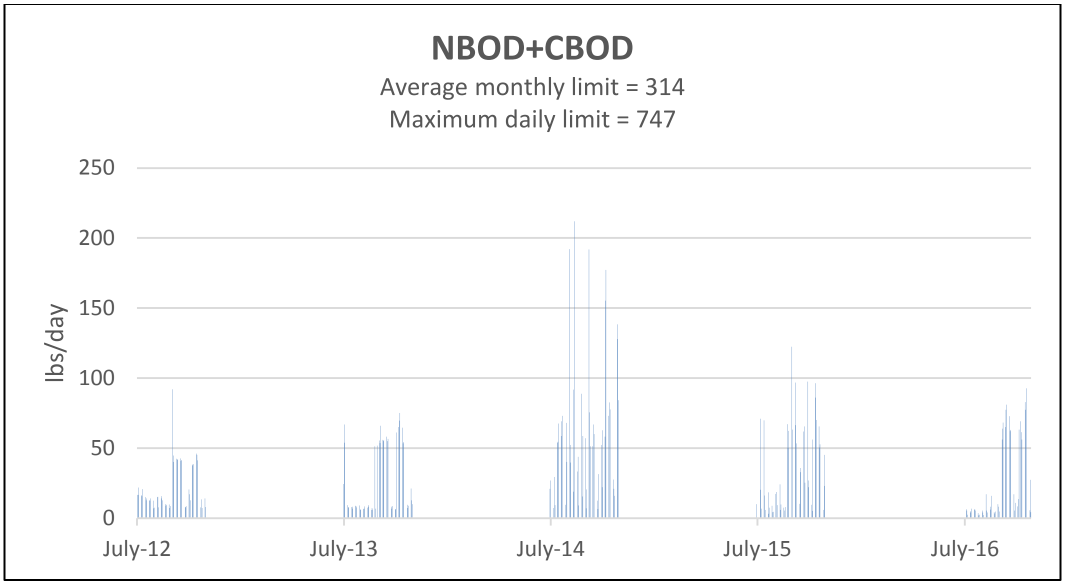
Jul-16
Oct-16
Maximum pH
Minimum pH


NBOD+CBOD
Average monthly limit = 314
Maximum daily limit = 747
lbs/day
250
200
150
100
50
0
July-12
July-13
July-14
July-15
July-16

Lake Stevens WWTP Chronic WET Test Results as NOEC/LOEC in % Effluent							
Test Code	Collected	Start Date	Organism	Endpoint	NOEC	LOEC	PMSD
RMAR2838	2/11/2013	2/12/2013	Atlantic mysid	7-day Survival	100	> 100	9.9%
				Biomass	100	> 100	13.8%
				Weight	100	> 100	11.7%
RMAR2840	2/11/2013	2/12/2013	topsmelt	7-day Survival	100	> 100	9.7%
				Biomass	100	> 100	21.8%
				Weight	100	> 100	22.3%
RMAR3069	8/26/2013	8/27/2013	Atlantic mysid	7-day Survival	100	> 100	10.6%
				Biomass	100	> 100	12.7%
				Weight	100	> 100	9.1%
RMAR3068	8/26/2013	8/27/2013	topsmelt	7-day Survival	100	> 100	8.2%
				Biomass	100	> 100	23.3%
				Weight	100	> 100	23.3%

Lake Stevens WWTP Acute WET Test Results as NOEC/LOEC in % Effluent							
Test Code	Collected	Start Date	Organism	Endpoint	NOEC	LOEC	PMSD
RMAR0210	11/3/2003	11/4/2003	fathead minnow	96-hour Survival	100	> 100	5.3%
RMAR2839	2/11/2013	2/12/2013	*Ceriodaphnia dubia*	48-hour Survival	100	> 100	5.0%
RMAR2837	2/11/2013	2/12/2013	fathead minnow	96-hour Survival	100	> 100	4.6%
RMAR2942	5/14/2013	5/14/2013	*Ceriodaphnia dubia*	48-hour Survival	100	> 100	5.0%
RMAR2943	5/14/2013	5/14/2013	fathead minnow	96-hour Survival	100	> 100	2.5%
RMAR3071	8/26/2013	8/27/2013	*Ceriodaphnia dubia*	48-hour Survival	100	> 100	5.0%
RMAR3070	8/26/2013	8/27/2013	fathead minnow	96-hour Survival	100	> 100	4.6%
RMAR3134	11/18/2013	11/19/2013	*Ceriodaphnia dubia*	48-hour Survival	100	> 100	5.0%
RMAR3135	11/18/2013	11/19/2013	fathead minnow	96-hour Survival	100	> 100	5.9%

Lake Stevens WWTP Acute WET Test Results as % Survival in 100% Effluent					
Test Code	Collected	Start Date	Organism	Endpoint	% Survival
RMAR2839	2/11/2013	2/12/2013	*Ceriodaphnia dubia*	48-hour Survival	100%
RMAR2837	2/11/2013	2/12/2013	fathead minnow	96-hour Survival	100%
RMAR2942	5/14/2013	5/14/2013	*Ceriodaphnia dubia*	48-hour Survival	100%
RMAR2943	5/14/2013	5/14/2013	fathead minnow	96-hour Survival	100%
RMAR3071	8/26/2013	8/27/2013	*Ceriodaphnia dubia*	48-hour Survival	100%
RMAR3070	8/26/2013	8/27/2013	fathead minnow	96-hour Survival	100%
RMAR3134	11/18/2013	11/19/2013	*Ceriodaphnia dubia*	48-hour Survival	100%
RMAR3135	11/18/2013	11/19/2013	fathead minnow	96-hour Survival	100%

Priority Pollutants Sampling Results

Parameter	Units	Date				
		8/9/2016	7/21/2015	8/26/2014	8/20/2013	5/7/2013
Mercury	ng/L	0.44	0.78	0.824	0.793	0.757
Phenol	µg/L	110	72	54	56	nd
Arsenic	µg/L	0.6	0.6	0.7	nd	nd
Copper	µg/L	6.5	14	7	9	8
Lead	µg/L	nd	nd	0.13	nd	nd
Nickel	µg/L	1.7	3	2	nd	nd
Selenium	µg/L	0.5	0.3	0.3	nd	nd
Zinc	µg/L	51	40	36	37	23
Chloroform	µg/L	nd	nd	0.6	nd	nd
1,1,1- Trichloroethane	µg/L	nd	nd	nd	nd	nd
Bis(2-ethylhexyl) phthalate	µg/L	7.1	1	nd	nd	10.5

Supplemental testing for Bis(2-ethylhexyl) phthalate - see attached memo.

MEMORANDUM

TO:	LAURA FRICKE DEPARTMENT OF ECOLOGY
FROM:	CAITLIN HUBBARD LAKE STEVENS SEWER DISTRICT
DATE:	JUNE 27, 2017
SUBJECT:	BIS (2-ETHYLHEXYL) PHTHALATE

Bis (2) Ethylhexyl Phthalate Investigation

Introduction:

Per the Fact Sheet issued on April 27, 2017, during the previous permit term, Lake Stevens Sewer District's composite samples taken for priority pollutant scans showed DEHP levels of up to 10.5 µg/L. These results may be evidence of contamination from sampling equipment (plastics), rather than the actual presence of DEHP in the effluent. Phthalates are plasticizers that are commonly used in hundreds of common consumer and building products. The chemical has also been identified as a common sampling and laboratory contaminate. The proposed permit includes additional sampling requirements for this pollutant.

Since phthalates were detected in this facility's effluent, the District has re-sampled the treatment plant's effluent, using clean sampling techniques to confirm that the detection is not a result of either sampling or laboratory contamination. The District has worked with an accredited laboratory, Analytical Resources, Incorporated, on specific clean sampling requirements, and has also sampled the treatment plant's influent in an attempt to determine if the contaminant source is from treatment plant's sampling equipment, or from the collection system. Samples were collected in clean glass bottles with polytetrafluoroethylene (PFTE or Teflon™) lids.

Summary of Bis (2-Ethylhexyl) Phthalate Results

All results in ug/L	Grab	Sampler Grab	24-Hour Composite
Influent	5.7	12.3	31.0
Effluent	13.5	ND	9.2

Conclusions:

- Results = puzzling;
- In the Influent row, the higher number in the 24-hour composite sample might suggest presence of the phthalate in the carboy of the composite sampler;
- In the Effluent row, the higher number in the grab sample might indicate a slug of the phthalate went through the plant;

In general, the results are inconclusive. Bis (2-ethylhexyl) phthalate appears to be coming into the treatment plant through the collection system. As stated in the fact sheet, as well as this http://www.huffingtonpost.com/maia-james/phthalates-health_b_2464248.html Huffington Post article, phthalates are ubiquitous. 95% of the population has detectable phthalate levels in their urine, and it ends up at the wastewater treatment plant. With the adoption of PEX water piping in new houses, mitigation of the bis (2-ethylhexyl) phthalate issue may be accomplished via restricting permits for use of the material in new housing developments, or via other restrictions in use of phalate-ridden materials, rather than by requiring treatment after the contaminant has made it into the sewer collection system.

You can retrieve additional detailed data on discharge monitoring, permit records, compliance, inspections and enforcement from Ecology water quality permit database system, called PARIS (Permitting and Reporting Information System).

http://www.ecy.wa.gov/programs/wq/permits/paris/paris.html

Appendix E – Technical Calculations

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found in the PermitCalc workbook on Ecology's webpage at: http://www.ecy.wa.gov/programs/wq/permits/guidance.html.

Simple Mixing:

Ecology uses simple mixing calculations to assess the impacts of certain conservative pollutants, such as the expected increase in fecal coliform bacteria at the edge of the chronic mixing zone boundary. Simple mixing uses a mass balance approach to proportionally distribute a pollutant load from a discharge into the authorized mixing zone. The approach assumes no decay or generation of the pollutant of concern within the mixing zone. The predicted concentration at the edge of a mixing zone (C_{mz}) is based on the following calculation:

$$C_{mz} = Ca + \frac{(Ce - Ca)}{DF}$$

where: Ce = Effluent Concentration
Ca = Ambient Concentration
DF = Dilution Factor

Reasonable Potential Analysis:

The spreadsheets Input 2 – Reasonable Potential, and LimitCalc in Ecology's PermitCalc Workbook determine reasonable potential (to violate the aquatic life and human health water quality standards) and calculate effluent limits. The process and formulas for determining reasonable potential and effluent limits in these spreadsheets are taken directly from the *Technical Support Document for Water Quality-based Toxics Control*, (EPA 505/2-90-001). The adjustment for autocorrelation is from EPA (1996a), and EPA (1996b).

Calculation of Water Quality-Based Effluent Limits:

Water quality-based effluent limits are calculated by the two-value wasteload allocation process as described on page 100 of the TSD (EPA, 1991) and shown below.

1. Calculate the acute wasteload allocation WLA_a by multiplying the acute criteria by the acute dilution factor and subtracting the background factor. Calculate the chronic wasteload allocation (WLA_c) by multiplying the chronic criteria by the chronic dilution factor and subtracting the background factor.

WLA_a = (acute criteria x DF_a) – [(background conc. x (DF_a - 1)]

WLA_c = (chronic criteria x DF_c) – [(background conc. x (DF_c -1)]

where: DF_a = Acute Dilution Factor
DF_c = Chronic Dilution Factor

2. Calculate the long term averages (LTA_a and LTA_c) which will comply with the wasteload allocations WLA_a and WLA_c.

$LTA_a = WLA_a \times e^{[0.5\sigma^2 - z\sigma]}$

where: $\sigma^2 = \ln[CV^2 + 1]$

$z = 2.326$

CV = coefficient of variation = std. dev/mean

$LTA_c = WLA_c \times e^{[0.5\sigma^2 - z\sigma]}$

where: $\sigma^2 = \ln[(CV^2 \div 4) + 1]$

$z = 2.326$

3. Use the smallest LTA of the LTA_a or LTA_c to calculate the maximum daily effluent limit and the monthly average effluent limit.

MDL = Maximum Daily Limit

$$MDL = LTA x\, e^{(Z\sigma - 0.5\sigma^2)}$$

where: $\sigma^2 = \ln[CV^2 + 1]$

z = 2.326 (99th percentile occurrence)

LTA = Limiting long term average

AML = Average Monthly Limit

$$AML = LTA x\, e^{(Z\sigma_n - 0.5\sigma_n^2)}$$

where: $\sigma^2 = \ln[(CV^2 \div n) + 1]$

n = number of samples/month

z = 1.645 (95th % occurrence probability)

LTA = Limiting long term average

Reasonable Potential Calculation

Facility	LSSD
Water Body Type	Freshwater
Rec. Water Hardness	27 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	6.4	15.0
Human Health Carcinogenic		239.0
Human Health Non-Carcinogenic		15.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ARSENIC (dissolved) 7440382 2M	COPPER - 744058 6M Hardness dependent	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	SELENIUM 7782492 10M	ZINC- 7440666 13M hardness dependent	PHENOL 108952 10A	CHLOROFORM 67663 11V	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B
Effluent Data	# of Samples (n)		240	5	5	5	5	5	5	5	5	5	8
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		5,040	0.7	14	0.13	0.0008	3	0.5	51	110	0.6	10.8
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L		53	0	1.41	0.08	0	0	0	1.3			
	Geo Mean, ug/L				0.8		0	0	0	0.7	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	9,644	360	4.9556	15.138	2.1	467.54	20	37.74	-	-	-
		Chronic	1,389	190	3.7079	0.5899	0.012	51.924	5	34.462	-	-	-
	WQ Criteria for Protection of Human Health, ug/L		-	-	1300	-	0.14	80	60	1000	9000	100	0.045
	Metal Criteria Translator, decimal	Acute	-	1	0.996	0.466	0.85	0.998	-	0.996	-	-	-
		Chronic	-	1	0.996	0.466	-	0.997	-	0.996	-	-	-
	Carcinogen?		N	Y	N	N	N	N	N	N	N	Y	Y

Aquatic Life Reasonable Potential

			AMMONIA	ARSENIC	COPPER	LEAD	MERCURY	NICKEL	SELENIUM	ZINC	PHENOL	CHLOROFORM	BIS(2-ETHYLHEXYL) PHTHALATE
Effluent percentile value			0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950			
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555			
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.988	0.549	0.549	0.549	0.549	0.549	0.549	0.549			
Multiplier			1.00	2.32	2.32	2.32	2.32	2.32	2.32	2.32			
Max concentration (ug/L) at edge of...		Acute	832	0.254	6.254	0.090	0.000	1.087	0.182	19.545			
		Chronic	385	0.108	3.477	0.084	0.000	0.463	0.077	9.084			
Reasonable Potential? Limit Required?			**NO**	**NO**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**			

Aquatic Life Limit Calculation

			AMMONIA	ARSENIC	COPPER	LEAD	MERCURY	NICKEL	SELENIUM	ZINC	PHENOL	CHLOROFORM	BIS(2-ETHYLHEXYL) PHTHALATE
# of Compliance Samples Expected per month					4								
LTA Coeff. Var. (CV), decimal					0.6								
Permit Limit Coeff. Var. (CV), decimal					0.6								
Waste Load Allocations, ug/L		Acute			24.102								
		Chronic			35.879								
Long Term Averages, ug/L		Acute			7.7387								
		Chronic			18.924								
Limiting LTA, ug/L					7.7387								
Metal Translator or 1?					1.00								
Average Monthly Limit (AML), ug/L					**12.1**								
Maximum Daily Limit (MDL), ug/L					**24.2**								

Human Health Reasonable Potential

		AMMONIA	ARSENIC	COPPER	LEAD	MERCURY	NICKEL	SELENIUM	ZINC	PHENOL	CHLOROFORM	BIS(2-ETHYLHEXYL) PHTHALATE
s	$s^2=\ln(CV^2+1)$			0.5545		0.5545	0.5545	0.5545	0.5545	0.5545	0.5545	0.5545
Pn	Pn=(1-confidence level)1/n			0.549		0.549	0.549	0.549	0.549	0.549	0.549	0.688
Multiplier				0.9336		0.9336	0.9336	0.9336	0.9336	0.9336	0.9336	0.7624
Dilution Factor				15		15	15	15	15	15	239	239
Max Conc. at edge of Chronic Zone, ug/L				1.6181		5E-05	1.9E-01	3.1E-02	3.8277	6.8466	0.0023	0.0345
Reasonable Potential? Limit Required?				**NO**		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Comments/Notes:

References: WAC 173-201A,

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

Freshwater Un-ionized Ammonia Criteria Calculation

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

INPUT	
1. Receiving Water Temperature (deg C):	21.0
2. Receiving Water pH:	7.7
3. Is salmonid habitat an existing or designated use?	Yes
4. Are non-salmonid early life stages present or absent?	Present
OUTPUT	
Using mixed temp and pH at mixing zone boundaries?	no
Ratio	13.489
FT	1.400
FPH	1.201
pKa	9.371
Unionized Fraction	0.021
Unionized ammonia NH3 criteria (mg/L as NH_3)	
Acute:	0.245
Chronic:	0.035
RESULTS	
Total ammonia nitrogen criteria (mg/L as N):	
Acute:	9.644
Chronic:	1.389

Freshwater Temperature Reasonable Potential and Limit Calculation

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

	Core Summer Critera
INPUT	**July 1-Sept 14**
1. Chronic Dilution Factor at Mixing Zone Boundary	15.0
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	20.6 °C
3. 7DADMax Effluent Temperature (95th percentile)	23.0 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	17.5 °C
OUTPUT	
5. Temperature at Chronic Mixing Zone Boundary:	20.8 °C
6. Incremental Temperature Increase or decrease:	0.2 °C
7. Maximum Allowable Incremental Temperature Increase:	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	20.9 °C
A. If ambient temp is warmer than WQ criterion	
9. Does temp fall within this warmer temp range?	YES
10. Temperature Limit if Required:	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 28/(T_{amb}+7) and within 0.3 °C of the criterion	
11. Does temp fall within this incremental temp. range?	---
12. Temp increase allowed at mixing zone boundary, if required:	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 28/(T_{amb}+7) of the criterion	
13. Does temp fall within this Incremental temp. range?	---
14. Temp increase allowed at mixing zone boundary, if required:	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))	
15. Does temp fall within this Incremental temp. range?	---
16. Temp increase allowed at mixing zone boundary, if required:	---
RESULTS	
17. Do any of the above cells show a temp increase?	**NO**
18. Temperature Limit if Required?	**NO LIMIT**

Reasonable Potential Calculation

Facility	LSSD
Water Body Type	Marine

Dilution Factors:	Acute	Chronic
Aquatic Life	6.4	15.0
Human Health Carcinogenic		239.0
Human Health Non-Carcinogenic		15.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ARSENIC (dissolved) 7440382 2M	COPPER - 744058 6M Hardness dependent	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	SELENIUM 7782492 10M	ZINC- 7440666 13M hardness dependent	PHENOL 108952 10A	CHLOROFORM 67663 11V	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B
Effluent Data	# of Samples (n)		240	5	5	5	5	5	5	5	5	5	8
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		5,040	0.7	14	0.13	0.0008	3	0.5	51	110	0.6	10.8
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L		53	0	1.41	0.08	0	0	0	1.3			
	Geo Mean, ug/L						0	0	0	0.7	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	9,647	69	4.8	210	1.8	74	290	90	-	-	-
		Chronic	1,449	36	3.1	8.1	0.025	8.2	71	81	-	-	-
	WQ Criteria for Protection of Human Health, ug/L		-	-	-	-	0.15	100	200	1000	70000	600	0.046
	Metal Criteria Translator, decimal	Acute	-	1	0.83	0.951	0.85	0.99	-	0.946	-	-	-
		Chronic	-	-	0.83	0.951	-	0.99	-	0.946	-	-	-
	Carcinogen?		N	Y	N	N	N	N	N	N	N	Y	Y

Aquatic Life Reasonable Potential

			AMMONIA	ARSENIC	COPPER	LEAD	MERCURY	NICKEL	SELENIUM	ZINC	PHENOL	CHLOROFORM	BIS(2-ETHYLHEXYL) PHTHALATE
Effluent percentile value			0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950			
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555			
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.988	0.549	0.549	0.549	0.549	0.549	0.549	0.549			
Multiplier			1.00	2.32	2.32	2.32	2.32	2.32	2.32	2.32			
Max concentration (ug/L) at edge of...		Acute	832	0.254	5.410	0.112	0.000	1.079	0.182	18.618			
		Chronic	385	0.108	3.117	0.094	0.000	0.460	0.077	8.689			
Reasonable Potential? Limit Required?			**NO**	**NO**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**			

Aquatic Life Limit Calculation

			AMMONIA	ARSENIC	COPPER	LEAD	MERCURY	NICKEL	SELENIUM	ZINC	PHENOL	CHLOROFORM	BIS(2-ETHYLHEXYL) PHTHALATE
# of Compliance Samples Expected per month					4								
LTA Coeff. Var. (CV), decimal					0.6								
Permit Limit Coeff. Var. (CV), decimal					0.6								
Waste Load Allocations, ug/L		Acute			23.106								
		Chronic			26.76								
Long Term Averages, ug/L		Acute			7.4189								
		Chronic			14.114								
Limiting LTA, ug/L					7.4189								
Metal Translator or 1?					0.83								
Average Monthly Limit (AML), ug/L					**13.9**								
Maximum Daily Limit (MDL), ug/L					**27.8**								

Human Health Reasonable Potential

		AMMONIA	ARSENIC	COPPER	LEAD	MERCURY	NICKEL	SELENIUM	ZINC	PHENOL	CHLOROFORM	BIS(2-ETHYLHEXYL) PHTHALATE
s	$s^2=\ln(CV^2+1)$					0.5545	0.5545	0.5545	0.5545	0.5545	0.5545	0.5545
Pn	Pn=(1-confidence level)1/n					0.549	0.549	0.549	0.549	0.549	0.549	0.688
Multiplier						0.9336	0.9336	0.9336	0.9336	0.9336	0.9336	0.7624
Dilution Factor						15	15	15	15	15	239	239
Max Conc. at edge of Chronic Zone, ug/L						5E-05	1.9E-01	3.1E-02	3.8277	6.8466	0.0023	0.0345
Reasonable Potential? Limit Required?						**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Comments/Notes:

References: WAC 173-201A,

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

Marine Un-ionized Ammonia Criteria Calculation

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

INPUT	
1. Receiving Water Temperature, deg C (90th percentile):	21.0
2. Receiving Water pH, (90th percentile):	7.7
3. Receiving Water Salinity, g/kg (10th percentile):	10.0
4. Pressure, atm (EPA criteria assumes 1 atm):	1.0
5. Unionized ammonia criteria (mg un-ionized NH_3 per liter) from EPA 440/5-88-004:	
Acute:	0.233
Chronic:	0.035
OUTPUT	
Using mixed temp and pH at mixing zone boundaries?	No
1. Molal Ionic Strength (not valid if >0.85):	0.201
2. pKa8 at 25 deg C (Whitfield model "B"):	9.268
3. Percent of Total Ammonia Present as Unionized:	2.0%
4. Total Ammonia Criteria (mg/L as $\underline{NH_3}$):	
Acute:	11.73
Chronic:	1.76
RESULTS	
Total Ammonia Criteria (mg/L as N)	
Acute:	**9.65**
Chronic:	**1.45**

Marine Temperature Reasonable Potential and Limit Calculation

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

INPUT	May-Sep
1. Chronic Dilution Factor at Mixing Zone Boundary	15.0
2. Annual max 1DADMax Ambient Temperature (Background 90th percentile)	21.0 °C
3. 1DADMax Effluent Temperature (95th percentile)	23.0 °C
4. Aquatic Life Temperature WQ Criterion	16.0 °C
OUTPUT	
5. Temperature at Chronic Mixing Zone Boundary:	21.13 °C
6. Incremental Temperature Increase or decrease:	0.13 °C
7. Incremental Temperature Increase 12/(T-2) if T≤ crit:	---
8. Maximum Allowable Temperature at Mixing Zone Boundary:	21.30 °C
A. If ambient temp is warmer than WQ criterion	
9. Does temp fall within this warmer temp range?	YES
10. Temp increase allowed at mixing zone boundary, if required:	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 12/(T_{amb}-2) and within 0.3 °C of th	
11. Does temp fall within this incremental temp. range?	---
12. Temp increase allowed at mixing zone boundary, if required:	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 12/(T_{amb}-2) of the criterion	
13. Does temp fall within this Incremental temp. range?	---
14. Temp increase allowed at mixing zone boundary, if required:	---
D. If ambient temp is cooler than (WQ criterion - 12/(T_{amb}-2))	
15. Does temp fall within this Incremental temp. range?	---
16. Temp increase allowed at mixing zone boundary, if required:	---
RESULTS	
17. Do any of the above cells show a temp increase?	**NO**
18. Temperature Limit if Required?	**NO LIMIT**

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	15.0
Receiving Water Fecal Coliform, #/100 ml	50
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*200*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**73**
Difference between mixed and ambient, #/100 ml	23

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

Appendix F – Response to Comments

Lake Stevens Sewer District submitted comments during their initial review of the draft permit and fact sheet. These comments and Ecology's responses are summarized as follows:

1. Section S.2.A. Monitoring Requirements

   A. **Comment summary:** The District does not concur with the requirement to monitor the UV transmittance and intensity, because (1) monitoring would require operating all the UV banks, use more electricity, and increase costs; and (2) the effluent meets permit requirements for fecal coliform bacteria even without UV disinfection. The District proposes that Ecology consider allowing it to turn off the UV system altogether.

      Ecology's response: It is true that MBR systems have the capability of removing most bacteria and some viruses. However, Ecology requires effluent disinfection because membranes are not an absolute barrier to pathogens. Monitoring the UV transmittance and intensity is a way to verify that the disinfection system is operating. Ecology does not allow MBR treatment facilities to shut off their UV disinfection systems, partially or fully. It was Ecology's error that this monitoring was not included in the previous permit.

   B. **Comment summary:** The District does not believe that routine testing for bis(2-ethylhexyl) phthalate is justified. The District submitted the results of some additional testing of their influent and effluent for this chemical.

      Ecology's response: We appreciate the additional testing data. Ecology has re-evaluated the reasonable potential for this pollutant, and concludes that the routine testing schedule for priority pollutants, combined with clean sampling techniques, will suffice for this permit term. The District must submit a revised mixing zone analysis which includes a dilution factor for human health carcinogens during this permit term. Although it will not be a permit requirement at this time, additional investigation into potential source control measures for this pollutant would be useful.

   C. **Comment summary:** The District requests clarification on the requirements for effluent testing for copper.

      Ecology's response: Based on effluent testing, ambient monitoring, and the approved dilution factors, there is a reasonable potential for the aquatic life water quality criteria for copper to be exceeded at the edge of the mixing zone. Therefore the proposed permit includes an effluent limit for copper. The District must demonstrate compliance with the effluent limit by regularly testing the effluent.

2. Section S.2.C.5.

   Comment summary: Please clarify the requirement to "establish a calibration frequency for each device or instrument in the O&M manual that conforms to the frequency recommended by the manufacturer." We do not interpret this to be every single device or instrument, but just the ones that pertain to our permit.

   Ecology's response: This section is titled "Flow measurement, field measurement, and continuous monitoring devices." Any such devices that are used to operate and monitor the treatment facility would be included. The permit pertains to the entire wastewater treatment facility, including the collection system and discharge outfall.

3. Section S.3.A.3.

   Comment summary: Please clarify the requirement to submit a copy of the laboratory report. Does this include bench sheets generated in our lab?

   Ecology's response: This requirement is for laboratory reports from outside (contract) laboratories, not to analyses conducted at the wastewater treatment facility.

Lake Stevens Sewer District submitted a follow-up comment regarding Section S.2.A. Monitoring Requirements.

> **Comment:** The LSSD WWTP does not have a means of continuously monitoring and recording UV transmittance, but does have means of monitoring by grab sample, and testing in our laboratory. The District requests the permit to require monitoring UV transmittance via a grab sample, and test in the LSSD lab.
>
> **Ecology's response:** This will be an acceptable method to verify proper operation of the UV system. The monitoring requirement for UV transmittance will be a 3-times-per-week grab sample.

APPENDIX C

INTERLOCAL AGREEMENTS

SEWAGE DISPOSAL AGREEMENT BETWEEN LAKE STEVENS SEWER DISTRICT AND CITY OF MARYSVILLE

THIS AGREEMENT is entered into this 22nd day of April, 1999 by and between the LAKE STEVENS SEWER DISTRICT, a municipal corporation of the State of Washington (the "District"), and the CITY OF MARYSVILLE, a municipal corporation of the State of Washington (the "City"). This agreement is entered into in accordance with Chapter 35.13A RCW and Chapter 57 RCW.

I. RECITALS

A. The District has constructed, owns and operates a sanitary sewage collection system, sewage trunk lines, sewage pump stations, sewage force mains, sewage treatment facilities and sewage outfall line. These facilities provide sanitary sewer service and sewage treatment to areas within the District.

B. The City is in the process of constructing a sewage collection system, sewage trunk lines, sewage pumping stations and sewage force mains to serve the area within its urban growth boundary.

C. There is an area within the City's Urban Growth Boundary and the City and District Comprehensive Sewer Planning Boundaries which shall be referred to as the "overlap" area, within which both the City and the District are capable of providing sanitary sewer service. The overlap area is depicted on **Exhibit A**, which is attached hereto and incorporated by this reference.

D. It is the intent of the parties to this agreement to resolve the dispute relating to the provision of sewer service to the "overlap" area depicted on **Exhibit A** and to provide an equitable formula for dividing the costs of maintaining and operating those portions of the District's system of sewers which benefit both parties.

II. TEMPORARY SEWER CONVEYANCE AND TREATMENT BY DISTRICT

A. The District agrees to provide for the temporary treatment of domestic sewage on behalf of the City of Marysville within that portion of the "overlap" area depicted on **Exhibit A** which is within the City's urban growth boundary. Such service shall continue to be served by the District until such time as the City's own sewage collection system is available to convey such sewage to the City's wastewater treatment plant.

B. For the conveyance and treatment of the City's sewage under this Agreement, the District agrees to bill the City at the same rate per unit as it does other single-family residential sewer customers within the District. The City shall pay the District within thirty (30) days of receipt of its billing. The City shall pay on late payments a penalty of ten percent (10%) of the delinquent amount and, in addition, from the date of delinquency there shall be charged interest at the rate of eight percent (8%) per annum on the delinquency charges and penalty added thereto.

C. The construction or extension of any sewage lines or collection facilities and/or appurtenances shall be in accordance with the development standards of the City.

D. The City shall review all proposals for developer extension of sewer lines within that part of the overlap area which is within the City's urban growth boundary and the District will be provided with a copy of such proposals for courtesy review and comment.

III. CITY OBLIGATIONS

A. The City shall be responsible for billing all sewer utility customers within that part of the overlap area which is within the City's urban growth boundary. The City shall bill said customers in accordance with the sewer rates as established by the City. All customers shall be required to apply for utility service on the contractual forms provided by the City and shall be subject to the rules, policies and regulations for utility service as established pursuant to City ordinance.

B. The City shall operate and maintain that portion of the sewage system that is within the City's urban growth boundary and within the overlap area in accordance with customary engineering standards of practice and in conformity with standards established by the Washington State Department of Ecology, the Washington State Department of Health, the United States Environmental Protection Agency, and other applicable standards.

C. The City agrees to meet, consult and work cooperatively with any property owner or owners who wish to petition for the formation of a ULID for sewer utility service within the overlap area.

D. The City and the District will cooperate to identify a location for a proper connection point that will enable the sewage within the City's urban growth boundary to be collected and transferred to Marysville's collection system at such time as said system is constructed and available for use.

E. Until such time as flows from the City's collection system within the overlap area are diverted from the District, the City shall charge its overlap customers all sewer connection fees as established by City ordinance. Within 30 days of a customer connection to its collection system within the overlap area, the City agrees to remit to the District, per unit capital improvement fees at the applicable rates in then effect by the District. The District agrees to keep the City informed as to current capital improvement fees, provide all copies relating thereto, and a 30-day notification of any District hearing in which changes would be considered.

IV. OTHER AGREEMENTS

A. That area known as the Plat of Ridgewood shall not be subject to this agreement, and the District shall continue to own, maintain and have full authority and jurisdiction over the sewer collection system contained therein.

B. The parties agree to amend their sewer comprehensive plans consistent with the terms of this agreement and shall specifically delete that portion of the City's urban growth boundary that is within the overlap area from the District's comprehensive planning area. In turn, the City shall withdraw its current SEPA appeal as set forth in the letter dated September 17, 1998.

C. In the event of a District-wide or area-wide moratorium affecting the **Exhibit A** area, the District shall not take action that would result in the discontinuance of service to customers within such area. Sewer connections that have been applied for or which are in process shall be honored upon payment of the connection fee. The District agrees to notify the City in writing at such time its wastewater treatment plant or applicable trunkage capacity reaches 85%. In such cases, the City will provide the District with notification of all development requests and/or applications for sewer service so that it may have an opportunity to review, prior to approval.

D. The City and the District each retain their rights to issue bonds and other obligations in accordance with applicable law, but neither party shall act in such a manner as to impair the rights of the holders or owners of bonds issued by the other.

E. The parties agree that any and all claims, disputes, differences and misunderstandings concerning this contract and its interpretation which may arise between the parties shall be determined and settled by binding arbitration. In the event the parties are unable to agree upon an arbitrator, each party shall designate an arbitrator, and the two arbitrators so chosen shall select a third arbitrator. The Rules of Mandatory Arbitration for Snohomish County Superior Court shall control. In the event of arbitration, the decision of the arbitrators shall be final and binding upon the parties. Arbitration expenses shall be shared equally by the parties.

F. This contract shall not be assigned by either party without the written consent of the other.

G. This contact may be mutually amended in writing by the parties.

H. This contract amends and replaces all prior agreements between the parties. It shall be binding upon the parties and upon their successors in interest indefinitely and until such time as the parties by mutual agreement terminate the same.

CITY OF MARYSVILLE

By ______________________
MAYOR

ATTEST:

By ______________________
CITY CLERK

Approved as to form:

By ______________________
CITY ATTORNEY

LAKE STEVENS SEWER DISTRICT

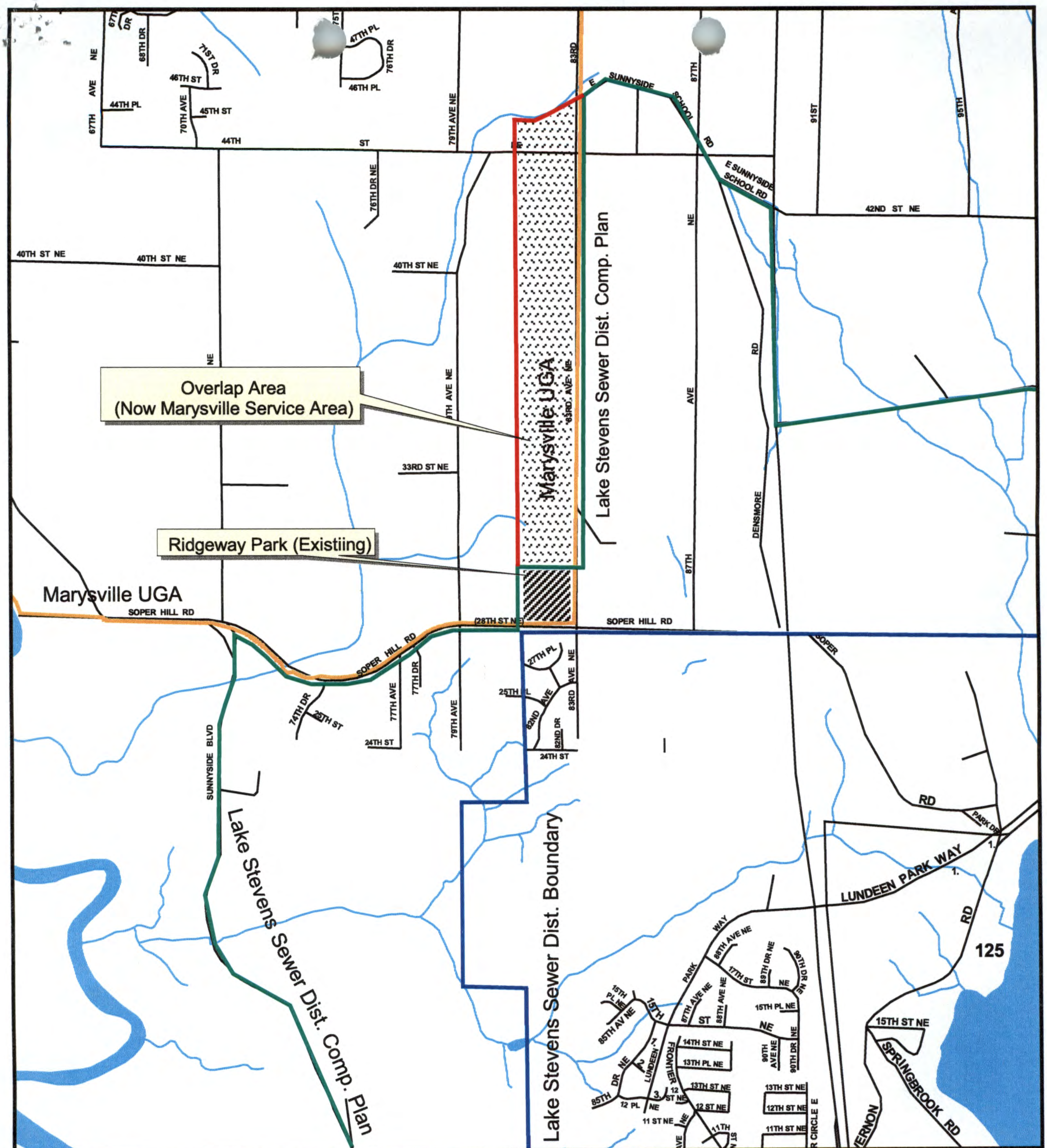
By ______________________
Commissioner

By ______________________
Commissioner

By ______________________
Commissioner

Approved as to form:

By ______________________
ATTORNEY FOR THE DISTRICT



Sewage Disposal Agreement Between Lake Stevens Sewer District and City of Marysville

Marysville UGA
Lake Stevens Sewer Dist. Comp. Plan
Lake Stevens Sewer Dist. Boundary

Exhibit A

COPY

CITY OF LAKE STEVENS AND LAKE STEVENS SEWER DISTRICT
UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT

THIS AGREEMENT is made and entered into this 23rd day of May, 2005, by and between the Lake Stevens Sewer District, a special purpose district of the State of Washington, hereinafter referred to as the "District", and the City of Lake Stevens, a municipal corporation of the State of Washington, hereinafter referred to as the "City".

A. WHEREAS, the District and City desire to enter into an agreement to determine the orderly transition of public sewer service in the Lake Stevens Urban Growth Area from two systems to one system, ultimately as the City's system; and

B. WHEREAS, the District owns and operates a wastewater collection, conveyance and treatment system for the benefit of District customers, including the City; and

C. WHEREAS, the City owns and operates a wastewater collection and conveyance system for the benefit of City customers; and

D. WHEREAS, the City has statutory approval rights and responsibilities for the District's Comprehensive Sewer Plan under RCW Chapter 57; and

E. WHEREAS, the District and City have previously entered into joint participation contracts dated April 28, 1970, April 21, 1983, July 1, 1986, and sewage disposal contracts dated September 1, 1991, and August 1, 1996, Wastewater Capital Facilities Agreement dated April 14, 2003 and Wastewater Treatment and Conveyance Services Agreement dated April 14, 2003, under the terms of which the District and the City shared in costs of building, improving and operating certain District facilities which are owned and operated by the District, and which serve the Parties; and

F. WHEREAS, the District and City are planning for the replacement, relocation, upgrade and expansion of the District's WWTP, with possible completion by or before the year 2011, and the cost of such project is appropriately borne by both new and existing customers of the District and City Systems; and

G. WHEREAS, the City is uniquely situated within the Lake Stevens Urban Growth Area such that less than 50 percent of the land area in the Lake Stevens Urban Growth Area is included in the City's corporate limits; and as the City annexes additional area within the Lake Stevens Urban Growth Area, the City will be assuming additional public service responsibilities from Snohomish County, including police services and roadway and stormwater systems in areas which are or can be served by the District wastewater collection and conveyance system; and

H. WHEREAS, the District's existing finances will allow the District to fund a higher proportion of Phase I WWTP improvements in anticipation of the long term economies of scale of a single-service provider that will benefit the entire community; and the District and City wish to minimize and equitably share future capital and operating costs of sewerage service in the Lake Stevens Urban Growth Area and recognize the increased efficiencies and economy of scale of unifying service under a single provider; and

I. WHEREAS, the City and District are each eligible, subject to other conditions, to separately apply for State Public Works Trust Fund loans and are able to use such loan proceeds in a coordinated manner for sewerage system improvements; and

J. WHEREAS, the City and the District recognize that the City has the current authority under RCW 35.13A to assume the assets and functions of the District under certain conditions and that the District has authority under Title 57 RCW to operate sewerage facilities within the incorporated boundaries of the City;

NOW, THEREFORE, in consideration of the terms and conditions contained herein, the District and the City agree as follows:

Article 1. Authority for Agreement

This Agreement is made and entered into pursuant to the authority vested in the District by the provisions of Chapter 57 RCW and the authority vested in the City pursuant to the provisions of Chapter 35.A RCW, and the authority vested in the City and the District pursuant to the provisions of Chapter 39.34 RCW.

Article 2. Definitions

For the purpose of this Agreement, the following words, terms and phrases shall have the meanings identified in this article:

2.1 "Capital Agreement" shall mean the Wastewater Capital Facilities Agreement dated April 14, 2003, and any amendments thereto, executed between the District and City.

2.2 "City System" shall mean the Wastewater collection and conveyance facilities and appurtenances thereto (e.g. sewer mains, side sewer stubs, manholes, lift stations, force mains and metering and sampling equipment) which are owned, operated and maintained by the City, not including real property or any interest therein.

2.3 "Comprehensive Plan" shall mean the City and/or Snohomish County comprehensive land use plan prepared and updated pursuant to RCW 36.70A, including land use, housing, capital facilities and utilities elements.

2.4 "Comprehensive Sewer Plan" shall mean the District general sewer plan or comprehensive plan for sewer system prepared and updated pursuant to RCW 57.16 and WAC 173-240.

2.5 "District System" shall mean the Wastewater collection, conveyance, treatment and disposal facilities and appurtenances thereto (e.g. sewer mains, side sewer stubs, manholes, lift stations, force mains and metering and sampling equipment, treatment plants and outfalls) which are owned, operated and maintained by the District, including real property.

2.6 "Engineering Report/Facilities Plan" shall mean the District planning document prepared and updated to examine the engineering and administrative aspects of the District's WWTP, prepared pursuant to WAC 173-240 and 40 CFR 35.719-1.

2.7 "Franchise Agreement" shall mean that separate agreement executed between the parties providing for District operations within City limits as provided for by State statute (RCW 35A.11 and 35A.47).

2.8 "Franchise Fee" shall mean that fee paid by the District to the City per the terms of the Franchise Agreement.

2.9 "Lake Stevens Urban Growth Area" or "Urban Growth Area" shall mean that portion of Snohomish County designated as the urban growth area around Lake Stevens, under the Washington State Growth Management Act.

2.10 "Utility Agreement Fee" shall mean that fee paid by the District to the City as specified in this Agreement.

2.11 "Planning Document" shall mean any one or combination of the Comprehensive Sewer Plan, the Engineering Report/Facilities Plan, or the Sewer Capital Facilities Plan.

2.12 "PWTF" shall mean the Public Works Trust Fund and its loan programs, administered by the State Public Works Board.

2.13 "Services Agreement" shall mean the Wastewater Treatment and Conveyance Services Agreement dated April 14, 2003, and any amendments thereto, executed between the District and City.

2.14 "Sewer Capital Facilities Plan" shall mean the sewer planning element of the District's Comprehensive Sewer Plan

2.15 "Step 1" shall mean the process and requirements for provision and transition of sewer service per Article 4 herein.

2.16 "Step 2" shall mean the process and requirements for provision and transition of sewer service per Article 5 herein.

2.17 "Sewer Utility Committee" shall mean a board comprised of three District Commissioners and three City Council members. The representatives from the District and City shall be selected by the District and City elected officials, respectively.

2.18 "Unified Sewer System" shall mean the combination and integration of the District System and City System, as a result of the transition of sewer service in Step 1 and continuing in Step 2.

2.19 "Unified Sewer System Capital Projects" shall mean those projects initiated by the District in Step 1 or the City in Step 2 to improve, enhance, expand, replace or rehabilitate portions of the Unified Sewer System, without respect to the project having been identified in a Planning Document or as a result of an unanticipated or emergency condition.

2.20 "Wastewater Treatment Plant" or "WWTP" shall mean the Lake Stevens Sewer District's Wastewater Treatment Plant and appurtenances, as presently located adjacent to Ebey Slough and/or as planned for construction adjacent to State Route 204.

Article 3. Summary of Sewer Services Transition Plan

In order to transition the provision of public sewer service within the UGA to a single service provider to minimize sewer service conditions as a hindrance to City annexations of area within the UGA, the Parties agree to a two-step process.

3.1. Step 1 provides for the transfer of the assets of the City System to the District after which the District shall own, operate and maintain the entire wastewater collection conveyance, treatment and discharge system in the UGA (the Unified Sewer System), until Step 2.

3.2. Step 2 provides for the ultimate transfer of the Unified Sewer System from the District to the City.

3.3. Upon the effective date of this agreement, Section 11.1 of the Capital Agreement shall be null and void.

Article 4. Step 1

4.1. Upon the effective date of Step 1 (June 1st, 2005), the City shall transfer the assets of the City System, not including real property and certain specific assets as specified herein, to the District. Such transfer shall be by bill of sale substantially in form presented in **Exhibit A**, attached and included herein by reference.

4.2. Upon the effective date of Step 1, and subject to the conditions of Articles 6 & 7, the District shall be solely responsible for the collection of rates and charges, planning, administration, operation, financing, maintenance, improvements, repair, replacement, upgrade and expansion of the Unified Sewer System, including funding of the City sewer obligations as described below. Such transfer shall continue until the effective date of Step 2. Upon the effective date of Step 1, the District System and City System shall be combined and integrated, and managed as one complete system (i.e. the Unified Sewer System).

4.3. Upon the effective date of this Agreement, the District adopts and establishes as policy with respect to City annexations in the UGA as follows, and such shall be included in all District Comprehensive Sewer Plans:

A. The City and District shall prepare a joint letter to applicants for District sewer service expressing support of City annexation in the UGA for local land use control and services. Such letter shall be included in materials presented to third parties interested in receiving sewer service from the District within the UGA.

B. Neither Party shall oppose lawful annexation proceedings commenced by the other Party at any time under this Agreement.

C. The District shall include a City-prepared annexation covenant substantially in the form presented in Exhibit B, included herein by reference, as a voluntary addendum to all District developer extension agreements and shall include the City-prepared annexation covenant with all District annexation application materials. Execution of the City-prepared annexation covenant shall be a voluntary element of developer extension applications and District annexation applications. The service to property that has not annexed to the City will be subject to paragraph D, below.

D. The District shall not provide sewer service to a property if such property is, at the time of application for sewer service, contiguous to the City limits and outside the District's corporate boundary unless City annexation covenants are duly executed for the entire subject property.

E. Originals of City annexation covenants received by the District shall be forwarded to the City within 15 days of receipt and the City will record such covenants at their own expense.

4.4. Within 6 months of the effective date of Step 1 the Parties shall enter into a Franchise Agreement, whereby the District shall obtain a franchise for operation of the Unified Sewer System within the City public rights of way and on City-owned real property, and easements granted to the City as applicable, within City-incorporated areas. The City shall designate in the Franchise Agreement the District as an agent of the City solely in regards to exercising the rights assigned to the City in easements granted to the City. The District shall pay the City the Franchise Fee stipulated therein until the effective date of Step 2. The Franchise Fee shall not exceed $2,000 per year, unless otherwise approved by the Sewer Utility Committee.

4.5. The City shall retain title to all real property of the current City System and shall retain all easements granted to the City for the benefit of the public sewer system. Subject to the terms of the Franchise Agreement, the District is hereby assigned the right to use all real property owned by the City for sewer system collection and conveyance facilities until the effective date of Step 2.

4.6. The District shall designate the City as a future assignee on all future easements.

4.7. The District shall pay a Utility Agreement Fee described below as the sole source of revenue for ancillary City liabilities or costs associated with the implementation and maintenance of this Agreement. Such fee shall be paid monthly starting thirty (30) days following the effective date of Step 1, through the effective date of Step 2. The Utility Agreement Fee may be adjusted after January 1st 2007 as described in Section 7.3.

A. Upon the effective date of Step 1 through December 31st 2005, the Utility Agreement Fee shall be $12,500 per month

B. The Utility Agreement Fee shall be $10,835 per month beginning January 1st, 2006

C. The Utility Agreement Fee shall be $9,165 per month beginning January 1st, 2007.

4.8. The Franchise Agreement and Utility Agreement Fees paid by the District are a business expense that shall not be separately identified on customer billings.

4.9. Each Party shall apply for PWTF pre-construction and construction loans for design and construction of the phase 1 WWTP replacement project including related conveyance projects and may apply for future Unified Sewer System projects, to the extent and when each is eligible. Prior to executing final PWTF loan agreements, the Parties shall execute agreements defining the responsibilities for draws and disbursement of loan funds, debt service and local match.

4.10. Within thirty (30) days of the effective date of Step 1, the City shall transfer all funds within the City's wastewater treatment plant replacement fund to the

District. The District shall not use said funds for any other purpose except for WWTP Phase I design or construction costs.

4.11. The District shall transfer to the City all funds necessary for the City sewer utility's share of the 1997 General Obligations Bonds, Series 1997, and PWTF Loan No. PW-02-691-029 debt payments thirty (30) days prior to scheduled City payments. The District may defease either of said City sewer debt obligations at any time consistent with existing City debt covenants.

4.12. Upon the effective date of Step 1, The City shall continue to bill and collect for all existing City sewer utility accounts until Jan 1st 2006. The City will transfer all revenues associated with sewer utility billing to the District on a daily basis. The City shall transfer all accounts to the District's billing system in whole, including delinquencies in January of 2006.

4.13. The District agrees to pay $275,000 towards the City's purchase of a jetter/vactor truck.

4.14. The City may initiate construction of facilities or further extend local collection lines(s) utilizing the District developer extension agreement process. The financial obligation associated with the said developer extension improvement(s) shall remain the sole obligation of the City, unless mutually agreed to and recommended by the Sewer Utility Committee. Accordingly, the City may initiate construction of sewer collection and conveyance system improvements and expansion projects in the industrial-zoned land in the City limits by creation of utility local improvement district or local improvement districts in combination with City developer extension agreements with the District. The City shall notify the Sewer Utility Committee of its intent to utilize this process for construction of sewer facilities.

4.15. Upon District annexation, the District shall implement sewer collection and conveyance system improvements and expansion projects in the industrial-zoned land in the City limits by creation of utility local improvement districts. The District shall notify the Sewer Utility Committee of its intent to utilize this process for construction of sewer facilities.

4.16. Neither Party shall surcharge rates or charges for customers outside their respective corporate boundary.

4.17. The District will invite the City to attend and participate in quality assurance/quality control workshops for major Unified Sewer System projects.

4.18. Both Parties shall negotiate all new contracts and loan agreements or other debt obligation instruments so that the obligations of either Party may be assumed by the other Party upon the effective date of Step 1 and/or Step 2, without penalty or cost due to such transfers.

4.19. The District shall prepare and implement an Industrial Wastewater Pretreatment program.

4.20. Upon the effective date of Step 1, both Parties shall cooperatively develop a set of written protocols and standards for the purpose of information sharing, project review, equipment sharing, standardization of sewer specifications both public and private, development review processes, easement conditions, and other process needs identified through the Sewer Utility Committee.

4.21. The City public works department decant facility will be allowed for discharge under a separate license agreement with District.

4.22. The Capital and Services Agreements shall remain in effect until of the effective date of Step 1 when said Agreements shall become null and void by this Agreement. The stranded cost and purchased capacity provisions of the Capital and Services Agreements are agreed to be null and void.

Article 5. Step 2

5.1. The Unified Sewer System shall, subject to the conditions in Article 5, be transferred in its entirety from the District to the City, no sooner than twenty years from the date of District acceptance of the Phase I WWTP improvements construction project subject to the City satisfying then- current statues regulating assumption of special purpose districts by code cities. Such timing may be extended or accelerated at the mutual agreement of the City and District.

5.2. If, after twenty years from the date of District acceptance of the Phase 1 WWTP improvements construction project, the City does not satisfy the then-current statute conditions for City assumption of the entire District, the Parties agree to the following process. The District shall call for a vote of eligible voters on the question of City assumption of the District and Unified Sewer System in its entirety, after 20 years and within 180 days thereafter following District acceptance of the Phase I WWTP improvements construction project. Approval by the voters shall require the District and City to plan for and implement the assumption of the District by the City and transfer of the Unified Sewer System to the City within one year of the date of certification of results of such vote of approval. Upon a vote of non-approval, the District shall, at the City's request but no more often than 24 months following the date of the prior election on this question, again submit to the voters in the UGA the question of City assumption of the District and Unified Sewer System in its entirety.

5.3. Upon the effective date of Step 2 as determined by satisfying the conditions of Paragraph 5.1 or 5.2 above, the District shall transfer all assets, debt, real and personal property, easements, agreements, etc. of the District and Unified Sewer

System to the City without compensation, unless compensation is required by law. In the event the District has acquired, developed or is otherwise providing drainage and/or street lighting services, such systems including all assets, debt, real and personal property, easements, agreements, etc. shall be transferred to the City without compensation.

5.4 The Parties agree that the Unified Sewer System shall not be separated or subdivided at any time during or following the effective date of Step 1. If after 20 years from the date of District acceptance of the Phase 1 WWTP improvements construction project, the conditions of 5.1 or 5.2 have not been satisfied, the City agrees to not assume portions of the Unified Sewer System with or following City annexations that do not result in satisfying the conditions of 5.1 above.

5.5 The District shall discontinue operation as a sewer, drainage and/or street lighting service provider upon the effective date of Step 2, and shall dissolve within 12 months following the effective date of Step 2.

Article 6. Comprehensive Planning

6.1. Upon the effective date of Step 1, the District will initiate an amendment to their existing Comprehensive Plan to include this executed agreement as policy and an appendix to the Comprehensive Plan. The Comprehensive Sewer Plan shall include policies and goals indicating support for the benefits of annexation by the City within the UGA including the provisions referenced in Section 4.3.

6.2. After completion of Comprehensive Sewer Plan amendment (Section 6.1) and consistent with the review process outlined in this agreement, the District will prepare a new Comprehensive Sewer Plan to include a single Sewer Capital Facilities Plan for the Unified Sewer System. The new Comprehensive Sewer Plan and Sewer Capital Facilities Plan element shall be adopted by the District, and following City approval shall be adopted by the City as satisfying the sewer element of the City Comprehensive Plan.

6.3. Until Step 2, the process described in Section 6.2 shall be utilized in all future City and District sewer planning updates and amendments.

6.4. Following adoption and City approval of the Comprehensive Sewer Plan, the District shall not defer or remove projects in the capital improvement plan with an estimated project cost of $500,000 or more and within City limits without a City-approved Comprehensive Sewer Plan amendment.

6.5. The Parties shall minimize infrastructure costs by coordinating the schedule for sewer system Capital Projects in conjunction with City and County transportation improvement projects when feasible.

Article 7. Sewer Utility Committee and Other Requirements

7.1. The current District and City Sewer Utility Committee will provide recommendations and oversight for planning, coordination, and management of the Unified Sewer System and may adopt rules of order, structure and operation of this overseeing committee except as specified herein.

7.2. The Sewer Utility Committee shall meet at least once a quarter but may meet more frequently consistent with Section 7.1.

7.3. A quorum consisting of a minimum of two (2) members from both the City and the District is required to conduct business and make recommendations.

7.4. The Sewer Utility Committee may, with a majority vote and a quorum of all six committee members, change the amount of the Utility Agreement Fee, Franchise fee and any other administrative requirements and structures regarding the Fees, consistent with Article 4.

7.5. The District hereby adopts and shall take subsequent action ratifying actions taken under Section 7.3.

7.6. The Sewer Utility Committee shall review any proposed change in rates or charges prior to implementation by the District.

7.7. The Sewer Utility Committee shall prepare and implement transition of employees of the District to the City as part of Step 2, subject to the requirements of RCW 35.13A.090 and/or other statutes.

7.8. The Sewer Utility Committee shall plan for the transfer of service prior to the effective date of Steps 1 and 2 to provide for continuity and orderly transition of service.

7.9. The Sewer Utility Committee shall review all Planning Documents and may provide recommendations, prior to the approval of said documents.

Article 8. Insurance

8.1. The District shall obtain and maintain in full force and effect throughout the term of this Agreement insurance with a self-insured risk pool as authorized under Washington law or with an insurance company licensed to do business in the State of Washington and acceptable by the City. Such insurance shall cover loss or damage to the Unified Sewer System, including loss or damage caused by the operation of the sewerage facilities. Upon request, the District shall provide the City with certificates of the insurance required therein. The City reserves the right to review these insurance requirements during the effective period of the Agreement and to request reasonable adjustments in insurance coverage and limits when deemed necessary and prudent by the City based upon the recommendation of its insurance carrier or changes in status, court decisions, or the claims history of the industry or the District. The insurance required by this section shall provide for the indemnification for the City for claims arising out of the use of City real property and easements in accordance with Section 12, herein.

Subject to the District's right to maintain reasonable deductibles, the District shall obtain and maintain in full force and effect for the duration of this Agreement, at the District's sole expense, insurance coverage in the following type and minimum amounts:

1 Comprehensive general liability insurance with limits not less than:
   (a) Ten million dollars ($10,000,000.00) for bodily injury or death to each person;
   (b) Ten million dollars ($10,000,000.00) for property damage resulting from any one (1) accident;
   (c) Ten million dollars ($10,000,000.00) for all other types of liability.

2. Automobile liability for owned, non-owned and hired vehicles with a limit of ten million dollars ($10,000,000.00) for each person and ten million ($10,000,000.00) for each accident.

The liability insurance policies required by this section shall be maintained by the District throughout the term of this agreement.

Article 9. Bonds and Other Obligations

9.1. The City and the District each retain their rights to issue bonds and other obligations in accordance with applicable law, but neither Party shall act in such a manner as to impair the rights of the holders or owners of bonds issued by the other Party.

9.2. Upon reasonable notice, the District shall make its financial records available for review and inspection by the City.

Article 10. Dispute Resolution

10.1. A dispute regarding the implementation of this Agreement shall be addressed as described herein. A written notice shall be provided stating the nature and basis for the dispute and the specific remedy requested.

10.2. Following receipt of notice of dispute, the Parties shall meet at least twice in the sixty-day period following issuance of written notice of dispute, to resolve claims or disputes regarding the terms of this Agreement. The review period may be extended as mutually agreed in writing. If the dispute is not resolved at end of review period, the parties shall proceed to mediation.

10.3. Mediation shall be conducted using a professional mediator or mediation service mutually agreeable to the parties. Each party shall be responsible for its own costs and for one-half of the mediator's fees.

10.4. The parties shall retain the ability to seek enforcement of the dispute resolution process through injunctive relief and specific performance in the Snohomish County Superior Court.

Article 11. Assignment, Amendment and Term

11.1 This contract shall not be assigned by either Party without the written consent of the other.

11.2 Any amendments to this Agreement must be in writing with mutual Agreement of the Parties.

11.3 The term of this Agreement is through the full performance of the terms of Article 5.

Article 12. Hold Harmless

12.1. The City shall protect, hold harmless and indemnify at its own expense the District, its elected and appointed officials, employees, and agents, from any loss or claim for damages of any nature whatsoever arising out of the City's performance of this Agreement. The District shall protect, hold harmless and indemnify, at its own expense, the City, its elected officials, employees, and agents, from any loss or claim for damages of any nature whatsoever arising out of the District's performance of this Agreement.

Article 13. Notice

13.1 Unless written notice is otherwise given, any notice shall be directed to the District by addressing the same as follows:

Secretary, Board of Commissioners
Lake Stevens Sewer District

1106 Vernon Road, Suite A
Lake Stevens, WA 98258

14.2 Unless written notice is otherwise given, any notice shall be directed to the City by addressing the same as follows:

Mayor
City of Lake Stevens
Post Office Box 257
1812 Main Street
Lake Stevens, Washington 98258

Article 14. Other Agreement Provisions

14.1 This Agreement shall be construed and interpreted in accordance with the laws of the State of Washington.

14.2 The recitals are a material part of this Agreement.

14.3 Should any terms in this Agreement be deemed invalid or unenforceable or contrary to any bond covenants of the City or the District, the remaining terms shall be unaffected. No term or provision herein shall be deemed waived and no breach excused unless such waiver shall be in writing and signed by the party claimed to have committed the waiver.

14.4 This Agreement, including the documents and exhibits referenced herein, constitutes the entire agreement between the Parties.

IN WITNESS WHEREOF, the Parties have executed this Agreement in duplicate as of the day first indicated above.

CITY OF LAKE STEVENS

By:______________________
Mayor

LAKE STEVENS SEWER DISTRICT:

By:______________________
President and Commissioner

By:______________________
Secretary and Commissioner

By:______________________
Commissioner

ATTEST:

____
City Clerk

Approved as to Form

By:______________________
City Attorney

By:______________________
District Attorney

Date approved by City Council May 23, 2005.

EXHIBIT A

BILL OF SALE

The CITY OF LAKE STEVENS, a municipal corporation of the State of Washington, "Grantor," for and in consideration of the covenants contained in that certain "Unified Sewer Services and Annexation Agreement" between the parties dated May 23rd, 2005, and the mutual benefits to be derived by the parties, hereby grants and conveys to LAKE STEVENS SEWER DISTRICT, a special purpose district of the State of Washington, "Grantee," the following-described property:

> Those certain specific assets of Grantor's wastewater collection and conveyance facilities and appurtenances thereto (e.g. sewer mains, side sewer stubs, manholes, lift stations, force mains and metering and sampling equipment) which are owned and operated by Grantor, more fully described in **EXHIBIT A-1** attached hereto and incorporated by this reference, but not including real property or any interest therein.

Disclaimer of Warranties. Grantor makes no representations or warranties with respect to, and shall have no liability for: (1) the condition of the property or the suitability, merchantability or fitness of the property for Grantee's intended use or for any use whatsoever; (2) compliance with laws or regulations or with respect to the existence of or compliance with any required permits, if any, of any governmental agency; (3) the presence of any hazardous substances in the property, including without limitation asbestos or urea-formaldehyde, or the presence of any environmentally hazardous wastes or materials; (4) the accuracy or completeness of any plans and specifications, reports, or other materials provided to Grantee; or (5) any other matter relating to the condition of the property. Without limiting the generality of the foregoing, Grantor shall have no liability to Grantee with respect to the condition of the property under common law, or any federal, state, or local law or regulation, including but not limited to the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C.A. Sections 9601, et seq., or the Model Toxics Control Act, as codified in RCW 70.105D., and Grantee hereby waives any and all claims which the Grantee has or may have against Grantor with respect to the condition of the property. To the extent feasible, Grantee has fully inspected or has had the opportunity to inspect the property, and Grantee assumes the responsibility and risks of all defects and conditions, including such defects and conditions, if any, that cannot be observed by casual inspection. Grantor and Grantee acknowledge that this disclaimer has been specifically negotiated. This conveyance is subject to all terms and provisions of the "Unified Sewer Services and Annexation Agreement," and in particular Article 5 of said agreement, providing for transfer back to Grantor of the property conveyed hereby.

EXHIBIT A - I

DETAILED DESCRIPTION OF ASSETS CONVEYED

Description	Identification No.
1983 Chevrolet Truck	Vin 1GCGC34M8DJ141659
2000 Hobbs Diesel Generator - 65 kw	S44192747
Onan Generator - 80 kw	
Transfer switch-Auto transfer to generator power when PUD power is off and transfer back when PUD power is working.	Goes with 80 kw Generator
Overhead vent for generator when the generator is inside a building	Goes with 80 kw Generator
2001 Gorman-Rupp Silent Pump	Serial #1201861
1986 Ford LNT 8000 with Camel Super 200 Educator*	Vin 1FDZU80U5GVA48308*
Lift Station #1	
Lift Station #2	
Lift Station #3	
Lift Station #4	
Lift Station #5	
Lift Station #6	
Lift Station #7 - New on Cedar Rd	
Lift Station #8	
Lift Station #9	
Generator Building @Pump Station #8	
Generator Building @Pump Station #9	
2 -Spare Volutes for LS#2	
2 -Smith & Loveless 30 hp for LS#1	
2-Smith & Loveless 10 hp for LS#2	
6-Spare Impellers (2-10 hp, 2-40 hp, 2-30 hp)	
1-New 4" Check Valve	
1-Used Check Valve for LS#1	
1-Used 3 hp Submersible Flyte for LS#4	
1-Floor mount bracket (spare) - Came w/pump-Never Used for LS#7 Doe Way	
1-8" mandrel	
1-New Spare Breaker for standby generator (Siemens 200A)	
3-New Spare Filter for Smith & Loveless	
1-Spare Blower Motor for Smith & Loveless Stations	
1-Used Allen Bradley Starter Breaker-Size 4	
2-New Compressors for Bubbler System-Smith & Loveless	
2-Used Compressors for Bubbler System-Smith & Loveless	
1-40 hp Seal for Pump	
1-10 hp Seal for Pump	
1-Station Seal for Pump for LS#1	
1-New Spare Blower for Smith & Loveless	
2-New Allen & Bradley Size #4 Starter Breaker for 40 hp	
1-8" Screw Plug	
2-6" Screw Plug	
1-4" Screw Plug	
1-8" Blowup Plug	

1-15" Blowup Plug
2-6" Blowup Plugs
3-Spare Merc Alarm Switch
2-Struthers & Dunn Relays
1-SSAC Alternating Relay Pump for LS#5
1-Potter & Burmfield Timed Relay
3-Fusetron FRN-R-300
3-Fusetron FRN-R-200
3-Stainless Seal Romac Industries 6.60 - 7.00
3-Repair Stainless Seal Romac Industries 9.00 - 9.40
1-Repair Stainless Seal Romac Industries 9.30 - 9.70
1-Repair Stainless Seal Romac Industries 11.85 - 12.25
2-Smith Blair Full Circle Repair Band
1-Seal for 100 hp Motors 927-967(H60A137) for LS#8
2-Used 20 hp Motors & Mounts for LS#7 Doe Way
4-Couplers Flange to Flange (misaligned from LS #8 Construction)
2-30 hp motors volutes & stands @ LS#8
1-12" Valve @ LS#8
2-Cutler-Hammer NEMA Size 3 Starter Breaker for running 30hp motors @LS#8
2-Cutler-Hammer 90 amp 3 pole breaker for running 30hp motors @LS#8
2-Spare Semiconductor A70P-300-4 Fuses @LS#8
3-Little Fuse, Time Delay, Current Limiting Dual Element Fuse CLSRK500 @LS#8
1-5 hp Submersible Sump for Transfer of Bioxide @LS#8

All the public sewer collection and conveyance system including mains, manholes, side sewer within right of way or sewer easement, lift stations and appurtenances of each element of the system, including but not limited to the following projects and facilities:

1967 Town of Lake Stevens Sewerage Project
1968 Esquire View #2
1977 Lake Stevens Estates
1978 Cedarbrook, Division I
1978 Cedarbrook, Division II
1978 Catherine Creek Park
1979 Tipping Short Plat
1980 Buck Bucksieb
1984 Maplewood Condo
1986 Lakeridge North
1988 Mar Da Rene Estates, Division I
1989 McDaniel Homesites
1989 Cascade Place
1989 Lake Stevens Estates, Division 2
1989 Overhill Estates
1989 Jor-Del Meadows
1989 Gary Ball Short Plat
1990 Lake Stevens Estates, Division 3
1990 Lake Stevens Estates, Division 3
1990 Cascade Place, Division 2
1990 Walker Hill Estates, Division 1
1990 LeFree Addition
1990 Lake Forest
1990 Walker Road Estates

1990 Walker Vista Estates
1991 Sunset Ridge
1991 The Park at Lake Stevens
1991 Pilchuck Vista/Anderson Short Plat
1991 Pilchuck Vista/Anderson Short Plat
1992 Walker Hill Estates, Division III
1992 Catherine Creek Gardens
1993 Shadowbrook
1994 McArthur Park
1994 Jakes Place
1994 The Reserve, Division I
1994 Equalization Basin 60K Gal.
1995 Meadow Estates Vista
1996 3 Township North
1997 Hunter Short Plat
1997 The Reserve, Divisions 2 and 3
1997 Lake Stevens Alternacare - Ashley Point
1997 Lift #1 Parallel FM Improvements
1997 The Reserve, Division 6
1997 Lake Stevens Woods
1997 Lift Station #1 Improvements
1997 Felt Short Plat
1997 Williams Woods, Division 2
Adams Short Plat
Williams Woods, Division 1
Walker Hill Estates, Division 2
Hill Short Plat
1999 Baker Vista
1999 Timberline Court
1999 Castle Dwellers
2002 Walker Hill Force Main
2003 Malia Heights
2003 Highland Crest Short Plat
2003 Adkins Short Plat

* Asset not transferred until purchase and delivery of new vactor

EXHIBIT B

ANNEXATION COVENANT AND POWER OF ATTORNEY

THE UNDERSIGNED, being owners of the following-described real property in Snohomish County, Washington, hereby declare and agree as follows:

Address:

Tax Parcel No.:

Legal Description:

1. <u>Intent to Annex</u>. The undersigned do hereby irrevocably declare their intention to annex the above-described property to the City of Lake Stevens, and to petition for and consent to such annexation immediately upon the initiation of an annexation by any of the methods provided by law of any area contiguous to the City in which the above-described land is located. The undersigned covenant and agree not to protest, in any manner whatsoever, the annexation of said property to the City of Lake Stevens.

2. <u>Power of Attorney</u>. The undersigned hereby make, constitute, and appoint the City of Lake Stevens as their true and lawful attorney, and the grant the City an irrevocable proxy to petition in their name, place and stead for approval of the annexation of the above-described property to the City of Lake Stevens. This Power of Attorney shall be a conveyance of an irrevocable interest in the above-described property to the City, and shall constitute a covenant running with the land in perpetuity; PROVIDED, that the City shall deliver a signed release of this Power of Attorney after the above-described property is annexed to the City.

3. <u>Binding Effect</u>. The foregoing shall be binding upon the undersigned, their heirs, successors and assigns, and shall constitute covenants running with the above-described property in perpetuity.

4. Certification. The undersigned Owner hereby certifies that I/we are the legal owner(s) of the above-described property and that the legal description above (or attached) is true and accurate.

DATED: __________ ____
OWNER

DATED: __________ ____
OWNER

APPROVED BY MORTGAGE HOLDER:

DATED: __________ By: ____

INDIVIDUAL NOTARY

STATE OF WASHINGTON)
) ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that ________________ and ____________________ are the persons who appeared before me, and said persons acknowledged that they signed this instrument and acknowledged it to be their free and voluntary act for the uses and purposes mentioned in the instrument.

DATED this _______ day of ____________________.

____
____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of Washington, residing at ___________
My commission expires _____________

REPRESENTATIVE NOTARY

STATE OF WASHINGTON)
) ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that ________________ is/are the persons(s) who appeared before me, and said person(s) acknowledged that he/she/they signed this instrument on oath stated the he/she/they was/were authorized to execute the instrument and acknowledged it as the _________________________ of ______________________ to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _______ day of ____________________.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of Washington, residing at ____________
My commission expires ____________

MORTGAGE HOLDER NOTARY

STATE OF WASHINGTON)
) ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that ________________ is/are the persons(s) who appeared before me, and said person(s) acknowledged that he/she/they signed this instrument on oath stated the he/she/they was/were authorized to execute the instrument and acknowledged it as the _________________________ of ______________________ to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _______ day of ____________________.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of Washington, residing at ____________
My commission expires ____________

COPY

AMENDMENT No. 1 TO CITY OF LAKE STEVENS AND LAKE STEVENS SEWER DISTRICT UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT

THIS AMENDMENT is made and entered into this 20th day of December 2005, by and between the Lake Stevens Sewer District, a special purpose district of the State of Washington, hereinafter referred to as the "District", and the City of Lake Stevens, a municipal corporation of the State of Washington, hereinafter referred to as the "City".

A. WHEREAS, the District and City entered into an agreement for the orderly transition of public sewer service in the Lake Stevens Urban Growth Area from two systems to one system, ultimately as the City's system; and

B. WHEREAS, the District and the City desire to modify the definition of the Utility Committee as set forth in section 2.17 of the Agreement; and

C. WHEREAS, Section 11.2 of the Agreement calls for any modification to be in writing;

NOW, THEREFORE, in consideration of the terms and conditions contained herein, the District and the City agree that Section 2.17 of the Agreement is hereby amended as follows:

"Sewer Utility Committee" shall mean a board comprised of three District Commissioners and three elected officials City of Lake Stevens. The representatives from the District and City shall be selected by the District and City elected officials, respectively.

IN WITNESS WHEREOF, the Parties have executed this Agreement in duplicate as of the day first indicated above.

CITY OF LAKE STEVENS	**LAKE STEVENS SEWER DISTRICT:**
By: Lynn E. Walty	By:
Mayor	President and Commissioner

By: Glenn M. Wood
Secretary and Commissioner

ATTESTED:

Norma Scott
City Clerk

By:
Commissioner

Date approved by City Council Dec. 12, 2005

APPROVED AS TO FORM:

Grant K. Weed
Grant K. Weed, City Attorney

CITY OF LAKE STEVENS AND LAKE STEVENS SEWER DISTRICT
UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT

THIS AGREEMENT is made and entered into this 23rd day of May, 2005, by and between the Lake Stevens Sewer District, a special purpose district of the State of Washington, hereinafter referred to as the "District", and the City of Lake Stevens, a municipal corporation of the State of Washington, hereinafter referred to as the "City".

A. WHEREAS, the District and City desire to enter into an agreement to determine the orderly transition of public sewer service in the Lake Stevens Urban Growth Area from two systems to one system, ultimately as the City's system; and

B. WHEREAS, the District owns and operates a wastewater collection, conveyance and treatment system for the benefit of District customers, including the City; and

C. WHEREAS, the City owns and operates a wastewater collection and conveyance system for the benefit of City customers; and

D. WHEREAS, the City has statutory approval rights and responsibilities for the District's Comprehensive Sewer Plan under RCW Chapter 57; and

E. WHEREAS, the District and City have previously entered into joint participation contracts dated April 28, 1970, April 21, 1983, July 1, 1986, and sewage disposal contracts dated September 1, 1991, and August 1, 1996, Wastewater Capital Facilities Agreement dated April 14, 2003 and Wastewater Treatment and Conveyance Services Agreement dated April 14, 2003, under the terms of which the District and the City shared in costs of building, improving and operating certain District facilities which are owned and operated by the District, and which serve the Parties; and

F. WHEREAS, the District and City are planning for the replacement, relocation, upgrade and expansion of the District's WWTP, with possible completion by or before the year 2011, and the cost of such project is appropriately borne by both new and existing customers of the District and City Systems; and

G. WHEREAS, the City is uniquely situated within the Lake Stevens Urban Growth Area such that less than 50 percent of the land area in the Lake Stevens Urban Growth Area is included in the City's corporate limits; and as the City annexes additional area within the Lake Stevens Urban Growth Area, the City will be assuming additional public service responsibilities from Snohomish County, including police services and roadway and stormwater systems in areas which are or can be served by the District wastewater collection and conveyance system; and

H. WHEREAS, the District's existing finances will allow the District to fund a higher proportion of Phase I WWTP improvements in anticipation of the long term economies of scale of a single-service provider that will benefit the entire community; and the District and City wish to minimize and equitably share future capital and operating costs of sewerage service in the Lake Stevens Urban Growth Area and recognize the increased efficiencies and economy of scale of unifying service under a single provider; and

I. WHEREAS, the City and District are each eligible, subject to other conditions, to separately apply for State Public Works Trust Fund loans and are able to use such loan proceeds in a coordinated manner for sewerage system improvements; and

J. WHEREAS, the City and the District recognize that the City has the current authority under RCW 35.13A to assume the assets and functions of the District under certain conditions and that the District has authority under Title 57 RCW to operate sewerage facilities within the incorporated boundaries of the City;

NOW, THEREFORE, in consideration of the terms and conditions contained herein, the District and the City agree as follows:

Article 1. Authority for Agreement

This Agreement is made and entered into pursuant to the authority vested in the District by the provisions of Chapter 57 RCW and the authority vested in the City pursuant to the provisions of Chapter 35.A RCW, and the authority vested in the City and the District pursuant to the provisions of Chapter 39.34 RCW.

Article 2. Definitions

For the purpose of this Agreement, the following words, terms and phrases shall have the meanings identified in this article:

2.1 "Capital Agreement" shall mean the Wastewater Capital Facilities Agreement dated April 14, 2003, and any amendments thereto, executed between the District and City.

2.2 "City System" shall mean the Wastewater collection and conveyance facilities and appurtenances thereto (e.g. sewer mains, side sewer stubs, manholes, lift stations, force mains and metering and sampling equipment) which are owned, operated and maintained by the City, not including real property or any interest therein.

2.3 "Comprehensive Plan" shall mean the City and/or Snohomish County comprehensive land use plan prepared and updated pursuant to RCW 36.70A, including land use, housing, capital facilities and utilities elements.

2.4 "Comprehensive Sewer Plan" shall mean the District general sewer plan or comprehensive plan for sewer system prepared and updated pursuant to RCW 57.16 and WAC 173-240.

2.5 "District System" shall mean the Wastewater collection, conveyance, treatment and disposal facilities and appurtenances thereto (e.g. sewer mains, side sewer stubs, manholes, lift stations, force mains and metering and sampling equipment, treatment plants and outfalls) which are owned, operated and maintained by the District, including real property.

2.6 "Engineering Report/Facilities Plan" shall mean the District planning document prepared and updated to examine the engineering and administrative aspects of the District's WWTP, prepared pursuant to WAC 173-240 and 40 CFR 35.719-1.

2.7 "Franchise Agreement" shall mean that separate agreement executed between the parties providing for District operations within City limits as provided for by State statute (RCW 35A.11 and 35A.47).

2.8 "Franchise Fee" shall mean that fee paid by the District to the City per the terms of the Franchise Agreement.

2.9 "Lake Stevens Urban Growth Area" or "Urban Growth Area" shall mean that portion of Snohomish County designated as the urban growth area around Lake Stevens, under the Washington State Growth Management Act.

2.10 "Utility Agreement Fee" shall mean that fee paid by the District to the City as specified in this Agreement.

2.11 "Planning Document" shall mean any one or combination of the Comprehensive Sewer Plan, the Engineering Report/Facilities Plan, or the Sewer Capital Facilities Plan.

2.12 "PWTF" shall mean the Public Works Trust Fund and its loan programs, administered by the State Public Works Board.

2.13 "Services Agreement" shall mean the Wastewater Treatment and Conveyance Services Agreement dated April 14, 2003, and any amendments thereto, executed between the District and City.

2.14 "Sewer Capital Facilities Plan" shall mean the sewer planning element of the District's Comprehensive Sewer Plan

2.15 "Step 1" shall mean the process and requirements for provision and transition of sewer service per Article 4 herein.

2.16 "Step 2" shall mean the process and requirements for provision and transition of sewer service per Article 5 herein.

2.17 "Sewer Utility Committee" shall mean a board comprised of three District Commissioners and three City Council members. The representatives from the District and City shall be selected by the District and City elected officials, respectively.

2.18 "Unified Sewer System" shall mean the combination and integration of the District System and City System, as a result of the transition of sewer service in Step 1 and continuing in Step 2.

2.19 "Unified Sewer System Capital Projects" shall mean those projects initiated by the District in Step 1 or the City in Step 2 to improve, enhance, expand, replace or rehabilitate portions of the Unified Sewer System, without respect to the project having been identified in a Planning Document or as a result of an unanticipated or emergency condition.

2.20 "Wastewater Treatment Plant" or "WWTP" shall mean the Lake Stevens Sewer District's Wastewater Treatment Plant and appurtenances, as presently located adjacent to Ebey Slough and/or as planned for construction adjacent to State Route 204.

Article 3. Summary of Sewer Services Transition Plan

In order to transition the provision of public sewer service within the UGA to a single service provider to minimize sewer service conditions as a hindrance to City annexations of area within the UGA, the Parties agree to a two-step process.

3.1. Step 1 provides for the transfer of the assets of the City System to the District after which the District shall own, operate and maintain the entire wastewater collection conveyance, treatment and discharge system in the UGA (the Unified Sewer System), until Step 2.

3.2. Step 2 provides for the ultimate transfer of the Unified Sewer System from the District to the City.

3.3. Upon the effective date of this agreement, Section 11.1 of the Capital Agreement shall be null and void.

Article 4. Step 1

4.1. Upon the effective date of Step 1 (June 1st, 2005), the City shall transfer the assets of the City System, not including real property and certain specific assets as specified herein, to the District. Such transfer shall be by bill of sale substantially in form presented in **Exhibit A**, attached and included herein by reference.

4.2. Upon the effective date of Step 1, and subject to the conditions of Articles 6 & 7, the District shall be solely responsible for the collection of rates and charges, planning, administration, operation, financing, maintenance, improvements, repair, replacement, upgrade and expansion of the Unified Sewer System, including funding of the City sewer obligations as described below. Such transfer shall continue until the effective date of Step 2. Upon the effective date of Step 1, the District System and City System shall be combined and integrated, and managed as one complete system (i.e. the Unified Sewer System).

4.3. Upon the effective date of this Agreement, the District adopts and establishes as policy with respect to City annexations in the UGA as follows, and such shall be included in all District Comprehensive Sewer Plans:

A. The City and District shall prepare a joint letter to applicants for District sewer service expressing support of City annexation in the UGA for local land use control and services. Such letter shall be included in materials presented to third parties interested in receiving sewer service from the District within the UGA.

B. Neither Party shall oppose lawful annexation proceedings commenced by the other Party at any time under this Agreement.

C. The District shall include a City-prepared annexation covenant substantially in the form presented in Exhibit B, included herein by reference, as a voluntary addendum to all District developer extension agreements and shall include the City-prepared annexation covenant with all District annexation application materials. Execution of the City-prepared annexation covenant shall be a voluntary element of developer extension applications and District annexation applications. The service to property that has not annexed to the City will be subject to paragraph D, below.

D. The District shall not provide sewer service to a property if such property is, at the time of application for sewer service, contiguous to the City limits and outside the District's corporate boundary unless City annexation covenants are duly executed for the entire subject property.

E. Originals of City annexation covenants received by the District shall be forwarded to the City within 15 days of receipt and the City will record such covenants at their own expense.

4.4. Within 6 months of the effective date of Step 1 the Parties shall enter into a Franchise Agreement, whereby the District shall obtain a franchise for operation of the Unified Sewer System within the City public rights of way and on City-owned real property, and easements granted to the City as applicable, within City-incorporated areas. The City shall designate in the Franchise Agreement the District as an agent of the City solely in regards to exercising the rights assigned to the City in easements granted to the City. The District shall pay the City the Franchise Fee stipulated therein until the effective date of Step 2. The Franchise Fee shall not exceed $2,000 per year, unless otherwise approved by the Sewer Utility Committee.

4.5. The City shall retain title to all real property of the current City System and shall retain all easements granted to the City for the benefit of the public sewer system. Subject to the terms of the Franchise Agreement, the District is hereby assigned the right to use all real property owned by the City for sewer system collection and conveyance facilities until the effective date of Step 2.

4.6. The District shall designate the City as a future assignee on all future easements.

4.7. The District shall pay a Utility Agreement Fee described below as the sole source of revenue for ancillary City liabilities or costs associated with the implementation and maintenance of this Agreement. Such fee shall be paid monthly starting thirty (30) days following the effective date of Step 1, through the effective date of Step 2. The Utility Agreement Fee may be adjusted after January 1st 2007 as described in Section 7.3.

A. Upon the effective date of Step 1 through December 31st 2005, the Utility Agreement Fee shall be $12,500 per month
B. The Utility Agreement Fee shall be $10,835 per month beginning January 1st, 2006
C. The Utility Agreement Fee shall be $9,165 per month beginning January 1st, 2007.

4.8. The Franchise Agreement and Utility Agreement Fees paid by the District are a business expense that shall not be separately identified on customer billings.

4.9. Each Party shall apply for PWTF pre-construction and construction loans for design and construction of the phase 1 WWTP replacement project including related conveyance projects and may apply for future Unified Sewer System projects, to the extent and when each is eligible. Prior to executing final PWTF loan agreements, the Parties shall execute agreements defining the responsibilities for draws and disbursement of loan funds, debt service and local match.

4.10. Within thirty (30) days of the effective date of Step 1, the City shall transfer all funds within the City's wastewater treatment plant replacement fund to the

District. The District shall not use said funds for any other purpose except for WWTP Phase I design or construction costs.

4.11. The District shall transfer to the City all funds necessary for the City sewer utility's share of the 1997 General Obligations Bonds, Series 1997, and PWTF Loan No. PW-02-691-020 debt payments thirty (30) days prior to scheduled City payments. The District may defease either of said City sewer debt obligations at any time consistent with existing City debt covenants.

4.12. Upon the effective date of Step 1, The City shall continue to bill and collect for all existing City sewer utility accounts until Jan 1st 2006. The City will transfer all revenues associated with sewer utility billing to the District on a daily basis. The City shall transfer all accounts to the District's billing system in whole, including delinquencies in January of 2006.

4.13. The District agrees to pay $275,000 towards the City's purchase of a jetter/vactor truck.

4.14. The City may initiate construction of facilities or further extend local collection lines(s) utilizing the District developer extension agreement process. The financial obligation associated with the said developer extension improvement(s) shall remain the sole obligation of the City, unless mutually agreed to and recommended by the Sewer Utility Committee. Accordingly, the City may initiate construction of sewer collection and conveyance system improvements and expansion projects in the industrial-zoned land in the City limits by creation of utility local improvement district or local improvement districts in combination with City developer extension agreements with the District. The City shall notify the Sewer Utility Committee of its intent to utilize this process for construction of sewer facilities.

4.15. Upon District annexation, the District shall implement sewer collection and conveyance system improvements and expansion projects in the industrial-zoned land in the City limits by creation of utility local improvement districts. The District shall notify the Sewer Utility Committee of its intent to utilize this process for construction of sewer facilities.

4.16. Neither Party shall surcharge rates or charges for customers outside their respective corporate boundary.

4.17. The District will invite the City to attend and participate in quality assurance/quality control workshops for major Unified Sewer System projects.

4.18. Both Parties shall negotiate all new contracts and loan agreements or other debt obligation instruments so that the obligations of either Party may be assumed by the other Party upon the effective date of Step 1 and/or Step 2, without penalty or cost due to such transfers.

4.19. The District shall prepare and implement an Industrial Wastewater Pretreatment program.

4.20. Upon the effective date of Step 1, both Parties shall cooperatively develop a set of written protocols and standards for the purpose of information sharing, project review, equipment sharing, standardization of sewer specifications both public and private, development review processes, easement conditions, and other process needs identified through the Sewer Utility Committee.

4.21. The City public works department decant facility will be allowed for discharge under a separate license agreement with District.

4.22. The Capital and Services Agreements shall remain in effect until of the effective date of Step 1 when said Agreements shall become null and void by this Agreement. The stranded cost and purchased capacity provisions of the Capital and Services Agreements are agreed to be null and void.

Article 5. Step 2

5.1. The Unified Sewer System shall, subject to the conditions in Article 5, be transferred in its entirety from the District to the City, no sooner than twenty years from the date of District acceptance of the Phase I WWTP improvements construction project subject to the City satisfying then- current statues regulating assumption of special purpose districts by code cities. Such timing may be extended or accelerated at the mutual agreement of the City and District.

5.2. If, after twenty years from the date of District acceptance of the Phase 1 WWTP improvements construction project, the City does not satisfy the then-current statute conditions for City assumption of the entire District, the Parties agree to the following process. The District shall call for a vote of eligible voters on the question of City assumption of the District and Unified Sewer System in its entirety, after 20 years and within 180 days thereafter following District acceptance of the Phase I WWTP improvements construction project. Approval by the voters shall require the District and City to plan for and implement the assumption of the District by the City and transfer of the Unified Sewer System to the City within one year of the date of certification of results of such vote of approval. Upon a vote of non-approval, the District shall, at the City's request but no more often than 24 months following the date of the prior election on this question, again submit to the voters in the UGA the question of City assumption of the District and Unified Sewer System in its entirety.

5.3. Upon the effective date of Step 2 as determined by satisfying the conditions of Paragraph 5.1 or 5.2 above, the District shall transfer all assets, debt, real and personal property, easements, agreements, etc. of the District and Unified Sewer

System to the City without compensation, unless compensation is required by law. In the event the District has acquired, developed or is otherwise providing drainage and/or street lighting services, such systems including all assets, debt, real and personal property, easements, agreements, etc. shall be transferred to the City without compensation.

5.4 The Parties agree that the Unified Sewer System shall not be separated or subdivided at any time during or following the effective date of Step 1. If after 20 years from the date of District acceptance of the Phase 1 WWTP improvements construction project, the conditions of 5.1 or 5.2 have not been satisfied, the City agrees to not assume portions of the Unified Sewer System with or following City annexations that do not result in satisfying the conditions of 5.1 above.

5.5 The District shall discontinue operation as a sewer, drainage and/or street lighting service provider upon the effective date of Step 2, and shall dissolve within 12 months following the effective date of Step 2.

Article 6. Comprehensive Planning

6.1. Upon the effective date of Step 1, the District will initiate an amendment to their existing Comprehensive Plan to include this executed agreement as policy and an appendix to the Comprehensive Plan. The Comprehensive Sewer Plan shall include policies and goals indicating support for the benefits of annexation by the City within the UGA including the provisions referenced in Section 4.3.

6.2. After completion of Comprehensive Sewer Plan amendment (Section 6.1) and consistent with the review process outlined in this agreement, the District will prepare a new Comprehensive Sewer Plan to include a single Sewer Capital Facilities Plan for the Unified Sewer System. The new Comprehensive Sewer Plan and Sewer Capital Facilities Plan element shall be adopted by the District, and following City approval shall be adopted by the City as satisfying the sewer element of the City Comprehensive Plan.

6.3. Until Step 2, the process described in Section 6.2 shall be utilized in all future City and District sewer planning updates and amendments.

6.4. Following adoption and City approval of the Comprehensive Sewer Plan, the District shall not defer or remove projects in the capital improvement plan with an estimated project cost of $500,000 or more and within City limits without a City-approved Comprehensive Sewer Plan amendment.

6.5. The Parties shall minimize infrastructure costs by coordinating the schedule for sewer system Capital Projects in conjunction with City and County transportation improvement projects when feasible.

Article 7. Sewer Utility Committee and Other Requirements

7.1. The current District and City Sewer Utility Committee will provide recommendations and oversight for planning, coordination, and management of the Unified Sewer System and may adopt rules of order, structure and operation of this overseeing committee except as specified herein.

7.2. The Sewer Utility Committee shall meet at least once a quarter but may meet more frequently consistent with Section 7.1.

7.3. A quorum consisting of a minimum of two (2) members from both the City and the District is required to conduct business and make recommendations.

7.4. The Sewer Utility Committee may, with a majority vote and a quorum of all six committee members, change the amount of the Utility Agreement Fee, Franchise fee and any other administrative requirements and structures regarding the Fees, consistent with Article 4.

7.5. The District hereby adopts and shall take subsequent action ratifying actions taken under Section 7.3.

7.6. The Sewer Utility Committee shall review any proposed change in rates or charges prior to implementation by the District.

7.7. The Sewer Utility Committee shall prepare and implement transition of employees of the District to the City as part of Step 2, subject to the requirements of RCW 35.13A.090 and/or other statutes.

7.8. The Sewer Utility Committee shall plan for the transfer of service prior to the effective date of Steps 1 and 2 to provide for continuity and orderly transition of service.

7.9. The Sewer Utility Committee shall review all Planning Documents and may provide recommendations, prior to the approval of said documents.

Article 8. Insurance

8.1. The District shall obtain and maintain in full force and effect throughout the term of this Agreement insurance with a self-insured risk pool as authorized under Washington law or with an insurance company licensed to do business in the State of Washington and acceptable by the City. Such insurance shall cover loss or damage to the Unified Sewer System, including loss or damage caused by the operation of the sewerage facilities. Upon request, the District shall provide the City with certificates of the insurance required therein. The City reserves the right to review these insurance requirements during the effective period of the Agreement and to request reasonable adjustments in insurance coverage and limits when deemed necessary and prudent by the City based upon the recommendation of its insurance carrier or changes in status, court decisions, or the claims history of the industry or the District. The insurance required by this section shall provide for the indemnification for the City for claims arising out of the use of City real property and easements in accordance with Section 12, herein.

Subject to the District's right to maintain reasonable deductibles, the District shall obtain and maintain in full force and effect for the duration of this Agreement, at the District's sole expense, insurance coverage in the following type and minimum amounts:

1 Comprehensive general liability insurance with limits not less than:
   (a) Ten million dollars ($10,000,000.00) for bodily injury or death to each person;
   (b) Ten million dollars ($10,000,000.00) for property damage resulting from any one (1) accident;
   (c) Ten million dollars ($10,000,000.00) for all other types of liability.

2. Automobile liability for owned, non-owned and hired vehicles with a limit of ten million dollars ($10,000,000.00) for each person and ten million ($10,000,000.00) for each accident.

The liability insurance policies required by this section shall be maintained by the District throughout the term of this agreement.

Article 9. Bonds and Other Obligations

9.1. The City and the District each retain their rights to issue bonds and other obligations in accordance with applicable law, but neither Party shall act in such a manner as to impair the rights of the holders or owners of bonds issued by the other Party.

9.2. Upon reasonable notice, the District shall make its financial records available for review and inspection by the City.

Article 10. Dispute Resolution

10.1. A dispute regarding the implementation of this Agreement shall be addressed as described herein. A written notice shall be provided stating the nature and basis for the dispute and the specific remedy requested.

10.2. Following receipt of notice of dispute, the Parties shall meet at least twice in the sixty-day period following issuance of written notice of dispute, to resolve claims or disputes regarding the terms of this Agreement. The review period may be extended as mutually agreed in writing. If the dispute is not resolved at end of review period, the parties shall proceed to mediation.

10.3. Mediation shall be conducted using a professional mediator or mediation service mutually agreeable to the parties. Each party shall be responsible for its own costs and for one-half of the mediator's fees.

10.4. The parties shall retain the ability to seek enforcement of the dispute resolution process through injunctive relief and specific performance in the Snohomish County Superior Court.

Article 11. Assignment, Amendment and Term

11.1 This contract shall not be assigned by either Party without the written consent of the other.

11.2 Any amendments to this Agreement must be in writing with mutual Agreement of the Parties.

11.3 The term of this Agreement is through the full performance of the terms of Article 5.

Article 12. Hold Harmless

12.1. The City shall protect, hold harmless and indemnify at its own expense the District, its elected and appointed officials, employees, and agents, from any loss or claim for damages of any nature whatsoever arising out of the City's performance of this Agreement. The District shall protect, hold harmless and indemnify, at its own expense, the City, its elected officials, employees, and agents, from any loss or claim for damages of any nature whatsoever arising out of the District's performance of this Agreement.

Article 13. Notice

13.1 Unless written notice is otherwise given, any notice shall be directed to the District by addressing the same as follows:

Secretary, Board of Commissioners
Lake Stevens Sewer District

1106 Vernon Road, Suite A
Lake Stevens, WA 98258

14.2 Unless written notice is otherwise given, any notice shall be directed to the City by addressing the same as follows:

Mayor
City of Lake Stevens
Post Office Box 257
1812 Main Street
Lake Stevens, Washington 98258

Article 14. Other Agreement Provisions

14.1 This Agreement shall be construed and interpreted in accordance with the laws of the State of Washington.

14.2 The recitals are a material part of this Agreement.

14.3 Should any terms in this Agreement be deemed invalid or unenforceable or contrary to any bond covenants of the City or the District, the remaining terms shall be unaffected. No term or provision herein shall be deemed waived and no breach excused unless such waiver shall be in writing and signed by the party claimed to have committed the waiver.

14.4 This Agreement, including the documents and exhibits referenced herein, constitutes the entire agreement between the Parties.

IN WITNESS WHEREOF, the Parties have executed this Agreement in duplicate as of the day first indicated above.

CITY OF LAKE STEVENS

By:____________________
Mayor

LAKE STEVENS SEWER DISTRICT:

By:____________________
President and Commissioner

By:____________________
Secretary and Commissioner

By:____________________
Commissioner

ATTEST:

____
City Clerk

Approved as to Form

By:____________________
City Attorney

By:____________________
District Attorney

Date approved by City Council May 23, 2005.

COPY

AMENDMENT No. 2 TO CITY OF LAKE STEVENS AND LAKE STEVENS SEWER DISTRICT UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT

THIS AMENDMENT is made and entered into this 9th day of March, 2006, by and between the Lake Stevens Sewer District, a special purpose district of the State of Washington, hereinafter referred to as the "District", and the City of Lake Stevens, a municipal corporation of the State of Washington, hereinafter referred to as the "City".

A. WHEREAS, the District and the City entered into a UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT relating to the provision of public sewer service in the Lake Stevens Urban Growth Area ("UGA"); and

B. WHEREAS, the Agreement describes, *inter alia*, the unification of the sewerage system within the UGA and coordination of capital projects and annexations affecting the sewerage system; and

C. WHEREAS, the District is currently in the process of planning for, designing, and obtaining permits for the construction of a new wastewater treatment plant (the "Sunnyside WWTP") with a preferred location on real property legally described in attached Exhibit A, which property is currently owned by the District (the "Sunnyside WWTP Property");

D. WHEREAS, as of the date of this Amendment the Sunnyside WWTP Property is located in unincorporated Snohomish County, and the parties hereto believe the purposes and intent of the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT will be fostered by annexation of the Sunnyside WWTP Property to the City, subject to the terms and conditions described in this Amendment;

NOW, THEREFORE, in consideration of the mutual covenants expressed herein and the terms and conditions set forth below, the District and the City agree that the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT is hereby amended as follows:

1. <u>Conveyance of Real Property for Municipal Purposes</u>: Title to the Sunnyside WWTP Property, legally described in attached **Exhibit A**, shall be conveyed to the City by statutory warranty deed, in the form attached hereto as

Exhibit B, and shall contain a servitude and covenant running with the land, indicating that the Sunnyside WWTP Property shall be used for the provision of sanitary sewerage services to include the Sunnyside WWTP. The **Exhibit A** legal description shall be amended, if required, to reflect the legal description contained in the preliminary commitment for title insurance to be issued for this transaction. The **Exhibit B** deed shall be amended, if required, to reflect the exceptions to title contained in the preliminary commitment for title insurance to be issued for this transaction.

2. <u>Lease of Sunnyside WWTP Property to the District</u>: For and in consideration of annual lease payment of Ten Dollars ($10.00), and upon conveyance of title to the Sunnyside WWTP Property to the City, the City hereby agrees to lease the subject property to the District for the purpose of constructing and operating the Sunnyside WWTP on the subject property. The form of lease shall be as set forth in **Exhibit C**. The term of the lease shall be concurrent with the District's ownership and operation of the Unified Sewer System, as described in the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT. The facilities constructed by the District on the subject property, including without limitation all additions, alterations and improvements and all appurtenant machinery and equipment and replacements thereto installed as part of the Sunnyside WWTP project shall not be considered fixtures and shall remain the property of the District, until such time as Step 2 of the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT is completed.

Except as otherwise expressly provided herein or in the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT, during the term of the lease the District shall have exclusive control and possession of the Sunnyside WWTP facilities, and the City shall have no liabilities, obligations or responsibilities whatsoever with respect thereto, and during the term of the lease the District agrees to indemnify, defend and hold harmless the City from and against any and all claims arising out of or from the use of the Sunnyside WWTP Property or out of the District's activities with respect to the Sunnyside WWTP.

3. <u>Annexation by City</u>: Following conveyance of title to the Sunnyside WWTP Property to the City and the lease-back as described above, the City shall initiate proceedings to annex the subject property for municipal purposes into the City's corporate boundary. If such annexation is approved, the District agrees to comply with the City's permitting requirements as those requirements pertain to the construction of the Sunnyside WWTP on the subject property.

4. <u>SEPA Review and Wetland Mitigation</u>: The parties agree that for purposes of SEPA review for the Sunnyside WWTP project, the District will continue to serve as the Lead Agency. The parties anticipate that construction

of the Sunnyside WWTP will necessitate filling an/or altering wetlands on the subject property, and that wetland mitigation will be required as part of the permitting for the Sunnyside WWTP. It is specifically agreed that, as consideration for the mutual covenants contained herein and subject to the requirements of best available science and applicable Federal, State, County and City regulations, the City shall support application to the applicable agency(ies) to allow wetland mitigation to be performed on such sites as the parties mutually agree. Provided, however, the responsibility for said wetland mitigation shall at all times remain that of the District.

5. Incorporation by Reference: Except as set forth herein, the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT and Amendment No. 1 thereto are hereby reaffirmed and incorporated by reference.

IN WITNESS WHEREOF, the Parties have executed this Agreement in duplicate as of the day first indicated above.

CITY OF LAKE STEVENS

By: Lynn E. Walty
Mayor

ATTESTED:

Norma J. Scott
City Clerk

Date approved by City Council March 13, 2006.

LAKE STEVENS SEWER DISTRICT:

By: ______________________
President and Commissioner

By: ______________________
Secretary and Commissioner

By: ______________________
Commissioner

EXHIBIT A

LEGAL DESCRIPTION

PARCEL A (tax parcel 290523-002-017-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet to the True Point of Beginning of this description;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet;
Thence South 79°35'07" East for 1204.40 feet to an existing fence line;
Thence North 0°17'10" East for 368.04 feet to the True Point of Beginning EXCEPT any portion thereof lying Easterly of the West right of way line of State Highway, known as (SSH 15-A); and
EXCEPT that portion described as follows:

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet to the True Point of Beginning;
Thence Northerly along the East margin of Old Pacific Highway 122.96 feet;
Thence North 89°33'15" East 150 feet;
Thence South 40°00'00" West to a point which is South 79°35'07" East from the True Point of Beginning;
Thence North 79°35'07" West to the True Point of Beginning.

PARCEL B (tax parcel 290523-002-016-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet to the True Point of Beginning;
Thence Northerly along East margin of Old Pacific Highway 122.96 feet;
Thence North 89°33'15" East 150 feet;
Thence South 40°00'00" West to a point which is South 79°35'07" East from the True Point of Beginning;
Thence North 79°35'07" West to the True Point of Beginning.

PARCEL C: (tax parcel no. 290523-002-021-00):

That portion of the Southwest quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., lying Easterly of Pacific Highway (NOW KNOWN AS Everett-Marysville County Road) and Westerly of State Highway No. 15-A (SR 204) described as follows:

Beginning at the intersection of the Easterly margin of said Pacific Highway with the South line of the Southwest quarter of the Northwest quarter;
Thence East along said South line 250 feet;
Thence North 70 feet;
Thence Northwesterly to a point on the East line of said Pacific Highway that is 210 feet North of said South line of the Southwest quarter of the Northwest quarter as measured at right angles to said South line;
Thence Southerly along East line of said Pacific Highway to True Point of Beginning;

PARCEL D: (tax parcel no. 290523-002-015-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence East 660 feet;
Thence North 60.96 feet;

Thence North 79°35'07" West 1,204 feet more or less to a point on the East line of the Pacific Highway (now known as Everett-Marysville County Road);
Thence Southerly along said East line to a point that is 210 feet North of the South line of the Southwest quarter of the Northwest quarter as measured at right angles to said line;
Thence Southeasterly to a point that is 70 feet North of a point on said South line that is 250 feet East of the East line of said Highway;
Thence South 70 feet to South line of the Southwest quarter of the Northwest quarter;
Thence Easterly along said South line to the Point of Beginning;

EXCEPT that portion Easterly of the Westerly line of State Highway No. 15-A (SR 204).

PARCEL E: (tax parcel no. 290523-002-014-00):

All that portion of Government Lot 3 and of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Beginning at a point 429 feet North of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence East, parallel to South line of said Southeast quarter of the Northwest quarter a distance of 171 feet;
Thence North 370.5 feet to the True Point of Beginning of this description;
Thence North 75 feet;
Thence West parallel to South line of Northwest quarter of said Section 23 to East line of Marysville Highway;
Thence Southwest along said Highway, to a point 799.5 feet due North of South line of said Government Lot 3;
Thence East, parallel to said South line of Northwest quarter of Section 23 to the Point of Beginning;
EXCEPT that portion, if any, lying within County Road known as the East Everett Road.

PARCEL E: (tax parcel no. 290523-002-011-00):

All that portion of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Beginning 429 feet North and 171 feet East of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence East 489 feet;

Thence North 445.5 feet;
Thence West 489 feet;
Thence South 445.5 feet to the True Point of Beginning;
EXCEPT that portion lying within County Road known as the East Everett Road;
EXCEPT that portion thereof conveyed to the State of Washington for highway purposes by deeds recorded under Auditor's file nos. 1132036 and 1140277; and
EXCEPT all that portion thereof lying Southeasterly and Northeasterly of Secondary State Highway No. 15-A as conveyed by said deeds.

PARCEL G: (tax parcel no. 290523-002-013-00):

That portion of Government Lot 3 and of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Commencing at a point 429 feet North and 171 feet East of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence North 370.5 feet;
Thence West to the East line of the Marysville Highway;
Thence Southwesterly along said East line to a point 429 feet due North of the South line of said Government Lot 3;
Thence East parallel to the South line of said Government Lot 3 and parallel to the South line of said Southeast quarter of the Northwest quarter to the Point of Beginning.

All situate in the County of Snohomish, State of Washington.

EXHIBIT B

After Recording Return to:

City Clerk
City of Lake Stevens
P.O. Box 257
Lake Stevens, WA 98258

STATUTORY WARRANTY DEED

Grantor:	LAKE STEVENS SEWER DISTRICT	
Grantee:	CITY OF LAKE STEVENS	
Legal Description:	NW¼ 23-29-05	Add'l on p. 5 - 8
Assessor's Tax Parcel ID#:	290523-002-011-00, 290523-002-013-00, 290523-002-014-00 290523-002-015-00, 290523-002-016-00, 290523-002-017-00 290523-002-021-00	

THE GRANTOR, LAKE STEVENS SEWER DISTRICT, a special purpose district of the State of Washington, for and in consideration of $10.00 and other valuable consideration, in hand paid, conveys and warrants to the CITY OF LAKE STEVENS, a municipal corporation of the State of Washington, the following described real estate, situated in the County of Snohomish, State of Washington:

See **EXHIBIT A** attached hereto.

SUBJECT TO: Relinquishment of access to State Highway and of light, view and air pursuant to instruments recorded at Auditor's file numbers 1127783, 1127784, 1132036 and 1140277.

AND SUBJECT TO: Release of Damage Agreement and the terms and conditions thereof between the State of Washington and James and Orletta Long, husband and wife, recorded August 24, 1955 under Auditor's file number 1157580, releasing State of Washington from all future claims for all damages resulting from slides, drainage, maintenance and operation of, by reason of any thing done or neglected to be done by the State of Washington through its employees or contractors, in connection with construction, operation and maintenance of said Secondary State Highway No. 15-A, Cavalero's Corner to Jct. S.S.H. No. 1-A.

AND SUBJECT TO: Easement and the terms and conditions thereof to Snohomish County for bank protection and/or other flood control works recorded November 21, 1960 under Auditor's file numbers 1430586.

AND SUBJECT TO: Matters disclosed by unrecorded survey, Gray & Osborne, Inc. Job 97587, as follows:

a. Mobile home located on easterly portion encroaches onto the SR 204 right of way;

b. Driveway appurtenant to the subject property, serving the mobile home and a single-family dwelling, is located south of the southerly line;

c. Encroachment of barn onto the 9th Street SW right of way;

d. Fence lines do not conform to the boundary lines of record.

AND SUBJECT TO: Easement and the terms and conditions thereof for water main in area within 1 foot of east line of Parcel G, recorded at Auditor's file no. 1085797.

AND SUBJECT TO: Easement in favor of Olympic Pipe Line Company, a Delaware corporation, for pipe line or pipe lines, recorded February 27, 1964 under Auditor's file number 1678618, affecting Parcels F and G.

AND SUBJECT TO: Easement and the terms and conditions thereof for pipe line affecting a 5-foot strip along the highway, disclosed by instrument recorded at Auditor's file no. 1187845, affecting Parcel F.

This conveyance is conditioned upon the subject property's use for the provision of sanitary sewerage services including, but not limited to, location of a waste water treatment plant on said property to be constructed and operated by Grantor in compliance with all terms and conditions of the Unified Sewer Services and Annexation Agreement, and Amendments 1 and 2, between Grantor and Grantee. This condition shall be construed as a servitude and a covenant running with the land, and shall be binding upon the Grantee, its heirs, successors and assigns, in perpetuity.

DATED this ______ day of ____________________, 2006.

LAKE STEVENS SEWER DISTRICT

By_______________________________________
GEORGE M. WOOD, President and Commissioner

By_______________________________________
JACK B. HATLEN, Secretary and Commissioner

By_______________________________________
JAMES B. MITCHELL, Commissioner

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that GEORGE M. WOOD is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the President and Commissioner of LAKE STEVENS SEWER DISTRICT to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of __________________, 2006.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at ________________
My commission expires ________________

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that JACK B. HATLEN is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the Secretary and Commissioner of LAKE STEVENS SEWER DISTRICT to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of __________________, 2006.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at ________________
My commission expires ________________

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that JAMES B. MITCHELL is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the Commissioner of LAKE STEVENS SEWER DISTRICT to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of __________________, 2006.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at _______________
My commission expires _______________

ACCEPTED:

CITY OF LAKE STEVENS

By___________________________________
LYNN WALTY, Mayor

EXHIBIT A

LEGAL DESCRIPTION

PARCEL A (tax parcel 290523-002-017-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet to the True Point of Beginning of this description;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet;
Thence South 79°35'07" East for 1204.40 feet to an existing fence line;
Thence North 0°17'10" East for 368.04 feet to the True Point of Beginning EXCEPT any portion thereof lying Easterly of the West right of way line of State Highway, known as (SSH 15-A); and
EXCEPT that portion described as follows:

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet to the True Point of Beginning;
Thence Northerly along the East margin of Old Pacific Highway 122.96 feet;
Thence North 89°33'15" East 150 feet;
Thence South 40°00'00" West to a point which is South 79°35'07" East from the True Point of Beginning;
Thence North 79°35'07" West to the True Point of Beginning.

PARCEL B (tax parcel 290523-002-016-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;

Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet to the True Point of Beginning;
Thence Northerly along East margin of Old Pacific Highway 122.96 feet;
Thence North 89°33'15" East 150 feet;
Thence South 40°00'00" West to a point which is South 79°35'07" East from the True Point of Beginning;
Thence North 79°35'07" West to the True Point of Beginning.

PARCEL C: (tax parcel no. 290523-002-021-00):

That portion of the Southwest quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., lying Easterly of Pacific Highway (NOW KNOWN AS Everett-Marysville County Road) and Westerly of State Highway No. 15-A (SR 204) described as follows:

Beginning at the intersection of the Easterly margin of said Pacific Highway with the South line of the Southwest quarter of the Northwest quarter;
Thence East along said South line 250 feet;
Thence North 70 feet;
Thence Northwesterly to a point on the East line of said Pacific Highway that is 210 feet North of said South line of the Southwest quarter of the Northwest quarter as measured at right angles to said South line;
Thence Southerly along East line of said Pacific Highway to True Point of Beginning;

PARCEL D: (tax parcel no. 290523-002-015-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence East 660 feet;
Thence North 60.96 feet;
Thence North 79°35'07" West 1,204 feet more or less to a point on the East line of the Pacific Highway (now known as Everett-Marysville County Road);
Thence Southerly along said East line to a point that is 210 feet North of the South line of the Southwest quarter of the Northwest quarter as measured at right angles to said line;
Thence Southeasterly to a point that is 70 feet North of a point on said South line that is 250 feet East of the East line of said Highway;
Thence South 70 feet to South line of the Southwest quarter of the Northwest quarter;

Thence Easterly along said South line to the Point of Beginning;

EXCEPT that portion Easterly of the Westerly line of State Highway No. 15-A (SR 204).

PARCEL E: (tax parcel no. 290523-002-014-00):

All that portion of Government Lot 3 and of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Beginning at a point 429 feet North of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence East, parallel to South line of said Southeast quarter of the Northwest quarter a distance of 171 feet;
Thence North 370.5 feet to the True Point of Beginning of this description;
Thence North 75 feet;
Thence West parallel to South line of Northwest quarter of said Section 23 to East line of Marysville Highway;
Thence Southwest along said Highway, to a point 799.5 feet due North of South line of said Government Lot 3;
Thence East, parallel to said South line of Northwest quarter of Section 23 to the Point of Beginning;
EXCEPT that portion, if any, lying within County Road known as the East Everett Road.

PARCEL F: (tax parcel no. 290523-002-011-00):

All that portion of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Beginning 429 feet North and 171 feet East of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence East 489 feet;
Thence North 445.5 feet;
Thence West 489 feet;
Thence South 445.5 feet to the True Point of Beginning;
EXCEPT that portion lying within County Road known as the East Everett Road;
EXCEPT that portion thereof conveyed to the State of Washington for highway purposes by deeds recorded under Auditor's file nos. 1132036 and 1140277; and
EXCEPT all that portion thereof lying Southeasterly and Northeasterly of Secondary State Highway No. 15-A as conveyed by said deeds.

PARCEL G: (tax parcel no. 290523-002-013-00):

That portion of Government Lot 3 and of the Southeast quarter of the Northwest quarter of

Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Commencing at a point 429 feet North and 171 feet East of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence North 370.5 feet;
Thence West to the East line of the Marysville Highway;
Thence Southwesterly along said East line to a point 429 feet due North of the South line of said Government Lot 3;
Thence East parallel to the South line of said Government Lot 3 and parallel to the South line of said Southeast quarter of the Northwest quarter to the Point of Beginning.

All situate in the County of Snohomish, State of Washington.

EXHIBIT C

LEASE

THIS LEASE is made this ____ day of ______________, 2006, by and between CITY OF LAKE STEVENS, a municipal corporation of the State of Washington, (hereinafter called "Lessor"), and LAKE STEVENS SEWER DISTRICT, a special purpose district of the State of Washington, (hereinafter called "Lessee").

IN CONSIDERATION of the rent provided for, and the covenants and agreements herein, Lessor and Lessee agree as follows:

1. **PROPERTY LEASED**: Lessor leases to Lessee the premises located on Sunnyside Blvd SE, in Everett, Snohomish County, Washington, said premises being legally described as:

See **EXHIBIT A** attached hereto

Assessor's Tax Parcel ID#s: 290523-002-011-00, 290523-002-013-00, 290523-002-014-00, 290523-002-015-00, 290523-002-016-00, 290523-002-017-00, 290523-002-021-00

2. **LEASE TERM**: The term of this lease shall commence upon full execution of this lease and end consistent with the terms of the Unified Sewer Services and Annexation Agreement between Lessor and Lessee, and all amendments thereto.

3. **RENT**: Lessee shall pay rent in the sum of TEN DOLLARS ($10.00) per annum or any portion thereof. As additional rent, Lessee shall perform all terms and conditions required of Lessee under that certain Unified Sewer Services and Annexation Agreement, and Amendments 1 and 2 thereto, pertaining to construction and operation of a new waste water treatment plant on the lease premises. Lessee's breach of any term or condition of the Unified Sewer Services and Annexation Agreement, and/or Amendments 1 and 2 thereto, shall constitute a breach of this lease.

4. **UTILITIES**: Lessee shall be solely responsible for and promptly pay all charges for utilities to the leased premises, including water, sewer, garbage and electricity. Lessee shall be responsible for and promptly pay all charges for telephone and any other utility not herein mentioned which may be used by Lessee on the leased premises.

5. **ACCEPTANCE OF CONDITION OF PREMISES**: Lessee is the prior owner of the premises and is fully familiar with the condition of the same. Lessor makes no

representations whatsoever as to the condition of the subject premises. Lessee accepts the subject premises "as is," including all defects known or unknown, patent or latent.

6. **INSURANCE/CASUALTY**: All property of Lessee, whether real or personal, located on said leased premises shall be at the risk of Lessee. Each party hereto waives any and every claim which arises, or may arise, in its favor and against the other party hereto during the term of this lease for all loss of, or damage to, any of its property located within or upon, or constituting a part of, the premises leased to Lessee hereunder, which loss or damage is covered by valid and collectible fire and extended coverage insurance policies to the extent such loss or damage is recoverable under said insurance policies. Said mutual waivers shall be in addition to, and not a limitation or derogation of, any other waiver or release contained in this lease with respect to any loss of, or damage to, property of the parties hereto. Insomuch as the above mutual waivers will preclude the assignment of any such claim by way of subrogation to an insurance company (or any other person), each party hereby agrees immediately to give each insurance company which has issued to it policies of fire and extended coverage insurance written notice of the terms of said mutual waivers, and to have said insurance policies properly endorsed, if necessary, to prevent invalidation of said insurance coverages by reason of said waivers.

7. **INSURANCE/LIABILITY**: Lessee shall, during the entire term, keep in full force and effect a policy, or policies, of public liability and property damage insurance with respect to the leased premises and the business operated thereat by Lessee, in which the limits of public liability shall be not less than $1,000,000 per person and $2,000,000 per accident, and in which the property damage liability shall be not less than $500,000. Said policy, or policies, shall contain a clause that the insurer shall not cancel or change the insurance without first giving Lessor 10 days' prior written notice.

8. **INDEMNIFICATION**: Lessee will indemnify Lessor and save it harmless from and against any and all claims, actions, damages, liability and expense in connection with loss of life, personal injury and/or damage to property arising from or out of any occurrence in, upon, or at the leased premises, or the occupancy or use by Lessee of the leased premises, or any part thereof, or Lessee's construction of sewage treatment plant improvements upon the leased premises, occasioned by any act or omission of Lessee, its agents, contractors, subcontractors, employees, customers and invitees.

In connection with Lessee's construction of improvements on the lease premises, Lessee shall comply with all laws and regulations of applicable governmental authorities, shall acquire all required permits, shall employ only licensed and bonded contractors and shall complete construction in compliance with good construction practices.

Lessee shall allow no liens to attach to the leased premises. Lessee shall pay any and all costs associated with design, permitting and construction of the improvements on the lease premises.

In the event Lessor shall be made a party to any litigation commenced by or against Lessee, then Lessee shall proceed and hold Lessor harmless, shall pay all costs, expenses and reasonable attorney's fees incurred, and shall reimburse Lessor for any attorney's fees and costs incurred and paid by Lessor in connection with such litigation.

9. **MAINTENANCE OF THE PREMISES**: Lessee shall be responsible for all maintenance of the lease premises and all improvements located thereon, without limitation, at Lessee's sole cost and expense. Lessee's maintenance duties shall include, but not be limited to the following:

(a) Lessee shall at all times keep the interior of all structures situated on the leased premises and all partitions, doors, floor covering, interior and exterior glass, lighting, interior plumbing and other fixtures, and other equipment and appurtenances thereof in good order, condition and repair, including repair of damage by unavoidable casualty.

(b) Lessee shall maintain the structural portions of the premises, including exterior walls, the roof, and air-conditioning and heating equipment, in good order, condition and repair, including repair of damage by unavoidable casualty.

(c) Lessee shall maintain the waste water treatment plant facilities in good working order, condition and repair, including repair of damage by unavoidable casualty.

(d) Lessee shall maintain all outdoor areas of the lease premises including sidewalks, landscaping, service areas, and automobile parking areas, in good, safe, attractive condition. Further, Lessee shall be liable for the removal of ice and snow from the sidewalks and parking areas on and about the premises.

(e) Lessee shall be responsible for all janitorial services to the leased premises.

If Lessee refuses or neglects to repair and maintain the premises as required herein to the reasonable satisfaction of Lessor as soon as reasonably possible after written demand, Lessor may make such repairs and do required maintenance without liability to Lessee for any loss or damage that may accrue to Lessee's fixtures or other property, or to Lessee's business by reason thereof, and upon completion thereof, Lessee shall pay Lessor's costs for such work, plus 10% for overhead.

10. **ALTERATIONS**: Lessee is specifically authorized to construct a new waste water treatment plant ("the Sunnyside WWTP") and all sewer utility related improvements, consistent with the terms and conditions of the Unified Sewer Services and Annexation Agreement, and Amendments 1 and 2 between the parties. Lessee shall not construct or make any other alterations, additions or improvements in or to the lease premises without the prior written consent of Lessor. Such consent shall not be unreasonably withheld.

The facilities constructed by Lessee on the lease premises, including without limitation all additions, alterations and improvements and all appurtenant machinery and equipment and replacements thereto installed as part of the Sunnyside WWTP project shall not be considered fixtures and shall remain the property of the Lessee, until such time as Step 2 of the Unified Sewer Services and Annexation Agreement is completed.

11. **RESTRICTIONS ON USE**: Lessee shall not use the leased premises for any purpose other than construction and operation of a sewage treatment plant and provision of sanitary sewerage services. Lessee shall not cause or permit any waste, damage or injury to the premises. Lessee covenants and agrees to fully and promptly comply with all statutes, ordinances and regulations of governmental agencies having jurisdiction. Lessee will not use or permit the use of the premises in any such manner as will tend to create a nuisance.

12. **HAZARDOUS SUBSTANCES**: Lessee shall not conduct any action or permit any action or condition which creates any hazardous substance, or leaves deposits of any hazardous substance in, on or under the lease premises or within the structures or upon the lease premises. For purposes of this paragraph, the definition of the term "hazardous substance" shall be as used in the Superfund Act or any other federal and/or state legislation regarding hazardous substances, provided that the definition of the term "hazardous substance" shall include petroleum and related byproducts and hydrocarbons. Lessee shall indemnify and hold Lessor harmless from any costs or damages incurred as a consequence of such hazardous substances, including costs of remedying such hazardous substances and damages incurred as a consequence of the existence of such hazardous substances on the property. This provision shall survive the expiration of the lease term.

13. **DESTRUCTION OF PREMISES**: In the event the leased premises are destroyed or damaged by fire, earthquake or other casualties, Lessee may rebuild and restore the premises, or such part thereof as may be damaged. No rent shall be abated as a result of such destruction or damage.

14. **RIGHT OF INSPECTION**: Lessee will allow Lessor, or Lessor's agents and employees, free access at all reasonable times to said premises for the purpose of inspection or making repairs, additions or alterations to the leased premises, or any property owned by or under the control of Lessor, but such right shall not be construed as an agreement by Lessor to make such repair, additions or alterations.

15. **ASSIGNMENT AND SUBLETTING**: Lessee shall not sublease, sublet or assign the leased premises, or any portion thereof, except by the written permission and consent of Lessor.

16. **DEFAULT**:

(a) Lessee: If Lessee shall fail to perform any of the covenants and agreements herein contained within 30 days after written notice of default, then Lessor may cancel this lease upon giving the notice required by law, and re-enter said premises; but notwithstanding such re-entry by Lessor, the liability of Lessee for the rent provided for herein shall not be extinguished for the balance of the term of the lease, and Lessee covenants and agrees to make good to Lessor any deficiency arising from re-entry and reletting of the premises at a lesser rental than herein agreed to. Lessee shall pay such deficiency each month as the amount thereof is ascertained by Lessor. In computing such deficiency, Lessee shall be charged with the average monthly rental that Lessee has paid up to the time of default.

In the event of any entry in, or taking possession of, the leased premises, Lessor shall have the right, but not the obligation, to remove from the leased premises all personal property located thereon, and may place the same in storage at a public warehouse, at the expense and risk of the owners.

If at any time Lessor waives any breach or default, or any right or option, such waiver shall not be construed to be a waiver of any other right or option, or any other past, existing or future breach or default.

(b) Lessor: In the event Lessor shall neglect or fail to perform or observe any of the covenants, provisions or conditions contained in the foregoing lease on its part to be performed or observed within 30 days after written notice of default (or if more than 30 days shall be required because of the nature of the default, if Lessor shall fail to proceed diligently to cure such default after notice), then, in that event, Lessor shall be responsible to Lessee for any and all damages sustained by Lessee as a result of Lessor's breach. Further, after such default, Lessee shall have the right to cure any such default at Lessor's expense, including in such expenditure all costs and attorney's fees incurred to cure such default or breach of lease, and may offset the costs of curing such default against rents and additional rents next due.

17. **COSTS OF LITIGATION**: Should either party bring a legal action to enforce any of the terms and conditions of this lease, then the party prevailing in such action shall have the right to a judgment against the other party for reasonable court costs, costs of preparation, and reasonable attorney's fees.

18. **SUCCESSORS**: All of the covenants, agreements, terms and conditions contained in this lease shall apply to, and be binding upon, Lessor and Lessee and their respective heirs, executors, administrators, successors and assigns.

19. **NOTICES**: Any notice required to be served in accordance with the terms of this lease shall be sent by registered or certified mail, return receipt requested, to the addresses for the parties set forth below:

Lessor: City of Lake Stevens
ATTN: City Clerk
P.O. Box 257
Lake Stevens, WA 98258

Lessee: Lake Stevens Sewer District
ATTN: Darwin C. Smith, Manager
1106 Vernon Road Suite A
Lake Stevens, WA 98258

DATED this ____ day of ______________, 2006.

CITY OF LAKE STEVENS, Lessor

By____
LYNN WALTY, Mayor

DATED this ____ day of ______________, 2006.

LAKE STEVENS SEWER DISTRICT

By____
GEORGE M. WOOD, President and Commissioner

By____
JACK B. HATLEN, Secretary and Commissioner

By____
JAMES B. MITCHELL, Commissioner

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that LYNN WALTY is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the Mayor of the CITY OF LAKE STEVENS to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of ______________________, 2006.

____

____

(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at ______________
My commission expires ______________

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that GEORGE M. WOOD is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the President and Commissioner of LAKE STEVENS SEWER DISTRICT to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of __________________, 2006.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at _______________
My commission expires _______________

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that JACK B. HATLEN is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the Secretary and Commissioner of LAKE STEVENS SEWER DISTRICT to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of __________________, 2006.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at _______________
My commission expires _______________

STATE OF WASHINGTON)
)ss.
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that JAMES B. MITCHELL is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the Commissioner of LAKE STEVENS SEWER DISTRICT to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED this _____ day of __________________, 2006.

____

____
(Legibly print name of notary)
NOTARY PUBLIC in and for the State of
Washington, residing at ______________
My commission expires ______________

EXHIBIT A
LEGAL DESCRIPTION

PARCEL A (tax parcel 290523-002-017-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet to the True Point of Beginning of this description;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet;
Thence South 79°35'07" East for 1204.40 feet to an existing fence line;
Thence North 0°17'10" East for 368.04 feet to the True Point of Beginning EXCEPT any portion thereof lying Easterly of the West right of way line of State Highway, known as (SSH 15-A); and EXCEPT that portion described as follows:

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet to the True Point of Beginning;
Thence Northerly along the East margin of Old Pacific Highway 122.96 feet;
Thence North 89°33'15" East 150 feet;
Thence South 40°00'00" West to a point which is South 79°35'07" East from the True Point of Beginning;
Thence North 79°35'07" West to the True Point of Beginning.

PARCEL B (tax parcel 290523-002-016-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence Easterly along the South line of said Northeast quarter of Section 23 for 660 feet to the West line of Tract 1 of East Everett 5 Acre Tracts;
Thence North along said West line for 429 feet;
Thence South 89°33'15" West for 1,066.14 feet to a point on the East marginal line of Pacific Highway;
Thence South 40°00' West along the East marginal line of Pacific Highway for 182.96 feet to the True Point of Beginning;

Thence Northerly along East margin of Old Pacific Highway 122.96 feet;
Thence North 89°33'15" East 150 feet;
Thence South 40°00'00" West to a point which is South 79°35'07" East from the True Point of Beginning;
Thence North 79°35'07" West to the True Point of Beginning.

PARCEL C: (tax parcel no. 290523-002-021-00):

That portion of the Southwest quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., lying Easterly of Pacific Highway (NOW KNOWN AS Everett-Marysville County Road) and Westerly of State Highway No. 15-A (SR 204) described as follows:

Beginning at the intersection of the Easterly margin of said Pacific Highway with the South line of the Southwest quarter of the Northwest quarter;
Thence East along said South line 250 feet;
Thence North 70 feet;
Thence Northwesterly to a point on the East line of said Pacific Highway that is 210 feet North of said South line of the Southwest quarter of the Northwest quarter as measured at right angles to said South line;
Thence Southerly along East line of said Pacific Highway to True Point of Beginning;

PARCEL D: (tax parcel no. 290523-002-015-00):

Beginning at the Southwest corner of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M.;
Thence East 660 feet;
Thence North 60.96 feet;
Thence North 79°35'07" West 1,204 feet more or less to a point on the East line of the Pacific Highway (now known as Everett-Marysville County Road);
Thence Southerly along said East line to a point that is 210 feet North of the South line of the Southwest quarter of the Northwest quarter as measured at right angles to said line;
Thence Southeasterly to a point that is 70 feet North of a point on said South line that is 250 feet East of the East line of said Highway;
Thence South 70 feet to South line of the Southwest quarter of the Northwest quarter;
Thence Easterly along said South line to the Point of Beginning;

EXCEPT that portion Easterly of the Westerly line of State Highway No. 15-A (SR 204).

PARCEL E: (tax parcel no. 290523-002-014-00):

All that portion of Government Lot 3 and of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Beginning at a point 429 feet North of the Southwest corner of said Southeast quarter of the Northwest quarter;

Thence East, parallel to South line of said Southeast quarter of the Northwest quarter a distance of 171 feet;
Thence North 370.5 feet to the True Point of Beginning of this description;
Thence North 75 feet;
Thence West parallel to South line of Northwest quarter of said Section 23 to East line of Marysville Highway;
Thence Southwest along said Highway, to a point 799.5 feet due North of South line of said Government Lot 3;
Thence East, parallel to said South line of Northwest quarter of Section 23 to the Point of Beginning;
EXCEPT that portion, if any, lying within County Road known as the East Everett Road.

PARCEL F: (tax parcel no. 290523-002-011-00):

All that portion of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Beginning 429 feet North and 171 feet East of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence East 489 feet;
Thence North 445.5 feet;
Thence West 489 feet;
Thence South 445.5 feet to the True Point of Beginning;
EXCEPT that portion lying within County Road known as the East Everett Road;
EXCEPT that portion thereof conveyed to the State of Washington for highway purposes by deeds recorded under Auditor's file nos. 1132036 and 1140277; and
EXCEPT all that portion thereof lying Southeasterly and Northeasterly of Secondary State Highway No. 15-A as conveyed by said deeds.

PARCEL G: (tax parcel no. 290523-002-013-00):

That portion of Government Lot 3 and of the Southeast quarter of the Northwest quarter of Section 23, Township 29 North, Range 5 East, W.M., described as follows:
Commencing at a point 429 feet North and 171 feet East of the Southwest corner of said Southeast quarter of the Northwest quarter;
Thence North 370.5 feet;
Thence West to the East line of the Marysville Highway;
Thence Southwesterly along said East line to a point 429 feet due North of the South line of said Government Lot 3;
Thence East parallel to the South line of said Government Lot 3 and parallel to the South line of said Southeast quarter of the Northwest quarter to the Point of Beginning.

All situate in the County of Snohomish, State of Washington.

RECEIVED
APR 13 2009
CITY OF LAKE STEVENS

Return Address:

City of Lake Stevens
Attn: City Clerk
P.O. Box 257
Lake Stevens, WA 98258

200903120419 3 PGS
03/12/2009 1:34pm $86.00
SNOHOMISH COUNTY, WASHINGTON

Please print or type information

Document Title (or transactions contained therein): **Amendment No. 3 to City of Lake Stevens and Lake Stevens Sewer District Unified Sewer Services and Annexation Agreement**

Grantor(s) (Last name first, then first name and initials): City of Lake Stevens
Lake Stevens Sewer District

_____ Additional names on page ____ of document.

Grantee(s) (Last name first, then first name and initials): City of Lake Stevens
Lake Stevens Sewer District

_____ Additional names on page ____ of document.

Legal description (abbreviated: i.e., lot, block, plat or section, township, range, qtr./qtr.): N/A

_____ Additional legal is on page ____ of document.

Reference Number(s) of Documents assigned or released: 200604250536
200604250552

_____ Additional legal is on page ____ of document.

Assessor's Property Tax Parcel/Account Number: N/A

_____ Property Tax Parcel ID is not yet assigned
_____ Additional parcel numbers on page ____ of document.

The Auditor/Recorder will rely on the information provided on the form. The staff will not read the document to verify the accuracy or completeness of the indexing information provided herein.

AMENDMENT No. 3 TO CITY OF LAKE STEVENS AND LAKE STEVENS SEWER DISTRICT UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT

THIS AMENDMENT is made and entered into this 2nd day of March 2009, by and between the Lake Stevens Sewer District, a special purpose district of the State of Washington, hereinafter referred to as the "District", and the City of Lake Stevens, a municipal corporation of the State of Washington, hereinafter referred to as the "City".

A. WHEREAS, the District and the City entered into a UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT relating to the provision of public sewer service in the Lake Stevens Urban Growth Area ("UGA"); and

B. WHEREAS, the Agreement describes, *inter alia*, the unification of the sewerage system within the UGA and coordination of capital projects and annexations affecting the sewerage system; and

C. WHEREAS, the District is currently in the process of constructing a new wastewater treatment plant (the "Sunnyside WWTP"); and

D. WHEREAS, the City and the District have obtained loans through the Public Works Trust Fund for the design and construction of the Sunnyside WWTP and desire to administer those loans in accordance with Section 4.9 of the Unified Sewer Services and Annexation agreement;

NOW, THEREFORE, in consideration of the terms and conditions set forth below, the District and the City agree that the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT is hereby amended as follows:

1. The City's PWTF loan amount is $10,000,000 with a fifteen percent (15%) matching funds and an interest rate of one-half of one percent (0.5%). The District covenants and agrees that all loan payments and the matching amount will be paid by the District from the revenue of the unified sewer system. Sixty (60) days prior to payment of PWTF loan interest and principal, the City will forward a copy of the invoice to the District requesting funds to cover the amount due. The District will remit to the City the installment payment within thirty (30) days of invoicing. (The timing of invoicing and remittance may be adjusted by mutual agreement of the parties to comply with their respective administrative requirements and all payment requirements of the City's PWTF Loan Agreement.) Repayment of the City's PWTF loan shall be on parity with the District's PWTF loan.

2. The District Agrees that it shall set all rates, fees and charges at a level sufficient to cover and satisfy all debt service and match requirements of the City's PWTF Loan Agreement for the term of said loan.

3. <u>Incorporation by Reference</u>: Except as set forth herein, the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT and Amendments No. 1 and No. 2 thereto are hereby reaffirmed and incorporated by reference.

IN WITNESS WHEREOF, the Parties have executed this Agreement in duplicate as of the day first indicated above.

CITY OF LAKE STEVENS

By: ______________________
Mayor

ATTESTED:

____
City Clerk

LAKE STEVENS SEWER DISTRICT:

By: ______________________
President and Commissioner

By: ______________________
Secretary and Commissioner

By: ______________________
Commissioner

Date approved by City Council Feb. 9, 2009.

APPROVED AS TO FORM:

____
Grant K. Weed, City Attorney

AMENDMENT NO. 4 TO CITY OF LAKE STEVENS AND LAKE STEVENS SEWER DISTRICT UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT

THIS AMENDMENT is made and entered into this 27th day of September, 2010, by and between the Lake Stevens Sewer District, a special purpose district of the State of Washington, hereinafter referred to as the "District", and the City of Lake Stevens, a municipal corporation of the State of Washington, hereinafter referred to as the "City".

A. WHEREAS, the District and the City entered into a UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT, together with Amendments No. 1, No. 2 and No. 3 thereto (as so amended, the "Agreement") relating to the provision of public sewer service in the Lake Stevens Urban Growth Area ("UGA"); and

B. WHEREAS, the Agreement describes, *inter alia*, the unification of the sewerage system within the UGA and coordination of capital projects and annexations affecting the sewerage system; and

C. WHEREAS, pursuant to Section 4.11 of the Agreement, the District has agreed to transfer to the City funds necessary to pay the City sewer utility's share of the City's Limited Tax General Obligation Bonds, Series 1997, which have since been refunded by the City's Limited Tax General Obligation Bonds, 2008 (the "2008 City LTGO Bonds") and Public Work Trust Fund ("PWTF") Loan No. PW-02-691-029; and

D. WHEREAS, the District is currently in the process of constructing a new wastewater treatment plant (the "Sunnyside WWTP"); and

E. WHEREAS, the City has also obtained PWTF Loan Nos. PW 05-691-PRE-137, PW-06-962-020 and PC-08-951-023 (collectively, together with PWTF Loan No. PW-02-691-029 and any future PWTF loans made to the City for the Sunnyside WWTP, the "City PWTF Loans") for the design and construction of the Sunnyside WWTP, and the City and the District have entered into agreements to administer those loans in accordance with Section 4.9 of the Agreement; and

F. WHEREAS, the District has also obtained certain PWTF loans (collectively, the "District PWTF Loans") for the design and construction of the Sunnyside WWTP and other improvements to the District's the sanitary sewage collection and disposal system (the "System"); and

G. WHEREAS, the District intends to issue revenue bonds (the "2010 District Revenue Bonds") to refund its existing revenue bonds and to finance the construction and equipping of the Sunnyside WWTP and related System improvements, and further intends to reserve the right to issue revenue bonds in the future (together with the 2010 District Revenue Bonds, the "District Parity Bonds") that have a lien and charge on the gross revenues of the System (the "Gross Revenues") that is equal in rank with the lien and charge of the 2010 District Revenue Bonds; and

H. WHEREAS, in connection with the issuance of the 2010 District Revenue Bonds, the City and the District desire to clarify the relative lien priority of the payments that the District is required to make to the City with respect to the 2008 City LTGO Bonds and the City PWTF Loans;

NOW, THEREFORE, in consideration of the terms and conditions set forth below, the District and the City agree that the UNIFIED SEWER SERVICES AND ANNEXATION AGREEMENT is hereby amended as follows:

1. Lien Priority. Notwithstanding any provision of the Agreement to the contrary, the City and the District agree that:

a. The amounts to be paid by the District to the City with respect to the 2008 City LTGO Bonds shall have a lien and charge upon the Gross Revenues prior and superior to any other liens and charges whatsoever except (i) System operating and maintenance expenses (the "Operating and Maintenance Expenses") and (ii) the amounts required to be paid into the District's revenue bond fund and any debt service reserve funds (including reimbursements in respect of debt service reserve credit facilities) established for District Parity Bonds; and

b. The amounts to be paid by the District to the City with respect to the City PWTF Loans shall have a lien and charge upon the Gross Revenues that is equal in rank with the lien and charge of the District PWTF Loans.

2. Deletion of Section 2 of Amendment No. 3. Section 2 of Amendment No. 3 to the Agreement is hereby deleted in its entirely.

3. Ratification. As amended hereby, the Agreement is ratified and confirmed.

IN WITNESS WHEREOF, the City and the District have executed this Agreement in duplicate as of the day first indicated above.

CITY OF LAKE STEVENS

By: Vern Little
Mayor

LAKE STEVENS SEWER DISTRICT:

By: Jack B Hatler
President and Commissioner

By: [signature]
Secretary and Commissioner

By: [signature]
Commissioner

ATTESTED:

Norma Scott
City Clerk

Date approved by City Council Sept. 27, 2010.

APPROVED AS TO FORM:

David Thompson
David O. Thompson, K&L Gates LLP
Bond Counsel to the City

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ORDINANCE
Rec: $130.50
10/6/2020 10:55 AM 1 of 28
SNOHOMISH COUNTY, WA

After Recording Return To:

Asst. Clerk of the Council
Snohomish County Council
3000 Rockefeller, M/S 609
Everett, WA 98201

Grantor:	Snohomish County
Grantee:	Lake Stevens Sewer District
Tax Account No:	Not Assigned
Legal Description:	See Section 1.3
Ref. # of Docs. Affected:	9602290317
Document Title:	An Ordinance of Snohomish County Council Granting a Nonexclusive Franchise Authorizing Limited Use of Public Road Rights-of-Way in Portions of Snohomish County, Washington to Lake Stevens Sewer District

SNOHOMISH COUNTY COUNCIL
Snohomish County, Washington

ORDINANCE NO. 20-038

GRANTING A NON-EXCLUSIVE FRANCHISE AUTHORIZING LIMITED USE OF THE PUBLIC ROAD RIGHTS-OF-WAY IN PORTIONS OF SNOHOMISH COUNTY, WASHINGTON TO LAKE STEVENS SEWER DISTRICT

WHEREAS, the Washington State Constitution, by and through its general grant of police power, and Section 36.55.010 of the Revised Code of Washington authorize counties to grant franchises for use of public rights-of-way; and

WHEREAS, Section 9.20 of the Snohomish County Charter and Title 13 of the Snohomish County Code specify requirements for franchises in Snohomish County rights-of-way; and

WHEREAS, a franchise is a legislative authorization to use public rights-of-way, however, actual construction and activities in the rights-of-way will also be subject to approved right-of-way use permits after review of specific plans; and

WHEREAS, Lake Stevens Sewer District has applied to Snohomish County, Washington, for a non-exclusive franchise to construct, maintain, operate, replace and repair sewer lines and associated facilities in, on, across, over, along, under, and/or through public rights-of-way within unincorporated Snohomish County; and

WHEREAS, the Snohomish County Council considered the Engineer's Report of the Department of Public Works, attached to and incorporated into this ordinance by reference, which report recommends that the subject franchise be granted, and further sets out guidelines and expectations for the right-of-way use permit process; and

WHEREAS, the Snohomish County Council held a public hearing on August 5, 2020, to solicit comments from the public and to consider whether to grant the requested franchise to Lake Stevens Sewer District; and

WHEREAS, it has been found to be in the public interest that a franchise, authorizing use of public rights-of-way for sewer lines and associated facilities, be granted to Lake Stevens Sewer District.

NOW, THEREFORE, BE IT ORDAINED:

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Section 1. Grant of Franchise.

1.1 Pursuant to Section 36.55.010 of the Revised Code of Washington ("RCW"), Section 9.20 of the Snohomish County Charter and Chapter 13.80 of the Snohomish County Code ("SCC"), Snohomish County, a political subdivision of the State of Washington (the "County"), hereby grants to Lake Stevens Sewer District, a Special Purpose District, (the "Grantee"), a non-exclusive franchise to use those portions of the County's rights-of-way described in Section 1.3 below, for the purposes described in Section 1.2 below, subject to compliance with all applicable provisions of the SCC, the Engineering Design & Development Standards (EDDS) and the terms and conditions contained in this franchise ordinance (the "Franchise").

1.2 This Franchise grants the Grantee the right, privilege and authority to use portions of the Public Rights-of-Way (as such term is defined below) of the County for the sole purposes of constructing, maintaining, operating, replacing and repairing its sewer facilities (the "Permitted Use") and for no other purpose or use whatsoever. The term "Public Rights-of-Way" as used in this Franchise shall mean all public streets, roads, ways, or alleys of the County as now or hereafter laid out, platted, dedicated or improved. Pursuant to this Franchise, the Grantee shall have the right to install, locate, construct, operate, maintain, use, replace and/or remove such equipment and facilities as may be reasonably necessary or convenient for the conduct of the Permitted Use (the "Grantee Facilities"), in, on, across, over, along, under or through certain Public Rights-of-Way of the County, subject to all applicable provisions of Title 13 SCC (including EDDS), Chapter 36.55 RCW, and the terms and conditions of County right-of-way use permits issued pursuant to Title 13 SCC and Section 4 of this Franchise. This Franchise merely authorizes the Grantee to occupy and use the Public Rights-of-Way at issue, and does not transfer, convey or vest any easement, title, servitude, or other real property interest in or to any Public Right-of-Way or portion thereof in or to the Grantee.

1.3 This Franchise covers all Public Rights-of-Way located within the following portions of unincorporated Snohomish County:

Township	Range	Sections
Twp. 29N	Rge. 5E	Sects. 11, 13, 14
Twp. 29N	Rge. 6E	Sects. 17, 19, 20, 29 & 30

Section 2. Non-Exclusive Franchise.

2.1 This Franchise is granted upon the express condition and understanding that it shall be a non-exclusive franchise which shall not in any manner prevent or hinder the County from granting to other parties, at other times and under such terms and conditions as the County, in its sole discretion, may deem appropriate, other franchises or similar use rights in, on, to, across, over, upon, along, under or through any Public Rights-of-Way. Owners, whether public or private, of any authorized facilities or equipment installed in, on, across, over, along, under, and/or through a Public Right-of-Way prior to the construction and/or installation of Grantee's Facilities in the same location, shall have preference as to positioning and location of their facilities. The position and location of all Grantee's Facilities in the Public Rights-of-Way shall be subject to the authority of the County Engineer.

2.2 This Franchise shall in no way prevent, inhibit or prohibit the County from using any of the Public Rights-of-Way covered or affected by this Franchise, nor shall this Franchise affect the County's jurisdiction, authority or power over any of them, in whole or in part. The County expressly retains its power to make or perform any and all changes, relocations, repairs, maintenance, establishments, improvements, dedications, or vacations of or to any of the Public Rights-of-Way as the County may, in its sole and absolute discretion, deem fit, including the dedication, establishment, maintenance and/or improvement of new Public Rights-of-Way, thoroughfares and other public properties of every type and description.

Section 3. Term, Early Termination, and Amendments.

3.1 The initial term of the Franchise shall be for a period of ten (10) years (the "Initial Term"), beginning on the Effective Date (as such term is defined in Section 32 of this Franchise) of the Franchise, and continuing until the date that is one day prior to the tenth (10th) anniversary of the Effective Date (the "Initial Term Expiration Date"), unless earlier terminated, revoked or amended pursuant to the provisions of this Franchise.

3.2 This Franchise shall automatically renew for an additional term of ten (10) years (the "Extended Term," and, together with the Initial Term, the "Term"), subject to the County's right to renegotiate and/or unilaterally terminate the Franchise at any time after the Initial Term Expiration Date, as more fully described in Section 3.3 below.

3.3 The County shall have the right, in its sole and absolute discretion, at any time after the Initial Term Expiration Date, to unilaterally elect to open negotiations with the Grantee regarding proposed amendments, alterations or other changes to the terms and conditions of this Franchise. In such event, the County shall deliver written notice to the Grantee stating the County's general desire to amend the terms and conditions of the Franchise. Within thirty (30) days after the date on which the Grantee receives the County's notice letter, the Grantee and the County shall enter into good faith negotiations regarding potential amendments to the initial terms and conditions of the Franchise. Should the parties reach agreement regarding any such amendments, the parties shall memorialize such amendments and seek approval of same from the County Council or such other County authority as may be proper. Should the parties prove unable to reach agreement regarding any proposed amendments within ninety (90) days after the date on which negotiations commenced, then this Franchise shall automatically terminate.

3.4 Other than the process set forth in Section 3.3 for amendments, this Franchise may be amended only upon the written consent of the County and the Grantee set forth in writing in the form of a County ordinance, signed by both parties, which states that it is an amendment to this Franchise and is approved and executed in accordance with the laws of the State of Washington.

Section 4. Regulation of Use; Permits Required.

4.1 The installation, location, maintenance, operation, relocation, removal or any other work related to any of the Grantee Facilities occurring in, on, across, over, along, under, and/or through any Public Right-of-Way covered by this Franchise, shall be performed in a safe and workmanlike manner, in such a way as to minimize interference with the free flow of traffic and the use of adjacent property, whether such property is public or private.

4.2 The Grantee shall not commence any work within Public Rights-of-Way until a right-of-way use permit authorizing such work has been issued by the County pursuant to Title 13 SCC. In addition to any standards of performance imposed by this Franchise, any and all work performed by Grantee pursuant to this Franchise shall be performed in accordance with all current County standards applicable to such work, including the County approved plans and specifications for the work, and the terms and conditions of any right-of-way use permit and/or other permits and/or approvals required under Title 13 SCC in order to accomplish the work (e.g., lane closure or road detour permits). Grantee understands and acknowledges that some or all of Grantee's activities may require additional project permits and approvals under County land use codes and development regulations, and Grantee accepts full responsibility for obtaining and complying with same.

4.3 In addition to any criteria set forth in Title 13 SCC, the EDDS, and the County's utility accommodation policies, in reviewing the Grantee's application for any right-of-way use permit pursuant to this Franchise, the County Engineer may apply the following criteria in reviewing proposed utility routes and in the issuance, conditioning, or denial of such permit:

(i) the capacity of the Public Rights-of-Way at issue to accommodate the proposed Grantee Facilities;

(ii) the capacity of the Public Rights-of-Way at issue to accommodate additional utility, cable, telecommunications, or other public facilities if the right-of-way use permit is granted;

(iii) the damage or disruption, if any, to public or private facilities, improvements, service, travel, or landscaping if the right-of-way use permit is granted;

(iv) the public interest in minimizing the cost and disruption of construction within the Public Rights-of-Way at issue, including, but not limited to, coordination with future utility installation or County projects;

(v) recent and/or proposed construction and/or improvements to the Public Rights-of-Way at issue;

(vi) the availability of alternate routes, locations, and/or methods of construction or installation for the proposed Grantee Facilities, including, but not limited to, whether other routes are preferred; and

(vii) whether the Grantee has received all requisite licenses, certificates, and authorizations from applicable federal, state, and local agencies with jurisdiction over the activities proposed by the Grantee.

4.4 Prior to commencing any work in a critical area as defined by SCC 30.91C.340, the Grantee shall comply with all applicable requirements of the County's critical areas regulations in chapters 30.62A, 30.62B, 30.62C and 30.65 SCC, and shall obtain any and all required permits and approvals. The granting of this Franchise shall in no way relieve the Grantee from its responsibility for avoiding "take" of any threatened or endangered species as defined by the Endangered Species Act of 1973, 16 U.S.C. § 1531, et seq., as amended, in the performance of any work authorized by this Franchise and/or any right-of-way use permits.

Section 5. Emergency Work.

Should any of the Grantee Facilities in the Public Rights-of-Way break or become damaged such that an immediate danger to the property, life, health or safety of any individual is presented, or should any site upon which the Grantee is engaged in construction or maintenance activities pursuant to this Franchise for any reason be in such a condition that an immediate danger to the property, life, health or safety of any individual is presented, the Grantee shall immediately take such measures as are reasonably necessary to repair the Grantee Facilities at issue or to remedy the dangerous conditions on the site at issue so as to protect the property, life, health or safety of individuals. In the event of an emergency described above, the Grantee may take corrective action immediately, without first applying for or obtaining any permits or other authorizations that might otherwise have been required by the SCC and/or this Franchise. However, the emergency provisions contained in this Section 5 shall not relieve the Grantee from its obligation to obtain any permits necessary for the corrective actions taken, and the Grantee shall apply for all such permits as soon as is reasonably possible after the occurrence of the emergency. In the event of any emergency described in this Section 5, the Grantee shall notify the County of the emergency as soon as may be reasonably feasible after the Grantee discovers the emergency (such notice may be telephonic).

Section 6. Compliance with Applicable Laws; Performance Standards.

6.1 The Grantee shall at all times during the Term of the Franchise undertake the Permitted Use in compliance with all federal, state and local laws, rules and regulations (including, but not limited to, the County's comprehensive plan, zoning code, and other development regulations) that are applicable to any and all work or other activities performed by Grantee pursuant to or under authority of the Franchise.

6.2 During any period of installation, maintenance, operation, relocation, removal or any other work related to any of the Grantee Facilities subject to this Franchise, Grantee shall use industry accepted best-practices to ensure that, to the extent reasonably feasible, such work does not impede: (i) public use of the Public Rights-of-Way at issue for vehicular and pedestrian transportation; (ii) construction and/or maintenance within Public Rights-of-Way and other authorized facilities, equipment and improvements; (iii) the operation, maintenance or improvement by the County of the Public Rights-of-Way or other public property impacted by Grantee's work; or (iv) use of the Public Rights-of-Way for other governmental purposes.

6.3 During any periods of construction within the Public Rights-of-Way, the Grantee shall at all times post and maintain proper barricades and comply with all applicable safety regulations as required by the SCC, the EDDS, or the laws of the State of Washington, including, but not limited to, RCW 39.04.180 for the construction of trench safety systems.

6.4 Before the Grantee commences any work under this Franchise which may affect any existing monuments or markers of any nature relating to subdivisions, plats, roads, or other surveys, Grantee shall reference all such monuments and markers using a method or methods approved by the County Engineer, and a complete set of reference notes for monuments and other ties shall be filed with the County prior to the commencement of construction. Reference points shall be so located that they will not be disturbed during Grantee's operations. The replacement of all such monuments or markers disturbed during construction shall be made as expeditiously as conditions permit, as directed by the County Engineer, and to federal, state and local standards. All costs incurred pursuant to this Section 6.4 shall be borne by Grantee.

6.5 If the Grantee shall at any time plan to make excavations in any area covered by the Franchise, the Grantee shall, upon receipt of a written request to do so, provide an opportunity for the County and/or any other grantees or authorized users of the Public Right-of-Way at issue to participate in such excavation, and shall coordinate the location and installation of its Grantee Facilities with the County or such other grantees or authorized entities, PROVIDED THAT, Grantee need not permit the County or any other party (ies) to participate in an excavation if the County Engineer determines that any of the following are true:

- (i) such joint use would unreasonably delay the performance of Grantee's work;
- (ii) despite good-faith efforts, the parties involved are unable to agree upon reasonable terms and conditions for accomplishing such joint use; or
- (iii) valid safety reasons exist for denying a request for such joint use.

6.6 If the Grantee shall at any time plan to include communication facilities in furtherance of the Permitted Use, the Grantee shall provide an opportunity for the County to enter into negotiations for shared use of such communication facilities, and shall coordinate negotiation of shared use of its communication facilities with the County; PROVIDED THAT, Grantee need not permit the County to participate in shared use of communication facilities if any of the following are true, in the reasonable judgment of the County and the Grantee:

(i) such shared use would unreasonably delay the performance of Grantee's work;

(ii) despite good-faith efforts, the parties involved are unable to agree upon reasonable terms and conditions, including but not limited to allocation of costs amongst various parties, for accomplishing such shared use;

(iii) valid safety reasons exist for denying a request for such shared use and/or the proposed facilities of the third party are in conflict with the best practices employed by the Grantee; or

(iv) the installation of communication facilities is for the purpose of an emergency action to protect the property, life, health or safety of individuals.

Section 7. Restoration of Public Rights-of-Way.

Promptly after completing any work in, on, under, over, across or upon any Public Rights-of-Way, including, but not limited to any excavation, installation, construction, relocation, maintenance, repair or removal of any Grantee Facilities, Grantee shall, at Grantee's sole cost and expense, restore the Public Rights-of-Way and any adjacent affected areas as required by the EDDS. Grantee shall also comply with any and all restoration conditions contained in applicable permits or approvals. The County Engineer shall have final authority to determine in each instance of restoration whether adequate restoration has been performed, reasonable wear and tear excepted.

Section 8. Record Plans, Record Drawings, and Records of Grantee Facility Locations.

8.1 The Grantee shall maintain adequate records to document obligations performed under this Franchise. The Grantee agrees and covenants that it shall, promptly upon substantial completion of any construction project involving a Public Right-of-Way, provide to the County, at no cost to the County, a copy of all as-built plans, maps and records revealing the approximate final locations and conditions of the Grantee Facilities located within such Public Right-of-Way. Additionally, the County may, at any time, deliver a written request to the Grantee for copies of maps and records showing the approximate location of all or any portion of the Grantee Facilities. In such event, the Grantee shall provide the County, at no cost to the County, with copies of the requested record plans, record drawings and other records within a reasonable time after receiving the County's request for same. The County shall have the right to review the Grantee's records regarding the subject matter of this Franchise at reasonable times, upon reasonable notice. The right to review records shall last for six (6) years from the expiration or earlier termination of this Franchise. In addition to the maps and records of the Grantee Facility locations, the Grantee shall provide the County, upon the County's request, with copies of records of construction, maintenance, operation, inspections, or regulatory compliance for all

Grantee Facilities subject to this Franchise as may be deemed necessary by the County, in its sole discretion, to manage the county roads, Public Rights-of-Way, or other property, or to protect the public health, safety, and welfare. Nothing in this Section 8 shall be construed to require Grantee to violate state or federal law concerning customer privacy, nor shall this Section 8 be construed to require Grantee to disclose proprietary or confidential information without adequate safeguards for its confidential or proprietary nature.

8.2 If the Grantee considers any portion of its records provided to the County, whether in electronic or hard copy form, to be protected from disclosure under law, the Grantee shall clearly identify any specific information that it claims to be confidential or proprietary. If the County receives a request under the Public Records Act, Chapter 42.56 RCW, to inspect or copy the information so identified by the Grantee and the County determines that release of the information is required by the Act or otherwise appropriate, the County's sole obligations shall be to notify the Grantee (a) of the request and (b) of the date that such information will be released to the requester unless the Grantee obtains a court order to enjoin that disclosure pursuant to RCW 42.56.540. If the Grantee fails to timely obtain a court order enjoining disclosure, the County will release the requested information on the date specified. The County has, and by this section assumes, no obligation on behalf of the Grantee to claim any exemption from disclosure under the Act. The County shall not be liable to the Grantee for releasing records not clearly identified by the Grantee as confidential or proprietary. The County shall not be liable to the Grantee for any records that the County releases in compliance with this section or in compliance with an order of a court of competent jurisdiction.

<u>Section 9.</u> <u>Relocation of Grantee Facilities.</u>

9.1 The Grantee agrees and covenants that it will promptly, at its sole cost and expense, protect, support, temporarily disconnect, relocate, or remove from the Public Rights of Way any Grantee Facilities when the County Engineer determines after full and fair consideration that such a relocation is necessary for any of the following reasons: (i) traffic conditions; (ii) public safety; (iii) dedications of new Public Rights-of-Way and the establishment and/or improvement thereof; (iv) widening and/or improvement of existing Public Rights-of-Way; (v) vacations of Public Rights-of-Way; (vi) freeway construction; (vii) change or establishment of road grade; or (viii) the construction of any public improvement or structure by any governmental agency acting in a governmental capacity; PROVIDED that the Grantee shall generally have the privilege to temporarily bypass, in the authorized portion of the same Public Right-of-Way, upon approval by the County Engineer, any Grantee Facilities required to be temporarily disconnected or removed. In the event of a conflict between this Section 9 and the specific terms of any existing real property interests and rights owned by the Grantee, such as a utility easement or other servitude, the terms of this Section 9 shall be subject to the specific terms of the real property interests and rights owned by the Grantee unless and until those rights are extinguished or amended (i) by mutual agreement, (ii) pursuant to a judicial condemnation order, (iii) by negotiated sale of said property rights between Grantee and the County in-lieu of condemnation, or (iv) by any other lawful means.

9.2 Upon the request of the County and in order to facilitate County improvements to Public Rights-of-Way, the Grantee agrees to locate and, if reasonably determined necessary by the County, to excavate and expose, at its sole cost and expense, portions of the Grantee Facilities for inspection so that the location of the facilities may be taken into account in the improvement design.

9.3 Grantee shall, upon reasonable prior written request of any person or entity holding a permit issued by the County to move any structure, temporarily move its facilities to allow the moving of such structure; PROVIDED (i) Grantee may impose a reasonable charge on the permittee for the movement of Grantee's Facilities; (ii) Grantee is granted a permit by the County for such work if a permit is needed; and (iii) Grantee is given not less than ten (10) business days' notice to arrange for such temporary relocation; EXCEPT in any case where the County Engineer determines Grantee Facilities are not reasonably movable.

9.4 Where the County imposes conditions or requirements on a third party development requiring the relocation of any Grantee Facilities, the County shall not be responsible for paying any costs related to such relocation. Nothing in this Franchise is intended or shall be construed to prohibit the Grantee from assessing on such person or entity, other than the County, the costs of relocation as a condition of such relocation.

9.5 To assist Grantee with anticipating relocations of Grantee Facilities related to County improvements to the Public Rights-of-Way, upon request, the County will provide the Grantee with copies of the most recently adopted Six-Year Transportation Improvement Program ("TIP") and Annual Construction Program ("ACP").

9.6 If the County determines that a County project necessitates the relocation of existing Grantee Facilities, the parties shall proceed as follows:

(i) The County shall provide the Grantee at least ninety (90) days written notice prior to the commencement of the construction phase of the County project at issue; PROVIDED, that under the following circumstances the County need only provide the Grantee with written notice as soon as may be reasonably practicable: (a) in the event of an emergency posing a threat to public safety, health or welfare; (b) in the event of an emergency beyond the control of the County and which will result in adverse financial consequences to the County; or (c) where the need to relocate the Grantee Facilities could not reasonably have been anticipated by the County.

(ii) The County shall provide the Grantee with copies of pertinent portions of the designs and specifications for the County project as well as a proposed new location for the Grantee Facilities at least ninety (90) days prior to the commencement of the construction phase of the County project to enable Grantee to promptly relocate such Grantee Facilities. Upon request of the Grantee, thirty-percent (30%), sixty-percent (60%) and ninety-percent (90%) design plans shall be provided to the Grantee. The County and the Grantee shall, upon the request of either party, meet to discuss the plans, specifications and schedule of the County project at issue at a mutually agreed time in a location determined by the County.

(iii) After receipt of such notice and such plans and specifications, the Grantee shall complete relocation of its facilities within the Public Right-of-Way at least ten (10) days prior to commencement of the construction phase of the County project at no charge, cost or expense to the County, unless otherwise agreed to within a separate agreement executed by both Parties. Relocation shall be accomplished in such a manner as to accommodate the County's project. In the event of an emergency, the Grantee shall relocate the Grantee Facilities at issue within a time period reasonably specified by the County Engineer.

(iv) The County and the Grantee may, for each individual County project, enter into an agreement for costs incurred by the County for relocation of Grantee's Facilities and associated work tied to the relocation.

(v) In the event of an emergency, the Grantee shall relocate the Grantee Facilities at issue within a time period reasonably specified by the County Engineer.

9.7 The Grantee may, after receipt of written notice requesting a relocation of any Grantee Facilities in accordance with Section 9.6, submit to the County proposed written alternatives to such relocation. The County shall evaluate such alternatives and advise the Grantee in writing if one or more of the alternatives are suitable to accommodate the County project. If so requested by the County, the Grantee shall submit additional information to assist the County in making such evaluation. The County shall give each alternative proposed by the Grantee full and fair consideration. Where, upon the request of the Grantee, the County incurs additional costs in performing any maintenance, operation, or improvement of or to public facilities due to measures taken by the County to avoid damaging or to otherwise accommodate one or more Grantee Facilities, the Grantee shall reimburse the County for the full amount of such additional costs promptly upon receiving the County's invoice for same. In the event the County ultimately determines that there is no reasonable or feasible alternative to relocation, the Grantee shall relocate the Grantee Facilities at issue as otherwise provided in this Section 9.

9.8 The provisions of this Section 9 shall in no manner preclude or restrict the Grantee from making any arrangements it may deem appropriate when responding to a request for relocation of any Grantee Facility by any person or entity other than the County, where the facilities to be constructed by said person or entity are not or will not become County-owned, operated or maintained facilities, provided that such arrangements do not unduly delay any County projects. The Grantee shall provide certified record drawings (or as-built drawings) detailing the location of Grantee's Facilities within the Public Right-of-Way required to be relocated or removed for the purpose of the non-County project.

9.9 Should relocation be required for a County project pursuant to this Section 9, the Grantee shall be responsible for timely relocation of the Grantee Facilities at issue and the coordination of such relocation with the County (or the County's contractor for the County project). The Grantee shall be fully responsible for the costs of any delays to County projects resulting from relocations of any Grantee Facilities. The Grantee shall indemnify, defend and hold harmless the County from and against any and all claims, lawsuits, or damages, including those brought by a contractor of the County engaged in a County project, arising out of or caused in whole or in part by the location or relocation of one or more Grantee Facilities, as more fully set forth in Section 16 of this Franchise.

<u>Section 10.</u> **<u>Undergrounding of Grantee Facilities.</u>**

10.1 The undergrounding requirements of this Section 10 shall apply where the Grantee Facilities consist of cable or any other facilities, equipment or systems which are reasonably capable of being placed underground. Where the Grantee Facilities consist of antennae or other facilities, equipment or systems which are required to remain above ground in order to be functional, the terms and conditions of this Section 10 shall not apply.

10.2 In any area of the County in which there are no aerial facilities other than antennae or other facilities required to remain above ground in order to be functional, or in any area in which telephone, electric power wires or other cables have been placed underground, the Grantee shall not be permitted to erect poles or to run or suspend wires, cables or other similar facilities thereon, but shall lay all such wires, cables or other facilities underground in the manner required by the County. The Grantee acknowledges and agrees that, even if the County does not require the undergrounding of all or any portion of the Grantee Facilities at the time the Grantee applies for the applicable right-of-way use permit, the County may, at any time in the future, and in the County's sole and absolute discretion, require the Grantee to convert all or any portion of the aerial Grantee Facilities to underground installation at the Grantee's sole cost and expense.

10.3 Whenever the County may require the undergrounding of the aerial facilities in any area of the County, the Grantee shall underground the aerial Grantee Facilities in that area of the County in the manner specified by the County, and concurrently with the other affected facilities. Where other facilities are present or proposed and involved in the undergrounding project, the Grantee shall only be required to pay its fair share of common costs borne by all facilities, in addition to the costs specifically attributable to the undergrounding of the Grantee Facilities. "Common costs" shall include necessary costs not specifically attributable to the installation or undergrounding of any particular facility, such as costs for common trenching and utility vaults. "Fair share" shall be determined for a project on the basis of the number and size of the Grantee Facilities being installed or undergrounded in comparison to the total number and size of all other utility facilities being installed or undergrounded.

Section 11. Maintenance of Grantee Facilities.

11.1 The Grantee shall maintain all Grantee Facilities in good condition and repair, in accordance with industry accepted best practices.

11.2 The Grantee shall take necessary steps to maintain a reasonably clear area around all Grantee Facilities installed above ground within Public Rights-of-Way. A minimum of five (5) feet of clearance will be maintained around each such object so as to provide clear visibility from the roadway for County operations and maintenance. Prior to using any chemical sprays within the Public Rights-of-Way to control or kill weeds and brush, the Grantee must obtain the County's permission. The County may limit or restrict the types, amounts, and timing of applications provided such limitations or restrictions are not in conflict with State law governing utility right-of-way maintenance.

Section 12. Hazardous Materials.

12.1 The County understands and agrees that the Permitted Use contemplated by the Grantee involves the use by Grantee of certain chemicals and/or materials within the Public Rights-of-Way that are classified as hazardous or otherwise harmful to life, health and/or safety (any such chemical or material, a "Hazardous Material") under one or more applicable federal, state or local laws, rules, regulations or ordinances (collectively, the "Hazardous Materials Laws"). The Grantee shall be permitted to use such Hazardous Materials within the Public Rights-of-Way as are reasonably necessary for the Grantee's conduct of the Permitted Use and which are customary for the industry in which the Grantee is engaged; PROVIDED, however, that the Grantee's use of any such Hazardous Materials within the Public Rights-of-Way shall at all times be undertaken in full compliance with all Hazardous Materials Laws, including any orders or instructions issued by any authorized regulatory agencies.

12.2 The Grantee covenants and agrees that it will neither cause nor permit, in any manner, the release, seepage or spill of any Hazardous Material upon, into, under, over, across or through any Public Right-of-Way or property adjacent thereto, whether public or private, in violation of any applicable Hazardous Materials Law. Any such release, seepage or spill of any Hazardous Material within the Public Rights-of-Way that is in violation of any applicable Hazardous Materials Law and is caused by Grantee or its directors, officers, agents, employees or contractors, is, referred to as "Release."

12.3 Should a Release occur, the Grantee shall immediately upon receiving notice thereof provide written notice of the Release to the County and the Washington State Department of Ecology. The Grantee agrees it shall indemnify, defend and hold the County, its elected and appointed officials, employees, agents and volunteers (collectively, the "County Parties") harmless from and against any and all claims, lawsuits, actions, judgments, awards, penalties, fines and other damages (including, but not limited to, reasonable attorneys' fees and costs) incurred or suffered by any of the County Parties, to the extent the Release is caused by any act or omission of Grantee or its directors, officers, agents, employees or, contractors (collectively, the "Grantee Parties") within Public Rights-of-Way or property adjacent thereto, whether public or private. Grantee shall be responsible, at its sole cost and expense, for completely cleaning up and remediating, as required by any governmental agency having jurisdiction, any Release caused by any Grantee Party within Public Rights-of-Way or property adjacent thereto, whether public or private. Notwithstanding the Grantee's obligation to completely remediate same, in the event of any Release by a Grantee Party, the County may (but need not), in the interest of protecting the health, safety, welfare and property of the public, immediately take whatever actions it deems necessary or advisable, in its sole discretion, to contain, clean up or remediate the Release at issue. Should the County choose to take any actions pursuant to the preceding sentence, the County shall be entitled to repayment from the Grantee of any and all reasonable costs and expenses incurred by the County in performing such actions.

12.4 Should the Grantee cause a Release as described in Section 12.2 above, failure to promptly comply with all orders or instructions lawfully issued by any authorized regulatory agencies regarding clean-up and remediation shall constitute a material breach of this Franchise, and the County Council may terminate or suspend the Franchise in accordance with Section 23.

Section 13. Dangerous Conditions, Authority for County to Abate.

13.1 Whenever the Grantee's excavation, construction, installation, relocation, maintenance, repair, abandonment, or removal of Grantee Facilities authorized by this Franchise has caused or contributed to a condition that, in the reasonable opinion of the County Engineer, substantially impairs the lateral support of the adjoining road or public or private property, or endangers the public, an adjoining public place, road facilities, County property or private property, the County Engineer may direct the Grantee to remedy the condition or danger to the satisfaction of the County Engineer, within a specified period of time and at the Grantee's sole cost and expense.

13.2 In the event that the Grantee fails or refuses to promptly take the actions directed by the County Engineer, or fails to fully comply with such directions, or if emergency conditions exist which require immediate action, in accordance with Section 13.1 above, the County may enter upon the property and take such actions as are reasonably necessary to protect the public, to protect the adjacent roads, or road facilities, to maintain the lateral support thereof, or to ensure the public safety, and the Grantee shall be liable to the County for all reasonable costs and expenses incurred by the County in performing such actions.

Section 14. Removal of Grantee Facilities; Abandonment of Grantee Facilities.

14.1 In no event may all or any portion of any Grantee Facility located in, on, under, over, across or through the public right-of-way be abandoned or temporarily abandoned in place by the Grantee without the express written consent of the County. Should the Grantee desire to deactivate, abandon, or temporarily abandon in place all or any portion of the Grantee Facilities, the Grantee shall request the County's permission to do so by delivering a written request to the

County not later than thirty (30) days after the date on which the Grantee discontinues use of any Grantee Facilities for any reason or this Franchise expires or terminates, whichever is earlier. The Grantee's request shall specify which Grantee Facilities the Grantee desires to deactivate or abandon in place. Within a reasonable time after the date on which the County receives the Grantee's written request, the County shall deliver a written response to the Grantee setting forth the County's decision, which shall be made in the County's sole and absolute discretion. If the County denies the Grantee's request with respect to all or any portion of the Grantee Facilities at issue, then the Grantee must promptly proceed to remove those Grantee Facilities for which the Grantee's request for abandonment has been denied.

14.2 If the County grants its approval to the Grantee's request for deactivation or abandonment, either in whole or in part, the County may impose conditions on such approval. The Grantee shall, at its sole cost and expense, as directed by the County, purge the Grantee Facilities that will be deactivated, abandoned, or temporarily abandoned of any product, Hazardous Material and/or other substance so as to render such Grantee Facilities safe in accordance with applicable law or such other standards as may be reasonably deemed appropriate by the County. The County's consent to such action by the Grantee shall not relieve the Grantee of the obligation and/or costs to remove or to alter such Facilities in the future in the event it is reasonably determined by the County that removal or alteration is necessary or advisable for the health and safety of the public, in which case the Grantee shall perform such work at no cost to the County. This paragraph shall survive the expiration, revocation or termination of this Franchise.

14.3 Should the Grantee fail to comply with the requirements of Section 14.1 within a reasonable time after either: (i) the expiration or earlier termination of the Franchise; or (ii) the County's denial of the Grantee's request for permission to deactivate or abandon all or any portion of the Grantee Facilities, the Grantee shall be deemed to have deactivated or abandoned the Grantee Facilities without authorization. In the event of any unauthorized abandonment of all or any portion of the deactivated or abandoned Grantee Facilities by the Grantee, the County may, at its election, and in addition to any other remedies or enforcement options available to the County under this Franchise, at law or in equity, remove all or any portion of the deactivated or abandoned Grantee Facilities on behalf of the Grantee and restore the Public Rights-of-Way following such removal. Should the County choose to perform any such removal and restoration activities on the Grantee's behalf, the County may dispose of the removed Grantee Facilities in any manner it deems fit and in accordance with applicable laws, and the Grantee shall be liable to the County for all costs and expenses incurred by the County in performing such removal and restoration activities.

Section 15. Fees, Compensation for Use of Public Rights-of-Way and Taxes.

15.1 The Grantee shall be subject to all permit fees allowed by law associated with activities undertaken within Public Rights-of-Way through the authority granted to the Grantee by this Franchise or under applicable provisions of the SCC.

15.2 Grantee shall pay itemized costs and expenses incurred by the County in the examination and report of the proposed franchise under SCC 13.80.030(4) and any other fees required under chapter 13.110 SCC.

15.3 In addition, the Grantee shall reimburse the County for any and all documented costs the County reasonably and necessarily incurs in response to an emergency involving any Grantee Facilities. The Grantee shall promptly reimburse the County, upon submittal by the County of an itemized billing, for the Grantee's proportionate share of all actual, identified costs and expenses incurred by the County in repairing any County facility, or altering such County facility if at the Grantee's request, as the result of the presence of any Grantee Facilities in the Public Right-of-Way. Such costs and expenses shall include, but not be limited to, the Grantee's proportionate share of the costs of County personnel assigned to review construction plans or to oversee or engage in any work in the Public Right-of-Way as a result of the emergency and the presence of the Grantee Facilities in the Public Right-of-Way. Any and all costs will be billed on an actual cost basis. The billing may be on an annual basis, but the County shall provide the Grantee with the County's itemization of costs at the conclusion of each project for informational purposes.

Section 16. Hold Harmless and Indemnification.

16.1 Grantee agrees to indemnify, defend, and hold harmless any County Party (as such term is defined in Section 12 above) from any and all claims, demands, liability, suits, and judgments, including costs of defense thereof, for bodily injury to persons, death, or property damage arising out of the acts or omissions of any of the Grantee Parties (as such term is defined in Section 12 above) in the use of a Public Right-of-Way pursuant to this Franchise. This covenant of indemnification shall include, but not be limited to, any and all claims, demands, liability, suits, and judgments arising out of the placement of Grantee's existing utility fixtures and any and all third party claims, demands, liability, suits, and judgments arising out of any of the Grantee Parties' failure to complete all utility related adjustments, relocations, repairs, or work in accordance with this Franchise and the work plan and schedule agreed to by the County and Grantee. In the event of liability for damages arising out of bodily injury to persons, death or property damage caused by or resulting from the concurrent negligence of Grantee and the County, its officers, employees and agents, Grantee's liability hereunder shall be only to the extent of Grantee's negligence.

16.2 In the event the County incurs attorneys' fees, legal expenses, or other costs to enforce the provisions of this Section 16 against Grantee, all such fees, expenses, and costs shall be recoverable from Grantee to the extent the County prevails in such enforcement action.

16.3 It is specifically and expressly understood that, solely to the extent required to enforce the indemnification, defense and hold harmless obligations contained in this Section 16, Grantee waives its immunity under RCW Title 51; provided, however, the foregoing waiver shall not in any way preclude Grantee from raising such immunity as a defense against any claim brought against Grantee by any of its employees. This waiver has been mutually negotiated by the parties.

16.4 The County shall give Grantee timely written notice of the matter of any claim or of the commencement of any such action, suit or other proceeding covered by the indemnification, defense and hold harmless obligations contained in this Section 16. In the event any such claim arises, the County or any other indemnified party shall tender the defense thereof to Grantee and Grantee shall have the right and duty to defend, settle or compromise any claims arising hereunder and the County shall cooperate fully therein.

16.5 The County's permitting approval, inspection, lack of inspection, or acceptance of any work performed by the Grantee Parties in connection with work authorized on Grantee Facilities, pursuant to this Franchise or pursuant to any other permit or approval issued in connection with this Franchise, shall not be grounds for avoidance of any of the indemnification, defense and hold harmless obligations contained in this Section 16.

16.6 The indemnification, defense and hold harmless obligations contained in this Section 16 shall survive the expiration, abandonment or termination of this Franchise.

Section 17. Limitation of County Liability.

The County's administration of this Franchise shall not be construed to create the basis for any liability on the part of the County Parties, except for and only to the extent of the County's negligence.

Section 18. Insurance.

18.1 Insurance Requirements

A. Insurance Required

Grantee shall procure, and maintain for the duration of this Franchise, insurance against claims for injuries to persons or damages to property which may arise from, or in connection with, the performance of work hereunder by the Grantee, its agents, representatives, employees and/or contractors /subcontractors. The Grantee or contractor/subcontractor shall pay the costs of such insurance. The Grantee shall furnish separate certificates of insurance and policy endorsements from each contractor/subcontractors as evidence of compliance with the insurance requirements of this Franchise.

The Grantee is responsible for ensuring compliance with all of the insurance requirements stated herein. Failure by the Grantee, its agents, employees, officers, contractor/subcontractors to comply with the insurance requirements stated herein shall constitute a material breach of this Franchise.

Each insurance policy shall be written on an "occurrence" form; except that insurance on a "claims made" form may be acceptable with prior County approval. If coverage is approved and purchased on a "claims made" basis, the Grantee warrants continuation of coverage, either through policy renewals or the purchase of an extended discovery period, if such extended coverage is available, for not less than three years from the date of Franchise termination, and/or conversion from a "claims made" form to an "occurrence" coverage form.

Nothing contained within these insurance requirements shall be deemed to limit the scope, application and/or limits of the coverage afforded by said policies, which coverage will apply to each insured to the full extent provided by the terms and conditions of the policy(s). Nothing contained in this provision shall affect and/or alter the application of any other provision contained within this Franchise.

B. Risk Assessment by Grantee

By requiring such minimum insurance, the County shall not be deemed or construed to have assessed the risks that may be applicable to the Grantee under this Franchise, nor shall such minimum limits be construed to limit the limits available under any insurance coverage obtained by the Grantee. The Grantee shall assess its own risks and, if it deems appropriate and/or prudent, maintain greater limits and/or broader coverage.

C. Minimum Scope and limits of Insurance. Coverage shall be at least as broad as and with limits not less than the following:

(i) General Liability

Insurance Services Office form number (CG 00 01) covering COMMERCIAL GENERAL LIABILITY including XCU coverage: $2,000,000 combined single limit per occurrence by bodily injury, personal injury, and property damage; and for those policies with aggregate limits, a $2,000,000 aggregate limit.

(ii) Automobile Liability

Insurance Services Office form number (CA 00 01) covering BUSINESS AUTO COVERAGE, symbol 1 "any auto"; or the appropriate coverage provided by symbols 2, 7, 8, or 9: $1,000,000 combined single limit per accident for bodily injury and property damage if the use of motor vehicles is contemplated.

(iii) Workers' Compensation

Workers' Compensation coverage, as required by the Industrial Insurance Act of the State of Washington, as well as any similar coverage required for this work by applicable federal or "Other States" state law: Statutory requirements of the state of residency.

(iv) Stop Gap/Employers Liability

Coverage shall be at least as broad as the indemnification, protection provided by the Workers' Compensation policy Part 2 (Employers Liability) or, in states with monopolistic state funds, the protection provided by the "Stop Gap" endorsement to the general liability policy: $1,000,000.

D. Minimum Limits of Insurance - Construction Period

Prior to commencement of Construction and until Construction is complete and approved by the Grantee and the County, the Grantee shall cause the Construction Contractor and related professionals to procure and maintain insurance against claims for injuries to persons or damages to property which may arise from, or in connection with the activities related to this Franchise. The Grantee and the County shall be named as additional insureds on liability policies except Workers Compensation and Professional Liability. The cost of such insurance shall be paid by the Grantee and/or any of the Grantee's contractor/subcontractors. The Grantee shall cause the Construction Contractor and related professionals to maintain limits no less than the following:

(i) Commercial General Liability: $ 2,000,000 combined single limit per occurrence for bodily injury, personal injury and property damage and $2,000,000 in the aggregate.

(ii) Automobile Liability: $1,000,000 combined single limit per accident for bodily injury and property damage.

(iii) Workers Compensation: Statutory requirements of the state of residency.

(iv) Stop Gap or Employers Liability Coverage: $1,000,000.

E. Deductibles and Self-Insured Retentions

Any deductibles or self-insured retentions must be declared to, and approved by, the County. The deductible and/or self-insured retention of the policies shall not apply to the Grantee's liability to the County and shall be the sole responsibility of the Grantee.

F. Other Insurance Provisions

The insurance policies required in this Franchise are to contain, or be endorsed to contain, the following provisions:

(i) All Liability Policies except Professional and Workers Compensation.

a. The County, its officers, officials, employees, and agents are to be covered as additional insured with respect to liability arising out of activities performed by or on behalf of the Grantee/contractor in connection with this Franchise. Such coverage shall include Products-Completed Operations.

b. To the extent of the Grantee's/contractor's negligence, the Grantee's/contractor's insurance coverage shall be primary insurance with respect to the County, its officers, officials, employees, and agents. Any insurance and/or self-insurance maintained by the County, its officers, officials, employees, or agents shall not contribute with the Grantee's insurance or benefit the Grantee in any way.

c. The Grantee's insurance shall apply separately to each insured against whom claim is made and/or lawsuit is brought, except with respect to the limits of the insurer's liability.

(ii) All Policies

Coverage shall not be suspended, voided, canceled, reduced in coverage or in limits, except by the reduction of the applicable aggregate limit by claims paid, until after 45 days prior written notice has been given to the County. In the event of said cancellation or intent not to renew, the Grantee shall obtain and furnish to the County evidence of replacement insurance policies meeting the requirements of this Section by the cancellation date. Failure to provide proof of insurance could result in suspension of the Franchise.

G. Acceptability of Insurers

Unless otherwise approved by the County, insurance is to be placed with insurers with a Bests' rating of no less than A-VII, or, if not rated with Bests, with minimum surpluses the equivalent of Bests' surplus size VIII.

Professional Liability, Errors, and Omissions insurance may be placed with insurers with a Bests' rating of B+VII. Any exception must be approved by the County.

If, at any time, the foregoing policies shall fail to meet the above requirements, the Grantee shall, upon notice to that effect from the County, promptly obtain a new policy, and shall submit the same to the County, with appropriate certificates and endorsements, for approval.

H. Verification of Coverage

The Grantee shall furnish the County with certificates of insurance and endorsements required by this Franchise. The certificates and endorsements for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. The certificates and endorsements for each insurance policy are to be on forms approved by the County prior to the commencement of activities associated with the Franchise. The County reserves the right to require complete, certified copies of all required insurance policies at any time.

I. Subcontractors

The Grantee shall include all subcontractors as insured under its policies or shall require separate certificates of insurance and policy endorsements from each subcontractor. If the Grantee is relying on the insurance coverage provided by subcontractors as evidence of compliance with the insurance requirements of this Franchise, then such requirements and documentation shall be subject to all of the requirements stated herein.

J. Insurance Review

In consideration of the duration of this Franchise, the parties agree that the Insurance section herein, at the discretion of the County Risk Manager, may be reviewed and adjusted with each amendment and within ninety (90) days of the end of the first five (5) year period of the term of this Franchise and the end of each successive five (5) year period thereafter. Any adjustments made as determined by the County Risk Manager, shall be in accordance with reasonably prudent risk management practices and insurance industry standards and shall be effective on the first day of each successive five (5) year period.

Adjustment, if any, in insurance premium(s) shall be the responsibility of the Grantee. Any failure by the County to exercise the right to review and adjust at any of the aforementioned timings shall not constitute a waiver of future review and adjustment timings.

18.2 Grantee shall furnish the County with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsements, evidencing the insurance requirements of the Grantee before commencement of the work.

18.3 In satisfaction of the insurance requirements set forth in this Section 18, Grantee may self-insure against such risks in such amounts as are consistent with good utility practice. Grantee shall provide the County with reasonable written evidence that Grantee is maintaining such self-insurance.

Section 19. Performance Security.

In accordance with RCW 36.32.590 and SCC 13.10.104(4), Grantee is a unit of local government and shall not be required to secure the performance of a County-issued permit with a surety bond or other financial security device.

Section 20. Annexation.

If any Public Right-of-Way, or portion thereof, is incorporated into the limits of any city or town, it shall not be subject to the terms of this Franchise.

Section 21. Vacation.

If any Public Right-of-Way, or portion thereof, is vacated, it shall not be subject to the terms of this Franchise. The County may retain a utility easement as allowed under RCW 36.87.140 when a Public Right-of-Way, or portion thereof, is vacated. The Grantee may request the County retain a utility easement; however in no case shall the County be obligated to retain such an easement. The County shall not be liable for any damages or loss to the Grantee by reason of such vacation and termination.

Section 22. Assignment.

22.1 Neither this Franchise nor any interest therein shall be leased, sold, partitioned, transferred, assigned, disposed of, or otherwise subject to a change in the identity of the Grantee (each such activity, a "Transfer"), in whole or in part, in any manner, without the prior written consent of the County Council. Should any such Transfer be approved by the County, then each and every one of the provisions, conditions, regulations and requirements contained in this Franchise shall be binding upon the approved transferee beginning on the date of the Transfer, and all privileges, as well as all obligations and liabilities of the Grantee shall inure to such transferee equally as if such transferee was specifically mentioned wherever the Grantee is named herein.

22.2 In the case of a Transfer to secure indebtedness, whether by mortgage or other security instrument, the County's consent shall not be required unless and until the secured party elects to realize upon the collateral. The Grantee shall provide prompt, written notice to the County of any assignment to secure indebtedness.

22.3 Any attempt by Grantee to Transfer this Franchise in violation of this Section 22 shall constitute a material breach by Grantee.

Section 23. Termination, Revocation, and Forfeiture.

If the Grantee (i) defaults on any material term or condition of this Franchise; (ii), willfully violates or fails to comply with any of the provisions of this Franchise; or, (iii) through willful misconduct or gross negligence fails to heed or comply with any notice given the Grantee by the County under the provisions of this Franchise, then the Grantee shall, at the election of the County Council, forfeit all rights conferred hereunder and the Franchise may be terminated by the County Council. Upon termination for any cause, all rights of the Grantee granted hereunder or under any right-of-way use permit shall cease, and the Grantee shall immediately commence to remove or, with approval of the County Engineer, abandon in place all of the Grantee Facilities from the Public Rights-of-Way in accordance with Section 14 above.

Section 24. Remedies to Enforce Compliance; No Waiver.

24.1 In lieu of termination, revocation or forfeiture as provided in Section 23, and without prejudicing any of its other legal rights and remedies, the County may elect to obtain an order from the Superior Court or other court, tribunal, or agency having competent jurisdiction compelling the Grantee to comply with the provisions of this Franchise and to recover damages and costs incurred by the County by reason of the Grantee's failure to comply. In addition to any other remedy provided herein, the County reserves the right to pursue any remedy to compel or force the Grantee and/or its permitted successors and assigns to comply with the terms hereof, and the pursuit of any right or remedy by the County shall not prevent the County from thereafter declaring a forfeiture or revocation for breach of the conditions herein.

24.2 Failure of the County to exercise any rights or remedies under this Franchise shall not constitute a waiver of any such right or remedy and shall not prevent the County from pursuing such right or remedy at any future time.

24.3 Nothing in this Franchise is or was intended to confer third-party beneficiary status on any person or entity to enforce the terms of this Franchise.

Section 25. County Ordinances and Regulations – Reservation of Police Power.

Nothing in this Franchise shall restrict the County's ability to adopt and enforce all necessary and appropriate ordinances regulating the performance of the conditions of the Franchise, including, but not limited to, any ordinances adopted under the County's police powers in the interest of public safety and for the welfare of the public. The County shall have the authority at all times to control by appropriate regulations, including design standards, and utility accommodation policies, the location, elevation, manner of construction, and maintenance of any Grantee Facilities located within any Public Right-of-Way, and the Grantee shall promptly conform with all such regulations, unless compliance would cause the Grantee to violate other requirements of law. In the event of a conflict between the regulatory provisions of this Franchise and any other ordinance(s) enacted under the County's police power authority, such other ordinance(s) shall take precedence over the provisions set forth herein.

Section 26. Eminent Domain, Powers of the People.

This Franchise is subject to the power of eminent domain and the right of the County Council or the people acting for themselves through initiative or referendum to repeal, amend or modify the Franchise in the interest of the public. In any proceeding under eminent domain, the Franchise itself shall have no value.

Section 27. Survival and Force Majeure.

27.1 Until such time as all of the Grantee Facilities have been removed from the Public Rights-of-Way in accordance with Section 14.1 above, or have been deactivated or abandoned in place in accordance with Sections 14.2 and 14.3 above, all of the provisions, conditions and requirements contained in the following sections of this Franchise shall survive the expiration, revocation, forfeiture or early termination of the Franchise: (i) Section 4 (Regulation of Use; Permits Required); (ii) Section 5 (Emergency Work); (iii) Section 6 (Compliance with Applicable Laws; Performance Standards); (iv) Section 7 (Restoration of Public Rights-of-Way); (v) Section 8 (Record Plans, Record Drawings, and Records of Grantee Facility Locations); (vi) Section 10 (Undergrounding of Grantee Facilities); (vii) Section 12 (Hazardous Materials); (viii) Section 13 (Dangerous Conditions, Authority for County to Abate); (ix) Section 14 (Removal of Grantee Facilities; Abandonment of Grantee Facilities); (x) Section 15 (Fees, Compensation for Use of Public Rights-of-Way and Taxes); (xi) Section 16 (Hold Harmless and Indemnification); (xii) Section 17 (Limitation of County Liability); (xiii) Section 18 (Insurance); (xiv) Section 19 (Performance Security); and (xv) Section 24 (Remedies to Enforce Compliance; No Waiver).

27.2 After such time as all Grantee Facilities have been either removed from the Public Rights-of-Way or abandoned/deactivated in place to the County's satisfaction pursuant to Section 14 above, only the following provisions shall survive the expiration or earlier termination of the Franchise: (i) Section 8 (Record Plans, Record Drawings, and Records of Grantee Facility Locations); (ii) Section 12 (Hazardous Materials); (iii) Section 16 (Hold Harmless and Indemnification); and (iv) Section 17 (Limitation of County Liability.

27.3 If the Grantee is prevented or delayed in the performance of any of its obligations under this Franchise by reason of a Force Majeure, then Grantee's performance shall be excused during a Force Majeure occurrence. Upon removal or termination of the Force Majeure occurrence the Grantee shall promptly perform its obligations in an orderly and expedited manner using industry accepted best practices. Grantee's performance shall not be excused by economic hardship nor by the misfeasance or malfeasance of its directors, officers, or employees.

27.4 For the purposes of this Franchise, "Force Majeure" means any event or circumstance (or combination thereof) and the continuing effects of any such event or circumstance (whether or not such event or circumstance was foreseeable or foreseen) that delays or prevents performance by the Grantee of any of its obligations under this Franchise, but only to the extent that and for so long as the event or circumstance is beyond the reasonable control of the Grantee and shall include, without limitation, all of the following events and circumstances: (i) acts of nature, including volcanic eruption, landslide, earthquake, flood, lightning, tornado or other unusually severe storm or environmental conditions, perils of the sea, wildfire or any other natural disaster; (ii) acts of public enemies, armed conflicts, act of foreign enemy, acts of terrorism (whether domestic or foreign, state-sponsored or otherwise), war (whether declared or undeclared), blockade, insurrection, riot, civil disturbance, revolution or sabotage; (iii) any form of compulsory government actions, acquisitions or condemnations, changes in applicable law, export or import restrictions, customs delays, rationing or allocations; (iv) accidents or other casualty, damage, loss or delay during transportation, explosions, fire, epidemics, quarantine or criminal acts; (vi) inability, after the use of commercially reasonable efforts, to obtain from any governmental authority any permit, approval, order, decree, license, certificate, authorization or permission to the extent required by applicable law; (vii) inability, after the use of commercially reasonable efforts, to obtain any consent or approval required by the Franchise; and (viii) third-party litigation contesting all or any portion of the Franchise or Grantee's rights under this Franchise.

Section 28. Governing Law and Stipulation of Venue.
This Franchise and all use of Public Rights-of-Way granted herein shall be governed by the laws of the State of Washington, unless preempted by federal law. Any action relating to this Franchise shall be brought in the Superior Court of Washington for Snohomish County, or in the case of a federal action, the United States District Court for the Western District of Washington at Seattle, unless an administrative agency has primary jurisdiction.

Section 29. Severability.
If any section, sentence, clause, phrase or provision of this Franchise or the application of such provision to any person or entity should be held to be invalid or unconstitutional by a court of competent jurisdiction, such invalidity or unconstitutionality shall not affect the validity or constitutionality of any other section, sentence, clause, phrase or provision of this Franchise nor the application of the provision at issue to any other person or entity.

Section 30. Notice and Emergency Contact.

Any notice or information required or permitted to be given to the parties under this Franchise may be sent to the following addresses unless otherwise specified:

SNOHOMISH COUNTY Department of Public Works 3000 Rockefeller Avenue, M/S 607 Everett, WA 98201	LAKE STEVENS SEWER DISTRICT 1106 Vernon Rd, Suite A Lake Stevens, WA 98258
Attn. Right-of-Way Coordinator Phone: (425) 388-3488	Attn. Tonya Christoffersen Phone: 425-334-8588

The Grantee shall also provide the County a current emergency contact name (or title) and phone number available 24-hours a day, seven days a week. The Grantee shall promptly notify the County of any change in the notice address or emergency contact (or title) and phone number.

Section 31. Acceptance.

Within ninety (90) days after the passage and approval of this Franchise by the County Council, the Franchise may be accepted by the Grantee by its filing with the County Council an unconditional written acceptance thereof. Failure of the Grantee to so accept the Franchise within said period of time shall be deemed a rejection thereof by the Grantee, and the rights and privileges herein granted shall automatically cease and terminate, unless the time period is extended by ordinance duly passed for that purpose.

Section 32. Effective Date.

This Franchise shall take effect, if at all, on the date on which each and every one of the following conditions have been met (the "Effective Date"): (i) ten (10) days have passed since the County Executive executed this Franchise, or this ordinance was otherwise enacted; (ii) the Grantee executes a copy of this Franchise and returns it to the County Council within the time provided in Section 31 above; (iii) the Grantee presents to the County acceptable evidence of insurance as required in Section 18 above; and (iv) the Grantee pays all applicable fees as set forth in Section 15 above.

PASSED this 5th day of August, 2020.

SNOHOMISH COUNTY COUNCIL
Snohomish County, Washington

N Nelson
Council Chairperson

ATTEST:
M Elena Lao
Asst. Clerk of the Council

(X) APPROVED
( ) VETOED
( ) EMERGENCY

Dave Somers
Snohomish County Executive

DATE: 8/7/2020

ATTEST:
Melissa Geraghty

Approved as to Form Only:

Christina Richmond Digitally signed by Christina Richmond Date: 2020.04.10 15:51:20 -07'00'

Deputy Prosecuting Attorney

Date: ______________________

D-20

ACCEPTANCE:

The provisions of this Franchise are agreed to and hereby accepted. By accepting this Franchise, Lake Stevens Sewer District covenants and agrees to perform and be bound by each and all of the terms and conditions imposed by the Snohomish County Charter, Snohomish County Code, and this Franchise.

Dated: Sept. 1, 2020

LAKE STEVENS SEWER DISTRICT

By: Tonya Christoffersen

Printed Name: Tonya Christoffersen

Title: General Manager

CERTIFICATION OF COMPLIANCE WITH CONDITIONS AND EFFECTIVE DATE:

I certify that I have received confirmation that: (1) the Grantee returned a signed copy of this Franchise to the County Council within the time provided in Section 31; (2) the Grantee has presented to the County acceptable evidence of insurance as required in Section 18 of this Franchise; and (3) the Grantee has paid all applicable processing costs and fees as set forth in Section 15 of this Franchise.

THE EFFECTIVE DATE OF THIS ORDINANCE IS:

September 25, 2020

By: Elena Lao

Name: Elena Lao

Title: Asst. Clerk of the Council

APPENDIX D

FLOW MONITORING EVALUATION

LAKE STEVENS SEWER DISTRICT

SNOHOMISH COUNTY **WASHINGTON**

LAKE STEVENS
SEWER DISTRICT

FLOW MONITORING EVALUATION

G&O #20408.07
APRIL 2021

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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INTRODUCTION

In order to more accurately estimate infiltration and inflow (I/I) contribution within the District's wastewater collection system, a flow monitoring study was conducted. Six flow meters were installed around the District's collection system to compare conditions in both older and newer portions of the system.

The information from this assessment will be used in the collection system evaluation, which will include hydraulic modeling, condition assessment, alternatives analysis and development of a collection system capital improvement plan.

Sewage flow rates that are much higher during wet-weather periods than during dry-weather periods typically indicate the presence of infiltration and/or inflow. Infiltration is groundwater that enters a sewer system through sites such as cracks in pipes and manholes, loose pipe joints, foundation drains, and basement sump pumps. Infiltration is generally assumed to be relatively constant throughout wet weather periods due to the consistent saturation of the soil surrounding the sewer pipes. Inflow is surface water that enters the system through sites such as cross connections with storm drains and downspouts, area drains, unplugged and leaking cleanouts, and ponding on manhole covers. Inflow is assumed to vary significantly based on rainfall and runoff rates. High volumes of I/I consume the capacity of pipes, lift stations, and treatment facilities, requiring that larger facilities be designed to accommodate the increased flow in the wastewater system.

The amount of infiltration and inflow (I/I) can be estimated on a peak day and peak hour basis by subtracting the dry weather wastewater flow from the respective peak day and peak hour wastewater flows. The available flow monitoring data were used to quantify I/I in the tributary areas

The District has maintained an ongoing effort to minimize I/I. Annual activities include identifying I/I sources through CCTV, manhole rehabilitation through SealGuard, and hydrocleaning.

The District is divided into 46 individual drainage basins, largely based upon which lift station or gravity sewer trunk each area is tributary. Each basin is described and evaluated in *Chapter 6, Collection System Evaluation*. Figure D-1 shows the locations of basins and District's 29 lift stations while Figure D-2 shows a schematic of the collection system.

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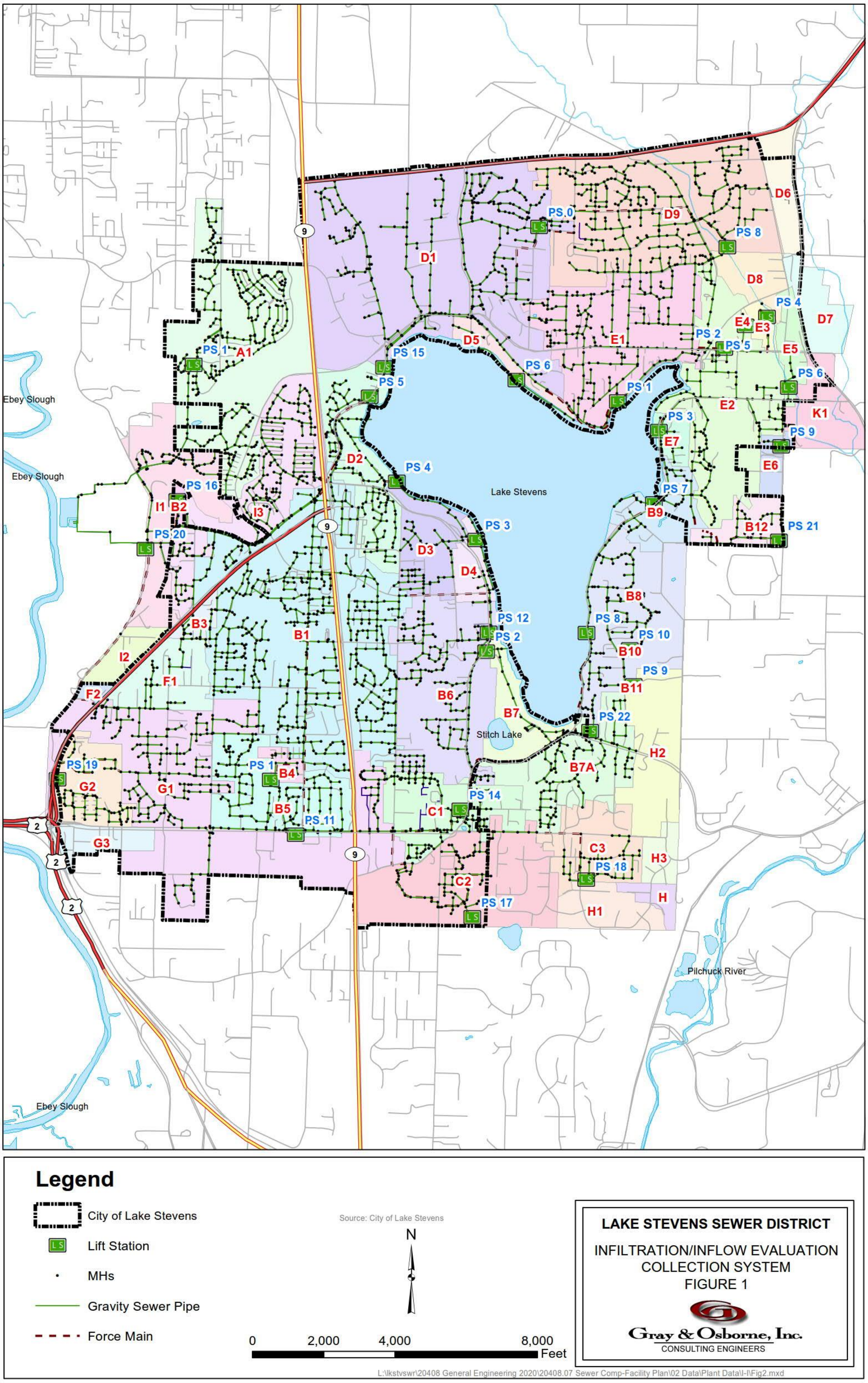

FIGURE D-1

Lake Stevens Sewer District Collection System

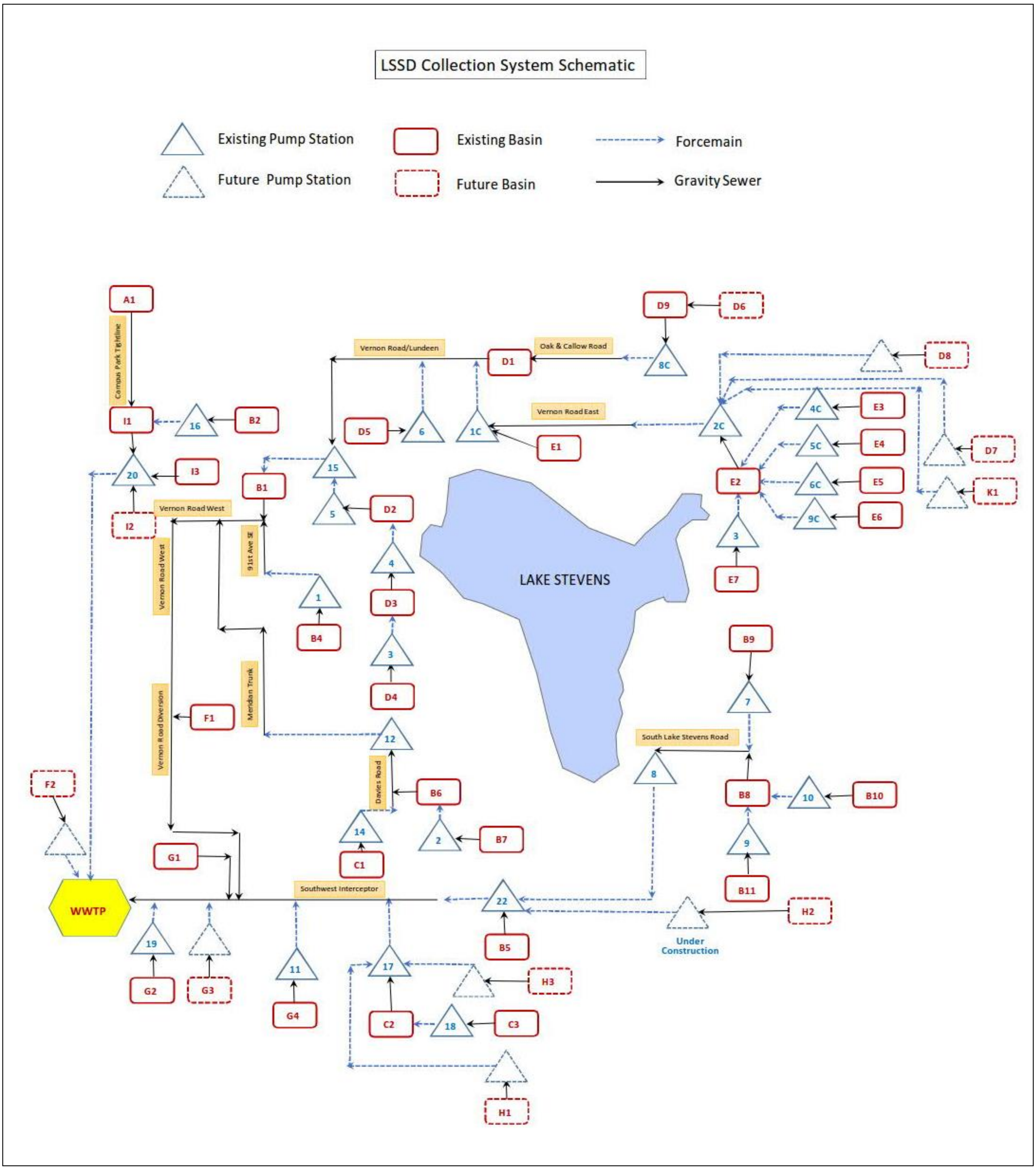

FIGURE D-2

Lake Stevens Sewer District Collection System Schematic

PEAK I/I FLOW AND UNIT I/I

For this analysis, peak I/I is defined as the difference between the recorded peak flow and the average dry-weather flow. As such, I/I does not include the small amount of constant dry-weather infiltration that is present in most collection systems.

The entry of I/I into different sections of District's sanitary system varies substantially from area to area. Some portions of the system are known to respond very quickly to rainfall, some react more slowly, while others appear not to react at all. Because flow varies with the size of the basin, a unit I/I rate for each basin was calculated by dividing the peak I/I (in gpd) by the sewered area within each basin, as described in *Chapter 6, Collection System Evaluation*. These unit I/I rates, in gallon per acre per day (gpad), allow the comparison of the level of I/I among basins of different sizes.

FLOW MONITORING DATA ANALYSIS

FLOW MONITORING LOCATIONS

To evaluate where I/I may occur within the District's sewer system, temporary flow meters were installed in six manholes for approximately 2 months from January to March 2021. The locations were selected to represent different geographic areas of the District, large and small drainage basins and basins with older and newer sewer pipes. The flow meter data was also used to develop diurnal curves for use in the sewer modeling effort. Table D-1 summarizes the locations and monitoring periods for each meter. Flow monitoring was performed using Hach Flow Loggers and FLO-DAR Sensors. The calibration certificates for each meter are included at the end of the chapter.

TABLE D-1

Meter Locations and Monitoring Periods

Flow Meter	Location	Tributary Area (Basin)	Monitoring Period
1	On 83rd Avenue SE, South of 20th Street SE	B5, B7A, B8, B9, B12, C2, C3, G1 (partial)	1/12/2021- 3/1/2021
2	On 105th Avenue SE, South of 26th Place SE	C2, C3	1/12/2021- 3/1/2021
3	On 125th Avenue SE, between 20th Street NE and 18th Street NE	E2 (partial), E5, E6, E7	1/12/2021- 3/1/2021
4	On 116th Drive NE, between Mitchell Road and Lakeshore Drive	E1 (partial)	1/13/2021- 3/1/2021
5	8th Street SE and 77th Drive SE	B1, B3, B6, B7, C1, D1, D2, D3, D4, D5, D9, E1, E2, E3, E5, E6, E7	1/13/2021- 3/1/2021
6	8th Street SE and 91st Avenue SE	D2 (partial), D3, D4	1/13/2021- 3/1/2021

The meter locations are shown in Figure D-3. Detailed tributary areas for each meter are shown in Figures D-4 through D-9. Meter 1 had an overlapping tributary area with Meter 2. Meters 3, 4 and 6 had overlapping tributary areas with Meter 5.

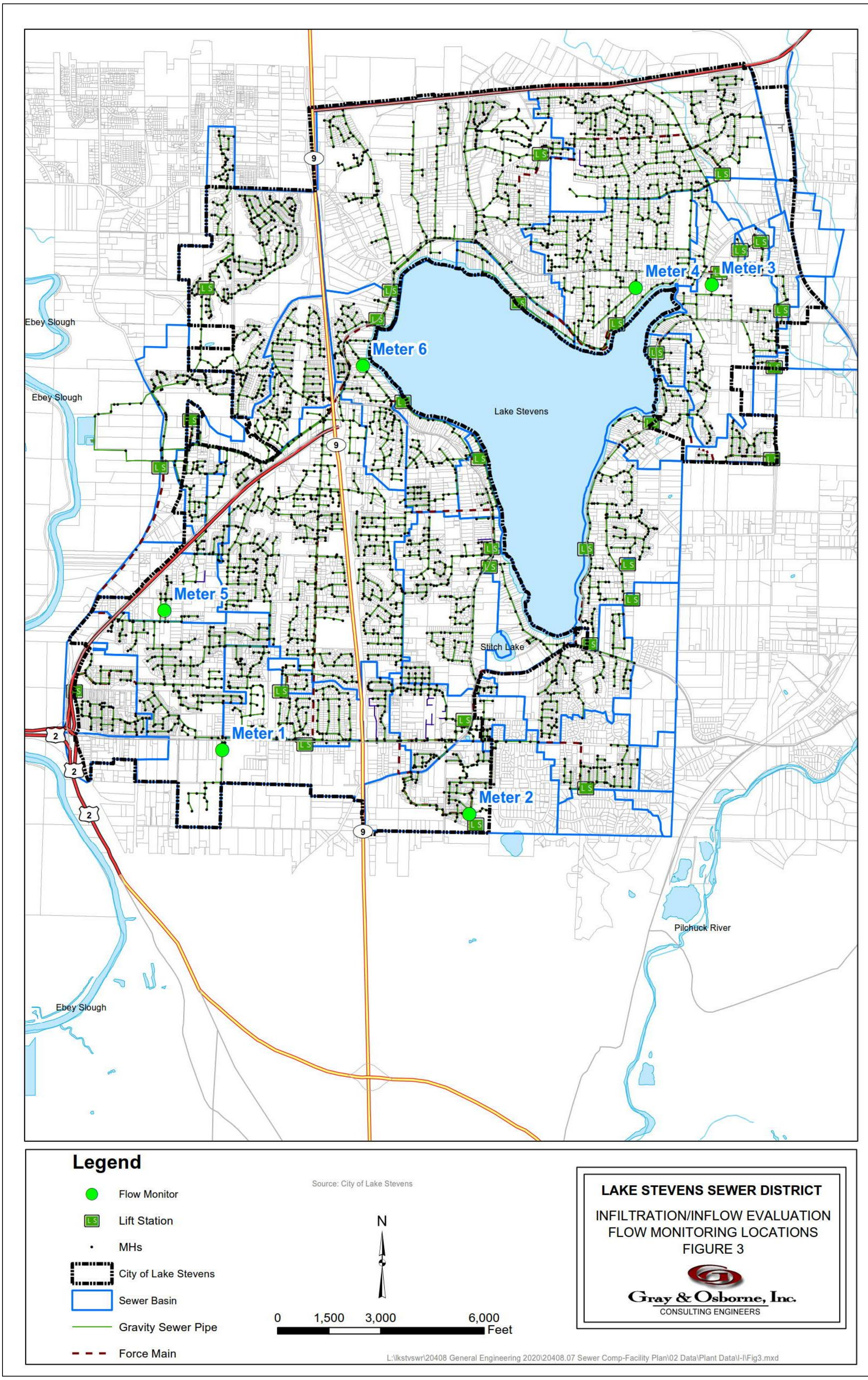

FIGURE D-3

Meter Locations

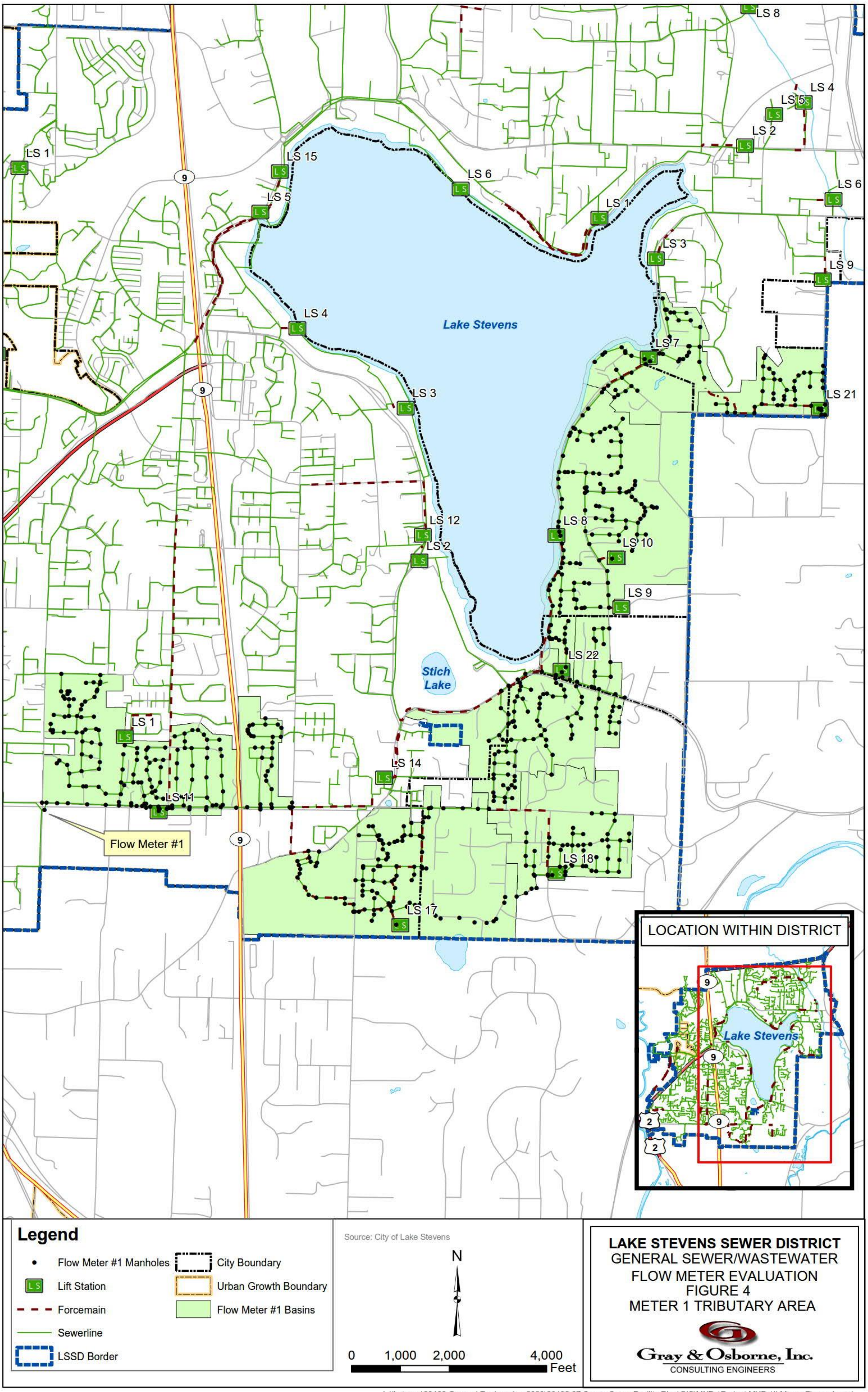

FIGURE D-4

Meter 1 Tributary Area

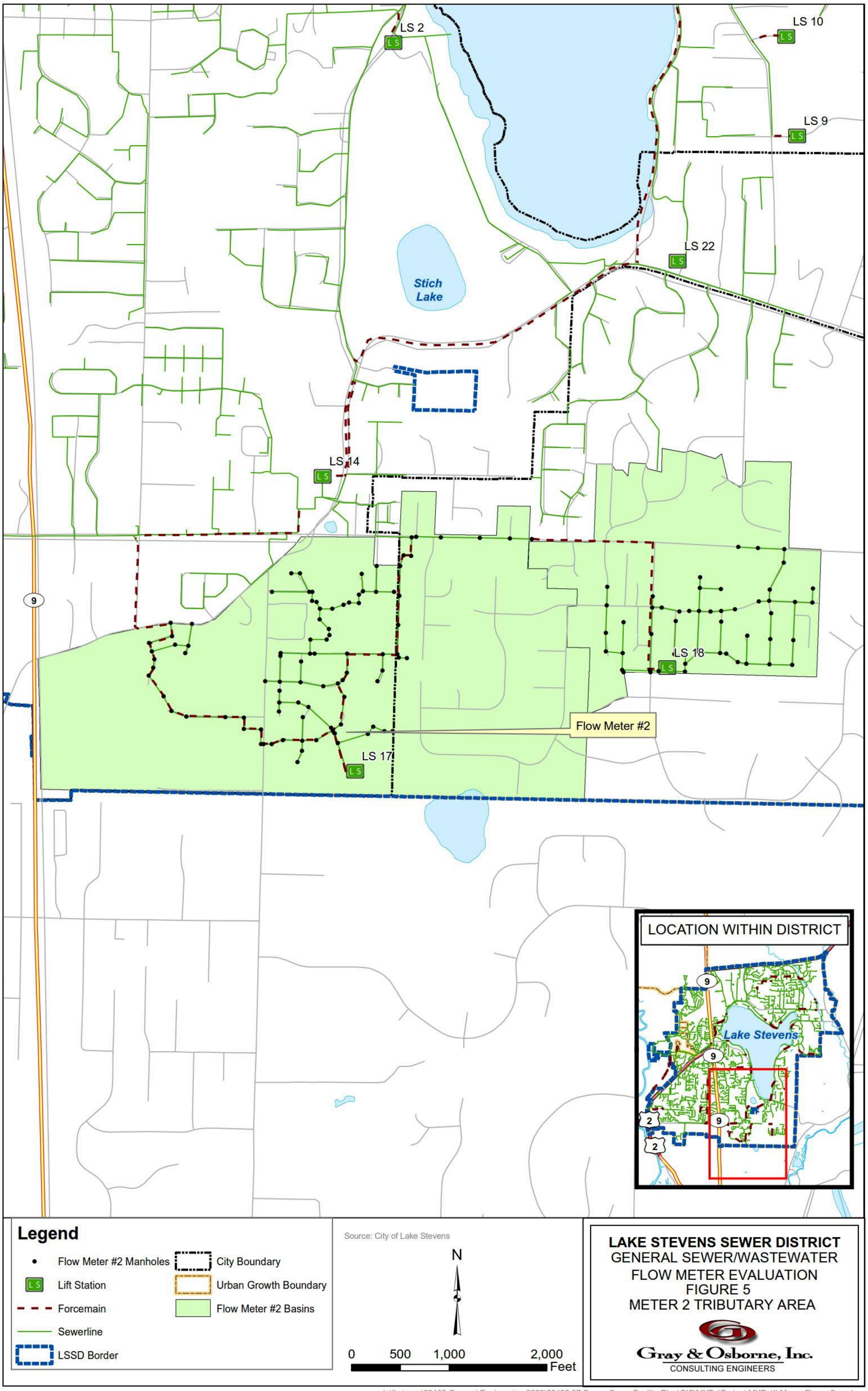

FIGURE D-5

Meter 2 Tributary Area

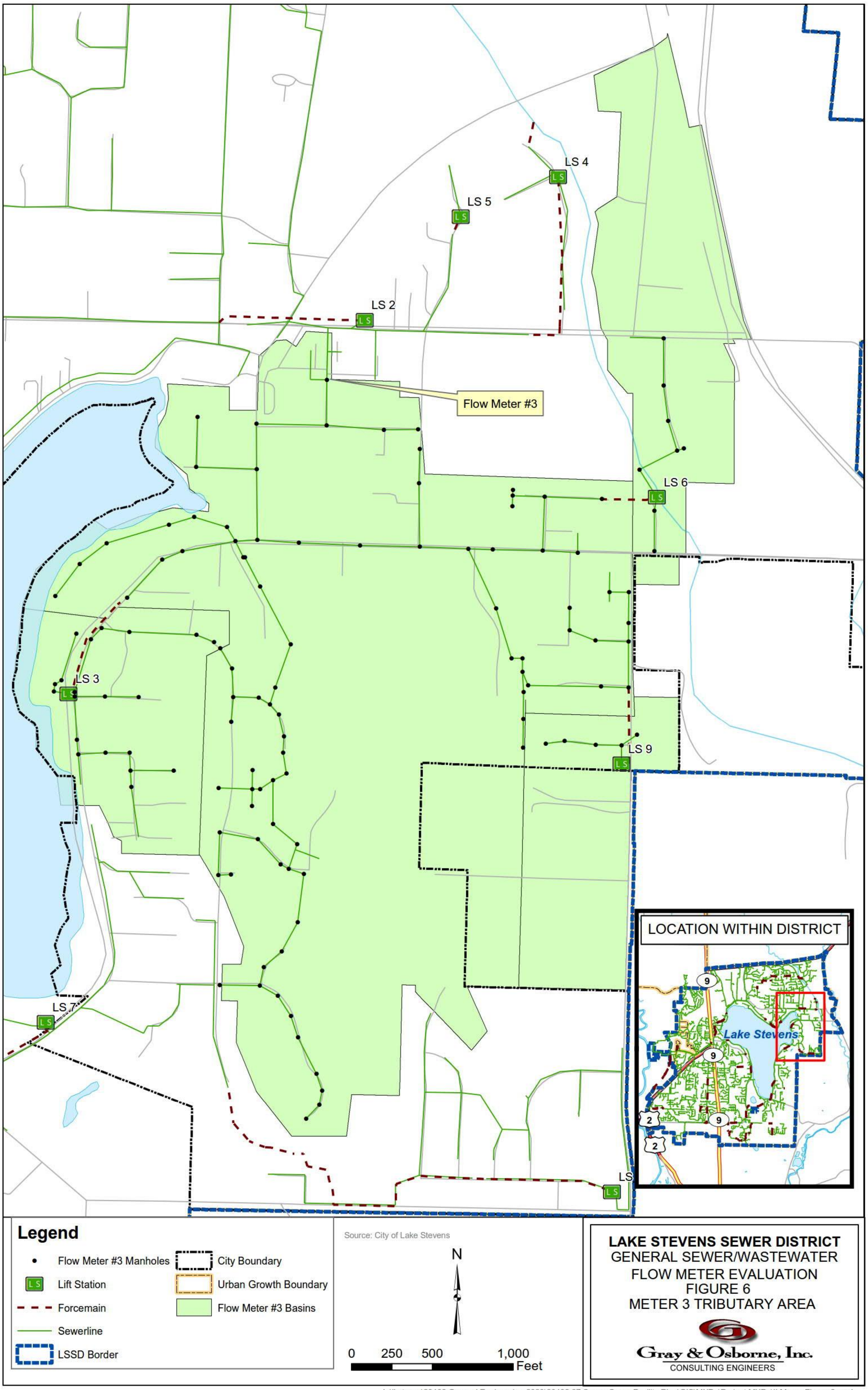

FIGURE D-6

Meter 3 Tributary Area

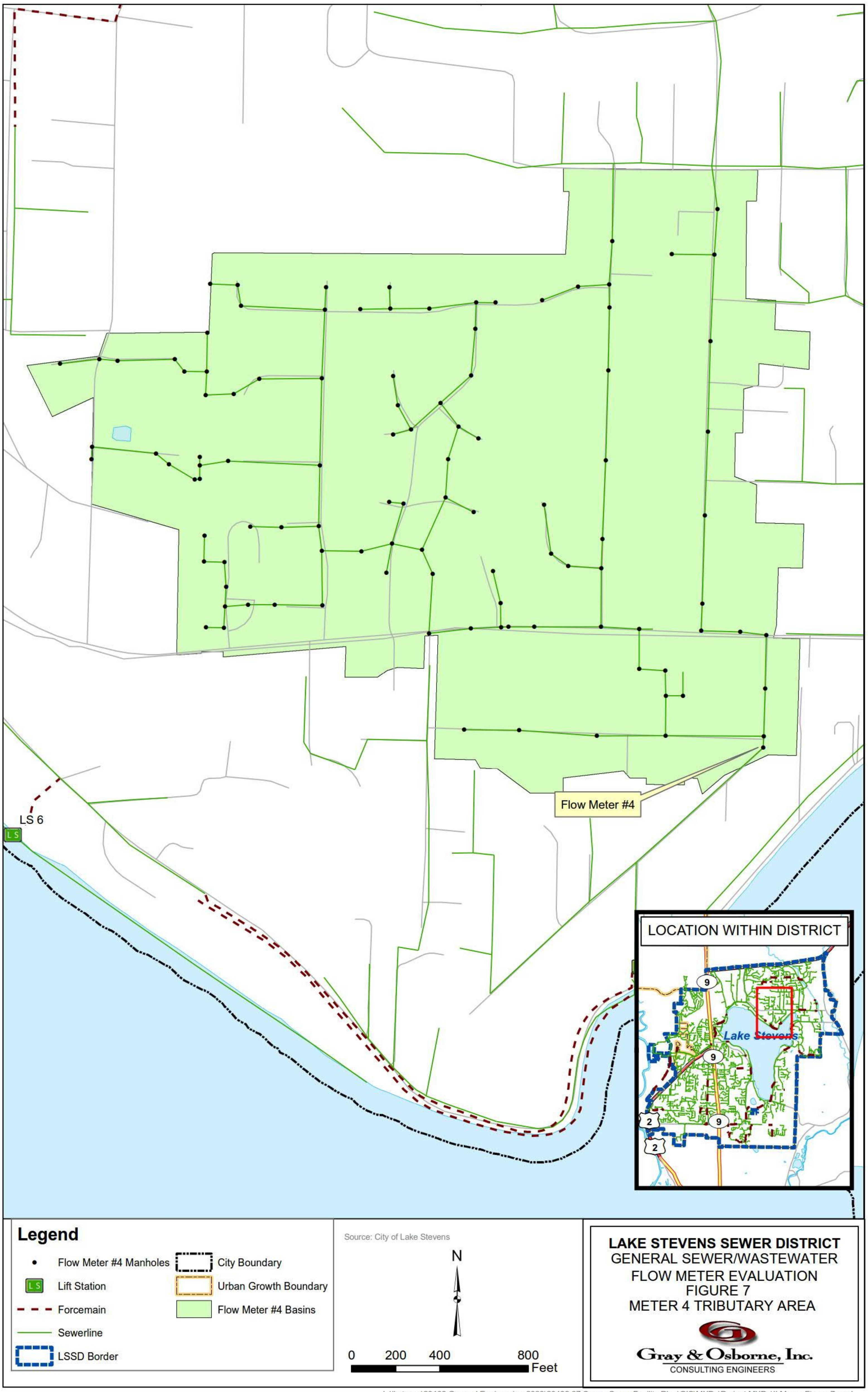

FIGURE D-7

Meter 4 Tributary Area

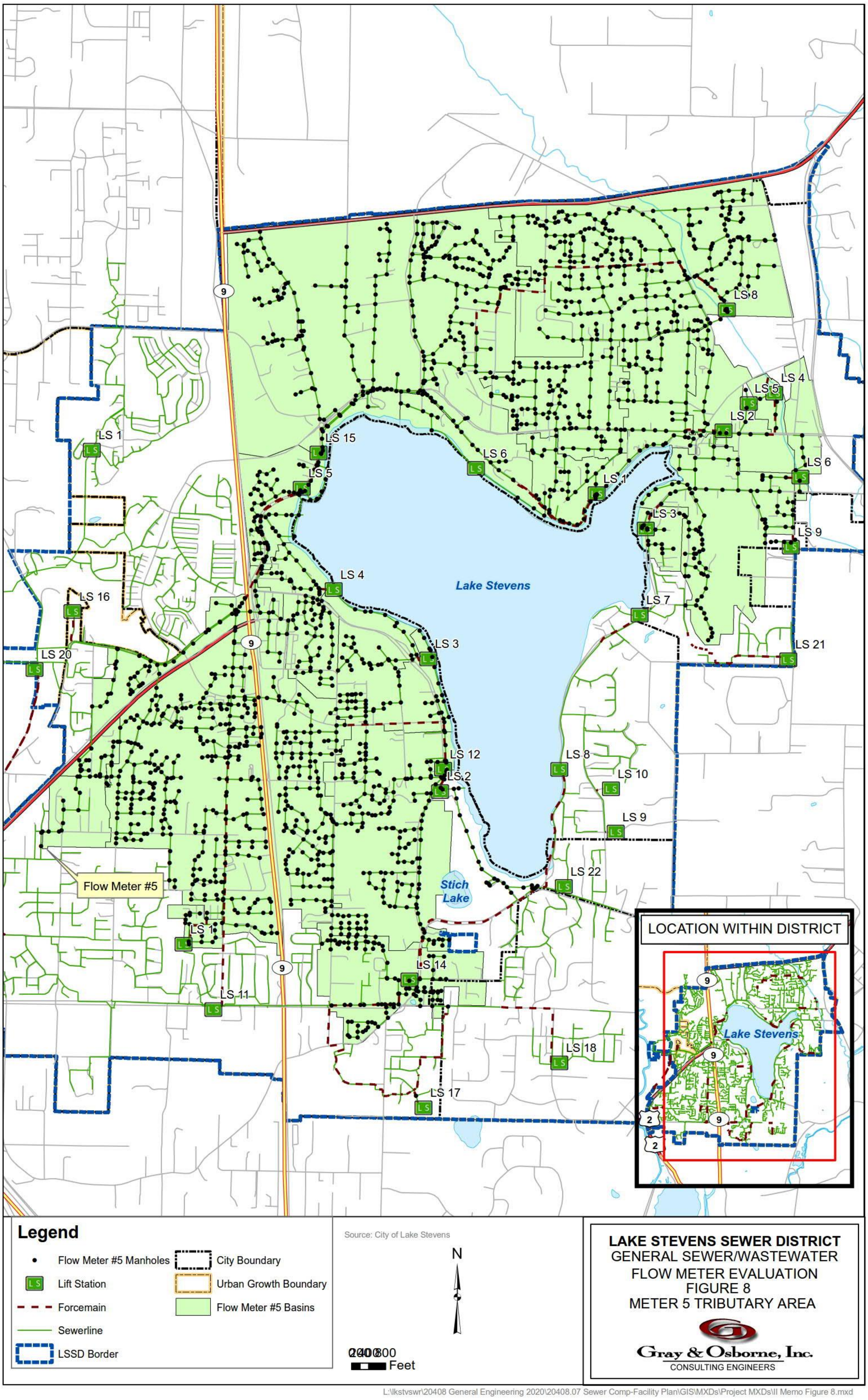

FIGURE D-8

Meter 5 Tributary Area

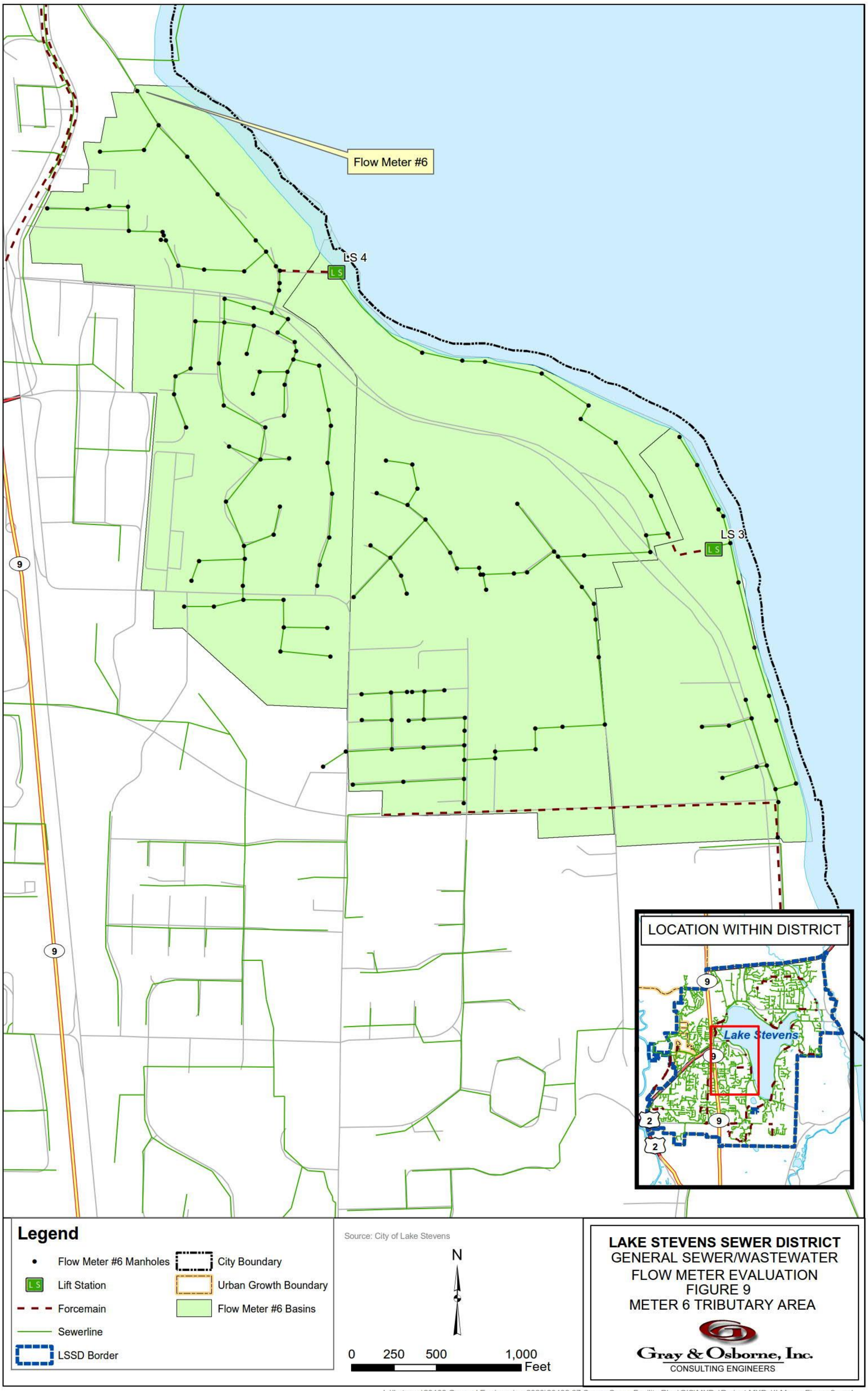

FIGURE D-9

Meter 6 Tributary Area

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FLOW MONITORING DATA

A comparison of the daily flow meter data with total daily rainfall (Figure D-10) shows that the sewer flows are strongly influenced by rainfall. Figure D-11 shows the flow meter data collected during the monitoring period using 5-minute intervals.

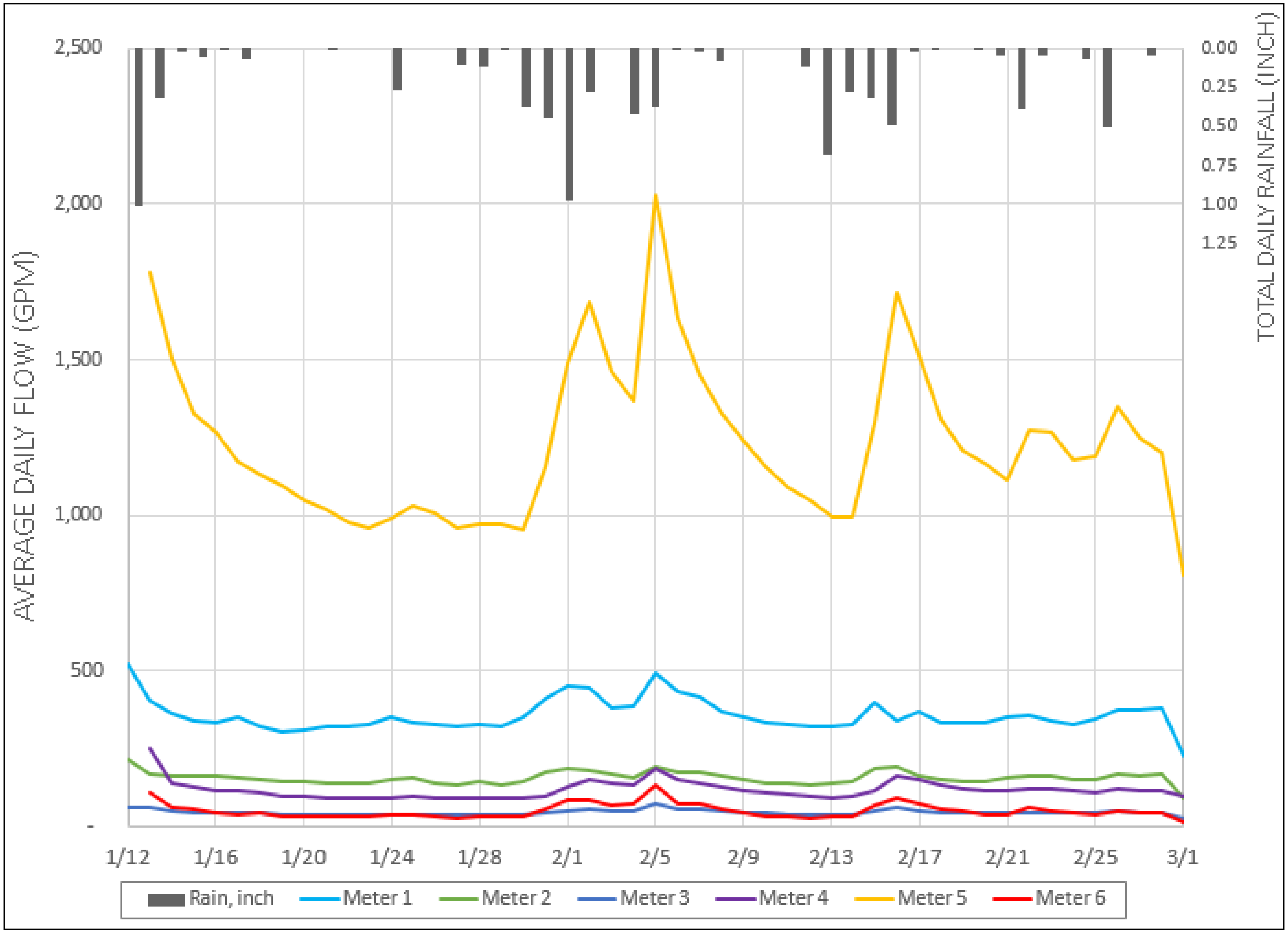

FIGURE D-10

Daily Metered Flow Data vs. Rainfall

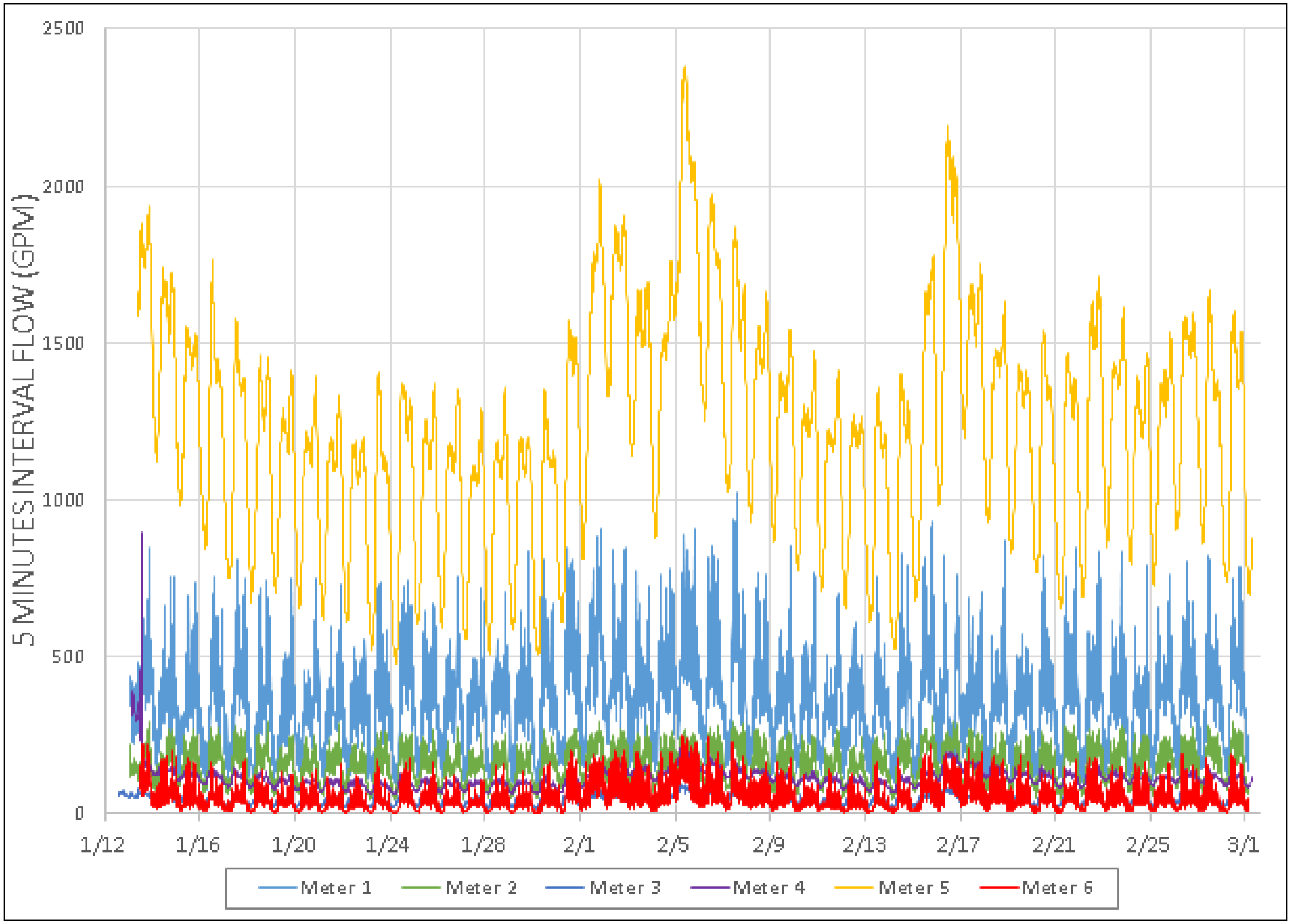

FIGURE D-11

Metered Flow Data (5-Minute Intervals)

In order to approximate the amount of I/I generated within the tributary area, flow monitoring should capture periods of dry and wet weather. Table D-2 lists the wet and dry weather flows measured during the flow monitoring period as well as the ratio of the maximum recorded flow to dry weather flow. The ratio demonstrates the level of I/I each generated within each tributary area during a peak storm event. It should be noted that the “dry” flows were measured over a period of 5 days within the wet season, and that the flow metering occurred during the time of year when groundwater may potentially be at a high level, which may result in higher flows than would be present in the summer.

Since Meter 1 is located downstream of Meter 2, the area in between was identified as an individual tributary area labeled as “1A.” The corresponding flow for this area was obtained by subtracting Meter 2 flow from Meter 1 flow.

The same method was applied to Meter 5. Since Meter 5 is located downstream of Meters 3, 4 and 6, the area in between was identified as an individual tributary area labeled as the as “5A.” The corresponding flow for this area was obtained by subtracting Meters 3, 4 and 6 flows from Meter 5 flow.

As indicated in Table D-2, the level of I/I varies substantially from area to area. The maximum to dry weather flow ratio reveals that the Meter 4 tributary area produced extremely high I/I flow during storm events. The data also indicates significant I/I in the Meter 6 tributary area.

TABLE D-2

Flow Monitoring Data Summary

Metered Area	Avg. Dry Day(3) (gpm)	Inst. Max.(4) (gpm)	Max. Daily (gpm)	Ratio Inst. Max/Dry Weather	Ratio Max Day/Dry Weather
1	322	1025	522	3.18	1.62
1A(1)	178	710	309	3.99	1.74
2	145	315	213	2.18	1.47
3	40	93	73	2.34	1.84
4	98	894	249	9.13	2.54
5	1058	2382	2029	2.25	1.92
5A(2)	886	1145	1576	1.29	1.78
6	34	250	132	7.37	3.87

(1) Metering “1A” area represents the monitoring area between the Meter 1 and Meter 2 areas.

(2) Metering “5A” area represents the monitoring area between the Meter 5 and Meter 3, 4 and 6 areas.

(3) Average dry day flow is the average daily flow during the dry week of 1/17 – 1/23, 2021.

(4) Instantaneous maximum flow is the highest 5-minute interval flow during the monitoring period.

The collected data was further evaluated to quantify the I/I in each metering area during each storm event. A separation of infiltration flow and inflow is not provided in this section since the flow monitoring period covers only the wet season and no true dry weather flow data were therefore available to identify the infiltration flow separately. Table D-3 summarizes the peak day flows for the five largest storm events during the monitoring period. For the area 1A, the peak flow was determined by subtracting the peak flow at Meter 2 from the peak flow at Meter 1 during the event. For the area 5A, the peak flow was determined by subtracting the peak flows at Meters 3, 4 and 6 was used as the peak flow.

TABLE D-3

Peak Flow Summary for the Flow Monitoring Period (2021)

Storm Events	**Jan. 12-14**	**Jan. 31-Feb. 1**	**Feb. 4-5**	**Feb. 12-13**	**Feb. 14-16**
Duration (hr)	28	38	25	23	47
Duration (days)	1.2	1.6	1.0	1.0	2.0
Total Precipitation (inches)	1.32	1.38	0.78	0.80	1.09
Metered Area	**Peak Day Flow (gpd)**				
1	751,000	649,000	712,000	462,000	577,000
1A(1)	444,000	380,000	435,000	270,000	310,000
2	307,000	270,000	276,000	202,000	278,000
3	92,000	72,000	105,000	57,000	87,000
4	358,000	185,000	263,000	143,000	233,000
5	2,562,000	2,142,000	2,921,000	1,510,000	2,472,000
5A(2)	1,963,000	1,758,000	2,364,000	1,270,000	2,022,000
6	155,000	127,000	189,000	46,000	130,000

(1) Metered Area "1A" represents the monitoring area between the Meter 1 and Meter 2 areas.
(2) Metered Area "5A" represents the monitoring area between the Meter 1 and Meters 3, 4 and 6 areas.

The values in Tables D-4 and D-5 help identify the portion of I/I that comes from different regions in the District for both the peak day and peak hour events. Flow monitoring data for the January 12 – 13 storm event, which had the highest precipitation during the monitoring period, was used to determine the peak I/I rate for all metered areas. It should be noted that the peak flows within each basin during the monitoring period did not all occur during the same storm event. However, the January 12 – 13 storm event resulted in high flows in each basin and is considered a representative event for the peak I/I condition.

Since flow varies with the size of the basin, a normalized I/I rates for each of the basins were calculated by dividing the peak day I/I flow in gpm by the basin area in acres. These normalized I/I rates allow the comparison of I/I amongst the different sized basins. For each meter, the type of zoning of the tributary area and ages of the collection system pipes were identified. The average year of pipe installation is listed.

TABLE D-4

Flow Monitoring Peak Day I/I Evaluation

Metered Area	Peak Day Flow (gpd)[5]	Dry Weather Flow (gpd)	Peak Day I/I (gpd)	I/I Percent of Peak Day Flow	Percent of Total I/I Flow[3]	Metered Area (acre)	Percent of Total Metered Area[3]	Peak Day Unit I/I (gpad)	Land Use Within of Tributary Area	Average Year of Pipe Installation[4]
1	751,000	464,000	287,000	38%		633		454	96 percent residential, 4 percent public and commercial	1998
1A[1]	444,000	256,000	189,000	42%	14%	493	16%	383	96 percent residential, 4 percent public and commercial	1996
2	307,000	208,000	99,000	32%	7%	140	5%	704	94 percent residential, 6 percent public and commercial	2008
3	92,000	57,000	35,000	38%	3%	162	5%	214	89 percent residential; 11 percent public, commercial and industrial	1989
4	358,000	141,000	217,000	61%	16%	133	4%	1,634	100 percent residential	1980
5	2,562,000	1,523,000	1,039,000	41%		2,424		429	81 percent residential; 19 percent public, commercial and industrial	1991
5A[2]	1,963,000	1,276,000	687,000	35%	52%	1,963	64%	350	79 percent residential; 21 percent public, commercial and industrial	1991
6	155,000	49,000	106,000	69%	8%	166	5%	641	92 percent residential, 8 percent public and commercial	1991
Sum[3]	3,320,000	1,987,000	1,332,000		100%	3,056	100%			
Minimum[3]				32%				214		
Maximum[3]				69%				1,634		
Average[3]				46%				654		

(1) Metered Area “1A” represents the monitoring area between the Meter 1 and Meter 2 areas.
(2) Metered Area “5A” represents the monitoring area between the Meter 5 and Meters 3, 4 and 6 areas.
(3) Meter 1 and 5 data excluded to avoid double counting since Area “1A” includes the Meter 1 region and Area “5A” includes the Meter 5 region.
(4) The year of piping was calculated as a weighted average year based on sewer area.
(5) Based on flows during the January 12-13, 2021 storm event.

TABLE D-5

Flow Monitoring Peak Hour I/I Evaluation

Metered Area	Peak Hour Flow (gpd)[5]	Dry Weather Flow (gpd)	Peak Hour I/I (gpd)	I/I Percent of Peak Hour Flow	Percent of Total I/I Flow[3]	Metered Area (acre)	Percent of Total Metered Area[3]	Peak Hour Unit I/I (gpad)	Land Use Within Tributary Area	Weighted Average Year of Piping Installed[4]
1	960,000	464,000	496,000	52%		633		783	96 percent residential, 4 percent public and commercial	1998
1A[1]	601,000	256,000	345,000	57%	16%	493	16%	701	96 percent residential, 4 percent public and commercial	1996
2	382,000	208,000	174,000	46%	8%	140	5%	1,242	94 percent residential, 6 percent public and commercial	2008
3	99,000	57,000	42,000	42%	2%	162	5%	258	89 percent residential; 11 percent public, commercial and industrial	1989
4	631,000	141,000	490,000	78%	22%	133	4%	3,690	100 percent residential	1980
5	2,765,000	1,523,000	1,242,000	45%		2,424		512	81 percent residential; 19 percent public, commercial and industrial	1991
5A[2]	2,250,000	1,276,000	974,000	43%	45%	1,963	64%	496	79 percent residential; 21 percent public, commercial and industrial	1991
6	202,000	49,000	153,000	76%	7%	166	5%	921	92 percent residential, 8 percent public and commercial	1991
Sum[3]	4,164,000	1,987,000	2,177,000		100%	3,056	100%			
Minimum[3]				42%				258		
Maximum[3]				78%				3,690		
Average[3]				57%				1,218		

(1) Metered "1A" represents the monitoring area between the Meter 1 and Meter 2 areas.
(2) Metered "5A" represents the monitoring area between the Meter 5 and Meter 3, 4 and 6 areas.
(3) Meter 1 and 5 data excluded to avoid double counting since the "1A" area includes the Meter 1 region., "5A" area includes the Meter 5 region..
(4) The year of piping was calculated as weighted year based on sewer area.
(5) Based on flows during the January 12-13, 2021 storm event.

FLOW MONITORING CONCLUSIONS

Figures D-12 and D-13 compare the distribution of peak day and peak hour I/I amongst each metered area. Figure D-14 graphically compares each metered region by basin size, while Figure D-15 compares the unit I/I rate amongst the basins. Likewise, Figure D-16 demonstrates the proportion of the peak day and peak hour flows that is attributable to I/I rather than sewage flow within each metered basin. The data portrays the flow response in each area during storm events. The Meter 1 area was not included in charts as it was replaced by two separate meter areas: "1A" and 2, the combination of which form the Meter 1 area. Similarly, the Meter 5 area was not included as it was replaced by four separate meter areas: "5A, 3, 4 and 6, the combination of which form the meter 5 area.

- As shown in Figure D-12 and Figure D-13, Meter Area 5A (representing Basin B1, B3, B6, B7, C1, D1, D2 north, D5, D9, E1 south, E2 south and E3) and Meter Area 4 (representing the north portion of Basins E1) generated the highest and second highest volumes of I/I, respectively.

- As shown in Figures D-12, D-13 and D-14, Meter Area 4 generates a disproportionate amount of I/I - 16 percent of the total peak day I/I and 22 percent of the peak hour I/I from a region that is only 4 percent of the total metered area. The same conclusion can be made for Meter Area 2 (representing Basins C2 and C3), which contributes 7 percent of the total peak day I/I and 8 percent of the peak hour I/I with only 5 percent of the total metered area being represented. Similarly, Meter Area 6 (representing Basins D3, D4 and south portion of Basin D2) contributes 8 percent of the total peak day I/I and 7 percent of the peak hour I/I with only 5 percent of the total metered area being represented.

- As shown in Figure D-15, Meter Areas 4 and 2 have the highest peak day and peak hour unit I/I rates.

- As shown in Figure D-16, Meter Areas 4 and 6 have the highest I/I to peak flow ratios.

- Overall, Meter Areas 4 has the highest I/I among all the areas that were metered, which is probably related to the aged piping in that area.

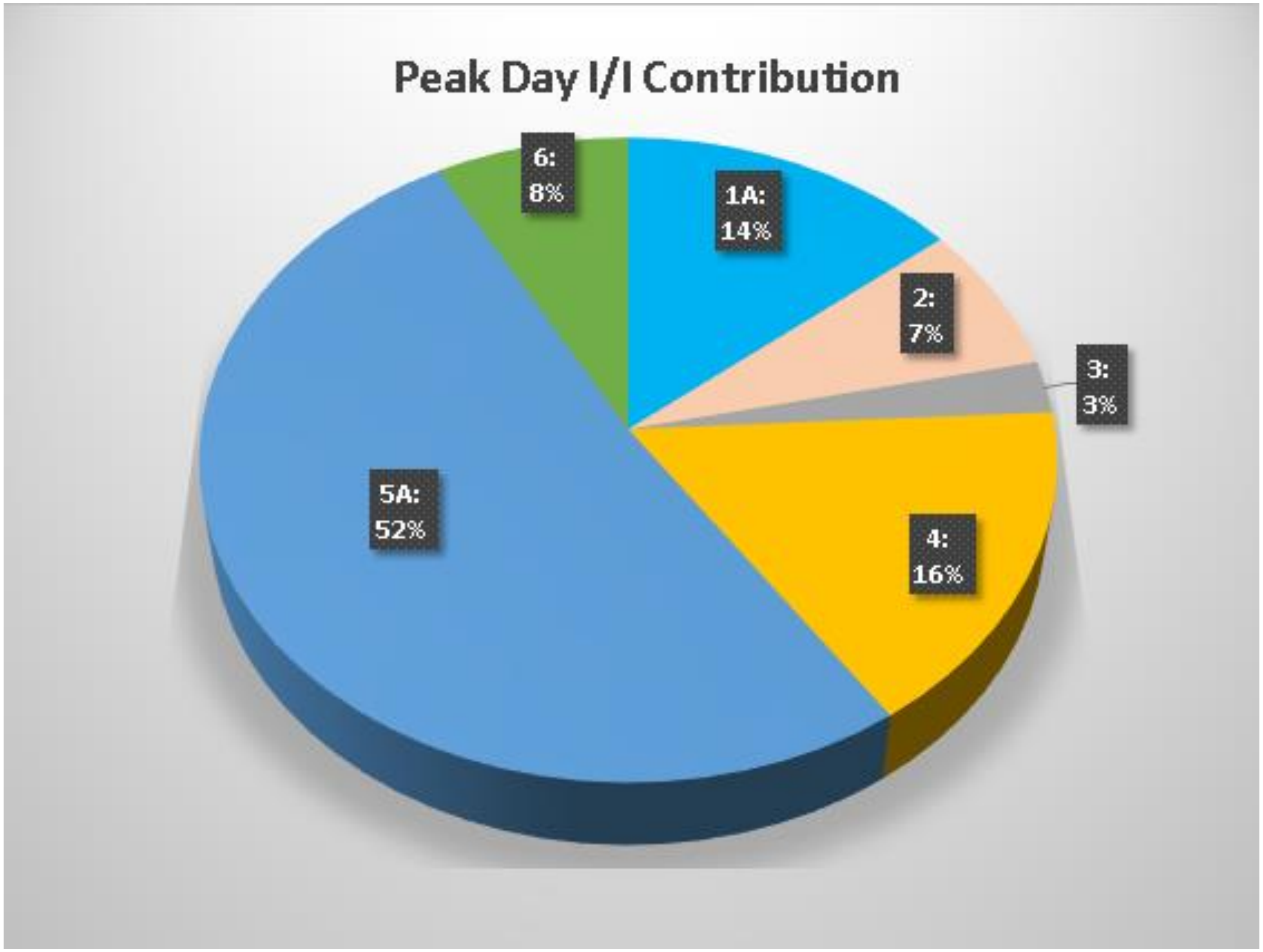

FIGURE D-12

Percent of Total Metered Area I/I Flow by Subbasin – Peak Day

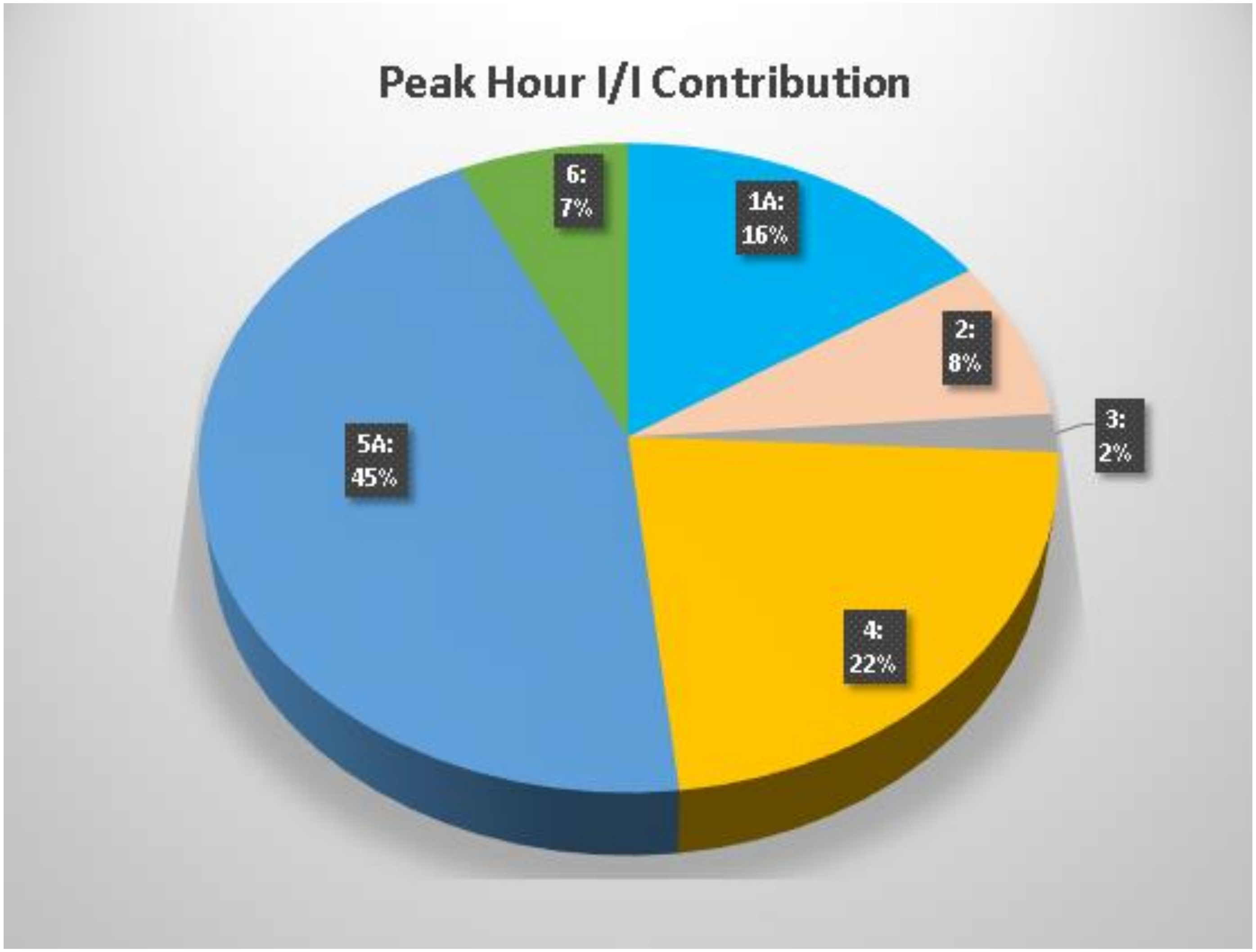

FIGURE D-13

Percent of Total Metered Area I/I Flow by Subbasin – Peak Hour

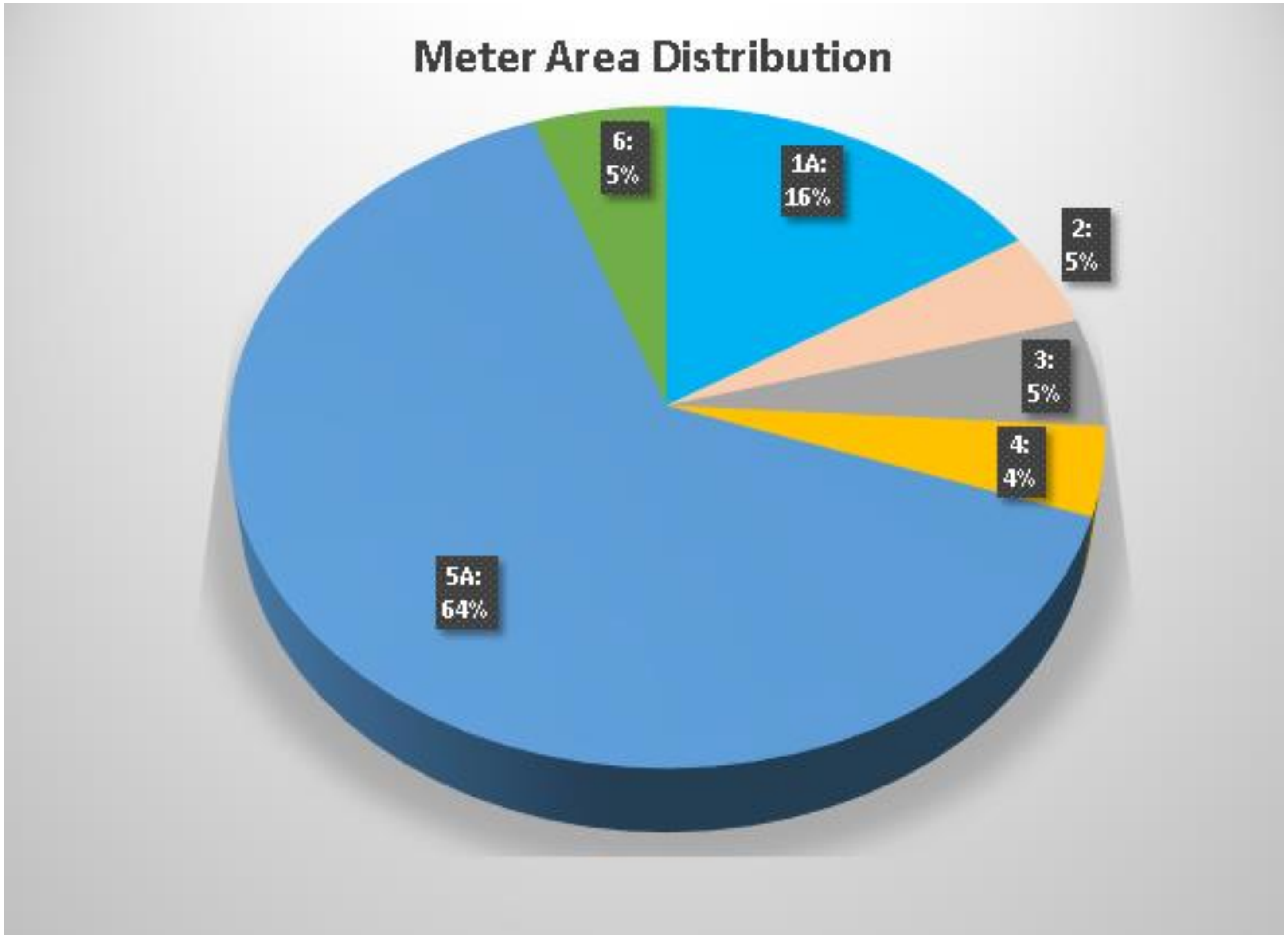

FIGURE D-14

Percent of Total Metered Area by Subbasin

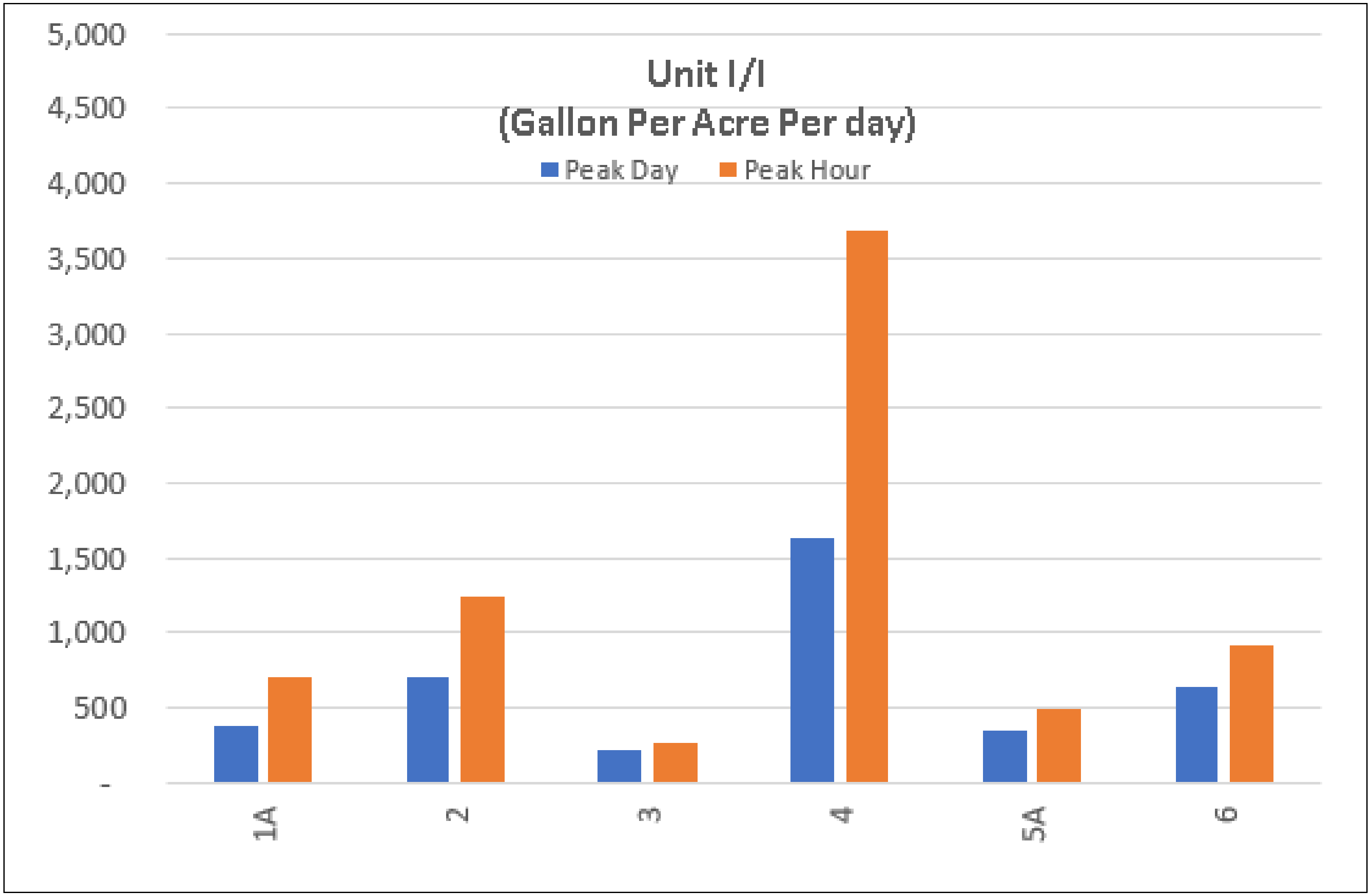

FIGURE D-15

Unit I/I Rate for Metered Areas

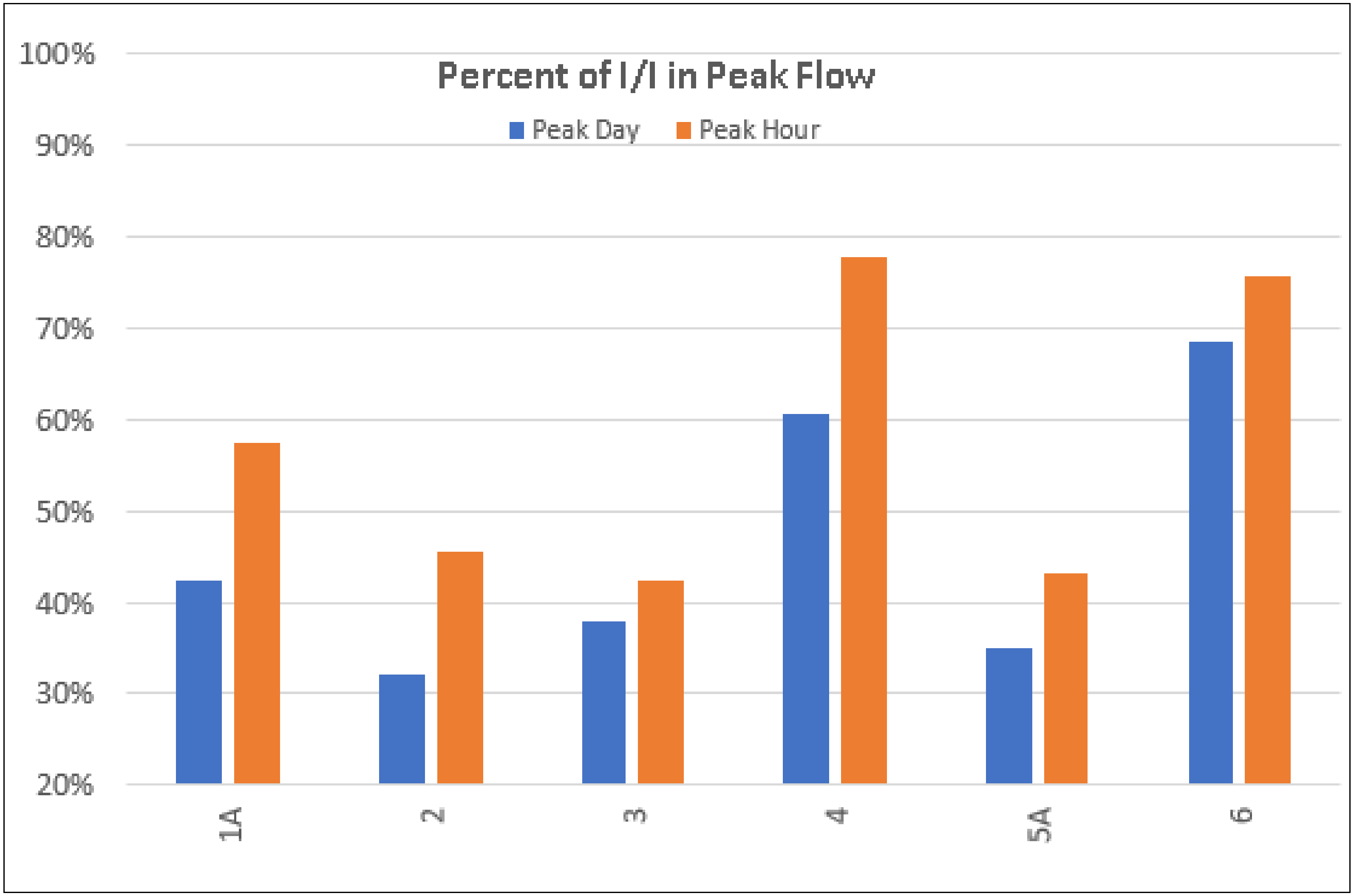

FIGURE D-16

Percent of Peak flow Attributable to I/I for Metered Areas

FLOW DATA ANALYSIS – OTHER STORM EVENTS

The flow distribution recorded for the three largest storm events that occurred during the monitoring period, 1/12/2021, 2/4/2021 and 2/15/2021, are summarized in Table 6. The wet weather and I/I flow distribution are relatively consistent among the areas during each event.

TABLE D-6

Peak Day Flow and I/I Allocation in Basins

Basin	1/12/2021				2/4/2021				2/15/2021			
	Peak Day WW Flow		Peak Day I/I		Peak Day WW Flow		Peak Day I/I		Peak Day WW Flow		Peak Day I/I	
	(mgd)	% of Total	(mgd)	% of Total	(mgd)	% of Total	(mgd)	% of Total	(mgd)	% of Total	(mgd)	% of Total
1A(1)	0.44	13%	0.19	14%	0.44	12%	0.18	11%	0.31	10%	0.05	5%
2	0.31	9%	0.10	7%	0.28	8%	0.07	4%	0.28	9%	0.07	6%
3	0.09	3%	0.03	3%	0.10	3%	0.05	3%	0.09	3%	0.03	3%
4	0.36	11%	0.22	16%	0.26	7%	0.12	7%	0.23	8%	0.09	9%
5A(2)	1.96	59%	0.69	52%	2.36	65%	1.09	66%	2.02	66%	0.75	70%
6	0.16	5%	0.11	8%	0.19	5%	0.14	9%	0.13	4%	0.08	8%
Sum	**3.32**	**100%**	**1.33**	**100%**	**3.63**	**100%**	**1.65**	**100%**	**3.06**	**100%**	**1.07**	**100%**

(1) Metered "1A" represents the monitoring area between the Meter 1 and Meter 2 areas.
(2) Metered "5A" represents the monitoring area between the Meter 5 and Meter 3, 4 and 6 areas.

APPENDIX A

FLOW METER CALIBRATION CERTIFICATES

Bainbridge
Associates, LLC

Flow Meter Calibration Certificate

Project name:	Lake Stevens Sewer District	**Date:** 1/12/2021

Manhole Name: **Meter 1 MH3358**
Street Address/Location: **83rd Ave SE X 20th Street SE**
GPS: __________ __________ MEID: **356610074157104**

Pipe Shape: **Circular** Pipe material: **Ductile** Pipe I.D.: **25"** Sensor 1 Offset: **30.5**

Antenna in: 8624300 Traffic Sensor S/N: **150100519105** Logger S/N: **141200000126 DDS**
Bainbridge Account: **Lnelson/HachWebData**
Manhole Depth: **~ 20 '** Condition of Manhole: **clean** Evidence of Surcharge: **None**

METER CALIBRATION

Rain Gauge Cal.

# of manual tips: N/A
Quantity recorded: N/A

Vmax:
Vmax x .90:

Prev. #1 Multiplier: 1.0
New #1 Multiplier: 1.0

Prev. #1 Level cal
New #1 level Cal:

	Level	Velocity
Measured	2.0	7.92
Meter	1.17	7.94 fps
Measured		
Meter		
Measured		
Meter		
Measured		
Meter		

Final Depth: 2,.0
Final Velocity: 7.92

Profile Start time:
Profile Time End:

Notes:
Right turn ~ 100 deg, clean fast flow down 12.9deg slope, 3" water flow during install, 25" ID pipe measured, Revisited with Ken Navidi.

Site Pictures



Controls for the Process Industry * Manufacturers Representatives

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Bainbridge
Associates, LLC

Flow Meter Calibration Certificate

Project name: **Lake Stevens Sewer District** **Date:** 1/12/2021

Manhole Name: **Meter 2 MH3198**
Street Address/Location: **2626 105th Ave SE**
GPS: __________ __________ MEID: **351862109965150**

Pipe Shape: **Circular** Pipe material: **PVC** Pipe I.D.: **8”** Sensor 1 Offset: **15.5**

Antenna in: **8624300 Traffic** Sensor S/N: **110400397710** Logger S/N: **141200000143 DDS**
Bainbridge Account: **Lnelson/HachWebData**
Manhole Depth: **~ 20 ‘** Condition of Manhole: **clean** Evidence of Surcharge: **None**

METER CALIBRATION

Rain Gauge Cal.

# of manual tips: N/A
Quantity recorded: N/A

Vmax:
Vmax x .90:

Prev. #1 Multiplier:
New #1 Multiplier: 1.0

Prev. #1 Level cal
New #1 level Cal: 0.49

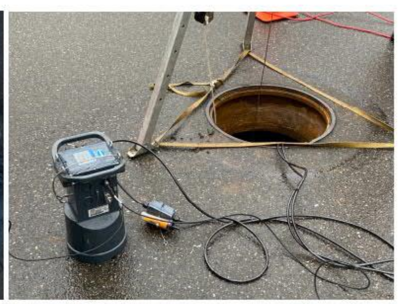
	Level	Velocity
Measured	1.5	7.15
Meter	2.0	7.76
Measured		
Meter		
Measured		
Meter		
Measured		
Meter		

Final Depth: 2.0
Final Velocity: 7.76

Profile Start time:
Profile Time End:

Notes:
Straight, clean fast flow down 5 deg slope, 8” ID pipe measured, new neighborhood

Site Pictures

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Bainbridge Associates, LLC

Flow Meter Calibration Certificate

Project name:	Lake Stevens Sewer District	**Date:** 1/12/2021

Manhole Name: **Meter 3 MH C1**
Street Address/Location: **1905 125th Ave NE**
GPS: ___________ ___________ MEID: **356610074157104**

Pipe Shape: **Circular** Pipe material: **Cast Iron** Pipe I.D.: **10"** Sensor 1 Offset: **16"**

Antenna in: **8624300 Traffic** Sensor S/N: **160100540449** Logger S/N: **150200000312 DDS**
Bainbridge Account: **Lnelson/HachWebData**

Manhole Depth: **~ 8 '** Condition of Manhole: **FOG** Evidence of Surcharge: **Yes**

METER CALIBRATION

Rain Gauge Cal.

# of manual tips: N/A
Quantity recorded: N/A

Vmax:
Vmax x .90:

Prev. #1 Multiplier: 1.0
New #1 Multiplier: 0.5

Prev. #1 Level cal 0
New #1 level Cal: +.12

	Level	Velocity
Measured	2.0	1.5
Meter	1.88	3.21
Measured		
Meter		
Measured		
Meter		
Measured		
Meter		

Final Depth: 2.0
Final Velocity: 2.65

Profile Start time:
Profile Time End:

Notes:
Straight, nasty w FOG, surcharge evidence, medium flow flat slope, 2" water flow during install, 10" ID pipe measured, has a side drop pipe which may create some intermittent noise.

Site Pictures



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Bainbridge
Associates, LLC

Flow Meter Calibration Certificate

Project name:	Lake Stevens Sewer District	**Date:** 1/13/2021

Manhole Name: **Meter 4 MH-G4**
Street Address/Location: **~1715 Mitchell Road (aka 116th Drive NE)**
GPS: ___________ ___________ MEID: **351862102204524**

Pipe Shape: **Circular** Pipe material: **Concrete** Pipe I.D.: **9.5"** Sensor 1 Offset: **16.5"**

Antenna in: **8624300 Traffic** Sensor S/N: **1891000571291** Logger S/N: **150600000660 DDS**
Bainbridge Account: **Lnelson/HachWebData**

Manhole Depth: **15 '** Condition of Manhole: **Rusty Lid** Evidence of Surcharge: **Yes**

METER CALIBRATION

Rain Gauge Cal.

# of manual tips: N/A
Quantity recorded: N/A

Vmax:
Vmax x .90:

Prev. #1 Multiplier: 1.0
New #1 Multiplier: 1.0

Prev. #1 Level cal 0
New #1 level Cal: +0.26

	Level	Velocity
Measured	2.45	2.5 fps
Meter	3.0"	1.55 fps
Measured	3.0	3.8 fps
Meter	2.74	3.5
Measured		
Meter		
Measured		
Meter		

Final Depth: 2.45
Final Velocity: 3.63

Profile Start time: 12:45
Profile Time End: 1:15

Notes:
Surchage evidence, rust throughout, Slight 10 deg curve within MH, Smooth flow, medium speed.

Site Pictures



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BA LLC

Bainbridge
Associates, LLC

Flow Meter Calibration Certificate

Project name:	Lake Stevens Sewer District	**Date:** 1/13/2021

Manhole Name: **Meter 5 MH-3726**
Street Address/Location: **800 91st Ave SE**
GPS: __________ __________ MEID: **351862102174701**

Pipe Shape: **Circular** Pipe material: **PVC** Pipe I.D.: **34"** Sensor 1 Offset: **39"**

Antenna in: **8624300 Traffic** Sensor S/N: **130600475970** Logger S/N: **150200000339 DDS**
Bainbridge Account: **Lnelson/HachWebData**

Manhole Depth: **15 '** Condition of Manhole: **clean** Evidence of Surcharge: **None**

METER CALIBRATION

Rain Gauge Cal.

# of manual tips: N/A
Quantity recorded: N/A

Vmax:
Vmax x .90:

Prev. #1 Multiplier:
New #1 Multiplier:

Prev. #1 Level cal
New #1 level Cal: + 0.49

	Level	Velocity
Measured	8	3.06
Meter	7.51	2.6
Measured		
Meter		
Measured		
Meter		
Measured		
Meter		

Final Depth: 8"
Final Velocity: 3 fps

Profile Start time: 8am
Profile Time End: 10am

Notes:

New MH, good flow, last MH before WWTP North side of town, medium slope.

Site Pictures



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Bainbridge Associates, LLC

Flow Meter Calibration Certificate

Project name: Lake Stevens Sewer District **Date:** 1/13/2021

Manhole Name: **Meter 6 MH-42**
Street Address/Location: **800 91st Ave SE (Springbrook Rd & Vernon Rd)**
GPS: ___________ ___________ MEID: **351862102165535**

Pipe Shape: **Circular** Pipe material: **Concrete** Pipe I.D.: **9.5"** Sensor 1 Offset: **15.5**

Antenna in: **8624300 Traffic** Sensor S/N: **150700529516** Logger S/N: **150100000217** DDS
Bainbridge Account: Lnelson/HachWebData

Manhole Depth: **9'** Condition of Manhole: **Older** Evidence of Surcharge: **None**

METER CALIBRATION

Rain Gauge Cal.

# of manual tips: N/A
Quantity recorded: N/A

Vmax:
Vmax x .90:

Prev. #1 Multiplier: 1.0
New #1 Multiplier: 1.0

Prev. #1 Level cal 0
New #1 level Cal: -.15

	Level	Velocity
Measured	2.0	3.0
Meter	1.71	3.66
Measured	3.5	2.85
Meter	3.15	2.91
Measured	2.5	
Meter	2.03	
Measured		
Meter		

Final Depth: 3.7
Final Velocity: 2.77

Profile Start time: 10 am
Profile Time End: 12 am

Notes:

Site Pictures



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APPENDIX B

METERING DATA

Date	Meter 1, gpm			Meter 2, gpm			Meter 3, gpm			Meter 4, gpm			Meter 5, gpm			Meter 6, gpm		
	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow
1/12/2021	522	667	687	213	266	287	64	67	75									
1/13/2021	406	554	845	169	217	297	59	69	80	249	438	894	1,779	1,920	1,937	108	140	221
1/14/2021	365	540	758	162	218	269	51	63	69	138	151	154	1,500	1,712	1,739	61	114	201
1/15/2021	339	467	737	162	225	270	46	57	63	124	144	146	1,328	1,519	1,553	53	99	186
1/16/2021	334	546	755	161	218	277	43	60	68	116	142	146	1,270	1,705	1,765	44	92	168
1/17/2021	350	535	814	158	226	279	44	59	69	112	142	149	1,173	1,559	1,579	40	111	171
1/18/2021	320	485	743	152	213	297	41	58	67	107	128	134	1,128	1,431	1,464	41	82	144
1/19/2021	301	461	752	144	208	252	40	53	61	100	120	125	1,096	1,403	1,412	32	65	136
1/20/2021	312	471	752	141	190	250	39	53	62	95	110	115	1,050	1,363	1,395	33	69	144
1/21/2021	322	492	733	139	209	286	39	53	59	93	107	114	1,017	1,307	1,337	31	60	157
1/22/2021	324	454	555	137	180	225	37	49	55	89	109	110	977	1,179	1,198	29	53	125
1/23/2021	329	527	739	141	219	262	38	56	66	89	116	124	962	1,396	1,407	30	82	175
1/24/2021	352	603	744	148	231	260	39	56	68	92	120	127	990	1,360	1,373	39	114	176
1/25/2021	333	532	669	154	214	267	38	51	59	96	115	122	1,030	1,350	1,369	39	113	167
1/26/2021	325	508	755	137	194	274	37	49	58	91	109	119	1,008	1,336	1,355	34	67	123
1/27/2021	322	467	717	135	197	260	35	47	55	90	106	114	957	1,269	1,292	29	67	106
1/28/2021	329	497	706	146	208	260	36	47	55	91	109	116	974	1,300	1,359	32	72	158
1/29/2021	322	445	838	135	191	226	35	49	67	90	106	110	973	1,185	1,202	29	52	136
1/30/2021	351	568	837	145	215	269	36	50	60	90	117	123	953	1,322	1,350	34	64	166
1/31/2021	409	595	849	171	238	270	42	57	67	100	127	136	1,153	1,539	1,573	54	127	204
2/1/2021	451	694	911	187	263	296	50	71	82	128	156	160	1,487	1,985	2,023	88	151	191
2/2/2021	443	585	849	180	241	273	57	70	77	148	159	172	1,685	1,880	1,904	87	156	206
2/3/2021	380	567	775	166	225	284	48	56	70	138	152	161	1,462	1,685	1,696	66	136	198
2/4/2021	389	560	783	159	234	264	48	67	77	131	154	159	1,365	1,737	1,759	73	158	196
2/5/2021	494	631	908	192	237	268	73	86	93	183	212	215	2,029	2,362	2,382	132	187	250
2/6/2021	433	603	852	175	233	281	58	76	80	151	177	183	1,632	1,949	1,974	72	145	244
2/7/2021	419	679	1,025	172	279	294	54	74	78	138	166	183	1,449	1,832	1,868	72	147	225
2/8/2021	371	578	771	162	219	272	47	59	74	128	144	153	1,329	1,624	1,663	55	108	168
2/9/2021	354	517	857	148	218	266	43	56	70	117	132	139	1,240	1,526	1,543	46	104	181
2/10/2021	336	492	767	141	203	251	42	53	65	110	131	138	1,155	1,463	1,476	34	58	125
2/11/2021	326	537	701	141	223	269	40	49	57	103	122	128	1,087	1,385	1,414	31	58	141
2/12/2021	319	455	613	132	189	243	40	51	58	99	115	122	1,049	1,258	1,277	28	57	129
2/13/2021	321	505	756	141	193	258	38	54	59	94	120	128	997	1,313	1,357	32	85	169
2/14/2021	329	529	827	145	209	271	40	55	65	97	123	129	994	1,379	1,399	33	80	178
2/15/2021	401	652	930	186	282	315	47	66	78	115	138	145	1,295	1,761	1,779	68	175	222
2/16/2021	339	599	826	193	248	297	61	81	88	162	193	198	1,716	2,160	2,191	90	144	192
2/17/2021	369	520	709	163	210	272	52	60	65	152	165	173	1,514	1,732	1,755	74	141	207
2/18/2021	335	555	871	151	217	262	46	56	66	134	150	157	1,310	1,591	1,631	56	121	185
2/19/2021	331	435	575	145	203	254	42	51	60	121	134	146	1,206	1,407	1,430	47	95	191
2/20/2021	336	505	824	146	204	264	41	59	64	115	143	153	1,166	1,521	1,539	37	71	142
2/21/2021	351	534	847	158	227	280	42	56	63	112	132	145	1,111	1,456	1,471	38	75	173
2/22/2021	359	564	837	160	250	272	46	59	66	119	143	153	1,273	1,676	1,711	60	142	181
2/23/2021	340	513	838	162	236	285	45	57	65	120	137	143	1,269	1,580	1,614	49	89	156
2/24/2021	328	498	793	153	204	255	43	55	63	114	133	141	1,176	1,448	1,467	45	97	164
2/25/2021	346	516	763	152	231	248	42	55	64	111	135	141	1,190	1,508	1,533	40	74	161

Date	Meter 1, gpm			Meter 2, gpm			Meter 3, gpm			Meter 4, gpm			Meter 5, gpm			Meter 6, gpm		
	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow	Average Daily Flow	Peak Hour Flow	Instantaneous Peak Flow
2/26/2021	373	511	803	166	207	276	47	59	71	121	139	147	1,347	1,571	1,594	48	151	191
2/27/2021	372	604	826	161	242	280	44	63	69	117	146	155	1,249	1,636	1,667	44	96	180
2/28/2021	383	583	788	167	250	296	43	60	76	114	140	148	1,204	1,579	1,605	46	112	189
3/1/2021	226	289	339	89	130	130	27	28	39	96	112	115	805	876	1,045	16	22	48
Min	***226***	***289***	***339***	***89***	***130***	***130***	***27***	***28***	***39***	***89***	***106***	***110***	***805***	***876***	***1,045***	***16***	***22***	***48***
Avg	***358***	***535***	***774***	***156***	***220***	***268***	***45***	***58***	***67***	***117***	***142***	***158***	***1,232***	***1,542***	***1,571***	***50***	***102***	***172***
Max	***522***	***694***	***1,025***	***213***	***282***	***315***	***73***	***86***	***93***	***249***	***438***	***894***	***2,029***	***2,362***	***2,382***	***132***	***187***	***250***

APPENDIX E

LIFT STATION CONDITION ASSESSMENT

CHS ENGINEERS

MEMORANDUM

To: Michael Bowers and Johnathan Dix
Lake Stevens Sewer District

From: Rodney Langer, P.E., CHS Engineers, LLC

Date: March 14, 2016

Subject: **Lift Station Condition Assessment**

RODNEY C. LANGER JR. STATE OF WASHINGTON 30046 REGISTERED PROFESSIONAL ENGINEER 3-14-16

This memo summarizes the evaluation of the District's wastewater lift stations, with a focus on general condition and consistency among stations, and consideration of flow metering and telemetry system upgrades. This evaluation was supported by Bob Casne, P.E., electrical engineer with RJC Engineering, PLLC, and Johnathan Dix. We relied on site visits to 11 stations to investigate representative configurations and conditions.

The objective of this assessment is to develop a general scope and priority of recommended improvements for lift station rehabilitation and corresponding budget, to support development of the Comprehensive Sewer Plan (CSP) and future capital improvement plan budgeting by the District.

A more detailed pre-design evaluation is recommended prior to work at each station, in order to more specifically identify the appropriate work and to prepare a more detailed estimate of construction and project cost.

This memo addresses "rehabilitation" (i.e. replacement of existing equipment and systems with current technology equipment and reconditioning of station facilities, without increase in pumping capacity) as independent from "upgrade" work (i.e. increased station capacity). The CSP includes recommendations for future capacity upgrades to several stations. The cost and impact of those capacity upgrades are not considered in this evaluation. Some stations should be rehabilitated prior to the need for more capacity and at some locations the upgrade and rehabilitation can be completed together. The need for additional or reduced capacity should be considered at the time of station rehabilitation.

General

The District owns and operates 29 lift stations (LS). These are numbered 1-21 (always District stations) and 1C-9C (originally City of Lake Stevens stations and transferred to the District in 2005). LS 13 has been eliminated by completion of a gravity connection to the Vernon Road Diversion sewer trunk. A third of the stations are located in the northeast quadrant[1] of the sewer service area, around the original incorporated area of the City. The next highest concentration is in the southwest quadrant, the largest quadrant geographically.

Thirteen of the stations are configured as wet well/dry well type of stations and 11 are wet well mounted vacuum prime type stations. Five stations are submersible and two of those are equipped with grinder pumps rather than solids handling pumps.

"Capacity" is the total flow capacity with one pump (largest pump) out of service. Most stations are duplex stations with equal capacity pumps. The stations range in capacity from 30 gpm to 5,250 gpm. Three have capacity for more than 1,000 gpm, seven are between 401 and 1,000 gpm, 13 are between 131 and 400 gpm and six are 131 gpm or lower.

Five stations are not equipped with a standby power generator and these stations are among the six lowest capacity stations. LS 5C is the largest station without standby power, at 200 gpm.

The oldest station was constructed in 1969 and the most recent was completed in 2012. Although some capacity upgrades and some specific equipment at each station has been replaced or added, with the exception of LS 1C the stations have not been comprehensively rehabilitated since time of installation. As of the end of 2015, six of the stations are less than 10 years old, six are between 11 and 20 years old and the remaining 17 are more than 30 years old.

LS 1, 9, 10, 18, 5C and 7C are designated as temporary stations. LS 1, 5C, 7C and 18 can be eventually eliminated by gravity connection to existing or future downstream piping. LS 9 and 10 will be removed and replaced by a future station further down the hill with future development. No recommendations for condition-based capital improvements are recommended for these temporary stations, except for telemetry system upgrades. Equipment maintenance and replacement is anticipated to be completed under the District's annual operation and maintenance budget, as needed for continued reliable service.

Additional details for each station are presented in Table 5-2 of the CSP and in the attached condition summary table. A general "categories" table (age, capacity, horsepower, etc.) is also attached. The relationship of each station with respect to its discharge to downstream stations and the WWTF is presented in Figure 5-3 of the CSP.

Flow Metering

The District is able to measure collection system flows at the WWTF headworks structure and by force main flow meters at eight stations: 5, 8, 12, 15, 17, 20, 1C, and

[1] Based on quadrants with a center point in the center of Lake Stevens.

8C. Additional flow metering capacity is desirable at other locations in the collection and conveyance system, to support ongoing evaluation of inflow and infiltration (I/I) throughout the collection system.

A flow meter is proposed for inclusion on the discharge from LS 2C when it is upgraded and routed past the influent line to LS 1C.

Other locations where permanent flow metering should be considered are on the discharge from stations 4, 11, 14 and 19. This would complete a metering system for all the significant pumped inflows in the collection system, as presently configured and as planned (for existing stations) in the future.

Addition of flow metering to any station would likely require addition of a vault and piping modification for installation of the flow metering tube and related electrical and instrumentation work, as well as site work and restoration. CHS recommends an alternative approach, foregoing the cost of meter and vault installation, as described below.

<u>Telemetry System</u>
The District relies on three telemetry systems for monitoring and communication of status and alarm conditions in the system of lift stations. LS 9 has no remote monitoring system. Eight of the nine “City” stations are served by one obsolete system and 13 stations are monitored by another obsolete system. Seven stations are monitored by a newer, internet based system with cell communications. The latter system is functional but limited in its monitoring capability. One or both obsolete systems rely on leased telephone line service for communication.

The District desires a comprehensive replacement telemetry system of current technology.

As part of this condition assessment, the District and CHS team reviewed two internet-based systems: Mission Communications and Aquavx by Antx, Inc. Each system requires a local RTU monitor to receive status inputs from the station power and instrumentation system. Data is collected and transmitted via cell communication to a web-based centralized monitoring system, external to the District. With internet access, the District operators can log in to the web based monitoring system and assess conditions at each connected station. Each system can accept analog and digital inputs and can be configured for automatic notifications via phone, email, and/or text to designated operators. Status and alarm reports can be generated and filed electronically.

Each station monitoring system can be configured to estimate time-based flow rates and volumes, based on analog or digital inputs. An analog input of the wet well level, for a constant horizontal cross section, can be used for calculating inflows and pumping rates, as a proxy for data that would be collected by a discharge flow meter. Analog inputs could be from existing or future analog level sensors used for pump control, or could be independent, simply for flow trending. Similarly, digital inputs from pump start and stop calls could be used for flow trending. The configuration would have to know the pump start and stop elevations. This would likely be less accurate, as the control setpoints could be adjusted independently of the trending calculation, and is inherently an indirect measure of wet well water level.

Regardless of the inputs, it seems reasonable to consider using the flow trending capability of a new station monitoring system rather than incur the expense of a flow meter and vault, and ongoing maintenance cost thereof.

Stations 4, 11 and 14 have older-style control systems (no PLC) but do have bubblers or ultrasonic equipment for level sensing. A pressure transducer could be added to the bubbler system for LS 4 and 11 (if needed) and an analog signal is already available at LS 14 and 19. Then an analog signal would be available for each of these stations to use for flow trending, with an upgraded station monitoring system.

Each system evaluated has a cost for the station equipment and related instrumentation wiring and installation, and an annual service contract. There are advantages for either system compared to the other and it is not clear which system will best serve the District over time. Both vendors provide the opportunity for data collection at regular intervals (e.g. every two hours) or at more or less real-time. They each offer flexibility in the service once each station's specific needs are more readily known.

CHS recommends the District plan to replace the station monitoring system at all stations as one project, for efficiency in configuration, training and continuing operations and response by staff. Alternatively, the upgrade can be implemented in a multi-year phased approach, with early focus on the most unreliable telemetry units. Each station will have various inputs as available until such time as the station, particularly the control system, is rehabilitated or upgraded.

Each vendor is willing to temporarily deploy a demonstration unit at a District station, to allow a trial use period before deciding which system to select. We recommend the District proceed with such a trial, for one to three months, before making a final selection of the system, and the level of data collection appropriate for each site.

An estimate of the cost of procurement and installation is attached. The total estimated cost for telemetry system upgrade is $126,000.

Rehabilitation Work

The approach for this assessment included a general evaluation of the stations in the following areas:

- Site – access, parking, drainage, surfacing, water source, etc.

- Force main – material and condition, bypass capacity, etc.
- Dry Well – structure, coating, hatch, pumps, piping, ladder, appurtenances
- Wet Well – structure, coating, hatch, piping, ladder, appurtenances
- Valve Vault – structure, hatch
- Power – standby generator and ATS, manual transfer switch, service, starters
- Control and Instrumentation – control panel, level sensors, redundancy, intrusion, smoke, etc.

Existing conditions in each area have been tabulated for each station and are presented in the Existing Conditions table included as an attachment. Where conditions are deficient or not-consistent with other stations or current standards, they are highlighted in light red shading. This shading is then an indicator of an item for action as part of the rehabilitation work.

<u>Lift Stations 1C and 2C</u>
The highest priority for lift station rehabilitation is for LS 1C. This station is located on a very compact site, immediately adjacent to the lake and a fish-bearing stream. Its generator is in an underground vault which extends under the stream. It is one of the system's oldest stations and its prior work was completed in the late 1990s. Its pumps are underperforming relative to nameplate capacity and it receives flow from six other stations. Rehabilitation of this station was identified as a priority and specific project in the prior CSP but no substantive work has been completed. In particular, a challenge to improvements at this station is the very restrictive site size and height limitations on the deed or easement the site is on.

The District, City and developers have been coordinating on the need for capacity upgrades at LS 1C, or at 2C situated further upstream. The present plan is for LS 2C to be upgraded and rehabilitated as part of a joint project between the City, District and a developer, in order to create more system conveyance capacity for the original downtown area. That project, scheduled for 2018, will upgrade the capacity of LS 2C and complete a force main extension from 2C to bypass flows around 1C. At that time, LS 1C can be rehabilitated and equipped with new pumps for lower capacity.

The prior CSP included a specific project and estimate for rehabilitation. That estimate has been updated, for rehabilitation and pump capacity reduction, for this assessment. The attached estimate documents the basis for a CIP project cost estimate of $630,000. It is recommended that the LS 1C project be scheduled for completion in 2018, or sooner if feasible in the context of work at LS 2C.

<u>Remaining Stations</u>
As noted above, with the exception of station monitoring equipment upgrades, no improvements are recommended for temporary stations LS 1, 9, 10, 18, 5C and 7C.

For each remaining station, a general set of improvements have been identified, with associated preliminary estimated construction cost. Those recommendations and costs are presented in the attached Summary of Recommendations table.

Following work at LS 1C and 2C, the next group of stations recommended for rehabilitation work are LS 2 through LS 8, LS 11, and LS 3C, 4C and 6C. These 11 stations are all at least 30 years old. The typical service life of lift station equipment is typically 25 years. Rehabilitation of these stations is recommended within 10 years, or sooner if feasible. For planning purposes it is recommended that these projects occur in years 2018 (one more with LS 1C and 2C), 2020, 2022, 2024 and 2026. Even at that pace, the oldest of the last group will then be up to 46 years old.

The next oldest group of stations (six) are presently 11 to 21 years old. They should be scheduled for rehabilitation in three groups, in 2028, 2030 and 2032. At that point in time they will be up to 32 years old at the start of this cycle.

That schedule leaves four stations presently less than 10 years old. By 2034 some will have reached their 25 year service life. Work is therefore scheduled for these stations in years 2034 and year 2036.

A summary of estimated project costs and priority/schedule is attached.

Thank you for the opportunity to complete this evaluation. Please contact us if you require additional information.

Lake Stevens Sewer District

Lift Station Condition Assessment - Categories

CHS Engineers, LLC February 2016

			Station Type				Age				Capacity (gpm)				Motor (hp)				Location (quadrants)				Generators (kW)			
LS ID	Temp.	Visited	W/D	VP	GP	Sub.	0-10	11-20	21-30	>30	<=130	131-400	401-1000	>1000	1-3	5-10	11-50	>50	NW	NE	SE	SW	None	0-50	51-200	>201
LS1	X		x							x	x					x						x	x			
LS2		X	x							x		x				x						x		x		
LS3			x							x		x				x						x		x		
LS4			x							x			x				x		x					x		
LS5		X	x							x			x				x		x						x	
LS6			x							x		x					x		x					x		
LS7		X		x						x		x				x				x				x		
LS8		X		x						x			x				x				x				x	
LS9	X				x					x	x				x						x		x			
LS10	X				x					x	x				x						x		x			
LS11				x						x		x					x					x				
LS12			x					x						x				x				x				x
LS13				*Removed*																*Removed*						
LS14		X		x				x					x			x						x		x		
LS15			x					x						x				x	x							x
LS16				x				x				x				x			x					x		
LS17		X		x			x					x					x					x				x
LS18	X			x			x					x					x				x				x	
LS19				x			x					x					x					x			x	
LS20		X		x			x							x				x				x				x
LS21				x			x				x					x					x			x		
LS1C		X	x							x			x				x			x					x	
LS2C			x							x			x				x			x				x		
LS3C			x							x		x				x				x				x		
LS4C		X				x				x	x				x					x			x			
LS5C	X	X				x				x		x				x				x			x			
LS6C			x							x	x					x				x				x		
LS7C	X					x	x					x				x				x				x		
LS8C		X	x					x					x					x		x						x
LS9C				x				x				x			x					x				x		
Counts	6	11	13	11	2	3	6	6	0	17	6	13	7	3	4	11	10	4	5	10	5	9	5	13	5	5

Lake Stevens Sewer District **Lift Station Condition Assessment - Existing Conditions** CHS Engineers, LLC March 2016									
Station	1 (Temporary)	2	3	4	5	6	7	8	9 (Temporary)
Visited	No	Yes	No	No	Yes	No	Yes	Yes	No
EXISTING STATION INFORMATION									
Type	WW/DW	WW/DW	WW/DW	WW/DW	WW/DW	WW/DW	Vacuum	Vacuum	Grinder
Year Online/upgraded	1969	1969, 1995	1970	1970	1969, 2003	1970, 1982	1980	1980, 2000	1980
Notes									
2015 Total Service Area (acres)	20	270	44	147	331	47	138	395	1.6
EXISTING SITE INFORMATION									
ROW or Easement	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Vehicle Access / Parking	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Water Service / RPBA	Adequate	Adequate	None	None	Adequate	None	Adequate	Adequate	Adequate
Surfacing	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Drainage	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Flooding	Adequate	Adequate
Site/Area Lighting	Inadequate	Inadequate	Inadequate	Inadequate	Ok	Inadequate	Inadequate	Inadequate	Inadequate
EXISTING PUMP & MOTOR INFORMATION									
Quantity	2	2	2	2	2	2	2	2	1
Manufacturer	Smith & Loveless	Fairbanks Morse	Fairbanks Morse	Fairbanks Morse	Smith & Loveless	Fairbanks Morse	Hydronix 181V	Smith & Loveless	Myers
Model	4B3	5432K	5432K	5432K	4B2A	5432K	40MPC	4C3B	WG20-21
2015 Existing Confirmed Capacity (gpm)	59	239	307	580	800	312	200	570	30
TDH (ft)	56	48	40.5	76.5	50	77.5	43	135	40
EXISTING PUMP MOTOR INFORMATION									
Power (HP)	7.5	7.5	7.5	20	15	7.5	7.5	30	2
Voltage	230/460	230/460	230/460	480Y/277	480Y/277	230/460	230/460	480Y/277	230
Phase	3	3	3	3	3	3	3	3	1

Station	1 (Temporary)	2	3	4	5	6	7	8	9 (Temporary)
EXISTING FORCE MAIN INFORMATION									
Size (in)	4	6	6	8	9.5	6	6	8 / 10	2
Material	AC	AC	AC	AC	HDPE	AC	PVC	HDPE / DI	PVC
Length (ft)	1120	364	448	123	1050	200	1240	2800 / 3280	305
Flow Meter	No	No	No	No	Yes	No	No	Yes	No
Flow Meter Vault					Ok				
Odor Control	No	No	No	No	No	No	No	No	No
Discharge Manhole	58-2	LS12	23T	35	LS15	77	801A	2823	815
Bypass Connection	No	No	No	No	Yes	No	No	No	No
EXISTING DRY WELL INFORMATION									
Size (ft)									
Material	Steel	Steel	Steel	Steel	Concrete	Steel			
Structural Condition	Ok	Ok	Ok	Ok	Ok	Ok			
Paint	Poor	Poor	Poor	Poor	Poor	Poor			
Leaks	None	None	None	None	None	None			
External Noise Concerns	None	None	None	None	None	None			
Hatch Material	Steel	Steel	Steel	Steel	Steel	Steel			
Ladder	Steel	Steel	Steel	Steel	Steel	Steel			
Fall Restraint	*Portable Equipment used*								
Pipe / Valve Size (in)									
Valve Type	Plug	Plug	Plug	Plug	Plug	Plug			
Pump Seal Water	Self flushing	Self flushing	Self flushing	Self flushing	Self flushing	Self flushing			
Ventilation	Undersized	Undersized	Undersized	Undersized	Undersized	Undersized			
Dehumidifier	Ok	Ok	Ok	Ok	Ok	Ok			
Lighting	Incandescent	Incandescent	Incandescent	Incandescent	Incandescent	Incandescent			
Smoke Detector	None	None	None	None	None	None			
Operator in Trouble Button	Ok	Ok	Ok	Ok	Ok	Ok			
Flood Sensor	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard			
Intrusion Sensor	None	None	None	None	None	None			
Sump Pump	Ok	Ok	Ok	Ok	Ok	Ok			
EXISTING WET WELL INFORMATION									
Size (ft)									
Material	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
Structural Condition	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Odor	None	None	None	None	None	None	None	None	None
Leaks	None	None	None	None	None	None	None	None	None
Hatch or Casting Access	CI/DI	CI/DI	CI/DI	CI/DI	CI/DI	CI/DI	Plate	Plate	Lid
Safety Grate									
Ladder / Steps/Rungs	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	
Grating / Railing	None	None	None	None	None	None			
Inlet Sewer Valve	None	None	Remove	Remove	Remove	Remove	None	None	None
Level Sensor	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard
Settling/Scum	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Lighting and Ventilation	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	

Station	1 (Temporary)	2	3	4	5	6	7	8	9 (Temporary)
EXISTING VALVE VAULT INFORMATION									
Size (ft)									
Material									
Structural Condition									
Leaks									
Hatch or Casting Access									
Ladder / Steps /Ventilation									
Pipe / Valve									
Drain									
Intrusion Sensor									
EXISTING BUILDING/EQUIPMENT ENCLOSURE									
Heat and Lighting					Ok				
Rain Protection for External Elec. Cabinets	None		Small building	None		None	Adequate	Adequate	None
EXISTING ELECTRICAL SYSTEMS INFORMATION									
Station Voltage	230/460	230/460	230/460	480Y/277	480Y/277	230/460	230/460	480Y/277	230
Phase	3	3	3	3	3	3	3	3	1
Phase Converter	No	No	No	No	No	No	No	No	No
Onsite Standby Power / ATS / Poles	None	15 kW LP / 3P	20 kW LP / 3P	30 kW LP / 3P	200 kW Diesel / 3P	30 kW LP / 3P	40 kW Diesel / 3P	100 kW Diesel / 3P	None
Manual Transfer Switch / Receptacle	Existing	Existing	Existing	Existing		Existing			Existing
Receptacle Size (AMPs)	100 - 4 pin	100 - 4 pin	100 - 4 pin	100 - 4 pin		100 - 4 pin			100 - 4 pin
EXISTING PUMP CONTROLLER INFORMATION									
Type - Relay logic or PLC	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard
EXISTING SCADA SYSTEMS INFORMATION									
Telemetry Type	Raco-Cell	Raco-Cell	Raco-Cell	Raco-Cell	Sensaphone	Raco-Cell	Sensaphone	Raco-Cell	None
OTHER UNUSUAL CONDITIONS								High Pump Temp on Pwr Tsfr	

Lake Stevens Sewer District **Lift Station Condition Assessment - Existing Conditions** CHS Engineers, LLC March 2016										
Station	10 (Temporary)	11	12	14	15	16	17	18 (Temporary)	19	20
Visited	No	No	No	Yes	No	No	Yes	No	No	Yes
EXISTING STATION INFORMATION										
Type	Grinder	Recessed Vacuum	WW/DW	Vacuum	WW/DW	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum
Year Online/upgraded	1980	1983	1996	2000	2003	2003	2005	2007	2008	2012
Notes										
2015 Total Service Area (acres)	2.2	180	1514	537	2436	9.3	368	121	109	685
EXISTING SITE INFORMATION										
ROW or Easement	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Vehicle Access / Parking	Adequate	Adequate	Adequate	Limited Parking	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Water Service / RPBA	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Surfacing	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Drainage	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Site/Area Lighting	Inadequate	Inadequate	Ok	Inadequate	Ok	Inadequate	Inadequate		Inadequate	Ok
EXISTING PUMP & MOTOR INFORMATION										
Quantity	2	2	3	2	4	2	2	2	2	2
Manufacturer	Myers	Hydronix / Paco	Cornell	Smith & Loveless	Smith & Loveless	Smith & Loveless	Smith & Loveless	Smith & Loveless	Smith & Loveless	Smith & Loveless
Model	WG20-21	NCVU-412-11-12	4x4x14T - VC18DR	4B2D	8D4C	4B2D	4D4B	4D4B	8D4V	8D4V
2015 Existing Confirmed Capacity (gpm)	30	400	2000	480	5250	155	290	290	290	1650
TDH (ft)	40	30	193	38	170	62	150	113	226	140
EXISTING PUMP MOTOR INFORMATION										
Power (HP)	2	25	75	10	125	7.5	40	25	75	100
Voltage	230	480Y/277	480Y/277	480Y/277	480Y/277	230/460	480Y/277	480Y/277	480Y/277	480Y/277
Phase	1	3	3	3	3	3	3	3	3	3

Station	10 (Temporary)	11	12	14	15	16	17	18 (Temporary)	19	20
EXISTING FORCE MAIN INFORMATION										
Size (in)	2	6	12	6	19.4	4	6	6	6	12
Material	PVC	PVC	DI	DI	HDPE	DI	HDPE	DI	DI	PVC
Length (ft)	560	65	3520	980	3360	717	3200	1386	2865	5588
Flow Meter	No	No	Yes	No	Yes	No	Yes	No	No	Yes
Flow Meter Vault			Ok							Ok
Odor Control	No	No	No	No	Yes	No	Yes	No	No	No
Discharge Manhole	811	3947	2535	2825	91B	3027	3345	3342	3476	3411
Bypass Connection	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes
EXISTING DRY WELL INFORMATION										
Size (ft)										
Material		Steel	Steel		Steel					
Structural Condition		Ok	Ok		Ok					
Paint		Poor	Poor		Poor					
Leaks		None	None		None					
External Noise Concerns		None	None		None					
Hatch Material		Steel	Steel		Steel?					
Ladder		Steel	Steel		Steel					
Fall Restraint		*Portable*	*Portable*		*Portable*					
Pipe / Valve Size (in)										
Valve Type		Plug	Plug		Plug					
Pump Seal Water		Self flushing	Self flushing		Self flushing					
Ventilation		Undersized	Ok		Ok					
Dehumidifier		Ok	Ok		Ok					
Lighting		Incandescent	Incandescent		Incandescent					
Smoke Detector		None	None		None					
Operator in Trouble Button		Ok	Ok		Ok					
Flood Sensor		Non-standard	Non-standard		Non-standard					
Intrusion Sensor		None	None		None					
Sump Pump		Ok	Ok		Ok					
EXISTING WET WELL INFORMATION										
Size (ft)										
Material	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
Structural Condition	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Odor	None	None	None	None	Some	None	None	None	None	None
Leaks	None	None	None	None	None	None	None	None	None	None
Hatch or Casting Access	Lid	Plate	CI/DI	Plate	CI/DI	Plate	Plate	Plate	Plate	Plate
Safety Grate										
Ladder / Steps/Rungs			Replace		Replace					
Grating / Railing			None		None		None		None	None
Inlet Sewer Valve	None	None	None	None	None	None	None	None	None	None
Level Sensor	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard
Settling/Scum	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Add Mixer
Lighting and Ventilation		*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*

Station	10 (Temporary)	11	12	14	15	16	17	18 (Temporary)	19	20
EXISTING VALVE VAULT INFORMATION										
Size (ft)										
Material										
Structural Condition										
Leaks										
Hatch or Casting Access										
Ladder / Steps /Ventilation										
Pipe / Valve										
Drain										
Intrusion Sensor										
EXISTING BUILDING/EQUIPMENT ENCLOSURE										
Heat and Lighting			Ok		Ok					Ok
Rain Protection for External Elec. Cabinets	None	None		Adequate		Adequate	Adequate	Adequate	Adequate	
EXISTING ELECTRICAL SYSTEMS INFORMATION										
Station Voltage	230	480Y/277	480Y/277	480Y/277	480Y/277	230/460	480Y/277	480Y/277	480Y/277	480Y/277
Phase	1	3	3	3	3	3	3	3	3	3
Phase Converter	No	No	No	No	No	No	No	No	No	No
Onsite Standby Power / ATS / Poles	None	60 kW - FUEL?? / 3P	250 kW Diesel / 3P	35 kW Diesel / 3P	350 kW Diesel / 3P	25 kW Diesel / 3P	250 kW Diesel / 3P	80 kW Diesel / 3P	200 kW Diesel / 3P	400 kW Diesel / 3P
Manual Transfer Switch / Receptacle	Existing	Existing	Existing		Existing	Existing		Existing	Existing	
Receptacle Size (AMPs)	100 - 4 pin	100 - 4 pin	100 - 4 pin		100 - 4 pin	100 - 4 pin		100 - 4 pin	100 - 4 pin	
EXISTING PUMP CONTROLLER INFORMATION										
Type - Relay logic or PLC	Non-standard	Non-standard	Ok	Non-standard	Non-standard	Non-standard	No	No	No	No
EXISTING SCADA SYSTEMS INFORMATION										
Telemetry Type	Raco-Cell	Sensaphone	Sensaphone	Sensaphone	Sensaphone	Sensaphone	Sensaphone	Sensaphone	Sensaphone	Sensaphone
OTHER UNUSUAL CONDITIONS			Influent gate valve MH leaking, hard to set tsfr delay		Odor at ww and FM discharge?				High Pump Temp on Pwr Tsfr	

Lake Stevens Sewer District **Lift Station Condition Assessment - Existing Conditions** CHS Engineers, LLC March 2016										
Station	21	1C	2C	3C	4C	5C (temporary)	6C	7C (Temporary)	8C	9C
Visited	No	Yes	No	No	Yes	Yes	No	No	Yes	No
EXISTING STATION INFORMATION										
Type	Vacuum	WW/DW	WW/DW	WW/DW	Submersible	Submersible	WW/DW	Submersible	WW/DW	Vacuum
Year Online/upgraded	2006	1970, 1989, 1998, 2004	1970, 2002	1970	1979	1992	1994	2007	2000, 2003	1999
Notes										
2015 Total Service Area (acres)	55	788	456	34	19	2.5	14	25	482	26
EXISTING SITE INFORMATION										
ROW or Easement	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Vehicle Access / Parking	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Water Service / RPBA	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Surfacing	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Drainage	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Flooding	Adequate	Adequate
Site/Area Lighting	Inadequate	Inadequate	Inadequate	Inadequate	Inadequate	Inadequate	Inadequate	Inadequate	Ok	Inadequate
EXISTING PUMP & MOTOR INFORMATION										
Quantity	2	3	2	2	2	2	2	2	2	2
Manufacturer	Smith & Loveless	Smith & Loveless	Smith & Loveless	Smith & Loveless	Flygt	Meyers	Smith & Loveless	Flygt	Smith & Loveless	Smith & Loveless
Model	4B2D	4C2	4B28	4B2A	3085	4VX-50-M4-23	4B3A	NP3102.090	6D5	4B2B
2015 Existing Confirmed Capacity (gpm)	130	650	700	200	100	200	100	210	670	150
TDH (ft)	66	112	40	43	27	30	55	45	260	33
EXISTING PUMP MOTOR INFORMATION										
Power (HP)	10	50	15	7.5	3	5	5	6.5	100	3
Voltage	480Y/277	480Y/277	480Y/277	230/460	230/460	230/460	230/460	230/460	480Y/277	230/460
Phase	3	3	3	3	3	3	3	3	3	3

Station	21	1C	2C	3C	4C	5C (temporary)	6C	7C (Temporary)	8C	9C
EXISTING FORCE MAIN INFORMATION										
Size (in)	4	8 (x2)	8	4	6	4	4	4	10	4
Material	DI	AC	CI	DI	PVC	PVC	DI	HDPE	DI	DI
Length (ft)	3027	2870	920	660	1137	145	337	110	5300	530
Flow Meter	No	Yes	No - pending	No	No	No	No	No	Yes	No
Flow Meter Vault		Ok							Ok	
Odor Control	No	No	No	No	No	No	No	No	Yes	No
Discharge Manhole	C82	79	B14	C32	D36	D34	C36	LS 8C FM	1182	C102
Bypass Connection	Yes	No	No	No	No	No	No	No	Yes	No
EXISTING DRY WELL INFORMATION										
Size (ft)										
Material		Steel	Steel	Steel			Steel		Steel	
Structural Condition		Ok	Ok	Ok			Ok		Ok	
Paint		Poor	Poor	Poor			Poor		Poor	
Leaks		None	None	None			None		None	
External Noise Concerns		None	Yes	None			None		None	
Hatch Material		Steel	Fiberglass	Fiberglass			Steel		Steel	
Ladder		Steel	Steel	Steel			Steel		Steel	
Fall Restraint		*Portable Equipment used*					*Portable*		*Portable*	
Pipe / Valve Size (in)										
Valve Type		Plug	Plug	Plug			Plug		Plug	
Pump Seal Water		Self flushing	Self flushing	Self flushing			Self flushing		Self flushing	
Ventilation		Undersized	Undersized	Undersized			Undersized		Ok	
Dehumidifier		Ok	Ok	Ok			Ok		Ok	
Lighting		Incandescent	Incandescent	Incandescent			Incandescent		Incandescent	
Smoke Detector		None	None	None			None		None	
Operator in Trouble Button		Ok	Ok	Ok			Ok		Ok	
Flood Sensor		Non-standard	Non-standard	Non-standard			Non-standard		Non-standard	
Intrusion Sensor		None	None	None			None		None	
Sump Pump		Ok	Ok	Ok			Ok		Ok	
EXISTING WET WELL INFORMATION										
Size (ft)										
Material	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
Structural Condition	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Odor	None	None	None	None	None	None	None	None	None	None
Leaks	None	None	None	None	None	None	None	None	None	None
Hatch or Casting Access	Plate	CI/DI	CI/DI	CI/DI	Aluminum	Steel	CI/DI	Aluminum	CI/DI	Plate
Safety Grate					None	None		Ok		
Ladder / Steps/Rungs		Poor	Poor	Poor		Poor	Poor		Poor	
Grating / Railing		None	None	None			None		None	
Inlet Sewer Valve	None	None	None	None	None	None	None	None	None	None
Level Sensor	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard
Settling/Scum	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok
Lighting and Ventilation	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*	*Portable*

Station	21	1C	2C	3C	4C	5C (temporary)	6C	7C (Temporary)	8C	9C
EXISTING VALVE VAULT INFORMATION										
Size (ft)										
Material					Concrete	Concrete		Concrete		
Structural Condition					Ok	Ok		Ok		
Leaks					None	None		None		
Hatch or Casting Access					Aluminum	Aluminum		Aluminum		
Ladder / Steps /Ventilation					Shallow	Shallow		Shallow		
Pipe / Valve					Ok	Ok		Ok		
Drain					To WW w/ CV	To WW w/ CV		To WW w/ CV		
Intrusion Sensor					None	None		None		
EXISTING BUILDING/EQUIPMENT ENCLOSURE										
Heat and Lighting									Ok	
Rain Protection for External Elec. Cabinets	Adequate	None	None	None	None	None	None	None		Adequate
EXISTING ELECTRICAL SYSTEMS INFORMATION										
Station Voltage	480Y/277	480Y/277	480Y/277	230/460	230/460	230	230	230/460	480Y/277	230
Phase	3	3	3	3	3	1	1	3	3	1
Phase Converter	No	No	No	No	No	Yes	Yes	No	No	Yes
Onsite Standby Power / ATS / Poles	35 kW Diesel / 3P	135 kW Diesel / 3P	50 kW LP / 3P	35 kW Diesel / 3P	None	None	35 kW Diesel / 3P	40 kW Diesel / 3P	230 kW Diesel / 3P	35 kW Diesel / 3P
Manual Transfer Switch / Receptacle	Existing	Existing	Existing	Existing	Existing	Existing	Existing	Existing		Existing
Receptacle Size (AMPs)	100 - 4 pin	100 - 4 pin	100 - 4 pin	100 - 4 pin	100 - 4 pin	100 - 4 pin	100 - 4 pin	100 - 4 pin		100 - 4 pin
EXISTING PUMP CONTROLLER INFORMATION										
Type - Relay logic or PLC	No	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard	Non-standard
EXISTING SCADA SYSTEMS INFORMATION										
Telemetry Type	Sensaphone	Chatterbox	Chatterbox	Chatterbox	Chatterbox	Raco-Cell	Chatterbox	Chatterbox	Chatterbox	Chatterbox
OTHER UNUSUAL CONDITIONS	High Pump Temp on Pwr Tsfr									

Lake Stevens Sewer District

Lift Station Condition Assessment - Action/Estimates

CHS Engineers, LLC March 2016

Station	1 (Temporary)	2	3	4	5	6	7	8	9 (Temporary)	10 (Temporary)
SITE AND FORCE MAIN IMPROVEMENTS										
Add Vehicle Parking										
Add Water Service/RPBA/Hot Box with HT			3000	3000		3000				
Fix / Improve Drainage							8000			
Add Area Lighting		2000	2000	2000	2000	2000	2000	2000		
Add Flow meter in Vault - Remote Transmitter				Flow Trending						
Force Main Bypass Connection		6000	6000	6000		6000	6000	6000		
Temporary Flow Bypass		8000	8000	8000	8000	8000	8000	12000		
Demo Bldg, Gen on Pad, Controls on Rack w/Rain Shelter		30000	30000	30000		30000				
Remove Parshall Flume										
Site Restoration		10000	10000	10000	10000	10000	10000	10000		
STATION IMPROVEMENTS - GENERAL/MECHANICAL										
Replace Pumps, Piping and Valves <10 HP		25000	25000			25000	25000			
Replace Pumps, Piping and Valves 11-50 HP				40000				40000		
Replace Pumps, Piping and Valves >50 HP										
Dry Well Interior - Remove Paint and Seal		8000	8000	8000	8000	8000				
Dry Well - Add/Upgrade Ventilation System		4000	4000	4000	4000	4000				
Add/Replace Dehumidifier		Gen. Maint.	Gen. Maint.	Gen. Maint.	Gen. Maint.	Gen. Maint.				
Replace Sump Pump		Gen. Maint.	Gen. Maint.	Gen. Maint.	Gen. Maint.	Gen. Maint.				
Add Cathodic Protection System		22000	22000	22000		22000				
WET WELL IMPROVEMENTS										
Replace Access Hatch		5000	5000	5000	5000	5000				
Add Hatch safety grate										
Replace Ladder / Steps		2000	2000	2000	2000	2000	2000	2000		
Add / Replace Grating / Handrails										
Remove inlet sewer valve			1000	1000	1000	1000				
POWER SERVICE IMPROVEMENTS										
Replace Customer Service Pole		2000	2000	2000	2000	2000	2000	2000		
Replace Utility Service Feeder		3000	3000	3000	3000	3000	3000	3000		
Replace/Upgrade Utility Disconnect Switch		3000	3000	3000	3000	3000	3000	3000		
Replace Standby Power Equipment <50 kW w/ATS		30000		30000		30000	30000			
Replace Standby Power Equipment 50-200 kW w ATS										
Replace Standby Power Equipment >200 kW w/ATS										
Replace MTS and Receptacle		3000	3000	3000		3000				

Lake Stevens Sewer District										
Lift Station Condition Assessment - Action/Estimates										
CHS Engineers, LLC March 2016										
Station	1 (Temporary)	2	3	4	5	6	7	8	9 (Temporary)	10 (Temporary)
STATION IMPROVEMENTS - ELECTRICAL										
General conduit and wiring replacement		25000	25000	25000	25000	25000	25000	25000		
Replacement Lighting		3000	3000	3000	3000	3000				
Provide Pump Receptacle, Plug, and Control Switch		2000	2000	2000	2000	2000				
Intrusion sensors - all access points		3000	3000	3000	3000	3000	3000	3000		
Replace Pump Control Panel - Package (w/o PLC)		20000	20000		20000	20000	20000			
Replace Pump Control Panel - Package (w/ PLC)				30000				30000		
Add/upgrade UPS		2000	2000	2000	2000	2000	2000	2000		
Replace motor starter panel < 10 HP		8000	8000			8000	8000			
Replace motor starter panel 11-50 HP (soft)				15000	15000			15000		
Replace motor starter panel >50 HP (VFD)										
Dry well - Add/Standardize Flood Sensor		1000	1000	1000	1000	1000				
Wet Well - Level Sensors - Primary/Redundant		4000	4000	4000	4000	4000	4000	4000		
Provide WW Pump and Level Cable Splice Boxes		8000	8000	8000	8000	8000	8000	8000		
Provide Handheld Pump Controller										
Replace/add Smoke Detector		500	500	500	500	500				
Add Operator in Trouble Button		500	500	500	500	500				
Add Check Valve Limit Switches		2000	2000	2000	2000	2000	2000	2000		
Subtotal	n/a	$242,000	$216,000	$278,000	$134,000	$246,000	$171,000	$169,000	n/a	n/a
Mobilization, Overhead and Profit (15%)	Temporary	$36,300	$32,400	$41,700	$20,100	$36,900	$25,650	$25,350	Temporary	Temporary
Startup, Testing, Documentation (5%)		$12,100	$10,800	$13,900	$6,700	$12,300	$8,550	$8,450		
Contingency (25%)		$60,500	$54,000	$69,500	$33,500	$61,500	$42,750	$42,250		
Subtotal		$350,900	$313,200	$403,100	$194,300	$356,700	$247,950	$245,050		
Sales Tax (8.6% +/-)		$30,177	$26,935	$34,667	$16,710	$30,676	$21,324	$21,074		
Total		$381,077	$340,135	$437,767	$211,010	$387,376	$269,274	$266,124		
Total Construction (Rounded)		$381,000	$340,000	$438,000	$211,000	$387,000	$269,000	$266,000		
Pre-design Evaluation		$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000		
All Overhead (Rounded, 25%, +/-)		$95,000	$85,000	$110,000	$53,000	$97,000	$67,000	$67,000		
Estimated Project Cost (Rounded)		**$484,000**	**$433,000**	**$556,000**	**$272,000**	**$492,000**	**$344,000**	**$341,000**		

Lake Stevens Sewer District

Lift Station Condition Assessment - Action/Estimates

CHS Engineers, LLC March 2016

Station	11	12	14	15	16	17	18 (Temporary)	19	20	21
SITE AND FORCE MAIN IMPROVEMENTS										
Add Vehicle Parking			15000							
Add Water Service/RPBA/Hot Box with HT										
Fix / Improve Drainage										
Add Area Lighting		2000	2000	2000	2000	2000		2000	2000	2000
Add Flow meter in Vault - Remote Transmitter	Flow Trending		Flow Trending					Flow Trending		
Force Main Bypass Connection	6000		6000		6000					
Temporary Flow Bypass	8000	16000	16000	16000	8000	8000		8000	16000	8000
Demo Bldg, Gen on Pad, Controls on Rack w/Rain Shelter	30000									
Remove Parshall Flume										
Site Restoration	10000	10000	10000	10000	10000	10000		10000	10000	10000
STATION IMPROVEMENTS - GENERAL/MECHANICAL										
Replace Pumps, Piping and Valves <10 HP	25000		25000		25000					25000
Replace Pumps, Piping and Valves 11-50 HP						40000	40000			
Replace Pumps, Piping and Valves >50 HP		80000		80000				80000	80000	
Dry Well Interior - Remove Paint and Seal		12000		8000						
Dry Well - Add/Upgrade Ventilation System										
Add/Replace Dehumidifier		Gen. Maint.		Gen. Maint.						
Replace Sump Pump		Gen. Maint.		Gen. Maint.						
Add Cathodic Protection System		22000		22000						
WET WELL IMPROVEMENTS										
Replace Access Hatch		5000		5000						
Add Hatch safety grate										
Replace Ladder / Steps		2000		2000						
Add / Replace Grating / Handrails	7000									
Remove inlet sewer valve										
POWER SERVICE IMPROVEMENTS										
Replace Customer Service Pole	2000									
Replace Utility Service Feeder	3000									
Replace/Upgrade Utility Disconnect Switch	3000									
Replace Standby Power Equipment <50 kW w/ATS										
Replace Standby Power Equipment 50-200 kW w ATS										
Replace Standby Power Equipment >200 kW w/ATS										
Replace MTS and Receptacle	3000									

Lake Stevens Sewer District

Lift Station Condition Assessment - Action/Estimates

CHS Engineers, LLC March 2016

Station	11	12	14	15	16	17	18 (Temporary)	19	20	21
STATION IMPROVEMENTS - ELECTRICAL										
General conduit and wiring replacement	25000					25000				
Replacement Lighting		3000		3000						
Provide Pump Receptacle, Plug, and Control Switch		2000		2000						
Intrusion sensors - all access points	3000	3000	3000	3000	3000	3000		3000	3000	3000
Replace Pump Control Panel - Package (w/o PLC)			20000		20000					20000
Replace Pump Control Panel - Package (w/ PLC)	30000	30000		30000		30000		30000	30000	
Add/upgrade UPS	2000									
Replace motor starter panel < 10 HP			8000		8000					8000
Replace motor starter panel 11-50 HP (soft)	15000					15000				
Replace motor starter panel >50 HP (VFD)		30000		30000				30000	30000	
Dry well - Add/Standardize Flood Sensor		1000		1000						
Wet Well - Level Sensors - Primary/Redundant	4000	4000	4000	4000	4000	4000		4000	4000	4000
Provide WW Pump and Level Cable Splice Boxes	8000									
Provide Handheld Pump Controller										
Replace/add Smoke Detector		500		500						
Add Operator in Trouble Button		500		500						
Add Check Valve Limit Switches	2000	2000	2000	2000	2000	2000		2000	2000	2000
Subtotal	$186,000	$225,000	$111,000	$221,000	$88,000	$139,000	n/a	$169,000	$177,000	$82,000
Mobilization, Overhead and Profit (15%)	$27,900	$33,750	$16,650	$33,150	$13,200	$20,850	Temporary	$25,350	$26,550	$12,300
Startup, Testing, Documentation (5%)	$9,300	$11,250	$5,550	$11,050	$4,400	$6,950		$8,450	$8,850	$4,100
Contingency (25%)	$46,500	$56,250	$27,750	$55,250	$22,000	$34,750		$42,250	$44,250	$20,500
Subtotal	$269,700	$326,250	$160,950	$320,450	$127,600	$201,550		$245,050	$256,650	$118,900
Sales Tax (8.6% +/-)	$23,194	$28,058	$13,842	$27,559	$10,974	$17,333		$21,074	$22,072	$10,225
Total	$292,894	$354,308	$174,792	$348,009	$138,574	$218,883		$266,124	$278,722	$129,125
Total Construction (Rounded)	$293,000	$354,000	$175,000	$348,000	$139,000	$219,000		$266,000	$279,000	$129,000
Pre-design Evaluation	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000		$8,000	$8,000	$8,000
All Overhead (Rounded, 25%, +/-)	$73,000	$89,000	$44,000	$87,000	$35,000	$55,000		$67,000	$70,000	$32,000
Estimated Project Cost (Rounded)	**$374,000**	**$451,000**	**$227,000**	**$443,000**	**$182,000**	**$282,000**		**$341,000**	**$357,000**	**$169,000**

Lake Stevens Sewer District **Lift Station Condition Assessment - Action/Estimates** CHS Engineers, LLC March 2016 **Station**	1C	2C	3C	4C	5C (temporary)	6C	7C (Temporary)	8C	9C
SITE AND FORCE MAIN IMPROVEMENTS									
Add Vehicle Parking	See CSP	See CSP							
Add Water Service/RPBA/Hot Box with HT	for estimate	for estimate							
Fix / Improve Drainage									
Add Area Lighting			2000	2000		2000		2000	2000
Add Flow meter in Vault - Remote Transmitter									
Force Main Bypass Connection			6000	6000		6000		6000	6000
Temporary Flow Bypass			8000	8000		8000		12000	8000
Demo Bldg, Gen on Pad, Controls on Rack w/Rain Shelter			30000	15000		30000			
Remove Parshall Flume									
Site Restoration			10000	10000		10000		10000	10000
STATION IMPROVEMENTS - GENERAL/MECHANICAL									
Replace Pumps, Piping and Valves <10 HP			25000	25000		25000			25000
Replace Pumps, Piping and Valves 11-50 HP									
Replace Pumps, Piping and Valves >50 HP								80000	
Dry Well Interior - Remove Paint and Seal			8000			8000		8000	
Dry Well - Add/Upgrade Ventilation System			4000			4000			
Add/Replace Dehumidifier			Gen. Maint.			Gen. Maint.		Gen. Maint.	
Replace Sump Pump			Gen. Maint.			Gen. Maint.		Gen. Maint.	
Add Cathodic Protection System			22000			22000		22000	
WET WELL IMPROVEMENTS									
Replace Access Hatch			5000			5000		5000	5000
Add Hatch safety grate				2000					
Replace Ladder / Steps			2000			2000		2000	
Add / Replace Grating / Handrails				7000					
Remove inlet sewer valve									
POWER SERVICE IMPROVEMENTS									
Replace Customer Service Pole			2000	2000		2000			
Replace Utility Service Feeder			3000	3000		3000			
Replace/Upgrade Utility Disconnect Switch			3000	3000		3000			
Replace Standby Power Equipment <50 kW w/ATS			30000			30000			
Replace Standby Power Equipment 50-200 kW w ATS									
Replace Standby Power Equipment >200 kW w/ATS									
Replace MTS and Receptacle			3000	3000		3000			

Lake Stevens Sewer District **Lift Station Condition Assessment - Action/Estimates** CHS Engineers, LLC March 2016									
Station	1C	2C	3C	4C	5C (temporary)	6C	7C (Temporary)	8C	9C
STATION IMPROVEMENTS - ELECTRICAL									
General conduit and wiring replacement			25000	25000		25000			
Replacement Lighting			3000			3000		3000	
Provide Pump Receptacle, Plug, and Control Switch			2000			2000			
Intrusion sensors - all access points			3000	3000		3000		3000	3000
Replace Pump Control Panel - Package (w/o PLC)			20000	20000		20000			20000
Replace Pump Control Panel - Package (w/ PLC)								30000	
Add/upgrade UPS			2000	2000		2000			
Replace motor starter panel < 10 HP			8000	8000		8000			8000
Replace motor starter panel 11-50 HP (soft)									
Replace motor starter panel >50 HP (VFD)								30000	
Dry well - Add/Standardize Flood Sensor			1000			1000		1000	
Wet Well - Level Sensors - Primary/Redundant			4000	4000		4000		4000	4000
Provide WW Pump and Level Cable Splice Boxes			8000	8000		8000			
Provide Handheld Pump Controller				2000					
Replace/add Smoke Detector			500			500		500	
Add Operator in Trouble Button			500			500		500	
Add Check Valve Limit Switches			2000	2000		2000		2000	
Subtotal	n/a	n/a	$242,000	$160,000	n/a	$242,000	n/a	$221,000	$91,000
Mobilization, Overhead and Profit (15%)	See CSP	See CSP	$36,300	$24,000	Temporary	$36,300	Temporary	$33,150	$13,650
Startup, Testing, Documentation (5%)	for estimate	for estimate	$12,100	$8,000		$12,100		$11,050	$4,550
Contingency (25%)			$60,500	$40,000		$60,500		$55,250	$22,750
Subtotal			$350,900	$232,000		$350,900		$320,450	$131,950
Sales Tax (8.6% +/-)			$30,177	$19,952		$30,177		$27,559	$11,348
Total			$381,077	$251,952		$381,077		$348,009	$143,298
Total Construction (Rounded)			$381,000	$252,000		$381,000		$348,000	$143,000
Pre-design Evaluation			$8,000	$8,000		$8,000		$8,000	$8,000
All Overhead (Rounded, 25%, +/-)			$95,000	$63,000		$95,000		$87,000	$36,000
Estimated Project Cost (Rounded)			**$484,000**	**$323,000**		**$484,000**		**$443,000**	**$187,000**

Lake Stevens Sewer District

Lift Station Condition Assessment - Summary and Schedule

CHS Engineers, LLC March 2016

Revised 03-14-16

Summary

Station	Schedule	Estimated Project Cost	Project Groups
1C	2018	$630,000	
2C	2018	$820,000	
3C	2018	$484,000	$1,934,000
3	2020	$433,000	
4	2020	$556,000	$989,000
4C	2022	$323,000	
5C	2022	*Decommission*	
6C	2022	$484,000	$807,000
2	2024	$484,000	
5	2024	$272,000	
6	2024	$492,000	$1,248,000
7	2026	$344,000	
8	2026	$341,000	
11	2026	$374,000	$1,059,000
8C	2028	$443,000	
9C	2028	$187,000	$630,000
12	2030	$451,000	
14	2030	$227,000	$678,000
15	2032	$443,000	
16	2032	$182,000	$625,000
17	2034	$282,000	
19	2034	$341,000	$623,000
20	2036	$357,000	
21	2036	$169,000	$526,000
13	*Removed*		
1	*Temporary*		
9	*Temporary*		
10	*Temporary*		
18	*Temporary*		
7C	*Temporary*		

Lift Station 1

Pump Name Plates

Gate Valves

Lift Station 1

Bubble Compressor and Tubes

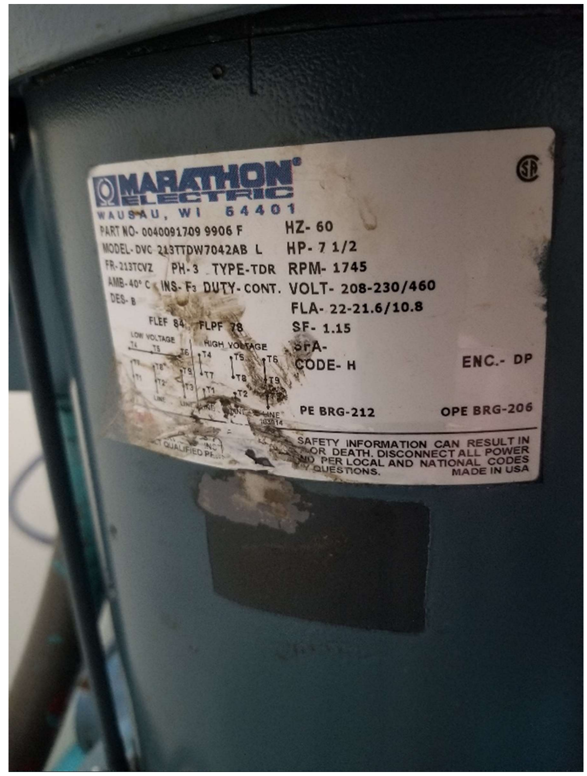
Check Valve

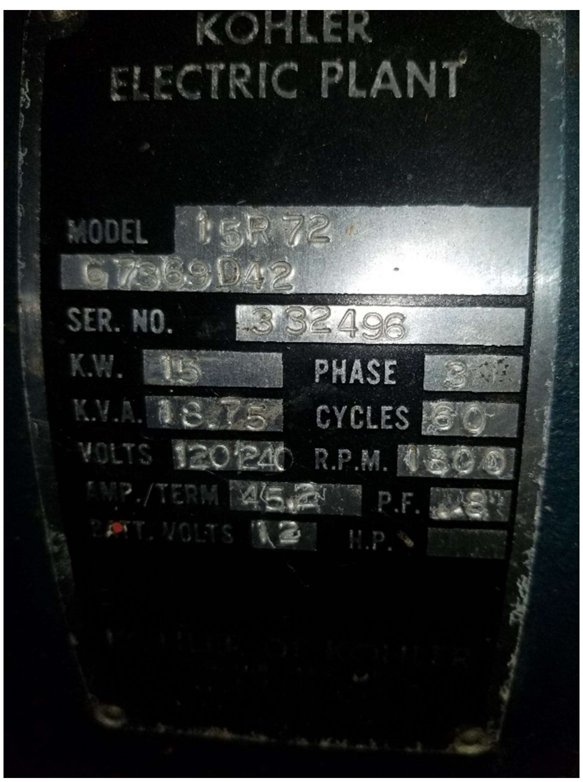
Lift Station 1

Site Visit

Lift Station 2

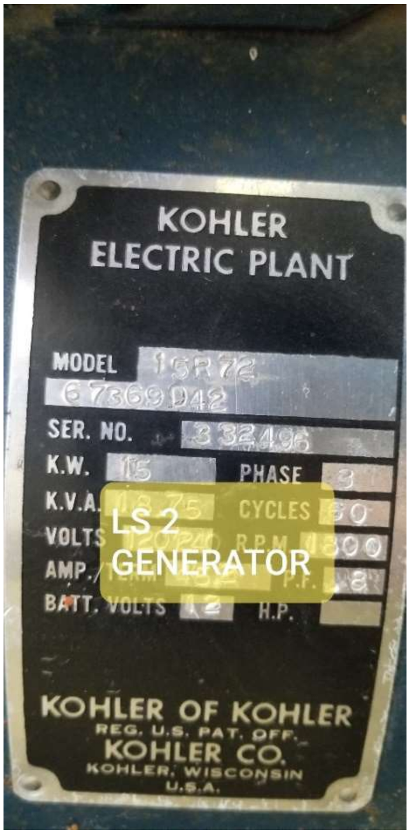
Pump Name Plates

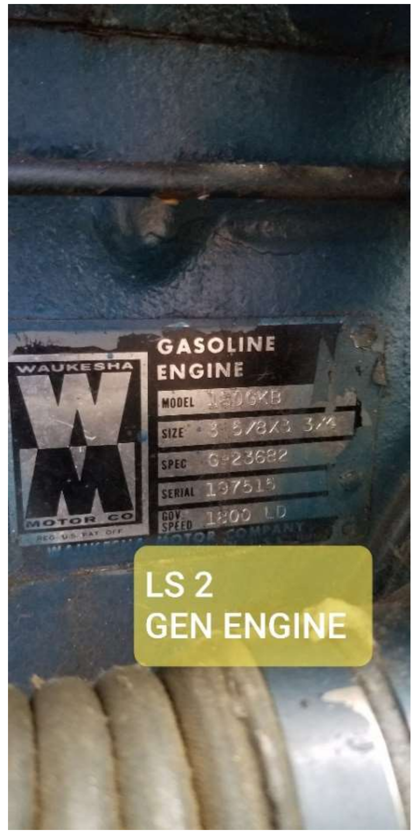




Lift Station 2

Generator Name Plates



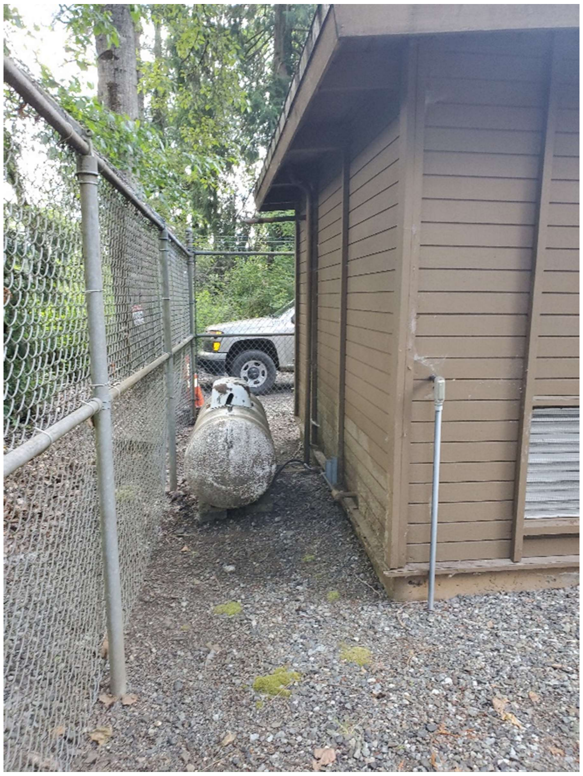


Valves

Lift Station 2

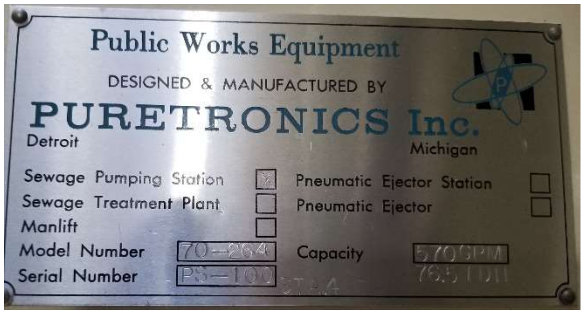
Site Visit

Lift Station 2

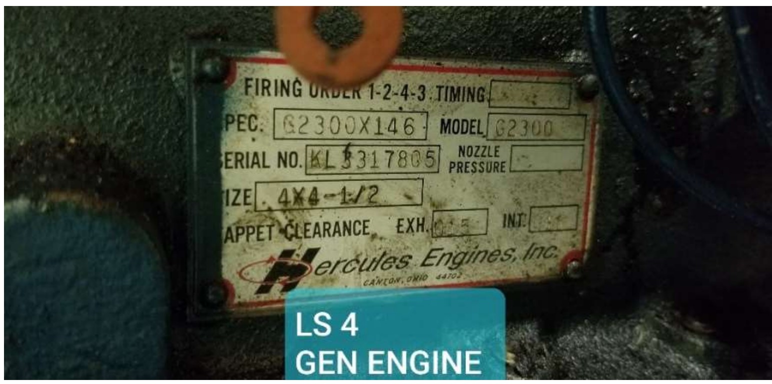


Lift Station 4

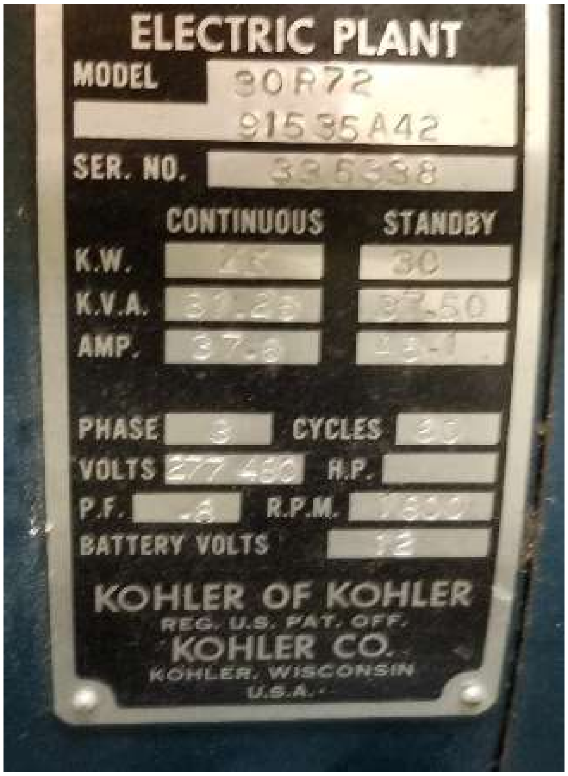
Pump Name Plates



Generator



Lift Station 4



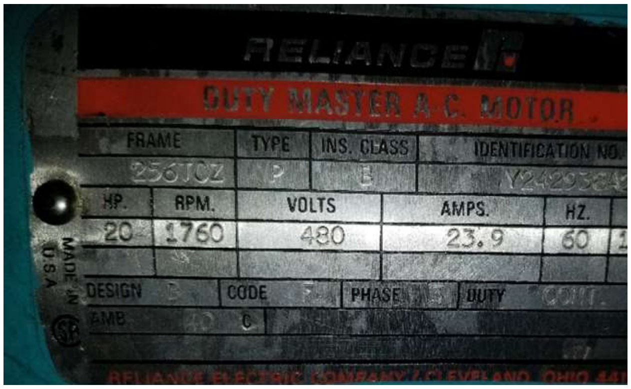
Valves

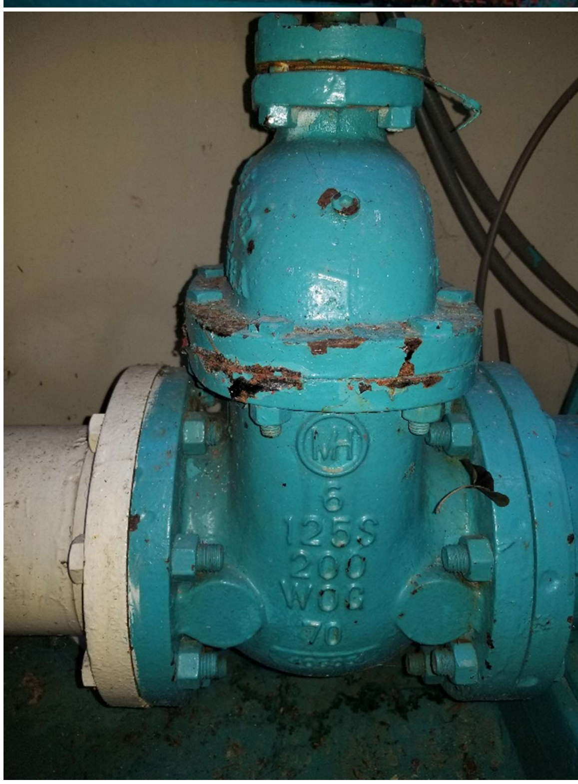
Lift Station 4

Lift Station 4

Site Visit

Lift Station 4



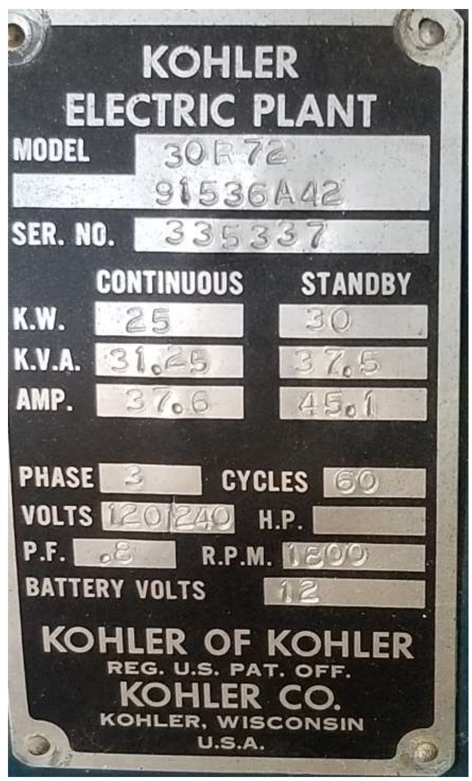


Lift Station 4

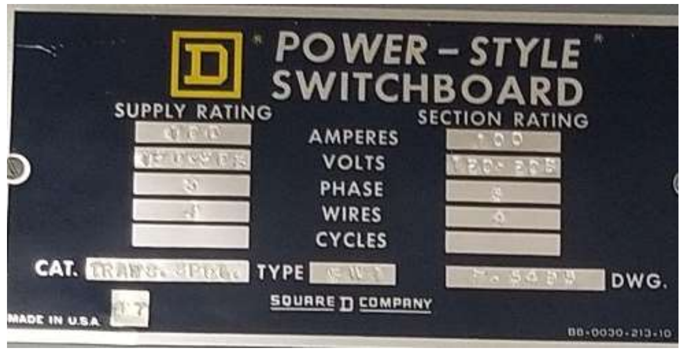
Lift Station 6

Pump Name Plates

Generator



Lift Station 6



Valves

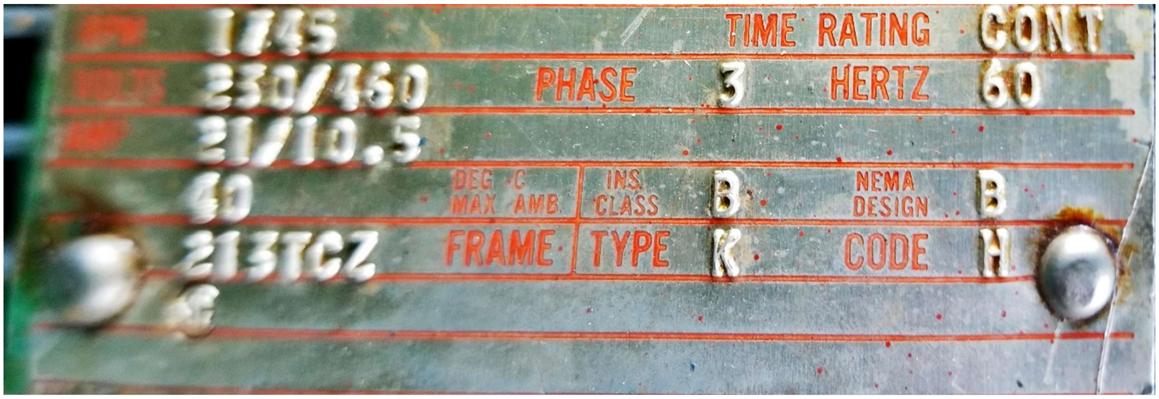
Lift Station 6

Site Visit

Lift Station 6

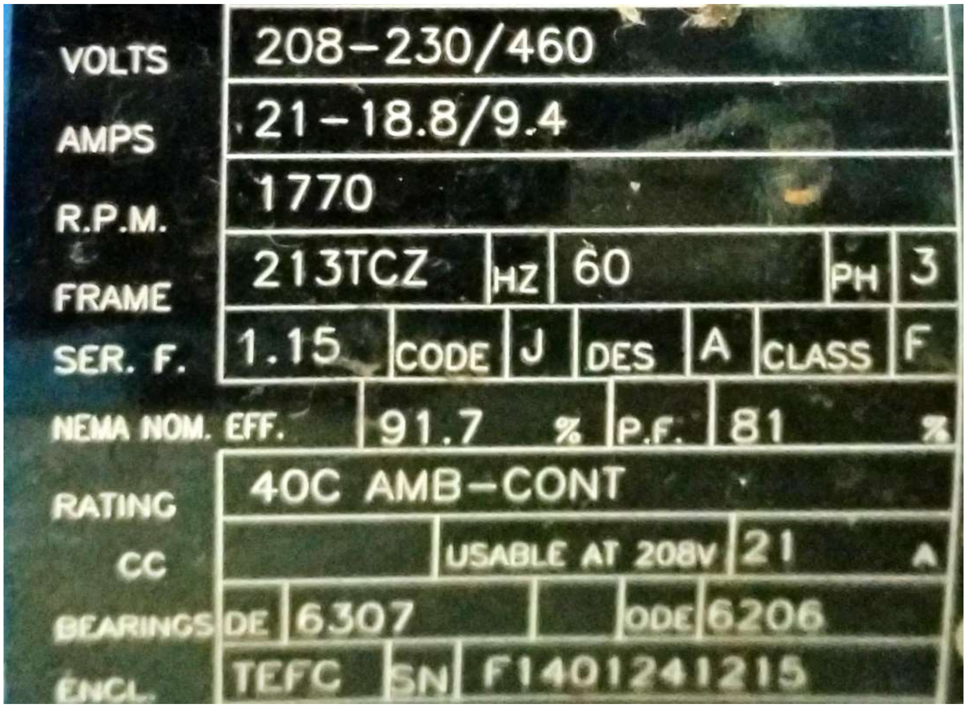
Lift Station 7

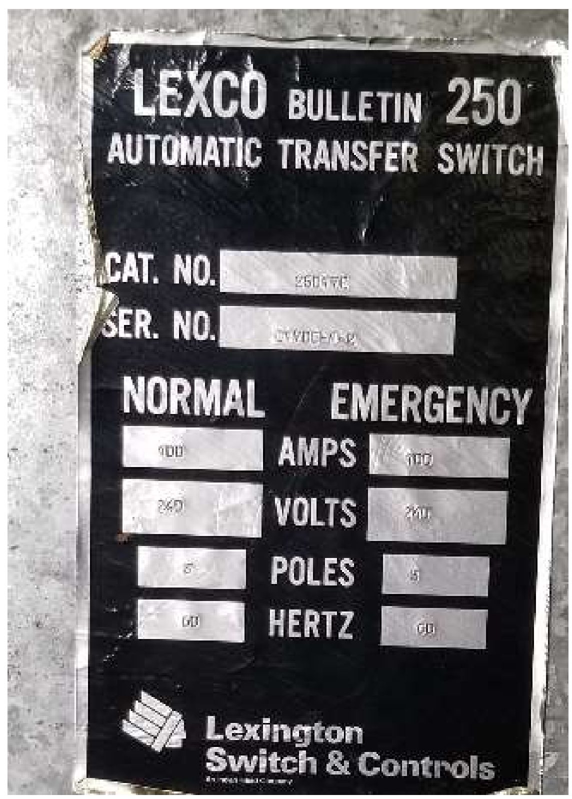
Name Plates



Lift Station 7

Generator





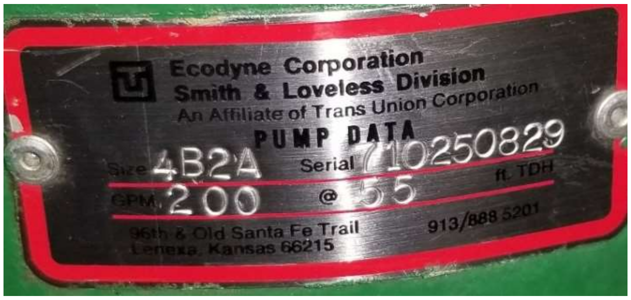
Lift Station 7

Site

Lift Station 7

Lift Station 3C

Pumps



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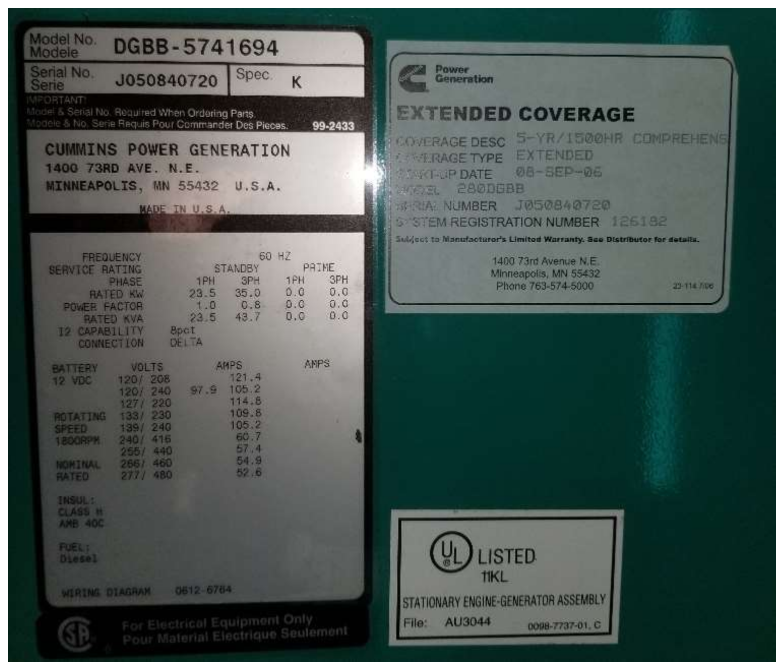
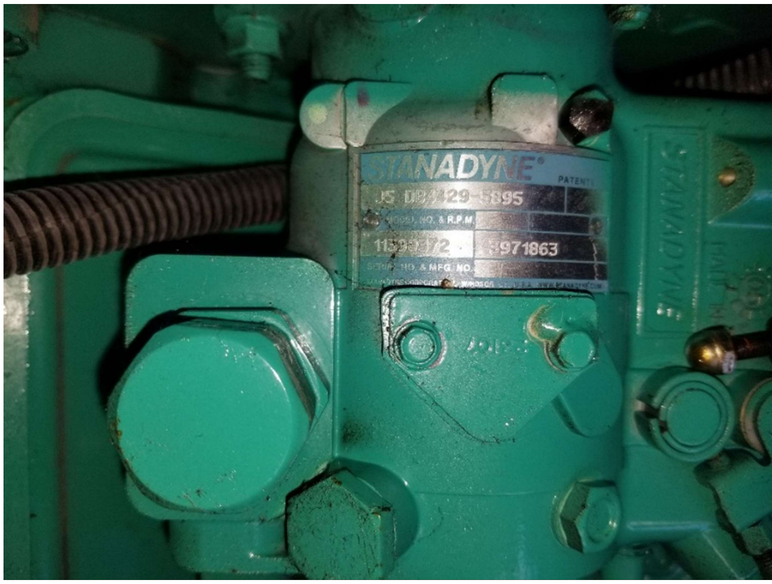


Lift Station 3C



Lift Station 3C

Valves

Lift Station 3C

Site

Lift Station 3C

Lift Station 3C

APPENDIX F

CONSTRUCTION COST ESTIMATES

Lake Stevens Sewer District
2021 Comprehensive Plan
DRAFT Capital Improvement Project Summary

2021 Comp Plan							
Capital Improvement Project	**ID**	**Proposed Funding Source**	**Estimated Year of Completion**	**Estimated Total Project Cost**	**Estimated District Contibution**	**Description**	**Status**
Years 1-6 (2022-2027)							
Gravity Sewer System Repair and Replacement			Annual	$ 1,500,000	$ 1,500,000	Replace 2,300 LF of pipe and 13 MHs annually. 20% of MHs & 15% pipes over 40 years old over 10 year CIP	
Anoxic Zone Wall Improvements	WWTF	Capital	2021	$ 6,000	$ 6,000	Raise Anoxic Zone Walls to prevent short-circuiting	
New LS 23 & FM	H5	Donated	2021	$ 1,580,000	$ -	Construct 401 gpm LS & 2,150 LF 6" FM	Under Construction
TIN Optimization Report	WWTF	Capital	2022	$ 30,000	$ 30,000	WWTF Process Performance Assessment and Initial Selection of Optimization Strategy per requirements of Nutrient Permit	
Backpulse Pipe Replacement	WWTF	Capital	2022	$ 25,000	$ 25,000	Replace corroded membrane backpulse water pipe sections	
20th St NE & Bus. Loop Rd to LS 2C	E2-B	Capital	2022	$ 1,150,000	$ 1,150,000	Replace 1,560 LF 10" with 15" gravity	In Design
Sewer System Comprehasive Plan / Facility Plan Update	Comp	Capital	2022	$ 345,000	$ 345,000	Evaluate existing WWTF in context of actual operation data to support increased capacity within same footprint	In Process
SR 9 Gravity Crossing	G7-B	Capital	2022	$ 500,000	$ 500,000	Extend 8" gravity sewer in 16" casing across SR 9 to allow gravity sewer service from Basin C2-2 to Basin G1-8 and to proposed LS G1	In Design
LS 2C Upgrade	E2-A	Capital	2022	$ 2,700,000	$ 2,700,000	Upgrade LS 2C from 700 gpm to 1,250 gpm	In Design
LS 2C Force Main	E2-C	Capital	2022	$ 2,730,000	$ 2,730,000	Construct 3,800 LF 10" FM; bypass LS 1C via existing 8" PVC FM	In Design
LS 5C Decommission & LSs 4C & 6C Rehabilitation	E4	Capital	2022	$ 1,710,000	$ 1,710,000	Construct up to 641 LF 8" to LS 4C and decommision LS 5C; Rehab of LS 6C	In Design
LS 8C Upgrade & Rehabilitation	D6	Donated	2022	$ 1,040,000	$ -	Increase Capacity from 600 to 1,050 gpm; Includes Replacing 360 LF of 8" FM with 10" FM	
Lift Station 11 Rehabilitation	G4	Capital	2022	$ 590,000	$ 590,000	Lift Station Rehabilitation per general condition assessment - LS 11	In Design
New LS G7 & FM	G7-A	Donated	2022	$ 1,410,000	$ -	Construct 140 gpm LS & 1,300 LF 4" FM	In Design
Process Blower Enclosure Cooling	WWTF	Capital	2022	$ 87,200	$ 87,200	Repair and improve Blower Room HVAC	
Mixed Liquor Alkalinity Addition System Improvements	WWTF	Capital	2022	$ 130,300	$ 130,300	Install magnesium hydroxide / calcium carbonate storage and dosage system	
Carbon Addition System	WWTF	Capital	2022	$ 231,100	$ 231,100	Pilot and install supplemental COD addition storage and dosage system	
District Office Upgrades - Generator	VBC-A	Capital	2022	$ 250,000	$ 250,000	Install Emergency Generator and Electrical system upgrade to District office	
WWTF Membrane Replacement	WWTF	Capital	2023	$ 3,858,000	$ 3,858,000	Replace WWTF membranes per Manufacturer's Recommendations - Paid $440,000 annualy 2023 - 2030	
LS 1C Rehabilitation	E1-A	Capital	2023	$ 740,000	$ 740,000	Rehabilitate existing structures and pumping, electrical, contol and instrumentation systems, including repalcement generator. Increase capacity to 821 gpm	In Design
Lift Station 3C Rehabilitation	E7	Capital	2023	$ 550,000	$ 550,000	Lift Station Rehabilitation per general condition assessment - LS 3C	
Centennial Townhomes DEA	E5-A	Donated	2023	$ 340,000	$ -	Construct 400 LF 10" gravity	
LS 1 Rehabilitation	B2	Capital	2024	$ 779,000	$ 779,000	Rehabilitate LS 1 to increase capacity to 100 gpm and add Generator	
Lift Station 6 Rehabilitation	D5	Capital	2024	$ 793,000	$ 793,000	Lift Station Rehabilitation per general condition assessment - LS 6	

Lake Stevens Sewer District
2021 Comprehensive Plan
DRAFT Capital Improvement Project Summary

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contibution	Description	Status
New LS H8 & FM	H8	75% Donated / 25% Capital	2024	$ 1,790,000	$ 447,500	Construct 140 gpm LS & 1,200 LF 4" FM; Hisey Project	
New Gravity Line - Industrial Area	D7-A	Capital	2024	$ 520,000	$ 520,000	Construct 840 LF 8" Grav in Easement Area in NE Corner of UGA	
District Office Upgrades - 2nd Floor	VBC-B	Capital	2024	$ 250,000	$ 250,000	Allowance for upgrade of District office including accessibility improvements and 2nd Floor Remodel - full scope and budget to be determined	
Nutrient Reduction Evaluation	WWTF	Capital	2025	$ 200,000	$ 200,000	Evaluate alternatives to meet 3 mg/L TIN per requirements of Nutrient Permit	
131st Ave NE	E5-B	Capital	2025	$ 1,020,000	$ 1,020,000	Construct 1,400 LF 8" gravity	
Lift Station 4 Rehabilitation	D3	Capital	2025	$ 902,000	$ 902,000	Lift Station Rehabilitation per general condition assessment - LS 4	
Lift Station 3 Rehabilitation	D4	Capital	2025	$ 624,000	$ 624,000	Lift Station Rehabilitation per general condition assessment - LS 3	
Lift Station 2 Rehabilitation	B4	Capital	2026	$ 780,000	$ 780,000	Lift Station Rehabilitation per general condition assessment - LS 2	
New Gravity Line - Industrial Area	D7-B	Capital	2026	$ 970,000	$ 970,000	Construct 3,160 LF 8" gravity in Easement Area in NE Corner of UGA	
LS 9 Decommissioning	H7	Capital	2026	$ 180,000	$ 180,000	Construct 170 LF 8" gravity	
Vactor and CCTV Truck Replacement		Capital	2027	$ 650,000	$ 650,000	Replace existing vactor and CCTV equipment at end of useful life	
New LS E8 & FM	E8-A	Capital	2027	$ 2,360,000	$ 2,360,000	Construct 140 gpm LS & 3,800 LF 4" FM	
Basin E8 Collection System (N Machias Rd)	E8-B	Capital	2027	$ 2,200,000	$ 2,200,000	Construct 4,000 LF 8" gravity	
New LS E9 & FM	E9-A	Capital	2027	$ 1,710,000	$ 1,710,000	Construct 140 gpm LS & 1,700 LF 4" FM	
26th, 27th & 28th Places NE	E9-B	Capital	2027	$ 1,590,000	$ 1,590,000	Construct 2,650 LF 8" gravity	
New LS C4 & FM	C4	75% Donated / 25% Capital	2027	$ 1,340,000	$ 335,000	Construct 140 gpm LS & 900 LF 4" FM	
Lift Station 7 Rehabilitation & Upgrade	H3-A	50% Donated / 50% Capital	2027	$ 752,000	$ 376,000	Lift Station Rehabilitation per general condition assessment - LS 7 and Increase capacity to 310 gpm	
Years 7-10 (2028-2031)							
Comprehensive Plan Update		Capital	2028	$ 200,000	$ 200,000	Full 6-year update to Comprehensive Sewer Plan	In Process
Mitchell Road Main Replacement	E1-B	Capital	2028	$ 560,000	$ 560,000	Replace 444 LF 8" with 12" gravity	
97th Drive SE & 99th Ave SE	G7-C	Capital	2028	$ 1,490,000	$ 1,490,000	Construct 1,150 LS 8" gravity	
Lift Station 8 Rehabilitation	H2	Capital	2028	$ 554,000	$ 554,000	Lift Station Rehabilitation per general condition assessment - LS 8 and Increase capacity to 866 gpm	
LS 15 Upgrade and Rehabilitation	D1-A	Capital	2028	$ 1,033,000	$ 1,033,000	Increase capacity to 5,430 gpm and rehabilitate per condition assessment. 10- to 20-Year CIP	
LS 2C FM Extension	E2-E	Donated	2028	$ 1,680,000	$ -	Construct 4,700 LF 10" FM from LS 1C to MH 701. Replaces 50 Year Old FM.	
Hartford Road	D7-C	Capital	2029	$ 280,000	$ 280,000	Construct 450 LF 8" gravity	
Dosing Station Reconstruction	A4	Capital	2029	$ 1,080,000	$ 1,080,000	Modernize Dosing Station, Upgrade commication system and improve pipeline access	
WAS Thickener	WWTF	Capital	2030	$ 668,800	$ 668,800	Install WAS rotary drum thickener system in Digester Building	
UV System Addition	WWTF	Capital	2030	$ 986,000	$ 986,000	Install additional UV banks to existing UV channel.	

Lake Stevens Sewer District
2021 Comprehensive Plan
DRAFT Capital Improvement Project Summary

Capital Improvement Project	ID	Proposed Funding Source	Estimated Year of Completion	Estimated Total Project Cost	Estimated District Contibution	Description	Status
Lift Station 12 Rehabilitation	B3	Capital	2030	$ 760,000	$ 760,000	Lift Station Rehabilitation per general condition assessment - LS 12	
New LS E10 & FM	E10	75% Donated / 25% Capital	2030	$ 1,600,000	$ 400,000	Construct 140 gpm LS & 1,300 LF 4" FM	
New LS G6 & FM	G6	75% Donated / 25% Capital	2030	$ 1,390,000	$ 347,500	Construct 140 gpm LS & 1,050 LF 4" FM	
Lift Station 5 Rehabilitation & Upgrade	D2	Capital	2031	$ 536,000	$ 536,000	Lift Station Rehabilitation per general condition assessment and upgrade to 880 gpm	
Lift Station 14 Rehabilitation	B5	Capital	2031	$ 386,000	$ 386,000	Lift Station Rehabilitation per general condition assessment - LS 14	
Lift Station 10 Rehabilitation	H6	Capital	2031	$ 585,000	$ 585,000	Rehabilitation of LS 10, Year 2031	
Years 11-20 (2032-2041)							
Lift Station 20 Rehabilitation	A1	Capital	2032	$ 397,000	$ 397,000	Lift Station Rehabilitation per general condition assessment - LS 20	
New LS C3 & FM	C3	75% Donated / 25% Capital	2032	$ 1,560,000	$ 390,000	Construct 182 gpm LS & 1400 LF 4" FM	
New LS C5 & FM	C5	75% Donated / 25% Capital	2032	$ 1,730,000	$ 432,500	Construct 140 gpm LS & 1,250 LF 4" FM	
Lift Station 16 Rehabilitation	A2	Capital	2033	$ 423,000	$ 423,000	Lift Station Rehabilitation per general condition assessment - LS 16	
Lift Station 9C Rehabilitation	E6	Capital	2033	$ 401,000	$ 401,000	Lift Station Rehabilitation per general condition assessment - 9C	
Purple Pennet & Nyden Farms Roads	H3-B	Capital	2034	$ 760,000	$ 760,000	Construct 1,050 LF 8" gravity	
Lift Station 19 Rehabilitation	G2	Capital	2035	$ 465,000	$ 465,000	Lift Station Rehabilitation per general condition assessment - LS 19	
New LS G3 & FM	G3	75% Donated / 25% Capital	2035	$ 1,420,000	$ 355,000	Construct 140 gpm LS, 800 LF 4" FM	
Lakeview Drive Sewers	D1-E	Donated	2035	$ 2,710,000	$ -	Construct 5,300 LF 8" gravity (ULID?)	
Cedar Road Sewers - West Side	D1-B	Donated	2035	$ 1,130,000	$ -	Construct 1,550 LF 8" gravity (ULID?)	
Cedar Road Sewers - East Side	D1-C	Donated	2035	$ 930,000	$ -	Construct 1,250 LF 8" gravity (ULID?)	
Soper Hill Sewers	D1-D	Donated	2035	$ 1,980,000	$ -	Construct 2,800 LF 8" gravity	
Decommission LS 18	C2-A	Capital	2035	$ 130,000	$ 130,000	Decommission LS 18 after Project C2-B	
White Oaks Sewer Extension	C2-B	Donated	2035	$ 6,450,000	$ -	Construct 3,600 LF 10" gravity & 6800 LF 8" gravity	
Lift Station 21 Rehabilitation	H4	Capital	2035	$ 317,000	$ 317,000	Lift Station Rehabilitation per general condition assessment - LS 21	
Lift Station 17 Rehabilitation	C1	Capital	2037	$ 456,000	$ 456,000	Lift Station Rehabilitation per general condition assessment - LS 17	
Vernon Road West @ VRD	B1-A	Capital	2037	$ 1,280,000	$ 1,280,000	Replace 473 LF 24" with 30" gravity & 550 LF 24" with 36" gravity	
Vernon Road West Trunk @ LS 15 Discharge	B1-C	Capital	2039	$ 1,040,000	$ 1,040,000	Replace 902 LF 21" gravity with 24" gravity	
Lift Station 22 Rehabilitation	H1	Capital	2040	$ 453,000	$ 453,000	Rehabilitation of LS 22	
91st Ave SE	B1-B	Capital	2041	$ 1,370,000	$ 1,370,000	Replace 1,700 LF 8" with 12" gravity in 91st Avenue SE.	

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project A1
Lift Station 20 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	22,000	$	22,000
2	Change in Site Conditions	1	EST	$	10,000	$	10,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
6	Replace Wet Well Level Sensors	1	LS	$	5,000	$	5,000
7	Replace Pumps	2	EA	$	35,000	$	70,000
8	Replace Piping and Valves	1	LS	$	20,000	$	20,000
9	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
10	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
11	Site Lighting Improvements	1	LS	$	10,000	$	10,000
12	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	233,000
		Sales Tax (9%)				$	20,970
	Total Construction Cost (rounded)					**$**	**254,000**
	Construction Contingency (20%)					$	50,800
	Engineering, Permitting, Administration (30%):					$	91,440
	Total Project Cost (rounded)					**$**	**397,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project A2
Lift Station 16 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	23,000	$	23,000
2	Change in Site Conditions	1	EST	$	10,000	$	10,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Clearing and Grubbing	1	LS	$	2,000	$	2,000
6	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
7	Replace Pumps	2	EA	$	15,000	$	30,000
8	Replace Piping and Valves	1	LS	$	8,000	$	8,000
9	Wet Well Rehabilitation	1	LS	$	60,000	$	60,000
10	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
11	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
12	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
13	Site Lighting Improvements	1	LS	$	10,000	$	10,000
14	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	249,000
		Sales Tax (9%)				$	22,410
	Total Construction Cost (rounded)					**$**	**271,000**
	Construction Contingency (20%)					$	54,200
	Engineering, Permitting, Administration (30%):					$	97,560
	Total Project Cost (rounded)					**$**	**423,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project A4
Dosing Station Reconstruction
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	58,000	$	58,000
3	Change in Site Conditions	1	EST	$	30,000	$	30,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	1,000	$	1,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	0	LF	$	4	$	-
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	170	TN	$	35	$	5,950
11	HMA Cl. 1/2 IN. PG 64-22	210	TN	$	200	$	42,000
12	Removal of Unsuitable Material (Trench)	10	CY	$	75	$	750
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	120	TN	$	35	$	4,200
15	PVC Sanitary Sewer Pipe 12 In. Diam.	100	LF	$	125	$	12,500
16	Erosion/Water Pollution Control	1	LS	$	10,000	$	10,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
18	Generator	1	LS	$	60,000	$	60,000
19	Electrical	1	LS	$	30,000	$	30,000
20	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
21	Topsoil Type A	0	CY	$	75	$	-
22	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
23	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	634,400
		Sales Tax (9%)				$	57,096
	Total Construction Cost (rounded)					**$**	**691,000**
	Construction Contingency (20%)					$	138,200
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	248,760
	Total Project Cost (rounded)					**$**	**1,080,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B1-A
Vernon Road West @ VRD
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY			UNIT PRICE		AMOUNT
1	Mobilization/Demobilization	1	LS	$	69,000	$	69,000
2	Force Account	1	EST	$	30,000	$	30,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	12,000	$	12,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	11,000	$	11,000
6	Sawcutting Existing Pavement	1,960	LF	$	4	$	7,840
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Crushed Surfacing Base Course	280	TN	$	35	$	9,800
9	HMA Cl. 1/2 IN. PG 64-22	350	TN	$	200	$	70,000
10	Manhole 72 In. Diam. Type 2	4	EA	$	10,000	$	40,000
11	Dewatering for Sewer	1	LS	$	10,000	$	10,000
12	Removal of Unsuitable Material (Trench)	70	CY	$	75	$	5,250
13	Trench Excavation Safety Systems	1	LS	$	30,000	$	30,000
14	Temporary Sewer Bypass Pumping	1	LS	$	20,000	$	20,000
15	Bank Run Gravel for Trench Backfill	1,090	TN	$	35	$	38,150
16	PVC Sanitary Sewer Pipe 36 In. Diam.	968	LF	$	350	$	338,800
17	Reconnect Side Sewer	5	EA	$	1,500	$	7,500
18	Erosion/Water Pollution Control	5	LS	$	5,000	$	25,000
19	Seeding, Fertilizing and Mulching	30	SY	$	15	$	450
20	Topsoil Type A	10	CY	$	75	$	750
21	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
22	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	750,540
		Sales Tax (9%)				$	67,549
	Total Construction Cost (rounded)					**$**	**818,000**
	Construction Contingency (20%)					$	163,600
	Engineering, Permitting, Administration (30%):					$	294,480
	Total Project Cost (rounded)					**$**	**1,280,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B1-B
91st Ave SE
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	73,000	$	73,000
2	Change in Site Conditions	1	EST	$	30,000	$	30,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	9,000	$	9,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	18,000	$	18,000
7	Sawcutting Existing Pavement	3,420	LF	$	4	$	13,680
8	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
9	Crushed Surfacing Base Course	490	TN	$	35	$	17,150
10	HMA Cl. 1/2 IN. PG 64-22	610	TN	$	200	$	122,000
11	Manhole 48 In. Diam. Type 2	10	EA	$	6,000	$	60,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	170	CY	$	75	$	12,750
14	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
15	Temporary Sewer Bypass Pumping	1	LS	$	10,000	$	10,000
16	Bank Run Gravel for Trench Backfill	2,980	TN	$	35	$	104,300
17	PVC Sanitary Sewer Pipe 12 In. Diam.	1,700	LF	$	125	$	212,500
18	Reconnect Side Sewer	27	EA	$	1,500	$	40,500
19	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
20	Seeding, Fertilizing and Mulching	140	SY	$	15	$	2,100
21	Topsoil Type A	20	CY	$	75	$	1,500
22	Cement Concrete Traffic Curb and Gutter	140	LF	$	50	$	7,000
23	Cement Concrete Sidewalk	80	SY	$	80	$	6,400
		Subtotal				$	799,880
		Sales Tax (9%)				$	71,989
	Total Construction Cost (rounded)					**$**	**872,000**
	Construction Contingency (20%)					$	174,400
	Engineering, Permitting, Administration (30%):					$	313,920
	Total Project Cost (rounded)					**$**	**1,370,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B1-C
Vernon Road West Trunk @ LS 15 Discharge
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	56,000	$	56,000
2	Force Account	1	EST	$	30,000	$	30,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	11,000	$	11,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	10,000	$	10,000
7	Sawcutting Existing Pavement	1,830	LF	$	4	$	7,320
8	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
9	Crushed Surfacing Base Course	260	TN	$	35	$	9,100
10	HMA Cl. 1/2 IN. PG 64-22	330	TN	$	200	$	66,000
11	Manhole 60 In. Diam. Type 2	6	EA	$	8,000	$	48,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	60	CY	$	75	$	4,500
14	Trench Excavation Safety Systems	1	LS	$	30,000	$	30,000
15	Temporary Sewer Bypass Pumping	1	LS	$	20,000	$	20,000
16	Bank Run Gravel for Trench Backfill	1,010	TN	$	35	$	35,350
17	PVC Sanitary Sewer Pipe 24 In. Diam.	902	LF	$	250	$	225,500
18	Reconnect Side Sewer	6	EA	$	1,500	$	9,000
19	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
20	Seeding, Fertilizing and Mulching	30	SY	$	15	$	450
21	Topsoil Type A	10	CY	$	75	$	750
22	Cement Concrete Traffic Curb and Gutter	30	LF	$	50	$	1,500
23	Cement Concrete Sidewalk	20	SY	$	80	$	1,600
		Subtotal				$	606,070
		Sales Tax (9%)				$	54,546
	Total Construction Cost (rounded)					**$**	**661,000**
	Construction Contingency (20%)					$	132,200
	Engineering, Permitting, Administration (30%):					$	237,960
	Total Project Cost (rounded)					**$**	**1,040,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B2
Lift Station 1 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	42,000	$	42,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	5,000	$	5,000
4	Project Temporary Traffic Control	1	LS	$	5,000	$	5,000
5	Clearing and Grubbing	1	LS	$	1,000	$	1,000
6	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
7	Replace Pumps	2	EA	$	15,000	$	30,000
8	Replace Piping and Valves	1	LS	$	10,000	$	10,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Dry Well Rehabilitation	1	LS	$	30,000	$	30,000
11	Wet Well Rehabilitation	1	LS	$	50,000	$	50,000
12	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
13	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
14	Replace Power Service & Electrical Equipment	1	LS	$	20,000	$	20,000
15	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
16	New Generator	1	LS	$	75,000	$	75,000
17	Fuel Tank and Pad	1	LS	$	25,000	$	25,000
18	Site Lighting Improvements	1	LS	$	10,000	$	10,000
19	New Water Service and Hose Bib	1	LS	$	10,000	$	10,000
20	Demolition and Disposal of Equpiment	1	LS	$	30,000	$	30,000
		Subtotal				$	458,000
		Sales Tax (9%)				$	41,220
	Total Construction Cost (rounded)					**$**	**499,000**
	Construction Contingency (20%)					$	99,800
	Engineering, Permitting, Administration (30%):					$	179,640
	Total Project Cost (rounded)					**$**	**779,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B3
Lift Station 12 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	41,000	$	41,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
6	Replace Pumps	3	EA	$	30,000	$	90,000
7	Replace Piping and Valves	1	LS	$	25,000	$	25,000
8	Wet Well Rehabilitation	1	LS	$	80,000	$	80,000
9	Dry Well Rehabilitation	1	LS	$	20,000	$	20,000
10	Odor Control Improvements	1	LS	$	10,000	$	10,000
11	Cathodic Protection	1	LS	$	25,000	$	25,000
12	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
13	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	80,000	$	80,000
14	Site Lighting Improvements	1	LS	$	10,000	$	10,000
15	Demolition and Disposal of Equipment	1	LS	$	20,000	$	20,000
		Subtotal				$	447,000
		Sales Tax (9%)				$	40,230
	Total Construction Cost (rounded)					**$**	**487,000**
	Construction Contingency (20%)					$	97,400
	Engineering, Permitting, Administration (30%):					$	175,320
	Total Project Cost (rounded)					**$**	**760,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B4
Lift Station 2 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	42,000	$	42,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	5,000	$	5,000
4	Project Temporary Traffic Control	1	LS	$	1,000	$	1,000
5	Clearing and Grubbing	1	LS	$	1,000	$	1,000
6	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
7	Replace Pumps	2	EA	$	15,000	$	30,000
8	Replace Piping and Valves	1	LS	$	10,000	$	10,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Dry Well Rehabilitation	1	LS	$	30,000	$	30,000
11	Wet Well Rehabilitation	1	LS	$	50,000	$	50,000
12	Cathodic Protection	1	LS	$	25,000	$	25,000
13	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
14	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
15	Replace Power Service & Electrical Equipment	1	LS	$	20,000	$	20,000
16	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
17	New Generator	1	LS	$	75,000	$	75,000
18	Fuel Tank and Pad	1	LS	$	25,000	$	25,000
19	Site Lighting Improvements	1	LS	$	10,000	$	10,000
20	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	459,000
		Sales Tax (9%)				$	41,310
	Total Construction Cost (rounded)					**$**	**500,000**
	Construction Contingency (20%)					$	100,000
	Engineering, Permitting, Administration (30%):					$	180,000
	Total Project Cost (rounded)					**$**	**780,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project B5
Lift Station 14 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 21,000	$ 21,000
2	Change in Site Conditions	1	EST	$ 10,000	$ 10,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Locate Existing Utilities for Sewer	1	LS	$ 2,000	$ 2,000
6	Replace Wet Well Level Sensors	1	LS	$ 5,000	$ 5,000
7	Replace Pumps	2	EA	$ 20,000	$ 40,000
8	Replace Piping and Valves	1	LS	$ 10,000	$ 10,000
9	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
10	Force Main Bypass Connection	1	LS	$ 10,000	$ 10,000
11	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
12	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
13	Site Parking Improvements	1	LS	$ 25,000	$ 25,000
14	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 227,000
		Sales Tax (9%)			$ 20,430
	Total Construction Cost (rounded)				**$ 247,000**
	Construction Contingency (20%)				$ 49,400
	Engineering, Permitting, Administration (30%):				$ 88,920
	Total Project Cost (rounded)				**$ 386,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project C1
Lift Station 17 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	25,000	$	25,000
2	Change in Site Conditions	1	EST	$	10,000	$	10,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Clearing and Grubbing	1	LS	$	2,000	$	2,000
6	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
7	Replace Pumps	2	EA	$	25,000	$	50,000
8	Replace Piping and Valves	1	LS	$	15,000	$	15,000
9	Wet Well Rehabilitation	1	LS	$	60,000	$	60,000
10	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
11	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
12	Site Lighting Improvements	1	LS	$	10,000	$	10,000
13	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	268,000
		Sales Tax (9%)				$	24,120
	Total Construction Cost (rounded)					**$**	**292,000**
	Construction Contingency (20%)					$	58,400
	Engineering, Permitting, Administration (30%):					$	105,120
	Total Project Cost (rounded)					**$**	**456,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project C2-A
Decommission LS 18
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	7,000	$	7,000
2	Change in Site Conditions	1	EST	$	3,000	$	3,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
6	Site Restoration	1	LS	$	10,000	$	10,000
7	Demolition and Disposal of Lift Station 18	1	LS	$	50,000	$	50,000
		Subtotal				$	76,000
		Sales Tax (9%)				$	6,840
	Total Construction Cost (rounded)					**$**	**83,000**
	Construction Contingency (20%)					$	16,600
	Engineering, Permitting, Administration (30%):					$	29,880
	Total Project Cost (rounded)					**$**	**130,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project C2-B
White Oaks Sewer Extension
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	345,000	$	345,000
2	Change in Site Conditions	1	EST	$	140,000	$	140,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	33,000	$	33,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	20,820	LF	$	4	$	83,280
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Crushed Surfacing Base Course	2,780	TN	$	35	$	97,300
9	HMA Cl. 1/2 IN. PG 64-22	3,480	TN	$	200	$	696,000
10	Manhole 48 In. Diam. Type 2	42	EA	$	6,000	$	252,000
11	Dewatering for Sewer	1	LS	$	10,000	$	10,000
12	Removal of Unsuitable Material (Trench)	670	CY	$	75	$	50,250
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	11,900	TN	$	35	$	416,500
15	PVC Sanitary Sewer Pipe 8 In. Diam.	6,800	LF	$	80	$	544,000
16	PVC Sanitary Sewer Pipe 10 In. Diam.	3,600	LF	$	100	$	360,000
17	Side Sewer	139	EA	$	5,000	$	695,000
18	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
19	Seeding, Fertilizing and Mulching	660	SY	$	15	$	9,900
20	Topsoil Type A	80	CY	$	75	$	6,000
21	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
22	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	3,788,230
		Sales Tax (9%)				$	340,941
	Total Construction Cost (rounded)					**$**	**4,129,000**
	Construction Contingency (20%)					$	825,800
	Engineering, Permitting, Administration (30%):					$	1,486,440
	Total Project Cost (rounded)					**$**	**6,450,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project C3
New LS C3 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	84,000	$	84,000
2	Change in Site Conditions	1	EST	$	40,000	$	40,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	7,000	$	7,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	2,780	LF	$	4	$	11,120
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	280	TN	$	35	$	9,800
11	HMA Cl. 1/2 IN. PG 64-22	350	TN	$	200	$	70,000
12	Removal of Unsuitable Material (Trench)	90	CY	$	75	$	6,750
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	1,570	TN	$	35	$	54,950
15	Force Main, 4 in. Diam., Incl. Bedding	1,400	LF	$	100	$	140,000
16	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
18	Generator	1	LS	$	60,000	$	60,000
19	Electrical	1	LS	$	30,000	$	30,000
20	Seeding, Fertilizing and Mulching	10	SY	$	15	$	150
21	Topsoil Type A	10	CY	$	75	$	750
22	Cement Concrete Traffic Curb and Gutter	10	LF	$	50	$	500
23	Cement Concrete Sidewalk	10	SY	$	80	$	800
		Subtotal				$	915,820
		Sales Tax (9%)				$	82,424
	Total Construction Cost (rounded)					**$**	**998,000**
	Construction Contingency (20%)					$	199,600
	Engineering, Permitting, Administration (30%):					$	359,280
	Total Project Cost (rounded)					**$**	**1,560,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project C4
New LS C4 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	72,000	$	72,000
2	Change in Site Conditions	1	EST	$	30,000	$	30,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	5,000	$	5,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	1,820	LF	$	4	$	7,280
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	180	TN	$	35	$	6,300
11	HMA Cl. 1/2 IN. PG 64-22	230	TN	$	200	$	46,000
12	Removal of Unsuitable Material (Trench)	60	CY	$	75	$	4,500
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	1,010	TN	$	35	$	35,350
15	Force Main, 4 in. Diam., Incl. Bedding	900	LF	$	100	$	90,000
16	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
18	Generator	1	LS	$	60,000	$	60,000
19	Electrical	1	LS	$	30,000	$	30,000
20	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
21	Topsoil Type A	0	CY	$	75	$	-
22	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
23	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	786,430
		Sales Tax (9%)				$	70,779
	Total Construction Cost (rounded)					**$**	**857,000**
	Construction Contingency (20%)					$	171,400
	Engineering, Permitting, Administration (30%):					$	308,520
	Total Project Cost (rounded)					**$**	**1,340,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project C5
New LS C5 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	93,000	$	93,000
2	Change in Site Conditions	1	EST	$	40,000	$	40,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	4,000	$	4,000
5	Clearing and Grubbing	1	LS	$	10,000	$	10,000
6	Sawcutting Existing Pavement	1,320	LF	$	4	$	5,280
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Package Lift Station	1	LS	$	400,000	$	400,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	130	TN	$	35	$	4,550
11	HMA Cl. 1/2 IN. PG 64-22	170	TN	$	200	$	34,000
12	Removal of Unsuitable Material (Trench)	80	CY	$	75	$	6,000
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	1,400	TN	$	35	$	49,000
15	Force Main, 4 in. Diam., Incl. Bedding	1,250	LF	$	100	$	125,000
16	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	40,000	$	40,000
18	Generator	1	LS	$	80,000	$	80,000
19	Electrical	1	LS	$	40,000	$	40,000
20	Seeding, Fertilizing and Mulching	460	SY	$	15	$	6,900
21	Topsoil Type A	50	CY	$	75	$	3,750
22	Cement Concrete Traffic Curb and Gutter	20	LF	$	50	$	1,000
23	Cement Concrete Sidewalk	20	SY	$	80	$	1,600
		Subtotal				$	1,014,080
		Sales Tax (9%)				$	91,267
	Total Construction Cost (rounded)					**$**	**1,105,000**
	Construction Contingency (20%)					$	221,000
	Engineering, Permitting, Administration (30%):					$	397,800
	Total Project Cost (rounded)					**$**	**1,730,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D1-A
LS 15 Upgrade and Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	56,000	$	56,000
2	Change in Site Conditions	1	EST	$	30,000	$	30,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
6	Replace Pumps	4	EA	$	40,000	$	160,000
7	Replace Piping and Valves	1	LS	$	30,000	$	30,000
8	Wet Well Rehabilitation	1	LS	$	100,000	$	100,000
9	Dry Well Rehabilitation	1	LS	$	20,000	$	20,000
10	Odor Control Improvements	1	LS	$	50,000	$	50,000
11	Cathodic Protection	1	LS	$	25,000	$	25,000
12	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
13	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	80,000	$	80,000
14	Site Lighting Improvements	1	LS	$	10,000	$	10,000
15	Demolition and Disposal of Equipment	1	LS	$	20,000	$	20,000
		Subtotal				$	607,000
		Sales Tax (9%)				$	54,630
	Total Construction Cost (rounded)					**$**	**662,000**
	Construction Contingency (20%)					$	132,400
	Engineering, Permitting, Administration (30%):					$	238,320
	Total Project Cost (rounded)					**$**	**1,033,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D1-B
Cedar Road Sewers - West Side
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 60,000	$ 60,000
2	Change in Site Conditions	1	EST	$ 30,000	$ 30,000
3	Survey	1	LS	$ 10,000	$ 10,000
4	Project Temporary Traffic Control	1	LS	$ 8,000	$ 8,000
5	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
6	Sawcutting Existing Pavement	3,120	LF	$ 4	$ 12,480
7	Locate Existing Utilities for Sewer	1	LS	$ 10,000	$ 10,000
8	Crushed Surfacing Base Course	420	TN	$ 35	$ 14,700
9	HMA Cl. 1/2 IN. PG 64-22	520	TN	$ 200	$ 104,000
10	Manhole 48 In. Diam. Type 2	6	EA	$ 6,000	$ 36,000
11	Dewatering for Sewer	1	LS	$ 10,000	$ 10,000
12	Removal of Unsuitable Material (Trench)	160	CY	$ 75	$ 12,000
13	Trench Excavation Safety Systems	1	LS	$ 20,000	$ 20,000
14	Bank Run Gravel for Trench Backfill	2,720	TN	$ 35	$ 95,200
15	PVC Sanitary Sewer Pipe 8 In. Diam.	1,550	LF	$ 80	$ 124,000
16	Side Sewer	20	EA	$ 5,000	$ 100,000
17	Erosion/Water Pollution Control	1	LS	$ 5,000	$ 5,000
18	Seeding, Fertilizing and Mulching	100	SY	$ 15	$ 1,500
19	Topsoil Type A	20	CY	$ 75	$ 1,500
20	Cement Concrete Traffic Curb and Gutter	0	LF	$ 50	$ -
21	Cement Concrete Sidewalk	0	SY	$ 80	$ -
		Subtotal			$ 659,380
		Sales Tax (9%)			$ 59,344
	Total Construction Cost (rounded)				**$ 719,000**
	Construction Contingency (20%)				$ 143,800
	Engineering, Permitting, Administration (30%):				$ 258,840
	Total Project Cost (rounded)				**$ 1,130,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D1-C
Cedar Road Sewers - East Side
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	50,000	$	50,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	6,000	$	6,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	2,520	LF	$	4	$	10,080
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Crushed Surfacing Base Course	340	TN	$	35	$	11,900
9	HMA Cl. 1/2 IN. PG 64-22	420	TN	$	200	$	84,000
10	Manhole 48 In. Diam. Type 2	5	EA	$	6,000	$	30,000
11	Dewatering for Sewer	1	LS	$	10,000	$	10,000
12	Removal of Unsuitable Material (Trench)	130	CY	$	75	$	9,750
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	2,190	TN	$	35	$	76,650
15	PVC Sanitary Sewer Pipe 8 In. Diam.	1,250	LF	$	80	$	100,000
16	Side Sewer	17	EA	$	5,000	$	85,000
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	90	SY	$	15	$	1,350
19	Topsoil Type A	10	CY	$	75	$	750
20	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
21	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	545,480
		Sales Tax (9%)				$	49,093
	Total Construction Cost (rounded)					**$**	**595,000**
	Construction Contingency (20%)					$	119,000
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	214,200
	Total Project Cost (rounded)					**$**	**930,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D1-D
Soper Hill Sewers
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	106,000	$	106,000
2	Change in Site Conditions	1	EST	$	50,000	$	50,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	14,000	$	14,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	5,620	LF	$	4	$	22,480
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Crushed Surfacing Base Course	750	TN	$	35	$	26,250
9	HMA Cl. 1/2 IN. PG 64-22	940	TN	$	200	$	188,000
10	Manhole 48 In. Diam. Type 2	12	EA	$	6,000	$	72,000
11	Dewatering for Sewer	1	LS	$	10,000	$	10,000
12	Removal of Unsuitable Material (Trench)	280	CY	$	75	$	21,000
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	4,900	TN	$	35	$	171,500
15	PVC Sanitary Sewer Pipe 8 In. Diam.	2,800	LF	$	80	$	224,000
16	Side Sewer	40	EA	$	5,000	$	200,000
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	190	SY	$	15	$	2,850
19	Topsoil Type A	30	CY	$	75	$	2,250
20	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
21	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	1,160,330
		Sales Tax (9%)				$	104,430
	Total Construction Cost (rounded)					**$**	**1,265,000**
	Construction Contingency (20%)					$	253,000
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	455,400
	Total Project Cost (rounded)					**$**	**1,980,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D1-E
Lakeview Drive Sewers
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	145,000	$	145,000
2	Change in Site Conditions	1	EST	$	60,000	$	60,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	26,000	$	26,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	5,620	LF	$	4	$	22,480
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Crushed Surfacing Base Course	750	TN	$	35	$	26,250
9	HMA Cl. 1/2 IN. PG 64-22	940	TN	$	200	$	188,000
10	Manhole 48 In. Diam. Type 2	12	EA	$	6,000	$	72,000
11	Dewatering for Sewer	1	LS	$	10,000	$	10,000
12	Removal of Unsuitable Material (Trench)	520	CY	$	75	$	39,000
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	9,280	TN	$	35	$	324,800
15	PVC Sanitary Sewer Pipe 8 In. Diam.	5,300	LF	$	80	$	424,000
16	Side Sewer	40	EA	$	5,000	$	200,000
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	190	SY	$	15	$	2,850
19	Topsoil Type A	30	CY	$	75	$	2,250
20	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
21	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	1,592,630
		Sales Tax (9%)				$	143,337
	Total Construction Cost (rounded)					**$**	**1,736,000**
	Construction Contingency (20%)					$	347,200
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	624,960
	Total Project Cost (rounded)					**$**	**2,710,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D2
Lift Station 5 Rehabilitation & Upgrade
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 29,000	$ 29,000
2	Change in Site Conditions	1	EST	$ 20,000	$ 20,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Locate Existing Utilities for Sewer	1	LS	$ 2,000	$ 2,000
6	Replace Pumps	2	EA	$ 25,000	$ 50,000
7	Replace Piping and Valves	1	LS	$ 10,000	$ 10,000
8	Wet Well Rehabilitation	1	LS	$ 50,000	$ 50,000
9	Dry Well Rehabilitation	1	LS	$ 30,000	$ 30,000
10	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
11	Replace Power Service & Electrical Equipment	1	LS	$ 20,000	$ 20,000
12	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
13	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
14	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 315,000
		Sales Tax (9%)			$ 28,350
	Total Construction Cost (rounded)				**$ 343,000**
	Construction Contingency (20%)				$ 68,600
	Engineering, Permitting, Administration (30%):				$ 123,480
	Total Project Cost (rounded)				**$ 536,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D4
Lift Station 3 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	34,000	$	34,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Clearing and Grubbing	1	LS	$	2,000	$	2,000
6	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
7	Replace Pumps	2	EA	$	15,000	$	30,000
8	Replace Piping and Valves	1	LS	$	10,000	$	10,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Dry Well Rehabilitation	1	LS	$	30,000	$	30,000
11	Wet Well Rehabilitation	1	LS	$	50,000	$	50,000
12	Cathodic Protection	1	LS	$	25,000	$	25,000
13	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
14	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
15	Replace Power Service & Electrical Equipment	1	LS	$	20,000	$	20,000
16	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
17	Site Lighting Improvements	1	LS	$	10,000	$	10,000
18	New Water Service and Hose Bib	1	LS	$	20,000	$	20,000
19	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	367,000
		Sales Tax (9%)				$	33,030
	Total Construction Cost (rounded)					**$**	**400,000**
	Construction Contingency (20%)					$	80,000
	Engineering, Permitting, Administration (30%):					$	144,000
	Total Project Cost (rounded)					**$**	**624,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D3
Lift Station 4 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 49,000	$ 49,000
2	Change in Site Conditions	1	EST	$ 20,000	$ 20,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Clearing and Grubbing	1	LS	$ 2,000	$ 2,000
6	Locate Existing Utilities for Sewer	1	LS	$ 5,000	$ 5,000
7	Replace Pumps	2	EA	$ 25,000	$ 50,000
8	Replace Piping and Valves	1	LS	$ 15,000	$ 15,000
9	Dry Well Rehabilitation	1	LS	$ 30,000	$ 30,000
10	Wet Well Rehabilitation	1	LS	$ 50,000	$ 50,000
11	Cathodic Protection	1	LS	$ 25,000	$ 25,000
12	Force Main Bypass Connection	1	LS	$ 10,000	$ 10,000
13	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
14	Replace Power Service & Electrical Equipment	1	LS	$ 20,000	$ 20,000
15	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
16	New Generator	1	LS	$ 100,000	$ 100,000
17	Fuel Tank and Pad	1	LS	$ 30,000	$ 30,000
18	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
19	New Water Service and Hose Bib	1	LS	$ 20,000	$ 20,000
20	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 530,000
		Sales Tax (9%)			$ 47,700
	Total Construction Cost (rounded)				**$ 578,000**
	Construction Contingency (20%)				$ 115,600
	Engineering, Permitting, Administration (30%):				$ 208,080
	Total Project Cost (rounded)				**$ 902,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D5
Lift Station 6 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	43,000	$	43,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Clearing and Grubbing	1	LS	$	2,000	$	2,000
6	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
7	Replace Pumps	2	EA	$	15,000	$	30,000
8	Replace Piping and Valves	1	LS	$	10,000	$	10,000
9	Dry Well Rehabilitation	1	LS	$	30,000	$	30,000
10	Wet Well Rehabilitation	1	LS	$	50,000	$	50,000
11	Cathodic Protection	1	LS	$	25,000	$	25,000
12	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
13	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
14	Replace Power Service & Electrical Equipment	1	LS	$	20,000	$	20,000
15	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
16	New Generator	1	LS	$	75,000	$	75,000
17	Fuel Tank and Pad	1	LS	$	25,000	$	25,000
18	Site Lighting Improvements	1	LS	$	10,000	$	10,000
19	New Water Service and Hose Bib	1	LS	$	20,000	$	20,000
20	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	466,000
		Sales Tax (9%)				$	41,940
	Total Construction Cost (rounded)					**$**	**508,000**
	Construction Contingency (20%)					$	101,600
	Engineering, Permitting, Administration (30%):					$	182,880
	Total Project Cost (rounded)					**$**	**793,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D6
LS 8C Upgrade & Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	56,000	$	56,000
2	Change in Site Conditions	1	EST	$	30,000	$	30,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	7,000	$	7,000
5	Clearing and Grubbing	1	LS	$	2,000	$	2,000
6	Sawcutting Existing Pavement	740	LF	$	4	$	2,960
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
9	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
10	Replace Pumps	2	EA	$	40,000	$	80,000
11	Replace Piping and Valves	1	LS	$	20,000	$	20,000
12	Odor Control System	1	LS	$	20,000	$	20,000
13	Dry Well Rehabilitation	1	LS	$	30,000	$	30,000
14	Wet Well Rehabilitation	1	LS	$	50,000	$	50,000
15	Cathodic Protection	1	LS	$	25,000	$	25,000
16	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
17	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
18	Crushed Surfacing Base Course	80	TN	$	35	$	2,800
19	HMA Cl. 1/2 IN. PG 64-22	100	TN	$	200	$	20,000
20	Removal of Unsuitable Material (Trench)	30	CY	$	75	$	2,250
21	Bank Run Gravel for Trench Backfill	410	TN	$	35	$	14,350
22	Force Main, 10 in. Diam., Incl. Bedding	360	LF	$	175	$	63,000
23	Site Improvements (Lighting)	1	LS	$	5,000	$	5,000
24	Replace Control Panel, Motor Starter Panel, Conduit a	1	LS	$	60,000	$	75,000
25	Demolition and Disposal of Equipment	1	LS	$	20,000	$	20,000
26	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
27	Topsoil Type A	0	CY	$	75	$	-
28	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
29	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	610,360
		Sales Tax (9%)				$	54,932
	Total Construction Cost (rounded)					**$**	**665,000**
	Construction Contingency (20%)					$	133,000
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	239,400
	Total Project Cost (rounded)					**$**	**1,040,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D7-A
New Gravity Line - Industrial Area
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 28,000	$ 28,000
2	Change in Site Conditions	1	EST	$ 20,000	$ 20,000
3	Survey	1	LS	$ 5,000	$ 5,000
4	Project Temporary Traffic Control	1	LS	$ 5,000	$ 5,000
5	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
6	Sawcutting Existing Pavement	20	LF	$ 4	$ 80
7	Locate Existing Utilities for Sewer	1	LS	$ 5,000	$ 5,000
8	Crushed Surfacing Base Course	0	TN	$ 35	$ -
9	HMA Cl. 1/2 IN. PG 64-22	0	TN	$ 200	$ -
10	Manhole 48 In. Diam. Type 2	5	EA	$ 6,000	$ 30,000
11	Dewatering for Sewer	1	LS	$ 10,000	$ 10,000
12	Removal of Unsuitable Material (Trench)	90	CY	$ 75	$ 6,750
13	Trench Excavation Safety Systems	1	LS	$ 20,000	$ 20,000
14	Bank Run Gravel for Trench Backfill	1,470	TN	$ 35	$ 51,450
15	PVC Sanitary Sewer Pipe 8 In. Diam.	840	LF	$ 80	$ 67,200
16	Side Sewer	5	EA	$ 5,000	$ 25,000
17	Erosion/Water Pollution Control	1	LS	$ 5,000	$ 5,000
18	Seeding, Fertilizing and Mulching	800	SY	$ 15	$ 12,000
19	Topsoil Type A	90	CY	$ 75	$ 6,750
20	Cement Concrete Traffic Curb and Gutter	0	LF	$ 50	$ -
21	Cement Concrete Sidewalk	0	SY	$ 80	$ -
		Subtotal			$ 302,230
		Sales Tax (9%)			$ 27,201
	Total Construction Cost (rounded)				**$ 329,000**
	Construction Contingency (20%)				$ 65,800
	Easement Acquisition				$ 63,000
	Engineering, Permitting, Administration (30%):				$ 118,440
	Total Project Cost (rounded)				**$ 520,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D7-B
New Gravity Line - Industrial Area
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	52,000	$	52,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	6,000	$	6,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	140	LF	$	4	$	560
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Crushed Surfacing Base Course	10	TN	$	35	$	350
9	HMA Cl. 1/2 IN. PG 64-22	20	TN	$	200	$	4,000
10	Manhole 48 In. Diam. Type 2	16	EA	$	6,000	$	96,000
11	Side Sewer	16	EA	$	5,000	$	80,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	120	CY	$	75	$	9,000
14	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
15	Bank Run Gravel for Trench Backfill	2,160	TN	$	35	$	75,600
16	PVC Sanitary Sewer Pipe 8 In. Diam.	1,230	LF	$	80	$	98,400
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	2,930	SY	$	15	$	43,950
19	Topsoil Type A	330	CY	$	75	$	24,750
20	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
21	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	565,610
		Sales Tax (9%)				$	50,905
	Total Construction Cost (rounded)					**$**	**617,000**
	Construction Contingency (20%)					$	123,400
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	222,120
	Total Project Cost (rounded)					**$**	**970,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project D7-C
Hartford Road
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	15,000	$	15,000
2	Change in Site Conditions	1	EST	$	6,000	$	6,000
3	Survey	1	LS	$	5,000	$	5,000
4	Project Temporary Traffic Control	1	LS	$	3,000	$	3,000
5	Clearing and Grubbing	1	LS	$	1,000	$	1,000
6	Sawcutting Existing Pavement	820	LF	$	4	$	3,280
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Crushed Surfacing Base Course	70	TN	$	35	$	2,450
9	HMA Cl. 1/2 IN. PG 64-22	90	TN	$	200	$	18,000
10	Manhole 48 In. Diam. Type 2	2	EA	$	6,000	$	12,000
11	Side Sewer	1	EA	$	5,000	$	5,000
12	Dewatering for Sewer	1	LS	$	5,000	$	5,000
13	Removal of Unsuitable Material (Trench)	50	CY	$	75	$	3,750
14	Trench Excavation Safety Systems	1	LS	$	10,000	$	10,000
15	Bank Run Gravel for Trench Backfill	790	TN	$	35	$	27,650
16	PVC Sanitary Sewer Pipe 8 In. Diam.	450	LF	$	80	$	36,000
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	50	SY	$	15	$	750
19	Topsoil Type A	10	CY	$	75	$	750
20	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
21	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	164,630
		Sales Tax (9%)				$	14,817
	Total Construction Cost (rounded)					**$**	**179,000**
	Construction Contingency (20%)					$	35,800
	Engineering, Permitting, Administration (30%):					$	64,440
	Total Project Cost (rounded)					**$**	**280,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E1-A
LS 1C Rehabilitation
July 2021 (ENR = 13248)

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 59,000	$ 59,000
2	Minor Changes	1	FA	$ 20,000	$ 20,000
3	Clearing & Grubbing	1	LS	$ 2,000	$ 2,000
4	Dewatering	1	LS	$ 2,000	$ 2,000
5	Erosion Control	1	LS	$ 2,000	$ 2,000
6	Trench Excavation Safety Systems	1	LS	$ 2,000	$ 2,000
7	Salvage & Demolition	1	LS	$ 20,000	$ 20,000
8	Temporary Bypass Pumping	1	LS	$ 10,000	$ 10,000
9	Gravel Base	50	TN	$ 30	$ 1,500
10	Grading and Paving	1	LS	$ 5,000	$ 5,000
11	Dry Pit Rehabilitation	1	LS	$ 25,000	$ 25,000
12	Wet Well Rehabilitation	1	LS	$ 30,000	$ 30,000
13	Submersible Pumps (2 x 70 HP)	1	LS	$ 170,000	$ 170,000
14	Variable Frequency Drive	1	LS	$ 19,000	$ 19,000
15	New Control Panel	1	LS	$ 40,000	$ 40,000
16	Piping, Valves and Accessories	1	LS	$ 10,000	$ 10,000
17	Electrical Modifications	1	LS	$ 100,000	$ 100,000
18	Instrumentation and Telemetry	1	LS	$ 15,000	$ 15,000
19	Landscaping	1	LS	$ 5,000	$ 5,000
20	Utility Service Upgrade (PUD)	1	LS	$ 10,000	$ 10,000
21	Programming, Startup, SCADA, Documentation	1	LS	$ 15,000	$ 15,000
22	Contruction Easement	1	LS	$ 2,000	$ 2,000
		Subtotal			$ 564,500
		Contingency (20%)			$ 112,900
		Subtotal			$ 677,400
		Sales Tax (9%)			$ 60,966
		Total			$ 738,366
	Total Construction Cost (Rounded)				**$ 740,000**
	Engineering, Permitting, Administration (30%):				$ 222,000
	Total Project Cost (rounded)				**$ 970,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E1-B
Mitchell Road Main Replacement
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	30,000	$	30,000
3	Change in Site Conditions	1	EST	$	20,000	$	20,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	3,000	$	3,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	6,000	$	6,000
7	Sawcutting Existing Pavement	910	LF	$	4	$	3,640
8	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
9	Crushed Surfacing Base Course	130	TN	$	35	$	4,550
10	HMA Cl. 1/2 IN. PG 64-22	160	TN	$	200	$	32,000
11	Manhole 48 In. Diam. Type 2	10	EA	$	6,000	$	60,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	50	CY	$	75	$	3,750
14	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
15	Temporary Sewer Bypass Pumping	1	LS	$	10,000	$	10,000
16	Bank Run Gravel for Trench Backfill	780	TN	$	35	$	27,300
17	PVC Sanitary Sewer Pipe 12 In. Diam.	444	LF	$	125	$	55,500
18	Reconnect Side Sewer	7	EA	$	1,500	$	10,500
19	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
20	Seeding, Fertilizing and Mulching	40	SY	$	15	$	600
21	Topsoil Type A	10	CY	$	75	$	750
22	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
23	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	327,590
		Sales Tax (9%)				$	29,483
	Total Construction Cost (rounded)					**$**	**357,000**
	Construction Contingency (20%)					$	71,400
	Engineering, Permitting, Administration (30%):					$	128,520
	Total Project Cost (rounded)					**$**	**560,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E2-A
LS 2C Upgrade
July 2021 (ENR = 13248)

	Item	Quantity			Unit Cost		Total
1	Mobilization/Demobilization	1	LS	$	170,000	$	170,000
2	Minor Changes	1	FA	$	40,000	$	40,000
3	Clearing & Grubbing	1	LS	$	2,000	$	2,000
4	Dewatering	1	LS	$	15,000	$	15,000
5	Erosion Control	1	LS	$	15,000	$	15,000
6	Temporary Shoring & Bracing	1	LS	$	20,000	$	20,000
7	Trench Excavation Safety Systems	1	LS	$	10,000	$	10,000
8	Salvage & Demolition	1	LS	$	20,000	$	20,000
9	Temporary Bypass Pumping	1	LS	$	15,000	$	15,000
10	Concrete Slabs and Foundations	1	LS	$	35,000	$	35,000
11	Gravel Base	130	TN	$	35	$	4,550
12	HMA	60	TN	$	250	$	15,000
13	Fencing	200	LF	$	75	$	15,000
14	Utilities and Miscellaneous Site Improvements	1	LS	$	10,000	$	10,000
15	Electrical Shelter	1	LS	$	20,000	$	20,000
16	New 54" Bypass Connection MH	1	EA	$	5,000	$	5,000
17	New 120" Dia. Wet Well	1	LS	$	80,000	$	80,000
18	Replace Wet Well Lid - Exist 96" Dia	1	LS	$	30,000	$	30,000
19	Painting & Dampproofing	1	LS	$	35,000	$	35,000
20	Submersible Pumps (2 x 160 HP)	1	LS	$	325,000	$	325,000
21	Variable Frequency Drive	1	LS	$	35,000	$	35,000
22	Valve Vault Replacement Lid and Access Hatches	1	LS	$	15,000	$	15,000
23	Piping, Valves and Accessories	1	LS	$	45,000	$	45,000
24	FM Odor Control	1	LS	$	20,000	$	20,000
25	Aux Generator System (Genset, Enclosure, ATS)	1	LS	$	200,000	$	200,000
26	General Electrical	1	LS	$	100,000	$	100,000
27	Main Control Panels (PLC, Motor Starter, Power Distribution)	1	LS	$	200,000	$	200,000
28	Utility Service (PUD)	1	LS	$	25,000	$	25,000
29	Programming, Startup, SCADA, Documentation	1	LS	$	50,000	$	50,000
30	Landscaping	1	LS	$	5,000	$	5,000

Subtotal	$	1,576,550
Contingency (20%)	$	315,310
Subtotal	$	1,891,860
Sales Tax (9%)	$	170,267
Total	$	2,062,127
Total Construction Cost (Rounded)	**$**	**2,070,000**
Engineering, Permitting, Administration (30%):	$	621,000
Total Project Cost (rounded)	**$**	**2,700,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E2-B
20th St NE & Bus. Loop Rd to LS 2C
July 2021 (ENR = 13248)

	Item	Quantity		Unit Cost	Total
1	Mobilization, Cleanup and Demobilization	1	LS	$ 41,000.00	$ 41,000.00
2	Survey	1	LS	$ 9,000.00	$ 9,000.00
3	Minor Changes	1	LS	$ 20,000.00	$ 20,000.00
4	Trench Excavation Safety Systems	1	LS	$ 18,000.00	$ 18,000.00
5	Project Temporary Traffic Control	1	LS	$ 9,000.00	$ 9,000.00
6	Locate Existing Utilities	1	LS	$ 5,000.00	$ 5,000.00
7	Removal of Structures and Obstructions	1	LS	$ 9,000.00	$ 9,000.00
8	Sanitary Sewer Pipe, 15 In. Diam Ductile Iron	1580	LF	$ 120.00	$ 189,600.00
9	Manhole, 54 In. Diam.	3	EA	$ 6,500.00	$ 19,500.00
10	Manhole Additional Height, 54 In. Diam.	15	VF	$ 250.00	$ 3,750.00
11	Manhole, 48 In. Diam.	8	EA	$ 6,000.00	$ 48,000.00
12	Manhole Additional Height, 48 In. Diam.	28	VF	$ 240.00	$ 6,720.00
13	Bank Run Gravel for Backfill	3290	CY	$ 20.00	$ 65,800.00
14	Side Sewer Pipe, 6 In. Diam	400	LF	$ 65.00	$ 26,000.00
15	Side Sewer Pipe, 8 In. Diam	400	LF	$ 65.00	$ 26,000.00
16	Connection to Existing MH	2	EA	$ 6,000.00	$ 12,000.00
17	ADA Ramps	8	EA	$ 3,500.00	$ 28,000.00
18	Removal of Unsuitable Material	140	CY	$ 50.00	$ 7,000.00
19	Crushed Surfacing Base Course	394	TN	$ 30.00	$ 11,820.00
20	Temporary Trench Patch	200	TN	$ 180.00	$ 36,000.00
21	Sawcutting	3350	LF	$ 5.00	$ 16,750.00
22	Planing Bituminous Pavement	606	SY	$ 5.00	$ 3,030.00
23	Commercial HMA Cl. 1/2" PG 58H-22	230	TN	$ 140.00	$ 32,200.00
24	Project Documentation	1	LS	$ 5,000.00	$ 5,000.00
25	Erosion/Water Pollution Control	1	LS	$ 5,000.00	$ 5,000.00
26	Abandon Existing Manhole	7	EA	$ 600.00	$ 4,200.00
27	Inside Drop Connection	3	EA	$ 4,000.00	$ 12,000.00

Subtotal	$ 669,370
Contingency (20%)	$ 133,874
Subtotal	$ 803,244
Sales Tax (9%)	$ 72,292
Total	$ 875,536
Total Construction Cost (Rounded)	**$ 880,000**
Engineering, Permitting, Administration (30%):	$ 264,000
Total Project Cost (rounded)	**$ 1,150,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E2-C
LS 2C Force Main
July 2021 (ENR = 13248)

	Item	Quantity		Unit Cost		Total
1.	Minor Changes (1-04.4(1))	1	CALC	$20,000.00		$20,000.00
2.	Survey (S.P. 1-05.4(2))	1	LS	$10,000.00		$10,000.00
3.	SPCC Plan (S.S. 1-07.15(1))	1	LS	$500.00		$500.00
4.	Mobilization, Cleanup, and Demobilization (1-09.7)	1	LS	$200,000.00		$200,000.00
5.	Project Temporary Traffic Control (1-10.4(1))	1	LS	$125,000.00		$125,000.00
6.	Sawcutting (2-02.5)	4,250	LF	$5.00		$21,250.00
	Removal of Concrete Road Panels (2-02.5)	2,725	SY	$10.00		$27,250.00
7.	Removal of Structures and Obstructions (2-02.5)	1	LS	$50,000.00		$50,000.00
8.	Excavation, Embankment and Grading, Incl. Haul (2-03.5)	100	CY	$45.00		$4,500.00
9.	Unsuitable Foundation Excavation Incl. Haul (2-03.5)	10	CY	$70.00		$700.00
10.	Locate Existing Utilities (2-09.5)	1	LS	$10,000.00		$10,000.00
11.	Construction Geotextile for Separation (2-12.5)	250	SY	$20.00		$5,000.00
12.	Crushed Surfacing Top Course (4-04.5)	560	TN	$75.00		$42,000.00
13.	Crushed Surfacing Base Course (4-04.5)	1,125	TN	$60.00		$67,500.00
14.	Planing Bituminous Pavement (5-04.5)	0	SY	$8.00		$0.00
15.	HMA Cl. 1/2" PG 58H-22 (5-04.5)	625	TN	$150.00		$93,750.00
16.	Job Mix Compliance Price Adjustment (5-04.5)	1	CALC	$0.00		$0.00
17.	Compaction Price Adjustment (5-04.5)	1	CALC	$0.00		$0.00
18.	Removal of Unsuitable Material (Trench) (7-08.5)	25	CY	$50.00		$1,250.00
19.	Bank Run Gravel for Trench Backfill (7-08.5)	3,900	TN	$25.00		$97,500.00
20.	Trench Excavation Safety Systems (7-08.5)	1	LS	$5,000.00		$5,000.00
21.	Ductile Iron Sanitary Sewer Force Main, 10 In Diam. (7-17.5)	3,750	LF	$175.00		$656,250.00
22.	PVC Sanitary Sewer Drain, 6" Diam. (7-17.5)	18	LF	$50.00		$900.00
23.	Air Vacuum Release Assembly (7-17.5)	2	EA	$10,000.00		$20,000.00
24.	Jack and Bore Launching and Receiving Pits (7-20.5)	1	LS	$85,000.00		$85,000.00
25.	Encasement Pipe, 24 In Diam. (7-20.5)	45	LF	$700.00		$31,500.00
26.	Erosion/Water Pollution Control (8-01.5)	1	LS	$10,000.00		$10,000.00
27.	Bark or Wood Chip Mulch (8-02.5)	10	CY	$200.00		$2,000.00
28.	Seeding, Fertilizing, and Mulching (8-02.5)	100	SY	$50.00		$5,000.00
29.	Paint Line (8-22.5)	3,000	LF	$2.00		$6,000.00
30.	Painted Wide Lane Line (8-22.5)	50	LF	$2.00		$100.00
31.	Plastic Stop Line (8-22.5)	30	LF	$14.00		$420.00
		Subtotal				$1,598,370.00
		Contingency (20%)			$	319,674
		Subtotal			$	1,918,044
		Sales Tax (9%)			$	172,624
		Total			$	2,090,668
	Total Construction Cost (Rounded)				**$**	**2,100,000**
	Engineering, Permitting, Administration (30%):				$	630,000
	Total Project Cost (rounded)				**$**	**2,730,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E2-E
LS 2C FM Extension
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	90,000	$	90,000
2	Change in Site Conditions	1	EST	$	40,000	$	40,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	12,000	$	12,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	13,000	$	13,000
7	Sawcutting Existing Pavement	9,420	LF	$	4	$	37,680
8	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
9	Crushed Surfacing Base Course	1,340	TN	$	35	$	46,900
10	HMA Cl. 1/2 IN. PG 64-22	1,670	TN	$	200	$	334,000
11	Manhole 48 In. Diam. Type 2	5	EA	$	6,000	$	30,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	120	CY	$	75	$	9,000
14	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
15	Temporary Sewer Bypass Pumping	1	LS	$	20,000	$	20,000
16	Bank Run Gravel for Trench Backfill	2,160	TN	$	35	$	75,600
17	Force Main, 10 in. Diam., Incl. Bedding	1,230	LF	$	175	$	215,250
18	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
19	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
20	Topsoil Type A	0	CY	$	75	$	-
21	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
22	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	983,430
		Sales Tax (9%)				$	88,509
	Total Construction Cost (rounded)					**$**	**1,072,000**
	Construction Contingency (20%)					$	214,400
	Engineering, Permitting, Administration (30%):					$	385,920
	Total Project Cost (rounded)					**$**	**1,680,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E5-A
Centennial Townhomes DEA
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 18,000	$ 18,000
2	Change in Site Conditions	1	EST	$ 7,000	$ 7,000
3	Survey	1	LS	$ 5,000	$ 5,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
6	Removal of Structures and Obstructions	1	LS	$ 5,000	$ 5,000
7	Sawcutting Existing Pavement	820	LF	$ 4	$ 3,280
8	Locate Existing Utilities for Sewer	1	LS	$ 5,000	$ 5,000
9	Crushed Surfacing Base Course	120	TN	$ 35	$ 4,200
10	HMA Cl. 1/2 IN. PG 64-22	150	TN	$ 200	$ 30,000
11	Manhole 48 In. Diam. Type 2	3	EA	$ 6,000	$ 18,000
12	Dewatering for Sewer	1	LS	$ 10,000	$ 10,000
13	Removal of Unsuitable Material (Trench)	40	CY	$ 75	$ 3,000
14	Trench Excavation Safety Systems	1	LS	$ 10,000	$ 10,000
15	Temporary Sewer Bypass Pumping	1	LS	$ -	$ -
16	Bank Run Gravel for Trench Backfill	700	TN	$ 35	$ 24,500
17	PVC Sanitary Sewer Pipe 10 In. Diam.	400	LF	$ 100	$ 40,000
18	Erosion/Water Pollution Control	1	LS	$ 5,000	$ 5,000
19	Seeding, Fertilizing and Mulching	0	SY	$ 15	$ -
20	Topsoil Type A	0	CY	$ 75	$ -
21	Cement Concrete Traffic Curb and Gutter	0	LF	$ 50	$ -
22	Cement Concrete Sidewalk	0	SY	$ 80	$ -
		Subtotal			$ 194,980
		Sales Tax (9%)			$ 17,548
	Total Construction Cost (rounded)				**$ 213,000**
	Construction Contingency (20%)				$ 42,600
	Engineering, Permitting, Administration (30%):				$ 76,680
	Total Project Cost (rounded)				**$ 340,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E5-B
131st Ave NE
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	55,000	$	55,000
2	Change in Site Conditions	1	EST	$	21,000	$	21,000
3	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	7,000	$	7,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	2,820	LF	$	4	$	11,280
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Crushed Surfacing Base Course	400	TN	$	35	$	14,000
9	HMA Cl. 1/2 IN. PG 64-22	500	TN	$	200	$	100,000
10	Manhole 48 In. Diam. Type 2	6	EA	$	6,000	$	36,000
11	Dewatering for Sewer	1	LS	$	10,000	$	10,000
12	Removal of Unsuitable Material (Trench)	140	CY	$	75	$	10,500
13	Trench Excavation Safety Systems	1	LS	$	10,000	$	10,000
14	Temporary Sewer Bypass Pumping	1	LS	$	-	$	-
15	Bank Run Gravel for Trench Backfill	2,450	TN	$	35	$	85,750
16	PVC Sanitary Sewer Pipe 8 In. Diam.	1,400	LF	$	80	$	112,000
17	Side Sewer	20	EA	$	5,000	$	100,000
18	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
19	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
20	Topsoil Type A	0	CY	$	75	$	-
21	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
22	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	597,530
		Sales Tax (9%)				$	53,778
	Total Construction Cost (rounded)					**$**	**651,000**
	Construction Contingency (20%)					$	130,200
	Engineering, Permitting, Administration (30%):					$	234,360
	Total Project Cost (rounded)					**$**	**1,020,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E6
Lift Station 9C Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 22,000	$ 22,000
2	Change in Site Conditions	1	EST	$ 10,000	$ 10,000
3	Survey	1	LS	$ 5,000	$ 5,000
4	Project Temporary Traffic Control	1	LS	$ 5,000	$ 5,000
5	Clearing and Grubbing	1	LS	$ 1,000	$ 1,000
6	Locate Existing Utilities for Sewer	1	LS	$ 5,000	$ 5,000
7	Replace Pumps	2	EA	$ 15,000	$ 30,000
8	Replace Piping and Valves	1	LS	$ 8,000	$ 8,000
9	Wet Well Rehabilitation	1	LS	$ 40,000	$ 40,000
10	Force Main Bypass Connection	1	LS	$ 10,000	$ 10,000
11	Temporary Bypass Pumping	1	LS	$ 10,000	$ 10,000
12	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
13	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
14	Demolition and Disposal of Equpiment	1	LS	$ 30,000	$ 30,000
		Subtotal			$ 236,000
		Sales Tax (9%)			$ 21,240
	Total Construction Cost (rounded)				**$ 257,000**
	Construction Contingency (20%)				$ 51,400
	Engineering, Permitting, Administration (30%):				$ 92,520
	Total Project Cost (rounded)				**$ 401,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E7
Lift Station 3C Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 30,000	$ 30,000
2	Change in Site Conditions	1	EST	$ 20,000	$ 20,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Clearing and Grubbing	1	LS	$ 2,000	$ 2,000
6	Locate Existing Utilities for Sewer	1	LS	$ 2,000	$ 2,000
7	Replace Pumps	2	EA	$ 20,000	$ 40,000
8	Replace Piping and Valves	1	LS	$ 10,000	$ 10,000
9	Odor Control System	1	LS	$ 10,000	$ 10,000
10	Wet Well Rehabilitation	1	LS	$ 50,000	$ 50,000
11	Cathodic Protection	1	LS	$ 25,000	$ 25,000
12	Force Main Bypass Connection	1	LS	$ 10,000	$ 10,000
13	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
14	Replace Power Service & Electrical Equipment	1	LS	$ 20,000	$ 20,000
15	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
16	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
17	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 323,000
		Sales Tax (9%)			$ 29,070
	Total Construction Cost (rounded)				**$ 352,000**
	Construction Contingency (20%)				$ 70,400
	Engineering, Permitting, Administration (30%):				$ 126,720
	Total Project Cost (rounded)				**$ 550,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E8-A
New LS E8 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	126,000	$	126,000
3	Change in Site Conditions	1	EST	$	50,000	$	50,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	19,000	$	19,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	4,820	LF	$	4	$	19,280
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	480	TN	$	35	$	16,800
11	HMA Cl. 1/2 IN. PG 64-22	610	TN	$	200	$	122,000
12	Removal of Unsuitable Material (Trench)	240	CY	$	75	$	18,000
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	4,250	TN	$	35	$	148,750
15	Force Main, 4 in. Diam., Incl. Bedding	3,800	LF	$	100	$	380,000
16	Erosion/Water Pollution Control	1	LS	$	10,000	$	10,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
18	Generator	1	LS	$	60,000	$	60,000
19	Electrical	1	LS	$	30,000	$	30,000
20	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
21	Topsoil Type A	0	CY	$	75	$	-
22	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
23	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	1,384,830
		Sales Tax (9%)				$	124,635
	Total Construction Cost (rounded)					**$**	**1,509,000**
	Construction Contingency (20%)					$	301,800
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	543,240
	Total Project Cost (rounded)					**$**	**2,360,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E8-B
Basin E8 Collection System (N Machias Rd)
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	118,000	$	118,000
3	Change in Site Conditions	1	EST	$	50,000	$	50,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	20,000	$	20,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	42,000	$	42,000
7	Sawcutting Existing Pavement	8,020	LF	$	4	$	32,080
8	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
9	Crushed Surfacing Base Course	670	TN	$	35	$	23,450
10	HMA Cl. 1/2 IN. PG 64-22	840	TN	$	200	$	168,000
11	Manhole 48 In. Diam. Type 2	18	EA	$	6,000	$	108,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	390	CY	$	75	$	29,250
14	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
15	Bank Run Gravel for Trench Backfill	7,000	TN	$	35	$	245,000
16	PVC Sanitary Sewer Pipe 8 In. Diam.	4,000	LF	$	80	$	320,000
17	Side Sewer	15	EA	$	5,000	$	75,000
18	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
19	Seeding, Fertilizing and Mulching	80	SY	$	15	$	1,200
20	Topsoil Type A	10	CY	$	75	$	750
21	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
22	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	1,292,730
		Sales Tax (9%)				$	116,346
	Total Construction Cost (rounded)					**$**	**1,409,000**
	Construction Contingency (20%)					$	281,800
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	507,240
	Total Project Cost (rounded)					**$**	**2,200,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E9-A
New LS E9 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	92,000	$	92,000
3	Change in Site Conditions	1	EST	$	40,000	$	40,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	9,000	$	9,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	3,020	LF	$	4	$	12,080
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	300	TN	$	35	$	10,500
11	HMA Cl. 1/2 IN. PG 64-22	380	TN	$	200	$	76,000
12	Removal of Unsuitable Material (Trench)	120	CY	$	75	$	9,000
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	2,010	TN	$	35	$	70,350
15	Force Main, 4 in. Diam., Incl. Bedding	1,800	LF	$	100	$	180,000
16	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
18	Generator	1	LS	$	60,000	$	60,000
19	Electrical	1	LS	$	30,000	$	30,000
20	Seeding, Fertilizing and Mulching	200	SY	$	15	$	3,000
21	Topsoil Type A	30	CY	$	75	$	2,250
22	Cement Concrete Traffic Curb and Gutter	100	LF	$	50	$	5,000
23	Cement Concrete Sidewalk	60	SY	$	80	$	4,800
		Subtotal				$	1,003,980
		Sales Tax (9%)				$	90,358
	Total Construction Cost (rounded)					**$**	**1,094,000**
	Construction Contingency (20%)					$	218,800
	Easement Acquisition					$	18,750
	Engineering, Permitting, Administration (30%):					$	393,840
	Total Project Cost (rounded)					**$**	**1,710,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E9-B
26th, 27th & 28th Places NE
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	85,000	$	85,000
3	Change in Site Conditions	1	EST	$	40,000	$	40,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	13,000	$	13,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Removal of Structures and Obstructions	1	LS	$	28,000	$	28,000
7	Sawcutting Existing Pavement	4,820	LF	$	4	$	19,280
8	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
9	Crushed Surfacing Base Course	400	TN	$	35	$	14,000
10	HMA Cl. 1/2 IN. PG 64-22	510	TN	$	200	$	102,000
11	Manhole 48 In. Diam. Type 2	12	EA	$	6,000	$	72,000
12	Dewatering for Sewer	1	LS	$	10,000	$	10,000
13	Removal of Unsuitable Material (Trench)	260	CY	$	75	$	19,500
14	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
15	Bank Run Gravel for Trench Backfill	4,640	TN	$	35	$	162,400
16	PVC Sanitary Sewer Pipe 8 In. Diam.	2,650	LF	$	80	$	212,000
17	Side Sewer	20	EA	$	5,000	$	100,000
18	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
19	Seeding, Fertilizing and Mulching	100	SY	$	15	$	1,500
20	Topsoil Type A	20	CY	$	75	$	1,500
21	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
22	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	930,180
		Sales Tax (9%)				$	83,716
	Total Construction Cost (rounded)					**$**	**1,014,000**
	Construction Contingency (20%)					$	202,800
	Engineering, Permitting, Administration (30%):					$	365,040
	Total Project Cost (rounded)					**$**	**1,590,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project E10
New LS E10 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	86,000	$	86,000
3	Change in Site Conditions	1	EST	$	40,000	$	40,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	7,000	$	7,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	140	LF	$	4	$	560
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	20	TN	$	35	$	700
11	HMA Cl. 1/2 IN. PG 64-22	20	TN	$	200	$	4,000
12	Removal of Unsuitable Material (Trench)	90	CY	$	75	$	6,750
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	1,460	TN	$	35	$	51,100
15	Force Main, 4 in. Diam., Incl. Bedding	1,300	LF	$	100	$	130,000
16	Boring Across Creek	1	LS	$	100,000	$	100,000
17	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
18	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
19	Generator	1	LS	$	60,000	$	60,000
20	Electrical	1	LS	$	30,000	$	30,000
21	Seeding, Fertilizing and Mulching	970	SY	$	15	$	14,550
22	Topsoil Type A	110	CY	$	75	$	8,250
23	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
24	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	938,910
		Sales Tax (9%)				$	84,502
	Total Construction Cost (rounded)					**$**	**1,023,000**
	Construction Contingency (20%)					$	204,600
	Engineering, Permitting, Administration (30%):					$	368,280
	Total Project Cost (rounded)					**$**	**1,600,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project G2
Lift Station 19 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	25,000	$	25,000
2	Change in Site Conditions	1	EST	$	10,000	$	10,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Clearing and Grubbing	1	LS	$	2,000	$	2,000
6	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
7	Replace Pumps	2	EA	$	30,000	$	60,000
8	Replace Piping and Valves	1	LS	$	10,000	$	10,000
9	Wet Well Rehabilitation	1	LS	$	60,000	$	60,000
10	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
11	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
12	Site Lighting Improvements	1	LS	$	10,000	$	10,000
13	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	273,000
		Sales Tax (9%)				$	24,570
	Total Construction Cost (rounded)					**$**	**298,000**
	Construction Contingency (20%)					$	59,600
	Engineering, Permitting, Administration (30%):					$	107,280
	Total Project Cost (rounded)					**$**	**465,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project G3
New LS G3 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	76,000	$	76,000
3	Change in Site Conditions	1	EST	$	30,000	$	30,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	4,000	$	4,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	920	LF	$	4	$	3,680
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	80	TN	$	35	$	2,800
11	HMA Cl. 1/2 IN. PG 64-22	100	TN	$	200	$	20,000
12	Removal of Unsuitable Material (Trench)	50	CY	$	75	$	3,750
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	790	TN	$	35	$	27,650
15	Force Main, 4 in. Diam., Incl. Bedding	700	LF	$	100	$	70,000
16	Boring Across 20th Street SE	1	LS	$	100,000	$	100,000
17	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
18	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
19	Generator	1	LS	$	60,000	$	60,000
20	Electrical	1	LS	$	30,000	$	30,000
21	Seeding, Fertilizing and Mulching	200	SY	$	15	$	3,000
22	Topsoil Type A	30	CY	$	75	$	2,250
23	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
24	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	833,130
		Sales Tax (9%)				$	74,982
	Total Construction Cost (rounded)					**$**	**908,000**
	Construction Contingency (20%)					$	181,600
	Engineering, Permitting, Administration (30%):					$	326,880
	Total Project Cost (rounded)					**$**	**1,420,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project G6
New LS G6 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	75,000	$	75,000
3	Change in Site Conditions	1	EST	$	30,000	$	30,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	6,000	$	6,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	2,120	LF	$	4	$	8,480
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Package Lift Station	1	LS	$	300,000	$	300,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	210	TN	$	35	$	7,350
11	HMA Cl. 1/2 IN. PG 64-22	270	TN	$	200	$	54,000
12	Removal of Unsuitable Material (Trench)	70	CY	$	75	$	5,250
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	1,180	TN	$	35	$	41,300
15	Force Main, 4 in. Diam., Incl. Bedding	1,050	LF	$	100	$	105,000
16	Erosion/Water Pollution Control	1	LS	$	10,000	$	10,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	30,000	$	30,000
18	Generator	1	LS	$	60,000	$	60,000
19	Electrical	1	LS	$	30,000	$	30,000
20	Seeding, Fertilizing and Mulching	0	SY	$	15	$	-
21	Topsoil Type A	0	CY	$	75	$	-
22	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
23	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	817,380
		Sales Tax (9%)				$	73,564
	Total Construction Cost (rounded)					**$**	**891,000**
	Construction Contingency (20%)					$	178,200
	Easement Acquisition					$	-
	Engineering, Permitting, Administration (30%):					$	320,760
	Total Project Cost (rounded)					**$**	**1,390,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project G7-A
New LS G7 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 76,000	$ 76,000
3	Change in Site Conditions	1	EST	$ 30,000	$ 30,000
2	Survey	1	LS	$ 10,000	$ 10,000
4	Project Temporary Traffic Control	1	LS	$ 7,000	$ 7,000
5	Clearing and Grubbing	1	LS	$ 5,000	$ 5,000
6	Sawcutting Existing Pavement	0	LF	$ 4	$ -
7	Locate Existing Utilities for Sewer	1	LS	$ 5,000	$ 5,000
8	Package Lift Station	1	LS	$ 300,000	$ 300,000
9	Odor Control System	1	LS	$ 10,000	$ 10,000
10	Crushed Surfacing Base Course	220	TN	$ 35	$ 7,700
11	HMA Cl. 1/2 IN. PG 64-22	140	TN	$ 200	$ 28,000
12	Removal of Unsuitable Material (Trench)	90	CY	$ 75	$ 6,750
13	Trench Excavation Safety Systems	1	LS	$ 20,000	$ 20,000
14	Bank Run Gravel for Trench Backfill	1,460	TN	$ 35	$ 51,100
15	Force Main, 4 in. Diam., Incl. Bedding	1,300	LF	$ 100	$ 130,000
17	Erosion/Water Pollution Control	1	LS	$ 20,000	$ 20,000
18	Site Improvements (Drainage, Lighting, etc.)	1	LS	$ 30,000	$ 30,000
19	Generator	1	LS	$ 60,000	$ 60,000
20	Electrical	1	LS	$ 30,000	$ 30,000
21	Seeding, Fertilizing and Mulching	0	SY	$ 15	$ -
22	Topsoil Type A	0	CY	$ 75	$ -
23	Cement Concrete Traffic Curb and Gutter	0	LF	$ 50	$ -
24	Cement Concrete Sidewalk	0	SY	$ 80	$ -
		Subtotal			$ 826,550
		Sales Tax (9%)			$ 74,390
	Total Construction Cost (rounded)				**$ 901,000**
	Construction Contingency (20%)				$ 180,200
	Engineering, Permitting, Administration (30%):				$ 324,360
	Total Project Cost (rounded)				**$ 1,410,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project G7-C
97th Drive SE & 99th Ave SE
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 80,000	$ 80,000
2	Change in Site Conditions	1	EST	$ 31,000	$ 31,000
3	Survey	1	LS	$ 10,000	$ 10,000
4	Project Temporary Traffic Control	1	LS	$ 12,000	$ 12,000
5	Clearing and Grubbing	1	LS	$ 1,000	$ 1,000
6	Sawcutting Existing Pavement	4,620	LF	$ 4	$ 18,480
7	Locate Existing Utilities for Sewer	1	LS	$ 5,000	$ 5,000
8	Crushed Surfacing Base Course	390	TN	$ 35	$ 13,650
9	HMA Cl. 1/2 IN. PG 64-22	490	TN	$ 200	$ 98,000
10	Manhole 48 In. Diam. Type 2	10	EA	$ 6,000	$ 60,000
11	Side Sewer	36	EA	$ 5,000	$ 180,000
12	Dewatering for Sewer	1	LS	$ 5,000	$ 5,000
13	Removal of Unsuitable Material (Trench)	230	CY	$ 75	$ 17,250
14	Trench Excavation Safety Systems	1	LS	$ 10,000	$ 10,000
15	Bank Run Gravel for Trench Backfill	4,030	TN	$ 35	$ 141,050
16	PVC Sanitary Sewer Pipe 8 In. Diam.	2,300	LF	$ 80	$ 184,000
17	Erosion/Water Pollution Control	1	LS	$ 5,000	$ 5,000
18	Seeding, Fertilizing and Mulching	50	SY	$ 15	$ 750
19	Topsoil Type A	10	CY	$ 75	$ 750
20	Cement Concrete Traffic Curb and Gutter	0	LF	$ 50	$ -
21	Cement Concrete Sidewalk	0	SY	$ 80	$ -
		Subtotal			$ 872,930
		Sales Tax (9%)			$ 78,564
	Total Construction Cost (rounded)				**$ 951,000**
	Construction Contingency (20%)				$ 190,200
	Engineering, Permitting, Administration (30%):				$ 342,360
	Total Project Cost (rounded)				**$ 1,490,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H1
Lift Station 22 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	25,000	$	25,000
2	Change in Site Conditions	1	EST	$	10,000	$	10,000
3	Survey	1	LS	$	2,000	$	2,000
4	Project Temporary Traffic Control	1	LS	$	2,000	$	2,000
5	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
6	Replace Wet Well Level Sensors	1	LS	$	5,000	$	5,000
7	Replace Pumps	2	EA	$	50,000	$	100,000
8	Replace Piping and Valves	1	LS	$	20,000	$	20,000
9	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
10	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
11	Site Lighting Improvements	1	LS	$	10,000	$	10,000
12	Demolition and Disposal of Equpiment	1	LS	$	20,000	$	20,000
		Subtotal				$	266,000
		Sales Tax (9%)				$	23,940
	Total Construction Cost (rounded)					**$**	**290,000**
	Construction Contingency (20%)					$	58,000
	Engineering, Permitting, Administration (30%):					$	104,400
	Total Project Cost (rounded)					**$**	**453,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H2
Lift Station 8 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 30,000	$ 30,000
2	Change in Site Conditions	1	EST	$ 20,000	$ 20,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Locate Existing Utilities for Sewer	1	LS	$ 2,000	$ 2,000
6	Replace Pumps	2	EA	$ 25,000	$ 50,000
7	Replace Piping and Valves	1	LS	$ 15,000	$ 15,000
8	Wet Well Rehabilitation	1	LS	$ 75,000	$ 75,000
9	Force Main Bypass Connection	1	LS	$ 10,000	$ 10,000
10	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
11	Replace Power Service & Electrical Equipment	1	LS	$ 20,000	$ 20,000
12	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
13	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
14	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 326,000
		Sales Tax (9%)			$ 29,340
	Total Construction Cost (rounded)				**$ 355,000**
	Construction Contingency (20%)				$ 71,000
	Engineering, Permitting, Administration (30%):				$ 127,800
	Total Project Cost (rounded)				**$ 554,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H3-A
Lift Station 7 Rehabilitation & Upgrade
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 41,000	$ 41,000
2	Change in Site Conditions	1	EST	$ 20,000	$ 20,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Locate Existing Utilities for Sewer	1	LS	$ 2,000	$ 2,000
6	Replace Pumps	2	EA	$ 15,000	$ 30,000
7	Replace Piping and Valves	1	LS	$ 10,000	$ 10,000
8	Wet Well Rehabilitation	1	LS	$ 75,000	$ 75,000
9	Force Main Bypass Connection	1	LS	$ 10,000	$ 10,000
10	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
11	Replace Power Service & Electrical Equipment	1	LS	$ 20,000	$ 20,000
12	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
13	New Generator	1	LS	$ 100,000	$ 100,000
14	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
15	Site Drainage Improvements	1	LS	$ 10,000	$ 10,000
16	New Water Service and Hose Bib	1	LS	$ 20,000	$ 20,000
17	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 442,000
		Sales Tax (9%)			$ 39,780
	Total Construction Cost (rounded)				**$ 482,000**
	Construction Contingency (20%)				$ 96,400
	Engineering, Permitting, Administration (30%):				$ 173,520
	Total Project Cost (rounded)				**$ 752,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H3-B
97th Drive SE & 99th Ave SE
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	41,000	$	41,000
2	Change in Site Conditions	1	EST	$	16,000	$	16,000
3	Survey	1	LS	$	8,000	$	8,000
4	Project Temporary Traffic Control	1	LS	$	6,000	$	6,000
5	Clearing and Grubbing	1	LS	$	1,000	$	1,000
6	Sawcutting Existing Pavement	2,120	LF	$	4	$	8,480
7	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
8	Crushed Surfacing Base Course	180	TN	$	35	$	6,300
9	HMA Cl. 1/2 IN. PG 64-22	220	TN	$	200	$	44,000
10	Manhole 48 In. Diam. Type 2	5	EA	$	6,000	$	30,000
11	Side Sewer	20	EA	$	5,000	$	100,000
12	Dewatering for Sewer	1	LS	$	5,000	$	5,000
13	Removal of Unsuitable Material (Trench)	110	CY	$	75	$	8,250
14	Trench Excavation Safety Systems	1	LS	$	10,000	$	10,000
15	Bank Run Gravel for Trench Backfill	1,840	TN	$	35	$	64,400
16	PVC Sanitary Sewer Pipe 8 In. Diam.	1,050	LF	$	80	$	84,000
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	50	SY	$	15	$	750
19	Topsoil Type A	10	CY	$	75	$	750
20	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
21	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	443,930
		Sales Tax (9%)				$	39,954
	Total Construction Cost (rounded)					**$**	**484,000**
	Construction Contingency (20%)					$	96,800
	Engineering, Permitting, Administration (30%):					$	174,240
	Total Project Cost (rounded)					**$**	**760,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H4
Lift Station 21 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$ 17,000	$ 17,000
2	Change in Site Conditions	1	EST	$ 10,000	$ 10,000
3	Survey	1	LS	$ 2,000	$ 2,000
4	Project Temporary Traffic Control	1	LS	$ 2,000	$ 2,000
5	Locate Existing Utilities for Sewer	1	LS	$ 2,000	$ 2,000
6	Replace Wet Well Level Sensors	1	LS	$ 5,000	$ 5,000
7	Replace Pumps	2	EA	$ 20,000	$ 40,000
8	Replace Piping and Valves	1	LS	$ 8,000	$ 8,000
9	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
10	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$ 50,000	$ 50,000
11	Site Lighting Improvements	1	LS	$ 10,000	$ 10,000
12	Demolition and Disposal of Equpiment	1	LS	$ 20,000	$ 20,000
		Subtotal			$ 186,000
		Sales Tax (9%)			$ 16,740
	Total Construction Cost (rounded)				**$ 203,000**
	Construction Contingency (20%)				$ 40,600
	Engineering, Permitting, Administration (30%):				$ 73,080
	Total Project Cost (rounded)				**$ 317,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H6
Lift Station 10 Rehabilitation
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	32,000	$	32,000
2	Change in Site Conditions	1	EST	$	20,000	$	20,000
3	Survey	1	LS	$	5,000	$	5,000
4	Project Temporary Traffic Control	1	LS	$	5,000	$	5,000
5	Clearing and Grubbing	1	LS	$	1,000	$	1,000
6	Locate Existing Utilities for Sewer	1	LS	$	5,000	$	5,000
7	Replace Pumps	2	EA	$	10,000	$	20,000
8	Replace Piping and Valves	1	LS	$	6,000	$	6,000
9	Wet Well Rehabilitation	1	LS	$	40,000	$	40,000
10	Force Main Bypass Connection	1	LS	$	10,000	$	10,000
11	Temporary Bypass Pumping	1	LS	$	10,000	$	10,000
12	Replace Power Service & Electrical Equipment	1	LS	$	20,000	$	20,000
13	Replace Control Panel, Motor Starter Panel, Conduit and Wiring	1	LS	$	50,000	$	50,000
14	New Generator	1	LS	$	50,000	$	50,000
15	Fuel Tank and Pad	1	LS	$	20,000	$	20,000
16	Site Lighting Improvements	1	LS	$	10,000	$	10,000
17	New Water Service and Hose Bib	1	LS	$	10,000	$	10,000
18	Demolition and Disposal of Equpiment	1	LS	$	30,000	$	30,000
		Subtotal				$	344,000
		Sales Tax (9%)				$	30,960
	Total Construction Cost (rounded)					**$**	**375,000**
	Construction Contingency (20%)					$	75,000
	Engineering, Permitting, Administration (30%):					$	135,000
	Total Project Cost (rounded)					**$**	**585,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H7
LS 9 Decommissioning
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	10,000	$	10,000
2	Change in Site Conditions	1	EST	$	4,000	$	4,000
3	Survey	1	LS	$	5,000	$	5,000
4	Project Temporary Traffic Control	1	LS	$	1,000	$	1,000
5	Clearing and Grubbing	1	LS	$	5,000	$	5,000
6	Sawcutting Existing Pavement	0	LF	$	4	$	-
7	Locate Existing Utilities for Sewer	1	LS	$	2,000	$	2,000
8	Crushed Surfacing Base Course	0	TN	$	35	$	-
9	HMA Cl. 1/2 IN. PG 64-22	0	TN	$	200	$	-
10	Manhole 48 In. Diam. Type 2	1	EA	$	6,000	$	6,000
11	Dewatering for Sewer	1	LS	$	5,000	$	5,000
12	Removal of Unsuitable Material (Trench)	20	CY	$	75	$	1,500
13	Trench Excavation Safety Systems	1	LS	$	10,000	$	10,000
14	Bank Run Gravel for Trench Backfill	300	TN	$	35	$	10,500
15	PVC Sanitary Sewer Pipe 8 In. Diam.	170	LF	$	80	$	13,600
16	Side Sewer	0	EA	$	5,000	$	-
17	Erosion/Water Pollution Control	1	LS	$	5,000	$	5,000
18	Seeding, Fertilizing and Mulching	190	SY	$	15	$	2,850
19	Topsoil Type A	30	CY	$	75	$	2,250
20	Site Restoration	1	LS	$	5,000	$	5,000
21	Demolition and Disposal of Lift Station 9	1	LS	$	15,000	$	15,000
22	Cement Concrete Traffic Curb and Gutter	0	LF	$	50	$	-
23	Cement Concrete Sidewalk	0	SY	$	80	$	-
		Subtotal				$	103,700
		Sales Tax (9%)				$	9,333
	Total Construction Cost (rounded)					**$**	**113,000**
	Construction Contingency (20%)					$	22,600
	Engineering, Permitting, Administration (30%):					$	40,680
	Total Project Cost (rounded)					**$**	**180,000**

LAKE STEVENS SEWER DISTRICT
General Sewer/Wastewater Facility Plan
Capital Improvement Projects
Project H8
New LS H8 & FM
July 2021 (ENR = 13248)

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT	
1	Mobilization/Demobilization	1	LS	$	96,000	$	96,000
3	Change in Site Conditions	1	EST	$	40,000	$	40,000
2	Survey	1	LS	$	10,000	$	10,000
4	Project Temporary Traffic Control	1	LS	$	6,000	$	6,000
5	Clearing and Grubbing	1	LS	$	10,000	$	10,000
6	Sawcutting Existing Pavement	2,420	LF	$	4	$	9,680
7	Locate Existing Utilities for Sewer	1	LS	$	10,000	$	10,000
8	Package Lift Station	1	LS	$	400,000	$	400,000
9	Odor Control System	1	LS	$	10,000	$	10,000
10	Crushed Surfacing Base Course	240	TN	$	35	$	8,400
11	HMA Cl. 1/2 IN. PG 64-22	310	TN	$	200	$	62,000
12	Removal of Unsuitable Material (Trench)	80	CY	$	75	$	6,000
13	Trench Excavation Safety Systems	1	LS	$	20,000	$	20,000
14	Bank Run Gravel for Trench Backfill	1,340	TN	$	35	$	46,900
15	Force Main, 4 in. Diam., Incl. Bedding	1,200	LF	$	100	$	120,000
16	Erosion/Water Pollution Control	1	LS	$	20,000	$	20,000
17	Site Improvements (Drainage, Lighting, etc.)	1	LS	$	40,000	$	40,000
18	Generator	1	LS	$	80,000	$	80,000
19	Electrical	1	LS	$	40,000	$	40,000
20	Seeding, Fertilizing and Mulching	460	SY	$	15	$	6,900
21	Topsoil Type A	50	CY	$	75	$	3,750
22	Cement Concrete Traffic Curb and Gutter	20	LF	$	50	$	1,000
23	Cement Concrete Sidewalk	20	SY	$	80	$	1,600
		Subtotal				$	1,048,230
		Sales Tax (9%)				$	94,341
	Total Construction Cost (rounded)					**$**	**1,143,000**
	Construction Contingency (20%)					$	228,600
	Engineering, Permitting, Administration (30%):					$	411,480
	Total Project Cost (rounded)					**$**	**1,790,000**

APPENDIX G

COLLECTION SYSTEM HYDRAULIC MODEL

LAKE STEVENS SEWER DISTRICT

SNOHOMISH COUNTY **WASHINGTON**

COLLECTION SYSTEM HYDRAULIC ANALYSIS

G&O #20408.07
JUNE 2021

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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MODEL INPUTS

The hydraulic model software, InfoSewer Pro Suite Version 7.6, was developed by Innovyze, and data used in development of the model is sourced from the District's GIS.

Past modeling efforts for the District have used a steady state model. This type of model uses an instantaneous peak flow at all locations and routes this flow through the network. The model used for this Plan is run as an Extended Period Simulation (EPS) model as opposed to a steady-state model. An EPS model allows tracking of the system over a period of time which more accurately accounts for attenuation of flow throughout the District's entire collection system. A duration of 72 hours is modeled; this allows 24 hours for the model to simulate the distribution of wastewater flow throughout the system before starting another 24-hour cycle to simulate a peak-day flow scenario with peak I/I included, and a final 24 hours to reduce flows to an average day with I/I below the peak.

MODEL NETWORK DATA

The hydraulic model consists of numerous layers, each of which mimics a shapefile (.shp) utilized in GIS. These layers include manholes (loading, chamber, or outlet), wet wells, pipes, force mains, and pumps. Loading manholes identified within the model are locations where flow is input directly. Chamber manholes are often not actual manholes but closed structures that are typically used as a modeling feature to assign an elevation at a specific location of a force main, such as an interim high point, prior to flowing into an outlet manhole. An outlet manhole is the location where a force main transitions to an open-channel gravity pipe. Twenty-seven of the District's existing 29 lift stations are included within the hydraulic model within the pump layer. Lift Stations 9 and 10 are not explicitly included in the existing modeling scenario as they collect flow from only very small basins, and the sewage collected by these lift stations is instead assigned to the basins downstream. The layer data is contained in a Geodatabase GIS file and in associated database files, which can be exported as a .shp file to then be utilized in a GIS system.

Average daily sewage flows are calculated separately outside of the model in a spreadsheet (i.e., based on the area, population, and infiltration and inflow parameters described in Chapter 4) and then assigned to each manhole. Flow is allocated to manholes based on the proximity of each manhole to the sewer customer location using the Thiessen polygon method. In this method, the center of each sewer customer parcel is associated with the nearest (straight-line distance) manhole. The model applies a peaking factor to the average daily flow to simulate the pattern of sewage flow throughout a typical day. This is described in more detail below.

The model includes nearly all sanitary sewer pipes in the District's collection system. This allows the District to provide ongoing, small scale analyses prior to conducting another large-scale modeling effort for the next Wastewater Comprehensive Plan Update.

Figure 6-1 displays this system as a whole along with the District's associated sewer basins. Necessary data for the model is shown in Table G-1.

TABLE G-1

Collection System Information

Category	Gravity Sewers	Manholes	Lift Stations
Dimensions	Length (Calculated from X and Y coordinates of manholes and Pump Stations)	Location (X and Y coordinates from District's GIS system)	Location (X and Y coordinates from District's GIS system)
Identification No.	Name (Generated by InfoSewer/GIS)	Name (Generated by InfoSewer/GIS)	Name of Station
Base Elevation	—	Rim Elevation	Ground Elevation
Depth	Upstream and Downstream Invert Elevations	Sump Elevation	Level Setting and Wet Well Depth
Size	Pipe Diameter	Manhole Diameter	Wet Well Diameter
Flow Criteria	Pipe Material	—	Pump Curve
Vertical Datum	NAVD 88	NAVD 88	NAVD 88

The ID number assigned to pipes and manholes is based on the corresponding ID number in the District's GIS where possible. If assignment of these IDs was unsuccessful, the modeling elements are automatically assigned a new ID name or number.

Information required to construct the network layer was obtained from record drawings, linear interpolation between known inverts, topographic data, or survey. Use of each item is described below.

District GIS

The pipeline and manhole information for the model is obtained from the District's GIS information representing both existing infrastructure and proposed infrastructure. The GIS information provided by the District includes the location of the manholes and the size and lengths of pipelines. The District's GIS data is continually updated to include new developments and system improvements or replacements as they are constructed.

For the initial model setup (Year 2021), a total of 3,632 pipes are modeled. The existing hydraulic model includes 134.1 miles of pipe, representing the majority of the total collection system. Under the 10-year, 20-year, and buildout conditions, 3,679 pipes are modeled representing 138.6 miles of pipe.

Manhole and pipe identification numbers are automatically generated within GIS and transferred into InfoSewer.

Record Drawings

The District also provided record drawings for the sewer system including lift stations. These record drawings are used as necessary to verify the pipe size and lengths and to determine the manhole rim and invert elevations. They are also used to identify wet well volumes and pump level settings. The majority of the District's GIS elevation data is based on the North American Vertical Datum of 1988 (NAVD 88). Where there appears to be a conflict in data, elevations are converted to NAVD 88 by adding 3.5 feet to the National Geodetic Vertical Datum of 1929 (NGVD 29) datum. NAVD 88 is the current District standard.

Many of the older record drawings obtained from the City of Lake Stevens are based on neither of these datums. The vertical elevation was estimated by adding 100 feet to that shown on the drawings. In most cases this resulted in a smooth transition between the older and newer systems. Otherwise, the elevation was estimated based on information in the NAVD 88 or NGVD 29 datum and the slope shown on the older drawings. Rim elevations were confirmed in the modeling through a comparison with the County's LIDAR GIS data.

As noted, the pipeline and manhole information for the model has been obtained from the District's GIS information. The GIS information provided by the District includes the location of the manholes, the manhole identification, pipe segment identification, and the size and lengths of pipelines. The GIS information was developed using record drawings for the sewer system.

Lift Stations and Force Mains

All lift stations are modeled as constant-discharge pumps, so that the lift stations produce a constant pumping rate regardless of head conditions or variable controls. Throughout the simulation, the pumps are called on or off by the wet well levels in the model. A future refinement of the model may include the pump curves for the larger lift stations and/or the results from drawdown tests for each lift station. The model output will indicate whether the lift station is over or under capacity based on flows directed to it that are generated within the tributary basin(s). Future lift stations are similarly modeled with a constant pumping rate.

The InfoSewer model uses the Hazen-Williams equation which utilizes a "C factor" to represent a friction coefficient of the pipe in force mains. The C factor used for each force main ranges from 100 to 130 depending on the age and material of the force main, with older pipes having a lower C factor. A C factor of 130 is considered standard for good-condition ductile iron pipe.

Because the lift stations and force mains are modeled in an EPS, wastewater flows are allowed to fill the wet well over time, calling the pumps to run, similar to the actual operation of the lift stations.

Sewer Basins

The basin layer contains data on the areas served by each branch of the collection system. The District's collection system is organized around seven trunk sewers or basins. Within each trunk sewer area, individual basins were identified. These basins were established primarily around topographic areas, and they may be seen on Figure 6-1. Altogether there are 47 basins within the District's service area.

HYDRAULIC MODELING FLOWS

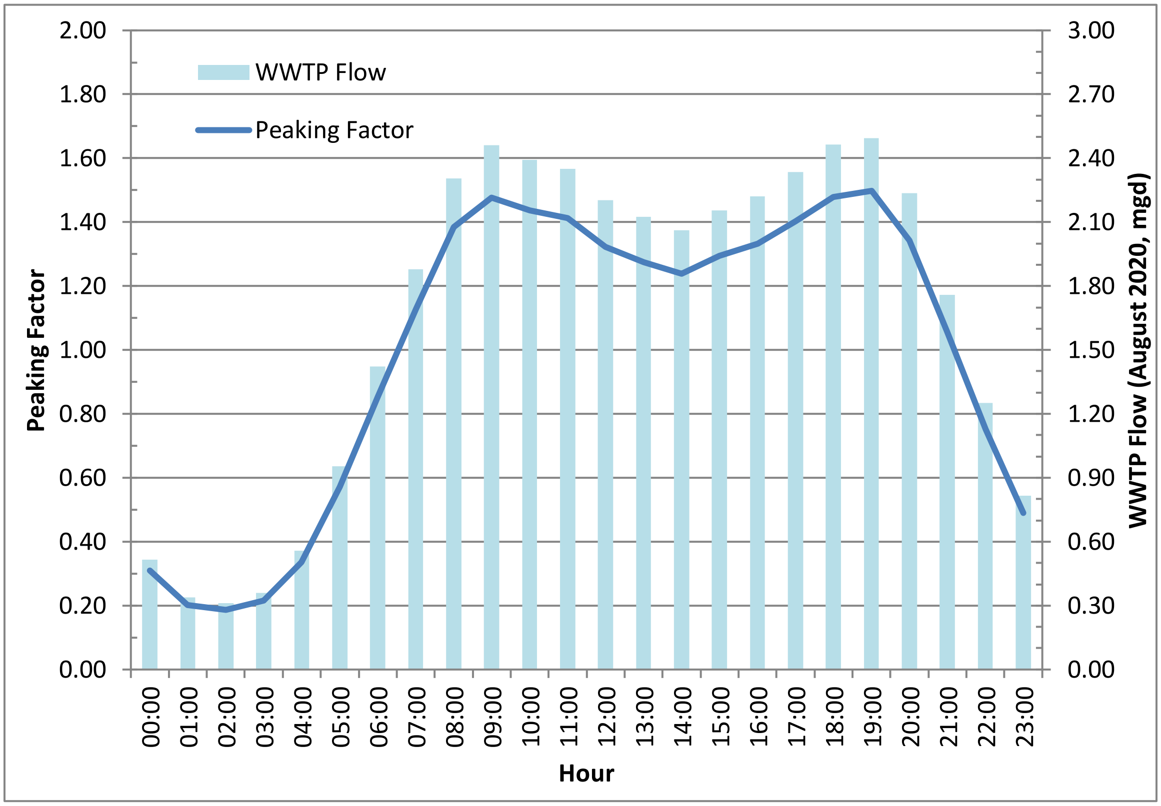
For InfoSewer input, two flow loading fields are necessary: average daily sewage flow and peak infiltration/inflow. Sewage flow was determined for each of the modeled scenarios based on District water use and billing data, and I/I flows were determined based on pipe age in each basin. Flow monitoring data (described in Appendix D of the Plan) was used to determine trends in the I/I flows throughout the District. This data indicates that areas within the District that have the oldest pipes tend to have higher I/I generation than newer areas.

The input flows are described below for both the existing and buildout conditions. The 20-year projected flows were determined assuming a consistent growth rate from 2021 through 2041.

Existing Conditions Hydraulic Modeling Data

For each subbasin the average annual sanitary flow is determined based on residential population, student/staff population, and commercial/industrial use. For the sanitary flow throughout the District, a diurnal curve was developed using hourly dry weather flows recorded at the WWTF. This is presented in Figure G-1. InfoSewer applies this diurnal peaking curve to the average sanitary flows assigned to each manhole in order to simulate the fluctuation of demand over a typical day.

The typical minimum flow at the WWTF over the course of the day during the dry season is approximately 0.94 mgd (650 gpm), occurring at 4:00 a.m., which indicates the presence of some dry-weather I/I flow. In order to create a diurnal curve that can be used to apply to sanitary flows, a dry-weather I/I flow of 0.65 mgd (450 gpm) was assumed and subtracted from the hourly WWTF flow data. The resulting hourly peaking factors range from 0.2 to 1.5. The minimum flow at the WWTF occurs approximately 2 hours later than the minimum flow observed at the lift stations, due to attenuation of flow within the system and travel time to the WWTF. The diurnal curve was therefore shifted by 2 hours in order to align the minimum sanitary flow with the actual time of minimum flow recorded at the lift stations.



(1) Flows and peaking factors are shifted by two hours to more accurately reflect the hours of maximum and minimum flow at the lift stations throughout the District. The maximum and minimum flow times occur later at the WWTP due to attenuation within the system. A dry-weather I/I flow of 0.65 mgd (450 gpm) was subtracted from the WWTP flow to more accurately approximate the sanitary sewer diurnal curve.

FIGURE G-1

Sanitary Flow Diurnal Curve(1)

Average daily sanitary flow is assigned to each manhole per the Thiessen polygon method. Each parcel has been analyzed to determine the nearest manhole to the centroid of that parcel using these Thiessen polygons. It is assumed that the nearest manhole to the centroid of each parcel will act as the recipient of domestic or commercial wastewater flows from that parcel. It is recognized that for larger parcels, the centroid of the parcel may not be located near the sewer connection. For modeling purposes, this method provides a simplification and allows a greater extent of the entire system to be evaluated.

Residential Sewage Flow

The existing sewered population for the 2021 scenario was identified through the District's billing information in the GIS records. All developer extensions that are currently under contract were considered to be existing connections, a total of 590 ERUs

District-wide. Commercial water use records were used to determine commercial flows for each connection individually. As shown in Chapter 3, the existing serviced population is 34,150. This corresponds to approximately 12,767 equivalent residential units (ERUs).

The location of this population within each of the basins was determined by overlaying the basin information onto the parcel data containing the District's billing information.

Average residential wastewater flow for each basin has been determined by multiplying the connected sewer population by a unit flow factor of 173 gallons per day per ERU.

The contributing area for I/I for each connection was determined from the Snohomish County parcel data in the GIS records. Only currently sewered area is considered in the I/I determination, and the area occupied by unsewered parcels was subtracted from the total basin area.

Non-Residential Sewage Flow (Schools, Commercial, and Industrial)

The basis for non-residential inputs into the hydraulic model consists of the last 5 years of water use records supplied by the District. Average winter water use for all non-residential customers was used to produce an average sewage flow per day for each parcel within the service area.

The flow inputs for InfoSewer originate from the flows described in Chapter 5. The loads include both sanitary flow and I/I flow. Existing average sanitary flows are determined from average daily winter water use and historic sewer flows, collected system-wide and confirmed by comparing to dry-weather lift station flows. Future flows (10-year, 20-year, and buildout) are based upon the projected number of ERUs per parcel and identification of developable parcels within the District's service area. The estimated number of ERUs for each parcel is based on the land use assigned to different areas within the District. Residential land use is assigned a number of ERUs based on the density allowed by the land use designation, and non-residential land use is assigned a number of ERUs as described in Chapter 2.

Inflow/Infiltration Flow

The I/I flows input to the existing model scenario are developed for each basin based on the weighted average of the pipe age in the basin. I/I rates were determined for different parts of the District's service area based on pipe age within each basin. Flow monitoring data recorded during February 2021 indicated that older parts of the system seem to have higher I/I generation than newer parts of the system. This is described in Appendix D.

The assumptions of peak hour unit I/I flow per acre range from 1,000 gpad to 3,500 gpad, with the oldest pipes assumed to have a higher I/I rate than newer pipes. For any future developments, an industry-standard unit I/I rate of 1,000 gpad is used, which assumes that newer pipes will be in relatively good condition when compared to older pipes.

TABLE G-2

Peak Hour I/I Rates by Basin

Basin	Sewered Area	Weighted Average Pipe Age	Assumed Peak Hour I/I rate
A1	31	2006	2,000
A2	6	2003	2,000
A3	162	1985	2,500
A4	185	2000	2,000
B1	572	1990	2,500
B2	20	1969	3,500
B3	165	1989	2,500
B4	58	1982	2,500
B5	71	2013	1,500
C1	80	2009	2,000
C2	55	2008	2,000
D1	366	1996	2,000
D2	148	1986	2,500
D3	63	1999	2,000
D4	28	1982	2,500
D5	45	1971	3,000
D6	338	1997	2,000
E1	300	1979	3,000
E2	188	1985	2,500
E3	15	1978	3,000
E4	2	1992	2,000
E5	8	1993	2,000
E6	9	1999	2,000
E7	26	1982	2,500
F1	16	2004	2,000
F2	29	2012	1,500
G1	162	2006	2,000
G2	72	2008	2,000
G4	129	1996	2,000
G5	136	2010	2,000
H1	87	2002	2,000
H2	145	1990	2,000
H3	56	1990	2,000
H4	28	2007	2,000
H6	2	1982	2,500
System-Wide Average			**2,270**

Flow monitoring results detailed in Appendix D provided some additional information about I/I for certain basin areas. The rainfall event captured by the flow monitoring was not a particularly large storm, less than equivalent to a 2-year storm for the area; and therefore, did not produce high I/I flow. The flow monitoring confirmed the assumption that areas in the District's collection system with older pipes tend to have higher I/I flows.

The development of the I/I rates used in the model is intended to produce flows at several of the largest lift stations that are similar to the recorded flows during a storm event on January 4, 2021. This storm event produced high flows throughout the District. The model calibration also intended to produce a flow at the WWTP that is similar to the peak day flow measured over the past 5 years of 6.9 mgd and the measured peak hour flow of 9.11 mgd. The model is intended to present a conservative analysis, and higher I/I rates were used in the modeling than were observed in the flow metering. The I/I rates used in the modeling are therefore higher than those that were determined in the flow metering period to present a more conservative analysis of the system.

Because the I/I rate determined for each basin represents the peak hour I/I rate, a curve is used to apply the I/I at different rates depending on the time step in the model. The peak hourly I/I rate is not applied for the entire duration, as that would be unrealistic. A base I/I rate of 50 percent of the peak hour I/I is applied to approximate typical wet-weather infiltration flow, and the I/I rate is then peaked according to a curve developed based on the hourly intensity of the rainfall event on January 4, 2021 to approximate the peak inflow to the collection system during a storm event. This is shown below in Figure G-2. The peak rainfall intensity during the storm occurred in the evening, at 6:00 p.m. on January 4, 2021.

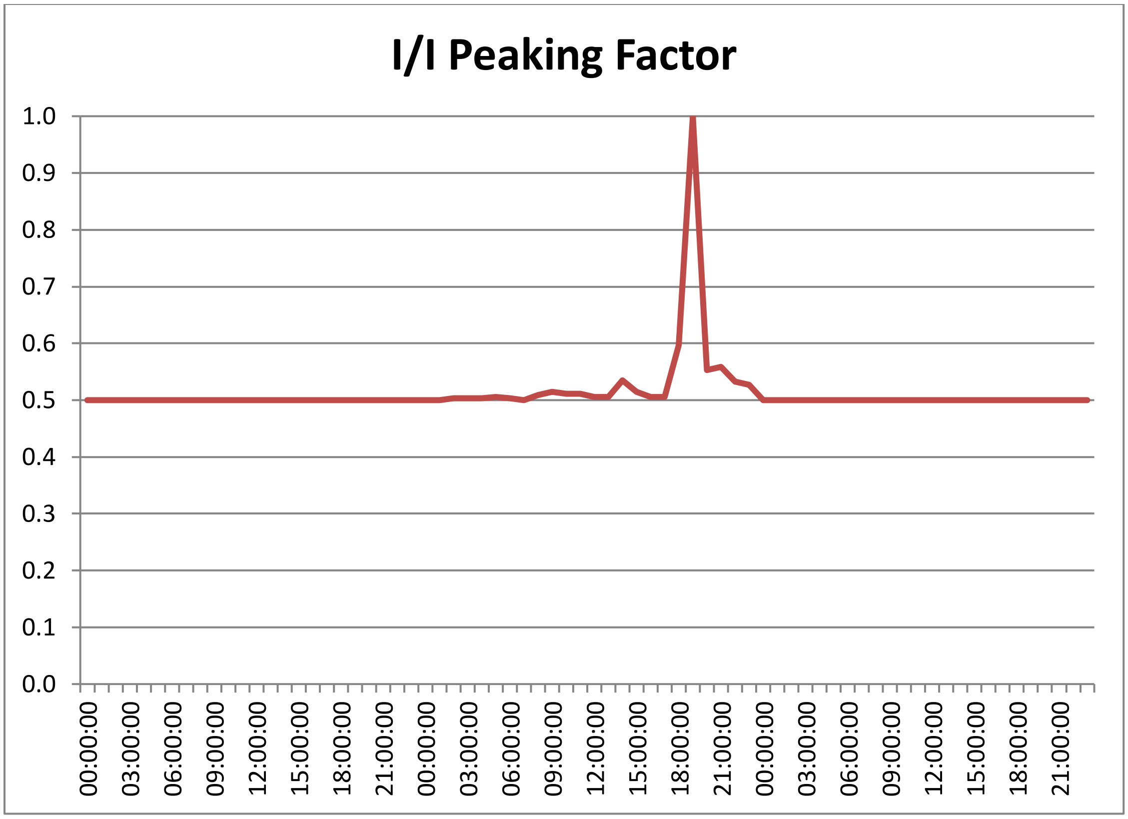


FIGURE G-2

I/I Peaking Curve

As a measure of conservativeness, the I/I rates determined through the calibration process are scaled up by an additional safety factor of 25 percent in the model analysis. This is to approximate a larger and more intense storm event than the analyzed storm.

MODEL CALIBRATION

The District has flow meters installed on the discharge side of seven of the larger pump stations. This flow meter data is recorded as frequently as several times per minute. The metered instantaneous flow at each timestamp was multiplied by the time between recordings to determine the number of gallons pumped. The total number of gallons was then summed on a 15-minute basis to determine the flow rate during each 15-minute time period. The modeled flows were compared with metered flows from 7 of the District's lift stations for both wet weather and dry weather flows: LS1C, LS8C, LS5, LS12, LS15, LS17, and LS20.

DRY WEATHER

In order to confirm that the sewage flow assumptions and diurnal curve applied to the sewage flow is an accurate representation of the true flows within the District, flow meter data recorded during On August 1-3, 2020 was compared with the modeled sewage flows. For this analysis, it is assumed that very little I/I is present in the system, so the model was run with no I/I applied. The flow metering at each lift station indicates that the summer I/I is low.

The dry weather lift station flows were averaged to develop a flow rate in gpm on an hourly basis, in order to compare with the modeled flows. The modeled flows are reported on 15-minute timesteps, but were averaged to an hourly basis for this analysis to compare with the metered flows. The dry weather flows measured at each of the seven lift stations compares well with the modeled flows at each lift station. The modeled flows are slightly peakier than the metered flows, as the modeled flow is measured at the inlet pipe to the wet well, while the metered flows are measured at the lift station discharge. The modeled flows capture high, intermittent flows from force main discharges upstream of some of the wet wells, causing higher peak flows. This is especially apparent at lift stations with many upstream force main discharges such as LS1C and LS15, or with an upstream force main discharge located very close to the wet well, such as LS5.

Figures G-3 through G-8 below include a visual comparison of the modeled hourly flows assuming no I/I flow (blue line) and metered hourly flows (red line) at each lift station.

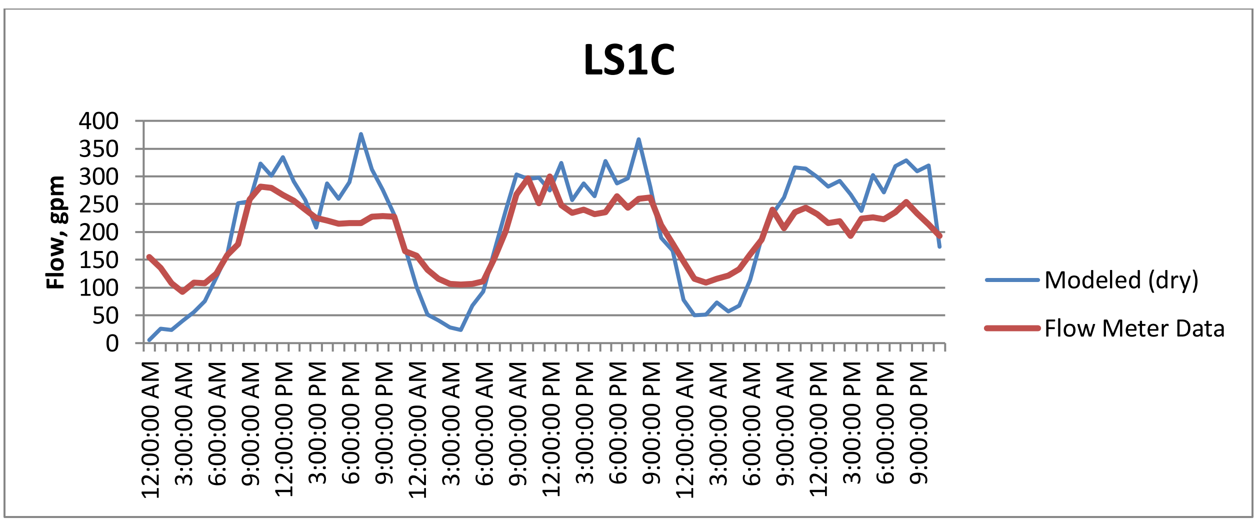


FIGURE G-3

Lift Station 1C Modeled Hourly Flow

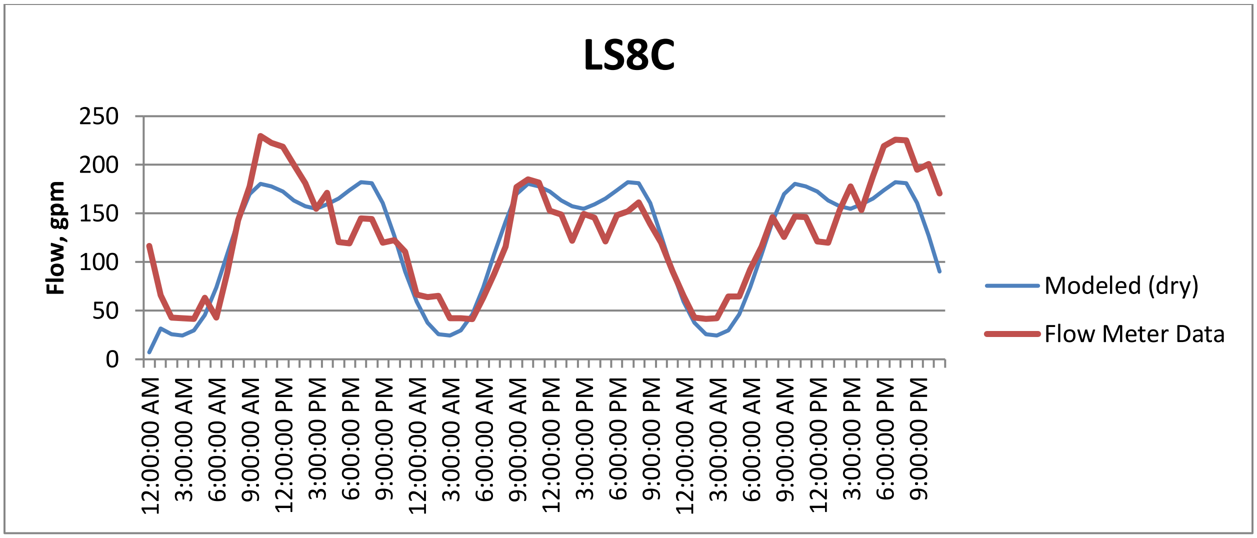


FIGURE G-4

Lift Station 8C Modeled Hourly Flow

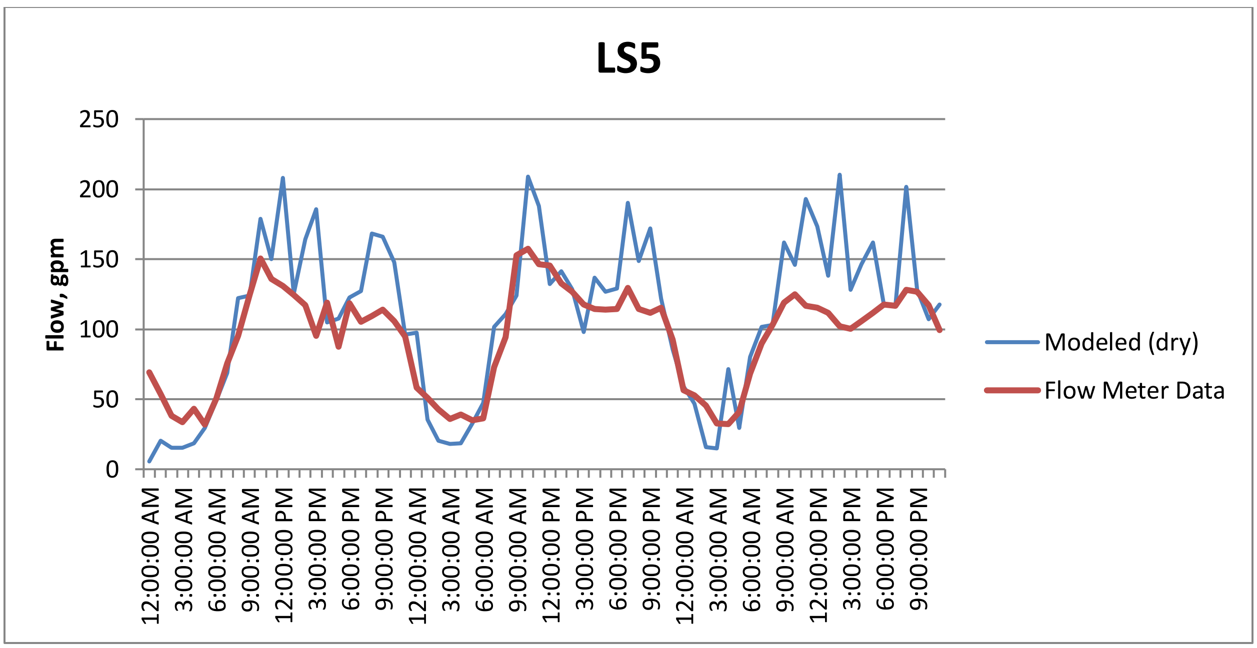


FIGURE G-5

Lift Station 5 Modeled Hourly Flow

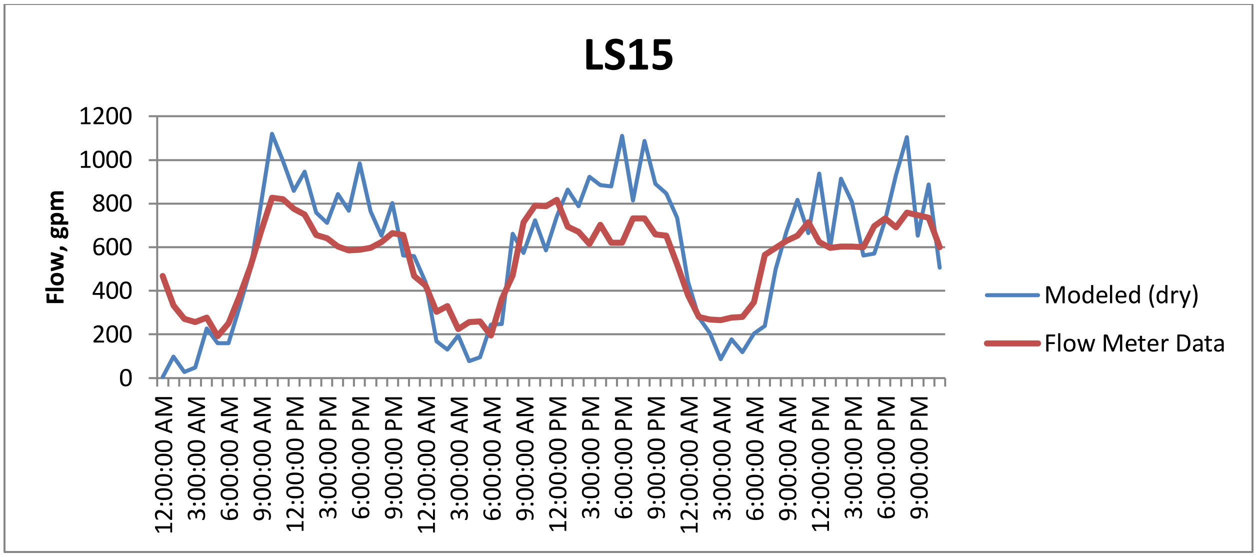


FIGURE G-6

Lift Station 15 Modeled Hourly Flow

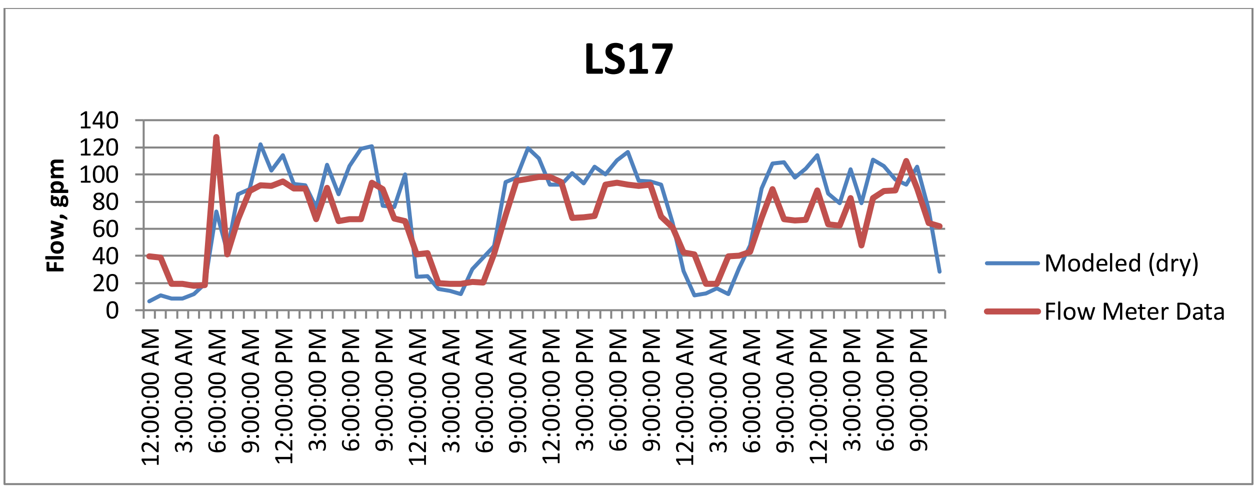


FIGURE G-7

Lift Station 17 Modeled Hourly Flow

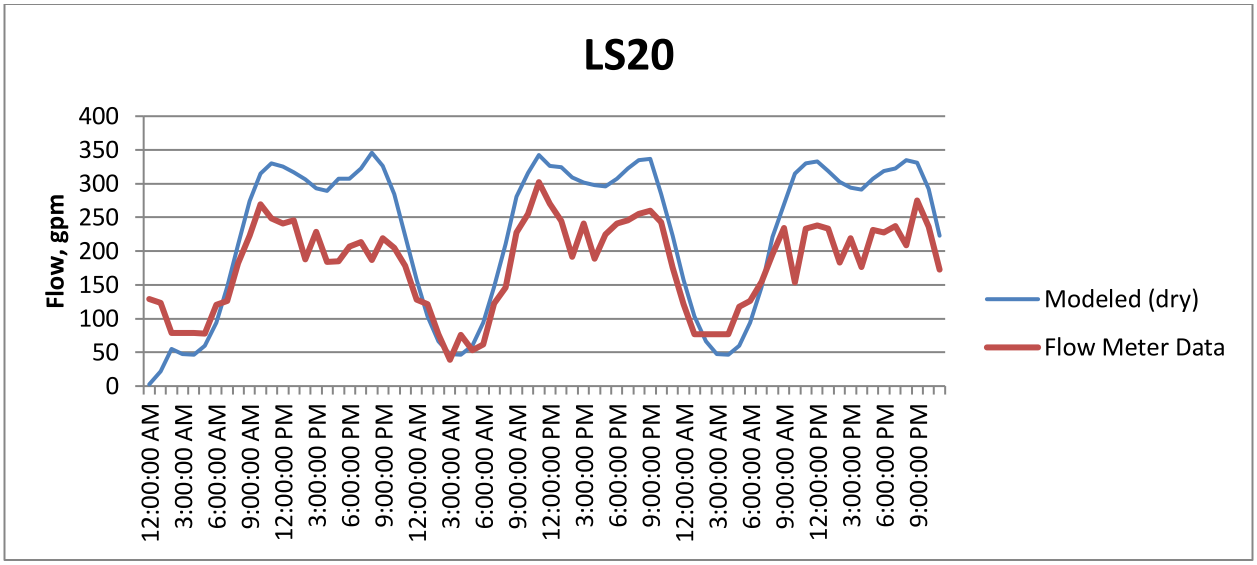


FIGURE G-8

Lift Station 18 Modeled Hourly Flow

The modeled flows to the WWTF were also compared with the measured flows at the WWTF, on a 15-minute timestep. Again, the modeled flows have a somewhat peakier appearance due to the force main discharges, which may not attenuate as much in the model as they do in reality. The general magnitude and pattern of the flows is similar to what was recorded by the flow meter, and this is demonstrated in Figure G-9.

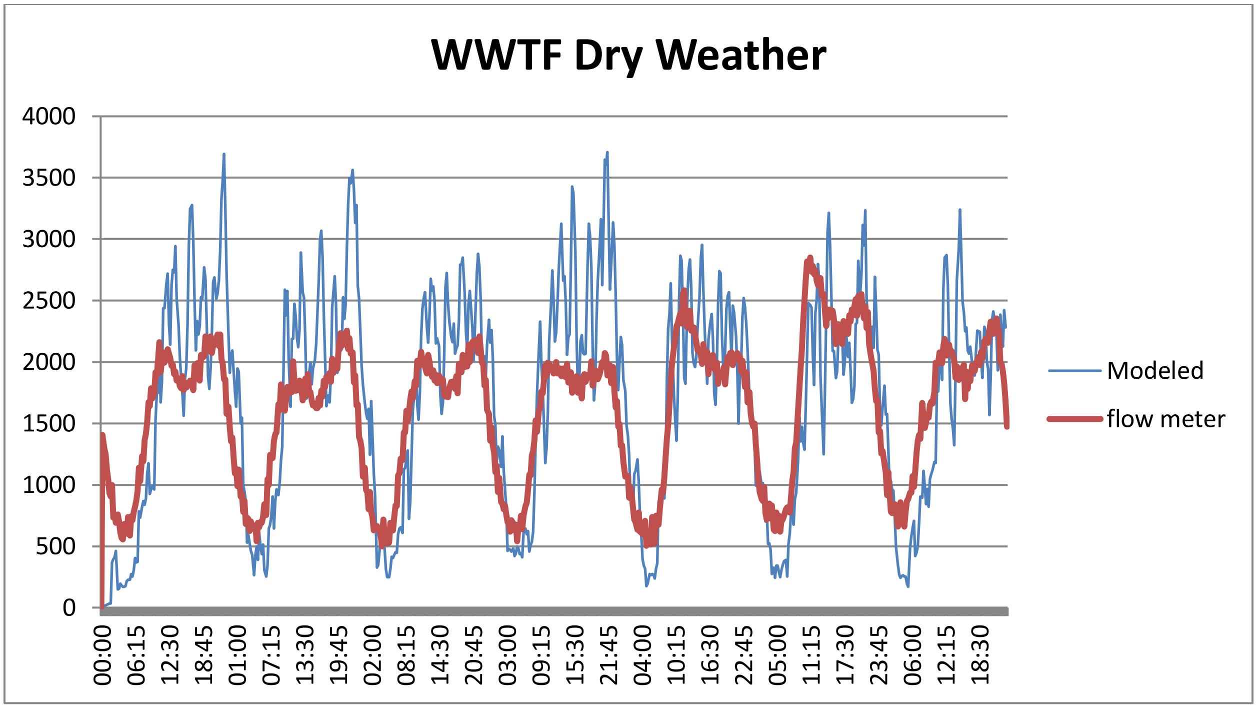


FIGURE G-9

Modeled Dry Weather Flow

WET WEATHER

Flows were recorded at the same lift stations during the January 4, 2021 storm event. The flow meter data during this event was averaged on a 15-minute basis in order to capture any temporary peak flows that might have occurred due to higher inflow during the storm event. The flow meter data provided for LS8C includes instantaneous flow rates recorded every 15 minutes, and as such, does not provide a good comparison with the modeled flows.

The modeled flows into LS1C are shown to be much higher than the flows recorded by the flow meter. During the winter, the District uses an additional auxiliary pump to provide more capacity at this lift station, as the tributary flow often exceeds the lift station's capacity. The auxiliary pump discharge is downstream of the lift station's flow meter, and therefore flows from this pump are not captured by the flow meter.

Figures G-10 through G-15 below include a visual comparison of the modeled 15-minute flows (blue line) and metered hourly flows (red line) at each lift station.

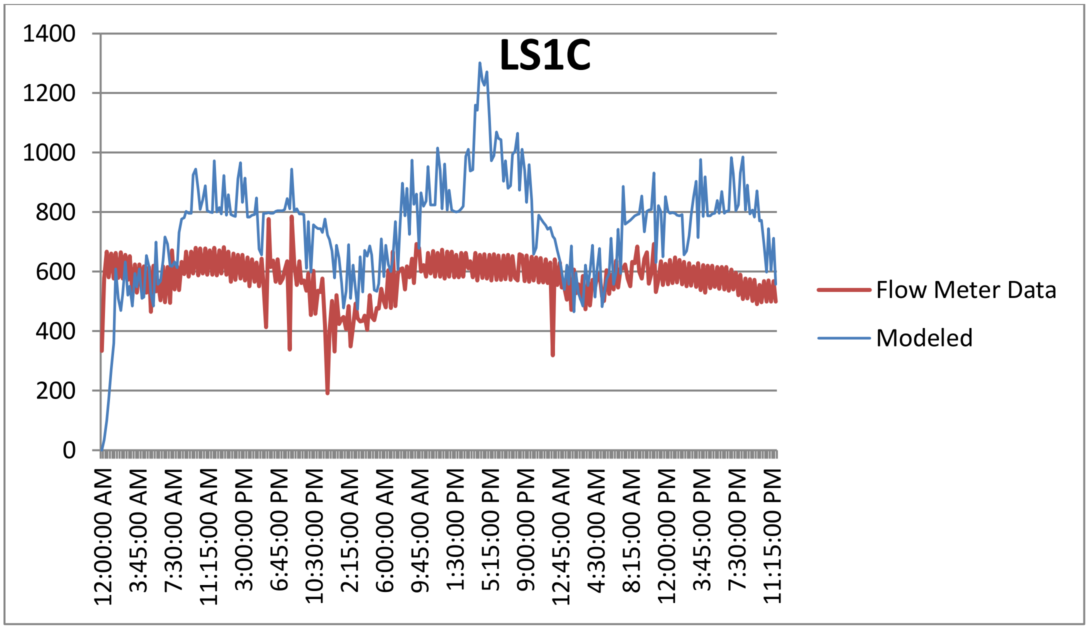


FIGURE G-10

Lift Station 1C Modeled 15-Minute Flow

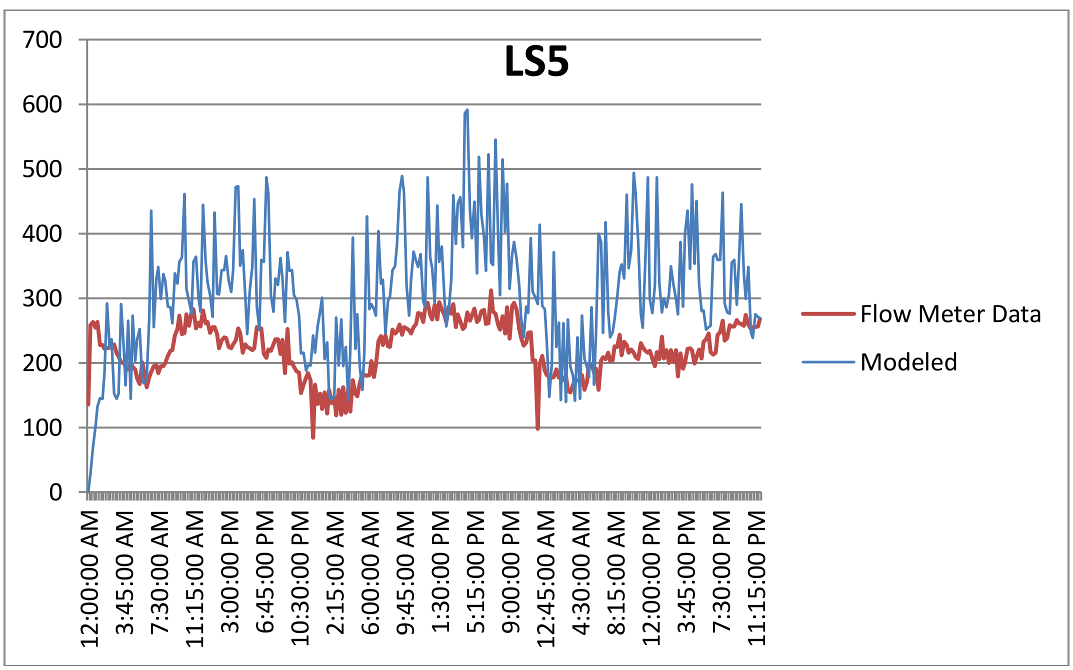


FIGURE G-11

Lift Station 5 Modeled 15-Minute Flow

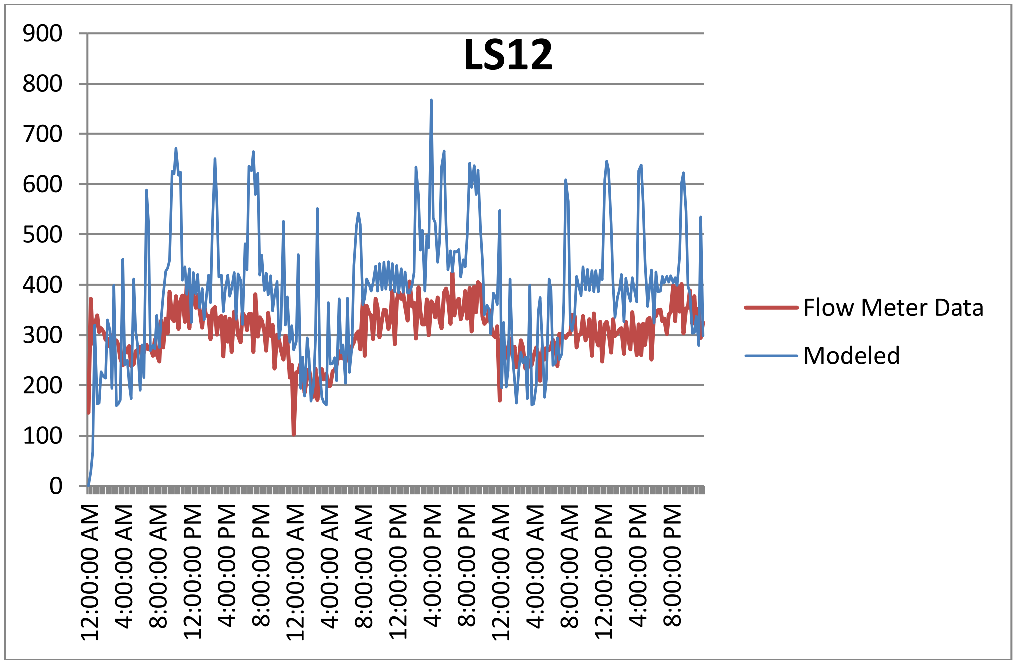


FIGURE G-12

Lift Station 12 Modeled 15-Minute Flow

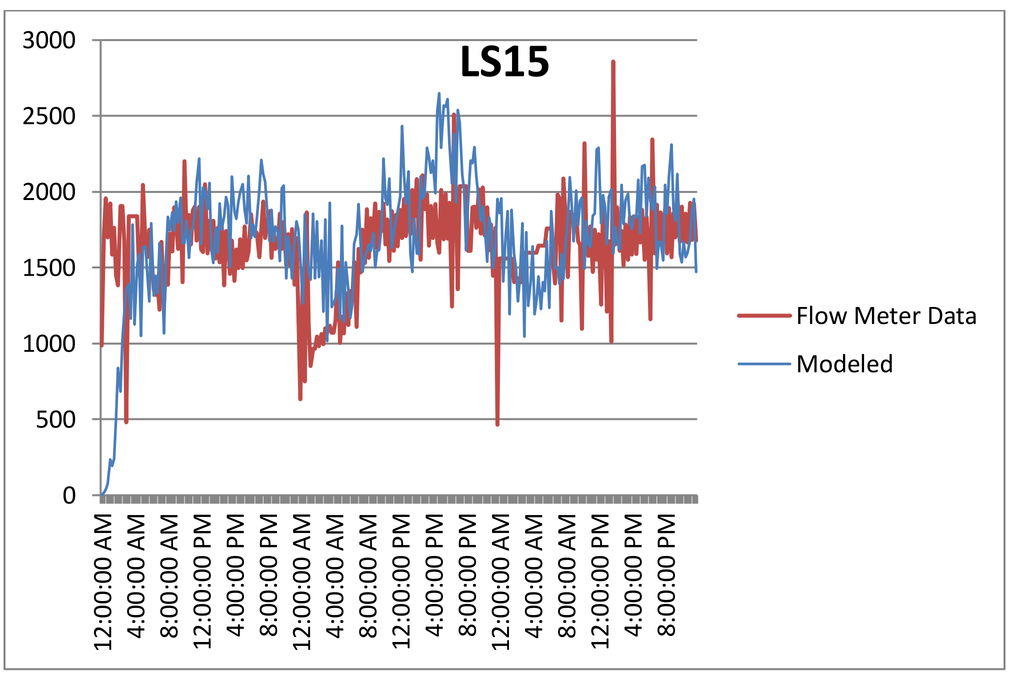


FIGURE G-13

Lift Station 15 Modeled 15-Minute Flow

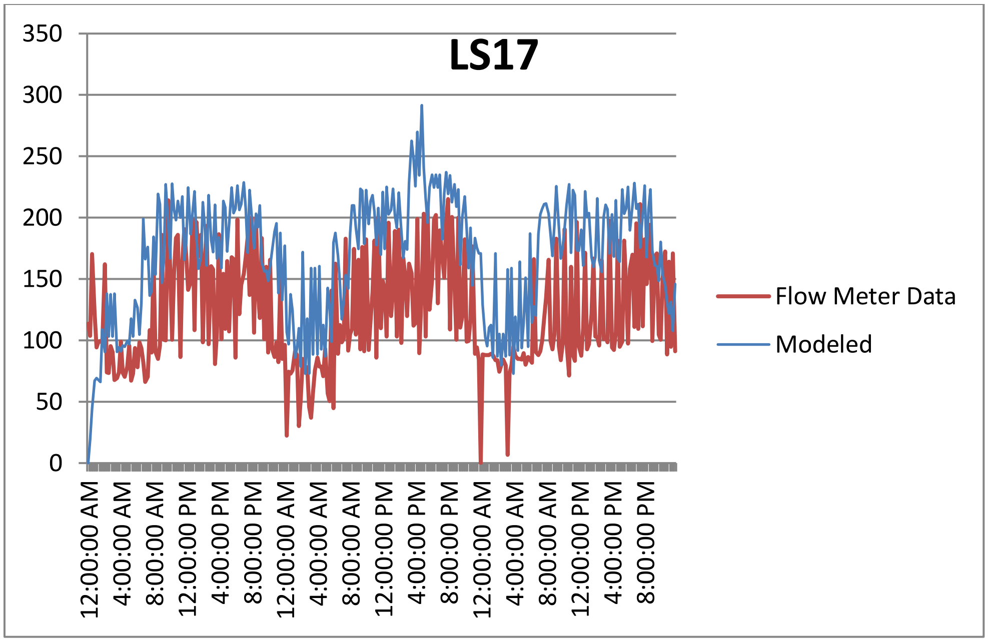


FIGURE G-14

Lift Station 17 Modeled 15-Minute Flow

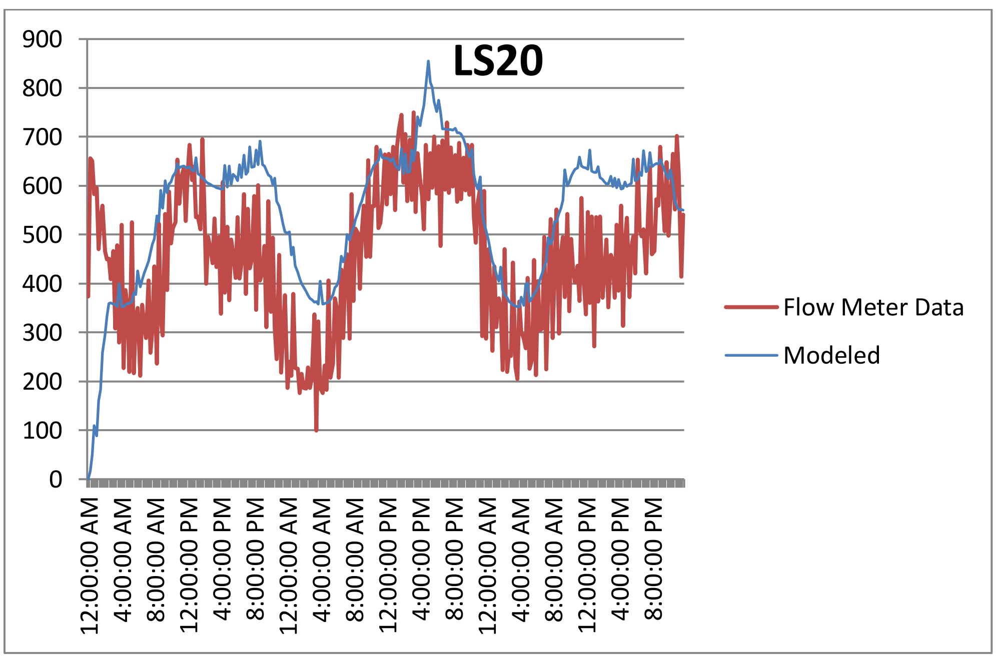


FIGURE G-15

Lift Station 20 Modeled 15-Minute Flow

The modeled wet-weather flows at the inlet pipe to the WWTF were compared with the peak day and peak hour metered flows at the facility. As noted in Chapter 3 of the Plan, the peak day flow at the WWTF was 6.9 mgd in 2020, while the peak hour flow was 9.11 mgd. The resulting modeled flows at the WWTF for the calibration effort are 7.19 mgd for the peak day and 9.45 mgd for the peak hour. This indicates that the calibrated model fairly well approximates the actual conditions measured at the treatment plant, and is somewhat conservative.

For the purpose of modeling a design storm, the calibrated I/I flow was scaled up by an additional 25 percent factor of safety. This is intended to approximate a larger storm, up to a 25- or 50-year event. The resulting modeled flows at the WWTF with this safety factor are 8.06 mgd for the peak day and 10.77 mgd for the peak hour.

Buildout Hydraulic Modeling Data

Residential and Non-Residential Sewage Flow

The Buildout ERU estimates were developed using the future land use projections, along with their associated densities, as outlined in Chapter 3 of the Plan. The total buildout ERU count, assuming that the UGA will be entirely sewered, is 21,923. Individual land use determinations are generally made at the City and County levels on a parcel-by-parcel basis, and these entities generally do not develop interim distributions of population growth for the 20-year timeframe. For the purposes of the sewer system modeling, it is assumed that areas will develop at a growth rate consistent with the City's determined growth rates noted in Chapter 3. This growth is assumed to occur throughout the District, as it is unknown where exactly development will occur at this time. Generally, any facilities or improvements that will be necessary in the future will be sized to accommodate flows for the Buildout condition rather than for the interim timeframes.

The same I/I assumptions were made for Buildout conditions as for the newest pipes in the Existing condition. It is assumed that all developable, future sewer areas will contribute 1,000 gpad.

It was assumed that rights-of way and un-buildable lands will not contribute flow to the system. A more detailed description of the development of growth projections is provided in Chapter 3. The future ERUs are assigned on a parcel-by-parcel level based on the land use designation of each parcel.

Future Inflow and Infiltration

For future peak hour flows within already-sewered area, the calibration I/I rate in each basin is escalated at a rate of 7 percent per decade to buildout. This is a standard developed by King County in their I/I analyses that reflects an increase in I/I rates due to deterioration and aging of pipes and manholes. While the District will likely conduct I/I reduction efforts that may offset this I/I escalation, assuming an increase in I/I is a more conservative approach when determining peak flows. The year of buildout was projected using the residential growth rate of 1.43 percent per year and the buildout residential ERU count determined in Chapter 4. The buildout ERU count will be reached in approximately 33 years at this growth rate, so buildout is assumed to be in 2054.

For currently unsewered areas that will be served in the future, the area served within each basin is assumed to have an I/I rate of 1,000 gpad. As unserved areas in the service area develop, the total sewered area will increase as well. The I/I rate of 1,000 gpad is assigned to all areas that will be sewered in the future, even if they are located within existing sewer basins. As detailed in Chapter 3, development is assumed to occur at a constant growth rate between 2021 and 2041 of 1.43 percent for properties with residential land use and 3.5 percent for properties with commercial land use. The addition of newly sewered area is assumed to occur at a constant growth rate over this 20-year period.

The safety factor of 25 percent applied for the existing condition design storm is again applied for the 20-year projection modeling as well as the buildout projection modeling.

APPENDIX A

MODELING RESULTS

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-1007	SMH-2212	SMH-2207	15	519	0.456	0.427	543	0.473	0.447	936	0.795	0.77
P-1008	SMH-2207	SMH-2204	15	514	0.568	0.616	539	0.585	0.646	933	1	1.118
P-1011	SMH-2352	SMH-2195	10	56	0.505	0.1	75	0.554	0.134	84	0.637	0.149
P-1026	SMH-2088	SMH-1991	12	183	0.109	0.021	201	0.114	0.023	209	0.117	0.023
P-1027	SMH-1905	SMH-2081	12	358	0.213	0.1	397	0.225	0.111	413	0.229	0.115
P-1029	SMH-2081	SMH-2082	12	359	0.142	0.043	397	0.149	0.048	414	0.152	0.05
P-1030	SMH-2082	SMH-2083	12	359	0.145	0.046	398	0.153	0.05	415	0.156	0.053
P-1037	SMH-1848	SMH-1799	10	262	0.425	0.376	281	0.442	0.403	289	0.449	0.415
P-1038	SMH-1799	SMH-1806	10	264	0.449	0.371	284	0.497	0.399	292	0.519	0.411
P-1039	SMH-1806	SMH-1805	10	416	0.595	0.663	499	0.674	0.797	535	0.711	0.854
P-104	SMH-366	SMH-2497	12	431	0.273	0.163	549	0.309	0.208	600	0.324	0.227
P-1040	SMH-1805	SMH-1804	10	418	0.569	0.618	502	0.652	0.742	538	0.685	0.795
P-1041	SMH-1804	SMH-1798	10	420	0.585	0.646	505	0.662	0.777	542	0.697	0.833
P-1042	SMH-1798	SMH-1800	10	422	0.603	0.677	508	0.686	0.814	545	0.724	0.873
P-1043	SMH-1800	SMH-1803	10	424	0.589	0.654	511	0.669	0.787	548	0.705	0.844
P-1044	SMH-1803	SMH-1802	10	426	0.607	0.683	513	0.691	0.823	551	0.73	0.883
P-105	SMH-365	SMH-366	12	429	0.426	0.378	547	0.49	0.483	598	0.516	0.527
P-106	SMH-364	SMH-365	12	383	0.291	0.143	462	0.335	0.173	496	0.354	0.186
P-107	SMH-354	SMH-364	12	381	0.321	0.223	460	0.355	0.27	494	0.369	0.29
P-108	SMH-352	SMH-354	12	377	0.223	0.109	456	0.249	0.132	490	0.261	0.142
P-109	SMH-351	SMH-352	12	375	0.343	0.253	454	0.379	0.306	487	0.394	0.328
P-1091	SMH-1729	SMH-1731	10	11	0.109	0.025	13	0.12	0.031	15	0.124	0.033
P-1092	SMH-1728	SMH-1729	10	8	0.075	0.011	9	0.082	0.014	10	0.085	0.015
P-1093	SMH-1727	SMH-1728	10	4	0.036	0.002	5	0.039	0.003	5	0.041	0.003
P-110	SMH-362	SMH-363	12	49	0.141	0.043	88	0.188	0.078	105	0.206	0.093
P-111	SMH-363	SMH-365	12	51	0.23	0.045	91	0.284	0.08	108	0.306	0.095
P-119	SMH-330	SMH-331	12	3	0.06	0.001	4	0.063	0.001	4	0.065	0.001
P-122	SMH-331	SMH-332	12	22	0.065	0.008	26	0.07	0.01	28	0.072	0.01
P-1225	SMH-1802	SMH-1801	10	428	0.658	0.686	516	0.764	0.827	553	0.774	0.887
P-1226	SMH-1801	SMH-1807	10	430	0.926	0.687	518	1	0.828	555	1	0.888
P-123	SMH-332	SMH-333	12	24	0.076	0.012	30	0.084	0.015	32	0.087	0.016
P-124	SMH-333	SMH-334	12	26	0.105	0.023	32	0.116	0.029	35	0.121	0.031
P-1247	SMH-1048	SMH-1047	12	264	0.397	0.332	323	0.444	0.407	349	0.464	0.439
P-125	SMH-334	SMH-335	12	29	0.11	0.025	35	0.121	0.031	38	0.126	0.034
P-1250	SMH-1441	SMH-1440	12	282	0.451	0.418	348	0.509	0.515	376	0.533	0.557
P-126	SMH-335	SMH-336	12	31	0.113	0.027	38	0.125	0.033	41	0.13	0.036
P-127	SMH-336	SMH-339	12	34	0.117	0.019	41	0.133	0.023	45	0.14	0.025
P-1336	SMH-868	SMH-869	10	303	1	0.298	354	1	0.349	376	1	0.371
P-1425	SMH-1041	SMH-1048	12	140	0.288	0.169	169	0.326	0.205	182	0.341	0.221
P-1426	SMH-1040	SMH-1041	12	137	0.229	0.115	166	0.252	0.139	178	0.262	0.15

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-1431	SMH-1477	SMH-1441	12	248	0.389	0.321	309	0.439	0.399	335	0.46	0.433
P-1439	SMH-1315	SMH-1470	12	168	0.346	0.222	214	0.391	0.282	233	0.41	0.308
P-1444	SMH-1469	SMH-1472	12	241	0.406	0.347	301	0.459	0.432	326	0.482	0.469
P-1445	SMH-1472	SMH-1471	12	244	0.384	0.312	303	0.433	0.389	329	0.453	0.422
P-1446	SMH-1471	SMH-1477	12	246	0.392	0.325	307	0.443	0.405	333	0.464	0.439
P-1465	SMH-1404	SMH-1405	12	144	0.27	0.145	184	0.307	0.185	202	0.322	0.203
P-1466	SMH-1405	SMH-1397	12	146	0.283	0.175	187	0.322	0.225	205	0.338	0.246
P-1467	SMH-1397	SMH-1400	12	149	0.278	0.169	190	0.316	0.216	208	0.331	0.237
P-1468	SMH-1400	SMH-1399	12	151	0.364	0.273	194	0.415	0.348	212	0.436	0.381
P-1469	SMH-1316	SMH-1315	12	165	0.281	0.173	210	0.318	0.22	230	0.333	0.24
P-1470	SMH-1401	SMH-1316	12	163	0.308	0.206	207	0.35	0.263	226	0.367	0.287
P-1552	SMH-1553	SMH-1550	12	479	0.388	0.319	561	0.424	0.374	625	0.45	0.416
P-1553	SMH-1552	SMH-1553	12	480	0.331	0.236	560	0.359	0.275	622	0.379	0.306
P-1554	SMH-1551	SMH-1552	12	482	0.283	0.175	563	0.306	0.204	623	0.323	0.225
P-1555	SMH-1544	SMH-1551	12	482	0.345	0.255	570	0.377	0.302	628	0.397	0.332
P-1565	SMH-1525	SMH-1528	12	481	0.363	0.282	574	0.399	0.336	587	0.404	0.344
P-1566	SMH-1526	SMH-1525	12	475	0.365	0.284	565	0.401	0.338	577	0.405	0.345
P-1567	SMH-1523	SMH-1526	12	479	0.245	0.132	568	0.267	0.156	580	0.27	0.16
P-1583	SMH-1548	SMH-1544	12	467	0.375	0.3	555	0.412	0.356	600	0.43	0.385
P-1584	SMH-1547	SMH-1548	12	458	0.442	0.404	548	0.49	0.483	582	0.508	0.513
P-1585	SMH-1529	SMH-1547	12	458	0.279	0.143	541	0.308	0.169	564	0.338	0.176
P-1586	SMH-1530	SMH-1529	12	462	0.35	0.263	557	0.387	0.318	578	0.395	0.33
P-1587	SMH-1527	SMH-1530	12	467	0.373	0.296	551	0.408	0.349	568	0.414	0.359
P-1588	SMH-1528	SMH-1527	12	480	0.368	0.289	569	0.404	0.342	584	0.409	0.351
P-1603	SMH-1524	SMH-1523	12	467	0.237	0.123	501	0.245	0.132	505	0.246	0.133
P-1604	SMH-1281	SMH-1524	12	479	0.231	0.117	518	0.241	0.127	521	0.241	0.128
P-1605	SMH-1661	SMH-1660	10	320	0.462	0.437	371	0.504	0.507	395	0.523	0.539
P-1606	SMH-1663	SMH-1662	10	378	0.3	0.196	428	0.32	0.221	449	0.328	0.232
P-1607	SMH-1666	SMH-1663	10	402	0.585	0.645	450	0.629	0.722	470	0.649	0.754
P-1608	SMH-1667	SMH-1666	10	433	0.697	0.694	482	0.718	0.773	503	0.752	0.807
P-1609	SMH-2126	SMH-1621	18	7	0.047	0.004	9	0.051	0.005	10	0.053	0.005
P-1610	SMH-1621	SMH-1620	18	10	0.054	0.006	12	0.059	0.007	13	0.061	0.007
P-1611	SMH-1620	SMH-1619	18	12	0.041	0.003	15	0.045	0.004	16	0.047	0.004
P-1612	SMH-1619	SMH-1594	18	17	0.049	0.005	20	0.053	0.006	21	0.134	0.006
P-1613	SMH-1594	SMH-1618	21	67	0.296	0.016	78	0.138	0.018	83	0.478	0.02
P-1614	SMH-1618	SMH-1279	21	70	0.927	0.016	82	0.624	0.019	87	1	0.02
P-1615	SMH-1236	SMH-1223	10	240	0.245	0.131	272	0.261	0.149	286	0.268	0.157
P-1616	SMH-1223	SMH-1224	10	241	0.209	0.09	274	0.231	0.103	288	0.24	0.108
P-1617	SMH-1224	SMH-1225	12	243	0.361	0.278	275	0.386	0.316	290	0.397	0.332
P-1618	SMH-1225	SMH-1226	12	244	0.629	0.288	277	0.643	0.328	291	0.648	0.344

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-1619	SMH-1226	SMH-1227	12	273	1	5.379	310	1	6.117	326	1	6.435
P-1622	SMH-1655	SMH-1657	10	755	0.428	0.381	777	0.435	0.392	786	0.438	0.397
P-1640	SMH-1102	SMH-1204	18	2023	0.656	0.207	2647	0.933	0.271	2860	1	0.292
P-1641	SMH-1098	SMH-1102	18	2022	0.368	0.29	2647	0.427	0.379	2860	0.446	0.409
P-1642	SMH-1099	SMH-1098	18	2022	0.34	0.225	2647	0.392	0.294	2859	0.4	0.318
P-1643	SMH-1135	SMH-1128	18	1768	0.34	0.111	2359	0.385	0.148	2474	0.415	0.155
P-1644	SMH-1129	SMH-1029	18	1763	0.352	0.265	2352	0.411	0.354	2467	0.422	0.371
P-1645	SMH-1097	SMH-1095	18	1774	0.429	0.202	2364	0.524	0.269	2480	0.529	0.282
P-1646	SMH-1101	SMH-1099	18	1811	0.609	0.687	2403	0.75	0.911	2524	0.783	0.957
P-1647	SMH-1088	SMH-1101	18	1812	0.577	0.593	2406	0.706	0.787	2527	0.731	0.827
P-1648	SMH-1086	SMH-1088	18	1812	0.713	0.857	2407	1	1.138	2527	1	1.195
P-1649	SMH-1083	SMH-1086	18	1814	0.649	0.666	2410	0.848	0.884	2530	0.911	0.928
P-1655	SMH-1095	SMH-1090	18	1772	0.656	0.63	2363	0.872	0.84	2479	0.87	0.882
P-1656	SMH-1090	SMH-1089	18	1770	0.791	0.967	2361	1	1.29	2477	1	1.353
P-1664	SMH-1100	SMH-1099	12	310	0.195	0.084	378	0.216	0.102	407	0.224	0.11
P-1666	SMH-1085	SMH-1083	18	1812	0.56	0.56	2409	0.645	0.745	2529	0.697	0.782
P-1667	SMH-1089	SMH-1085	18	1814	0.547	0.581	2412	0.659	0.772	2531	0.683	0.81
P-1669	SMH-1052	SMH-1078	12	276	0.381	0.308	338	0.425	0.377	364	0.444	0.406
P-1670	SMH-1078	SMH-1081	12	279	0.272	0.097	341	0.309	0.119	368	0.325	0.128
P-1671	SMH-1081	SMH-1087	12	306	0.435	0.392	373	0.487	0.478	402	0.509	0.515
P-1676	SMH-1087	SMH-1100	12	309	0.208	0.095	376	0.229	0.115	405	0.238	0.124
P-1677	SMH-1047	SMH-1052	12	267	0.423	0.372	327	0.474	0.456	353	0.495	0.492
P-1681	SMH-1498	SMH-1672	18	1352	0.596	0.666	1842	0.746	0.907	1838	0.745	0.905
P-1682	SMH-1499	SMH-1498	18	1703	0.784	0.559	2002	0.8	0.657	2003	0.8	0.657
P-1683	SMH-1672	SMH-1497	18	1032	0.473	0.454	1592	0.617	0.7	1589	0.616	0.699
P-1684	SMH-1497	SMH-1464	18	1020	0.409	0.351	1483	0.506	0.511	1483	0.506	0.51
P-1685	SMH-1464	SMH-1463	18	1366	0.467	0.429	1977	0.585	0.621	2055	0.585	0.646
P-1686	SMH-1463	SMH-1465	18	1362	0.547	0.58	1924	0.696	0.819	2002	0.71	0.852
P-1687	SMH-1465	SMH-1457	18	1358	0.622	0.709	1883	0.805	0.984	1962	1	1.025
P-1688	SMH-1457	SMH-1467	18	1357	0.658	0.517	1867	0.791	0.712	1946	0.966	0.742
P-1689	SMH-1159	SMH-1157	18	1356	0.627	0.718	1842	0.798	0.975	1924	1	1.019
P-1690	SMH-1467	SMH-1466	18	1359	1	0.592	1860	1	0.81	1939	1	0.844
P-1691	SMH-1155	SMH-1147	18	1331	1	1.182	1810	1	1.607	1892	1	1.679
P-1692	SMH-1137	SMH-1135	18	1731	0.283	0.175	2320	0.329	0.234	2432	0.338	0.246
P-1728	SMH-1195	SMH-1205	10	66	0.11	0.025	78	0.119	0.03	83	0.123	0.032
P-1729	SMH-1210	SMH-2333	12	312	0.386	0.316	354	0.414	0.358	372	0.425	0.377
P-1730	SMH-2333	SMH-2334	12	313	0.436	0.356	355	0.472	0.404	373	0.487	0.425
P-1731	SMH-1198	SMH-1163	10	385	0.568	0.617	441	0.62	0.706	465	0.643	0.745
P-1732	SMH-1197	SMH-1198	10	384	0.568	0.617	440	0.62	0.705	464	0.642	0.743
P-1733	SMH-1202	SMH-1197	10	383	0.568	0.616	439	0.619	0.704	462	0.642	0.743

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-1734	SMH-1200	SMH-1202	10	383	0.566	0.613	437	0.617	0.701	461	0.64	0.739
P-1735	SMH-1203	SMH-1200	10	382	0.565	0.612	436	0.616	0.699	460	0.638	0.737
P-1736	SMH-1207	SMH-1208	10	69	0.108	0.024	82	0.117	0.029	87	0.12	0.031
P-1737	SMH-1205	SMH-1207	10	68	0.11	0.026	80	0.119	0.03	85	0.123	0.032
P-1739	SMH-1172	SMH-2363	10	505	0.354	0.269	564	0.376	0.301	589	0.385	0.314
P-1740	SMH-1170	SMH-1171	10	393	0.303	0.199	450	0.325	0.228	475	0.334	0.241
P-1741	SMH-1169	SMH-1170	10	392	0.34	0.249	449	0.365	0.285	473	0.376	0.3
P-1742	SMH-1190	SMH-1169	10	388	0.338	0.246	445	0.363	0.282	469	0.374	0.297
P-1743	SMH-1192	SMH-1190	10	387	0.278	0.169	443	0.298	0.193	467	0.306	0.204
P-1744	SMH-1163	SMH-1192	10	386	0.324	0.226	442	0.347	0.259	466	0.357	0.273
P-1746	SMH-2363	SMH-2362	10	479	0.331	0.236	538	0.352	0.265	562	0.36	0.277
P-1747	SMH-1246	SMH-1240	24	5257	0.357	0.272	4887	0.343	0.253	5385	0.361	0.279
P-1748	SMH-1239	SMH-1206	24	5190	0.299	0.194	4626	0.282	0.173	5387	0.305	0.202
P-1749	SMH-1206	SMH-1209	24	5183	0.296	0.191	4610	0.279	0.17	5388	0.306	0.199
P-1750	SMH-1209	SMH-1204	24	5162	0.642	0.268	4559	0.86	0.236	5387	1	0.279
P-1751	SMH-1199	SMH-3138	24	5987	0.617	0.624	6242	0.679	0.65	8248	0.831	0.859
P-1752	SMH-1191	SMH-1189	24	2	0	0	4	0.012	0	5	0.013	0
P-1753	SMH-1189	SMH-1181	24	4	0.011	0	7	0.014	0	8	0.015	0
P-1754	SMH-1185	SMH-1183	24	10	0.016	0	13	0.019	0.001	15	0.02	0.001
P-1755	SMH-1241	SMH-1237	10	63	0.125	0.033	74	0.135	0.039	79	0.139	0.042
P-1756	SMH-1237	SMH-1195	10	65	0.123	0.032	76	0.133	0.038	81	0.138	0.041
P-1757	SMH-1254	SMH-1247	21	5277	0.5	0.5	5056	0.495	0.479	5356	0.773	0.507
P-1758	SMH-1247	SMH-1246	21	5269	1	1.067	4958	1	1.004	5383	1	1.09
P-1759	SMH-1257	SMH-1254	21	5281	1	1.274	5103	1	1.231	5351	1	1.291
P-1761	SMH-1278	SMH-1255	10	77	0.244	0.13	89	0.263	0.152	95	0.388	0.161
P-1762	SMH-1255	SMH-1245	10	79	0.75	0.126	93	0.727	0.148	99	1	0.157
P-1763	SMH-1245	SMH-1241	10	61	0.122	0.032	72	0.132	0.037	77	0.136	0.04
P-1764	SMH-1259	SMH-1258	10	54	0.198	0.086	63	0.213	0.1	66	0.219	0.106
P-1765	SMH-1248	SMH-1256	10	49	0.15	0.048	57	0.16	0.056	60	0.165	0.059
P-1766	SMH-1252	SMH-34	10	38	0.109	0.024	43	0.116	0.028	46	0.12	0.029
P-1767	SMH-1250	SMH-1252	10	31	0.152	0.05	36	0.162	0.057	38	0.168	0.061
P-1768	SMH-1153	SMH-1250	12	5	0.052	0.005	6	0.058	0.007	7	0.064	0.008
P-1769	SMH-1154	SMH-1153	12	2	0.035	0.002	3	0.04	0.003	4	0.048	0.004
P-1770	SMH-1145	SMH-1154	12	0	0	0	1	0.013	0	3	0.024	0.001
P-1784	SMH-1227	SMH-1211	12	280	0.352	0.266	318	0.378	0.303	335	0.388	0.319
P-1785	SMH-1211	SMH-2368	12	280	0.388	0.318	319	0.416	0.362	336	0.428	0.381
P-1786	SMH-1213	SMH-1214	12	310	0.43	0.384	352	0.461	0.435	370	0.475	0.457
P-1787	SMH-1214	SMH-1210	12	311	0.408	0.35	353	0.438	0.397	371	0.451	0.417
P-1794	SMH-1182	SMH-1176	24	478	0.098	0.02	541	0.104	0.023	567	0.107	0.024
P-1795	SMH-1176	SMH-1174	24	492	0.073	0.011	561	0.077	0.012	590	0.079	0.013

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-1796	SMH-1173	SMH-3306	16	515	0.731	0.025	596	0.742	0.028	630	0.745	0.03
P-1809	SMH-1258	SMH-1277	10	60	0.165	0.059	69	0.177	0.068	73	0.182	0.072
P-1810	SMH-1277	SMH-1278	10	62	0.149	0.048	72	0.16	0.056	76	0.165	0.059
P-1811	SMH-1279	SMH-1257	21	5286	1	1.118	5286	1	1.118	5347	1	1.13
P-1829	SMH-1443	SMH-1464	18	344	0.336	0.111	510	0.377	0.164	582	0.408	0.187
P-1833	SMH-1669	SMH-1668	10	54	0.216	0.087	74	0.253	0.119	83	0.268	0.133
P-1834	SMH-1584	SMH-1669	10	50	0.191	0.08	68	0.224	0.11	76	0.237	0.123
P-1835	SMH-1582	SMH-1584	10	46	0.184	0.074	63	0.216	0.102	71	0.228	0.114
P-1836	SMH-1583	SMH-1582	10	43	0.176	0.068	59	0.207	0.094	66	0.219	0.106
P-1837	SMH-1589	SMH-1583	10	39	0.17	0.063	55	0.201	0.088	62	0.213	0.099
P-1838	SMH-1581	SMH-1589	10	36	0.154	0.052	51	0.183	0.073	57	0.194	0.082
P-1839	SMH-1579	SMH-1581	10	6	0.064	0.008	8	0.072	0.011	9	0.075	0.012
P-1877	SMH-999	SMH-1002	12	229	0.306	0.203	261	0.327	0.231	274	0.336	0.243
P-1878	SMH-1002	SMH-1012	12	232	0.339	0.194	264	0.363	0.221	278	0.374	0.233
P-1879	SMH-1013	SMH-1015	12	248	0.324	0.227	283	0.347	0.259	298	0.357	0.273
P-1880	SMH-1015	SMH-1016	12	270	0.334	0.241	309	0.359	0.276	326	0.369	0.291
P-1882	SMH-941	SMH-1117	12	336	0.398	0.334	396	0.436	0.393	422	0.451	0.419
P-1884	SMH-1117	SMH-1116	12	339	0.392	0.293	400	0.893	0.345	426	1	0.367
P-1890	SMH-1145	SMH-1147	12	448	0.314	0.214	529	0.343	0.253	563	0.354	0.269
P-1891	SMH-1146	SMH-1145	10	441	0.619	0.705	523	0.699	0.835	558	0.736	0.891
P-1892	SMH-1143	SMH-1146	10	436	0.615	0.698	517	0.694	0.828	552	0.73	0.884
P-1893	SMH-1123	SMH-3092	10	402	0.613	0.695	476	0.692	0.824	509	0.728	0.88
P-1906	SMH-1555	SMH-1554	18	917	0.511	0.518	1064	0.559	0.602	1160	0.591	0.656
P-1907	SMH-1575	SMH-1555	18	920	1	0.252	1065	1	0.291	1161	1	0.318
P-1908	SMH-1571	SMH-1575	12	474	1	0.303	565	1	0.361	634	1	0.405
P-1909	SMH-1572	SMH-1571	12	475	0.378	0.303	566	0.416	0.362	635	0.443	0.406
P-1910	SMH-1550	SMH-1572	12	476	0.379	0.305	559	0.414	0.359	624	0.44	0.4
P-1944	SMH-1038	SMH-1040	12	127	0.281	0.173	154	0.31	0.209	166	0.322	0.225
P-2002	SMH-1310	SMH-1281	12	507	0.224	0.11	517	0.25	0.112	520	0.255	0.112
P-2022	SMH-1399	SMH-1401	12	160	0.371	0.293	204	0.423	0.373	223	0.445	0.408
P-2023	SMH-1470	SMH-1469	12	239	0.372	0.294	298	0.419	0.366	323	0.438	0.398
P-2027	SMH-1444	SMH-1443	18	331	0.211	0.086	495	0.257	0.129	566	0.275	0.147
P-2028	SMH-1466	SMH-1454	18	1352	1	1	1862	1	1	1941	1	1
P-2029	SMH-1454	SMH-1452	18	1351	0.472	0.371	1841	0.591	0.506	1922	0.591	0.528
P-2030	SMH-1452	SMH-1451	18	1344	0.52	0.534	1835	0.634	0.729	1915	0.653	0.761
P-2031	SMH-1451	SMH-1159	18	1337	0.53	0.507	1825	0.642	0.692	1906	0.685	0.723
P-2032	SMH-1157	SMH-1155	18	1355	0.479	0.465	1843	0.577	0.633	1925	0.594	0.661
P-2044	SMH-1012	SMH-1013	12	245	0.379	0.305	279	0.407	0.349	294	0.419	0.367
P-2049	SMH-1128	SMH-1129	18	1764	0.465	0.442	2352	0.552	0.589	2467	0.569	0.618
P-2050	SMH-1029	SMH-1097	18	1769	0.334	0.241	2358	0.39	0.321	2473	0.4	0.337

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-2051	SMH-1256	SMH-1259	10	52	0.13	0.036	60	0.14	0.042	63	0.144	0.044
P-2053	SMH-1664	SMH-2345	10	350	0.371	0.293	400	0.405	0.335	423	0.456	0.355
P-2054	SMH-1662	SMH-1664	10	360	0.256	0.143	411	0.273	0.163	433	0.281	0.172
P-2056	SMH-1240	SMH-1239	24	5214	0.356	0.271	4692	0.336	0.244	5386	0.362	0.28
P-2057	SMH-2334	SMH-1203	10	380	0.553	0.59	435	0.602	0.675	458	0.623	0.711
P-2060	SMH-2347	SMH-1236	10	233	0.226	0.107	265	0.242	0.121	279	0.248	0.128
P-2061	SMH-1204	SMH-636	24	6167	1	1.003	6245	1	1.015	8221	1	1.337
P-2062	SMH-1201	SMH-1199	24	6005	1	1.177	6244	1	1.224	8250	1	1.617
P-2063	SMH-1171	SMH-1172	10	531	0.357	0.273	590	0.378	0.303	615	0.386	0.316
P-2065	SMH-1174	SMH-1173	16	485	0.111	0.026	555	0.118	0.03	584	0.121	0.031
P-2073	SMH-1630	SMH-1661	10	333	0.356	0.272	384	0.384	0.313	407	0.397	0.332
P-2077	SMH-1440	SMH-1444	12	330	0.427	0.38	494	0.54	0.569	565	0.588	0.651
P-2079	SMH-1037	SMH-1038	12	124	0.3	0.196	151	0.331	0.237	162	0.344	0.255
P-2080	SMH-944	SMH-1037	12	70	0.203	0.09	86	0.224	0.11	92	0.232	0.118
P-2081	SMH-943	SMH-944	12	64	0.207	0.081	77	0.227	0.097	83	0.235	0.104
P-2086	SMH-1992	SMH-1991	18	71	0.055	0.006	80	0.058	0.007	84	0.06	0.007
P-2090	SMH-1184	SMH-1185	24	8	0.015	0	11	0.017	0.001	12	0.018	0.001
P-2091	SMH-1181	SMH-1184	24	6	0.013	0	9	0.016	0	10	0.017	0
P-2098	SMH-2193	SMH-2343	24	1514	0.373	0.296	1715	0.399	0.335	2103	0.447	0.411
P-2100	SMH-2345	SMH-1630	10	337	0.521	0.536	388	0.568	0.617	411	0.589	0.653
P-2103	SMH-2354	SMH-943	12	61	0.361	0.063	73	0.378	0.076	79	0.385	0.081
P-211	SMH-515	SMH-503	10	206	0.436	0.394	248	0.484	0.473	265	0.504	0.507
P-2111	SMH-1183	SMH-1182	24	12	0.129	0	16	0.134	0	18	0.136	0.001
P-2112	SMH-2362	SMH-1182	10	477	0.266	0.155	537	0.282	0.174	561	0.289	0.182
P-2113	SMH-1208	SMH-2334	10	71	0.337	0.034	84	0.367	0.04	90	0.379	0.043
P-2116	SMH-1245	SMH-1247	10	20	1	0.032	24	1	0.037	25	1	0.04
P-2126	SMH-2368	SMH-1213	12	281	0.398	0.294	320	0.426	0.335	337	0.439	0.353
P-213	SMH-503	SMH-502	10	208	0.339	0.247	250	0.373	0.297	268	0.388	0.318
P-2289	SMH-676	SMH-675	24	1664	0.341	0.163	1943	0.369	0.191	2355	0.425	0.231
P-2290	SMH-675	SMH-674	24	2160	0.409	0.352	2494	0.444	0.406	3304	0.522	0.538
P-2291	SMH-674	SMH-673	24	2163	0.369	0.29	2498	0.399	0.335	3309	0.467	0.444
P-2292	SMH-673	SMH-672	24	2164	0.383	0.31	2501	0.414	0.359	3311	0.485	0.475
P-2293	SMH-659	SMH-658	24	5252	0.915	0.803	5253	0.798	0.803	5253	1	0.803
P-2294	SMH-658	SMH-1279	24	5252	1	0.816	5253	0.845	0.816	5256	1	0.816
P-24	SMH-45	SMH-43	10	18	0.124	0.033	20	0.132	0.037	21	0.135	0.039
P-2416	SMH-2419	SMH-2087	12	168	0.161	0.056	185	0.168	0.062	192	0.172	0.064
P-2433	SMH-2218	SMH-2456	18	1037	0.323	0.217	1158	0.345	0.243	1209	0.354	0.254
P-2481	SMH-191	SMH-2481	15	1576	0.359	0.276	1831	0.39	0.321	1233	0.316	0.216
P-2492	SMH-2491	SMH-351	10	244	0.296	0.191	298	0.328	0.233	322	0.342	0.251
P-2493	SMH-2492	SMH-2429	10	242	0.33	0.235	296	0.367	0.288	319	0.383	0.31

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-2494	SMH-2429	SMH-2491	10	243	0.329	0.233	297	0.366	0.285	320	0.381	0.308
P-2495	SMH-2431	SMH-2492	10	241	0.388	0.318	294	0.433	0.389	318	0.452	0.42
P-2496	SMH-2430	SMH-2431	10	240	0.318	0.219	293	0.353	0.268	316	0.368	0.289
P-2497	SMH-2432	SMH-2430	10	239	0.293	0.188	292	0.326	0.23	315	0.339	0.248
P-2498	SMH-2433	SMH-2432	10	221	0.292	0.186	268	0.323	0.226	288	0.335	0.242
P-2499	SMH-2434	SMH-2433	10	220	0.265	0.154	267	0.293	0.187	287	0.304	0.201
P-2500	SMH-2435	SMH-2434	10	219	0.233	0.119	264	0.256	0.143	283	0.265	0.154
P-2501	SMH-2439	SMH-2435	10	218	0.221	0.107	262	0.242	0.128	281	0.251	0.138
P-2502	SMH-2436	SMH-2439	10	216	0.373	0.296	260	0.412	0.356	279	0.428	0.382
P-2503	SMH-2437	SMH-2436	10	214	0.423	0.372	257	0.469	0.447	276	0.488	0.479
P-2504	SMH-502	SMH-2438	10	210	0.334	0.24	252	0.371	0.289	271	0.39	0.309
P-2505	SMH-2438	SMH-2437	10	212	0.466	0.443	255	0.519	0.532	273	0.541	0.571
P-2520	SMH-2509	SMH-331	12	11	0.051	0.005	13	0.056	0.006	14	0.058	0.007
P-2536	SMH-2551	SMH-2552	10	47	0.191	0.08	64	0.222	0.108	71	0.235	0.121
P-2553	SMH-2570	SMH-2571	12	343	0.369	0.29	625	0.517	0.529	744	0.575	0.629
P-2568	SMH-2567	SMH-2566	12	1	0.027	0.001	278	0.344	0.254	395	0.416	0.362
P-2569	SMH-2566	SMH-2565	12	3	0.038	0.003	278	0.347	0.259	396	0.421	0.37
P-2570	SMH-2565	SMH-2568	12	4	0.046	0.004	278	0.349	0.261	397	0.423	0.373
P-2571	SMH-2568	SMH-2570	12	6	0.18	0.006	277	0.398	0.279	397	0.464	0.4
P-2598	SMH-2594	SMH-1137	18	1732	0.556	0.596	2320	0.675	0.798	2432	0.7	0.837
P-2599	SMH-1147	SMH-2594	18	1725	0.655	0.765	2313	1	1.026	2425	1	1.075
P-26	SMH-43	SMH-41	10	23	0.139	0.042	28	0.152	0.05	30	0.157	0.054
P-2648	SMH-2632	SMH-2633	36	7133	0.199	0.087	8554	0.218	0.104	10580	0.242	0.128
P-2649	SMH-2633	SMH-2634	36	7130	0.195	0.083	8551	0.213	0.1	10581	0.237	0.124
P-2650	SMH-2634	SMH-2636	36	7119	0.158	0.054	8562	0.173	0.065	10583	0.192	0.081
P-2651	SMH-2636	SMH-2637	36	7109	0.241	0.128	8561	0.265	0.154	10584	0.295	0.19
P-2652	SMH-2637	SMH-2638	36	7108	0.303	0.096	8557	0.315	0.116	10585	0.327	0.143
P-2667	SMH-2657	SMH-2656	30	2010	0.236	0.122	2625	0.27	0.16	2726	0.276	0.166
P-2668	SMH-2656	SMH-2655	30	2002	0.206	0.093	2623	0.236	0.122	2722	0.24	0.127
P-2669	SMH-2655	SMH-2654	36	7154	0.228	0.114	8547	0.249	0.136	10577	0.278	0.169
P-2670	SMH-2654	SMH-2632	36	7146	0.28	0.162	8546	0.302	0.194	10573	0.335	0.24
P-2675	SMH-2664	SMH-2659	30	2007	0.247	0.133	2603	0.282	0.173	2702	0.287	0.18
P-2680	SMH-2659	SMH-2657	30	2011	0.173	0.065	2624	0.197	0.085	2726	0.201	0.089
P-2695	SMH-2686	SMH-2664	30	2006	0.178	0.064	2603	0.205	0.083	2706	0.207	0.087
P-2698	SMH-2687	SMH-2686	30	1939	0.161	0.056	2503	0.182	0.073	2600	0.186	0.076
P-27	SMH-41	SMH-40	10	26	0.145	0.045	31	0.158	0.054	33	0.163	0.058
P-2700	SMH-2688	SMH-2687	30	1938	0.25	0.137	2503	0.285	0.177	2602	0.291	0.184
P-2701	SMH-2689	SMH-2688	30	1939	0.23	0.116	2504	0.262	0.15	2606	0.267	0.156
P-28	SMH-40	SMH-39	10	28	0.152	0.05	33	0.166	0.06	35	0.172	0.064
P-2806	SMH-2815	SMH-2689	30	1964	0.183	0.073	2513	0.206	0.093	2611	0.21	0.097

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-2808	SMH-2816	SMH-2815	30	1972	0.161	0.056	2520	0.181	0.072	2616	0.185	0.074
P-2810	SMH-2814	SMH-2816	30	1921	0.263	0.151	2450	0.297	0.192	2539	0.303	0.199
P-2877	SMH-2854	SMH-2419	10	167	0.369	0.29	183	0.387	0.318	190	0.395	0.33
P-2878	SMH-2855	SMH-2854	10	165	0.387	0.316	181	0.406	0.347	188	0.415	0.36
P-2879	SMH-2856	SMH-2855	10	153	0.373	0.296	168	0.392	0.325	174	0.4	0.337
P-2880	SMH-2857	SMH-2856	10	150	0.363	0.282	165	0.382	0.309	171	0.39	0.321
P-29	SMH-39	SMH-38	10	30	0.165	0.059	36	0.18	0.07	39	0.186	0.075
P-2931	SMH-2913	SMH-362	12	15	0.078	0.013	29	0.107	0.024	35	0.117	0.029
P-2932	SMH-2925	SMH-2924	24	1641	0.287	0.179	2170	0.331	0.237	2210	0.335	0.242
P-2933	SMH-2922	SMH-2921	30	1626	0.23	0.116	2161	0.265	0.154	2212	0.268	0.158
P-2934	SMH-2919	SMH-2918	30	1636	0.244	0.13	2175	0.281	0.173	2229	0.285	0.177
P-2935	SMH-2918	SMH-2917	30	1642	0.197	0.085	2183	0.227	0.113	2238	0.23	0.116
P-2936	SMH-2924	SMH-2923	30	1634	0.192	0.08	2171	0.22	0.107	2214	0.223	0.109
P-2937	SMH-2923	SMH-2922	30	1631	0.228	0.114	2167	0.263	0.151	2215	0.266	0.155
P-2938	SMH-2921	SMH-2920	30	1628	0.231	0.117	2164	0.266	0.155	2217	0.27	0.159
P-2939	SMH-2920	SMH-2919	30	1639	0.192	0.08	2178	0.226	0.107	2232	0.223	0.109
P-2940	SMH-2917	SMH-2915	30	1641	0.234	0.121	2182	0.271	0.16	2238	0.274	0.164
P-2941	SMH-2915	SMH-2914	30	1647	0.224	0.11	2189	0.259	0.147	2245	0.262	0.15
P-2942	SMH-2914	SMH-2916	30	1656	0.164	0.058	2202	0.188	0.077	2256	0.19	0.079
P-2943	SMH-2916	SMH-2814	30	1657	0.131	0.037	2203	0.151	0.049	2258	0.152	0.05
P-2966	SMH-2933	SMH-2931	24	1645	0.3	0.196	2177	0.347	0.259	2210	0.35	0.263
P-2967	SMH-2931	SMH-2925	24	1644	0.302	0.199	2174	0.35	0.263	2210	0.353	0.267
P-2968	SMH-2932	SMH-2933	24	1639	0.298	0.193	2154	0.343	0.254	2190	0.346	0.258
P-30	SMH-38	SMH-37	10	32	0.164	0.059	40	0.182	0.072	43	0.189	0.078
P-3047	SMH-3028	SMH-2929	10	125	0.165	0.059	208	0.212	0.099	236	0.226	0.112
P-31	SMH-37	SMH-36	10	34	0.175	0.066	42	0.194	0.082	46	0.201	0.089
P-3120	SMH-3092	SMH-1143	10	434	0.575	0.629	515	0.644	0.746	549	0.675	0.797
P-3134	SMH-3124	SMH-3123	36	5375	0.384	0.305	6243	0.435	0.354	8266	0.509	0.469
P-3135	SMH-3123	SMH-3122	36	5354	0.425	0.377	6242	0.464	0.439	8263	0.548	0.582
P-3136	SMH-3122	SMH-3121	36	5345	0.428	0.382	6241	0.468	0.446	8262	0.557	0.59
P-3137	SMH-3121	SMH-3120	36	5325	0.437	0.395	6242	0.478	0.463	8263	0.566	0.613
P-3138	SMH-3120	SMH-3119	36	5311	0.439	0.398	6244	0.481	0.468	8266	0.57	0.62
P-3139	SMH-3119	SMH-3118	36	5300	0.426	0.378	6244	0.467	0.445	8266	0.552	0.589
P-3140	SMH-3118	SMH-3117	36	5291	0.425	0.376	6245	0.467	0.444	8268	0.551	0.588
P-3141	SMH-3117	SMH-3116	36	5287	0.392	0.325	6246	0.43	0.384	8269	0.505	0.508
P-3142	SMH-3116	SMH-3115	36	5285	0.153	0.05	6248	0.166	0.06	8271	0.19	0.079
P-3143	SMH-3129	SMH-3128	36	5439	0.411	0.354	6222	0.443	0.405	8244	0.598	0.537
P-3144	SMH-3128	SMH-3126	36	5401	0.43	0.368	6220	0.505	0.423	8241	0.801	0.561
P-3145	SMH-3126	SMH-3125	36	5372	0.532	0.427	6219	0.625	0.495	8239	0.96	0.656
P-3146	SMH-3125	SMH-3124	36	5359	0.623	0.711	6222	0.693	0.826	8242	1	1.094

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-3147	SMH-3138	SMH-3137	36	5887	0.486	0.476	6234	0.503	0.504	8247	0.597	0.667
P-3148	SMH-3137	SMH-3136	36	5851	0.487	0.477	6235	0.505	0.509	8250	0.601	0.673
P-3149	SMH-3136	SMH-3135	36	5784	0.482	0.47	6232	0.503	0.506	8249	0.599	0.67
P-3150	SMH-3135	SMH-3134	36	5732	0.473	0.454	6228	0.496	0.493	8247	0.589	0.653
P-3151	SMH-3134	SMH-3133	36	5682	0.427	0.37	6224	0.461	0.405	8245	0.538	0.537
P-3152	SMH-3133	SMH-3132	36	5637	0.456	0.426	6223	0.483	0.471	8245	0.572	0.624
P-3153	SMH-3132	SMH-3131	36	5584	0.436	0.394	6221	0.464	0.438	8244	0.547	0.581
P-3154	SMH-3131	SMH-3130	36	5546	0.441	0.402	6223	0.471	0.451	8247	0.557	0.597
P-3155	SMH-3130	SMH-3129	36	5521	0.402	0.34	6225	0.429	0.383	8249	0.506	0.507
P-3160	SMH-3152	SMH-3151	24	1800	0.321	0.224	1996	0.339	0.248	2049	0.344	0.255
P-3161	SMH-3140	SMH-3139	24	1835	0.309	0.207	2218	0.341	0.25	2208	0.34	0.249
P-3162	SMH-3145	SMH-3140	24	1862	0.337	0.245	2230	0.371	0.293	2212	0.369	0.291
P-3163	SMH-3141	SMH-3145	24	1894	0.234	0.075	2255	0.27	0.089	2231	0.26	0.088
P-3165	SMH-3144	SMH-3143	24	1562	0.188	0.077	1950	0.21	0.096	1986	0.211	0.098
P-3166	SMH-3146	SMH-3144	24	1597	0.186	0.076	1958	0.206	0.093	2010	0.208	0.095
P-3167	SMH-3148	SMH-3146	24	1606	0.306	0.203	1958	0.339	0.248	2006	0.343	0.254
P-3168	SMH-3150	SMH-3148	24	1674	0.31	0.209	1964	0.337	0.245	2024	0.343	0.253
P-3169	SMH-3151	SMH-3150	24	1723	0.337	0.244	1970	0.361	0.279	2037	0.368	0.289
P-3170	SMH-3153	SMH-3152	21	1826	0.222	0.108	2027	0.234	0.12	2053	0.239	0.122
P-3171	SMH-3156	SMH-3153	21	1933	0.267	0.156	2020	0.273	0.163	2036	0.274	0.164
P-3193	SMH-3142	SMH-3141	24	404	0.065	0.008	405	0.065	0.008	405	0.065	0.008
P-3197	SMH-3159	SMH-3157	21	1851	0.587	0.084	1852	0.588	0.084	1853	0.589	0.084
P-3198	SMH-3183	SMH-3184	18	496	0.119	0.03	549	0.125	0.033	573	0.128	0.035
P-3199	SMH-3115	SMH-3178	36	5275	0.175	0.056	6249	0.189	0.066	8270	0.222	0.087
P-32	SMH-36	SMH-558	10	37	0.173	0.065	45	0.191	0.08	49	0.199	0.086
P-3200	SMH-3178	SMH-3179	36	5259	0.288	0.095	6248	0.319	0.113	8271	0.377	0.15
P-3201	SMH-3179	SMH-3180	36	5250	0.396	0.33	6247	0.452	0.393	8268	0.538	0.52
P-3202	SMH-3180	SMH-3176	36	5237	0.457	0.429	6246	0.507	0.511	8266	0.603	0.677
P-3203	SMH-3176	SMH-3175	36	5243	0.334	0.048	6259	0.384	0.057	8283	0.465	0.075
P-3204	SMH-3175	SMH-2655	36	5236	0.543	0.573	6277	0.609	0.687	8304	0.748	0.909
P-3208	SMH-3182	SMH-3183	15	495	0.256	0.144	549	0.27	0.16	572	0.276	0.166
P-3252	SMH-3232	SMH-3231	24	1743	0.255	0.143	2206	0.288	0.18	2184	0.293	0.179
P-3253	SMH-3231	SMH-3230	24	1728	0.318	0.219	2201	0.361	0.279	2186	0.36	0.277
P-3254	SMH-3230	SMH-3229	24	1705	0.316	0.216	2193	0.361	0.278	2187	0.36	0.277
P-3255	SMH-3229	SMH-3228	24	1680	0.313	0.213	2180	0.359	0.276	2186	0.36	0.277
P-3256	SMH-3228	SMH-3227	24	1669	0.239	0.125	2179	0.273	0.163	2188	0.273	0.163
P-3257	SMH-3227	SMH-3226	24	1656	0.168	0.061	2165	0.191	0.08	2188	0.192	0.081
P-3260	SMH-3226	SMH-2932	24	1649	0.145	0.045	2164	0.165	0.059	2191	0.174	0.06
P-3283	SMH-3256	SMH-3257	12	15	0.048	0.004	18	0.051	0.005	19	0.053	0.005
P-3284	SMH-3257	SMH-2920	12	17	0.039	0.003	20	0.042	0.003	22	0.043	0.004

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-3371	SMH-3306	SMH-3307	15	508	0.249	0.136	590	0.268	0.157	624	0.276	0.166
P-3372	SMH-3308	SMH-3307	21	512	0.24	0.127	568	0.253	0.14	592	0.259	0.146
P-3373	SMH-3309	SMH-3308	21	511	0.213	0.099	567	0.224	0.11	592	0.229	0.115
P-3374	SMH-3310	SMH-3309	21	511	0.309	0.207	567	0.326	0.23	591	0.333	0.24
P-3375	SMH-3311	SMH-3310	21	510	0.306	0.203	566	0.323	0.225	590	0.33	0.235
P-3376	SMH-3312	SMH-3311	21	510	0.31	0.209	566	0.327	0.231	590	0.335	0.241
P-3377	SMH-3313	SMH-3312	21	509	0.305	0.202	565	0.322	0.224	589	0.329	0.234
P-3378	SMH-3314	SMH-3313	21	509	0.308	0.206	564	0.325	0.229	589	0.333	0.239
P-3379	SMH-3315	SMH-3314	21	508	0.308	0.206	564	0.325	0.229	588	0.333	0.239
P-3392	SMH-3316	SMH-3315	12	254	0.326	0.23	282	0.344	0.255	294	0.352	0.266
P-3471	SMH-2120	SMH-2981	15	471	0.325	0.228	521	0.343	0.252	544	0.35	0.263
P-3484	SMH-3438	SMH-3437	18	929	0.192	0.08	999	0.199	0.087	1030	0.202	0.089
P-3485	SMH-3437	SMH-3436	18	931	0.189	0.078	1002	0.195	0.084	1033	0.198	0.086
P-3486	SMH-3436	SMH-3435	18	933	0.23	0.105	1007	0.242	0.113	1038	0.246	0.117
P-3487	SMH-3435	SMH-3434	18	935	0.31	0.209	1010	0.323	0.225	1042	0.328	0.233
P-3488	SMH-3434	SMH-3433	18	938	0.325	0.229	1013	0.339	0.247	1045	0.344	0.255
P-3489	SMH-3433	SMH-3432	18	940	0.343	0.235	1017	0.357	0.254	1049	0.363	0.263
P-3490	SMH-3432	SMH-2221	18	942	0.35	0.262	1019	0.365	0.284	1052	0.371	0.293
P-3592	SMH-3520	SMH-3438	15	753	0.189	0.078	781	0.193	0.081	794	0.194	0.082
P-3593	SMH-3521	SMH-3520	15	743	0.229	0.115	769	0.233	0.119	780	0.234	0.12
P-3612	SMH-3682	SMH-3521	15	741	0.192	0.081	766	0.196	0.084	777	0.197	0.085
P-3633	SMH-3585	SMH-3584	10	20	0.136	0.04	28	0.157	0.054	31	0.166	0.06
P-3634	SMH-3584	SMH-3583	10	37	0.179	0.07	50	0.208	0.095	56	0.22	0.106
P-3635	SMH-3583	SMH-3582	10	39	0.185	0.075	52	0.215	0.102	58	0.227	0.113
P-3636	SMH-3582	SMH-3581	10	42	0.191	0.079	56	0.221	0.107	62	0.233	0.119
P-3637	SMH-3581	SMH-3580	10	43	0.193	0.081	58	0.225	0.111	65	0.237	0.123
P-3638	SMH-3580	SMH-2551	10	45	0.2	0.088	61	0.233	0.119	68	0.245	0.132
P-3699	SMH-3684	SMH-3683	15	732	0.247	0.134	753	0.251	0.138	762	0.252	0.139
P-3703	SMH-3688	SMH-3684	15	728	0.386	0.316	748	0.392	0.324	756	0.394	0.328
P-3704	SMH-3689	SMH-3688	15	726	0.41	0.353	745	0.416	0.362	753	0.419	0.366
P-3736	SMH-3723	SMH-3721	12	92	0.079	0.013	115	0.087	0.016	125	0.091	0.017
P-3870	SMH-1807	LS_8	10	530	0.4	0.337	649	1	0.412	700	1	0.445
P-3872	SMH-2571	LS_17	18	344	0.177	0.068	627	0.56	0.124	746	0.572	0.148
P-3882	SMH-3184	SMH-2967	15	499	0.433	0.389	553	0.459	0.431	577	0.47	0.45
P-3884	SMH-2967	SMH-3316	12	507	0.323	0.226	563	0.341	0.251	587	0.349	0.261
P-3910	SMH-1586	SMH-1585	10	4	0.038	0.003	5	0.041	0.003	5	0.042	0.003
P-3922	SMH-1580	SMH-1579	10	3	0.045	0.004	4	0.051	0.005	4	0.053	0.005
P-3924	SMH-1668	LS_3	10	71	0.233	0.119	98	0.273	0.163	109	0.289	0.183
P-3928	SMH-1660	LS_4	10	304	0.534	0.558	356	0.589	0.652	380	0.614	0.696
P-3934	SMH-1656	SMH-2110	10	669	1	1.53	730	1	1.67	794	1	1.817

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-3936	SMH-1657	SMH-1656	10	751	0.7	0.154	773	0.851	0.159	788	0.88	0.162
P-3938	SMH-2106	SMH-3726	10	544	1	1.108	645	1	1.315	705	1	1.438
P-3940	SMH-2064	SMH-2062	10	596	0.518	0.531	718	0.581	0.639	776	0.611	0.691
P-3948	SMH-2063	LS_5	18	661	0.132	0.038	803	0.145	0.046	879	0.152	0.05
P-3950	SMH-2078	SMH-671	18	2	0.033	0.002	3	0.037	0.003	3	0.039	0.003
P-3952	SMH-671	SMH-2077	18	4	0.033	0.002	6	0.037	0.003	6	0.039	0.003
P-3954	SMH-2077	SMH-2069	18	7	0.043	0.003	9	0.047	0.004	10	0.049	0.005
P-3956	SMH-2069	SMH-2076	18	9	0.053	0.005	11	0.058	0.007	12	0.06	0.007
P-3960	SMH-2076	SMH-2075	18	12	0.054	0.006	14	0.059	0.007	15	0.061	0.007
P-3962	SMH-2075	SMH-2066	18	15	0.06	0.007	17	0.065	0.008	19	0.067	0.009
P-3964	SMH-2066	SMH-2065	18	17	0.069	0.009	21	0.075	0.011	22	0.077	0.012
P-3966	SMH-2065	SMH-2115	18	19	0.081	0.012	23	0.089	0.014	25	0.092	0.015
P-3968	SMH-2115	SMH-2061	18	22	0.09	0.016	26	0.098	0.019	28	0.101	0.02
P-3970	SMH-2061	SMH-2060	18	24	0.093	0.018	29	0.101	0.021	31	0.104	0.023
P-3972	SMH-2060	SMH-2063	18	26	0.06	0.007	31	0.065	0.008	34	0.067	0.009
P-3974	SMH-3726	SMH-2064	10	599	0.623	0.711	717	0.709	0.851	778	0.758	0.923
P-3988	SMH-672	LS_15	24	2969	0.265	0.153	3316	0.28	0.171	4129	0.313	0.213
P-3990	SMH-3683	SMH-3682	15	738	0.233	0.12	762	0.237	0.123	772	0.239	0.125
P-3994	SMH-2767	SMH-3689	15	725	0.424	0.118	742	0.427	0.12	750	0.428	0.122
P-3996	SMH-2237	SMH-1875	15	516	0.42	0.367	553	0.436	0.393	949	0.602	0.676
P-3998	SMH-1875	SMH-675	18	517	0.322	0.212	555	0.354	0.227	952	0.461	0.389
P-4000	SMH-2310	SMH-2309	12	669	0.747	0.408	677	0.749	0.413	1380	1	0.842
P-4012	SMH-232	LS_2C	10	810	1	2.602	1017	1	3.267	1270	1	4.08
P-4052	SMH-1554	LS_2A	18	936	0.328	0.232	1101	0.357	0.273	1193	0.372	0.295
P-4058	SMH-3158	SMH-3157	12	5	0.025	0.001	15	0.044	0.004	20	0.05	0.005
P-4060	SMH-3157	SMH-3156	21	1842	0.365	0.285	1864	0.367	0.288	1870	0.368	0.289
P-4062	SMH-3143	SMH-3141	24	1524	0.186	0.076	1935	0.209	0.096	1970	0.211	0.098
P-4064	SMH-3139	SMH-3232	24	1791	0.32	0.222	2212	0.358	0.275	2184	0.356	0.271
P-4072	SMH-636	SMH-1201	24	6088	1	1.638	6252	1	1.682	8251	1	2.219
P-4078	SMH-34	SMH-1248	10	45	0.11	0.026	52	0.118	0.03	55	0.122	0.031
P-4086	SMH-2497	LS_8C	12	730	0.495	0.263	900	0.52	0.324	973	0.529	0.351
P-4088	SMH-2481	LS_1C	15	1578	1	0.177	1834	1	0.206	1236	1	0.139
P-4126	SMH-3307	LS_20	20	1000	0.27	0.16	1139	0.289	0.182	1199	0.297	0.191
P-4128	SMH-3316	SMH-3315	12	254	0.326	0.23	282	0.344	0.255	294	0.352	0.266
P-4130	SMH-869	LS_11	10	304	1	0.308	355	1	0.36	378	1	0.383
P-4138	SMH-1752	SMH-3744	12	746	1	0.843	777	1	0.878	791	1	0.893
P-4140	SMH-3744	SMH-3746	12	843	1	0.959	1168	1	1.33	1211	1	1.379
P-4142	SMH-3746	LS_22	12	837	1	0.969	1162	1	1.345	1210	1	1.4
P-4176	SMH-3846	LS_C4	10				9	0.047	0.004	17	0.062	0.008
P-4178	SMH-3778	SMH-3780	10				36	0.157	0.054	51	0.187	0.077

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-4180	SMH-3780	SMH-3782	10				2	0.039	0.003	3	0.046	0.004
P-4182	SMH-3784	SMH-3842	10				10	0.114	0.027	14	0.135	0.039
P-4184	SMH-3786	SMH-3784	10				8	0.094	0.011	12	0.112	0.016
P-4186	SMH-3788	SMH-3786	10				5	0.057	0.003	8	0.067	0.004
P-4188	SMH-3790	SMH-3778	10				33	0.173	0.065	47	0.206	0.093
P-4190	SMH-3792	SMH-3790	10				30	0.164	0.053	43	0.196	0.076
P-4192	SMH-3794	SMH-3792	10				24	0.154	0.05	35	0.184	0.072
P-4194	SMH-3796	SMH-3794	10				22	0.122	0.017	31	0.145	0.024
P-4196	SMH-3798	SMH-3796	10				14	0.062	0.008	20	0.074	0.011
P-4198	SMH-3800	SMH-3798	10				10	0.052	0.003	14	0.062	0.005
P-4200	SMH-3802	SMH-2567	12				280	0.205	0.092	396	0.243	0.13
P-4202	SMH-3804	SMH-3802	12				281	0.341	0.25	394	0.41	0.352
P-4204	SMH-3806	SMH-3804	12				281	0.306	0.196	393	0.372	0.274
P-4206	SMH-3808	SMH-3806	12				285	0.337	0.245	395	0.402	0.339
P-4208	SMH-3810	SMH-3808	12				284	0.298	0.185	392	0.355	0.256
P-4210	SMH-3812	SMH-3810	12				284	0.301	0.197	391	0.356	0.271
P-4212	SMH-3814	SMH-3812	12				287	0.209	0.056	395	0.265	0.077
P-4214	SMH-3816	SMH-3814	12				291	0.184	0.074	396	0.214	0.101
P-4216	SMH-3818	SMH-3816	12				291	0.16	0.052	396	0.195	0.071
P-4218	SMH-3820	SMH-3818	12				296	0.228	0.114	395	0.264	0.153
P-4220	SMH-3822	SMH-3820	12				289	0.327	0.231	390	0.383	0.311
P-4222	SMH-3824	SMH-3822	12				291	0.346	0.258	390	0.405	0.345
P-4224	SMH-3826	SMH-3824	12				295	0.287	0.18	392	0.351	0.239
P-4226	SMH-3828	SMH-3826	12				294	0.565	0.188	392	0.586	0.25
P-4228	SMH-3830	SMH-3828	10				168	0.623	0.105	266	0.648	0.166
P-4230	SMH-3832	SMH-3830	12				169	0.237	0.124	265	0.298	0.194
P-4248	SMH-2605	SMH-3832	12				169	0.208	0.095	267	0.261	0.149
P-4252	SMH-3782	SMH-3840	10				4	0.11	0.003	5	0.121	0.004
P-45	SMH-558	SMH-557	10	39	0.212	0.064	48	0.226	0.078	52	0.231	0.085
P-457	SMH-192	SMH-191	15	964	0.509	0.511	1032	0.546	0.548	361	0.394	0.191
P-458	SMH-193	SMH-192	15	962	0.711	0.854	1029	0.752	0.914	357	0.387	0.317
P-459	SMH-194	SMH-193	15	960	0.712	0.855	1026	0.752	0.914	353	0.385	0.315
P-483	SMH-236	SMH-2421	10	919	0.706	0.404	971	0.721	0.427	295	0.243	0.13
P-489	SMH-195	SMH-194	15	958	0.707	0.848	1023	0.746	0.906	350	0.382	0.31
P-490	SMH-196	SMH-195	15	955	0.707	0.848	1018	0.745	0.904	345	0.38	0.306
P-491	SMH-197	SMH-196	15	951	0.71	0.852	1013	0.747	0.908	339	0.378	0.304
P-492	SMH-198	SMH-197	15	946	0.701	0.839	1007	0.737	0.893	333	0.373	0.296
P-493	SMH-199	SMH-198	15	943	0.708	0.849	1003	0.744	0.903	328	0.373	0.296
P-494	SMH-203	SMH-199	15	939	0.696	0.831	998	0.73	0.883	323	0.366	0.286
P-509	SMH-219	SMH-218	10	106	0.305	0.203	291	0.534	0.558	340	0.589	0.652

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-510	SMH-218	SMH-217	10	110	0.164	0.059	286	0.264	0.153	339	0.288	0.181
P-513	SMH-217	SMH-230	10	316	0.246	0.133	391	1	0.165	348	1	0.147
P-515	SMH-230	SMH-232	10	323	0.853	0.171	384	1	0.203	352	1	0.187
P-516	SMH-231	SMH-232	10	675	1	0.648	871	1	0.835	1002	1	0.961
P-517	SMH-211	SMH-231	10	602	1	1.179	777	1	1.522	906	1	1.776
P-518	SMH-210	SMH-211	10	604	1	1.159	778	1	1.494	908	1	1.744
P-521	SMH-207	SMH-210	10	599	1	1.147	767	1	1.469	902	1	1.727
P-522	SMH-206	SMH-207	10	607	1	1.106	777	1	1.416	909	1	1.657
P-525	SMH-141	SMH-206	15	604	0.443	0.405	778	1	0.522	903	1	0.606
P-526	SMH-118	SMH-141	15	261	0.264	0.153	365	1	0.214	429	1	0.251
P-540	SMH-151	SMH-150	10	457	1	0.699	579	1	0.885	631	1	0.965
P-548	SMH-2421	SMH-203	15	933	0.507	0.359	991	0.539	0.381	316	0.261	0.121
P-557	SMH-2442	SMH-2509	12	9	0.069	0.009	11	0.074	0.011	12	0.077	0.012
P-569	SMH-2304	SMH-2305	12	983	1	1	1002	1	1	1710	1	1
P-570	SMH-2308	SMH-2307	12	981	0.478	0.463	993	0.482	0.469	1699	0.678	0.802
P-571	SMH-2312	SMH-2308	12	985	0.536	0.562	995	0.54	0.568	1700	0.794	0.97
P-573	SMH-2314	SMH-2310	12	659	0.564	0.61	662	0.565	0.612	1363	1	1.261
P-574	SMH-2313	SMH-2314	12	653	0.563	0.478	654	0.488	0.479	1355	1	0.992
P-612	SMH-2309	SMH-2312	12	984	0.603	0.623	993	0.575	0.629	1697	1	1.075
P-613	SMH-2307	SMH-2304	12	980	0.908	0.345	993	0.977	0.349	1698	1	0.597
P-614	SMH-2305	SMH-2306	12	963	0.414	0.359	983	0.419	0.366	1691	0.576	0.63
P-615	SMH-2306	SMH-2302	12	955	0.446	0.41	976	0.452	0.419	1685	0.631	0.724
P-699	SMH-2147	SMH-2116	10	223	0.392	0.324	253	0.42	0.368	266	0.432	0.387
P-718	SMH-2107	SMH-2106	10	568	0.512	0.204	645	1	0.232	715	1	0.257
P-727	SMH-2348	SMH-2349	10	43	0.179	0.07	56	0.203	0.091	62	0.213	0.1
P-728	SMH-2349	SMH-2350	10	47	0.186	0.076	62	0.215	0.101	69	0.226	0.112
P-729	SMH-2350	SMH-2351	10	51	0.193	0.081	68	0.223	0.109	76	0.235	0.121
P-730	SMH-2351	SMH-2352	10	54	0.198	0.086	72	0.229	0.115	80	0.241	0.128
P-732	SMH-2242	SMH-2348	10	39	0.17	0.063	49	0.191	0.079	54	0.199	0.087
P-735	SMH-2232	SMH-2231	15	517	0.42	0.368	550	0.435	0.392	946	0.602	0.675
P-736	SMH-2231	SMH-2238	15	516	0.417	0.363	550	0.432	0.387	946	0.596	0.665
P-737	SMH-2238	SMH-2237	15	516	0.422	0.372	551	0.438	0.398	948	0.607	0.684
P-757	SMH-2206	SMH-2236	15	517	0.411	0.353	546	0.423	0.373	941	0.583	0.643
P-758	SMH-2236	SMH-2235	15	515	0.41	0.353	546	0.423	0.374	941	0.584	0.644
P-759	SMH-2235	SMH-2233	15	515	0.41	0.352	547	0.423	0.374	942	0.584	0.644
P-760	SMH-2233	SMH-2232	15	515	0.411	0.354	547	0.425	0.376	942	0.586	0.648
P-763	SMH-2057	SMH-2058	12	39	0.152	0.05	44	0.163	0.057	47	0.167	0.061
P-764	SMH-2058	SMH-2059	12	41	0.154	0.052	47	0.165	0.059	49	0.169	0.062
P-767	SMH-2059	SMH-2054	12	46	0.156	0.053	52	0.166	0.06	55	0.17	0.063
P-768	SMH-2054	SMH-2053	12	48	0.173	0.065	54	0.184	0.074	57	0.189	0.078

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-772	SMH-2049	SMH-2048	12	58	0.183	0.073	66	0.194	0.082	69	0.199	0.086
P-773	SMH-2050	SMH-2049	12	56	0.187	0.076	63	0.199	0.086	66	0.204	0.091
P-774	SMH-2053	SMH-2050	12	53	0.169	0.062	60	0.18	0.071	64	0.184	0.074
P-775	SMH-2048	SMH-2046	12	62	0.177	0.068	70	0.188	0.077	73	0.192	0.081
P-776	SMH-2045	SMH-2057	12	37	0.148	0.047	42	0.159	0.055	45	0.163	0.058
P-778	SMH-2046	SMH-1994	16	63	0.136	0.04	71	0.144	0.045	74	0.148	0.047
P-779	SMH-2224	SMH-2192	12	167	0.33	0.235	236	0.396	0.331	265	0.448	0.372
P-819	SMH-2108	SMH-2107	10	560	1	1.039	649	1	1.204	723	1	1.341
P-820	SMH-2109	SMH-2108	10	568	0.564	0.555	666	0.79	0.65	738	0.794	0.72
P-821	SMH-2111	SMH-2109	10	606	0.327	0.226	680	0.382	0.254	750	0.364	0.28
P-822	SMH-2112	SMH-2111	10	609	0.39	0.321	695	0.419	0.366	762	0.441	0.402
P-823	SMH-2110	SMH-2112	10	635	0.756	0.92	700	1	1.013	765	1	1.108
P-830	SMH-2221	SMH-2220	18	984	0.343	0.253	1077	0.36	0.277	1118	0.367	0.287
P-831	SMH-2220	SMH-2219	18	1024	0.23	0.088	1140	0.249	0.098	1190	0.255	0.103
P-832	SMH-2219	SMH-2218	18	1026	0.335	0.242	1143	0.355	0.27	1193	0.363	0.282
P-833	SMH-2456	SMH-2201	18	1038	0.399	0.335	1159	0.424	0.374	1211	0.434	0.391
P-837	SMH-2216	SMH-2213	12	535	0.314	0.214	555	0.32	0.222	948	0.426	0.378
P-838	SMH-2213	SMH-2212	12	525	0.381	0.242	547	0.4	0.252	940	0.592	0.434
P-839	SMH-2204	SMH-2206	15	519	0.362	0.28	547	0.372	0.295	941	0.505	0.508
P-840	SMH-2215	SMH-2216	12	533	0.3	0.196	551	0.305	0.202	943	0.406	0.346
P-841	SMH-2214	SMH-2215	12	534	0.331	0.237	549	0.336	0.243	941	0.45	0.417
P-842	SMH-2302	SMH-2214	12	535	0.263	0.151	548	0.266	0.155	940	0.352	0.266
P-858	SMH-1993	SMH-1992	18	71	0.121	0.031	80	0.128	0.035	84	0.131	0.037
P-859	SMH-2971	SMH-2118	15	11	0.036	0.002	12	0.038	0.003	13	0.039	0.003
P-861	SMH-2981	SMH-2119	15	494	0.32	0.222	547	0.338	0.246	570	0.345	0.256
P-862	SMH-2121	SMH-2120	15	470	0.291	0.184	521	0.307	0.204	543	0.313	0.213
P-863	SMH-2122	SMH-2121	15	363	0.235	0.121	403	0.248	0.135	420	0.253	0.14
P-870	SMH-2085	SMH-1905	12	261	0.449	0.147	289	0.461	0.162	301	0.466	0.169
P-871	SMH-1994	SMH-1993	16	70	0.187	0.076	79	0.198	0.086	82	0.203	0.09
P-875	SMH-1990	SMH-2063	10	639	1	1.229	781	1	1.504	854	1	1.643
P-876	SMH-1989	SMH-1990	10	646	0.464	0.269	784	0.492	0.326	861	0.511	0.358
P-877	SMH-2062	SMH-1989	10	652	0.463	0.439	783	0.516	0.527	863	0.547	0.581
P-925	SMH-2302	SMH-2203	16	415	0.197	0.085	426	0.2	0.087	744	0.264	0.152
P-926	SMH-2203	SMH-2202	16	411	0.196	0.084	424	0.199	0.087	742	0.263	0.152
P-927	SMH-2202	SMH-2201	16	409	0.196	0.084	424	0.199	0.087	743	0.264	0.152
P-928	SMH-2201	SMH-2200	24	1418	0.305	0.193	1578	0.325	0.214	1948	0.366	0.265
P-929	SMH-2200	SMH-2199	24	1415	0.369	0.29	1575	0.391	0.323	1945	0.439	0.398
P-930	SMH-2199	SMH-2198	24	1416	0.245	0.074	1575	0.262	0.083	1945	0.297	0.102
P-931	SMH-2198	SMH-2196	24	1414	0.361	0.279	1574	0.382	0.31	1944	0.429	0.383
P-932	SMH-2196	SMH-2197	24	1414	0.36	0.278	1573	0.382	0.309	1943	0.429	0.382

Pipe	From MH	TO MH	Diam (in)	2020 (existing)			2040 (20-year)			Buildout		
				2020 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	2040 Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q	BO Flow (gpm)	Maximum Adjusted d/D	Maximum q/Q
P-933	SMH-2197	SMH-2195	24	1467	0.369	0.287	1649	0.393	0.323	2029	0.441	0.397
P-934	SMH-2195	SMH-2194	24	1514	0.374	0.297	1715	0.4	0.337	2102	0.448	0.413
P-935	SMH-2194	SMH-2193	24	1514	0.376	0.3	1715	0.402	0.34	2103	0.45	0.417
P-936	SMH-2343	SMH-2192	24	1515	0.374	0.298	1715	0.409	0.337	2103	0.458	0.413
P-937	SMH-2192	SMH-1874	24	1663	0.387	0.317	1941	0.421	0.37	2353	0.469	0.448
P-938	SMH-1874	SMH-676	24	1663	0.4	0.338	1942	0.436	0.394	2354	0.487	0.478
P-974	SMH-2113	SMH-2126	18	5	0.038	0.003	6	0.041	0.003	6	0.043	0.003
P-989	SMH-2086	SMH-1889	12	256	0.176	0.034	283	0.188	0.038	295	0.193	0.039
P-990	SMH-1889	SMH-1888	12	257	0.396	0.232	284	0.416	0.256	296	0.426	0.267
P-991	SMH-1888	SMH-1887	12	258	0.647	0.288	285	0.669	0.319	297	0.68	0.333
P-992	SMH-1887	SMH-1886	12	260	1	0.262	288	1	0.29	300	1	0.302
P-993	SMH-1991	SMH-2089	12	255	0.146	0.03	282	0.154	0.033	294	0.157	0.035
P-994	SMH-2089	SMH-2086	12	255	0.174	0.066	282	0.183	0.073	294	0.187	0.076
P-995	SMH-1886	SMH-2085	12	261	1	1	289	1	1	301	1	1
TO_WWTP_PIPE	SMH-2638	TO_WWTP	42	8758	0.286	0.179	10209	0.31	0.209	12236	0.341	0.25

APPENDIX H

LIFT STATION 2C PREDESIGN REPORT

LAKE STEVENS SEWER DISTRICT

SNOHOMISH COUNTY **WASHINGTON**

LIFT STATION 2C UPGRADE
PREDESIGN REPORT

G&O #14408.07
MAY 2015

Gray & Osborne, Inc.
CONSULTING ENGINEERS

LAKE STEVENS SEWER DISTRICT

SNOHOMISH COUNTY **WASHINGTON**

LAKE STEVENS
SEWER DISTRICT
Serving You Since 1957

LIFT STATION 2C UPGRADE PREDESIGN REPORT

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G&O #14408.07
MAY 2015

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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OVERVIEW

The Lake Stevens Sewer District (District) operates and maintains Lift Station (LS) 2C, a sanitary sewer lift station located at 12600 20th Street NE in Lake Stevens (Figure 1). Currently LS 2C directs sewer flows to LS 1C. The District plans to upgrade LS 2C to bypass flows around LS 1C and reduce the flow tributary to LS 1C based on a 2014 Technical Memoranda completed by Gray & Osborne, Inc. examining the improvements necessary for a proposed Downtown Redevelopment Project with approximately 100 Equivalent Residential Units (ERU) and future potential development in the downtown core.

Gray & Osborne completed a Feasibility Study on May 9, 2014, reviewing the improvements needed to provide sewer service for 100 units of a potential project in the vicinity of the City's permit center. A portion of flows that are currently tributary to Lift Station 1C would be diverted to the new lift station to reduce the improvements necessary at Lift Station 1C and to provide capacity for downtown development. The District requested a scope for a predesign report on the recommended alternative and a draft was provided to the District on June 10, 2014. At the Joint District/City Utility Committee Meeting on August 11, 2014, the District requested that Gray & Osborne examine the cost and feasibility of a new regional lift station in the vicinity of 23rd and North Lakeshore Drive. Gray & Osborne provided a memorandum on August 13, 2014, responding to the Utility Committee request. This study included an analysis of constructing a new lift station near property that is currently owned by the City of Lake Stevens at 12300 North Lakeshore Drive. At the meeting on August 21, 2014, with the Lake Stevens Sewer District, the City of Lake Stevens, and a potential developer, the City requested additional information concerning a regional lift station that would serve both the current development and future development needs for the downtown area. The City requested to know the number of future connections (ERUs) this regional lift station could provide as well as related costs for the improvements and cost per additional ERU. These three draft memoranda are included in Appendix A. The District has authorized $12,050 for the Feasibility Report on May 8, 2014, an amendment to the Feasibility Report of $4,600, and $39,990 for the Predesign Report on August 14, 2014. To date we have expended approximately $40,100 of the $56,640 authorized budgets.

The intent of the design upgrade is for LS 2C to become the regional lift station for the downtown Lake Stevens area. This predesign report provides details consistent with the intent of the adopted *2007 Sanitary Sewer System Comprehensive Plan* (2007 Comp Plan) and the feasibility technical memoranda.

This predesign report documents the condition and function of the existing facility and reviews the current and future upgrades necessary to convey existing and future sanitary sewer flows. A new submersible pump station will be installed in the existing wet well and valve vault. The valve vault will be located in the surplus generator vault onsite. The existing generator and electrical service and controls will need to be replaced to meet the pumping requirements of bypassing Lift Station 1C.

Due to the limitations of the downstream surplus force main this project will connect to, the improvements are presented in two phases. Phase 1 would include upgrading the lift station and installation of 3,000 feet of 12-inch force main to connect to the existing surplus 8-inch force main at Lift Station 1C. Phase 2 of the capacity increase would occur in the future and increase capacity by replacing the existing surplus 8-inch force main with a 12-inch force main. This increase in size significantly reduces the friction losses in those 3,000 feet of pipe and thereby allows the same pumps to increase in capacity without physical alteration.

DESCRIPTION OF EXISTING LIFT STATION

The lift station was constructed in 1971 as a wet-pit/dry-pit pump station with an 8-foot-diameter concrete wet well and 7-foot-diameter steel dry well. Two eight-inch flooded inlet pipes connect the wetwell with two centrifugal pumps and associated valves and piping in the dry pit. The wetwell is accessed via a round 24-inch ring and manhole cover and the dry pit is accessed through a 36-inch steel manway (Figure 2). The station was upgraded in 2004 with two Smith & Loveless 4B2A 15-horsepower flooded suction centrifugal pumps. The original installation included a below-grade generator in an 8-foot-wide x 14-foot-long x 8-foot-high vault. The below-grade generator was removed during an upgrade to a 50 kW above-grade diesel-powered auxiliary generator in 2007. The pumping capacity of the existing station is 700 gallons per minute (gpm), at a total dynamic head (TDH) of 40 feet with the largest pump out of service (per Department of Ecology (Ecology) *Criteria for Sewage Works Design*). It currently discharges through 920 feet of 8-inch ductile iron force main to the Lake Shore Road gravity sewer trunk which drains by gravity to LS 1C.

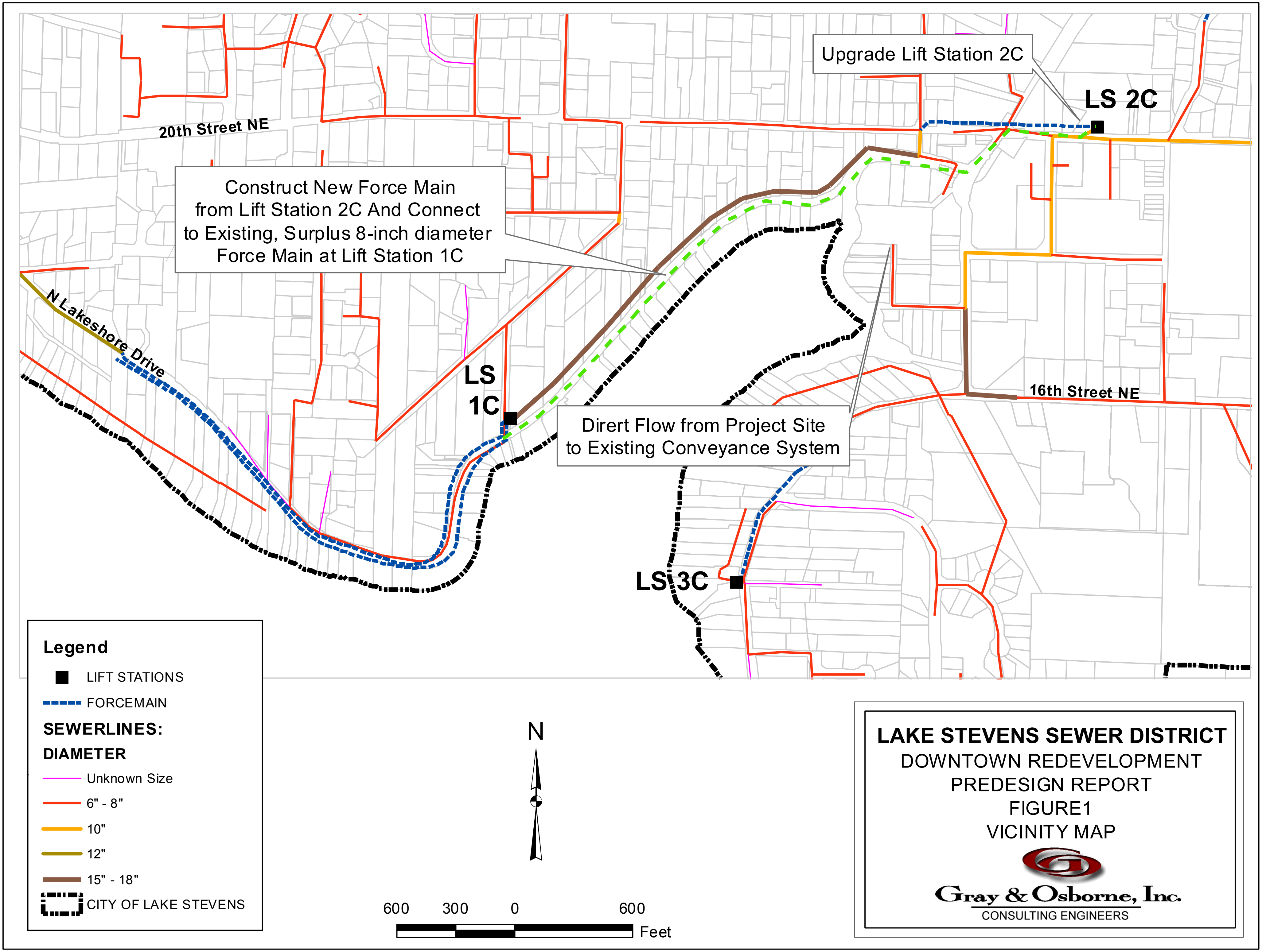
DESIGN FLOW RATE

The instantaneous peak flow tributary to the lift station is identified as 965 gpm in the 2007 Comp Plan using the assumption that all tributary lift stations are pumping and the gravity tributary basins is experiencing a peak flow event. Five lift stations are tributary to LS 2C: Lift Stations 3C, 4C, 5C, 6C and 9C with pumping capacities of 200, 100, 200, 100 and 150 gpm, respectively. The 2007 Comp Plan estimated the direct gravity flow tributary to LS 2C to be 215 gpm. The 2007 Comp Plan identifies the Buildout flow for the area tributary to LS 2C to be 2,250 gpm.

The design of Phase 1 of this upgrade of LS 2C will accommodate 420 ERUs anticipated within the tributary basin. The peak flow from these additional 420 ERUs is estimated as follows:

- 2.97 people/ERU and 70 gallons/person/day (average) = 0.14 gpm/ERU

- 1,100 gallon/acre/day of Infiltration over 8,000 square feet/ERU
  = 0.14 gpm/ERU



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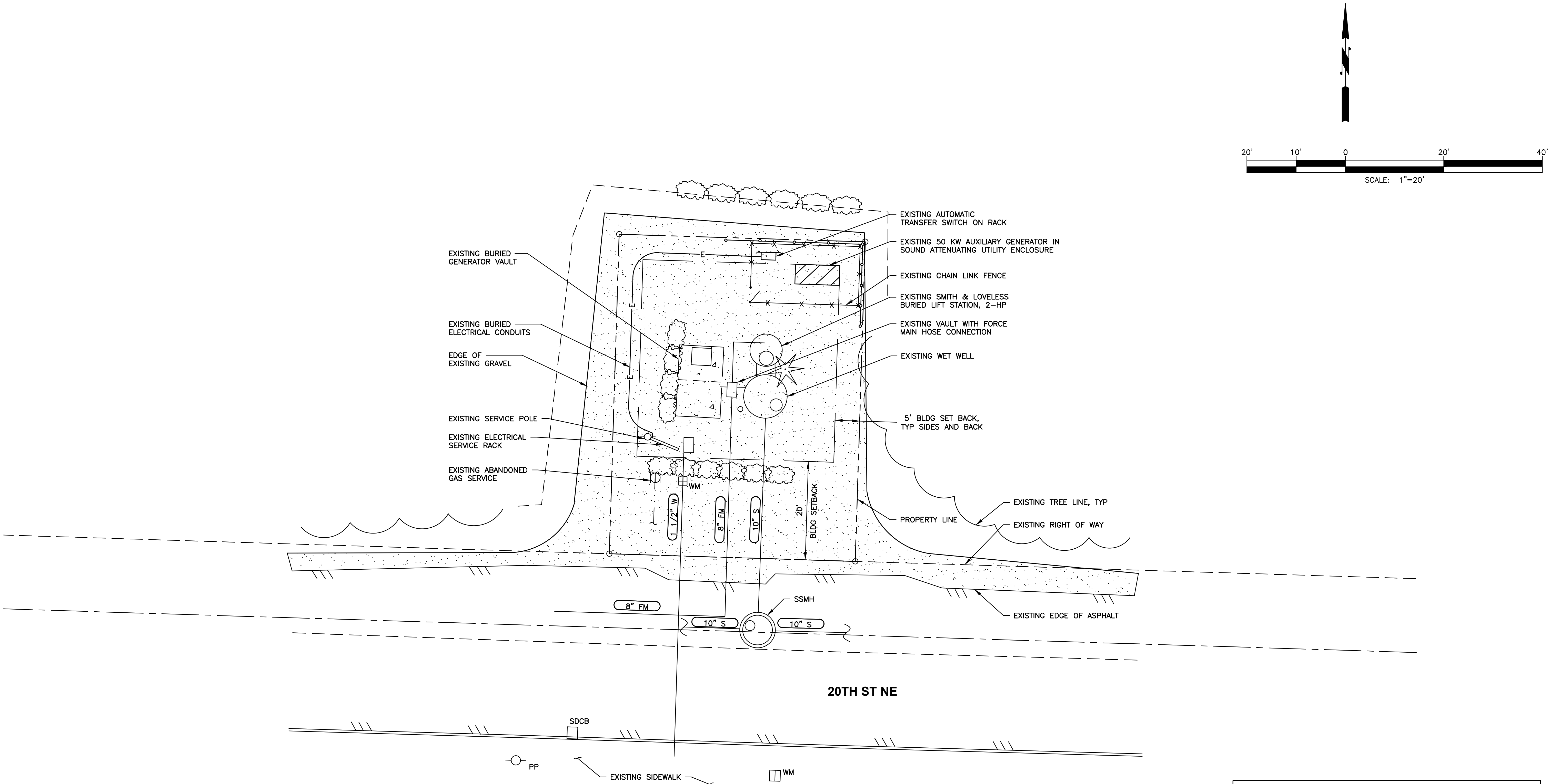

LIFT STATION 2C EXISTING SITE PLAN

0
1"
ONE INCH AT FULL SCALE.
IF NOT, SCALE ACCORDINGLY

LAKE STEVENS SEWER DISTRICT

LIFT STATION 2C UPGRADE PREDESIGN

FIGURE NO. 2

LIFT STATION 2C EXISTING SITE PLAN

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- Peaking Factor: 3.0 on sanitary component of flow

Accordingly, the peak flow from each ERU is approximately 0.57 gpm (=0.14 gpm domestic flow x peak of 3.0 + 0.14 gpm for infiltration). The proposed upgrade will accommodate an increase to the peak flow of 240 gpm.

It may be possible to reduce the pumping capacity of some of the upstream lift stations for the flow from the upstream lift stations. Table 1 lists each upstream lift stations with its peak tributary flow, wet well volume, force main size and corresponding minimum force main flow at a velocity of 2 feet per second through its force main.

TABLE 1

Tributary Lift Station Information

	LS 3C	LS 4C	LS 5C	LS 6C	LS 9C
Pumping Capacity (gpm)	200	100	200	100	150
Existing Peak Tributary Flow (gpm)	40	26	6	20	11
Buildout Peak Tributary Flow (gpm)	72	57	188	281	78
Wet Well Active Volume (cf)	56.5	226.2	113.1	77.0	42.4
Force Main Diameter (in)	4	4	4	4	4
Minimum Recommended Force Main Flow (gpm)	78.3	78.3	78.3	78.3	78.3

Because many of the five tributary lift stations to Lift Station 2C pump for short periods of time before their respective wet wells are emptied and the pumps shut off, the need to design to the additive peak flows of the gravity tributary basin and the sum of the maximum pumping rates of the tributary stations is overly conservative. Due to the relatively small volume of gravity flow to the five lift stations tributary to Lift Station 2C, a peak hour flow analysis was completed for both the flow rate and the total volume pumped to Lift Station 2C during peak hour flow rates. This analysis showed that required capacity of flow to meet the peak hour flow rate versus the instantaneous flow rate was lower than stated in the 2007 Comp Plan. This peak hour analysis is used by this predesign report for sizing the Lift Station 2C improvements. The peak hour analysis results are shown in Table 2 below.

TABLE 2

Lift Station 2C Peak Flows

LS 2C	Existing Conditions	Phase 1	Phase 2	Buildout
Peak Tributary Gravity Flow (gpm)	215	455	735	1,250
Instantaneous Peak Tributary Lift Station Flow (gpm)	750	750	810	950
Peak Hour Tributary Lift Station Flow (gpm)	400	400	810	950
Instantaneous Pump Capacity Required (gpm)	965	1,205	1,545	2,200
Peak Hour Pump Capacity Required (gpm)	615	855	1,545	2,200
Pumping Capacity provided (gpm)	650	1,165	1,780	2,250

FORCE MAIN SIZE

A new 3,800 LF force main is required to convey flow from LS 2C around its existing discharge that is tributary to LS 1C. This will eliminate the need for LS 1C to convey the downtown flows from LS 2C. This new force main will connect to an existing surplus 8-inch-diameter 3,000 LF force main near LS 1C. As future capacity beyond Phase 1 is needed, an upgrade is planned that would replace this existing 8-inch force main with a larger pipe, which would reduce the friction losses and increase the capacity of the system without physical modification to the station. The 2007 Comp Plan identifies the size of the new and upgraded force main as 12-inch diameter. Table 3 shows the velocity of both the current design flow and Buildout flow from LS 2C through 8-, 10- and 12-inch-diameter Class 52 ductile iron force mains.

TABLE 3

Force Main Velocity (ft/sec)

Flow	Force Main Diameter		
	8-inch (ft/sec)	10-inch (ft/sec)	12-inch (ft/sec)
1,200 gpm	7.0	4.6	3.2
2,250 gpm	13.1	8.5	5.9

The minimum recommended force main velocity is 2 feet per second in order to keep solids suspended within the flow. Flow rates as low as 725 gpm will meet this minimum velocity requirement for the pipes shown above. Higher velocity in the force main increases frictional losses and thereby requires higher horsepower pumps. Although the maximum recommended force main velocity is generally 8 feet per second, force main velocity of 6 feet per second or less will typically require substantially less pumping power due to the reduced friction losses. This reduced power requirement allows for smaller capital and operational costs by allowing smaller pumps and less electrical demand.

The total dynamic head (static head plus friction losses) for both the current design flow and Buildout flow from LS 2C for either 10- or 12-inch-diameter Class 52 ductile iron force main are shown in Table 4. The condition for the current design flow includes 3,000 LF of 8-inch-diameter pipe and 3,800 LF of new pipe. The condition for the Buildout flow includes 6,800 LF of new pipe. This assumes a C factor of 100, as is typical of force mains within the District.

TABLE 4

Total Dynamic Head (ft)

	New Force Main Diameter	
Flow	**10-inch (ft)**	**12-inch (ft)**
Phase 1/2 (1,200 gpm)	265	233
Buildout (2,250 gpm)	400	220

Because of the significantly lower head condition with the 12-inch-diameter force main under the Buildout flow scenario, the 12-inch-diameter force main is recommended.

Replacing the existing 3,000 LF 8-inch force main with a 12-inch-diameter force main will allow an increase in capacity of the lift station from 1,165 gpm to 1,780 gpm. To attain the buildout flow of 2,250 another upgrade to the lift station would be required. However, this level of development is uncertain and well beyond the typical design life of the improvements proposed to be installed as Phase 1 and Phase 2.

WET WELL CAPACITY

The existing 8-foot-diameter wet well has approximately 2 feet of active storage. Table 5 below lists the current operating conditions for LS 2C.

TABLE 5

LS 2C Existing Operating Conditions

	Elevation
10-Inch Inlet Pipe Invert	200.55'
Pump On	199.34'
Pump Off	197.51'
Wet Well Bottom	194.84'

The active storage volume within the wet well is currently approximately 92.5 cubic feet (752 gallons).

The types of submersible pumps that meet the current design flow (1,205 gpm) and maximum head condition (265 feet) are Flygt pumps, model numbers N3315 and N3231. These pumps have a recommended maximum of 15 starts/hour (4 minutes between starts) and require a minimum water level from the bottom of the wet well of 27 inches.

Modification of the “Pump On” elevation to 6 inches below the invert elevation of the inlet pipe (200.05') and modification of the “Pump Off” elevation to 1 foot above the new minimum water level (198.09') will provide an active storage volume within the wet well of 98.5 cubic feet (737 gallons).

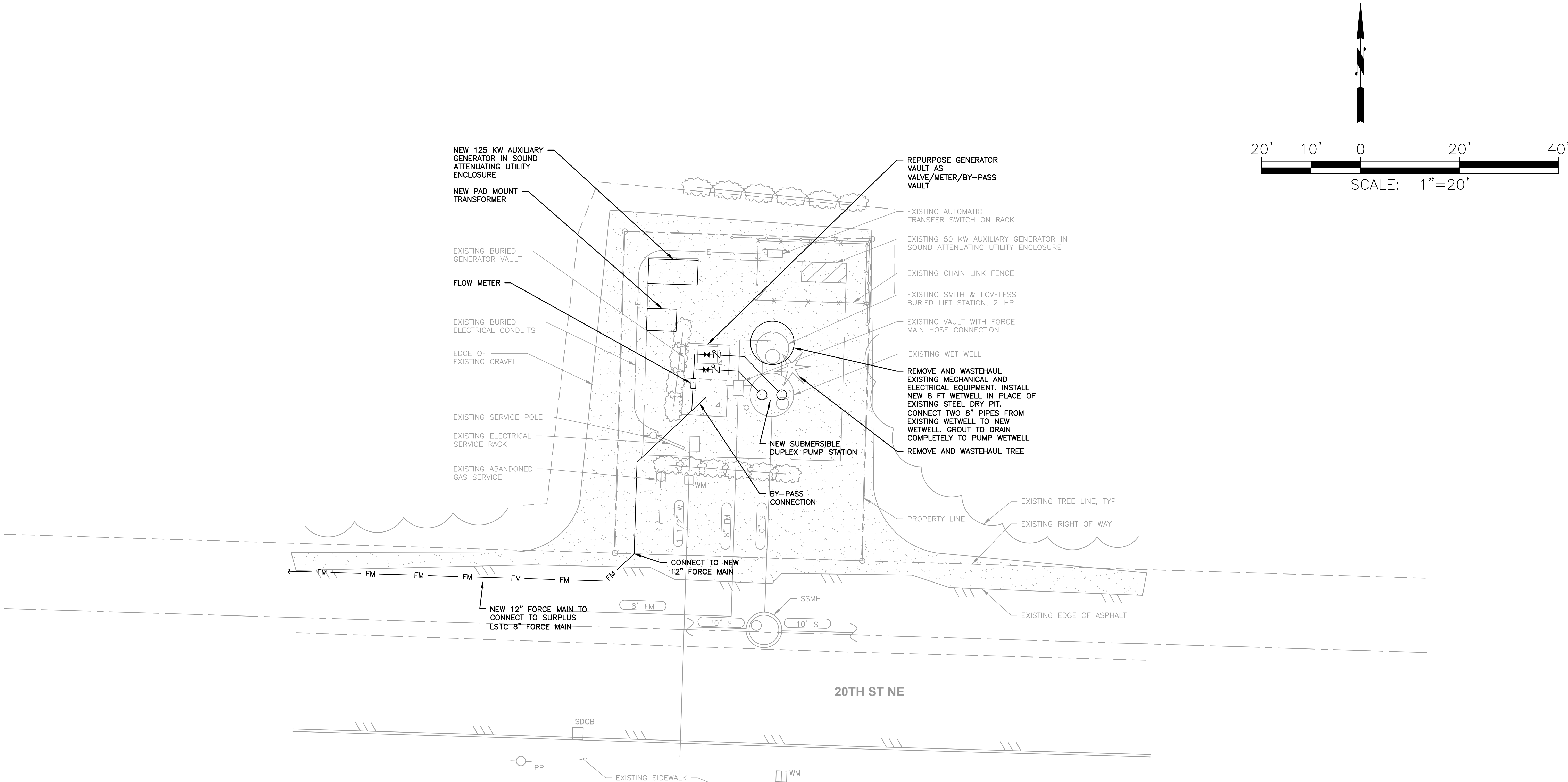
SUBMERSIBLE PUMP STATION

The proposed improvements include a duplex submersible, centrifugal pump station in the existing wetwell, installation of check and isolation valves, meter, and bypass connection in the existing generator vault, expansion of the wetwell volume by converting the existing dry well to wetwell storage, and replacement/upgrade of the electrical controls and standby power. The submersible pump station system allows up to 15 starts per hour, which reduces the volume of storage required compared to a vacuum prime system. Due to the size and weight of the pumps, an on-site hoist will need to be included in the upgrade design for removal and replacement of the pumping equipment (Figures 3 through 5).

Based on the current upgrade flow requirements, an 85-hp submersible pump can meet the duty point but could not meet the future Phase 2 flow requirements without complete replacement of the submersible pumps. The supplier also quoted a 130-hp submersible pump that could meet the Phase 1 and future Phase 2 flow requirements without a change in the pump. To meet the Phase 1 requirements, a Variable Frequency Drive (VFD) would be used to slow the pump. By doing so the larger pump draws only the power necessary for this lower flow and is able to attain a higher hydraulic pumping efficiency. This will lead to future cost savings in both operations and capital costs. The difference in cost between the 85-hp and 130-hp stations is approximately $35,000 to $40,000. Equipment documentation is provided in Appendix B.

ELECTRICAL SERVICE AND EQUIPMENT

Power to the lift station site is currently provided by Snohomish PUD No. 1 from a transformer drop at the station. The rated electrical service is 200 amps, 240 VAC service. For the proposed 85/130-hp pumps, the electrical service will need to provide 400 amps at 480 VAC. Increasing the electrical service will require either three new pole mounted transformers or a pad mounted transformer on site. The existing electrical overhead utility distribution lines will not need to be upgraded.



LIFT STATION 2C PROPOSED SITE PLAN

0 1"

ONE INCH AT FULL SCALE.
IF NOT, SCALE ACCORDINGLY

LAKE STEVENS SEWER DISTRICT

LIFT STATION 2C UPGRADE PREDESIGN

FIGURE NO. 3

LIFT STATION 2C PROPOSED SITE PLAN

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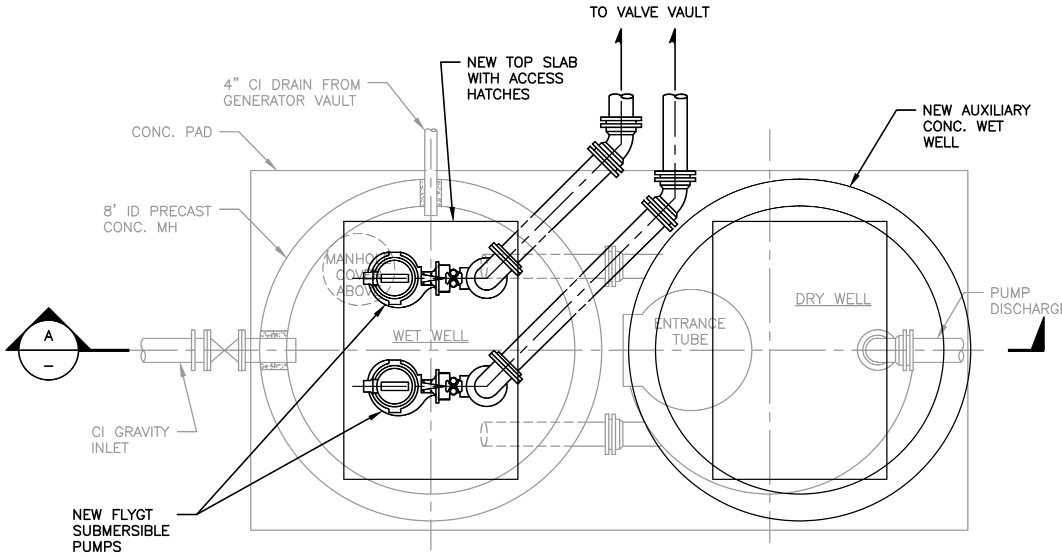
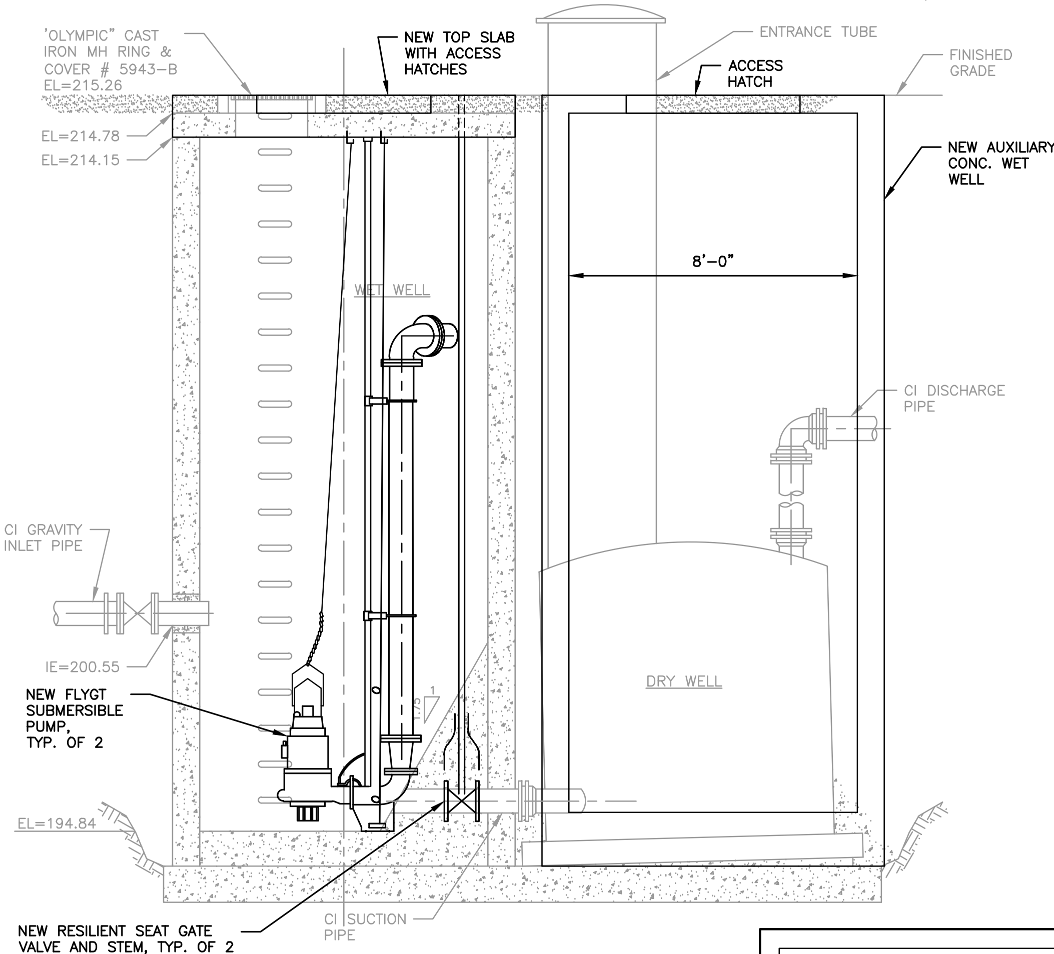


PUMP STATION NO. 2 PLAN

SCALE: 3/16"=1'-0"



A
SECTION

SCALE: 3/16"=1'-0"

0 1"

ONE INCH AT FULL SCALE.
IF NOT, SCALE ACCORDINGLY

LAKE STEVENS SEWER DISTRICT

LIFT STATION 2C UPGRADE PREDESIGN

FIGURE NO. 4

LIFT STATION 2C PLAN AND SECTION

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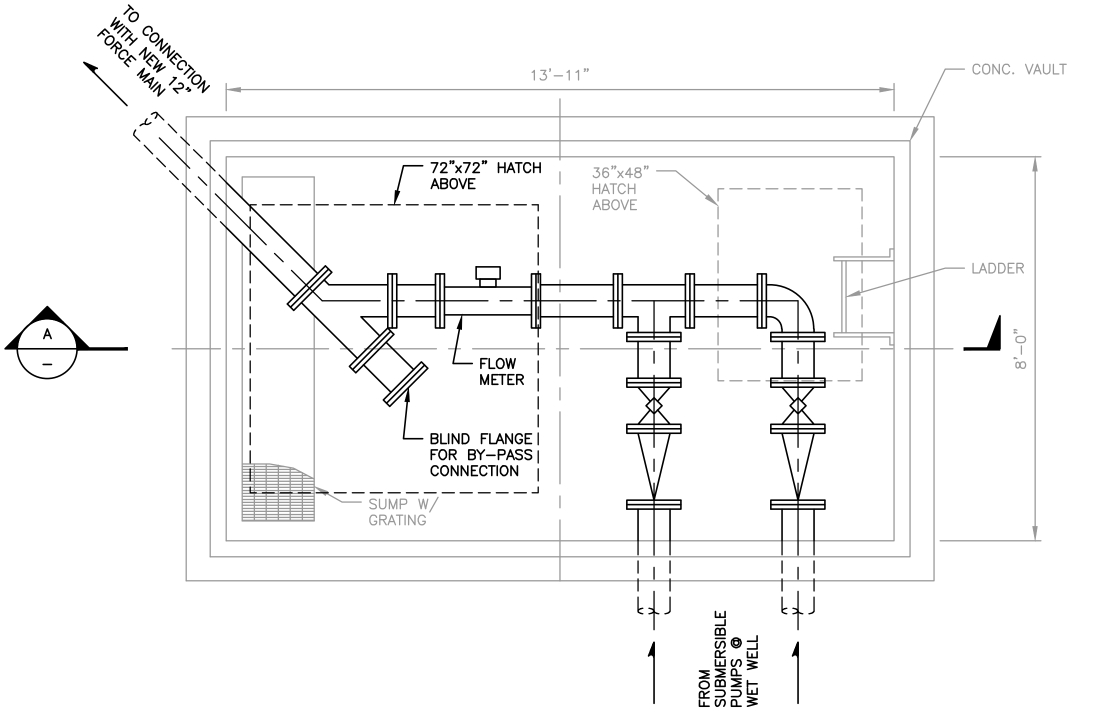
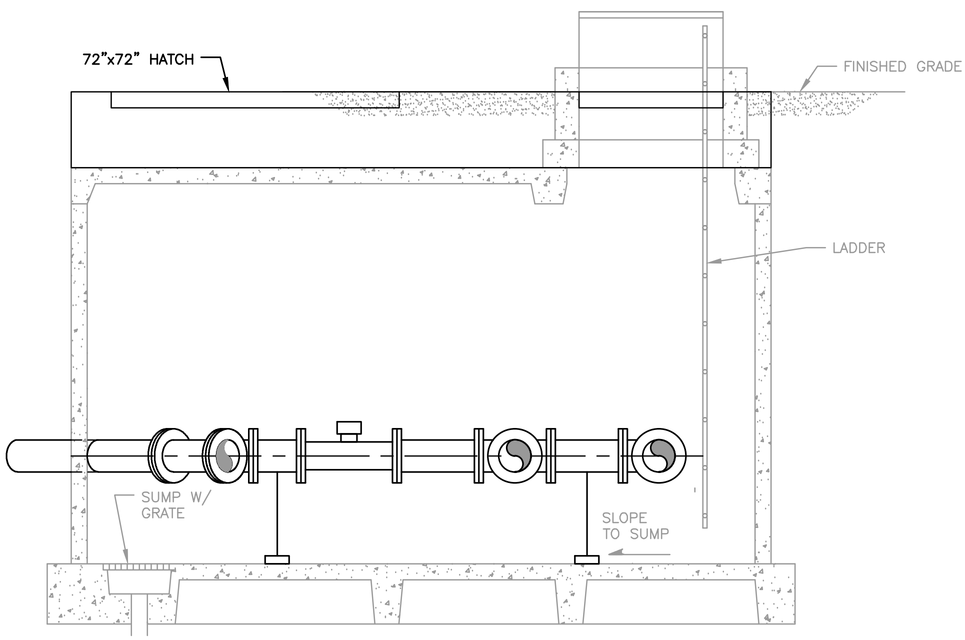


VAULT PLAN

SCALE: 1/4"=1'-0"



A
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SECTION

SCALE: 1/4"=1'-0"

LAKE STEVENS SEWER DISTRICT

LIFT STATION 2C UPGRADE PREDESIGN

FIGURE NO. 5

VAULT PLAN AND SECTION

Gray & Osborne, Inc.

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The larger pumps will require larger electrical equipment including Variable Frequency Drives and standby power generation with controls and telemetry for the station. Due to the existing equipment on site and the need to maintain operation of the station, a single building to enclose the generator and the electrical controls is not feasible. Equipment documentation is provided in Appendix B.

ODOR CONTROL

The total volume of the proposed 12- and 8-inch diameter force main combination is 4,010 cubic feet (30,000 gallons). Low flows are approximately 25 percent of the peak hour design flow. The existing low flow is approximated as 25 percent of 600 gpm or 150 gpm. The corresponding detention time in the force main is 80 minutes.

As flows increase, detention times will also decrease to remain below 2 hours. Based on this preliminary assessment, odor control will not be considered in this design.

DOWNSTREAM CAPACITY CONSIDERATIONS

Downstream of the 8-inch-diameter force main discharge, the existing 12-inch-diameter gravity pipe system in Vernon Road can convey 1,110 gpm of flow without surcharging the pipes. Table 3 shows the surcharge that would result within the gravity conveyance system at the discharge manhole along Vernon Road (SSMH 79) at various high flows.

TABLE 6

Depth of Surcharge at SSMH 79 in Vernon Road

Total Flow (gpm)	Surcharge (ft)
1,110	0
1,250	0.27
1,390	0.50
1,470	1.0
1,615	2.0
1,680	3.0

It has been a policy of the District that surcharge within the gravity sewer conveyance system not be permitted. As proposed, both LS 1C and LS 2C will discharge to this location. After flows from LS 2C are bypassed around LS 1C, the peak hour tributary flow to LS 1C will be 175 gpm. The pumps that are currently permanently installed at LS 1C operate at a rate of approximately 600 gpm. Accordingly, the total peak flow through this capacity-limited section of gravity sewer main will be 1,765 gpm (= 1,165 gpm design flow from LS 2C + 600 gpm pumping capacity of LS 1C).

If either the LS 1C or LS 2C force main were extended 1,660 feet to the west to bypass this area of low capacity, the gravity conveyance system would have capacity to convey 2,600 gpm. The cost of this 1,660 foot bypass project is approximately $660,000.

LAND USE AND ZONING SITE CONSTRAINTS

The existing use of the parcel for LS 2C is for a sanitary sewer lift station. Due to the upgrade of the capacity of the station, we anticipate the following review and permitting will be required by the City of Lake Stevens. We recommend review and concurrence from the City Planning Department.

Conditional Use Permit (CUP) – The lift station parcel has a land use of medium density residential and a zoning designation of high urban residential. Utility structures are allowed within the land use and zoning classifications but typically will require a CUP. The process for a CUP involves an application and an administrative decision.

Noise – The above-grade work at the site will include installation of a new emergency generator. Based on a review of LSMC Section 9.56.050, this standby equipment is completely exempt from the noise requirements by A.3.

Setbacks – The predesign investigation is considering whether or not it will possible to provide a building to house the new electrical controls and/or generator. Our review of Table 14.48-I of the LSMC indicates that the building setbacks are 20 feet from right-of-way and 5 feet from the side property line.

Grading - Below grade work will include installation of a new, likely 8-foot diameter, wet well and associated piping. A Type I Grading Permit (for less than 100 cubic yards) will be required.

ADDITIONAL DEVELOPMENT CAPACITY

The analysis presented in this report allows for future development within the downtown core and Lift Station 1C and 2C basins. Due to the various components of the improvements, including Phase 1 Lift Station 2C, Phase 1 12-Inch Force Main Installation, Phase 2 12-inch replacement of existing 8-inch Force Main, and Buildout Lift Station upgrades and gravity bypass improvements, it is likely that different proportional costs (reimbursables) will be developed for each component of the improvements. The following table presents the additional capacity provided by each component of the improvements and the current cost estimates based on this predesign report and/or previous cost estimate development as part of the feasibility memoranda and the Comprehensive Sanitary Sewer Plan for the first two Phases presented in this report. Since buildout improvements are unlikely to be required within the 20 year allowable reimbursable period, they are not included in this table.

TABLE 7

Additional Development Capacity

Upgrade	Additional Capacity (ERUs)	Estimated Project Cost	Cost/Reimbursable (per additional ERU)
Phase 1: Lift Station 2C	420	$1,860,000	$4,428.57
Phase 1: 12-Inch Force Main Installation	1,500*	$1,520,000	$1,013.33
Phase 2: 12-Inch FM Replacement of existing 8-Inch FM	1,080	$1,510,000	$1,398.15

*The 12-inch Force main has a potential capacity that is greater than the anticipated flow for all anticipated development in the basin. The listed capacity reflects only that available by the proposed lift station upgrades.

RECOMMENDATION

Based on the information presented in this predesign report, a 130-hp submersible lift station with VFD controls, new 125kW generator and electrical power and controls, and site improvements are recommended. The larger pump will operate at a higher hydraulic efficiency than the smaller 85-hp pump and eliminates the need for any physical improvements at the lift station site for Phase 2 flows. Phase 2 improvements would require replacement of the 3,000 foot existing 8-inch force main with a 12-inch force main and reprogramming at the lift station but no physical alternation of the site would be required.

The construction cost estimate for the 130-hp submersible lift station upgrade, including the wetwell expansion, new generator and electrical service and controls, valving and flow meter is $1,430,000. The total project cost is estimated at $1,860,000. A detailed cost estimate is included in Appendix C.

APPENDIX A

FEASIBILITY MEMORANDA

Gray & Osborne, Inc.
CONSULTING ENGINEERS
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MEMORANDUM

TO:	Lake Stevens Sewer District
FROM:	Barry Baker, P.E.
	Greg Harem, P.E.
	Leigh Nelson, P.E.
DATE:	May 9, 2014
SUBJECT:	DRAFT Downtown Redevelopment Project

A proposed Downtown Redevelopment project is located southwest of the intersection of North Lakeshore Drive and Main Street in Lake Stevens. The project site is located in an area currently serviced by sanitary sewer and tributary to either Lift Station 1C or Lift Station 2C as shown on Figure 1. The current proposed mixed use project includes approximately 110 residential units and an estimated 4,000 square feet of new commercial space on 2.86 acres in the first phase of construction, anticipated to begin construction in spring 2015.

The Lake Stevens Sewer District 2007 Sanitary Sewer Comprehensive Plan and 2010 Amendment (Comprehensive Plan) outlines the facilities and upgrades that would be necessary to provide sewer service to the project area. The upgrades presented in the Comprehensive Plan include constructing a new wet well and replacing the pump station at Lift Station 2C, and installing approximately 3,800 feet of new force main from Lift Station 2C in North Lakeshore Drive to discharge into the currently surplus force main installed for Lift Station 1C. The planned upgrades will increase capacity at Lift Station 2C, and will allow Lift Station 2C to bypass Lift Station 1C, creating additional capacity at Lift Station 1C. The estimated cost of these projects, as outlined in the Comprehensive Plan and updated to year 2014, is approximately $5.1 million.

This feasibility study will evaluate alternatives for sewer service to the proposed downtown redevelopment project, which would be a revision to the District's Capital Improvement Plan (CIP) that may provide interim capacity for the proposed development, and/or provide capacity for the overall projected development within the tributary basin consistent with the goals of the District's Comprehensive Plan. The following sewer service alternatives will be evaluated:

- Comprehensive Plan: Upgrade Lift Station 2C and extend force main to bypass Lift Station 1C.
- Alternative 1: Construct a new lift station on the redevelopment project property, in lieu of the planned upgrades to Lift Station 2C.

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- Alternative 2: Redirect the Lift Station 2C force main discharge to Lift Station 8C.
- Alternative 3: Convey flow from the proposed downtown redevelopment project directly to Lift Station 1C, with interim improvements to Lift Station 1C.

Drainage basin delineations and population and flow projections from the District's Comprehensive Plan will be used in this analysis.

Existing Development & Sewer Flows
The proposed project is located on two parcels with a total area of 1.1 acres that currently contain residential structures. These structures are connected to the sewer system. The connections on these properties total 14 ERUs. The parcels are identified in the Comprehensive Plan as local commercial. An adjacent parcel that contains the City's Permit Center is part of a future phase of the proposed project and is not considered in this feasibility study.

The existing structures on the property are tributary to Lift Station 1C. The following assumptions, as outlined in the Comprehensive Plan, are used to calculate peak hour sewer flows:

- Residential: 2.97 people/ ERU & 70 gallons/person/day (average)
- Residential Inflow & Infiltration: 1,100 gallon/acre/day
- Peaking Factor: 2.2 – 3.1, varies based on average sanitary flow
- Commercial: 2,700 gallons/acre/day (peak) plus I&I

Accordingly the peak hour sewer flow from the existing development is 6.3 gallons/minute (gpm).

The Comprehensive Plan indicates that Lift Station 1C has a design capacity of 900 gpm and an existing tributary flow of 915 gpm. The design capacity of 900 gpm is the rated capacity of the lift station from the upgrade that was completed by the City of Lake Stevens in 1998. Upgrades included construction of a new 8-inch Class 200 PVC force main, allowing the existing 8-inch asbestos cement (A.C.) force main to be placed into backup service. The upgrade design appears to have assumed a Hazen-Williams friction loss factor (C-value) in the force main in the range of 140 in calculating total head loss. The existing tributary flow of 915 gpm assumes a maximum existing design flow of 700 gpm from Lift Station 2C. This study assumes that the flow from Lift Station 2C will be bypassed around Lift Station 1C when the capacity of Lift Station 2C is increased beyond 700 gpm.

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Flow monitoring indicates that the pumping rate of Lift Station 1C has deteriorated from a recent historic rate of 710 gpm, to the current rate of approximately 650 gpm. Calibrated C-values associated with flow rates of 710 gpm and 650 gpm are approximately 105 and 95, respectively. Currently, the District utilizes a self-priming portable diesel pump to supplement the pumping capacity of Lift Station 1C during high flow events.

Although the Comprehensive Plan shows sewer flow from the proposed redevelopment site going to Lift Station 1C, the project could instead send sewer flow to Lift Station 2C. The Comprehensive Plan indicates that Lift Station 2C has an existing capacity of 700 gpm and a tributary flow of 965 gpm, including five upstream lift stations with a total pumping capacity of 650 gpm. Since the Comprehensive Plan was issued, the impellers at Lift Station 2C have been revised to a single-vane type, to minimize ragging problems, resulting in a temporary reduction in the pumping capacity to approximately 550 gpm. Smith & Loveless recommends limiting pump rates to between 500 and 600 gpm for pumps using the single-vane impeller.

Proposed Development & Sewer Flow
The proposed mixed use development is anticipated to include approximately 110 residential units and 4,000 square feet of retail space.

Per the assumptions used in the Comprehensive Plan, the peak hour flow from the proposed development will be approximately 52 gpm.

Because the property has the zoning designation Central Business District, the Comprehensive Plan projected the sewer flow from the project area at buildout to be 7.5 gpm, approximately 45 gpm less than currently proposed.

Cost estimates for the projects presented for each Alternative are included in the Attachment A. The cost estimates do not include extension of the local sewer collection system required to direct flow from the project site to the existing conveyance system.

Comprehensive Plan
The Comprehensive Plan indicates that in order to provide sewer capacity for the areas that are tributary to either Lift Stations 1C or 2C, replacement of both Lift Station 2C and its force main is required in order to eliminate the Lift Station 2C flow to Lift Station 1C. The locations of these improvements are shown on Figure 2.

Project E2-A in the Comprehensive Plan includes construction of a new wet well to provide storage for the existing flows to Lift Station 2C with the current pumps and modify float controls at Lift Stations 3C, 4C and 5C. Project E2-C in the Comprehensive Plan would increase the capacity of Lift Station 2C from 700 to 1,000

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gpm by replacing the pump station and constructing 3,800 LF of 12-inch diameter force main to connect to the existing parallel 8-inch diameter A.C. force main (currently utilized by the portable diesel standby pump). The new force main will bypass Lift Station 1C. The 8-inch force main is not currently in use and is expected to be in acceptable condition. Connection to it would route flows from Lift Station 2C around Lift Station 1C, thereby reducing flows to Lift Station 1C. A future upgrade to Lift Station 2C would require that the 8-inch force main be replaced with a 12-inch force main.

These projects were included in the Comprehensive Plan and the estimate project costs have been adjusted using the ENR Construction Cost Index for Seattle (October 2007 = 8612, March 2014 = 10136):

The total estimated cost of the facilities required for sewer service to the project site in the Comprehensive Plan is $5,092,000 and includes the following:

- Project E2- A – $812,000
- Project E2- C – $4,280,000

Additionally the gravity conveyance system between the site and Lift Station 2C has one section of pipe (322 LF of 10-inch diameter pipe) with 43 gpm of capacity remaining and one section of pipe (425 LF of 10-inch diameter pipe) with 97 gpm of capacity remaining. One or both of these sections of pipe will need to be replaced if the project is conveyed to Lift Station 2C.

Currently the District's Comp Plan identifies Project E2-A as a District-funded project and Project E2-C as a donated facility. Although the District's 2010 Comprehensive Plan Amendment identified that Project E2-A would be completed in 2015; the District's 2014 budget projection revised the project to be completed in 2017.

Alternative 1

Alternative 1 would construct a new submersible lift station on the redevelopment project property, in lieu of the planned upgrades to the existing Lift Station 2C. The locations of these improvements are shown on Figure 3.

This alternative would divert flows upstream of the intersection of Main Street and 18th Street NE to the project site, and would provide a new lift station at the project site to bypass these flows, together with flows from the new project, away from Lift Station 2C and around Lift Station 1C. Because of the inlet pipe depth that would be required, an above-grade wet-well mounted station is not feasible, so a submersible station would be proposed.

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The diverted flow would include those from the following smaller lift stations that are currently tributary to Lift Station 2C: Lift Station 3C (200 gpm), 6C (100 gpm) and 9C (150 gpm). Approximately 700 feet of new 15-inch diameter pipe will be required between 18th Street NE and the project site. Additionally, a force main of approximately 2,700 feet would be required to convey flow from the lift station to connect to the existing parallel 8-inch diameter A.C. force main (currently utilized by the portable diesel standby pump).

The Comprehensive Plan indicates that the existing flow upstream of this diversion is 525 gpm and would increase to 1,098 gpm at buildout. The new lift station at the project site would need to convey the projected 1,098 gpm buildout flows in addition to project requirements.

The buildout flow to Lift Station 2C is shown in the Comprehensive Plan as 1,989 gpm. Alternative 1 would decrease the existing flow to Lift Station 2C to approximately 415 gpm, and the flow at buildout to approximately 900 gpm.

The total estimated cost of the facilities required for Alternative 1 is $3,080,000 and includes the following:

- New Lift Station - $1,860,000
- 10-inch diameter force main - $850,000
- 15-inch diameter gravity conveyance - $370,000

Alternative 2
Alternative 2 would upgrade Lift Station 2C and direct the discharge to Lift Station 8C via a new force main. The locations of these improvements are shown on Figure 4.

This alternative would direct flow from Lift Station 2C to Lift Station 8C by constructing a new force main from Lift Station 2C north on Grade Road to Lift Station 8C. This would require an upgrade of Lift Station 2C and installation of approximately 3,500 feet of new 12-inch diameter force main.

The Comprehensive Plan indicates that the flow currently tributary to Lift 8C is 485 gpm and that its current capacity is 600 gpm. The existing flow that would be tributary to Lift Station 8C for this Alternative would be 1,500 gpm (485 gpm currently tributary to Lift Station 8C, 965 gpm currently tributary to Lift Station 2C and 50 gpm from the project site).

Because the existing Lift Station 8C may only be upgraded to a maximum capacity of approximately 1,150 gpm, a new lift station will be required for Alternative 2.

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Most of the existing 8,000 foot force main from Lift Station 8C is 10-inch diameter pipe. An upgrade of Lift Station 8C would require that a 650-foot section of 8-inch diameter force main in 32nd Avenue be replaced. Replacing this section of pipe with 10-inch diameter pipe is included in the Comprehensive Plan as part of Project D9-A. The maximum recommended velocity within a force main is 8 feet/second. The flow through a 10-inch diameter force main at 8 feet/second is 1,875 gpm, which would satisfy interim requirements, but would not meet buildout requirements. Because the buildout flow to Lift Station 8C for this Alternative would be 3,400 gpm, a new 18-inch diameter force main would be required as part of future upgrades.

Also, capacity limitations in the gravity conveyance system downstream of the Lift Station 8C force main discharge would require diversion of the existing force main discharge to the new sewer conveyance system that is proposed to be installed by future development. This project is included in the Comprehensive Plan and assumed to be entirely donated by proposed Nourse development.

Additionally, a section of the gravity conveyance system between the project site and Lift Station 2C does not have capacity for the additional flow from the proposed project. Replacing this pipe is included in the Comprehensive Plan as part of Project E2-B.

The estimated cost of the facilities required for Alternative 2 is $9,130,000 and includes the following:

- Replace Lift Station 8C - $4,930,000
- Upgrade Lift Station 2C - $2,290,000
- 12-inch diameter force main for Lift Station 2C - $1,330,000
- 18-inch diameter force main with 10-inch slipline (650 feet) for Lift Station 8C - $580,000

It should be noted that the cost above does not include the costs for the new over-sized gravity sewer system associated with the proposed Nourse project which would need to be installed prior to the replacement of Lift Station 8C. It also does not include the costs for replacing the portion of the gravity conveyance system in 125th Ave NE between 18th and 20th Streets NE. Replacing this pipe is a portion of with Project E2-B in the Comprehensive Plan. Also, because the static head at Lift Station 8C is approximately 150 feet higher than it would be at the Lift Station 2C site, the on-going power costs of pumping through Lift Station 8C would be substantially higher than pumping flow along Lakeview Drive, where the static head is minimal.

Alternative 3
Alternative 3 would convey flow from the proposed downtown redevelopment project directly to Lift Station 1C and construct interim improvements to Lift Station 1C. Four

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sub-alternatives for upgrading Lift Station 1C are considered. Under this alternative, Lift Station 1C would utilize the existing PVC force main and the existing parallel 8-inch A.C. force main (currently utilized by the portable diesel standby pump), reducing friction losses and thereby creating additional capacity. Under this alternative, interim flow to Lift Station 1C is estimated at 960 gpm and includes the following:

- 215 gpm gravity tributary
- 700 gpm pumped from Lift Station 2C
- 45 gpm from the proposed redevelopment.

Buildout flow to Lift Station 1C would be 1,055 gpm and includes the following:

- 1,010 gpm gravity tributary in the Comprehensive Plan
- 45 gpm from the proposed redevelopment.

Prior to buildout, the Comprehensive Plan shows that Lift Station 2C will be routed around Lift Station 1C, and a new parallel force main will be constructed to replace the existing 8-inch A.C. force main, for use by Lift Station 1C.

As noted above, the observed capacity of Lift Station 1C is currently 650 gpm, or approximately 265 gpm less than the estimated existing peak hour flow of 915 gpm and approximately 310 gpm less than the estimated peak hour interim flow of 960 gpm for this alternative. The District currently uses a portable self-priming diesel pump, pumping through the parallel standby 8-inch A.C force main, as a backup at Lift Station 1C during high-flow periods. Use of a portable self-priming diesel pump is not consistent with either District or Department of Ecology standards for a permanent facility, and would be eliminated under this alternative. Ecology requires that pumps required to meet peak hour flow be electrically powered and requires access to a backup power source. This requirement is not currently met at Lift Station 1C.

The existing 80 kW standby generator is installed in a buried vault beneath a roadside ditch, where it is vulnerable to corrosion, infiltration and inflow. The generator also relies on City water for cooling, which is inconsistent with District standards. The Comprehensive Plan shows the existing generator being replaced with a new generator in 2008, for reliability and in conjunction with interim upgrades to Lift Station 1C capacity. Under this alternative, a new generator would be installed at grade, in a sound-attenuating building or enclosure. The existing generator has marginal capability to operate both existing pumps, and the new generator would be upsized under this alternative. The required generator size would depend on the size and quantity of pumps incorporated into the lift station upgrades.

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The existing 8-inch A.C. force main, which is currently placed in service only during high-flow periods for use with the backup diesel self-priming pump, was constructed in 1970. The force main currently carries a flow of approximately 800 gpm when in use, and is assumed to be serviceable. Use of the existing 8-inch A.C. main to convey approximately one-half of the 960 gpm interim flow identified for Lift Station 1C under this alternative is consistent with its proposed use as described in the Comprehensive Plan. The Comprehensive Plan calls for the 8-inch A.C. force main to convey approximately one-half of an interim flow of 1,100 gpm from the upgraded Lift Station 1C, beginning in 2008. The Comprehensive Plan further calls for the 8-inch A.C. main to be re-purposed in 2012 to convey interim flows of approximately 1,000 gpm from the upgraded Lift Station 2C. In 2017, with construction of a new parallel force mains for both Lift Station 1C and Lift Station 2C, the Comprehensive Plan calls for the 8-inch A.C. force main to be permanently abandoned. Since the condition of the existing 8-inch A.C. main is unknown, this alternative would evaluate the representative condition of the portions of the force main that can be accessed from either end. Lining of the force main using a cured-in-place pipe (CIPP) liner is addressed in this alternative, in the event that lining is warranted by pipe condition or is desired to minimize risk of failure.

The existing 8-inch PVC and 8-inch A.C. force mains both discharge to MH 79 on the Vernon Road Trunk. Segments of the downstream Vernon Road East Main gravity trunk are near capacity. The Comprehensive Plan calls for modifications to de-rate the existing Lift Station 6, which also pumps to the Vernon Road East Main, from 313 gpm to 170 gpm, to create 143 gpm capacity for increased flow from Lift Station 1C. However, the need for this element is based on an increase in Lift Station 1C flows to 1,100 gpm. Under this alternative, Lift Station 1C capacity would be increased to approximately 960 gpm, which would allow de-rating of Lift Station 6 to be postponed until otherwise required.

In order to bring Lift Station 1C into compliance with District standards, the interim upgrades to Lift Station 1C would need to meet the following general requirements:

- Increase interim capacity from 650 gpm (current) to 960 gpm.
- Size any major component replacements to be consistent with a buildout capacity of 1,055 gpm.
- Eliminate dependency on the existing temporary diesel backup pump to meet capacity requirements.
- Install a new standby generator above grade, compatible with both interim and buildout conditions.
- Provide a second flow meter manhole on the existing 8-inch force main, to monitor flow in the parallel 8-inch A.C. main, or provide a new meter on the common discharge to monitor total flow.

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- Add valving within a vault as required to allow the District to use either or both of the parallel force mains with permanent or temporary bypass pumps, for maintenance and operational flexibility.

Four sub-alternatives for providing interim capacity at Lift Station 1C are identified, as listed below. Additional requirements are discussed in the context of the listed sub-alternatives.

- Alternative 3A: Upgrade the existing flooded suction Smith & Loveless pump station.
- Alternative 3B: Install a new wet well mounted, vacuum prime Smith & Loveless pump station on the existing wet well; abandon the existing flooded suction station.
- Alternative 3C: Install a new submersible pump in the existing wet well to operate in conjunction with the existing duplex flooded-suction station in a triplex configuration.
- Alternative 3D: Install a duplex submersible station in the existing wet well; abandon the existing flooded suction station.

Alternative 3A

Alternative 3A would upgrade the existing flooded-suction pump station to pump through the two existing force mains to produce additional capacity. The existing 12-inch diameter impellers are the largest size available for the existing 4D3 pumps. Preliminary discussion with Smith & Loveless indicates that the existing 4D3 pumps are the largest capacity pumps that can be fit into the existing 7-foot diameter dry pit station. The estimated pumping rate for one 4D3 pump, pumping through both force mains and assuming a C-value of 95 (as calibrated earlier from existing flow in the PVC force main), is approximately 1,010 gpm. The estimated pumping rate is reduced to approximately 975 gpm if a CIPP liner is installed in the 8-inch A.C. main. Comparative system curves associated with C-values of 95, 105 and 120are plotted onto the 12-inch impeller curve in Attachment B. In all of the cases evaluated, the estimated pumping rate satisfies the interim flow requirement of 960 gpm. If, however, the upgraded lift station configuration is unable to meet the buildout flow requirement of 1,055 gpm, further upgrades may be necessary in the future, such as increasing the size of the future parallel replacement force main from 8-inch to 10-inch. The ultimate flow under Alternative 3A is approximately 1,200 gpm, and is limited by the operating range of the pump.

A consequence of pumping at a higher rate through the dual force mains is that the existing 4D3 pumps would operate near the end of their curve, at or just beyond the overload point for the existing 40 hp motors. To protect the motors and to ensure

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adequate capacity, it would be necessary to replace the existing 40 hp rotating assemblies with 50 hp rotating assemblies, and to install variable frequency drives to prevent the pumps from running off the end of the curve. Current electrical code and space restrictions in the dry pit would require mounting the new motor starters at grade, and relocating a new pump control panel at grade as well.

These electrical modifications would be constructed in conjunctions with upgrades to the electrical service and the standby generator upgrades. Increasing motor size to 50 hp would require upsizing the existing electrical service from 400A/240V/3Ph to a minimum of 200A/480V/3Ph. The feasibility of upgrading to 480V would be verified during design. Generator size for Alternative 3A is estimated at 125 kW, and would be located in a custom, sound-attenuating building with approximate dimensions of 14 feet x 20 feet. Per District standards, the electrical equipment would be mounted on a rack at grade, with an overhead shelter with a maximum height of approximately 9 feet.

Estimated cost of Alternative 3A is $1,430,000, assuming conversion to 480V utility service. A preliminary estimate for CIPP lining of the existing 8-inch A.C. force main would add approximately $600,000 to the cost of the alternative, if required.

Alternative 3B

Alternative 3B would abandon the existing flooded suction pump station and install a new Smith & Loveless wet well mounted vacuum prime station on the existing wet well. The estimated pumping rate achievable under Alternative 3B is approximately 1,035 gpm at a C-value of 95, slightly higher than under Alternative 3A. The estimated pumping rate is reduced to approximately 1,000 gpm if a CIPP liner is installed in the 8-inch A.C. main. Comparative system curves associated with C-values of 95, 105 and 120 are plotted onto the 12-inch impeller curve in Attachment B. As with Alternative 3A, the estimated pumping rate satisfies the interim flow requirement of 960 gpm for all cases evaluated. Future increases in pump capacity would also be limited under this capacity to a maximum value in the range of 1,200 gpm, despite the larger operating range of the 6D3 pump, due to suction lift restrictions at higher pumping rates. Other larger wet-well mounted stations with 8-inch piping and higher capacity are available, but at significant increase in footprint and cost, and are not evaluated in this study.

Pump motor size under Alternative 3B would be 50 hp, and electrical upgrades would be similar to those required for Alternative 3A.

Estimated cost of Alternative 3B is $1,530,000, assuming conversion to 480V utility service. The preliminary estimate for CIPP lining of the existing 8-inch A.C. force main would add approximately $600,000 to the cost of the alternative, if required.

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Alternative 3C

Alternative 3C would retain the existing flooded suction pump station in service, and would add a third pump (submersible) of similar capacity, to operate in a triplex configuration. Under Alternative 3C, the pumping rate would be determined by the performance of any two pumps operating together through the two existing force mains. The estimated pumping rate achievable under Alternative 3C is approximately 1,260 gpm, higher than under Alternatives 3A or 3B, at a C-value of 95. The estimated pumping rate is reduced to approximately 1,180 gpm if a CIPP liner is installed in the 8-inch A.C. main. Comparative system curves associated with C-values of 95, 105 and 120 are plotted onto the 12-inch impeller, two-pump curve in Attachment B. The ultimate pumping capacity under Alternative 3C is on the order of 1,600 gpm if the common 8-inch discharge piping is replaced, providing room for expansion if land use conditions change in the future.

As in Alternative 3A, the existing 4D3 pumps could be ultimately upgraded to 50 hp rotating assemblies and 12-inch impellers, but unlike under Alternative 3A, could satisfy interim flow requirements with smaller impellers and 40 hp motors. This alternative assumes replacement of the impellers only on the existing pumps. A submersible pump would be selected to meet ultimate flow requirements, and would be controlled with a variable frequency drive to operate compatibly with the 4D3 pumps. Total pump horsepower would be on the order of 140 to 160 hp for Alternative 3C, in comparison with 100 hp for Alternatives 3A and 3B. Consequently, the electrical utility service and generator size would be larger, and additional equipment and space would be required for components and control equipment. Increasing total pump horsepower to 160 hp would require upsizing the existing electrical service to a minimum of 400A/480V/3Ph. As with the other sub-alternatives, the feasibility of upgrading to 480V would be evaluated during design. Generator size for Alternative 3C is estimated at 175 kW, and would be located in a custom, sound-attenuating building or enclosure with approximate dimensions of 14 ft x 20 ft. The discharge valve vault would need to incorporate the check valve and isolation valve for the new submersible pump, in addition to piping improvements that would be common to all three sub-alternatives.

Estimated cost of Alternative 3C is $1,710,000. The preliminary estimate for CIPP lining of the existing 8-inch A.C. force main would add approximately $600,000 to the cost of the alternative, if required.

Alternative 3D

Alternative 3D would abandon the existing flooded suction pump station and install a new duplex submersible pump station in the existing wet well. The estimated pumping rate achievable under Alternative 3D is arbitrarily set at 1,250 gpm at a C-value of 95,

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which satisfies both the interim and buildout requirement, but could be higher if desired. The estimated pumping rate is reduced by approximately 3% if a CIPP liner is installed in the 8-inch A.C. main.

Pump motor size under Alternative 3D would be 70 hp for the selected operating point, for a total pump horsepower of 140 hp, similar to the 140-160 hp requirement for Alternative 3C. Electrical utility service upgrades would be similar to those required for Alternative 3C. Generator size for Alternative 3C is estimated at 150 kW, and would be located in a custom, sound-attenuating building or enclosure with approximate dimensions of 14 ft x 20 ft. Pump control complexity would be similar to that of Alternatives 3A and 3B, with higher capacity motor starting equipment.

As with Alternative 3C, the discharge valve vault would need to incorporate the check valves and isolation valves for the new submersible pumps, in addition to piping improvements that would be common to all three sub-alternatives.

Estimated cost of Alternative 3D is $1,640,000. The preliminary estimate for CIPP lining of the existing 8-inch A.C. force main would add approximately $600,000 to the cost of the alternative, if required.

Additional Considerations Associated with Alternative 3

Alternative 3 is discussed in greater detail than Alternatives 1 and 2 in this study, due to its substantially lower cost, and the fact that the improvements to Lift Station 1C could be installed in a manner generally compatible with the Comprehensive Plan. As outlined in this study, any of the sub-alternatives discussed under Alternative 3 would address, partially or fully, the goals of Projects E1-A and E1-B, and would minimize future work associated with completion of Project E1-C.

Additional considerations associated with selection of one of the sub-alternatives under Alternative 3 would include the following:

- Feasibility of the Smith & Loveless alternatives.
- Feasibility and cost to line the existing 8-inch A.C. force main with a CIPP liner.
- Unknown condition of the existing 8-inch A.C. force main, and to a lesser extent, the 8-inch PVC force main.
- Unknown condition of the existing steel dry pit station and piping.
- Limitations associated with expansion on the existing Lift Station 1C site, including limited parcel area, height restrictions associated with the original deed, and potential permit issues.

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With respect to pump sizing for Alternatives 3A and 3B, Smith & Loveless has expressed concern that the proposed solutions would require further review once additional information is obtained regarding force main condition and actual operating conditions, and might even prove unfeasible as described. The review would typically occur during predesign, and could result in a reprioritization of the alternatives at that time.

A similar caution is provided with respect to preliminary pricing stated herein for the CIPP liner for the 8-inch A.C. force main. The preliminary cost estimate is based on phone conversations with a single installer (Michels Corporation). The other major installer of municipal pipe restoration (Insituform Technologies) was not willing to provide even range of budget pricing without opportunity for a site visit and up to 2 weeks to review design parameters, which would typically be generated in predesign.

As discussed herein, reuse of the existing 8-inch force main to convey flow from Lift Station 1C in parallel with the existing 8-inch PVC force main is a critical component of Alternative 3. Eventual replacement of the 8-inch A.C. main with a new parallel PVC force main is not scheduled to occur, per the Comprehensive Plan, until the capacity of Lift Station 2C is expanded beyond 1,000 gpm. In the meantime, there is a risk associated with potential failure of the 8-inch A.C. main during the interim period in which it conveys flow from Lift Station 1C, and later conveys flow from Lift Station 2C to bypass around Lift Station 1C. Options for evaluating the condition of the 8-inch A.C. force main with respect to potential failure include:

- Clean and TV from the discharge end at MH 79 as far back towards Lift Station 1C as possible.
- Insert one or more inspection access points in the force main for additional visual inspection.

The condition of both force mains, and the 8-inch A.C. main in particular, is also a factor with respect to friction loss and the amount of pump horsepower needed to achieve the required capacity. As discussed earlier, the pumping rate through the PVC force main is observed to have recently decreased from a prior value of 710 gpm, to approximately 650 gpm, and may have decreased from an even higher previous value. Possible explanations include a buildup of air or sediments within the force main, and/or wear on the existing impeller. Options for further evaluating the condition of the two force mains with respect to potential failure should be investigated, and would include:

- Perform drawdown testing at Lift Station 1C to verify the accuracy of the existing flow meter.
- Perform pump tests through the PVC main alone, and through the two force mains in parallel, to establish baseline flow rates. Install one new 12-inch impeller and repeat the pump tests to determine the impact of the new impeller.

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- Double pump through the individual force mains to create higher flushing velocity for a period of time, and repeat the pump tests to determine the impact of flushing.

The District intends to schedule a corrosion specialist to evaluate the structural condition of the buried City pump stations this year. The presence of significant deterioration at Lift Station 1C would impact any decision to expend funds on upgrade and reuse of the existing station. If reuse of the existing station at Lift Station 1C is under consideration, the District may want to accelerate the schedule and to include representative non-destructive testing of the metal thickness on the pump station shell and interior piping.

The property on which Lift Station 1C is located is owned by the City of Lake Stevens. The dimensions of the property are approximately 12.5 feet by and average of 65 feet. The property was deeded to the City by the then-owner of the adjacent property. The deed to the property (included as Attachment B) contains the following restriction:

> *That said property is subject to the limitation that it shall be used as a sewage pumping station for the Town of Lake Stevens or other agency operating said sewage system within said Town and all construction shall be done underground and that there shall be no overground construction exceeding two feet above the surface of the ground except that the Grantee may construct a power pole and cause a meter and vent pipe to be placed upon said property.*

In order to complete any substantial upgrades to Lift Station 1C aboveground facilities will be required, so this deed restriction will need to be removed. The adjacent property has since subdivided to four properties. It appears that the current owners of the four subdivided properties will need to consent to the removal of the deed restriction. It is recommended that the District's attorney and a real property negotiator be consulted in order to develop a strategy to obtain the consent.

It is anticipated that aesthetic considerations will need to be made in order to obtain this consent. Accordingly, it is assumed that any new aboveground generator will need to be placed within a building that will both blend with the character of the surrounding residential neighborhood and provide a higher level of noise attenuation than standard enclosures. The existing site is not wide enough to fit a building that could contain a generator. It will be necessary to obtain additional property, as well as a building setback variance to construct a generator building.

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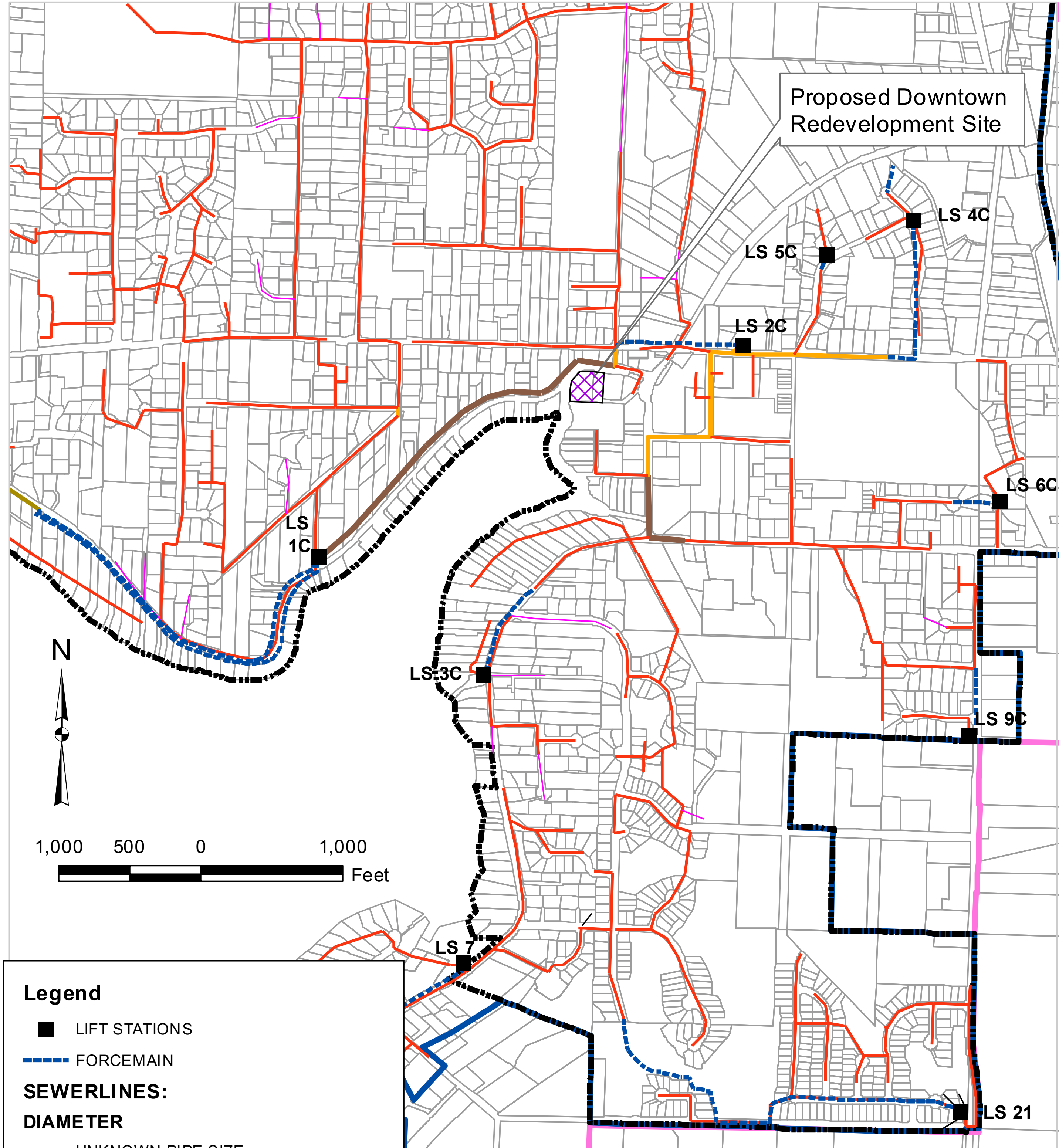
Summary
The estimated project cost for each of the Alternatives is presented below.

Alternative	**Description**	**Project Cost**
Comprehensive Plan	Upgrade Lift Station 2C and extend force main to bypass Lift Station 1C	$ 5,092,000
Alternative 1	Construct a new lift station on the redevelopment project property, in lieu of the planned upgrades to Lift Station 2C	$ 3,080,000
Alternative 2	Redirect the Lift Station 2C force main discharge to Lift Station 8C	$ 9,130,000
Alternative 3	Convey flow from the proposed downtown redevelopment project directly to Lift Station 1C, with interim improvements to Lift Station 1C	
Alternative 3A	Upgrade the existing flooded suction Smith & Loveless pump station	$ 1,430,000
Alternative 3B	Install a new wet well mounted, vacuum prime Smith & Loveless pump station on the existing wet well; abandon the existing flooded suction station	$ 1,530,000
Alternative 3C	Install a new submersible pump in the existing wet well to operate in conjunction with the existing duplex flooded-suction station in a triplex configuration	$ 1,710,000
Alternative 3D	Install a duplex submersible station in the existing wet well; abandon the existing flooded suction station	$ 1,640,000

We recommend Alternative 3, an upgrade to Lift Station 1. The exact details of that upgrade, including the type of pump station and whether the existing A.C. force main will need to be rehabilitated, will be determined during the predesign phase of the project.

Attachments:
Attachment A – Preliminary Construction Cost Estimates
Attachment B – Lift Station 1C Property Deed
Attachment C – Lift Station 1C, C-Values & Pump Curves



Legend

- LIFT STATIONS
- FORCEMAIN

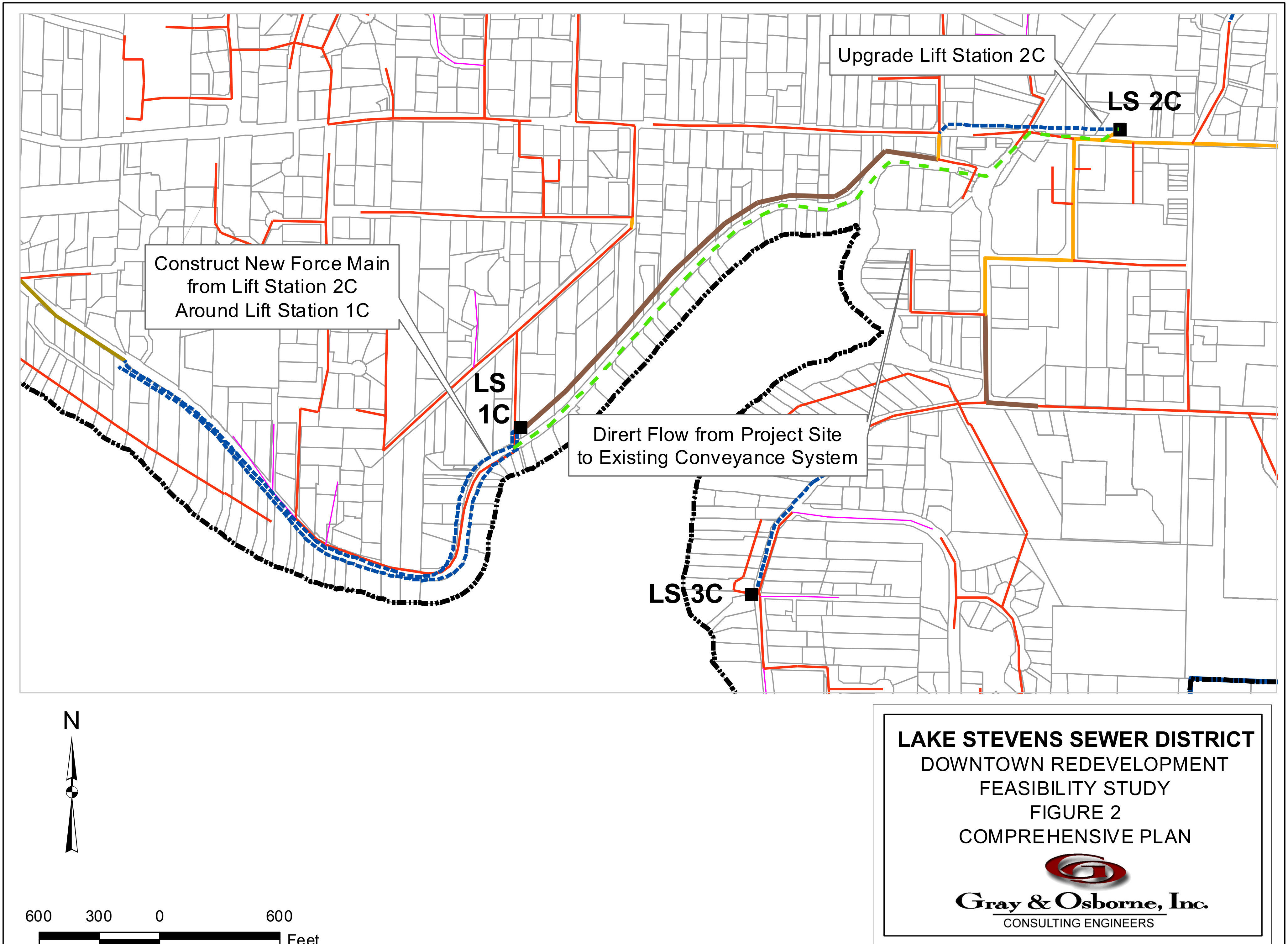
SEWERLINES:

DIAMETER

- UNKNOWN PIPE SIZE
- 6" - 8" SEWER PIPE
- 10" SEWER PIPE
- 12" SEWER PIPE
- 15" - 18" SEWER PIPE
- 21" - 24" SEWER PIPE
- 30" - 36" SEWER PIPE
- CITY OF LAKE STEVENS
- INCORPORATED DISTRICT BOUNDARY
- UGA BOUNDARY

LAKE STEVENS SEWER DISTRICT
DOWNTOWN REDEVELOPMENT
FEASIBILITY STUDY
FIGURE 1
VICINITY MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS



LAKE STEVENS SEWER DISTRICT
DOWNTOWN REDEVELOPMENT
FEASIBILITY STUDY
FIGURE 2
COMPREHENSIVE PLAN

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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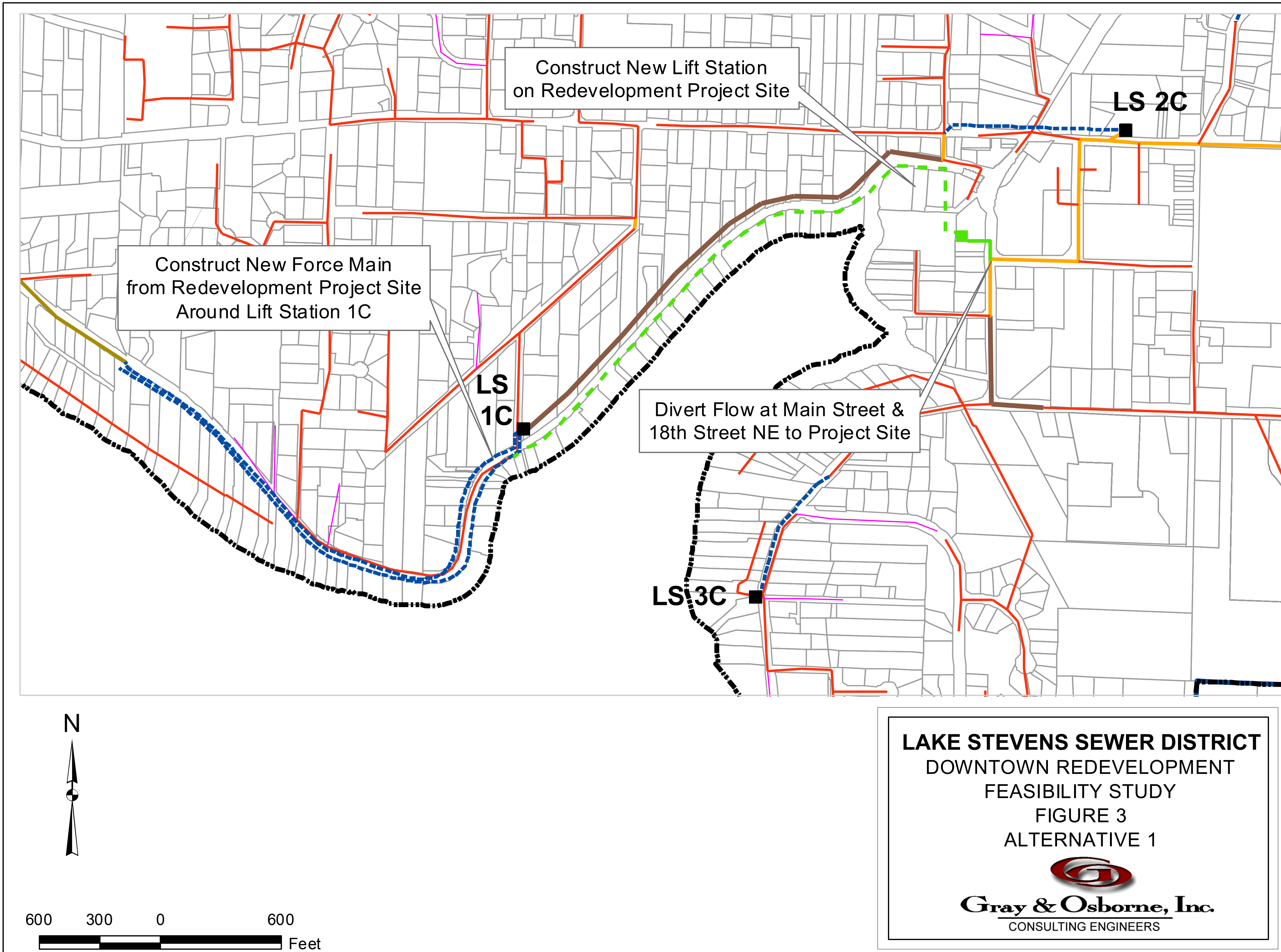

LAKE STEVENS SEWER DISTRICT
DOWNTOWN REDEVELOPMENT
FEASIBILITY STUDY
FIGURE 3
ALTERNATIVE 1

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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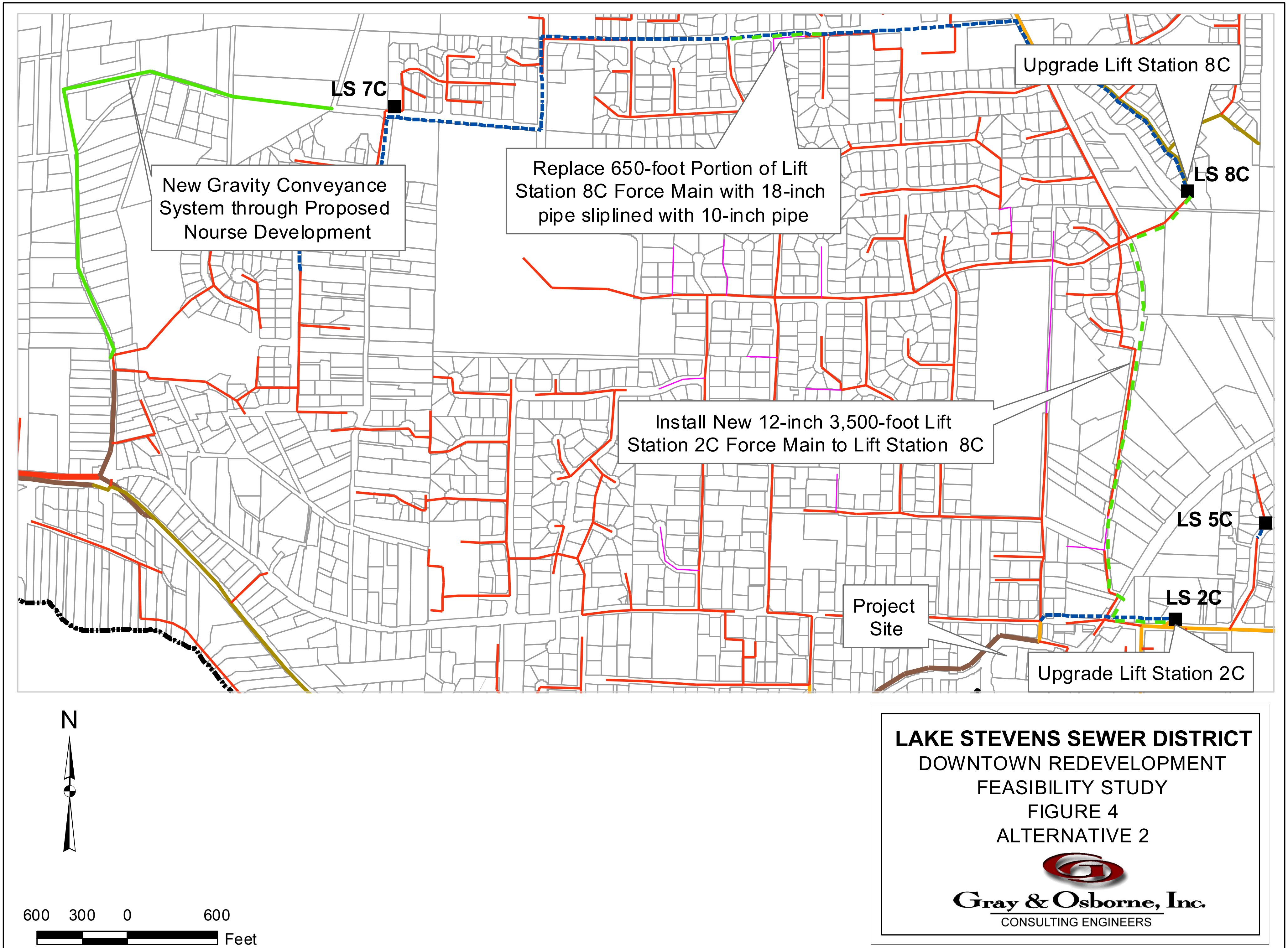

LAKE STEVENS SEWER DISTRICT

DOWNTOWN REDEVELOPMENT FEASIBILITY STUDY

FIGURE 4

ALTERNATIVE 2

Gray & Osborne, Inc.
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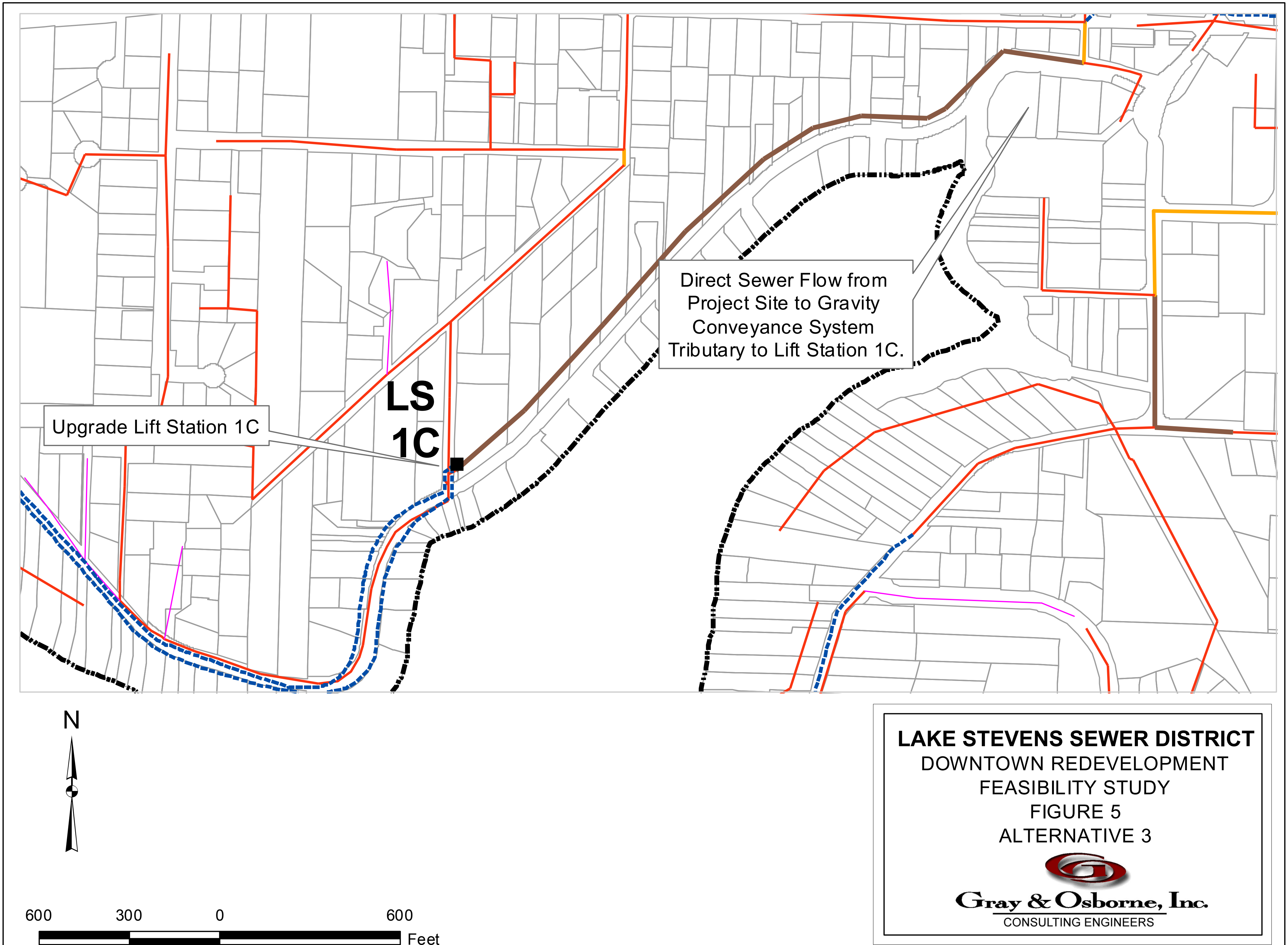

LAKE STEVENS SEWER DISTRICT
DOWNTOWN REDEVELOPMENT
FEASIBILITY STUDY
FIGURE 5
ALTERNATIVE 3

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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Attachment A

Preliminary Construction Cost Estimates

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 1 - Force Main

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 53,000	$ 53,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$ 14,000	$ 14,000
3	Environmental Controls	1	LS	$ 6,000	$ 6,000
4	Trench Excavation Safety Systems	1	LS	$ 7,000	$ 7,000
5	Dewatering	1	LS	$ 9,000	$ 9,000
6	Temporary Bypass Pumping	0	LS	$ -	$ -
7	Traffic Control	1	LS	$ 14,000	$ 14,000
8	Locate Existing Utilities	1	LS	$ 5,000	$ 5,000
9	10" Force Main (Including bedding, backfill	2,700	LF	$ 75	$ 202,500
	in ROW	2,700			
	in unimp easmnt	0			
10	Special Excavation of Unsuitable Material	50	CY	$ 40	$ 2,000
11	Connection to Existing Manhole	1	EA	$ 2,500	$ 2,500
12	Foundation Gravel	210	TN	$ 25	$ 5,250
13	Gravel Base	1,700	TN	$ 25	$ 42,500
14	Asphalt Treated Base	300	TN	$ 100	$ 30,000
15	Sawcutting	5,410	LF	$ 4	$ 21,640
16	Hot Mix Asphalt	800	TN	$ 100	$ 80,000
17	Hydroseeding	0	SY	$ 3	$ -

Subtotal	$ 494,390
Contingency (20%)	$ 98,878
Subtotal	$ 593,268
Sales Tax (8.5%)	$ 50,428
Total	$ 643,696
Total Construction Cost (Rounded)	**$ 650,000**
All Overhead (30%)	$ 200,000
Total Project Cost (Rounded)	**$ 850,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 1 - Lift Station on Project Site

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 118,000	$ 118,000
2	Dewatering	1	LS	$ 5,000	$ 5,000
3	Erosion Control	1	LS	$ 5,000	$ 5,000
4	Temporary Shoring & Bracing	1	LS	$ 25,000	$ 25,000
5	Trench Excavation Safety Systems	1	LS	$ 2,000	$ 2,000
6	Concrete Slabs and Foundations	1	LS	$ 25,000	$ 25,000
7	Lift Station Site Paving	1	LS	$ 20,000	$ 20,000
8	Fencing	200	FT	$ 50	$ 10,000
9	Utilities & Misc. Site Improvements	1	LS	$ 10,000	$ 10,000
10	Electrical Shelter	1	LS	$ 20,000	$ 20,000
11	Hoist	1	LS	$ 15,000	$ 15,000
12	10 ft Dia Wet Well and Inlet MH Structures	1	LS	$ 85,000	$ 85,000
13	Painting & Dampproofing	1	LS	$ 35,000	$ 35,000
14	New Submersible Pumps (2x50 hp)	1	LS	$ 125,000	$ 125,000
15	Valve Vault	1	LS	$ 20,000	$ 20,000
16	Piping, Valves and Accessories	1	LS	$ 45,000	$ 45,000
17	175 kWGenerator System	1	LS	$ 80,000	$ 80,000
18	Generator Building	1	LS	$ 70,000	$ 70,000
19	Electrical	1	LS	$ 240,000	$ 240,000
20	Instrumentation & Telemetry	1	LS	$ 110,000	$ 110,000
21	Utility Service (PUD)	1	LS	$ 12,000	$ 12,000
22	Programming, Startup, SCADA, Documentation	1	LS	$ 20,000	$ 20,000

Subtotal	$ 1,097,000
Contingency (20%)	$ 219,400
Subtotal	$ 1,316,400
Sales Tax (8.5%)	$ 111,894
Total	$ 1,428,294
Total Construction Cost (Rounded)	**$ 1,430,000**
All Overhead (30%)	$ 430,000
Total Project Cost (Rounded)	**$ 1,860,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 1 - New Gravity Pipe

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 23,000	$ 23,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$ 5,000	$ 5,000
3	Environmental Controls	1	LS	$ 4,000	$ 4,000
4	Trench Excavation Safety Systems	1	LS	$ 5,000	$ 5,000
5	Dewatering	1	LS	$ 4,000	$ 4,000
6	Temporary Bypass Pumping	0	LS	$ -	$ -
7	Traffic Control	1	LS	$ 3,000	$ 3,000
8	Locate Existing Utilities	1	LS	$ 5,000	$ 5,000
9	15" PVC (Including bedding, backfill)	700	LF	$ 120	$ 84,000
	in ROW	460			
	in unimp easmnt	240			
10	48" Precast Manhole (Basic to 8')	5	EA	$ 4,000	$ 20,000
11	Connection to Existing Manhole	1	EA	$ 2,500	$ 2,500
12	Special Excavation of Unsuitable Material	20	CY	$ 40	$ 800
13	Foundation Gravel	120	TN	$ 25	$ 3,000
14	Gravel Base	1,100	TN	$ 25	$ 27,500
15	Asphalt Treated Base	80	TN	$ 100	$ 8,000
16	Sawcutting	930	LF	$ 4	$ 3,720
17	Hot Mix Asphalt	130	TN	$ 100	$ 13,000
18	Hydroseeding	700	SY	$ 3	$ 2,100

Subtotal	$ 213,620
Contingency (20%)	$ 42,724
Subtotal	$ 256,344
Sales Tax (8.5%)	$ 21,789
Total	$ 278,133
Total Construction Cost (Rounded)	**$ 280,000**
All Overhead (30%)	$ 90,000
Total Project Cost (Rounded)	**$ 370,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 2 - LS 2C Upgrade (1000 gpm)

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 145,000	$ 145,000
2	Clearing & Grubbing	1	LS	$ 2,000	$ 2,000
3	Dewatering	1	LS	$ 5,000	$ 5,000
4	Erosion Control	1	LS	$ 10,000	$ 10,000
5	Temporary Shoring & Bracing	1	LS	$ 50,000	$ 50,000
6	Trench Excavation Safety Systems	1	LS	$ 2,000	$ 2,000
7	Salvage & Demolition	1	LS	$ 20,000	$ 20,000
8	Temporary Bypass Pumping	1	LS	$ 10,000	$ 10,000
9	Concrete Slabs and Foundations	1	LS	$ 25,000	$ 25,000
10	Gravel Base	200	TN	$ 25	$ 5,000
11	Grading and Paving	1	LS	$ 20,000	$ 20,000
12	Fencing	200	LF	$ 50	$ 10,000
13	Utilities and Miscellaneous Site Improvements	1	LS	$ 10,000	$ 10,000
14	Electrical Shelter	1	LS	$ 20,000	$ 20,000
15	Hoist	1	LS	$ 25,000	$ 25,000
16	New Wet Well Storage and Saddle MH Structures	1	LS	$ 85,000	$ 85,000
17	Repl Wet Well Lid - Exist 96" Dia	1	LS	$ 12,000	$ 12,000
18	Painting & Dampproofing	1	LS	$ 35,000	$ 35,000
19	Submersible Pumps (2 x 50 HP)	1	LS	$ 125,000	$ 125,000
20	Valve Vault	1	LS	$ 20,000	$ 20,000
21	Piping, Valves and Accessories	1	LS	$ 45,000	$ 45,000
22	FM Odor Control, incl shelter	1	LS	$ 35,000	$ 35,000
23	Wet Well Odor Control	1	LS	$ 75,000	$ 75,000
24	175 kW Aux Generator System	1	LS	$ 80,000	$ 80,000
25	Generator Building	1	LS	$ 70,000	$ 70,000
26	Electrical	1	LS	$ 260,000	$ 260,000
27	Instrumentation & Telemetry	1	LS	$ 110,000	$ 110,000
28	Landscaping	1	LS	$ 5,000	$ 5,000
29	Utility Service (PUD)	1	LS	$ 12,000	$ 12,000
30	Programming, Startup, SCADA, Documentation	1	LS	$ 20,000	$ 20,000

Subtotal	$ 1,348,000
Contingency (20%)	$ 269,600
Subtotal	$ 1,617,600
Sales Tax (8.5%)	$ 137,496
Total	$ 1,755,096
Total Construction Cost (Rounded)	**$ 1,760,000**
All Overhead (30%)	$ 530,000
Total Project Cost (Rounded)	**$ 2,290,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 2 - Upgrade LS 8C

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 312,000	$ 312,000
2	Dewatering	1	LS	$ 20,000	$ 20,000
3	Erosion Control	1	LS	$ 15,000	$ 15,000
4	Temporary Shoring & Bracing	1	LS	$ 100,000	$ 100,000
5	Trench Excavation Safety Systems	1	LS	$ 5,000	$ 5,000
6	Excavation, Backfill & Grading	1	LS	$ 150,000	$ 150,000
7	Concrete Slabs and Foundations	1	LS	$ 50,000	$ 50,000
8	Grading and Paving	1	LS	$ 40,000	$ 40,000
9	Fencing	300	LF	$ 50	$ 15,000
10	Utilities, Gravity Sewer & Misc. Site Improvements	1	LS	$ 100,000	$ 100,000
11	Electrical Shelter	1	LS	$ 30,000	$ 30,000
12	Additional Wet Well	1	LS	$ 90,000	$ 90,000
13	Painting & Dampproofing	1	LS	$ 60,000	$ 60,000
14	Smith & Loveless Capsule Lift Station (3x200 hp)	1	LS	$ 1,000,000	$ 1,000,000
15	Valve Vault	1	LS	$ 30,000	$ 30,000
16	Piping, Valves and Accessories	1	LS	$ 120,000	$ 120,000
17	Generator System	1	LS	$ 300,000	$ 300,000
18	Electrical	1	LS	$ 300,000	$ 300,000
19	Instrumentation & Telemetry	1	LS	$ 125,000	$ 125,000
20	Utility Service (PUD)	1	LS	$ 25,000	$ 25,000
21	Programming, Startup, SCADA, Documentation	1	LS	$ 20,000	$ 20,000

Subtotal	$ 2,907,000
Contingency (20%)	$ 581,400
Subtotal	$ 3,488,400
Sales Tax (8.5%)	$ 296,514
Total	$ 3,784,914
Total Construction Cost (Rounded)	**$ 3,790,000**
All Overhead (30%)	$ 1,140,000
Total Project Cost (Rounded)	**$ 4,930,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 2 - LS 8C Force Main

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 36,000	$ 36,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$ 4,000	$ 4,000
3	Environmental Controls	1	LS	$ 2,000	$ 2,000
4	Trench Excavation Safety Systems	1	LS	$ 2,000	$ 2,000
5	Dewatering	1	LS	$ 2,000	$ 2,000
6	Temporary Bypass Pumping	1	LS	$ 9,000	$ 9,000
7	Traffic Control	1	LS	$ 5,000	$ 5,000
8	Locate Existing Utilities	1	LS	$ 1,000	$ 1,000
9	Removal of Structures and Obstructions	1	LS	$ 130,000	$ 130,000
10	18" Force Main with 10" Slipline(Including bedding, backfill)	650	LF	$ 150	$ 97,500
	in ROW	650			
	in unimp easmnt	0			
11	Special Excavation of Unsuitable Material	20	CY	$ 40	$ 800
12	Foundation Gravel	50	TN	$ 25	$ 1,250
13	Gravel Base	390	TN	$ 25	$ 9,750
14	Asphalt Treated Base	80	TN	$ 100	$ 8,000
15	Sawcutting	1,320	LF	$ 4	$ 5,280
16	Hot Mix Asphalt	180	TN	$ 100	$ 18,000
17	Hydroseeding	0	SY	$ 3	$ -

Subtotal	$ 331,580
Contingency (20%)	$ 66,316
Subtotal	$ 397,896
Sales Tax (8.5%)	$ 33,821
Total	$ 431,717
Total Construction Cost (Rounded)	**$ 440,000**
All Overhead (30%)	$ 140,000
Total Project Cost (Rounded)	**$ 580,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 2 - LS 2C Force Main

	Item	Quantity			Unit Cost		Total
1	Mobilization/Demobilization	1	LS	$	84,000	$	84,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$	18,000	$	18,000
3	Environmental Controls	1	LS	$	7,000	$	7,000
4	Trench Excavation Safety Systems	1	LS	$	13,000	$	13,000
5	Dewatering	1	LS	$	21,000	$	21,000
6	Traffic Control	1	LS	$	18,000	$	18,000
7	Locate Existing Utilities	1	LS	$	12,000	$	12,000
8	Removal of Structures and Obstructions	1	LS	$	23,000	$	23,000
9	12" Force Main (Including bedding, backfill)	3,500	LF	$	90	$	315,000
	in ROW	3,500					
	in unimp easmnt	0					
10	Air Vacuum Release	1	EA	$	6,000	$	6,000
11	Special Excavation of Unsuitable Material	70	CY	$	40	$	2,800
12	Foundation Gravel	270	TN	$	25	$	6,750
13	Gravel Base	2,090	TN	$	25	$	52,250
14	Asphalt Treated Base	390	TN	$	100	$	39,000
15	Sawcutting	7,020	LF	$	4	$	28,080
16	Planing Bituminous Pavement	9,800	SY	$	4	$	39,200
17	Hot Mix Asphalt	970	TN	$	100	$	97,000
18	Hydroseeding	0	SY	$	3	$	-
	Subtotal					$	782,080
	Contingency (20%)					$	156,416
	Subtotal					$	938,496
	Sales Tax (8.5%)					$	79,772
	Total					$	1,018,268
	Total Construction Cost (Rounded)					**$**	**1,020,000**
	All Overhead (30%)					$	310,000
	Total Project Cost (Rounded)					**$**	**1,330,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 3A - LS 1C Upgrade (960 gpm)

	Item	Quantity		Unit Cost		Total
1	Mobilization/Demobilization	1	LS	$	88,000	$ 88,000
2	Clearing & Grubbing	1	LS	$	2,000	$ 2,000
3	Dewatering	1	LS	$	5,000	$ 5,000
4	Erosion Control	1	LS	$	5,000	$ 5,000
5	Temporary Shoring & Bracing	1	LS	$	10,000	$ 10,000
6	Trench Excavation Safety Systems	1	LS	$	2,000	$ 2,000
7	Salvage & Demolition	1	LS	$	10,000	$ 10,000
8	Temporary Bypass Pumping	1	LS	$	20,000	$ 20,000
9	Concrete Slabs and Foundations	1	LS	$	25,000	$ 25,000
10	New 8 ft Wet Well Lid w/ Hatch	1	LS	$	12,000	$ 12,000
11	Gravel Base	200	TN	$	25	$ 5,000
12	Grading and Paving	1	LS	$	20,000	$ 20,000
13	Fencing	200	LF	$	50	$ 10,000
14	Utilities and Miscellaneous Site Improvements	1	LS	$	10,000	$ 10,000
15	Electrical Shelter	1	LS	$	20,000	$ 20,000
16	Hoist	0	LS	$	15,000	$ -
17	New Pump Rotating Assemblies (2 x 50 hp)	1	LS	$	70,000	$ 70,000
18	Valve Vault	1	LS	$	15,000	$ 15,000
19	Piping, Valves and Accessories	1	LS	$	40,000	$ 40,000
20	125 kW Aux Generator System	1	LS	$	70,000	$ 70,000
21	Generator Building	1	LS	$	70,000	$ 70,000
22	Electrical incl New 480V Utility Service	1	LS	$	170,000	$ 170,000
23	Instrumentation & Telemetry	1	LS	$	100,000	$ 100,000
24	Landscaping	1	LS	$	15,000	$ 15,000
25	Utility Service Costs (PUD)	1	LS	$	10,000	$ 10,000
26	Programming, Startup, SCADA, Documentation	1	LS	$	15,000	$ 15,000

Subtotal	$ 819,000
Property Acquisition	$ 30,000
Contingency (20%)	$ 163,800
Subtotal	$ 1,012,800
Sales Tax (8.5%)	$ 86,088
Total	$ 1,098,888
Total Construction Cost (Rounded)	**$ 1,100,000**
All Overhead (30%)	$ 330,000
Total Project Cost (Rounded)	**$ 1,430,000**

DRAFT

Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 3B - LS 1C Upgrade (960 gpm)

	Item	Quantity			Unit Cost		Total
1	Mobilization/Demobilization	1	LS	$	93,000	$	93,000
2	Clearing & Grubbing	1	LS	$	2,000	$	2,000
3	Dewatering	1	LS	$	5,000	$	5,000
4	Erosion Control	1	LS	$	5,000	$	5,000
5	Temporary Shoring & Bracing	1	LS	$	10,000	$	10,000
6	Trench Excavation Safety Systems	1	LS	$	2,000	$	2,000
7	Salvage & Demolition	1	LS	$	10,000	$	10,000
8	Temporary Bypass Pumping	1	LS	$	20,000	$	20,000
9	Concrete Slabs and Foundations	1	LS	$	25,000	$	25,000
10	New 8 ft Wet Well Lid w/ Hatch	0	LS	$	12,000	$	-
11	Gravel Base	200	TN	$	25	$	5,000
12	Grading and Paving	1	LS	$	20,000	$	20,000
13	Fencing	200	LF	$	50	$	10,000
14	Utilities and Miscellaneous Site Improvements	1	LS	$	10,000	$	10,000
15	Electrical Shelter	1	LS	$	20,000	$	20,000
16	Hoist	0	LS	$	15,000	$	-
17	New WWMPS (2 x 50 hp)	1	LS	$	160,000	$	160,000
18	Valve Vault	1	LS	$	15,000	$	15,000
19	Piping, Valves and Accessories	1	LS	$	20,000	$	20,000
20	125 kW Aux Generator System	1	LS	$	70,000	$	70,000
21	Generator Building	1	LS	$	70,000	$	70,000
22	Electrical incl New 480V Utility Service	1	LS	$	155,000	$	155,000
23	Instrumentation & Telemetry	1	LS	$	100,000	$	100,000
24	Landscaping	1	LS	$	15,000	$	15,000
25	Utility Service Costs (PUD)	1	LS	$	10,000	$	10,000
26	Programming, Startup, SCADA, Documentation	1	LS	$	15,000	$	15,000
	Subtotal					$	867,000
	Property Acquisition					$	30,000
	Contingency (20%)					$	173,400
	Subtotal					$	1,070,400
	Sales Tax (8.5%)					$	90,984
	Total					$	1,161,384
	Total Construction Cost (Rounded)					**$**	**1,170,000**
	All Overhead (30%)					$	360,000
	Total Project Cost (Rounded)					**$**	**1,530,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 3C - LS 1C Upgrade (960 gpm)

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 105,000	$ 105,000
2	Clearing & Grubbing	1	LS	$ 2,000	$ 2,000
3	Dewatering	1	LS	$ 5,000	$ 5,000
4	Erosion Control	1	LS	$ 5,000	$ 5,000
5	Temporary Shoring & Bracing	1	LS	$ 10,000	$ 10,000
6	Trench Excavation Safety Systems	1	LS	$ 2,000	$ 2,000
7	Salvage & Demolition	1	LS	$ 10,000	$ 10,000
8	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
9	Concrete Slabs and Foundations	1	LS	$ 25,000	$ 25,000
10	New 8 ft Wet Well Lid w/ Hatch	1	LS	$ 12,000	$ 12,000
11	Gravel Base	200	TN	$ 25	$ 5,000
12	Grading and Paving	1	LS	$ 20,000	$ 20,000
13	Fencing	200	LF	$ 50	$ 10,000
14	Utilities and Miscellaneous Site Improvements	1	LS	$ 10,000	$ 10,000
15	Electrical Shelter	1	LS	$ 20,000	$ 20,000
16	Hoist	1	LS	$ 15,000	$ 15,000
17	Repl Impellers (2 ea); New Subm Pump (1x 60 hp)	1	LS	$ 70,000	$ 70,000
18	Valve Vault	1	LS	$ 20,000	$ 20,000
19	Piping, Valves and Accessories	1	LS	$ 50,000	$ 50,000
20	175 kW Aux Generator System	1	LS	$ 80,000	$ 80,000
21	Generator Building	1	LS	$ 70,000	$ 70,000
22	Electrical incl New 480V Utility Service	1	LS	$ 260,000	$ 260,000
23	Instrumentation & Telemetry	1	LS	$ 110,000	$ 110,000
24	Landscaping	1	LS	$ 15,000	$ 15,000
25	Utility Service Costs (PUD)	1	LS	$ 10,000	$ 10,000
26	Programming, Startup, SCADA, Documentation	1	LS	$ 15,000	$ 15,000

Subtotal	$ 976,000
Property Acquisition	$ 30,000
Contingency (20%)	$ 195,200
Subtotal	$ 1,201,200
Sales Tax (8.5%)	$ 102,102
Total	$ 1,303,302
Total Construction Cost (Rounded)	**$ 1,310,000**
All Overhead (30%)	$ 400,000
Total Project Cost (Rounded)	**$ 1,710,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Alternative 3D - LS 1C Upgrade (960 gpm)

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 101,000	$ 101,000
2	Clearing & Grubbing	1	LS	$ 2,000	$ 2,000
3	Dewatering	1	LS	$ 5,000	$ 5,000
4	Erosion Control	1	LS	$ 5,000	$ 5,000
5	Temporary Shoring & Bracing	1	LS	$ 10,000	$ 10,000
6	Trench Excavation Safety Systems	1	LS	$ 2,000	$ 2,000
7	Salvage & Demolition	1	LS	$ 10,000	$ 10,000
8	Temporary Bypass Pumping	1	LS	$ 20,000	$ 20,000
9	Concrete Slabs and Foundations	1	LS	$ 25,000	$ 25,000
10	New 8 ft Wet Well Lid w/ Hatch	1	LS	$ 12,000	$ 12,000
11	Gravel Base	200	TN	$ 25	$ 5,000
12	Grading and Paving	1	LS	$ 20,000	$ 20,000
13	Fencing	200	LF	$ 50	$ 10,000
14	Utilities and Miscellaneous Site Improvements	1	LS	$ 10,000	$ 10,000
15	Electrical Shelter	1	LS	$ 20,000	$ 20,000
16	Hoist	1	LS	$ 15,000	$ 15,000
17	New Sewage Pumps (2 x 70 hp Subm)	1	LS	$ 130,000	$ 130,000
18	Valve Vault	1	LS	$ 20,000	$ 20,000
19	Piping, Valves and Accessories	1	LS	$ 30,000	$ 30,000
20	150 kW Aux Generator System	1	LS	$ 75,000	$ 75,000
21	Generator Building	1	LS	$ 70,000	$ 70,000
22	Electrical incl New 480V Utility Service	1	LS	$ 200,000	$ 200,000
23	Instrumentation & Telemetry	1	LS	$ 100,000	$ 100,000
24	Landscaping	1	LS	$ 15,000	$ 15,000
25	Utility Service Costs (PUD)	1	LS	$ 10,000	$ 10,000
26	Programming, Startup, SCADA, Documentation	1	LS	$ 15,000	$ 15,000
	Subtotal				$ 937,000
	Property Acquisition				$ 30,000
	Contingency (20%)				$ 187,400
	Subtotal				$ 1,154,400
	Sales Tax (8.5%)				$ 98,124
	Total				$ 1,252,524
	Total Construction Cost (Rounded)				**$ 1,260,000**
	All Overhead (30%)				$ 380,000
	Total Project Cost (Rounded)				**$ 1,640,000**

Attachment B

Lift Station 1C Property Deed

L140323

2161459

OFFICIAL RECORDS

VOL NO
PAGE
REQ OF
AUG 26 1970
DEPUTY

2161459

STATUTORY WARRANTY DEED

THE GRANTORS, DONOVAN A. MINSHULL and Anna Lee MINSHULL, his wife, for and in consideration of SIX THOUSAND FIVE HUNDRED SEVENTY-TWO and 28/100 ($6572.28) DOLLARS O R the reduction of the total assessment on Parcel No. 131 8-9, Rucker Mill Plat 2, Lots 8-9 inc Shorelands to a total of FOUR THOUSAND ($4,000.00) DOLLARS, in hand paid, convey and warrant to TOWN OF LAKE STEVENS, WASHINGTON, the following described real estate, situated in the County of Snohomish, State of Washington:

Beginning at the intersection of the North margin of Vernon Road and the West line of Lot 8 of Rucker's Mill Plat No. 2 as recorded in Volume 7, Page 54, Records of Snohomish County; thence Northerly along the West line of said Lot 8 a distance of 70 feet; thence Easterly at right angles to said West line a distance of 15 feet; thence Southerly parallel with said West line to the North margin of Vernon Road; thence Southwesterly along said North margin to the point of beginning; together with the West 15 feet of that portion of said Lot 8 situated South of the South margin of Vernon Road together with the shorelands lying adjacent to the West 15 feet of said Lot 8.

In consideration of the foregoing, Grantee agrees as follows:

1. That said property is subject to the limitation that it shall be used as a sewage pumping station for the Town of Lake Stevens or other agency operating said sewage system within said Town and all construction shall be done underground and that there shall be no overground construction exceeding two feet above the surface of the ground except that the Grantee may construct a power pole and cause a meter and vent pipe to be placed upon said property.

2. Grantee further agrees that after the same has been constructed, it will cause a lawn to be planted upon such land not used for above ground improvements and will themselves cause the same to be regularly mowed and cared for.

3. Grantee further agrees that the creek on the East side of Mitchell Road will not be changed from its present channel North of a point 100' North of the Vernon Road right-of-way.

4. Grantee further agrees that no odor or noise will eminate from their ~~construction~~ the or operation of the sewer pumping station on the above described property during the time that Grantors shall remain the owners of said property.

DATED this 26th day of August, 1970.

NO SALES TAX REQUIRED

AUG 26 1970

OFFICIAL RECORDS
437 352

STATE OF WASHINGTON } ss.
County of Snohomish }

On this day personally appeared before me DONOVAN A. MINSHULL and Anna Lee MINSHULL, his wife, to me known to be the individuals described in and who executed the within and foregoing instrument, and acknowledged that they signed the same as their free and voluntary act and deed, for the uses and purposes therein mentioned.

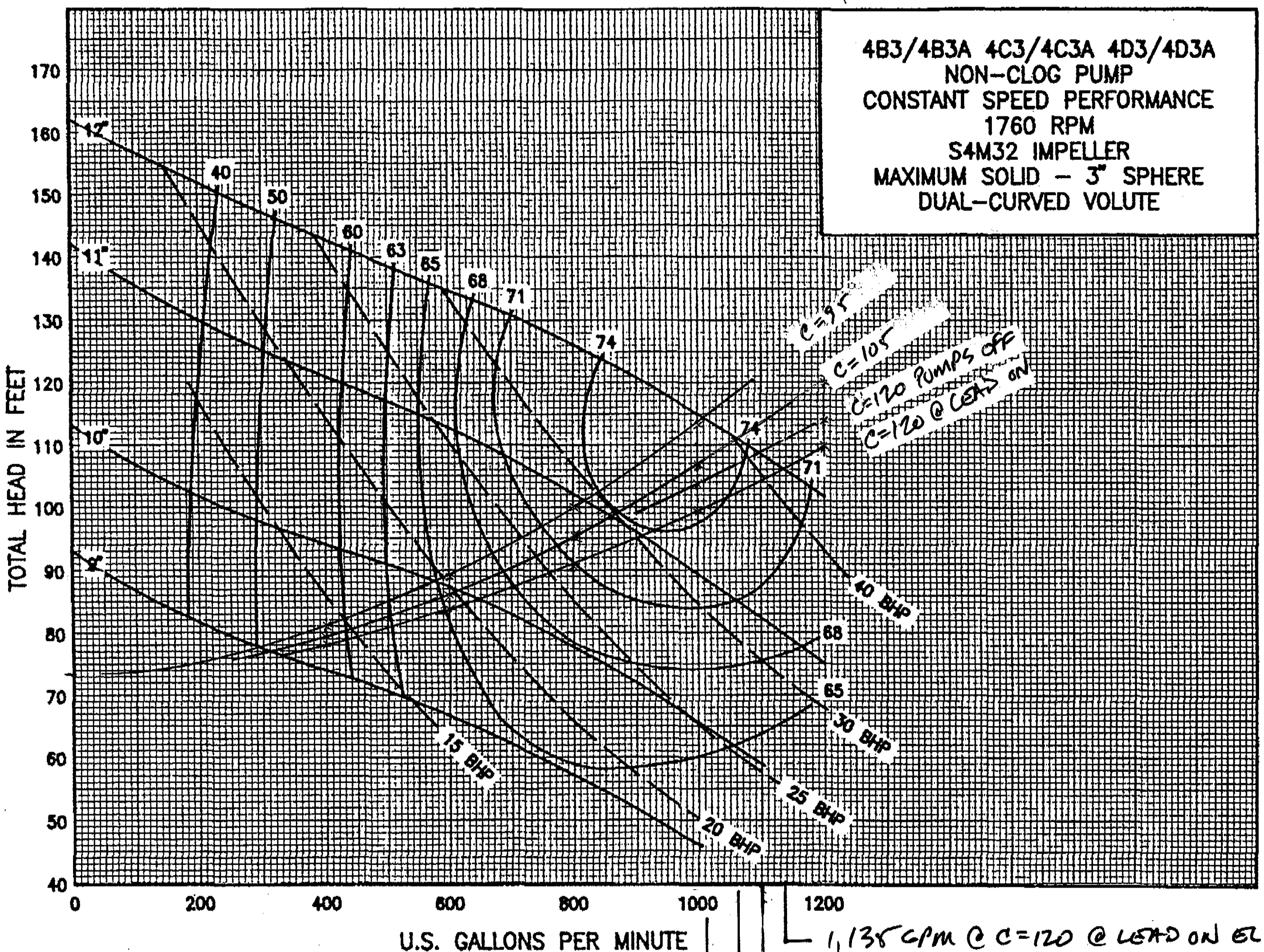
GIVEN under my hand and official seal the 3rd day of August, 1970.

[illegible]
Notary Public in and for the State of Washington, residing at:
[illegible]

Attachment C

Lift Station 1C, C-Values & Pump Curves

3A LSIC
EX. FLOODED SUCTION PUMP STATION
EX. CL200 PVC 8" & AC. 8" FORCE MAINS
12" IMPELLER



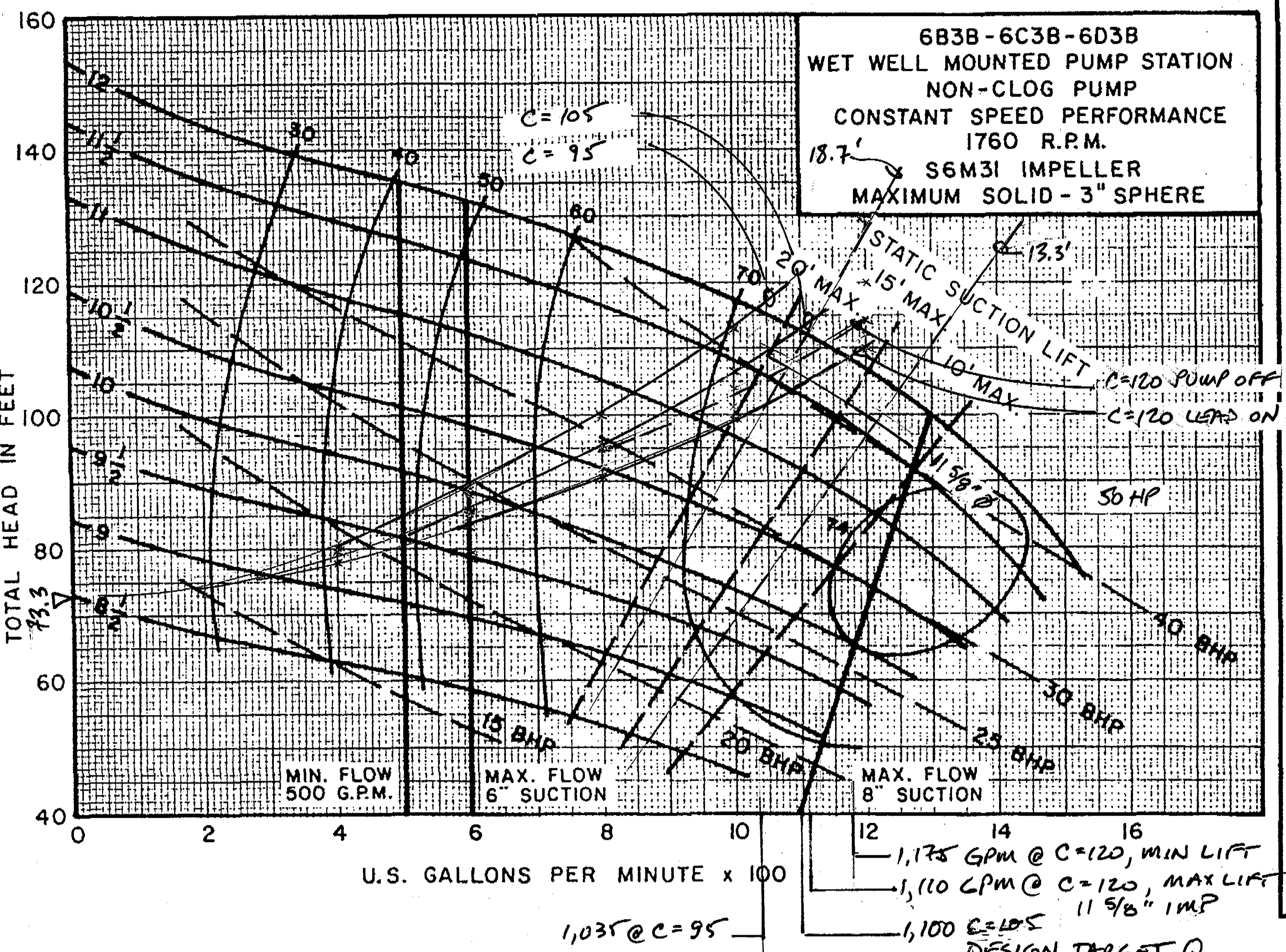
1,135 GPM @ C=120 @ LEAD ON EL.
1,100 GPM @ C=120 @ PUMPS OFF
DESIGN TARGET Q
1,010 GPM @ C=95
1,060 GPM @ C=105

ENGINEERING DATA
Smith & Loveless, Inc.
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215

Pump Performance Curves
Constant Speed
4B3/4B3A-4C3/4C3A-4D3/4D3A
1760 RPM
December, 1998

3B LSSD LS 1C
NEW WWMPS
EX. CL 200 PVC 8" & AC. 8" FORCE MAINS
12" ⌀ IMPELLER (EXCEPT AS NOTED)

SUCTION LIFT
MIN 221 - 206.7 = 13.3 FT @ LEAD ON
MAX 221 - 202.3 = 18.7 FT @ PUMP OFF



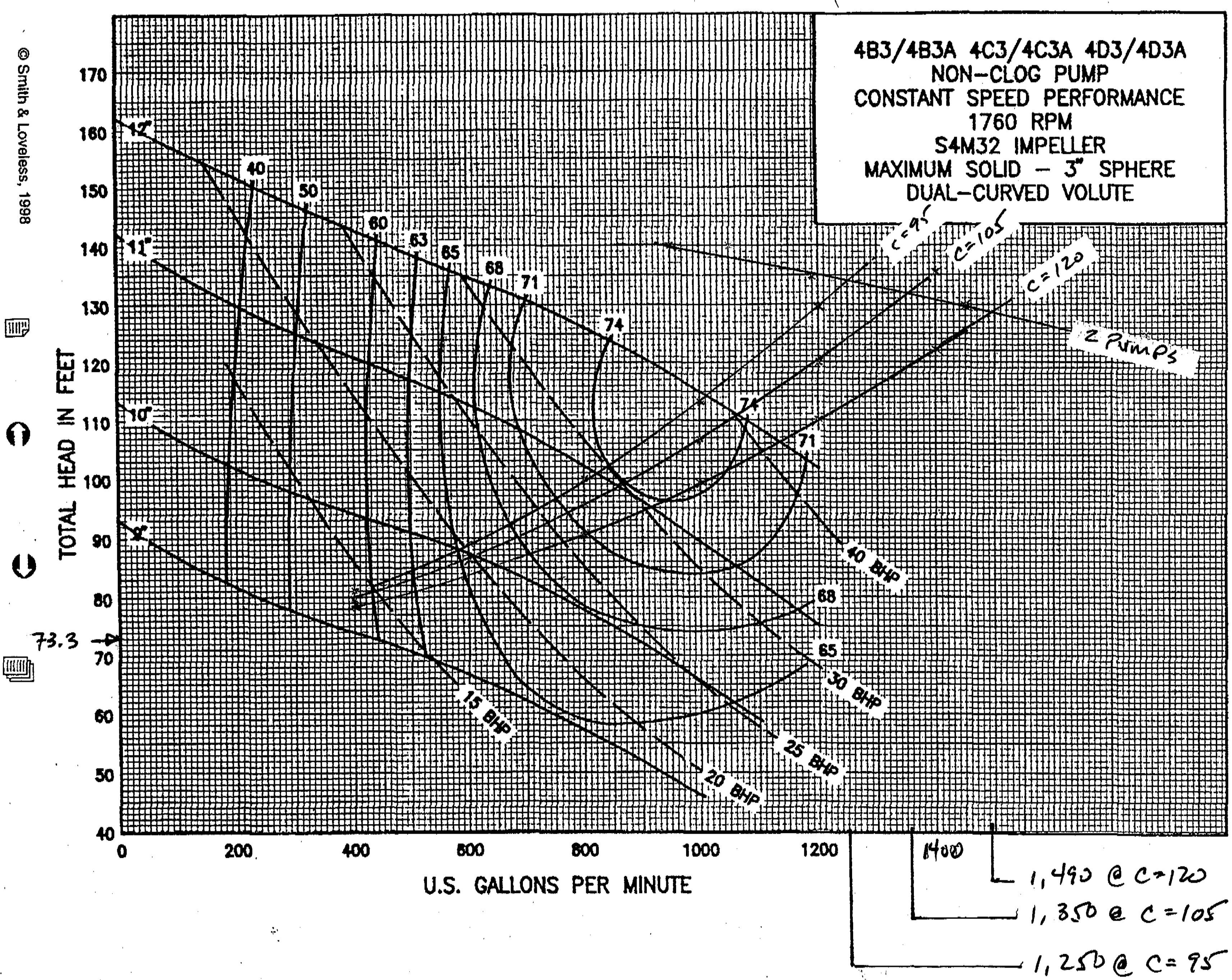
ENGINEERING DATA

Smith & Loveless, Inc.®
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215-1284

Vacuum Primed Pump Performance Curves
Constant Speed
6B3B, 6C3B, 6D3B
Non-Clog Pump
1760 RPM

(3C) LS 1C EXISTING FLOODED SUCTION P.S. + ONE MATCHED SUBMERSIBLE

EX CL. 200 8" PVC & 8" A.C. FORCE MAINS
12" IMPELLER



ENGINEERING DATA

Smith & Loveless, Inc.

14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215

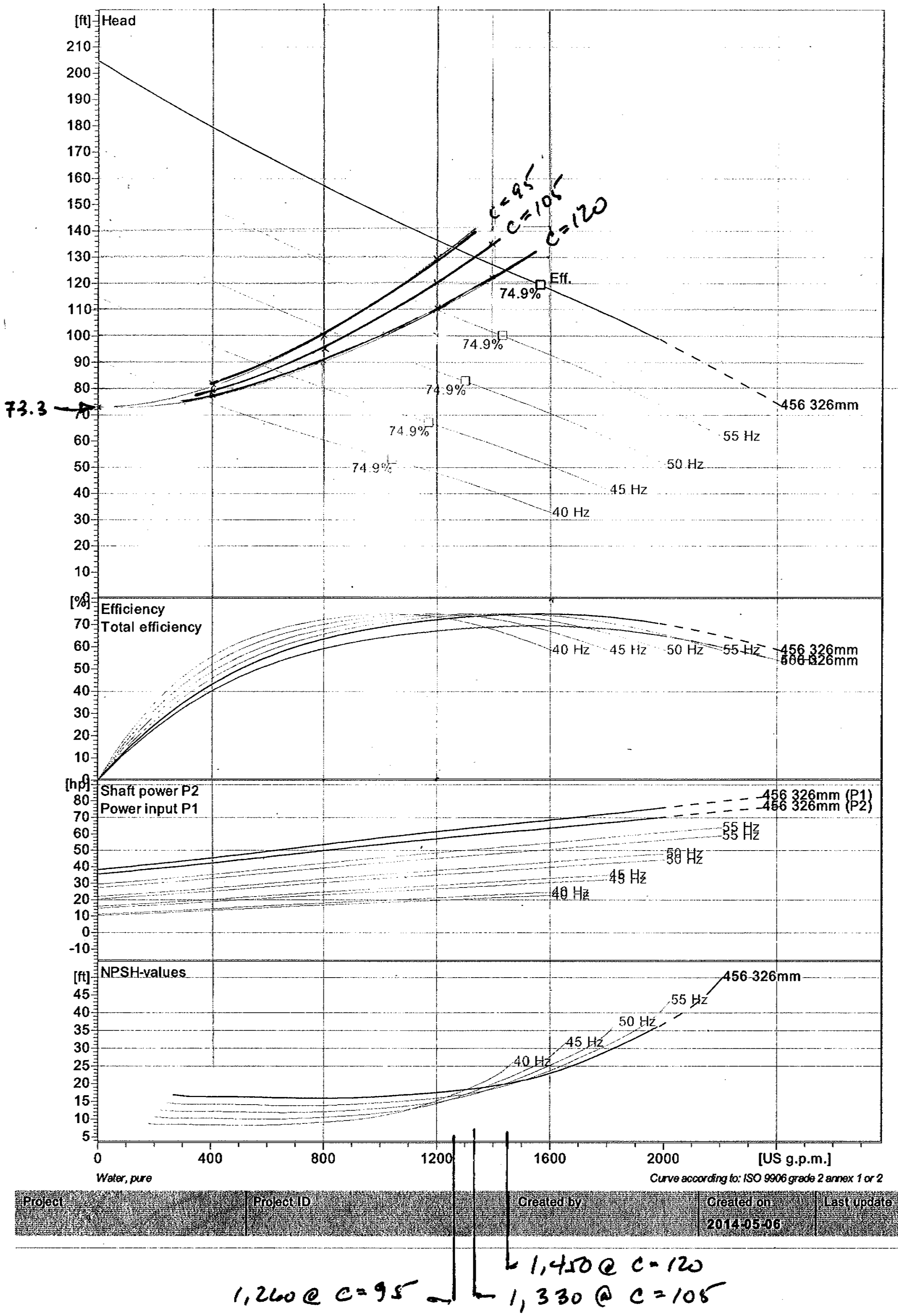
Pump Performance Curves
Constant Speed
4B3/4B3A-4C3/4C3A-4D3/4D3A
1760 RPM
December, 1998

xylem
Let's Solve Water

3D LS 1C NEW DUPLEX SUBMERSIBLE P.S.
EX. CL 200 8" PVC & 8" A.C. FORCEMAINS

NP 3202 HT 3~ 456
VFD Curve

FLYGT



Project	Project ID	Created by	Created on	Last update
			2014-05-06	

Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 • (206) 284–0860

MEMORANDUM

TO:	File
FROM:	Leigh Nelson
DATE:	August 14, 2014
SUBJECT:	Lake Stevens Sewer District, Lift Station at 12300 N Lakeshore Drive

---

On August 11, 2014, the City of Lake Stevens/Lake Stevens Sewer District Utility Committee requested Gray & Osborne has been requested by the Lake Stevens Sewer District to review the feasibility of constructing a new lift station in the vicinity of property that is currently owned by the City of Lake Stevens at 12300 N Lakeshore Drive in Lake Stevens. A portion of flows that are currently tributary to LS 1C would be diverted to the new lift station to reduce the improvements necessary at LS 1C and provide capacity for downtown development.

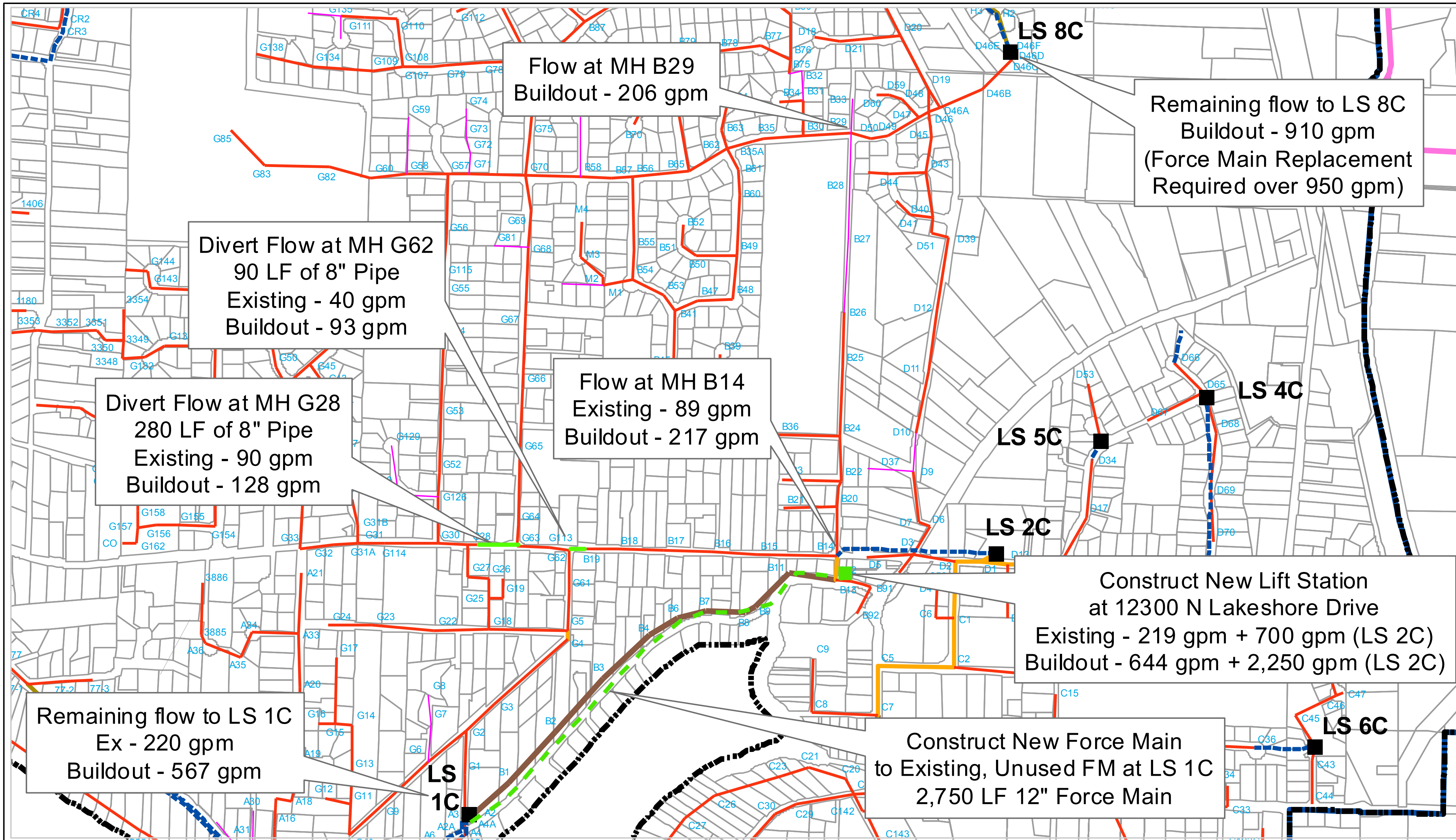
The existing peak flows that could be directed to the new lift station include those from LS 2C and are 919 gpm. An additional 45 gpm are proposed by the Lake View development. Accordingly, the new lift station would be sized to pump a minimum of approximately 1,000 gpm. The lift station would convey flow in a new, 2,750 lineal-foot, 12-inch diameter force main to an existing, surplus 8-inch diameter force main. A total of 370 lineal-feet of 8-inch diameter gravity pipe will be required to be installed in 20th Street NE to divert flows that are currently tributary to LS 1C.

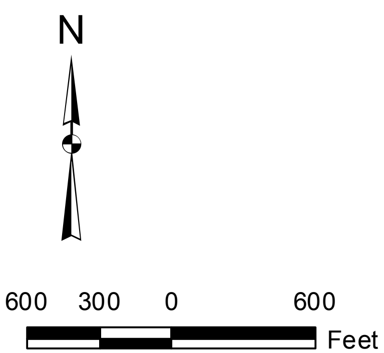
The attached Figure shows the location of the new lift station, force main and gravity main. Also attached are cost estimates for these improvements.

The total estimated cost for these improvements is **$3,090,000** as follows:

- 1,000 gpm lift station - $1,950,000
- 2,750 LF 12-inch force main - $940,000
- 370 LF 8-inch gravity main - $200,000

To be able to provide service to the proposed Lake View development, the entirety of this project will need to be constructed and the existing 8-inch diameter A.C. force main would need to be utilized. A complete discussion of utilization of the existing force main may be found in the Draft Downtown Redevelopment Project Memorandum dated May 9, 2014.





LAKE STEVENS SEWER DISTRICT

DOWNTOWN REDEVELOPMENT
FEASIBILITY STUDY
NEW LIFT STATION
AT 12300 N LAKESHORE DRIVE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\14408 General Engineering 2014\1440804 Downtown Feasibility Study\Alt Location\Figure.mxd

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Lift Station at 12300 N Lakeshore Drive - Lift Station (1,000 gpm)

	Item	Quantity			Unit Cost		Total
1	Mobilization/Demobilization	1	LS	$	118,000	$	118,000
2	Dewatering	1	LS	$	5,000	$	5,000
3	Erosion Control	1	LS	$	5,000	$	5,000
4	Temporary Shoring & Bracing	1	LS	$	25,000	$	25,000
5	Trench Excavation Safety Systems	1	LS	$	2,000	$	2,000
6	Concrete Slabs and Foundations	1	LS	$	25,000	$	25,000
7	Lift Station Site Paving	1	LS	$	20,000	$	20,000
8	Fencing	200	FT	$	50	$	10,000
9	Utilities & Misc. Site Improvements	1	LS	$	10,000	$	10,000
10	Electrical Shelter	1	LS	$	20,000	$	20,000
11	Hoist	1	LS	$	15,000	$	15,000
12	10 ft Dia Wet Well and Inlet MH Structures	1	LS	$	85,000	$	85,000
13	Painting & Dampproofing	1	LS	$	35,000	$	35,000
14	New Submersible Pumps (2x50 hp)	1	LS	$	125,000	$	125,000
15	Valve Vault	1	LS	$	20,000	$	20,000
16	Piping, Valves and Accessories	1	LS	$	45,000	$	45,000
17	175 kWGenerator System	1	LS	$	80,000	$	80,000
18	Generator Building	1	LS	$	70,000	$	70,000
19	Electrical	1	LS	$	240,000	$	240,000
20	Instrumentation & Telemetry	1	LS	$	110,000	$	110,000
21	Utility Service (PUD)	1	LS	$	12,000	$	12,000
22	Programming, Startup, SCADA, Documentation	1	LS	$	20,000	$	20,000
		Subtotal				$	1,097,000
		Contingency (20%)				$	219,400
		Subtotal				$	1,316,400
		Sales Tax (8.5%)				$	111,894
		Total				$	1,428,294
		Total Construction Cost (Rounded)				**$**	**1,500,000**
		All Overhead (30%)				$	450,000
		Total Project Cost (Rounded)				**$**	**1,950,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Lift Station at 12300 N Lakeshore Drive - Force Main

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 59,000	$ 59,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$ 14,000	$ 14,000
3	Environmental Controls	1	LS	$ 6,000	$ 6,000
4	Trench Excavation Safety Systems	1	LS	$ 7,000	$ 7,000
5	Dewatering	1	LS	$ 9,000	$ 9,000
6	Temporary Bypass Pumping	0	LS	$ -	$ -
7	Traffic Control	1	LS	$ 14,000	$ 14,000
8	Locate Existing Utilities	1	LS	$ 5,000	$ 5,000
9	12" Force Main (Including bedding, backfill	2,750	LF	$ 90	$ 247,500
	in ROW	2,750			
	in unimp easmnt	0			
10	Special Excavation of Unsuitable Material	60	CY	$ 40	$ 2,400
11	Connection to Existing Manhole	1	EA	$ 2,500	$ 2,500
12	Foundation Gravel	210	TN	$ 25	$ 5,250
13	Gravel Base	1,700	TN	$ 25	$ 42,500
14	Asphalt Treated Base	310	TN	$ 100	$ 31,000
15	Sawcutting	5,510	LF	$ 4	$ 22,040
16	Hot Mix Asphalt	800	TN	$ 100	$ 80,000
17	Hydroseeding	0	SY	$ 3	$ -

Subtotal	$ 547,190
Contingency (20%)	$ 109,438
Subtotal	$ 656,628
Sales Tax (8.5%)	$ 55,813
Total	$ 712,441
Total Construction Cost (Rounded)	**$ 720,000**
All Overhead (30%)	$ 220,000
Total Project Cost (Rounded)	**$ 940,000**

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Lake Stevens Sewer District
Downtown Redevelopment Feasibility Study
Preliminary Cost Estimate
Lift Station at 12300 N Lakeshore Drive - New Gravity Pipe

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 12,000	$ 12,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$ 3,000	$ 3,000
3	Environmental Controls	1	LS	$ 2,000	$ 2,000
4	Trench Excavation Safety Systems	1	LS	$ 3,000	$ 3,000
5	Dewatering	1	LS	$ 2,000	$ 2,000
6	Temporary Bypass Pumping	0	LS	$ -	$ -
7	Traffic Control	1	LS	$ 2,000	$ 2,000
8	Locate Existing Utilities	1	LS	$ 3,000	$ 3,000
9	8" PVC (Including bedding, backfill)	370	LF	$ 65	$ 24,050
	in ROW	370			
	in unimp easmnt	0			
10	48" Precast Manhole (Basic to 8')	1	EA	$ 4,000	$ 4,000
11	Connection to Existing Manhole	4	EA	$ 2,500	$ 10,000
12	Special Excavation of Unsuitable Material	10	CY	$ 40	$ 400
13	Foundation Gravel	70	TN	$ 25	$ 1,750
14	Gravel Base	900	TN	$ 25	$ 22,500
15	Asphalt Treated Base	60	TN	$ 100	$ 6,000
16	Sawcutting	750	LF	$ 4	$ 3,000
17	Hot Mix Asphalt	110	TN	$ 100	$ 11,000
18	Hydroseeding	0	SY	$ 3	$ -
	Subtotal				$ 109,700
	Contingency (20%)				$ 21,940
	Subtotal				$ 131,640
	Sales Tax (8.5%)				$ 11,189
	Total				$ 142,829
	Total Construction Cost (Rounded)				**$ 150,000**
	All Overhead (30%)				$ 50,000
	Total Project Cost (Rounded)				**$ 200,000**

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

TO:	LAKE STEVENS SEWER DISTRICT
FROM:	BARRY BAKER, P.E. LEIGH NELSON, P.E.
DATE:	SEPTEMBER 11, 2014
SUBJECT:	LIFT STATION AT 12300 NORTH LAKESHORE DRIVE, DOWNTOWN FEASIBILITY STUDY LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON G&O #14408.04

SUMMARY

Gray & Osborne completed a draft Feasibility Study reviewing the improvements needed to provide sewer service for 100 units of a potential project in the vicinity of the City's permit center. Conveying any additional flows from the downtown area of the City of Lake Stevens will require upgrades, replacement, or new lift stations and force mains within the Lift Station 1C, Lift Station 2C, or Lift Station 8C drainage basins. In addition, the gravity conveyance system between the existing discharge of Lift Station 1C and the Vernon Road trunk tributary to Lift Station 15 has limitations for additional future flows. Downstream of the Lift Station 1C force main discharge, the existing 12-inch diameter gravity pipe system in Vernon Road can convey 1,110 gallons per minute (gpm) of flow without surcharging the pipes. If surcharging is allowed, additional capacity could be attained. This memorandum assumes the gravity system could allow 0.5 foot of surcharge. The following table summarizes the projects discussed herein and the additional capacity that the projects provide.

3710 168th Street NE, Building B, Suite 210 Arlington, Washington 98223 (360) 454-5490 Fax (360) 454-5491

TABLE 1

Summary of Scenarios

Scenario	Total Cost	Additional ERUs	Cost/Additional ERU
Scenario A: (new lift station with Lift Station 1C discharging to the existing point in Vernon Road and allowing 0.5 foot of surcharge)	$3,395,000	662	$5,128
Scenario B: (new lift station with Lift Station 1C discharging to new lift station and allowing 0.5 foot of surcharge)	$3,705,000	502	$7,380
Scenario B + Additional Bypass Force Main Along Vernon Road	$4,365,000	1,182	$3,693

The City of Lake Stevens prepared a draft Downtown Framework Plan in 2012 that includes 392 new equivalent residential units (ERUs) within the downtown area. Any of the regional lift station scenarios presented in this memorandum can provide the capacity for the proposed development as well as serve the Downtown Framework Plan, provided other development within the basin does not use the additional capacity. Local improvements, such as gravity systems or improvements/revisions to lift stations, may be required to convey flow to the regional lift station and are not included in this analysis.

BACKGROUND

Gray & Osborne completed a Feasibility Study on May 9, 2014, reviewing the improvements needed to provide sewer service for 100 units of a potential project in the vicinity of the City's permit center. This study included an analysis of constructing a new lift station near property that is currently owned by the City of Lake Stevens at 12300 North Lakeshore Drive. A portion of flows that are currently tributary to Lift Station 1C would be diverted to the new lift station to reduce the improvements necessary at Lift Station 1C and to provide capacity for downtown development.

The District requested a scope for a predesign report on the recommended alternative and a draft was provided to the District on June 10, 2014. At the Joint District/City Utility Committee Meeting on August 11, 2014, the District requested that Gray & Osborne examine the cost and feasibility of a new regional lift station in the vicinity of 23rd and North Lakeshore Drive. Gray & Osborne provided a memorandum on August 13, 2014, responding to the Utility Committee request. At the meeting on August 21, 2014, with the Lake Stevens Sewer District, the City of Lake Stevens, and a potential developer, the City requested additional information concerning a regional lift station that would serve both the current development and future development needs for the downtown area. The City requested to know the number of future connections (ERUs) this regional lift station could provide as well as related costs for the improvements and cost per additional ERU.

All flows discussed below are the peak hour flows, as determined in the Sewer District's 2007 Sanitary Sewer Comprehensive Plan. The peak hour flow is typically used for conveyance system sizing. Throughout the analysis of the following scenarios, it is assumed that each ERU is 0.5 gpm.

Downstream of the Lift Station 1C force main discharge, the existing 12-inch diameter gravity pipe system in Vernon Road can convey 1,110 gpm of flow without surcharging the pipes. Table 1 shows the surcharge that would result within the gravity conveyance system (at Sanitary Sewer Manhole (SSMH) 79 along Vernon Road) at various flows.

TABLE 2

Depth of Surcharge at SSMH 79 in Vernon Road

Total Flow (gpm)	Surcharge (ft)
1,110	0
1,250	0.27
1,390	0.50
1,470	1.0
1,615	2.0
1,680	3.0

It has been a policy of the District that surcharge within the gravity sewer conveyance system not be permitted.

If the Lift Station 1C force main was extended 1,660 feet to the west to bypass this area of low capacity, the gravity conveyance system would have the capacity to convey 2,600 gpm. The cost of this project is approximately $660,000.

PHASE 1

As a first phase, construction of the lift station to accommodate upcoming projects, the proposed regional station, could convey flow through 2,750 linear feet of a new 15-inch diameter force main to an existing, surplus 8-inch diameter asbestos-cement force main used at Lift Station 1C. The maximum recommended velocity through a force main is 8 feet per second (fps). The flow capacity through an 8-inch diameter force main at a velocity of 8 fps is 1,250 gpm. A complete discussion of utilization of the existing force main may be found in the draft Downtown Redevelopment Project Memorandum dated May 9, 2014.

In addition to construction of the new station, a total of 370 linear feet of 8-inch diameter gravity pipe will be required to be installed in 20th Street NE to divert flows that are currently tributary to Lift Station 1C.

The following scenarios will be considered for the first phase of the new lift station. The existing sewer flows that would be pumped in each scenario are listed:

- **Scenario A (Lift Station 1C Discharge Remains Unchanged) –** Divert 219 gpm from the Lift Station 1C basin and 700 gpm from Lift Station 2C to the new lift station (919 gpm total existing flow); install 2,750 linear feet of 15-inch diameter force main between the new station and the existing 8-inch asbestos-cement force main at Lift Station 1C.

- **Scenario B (Lift Station 1C Diverted to New Lift Station) –** Divert 219 gpm from the Lift Station 1C basin, 220 gpm from Lift Station 1C, and 700 gpm from Lift Station 2C to the new lift station (1,139 gpm total existing flow); install 2,750 linear feet of both 6-inch diameter and 15-inch diameter force main between Lift Station 1C and the new lift station.

It is assumed that the first phase of construction would include one of the new lift station's two 12-foot diameter wet wells that will be required for buildout flows. This wet well would allow the station to have a capacity of up to approximately 1,730 gpm before the second wet well would be required.

Scenario A

Under this scenario, the existing, 8-inch diameter surplus asbestos-cement force main from Lift Station 1C would be used to pump flow from the new lift station via connection with the new station's 15-inch force main. The existing flows to Lift Station 1C could be decreased to 220 gpm (the existing tributary flow). Lift Station 1C will continue to discharge to the existing discharge location at SSMH 79 along Vernon Road.

If the new lift station was sized to pump the maximum allowable flow through the 8-inch diameter force main (1,250 gpm), the total flow in the downstream gravity conveyance system if Lift Station 1C was downgraded to 220 gpm would be 1,470 gpm (1,250 gpm plus 220 gpm). Per Table 2, this would result in 0.66 foot of surcharge in the downstream gravity conveyance system.

The projects required for Scenario A include the following:

- Construction of a New Lift Station (1,250 gpm capacity, 12-foot diameter wet well, and two 130-horsepower pumps) – $2,100,000
- Install 2,750 Linear Feet of 15-Inch Diameter Force Main from New Station to Lift Station 1C – $1,090,000
- Divert Flows from Lift Station 1C via New Gravity Mains – $200,000
- New Radiator for Lift Station 1C Generator – $5,000

The capacity above the existing tributary flow to the new station is 331 gpm (1,250 gpm force main capacity minus 991 gpm of existing flow to the station). This extra capacity equates to 662 ERUs (331 gpm times 1 ERU per 0.5 gpm).

Scenario B

Under this scenario, both existing 8-inch diameter force mains at Lift Station 1C would be used to pump flow from the new lift station. A new 6-inch diameter force main to convey flow from Lift Station 1C to the new lift station will be installed in the same trench as the new 15-inch diameter force main that would convey flow from the new station toward the existing force mains at Lift Station 1C.

If the new lift station was sized to pump the maximum recommended flow through the two existing 8-inch diameter force mains of 2,500 gpm, flooding would occur in the downstream gravity conveyance system.

If the new lift station was sized to pump 1,390 gpm, Table 2 shows that 0.5 foot of surcharge would result in the gravity conveyance system. The maximum water surface at SSMH 79 would be approximately 7.5 feet below the ground surface elevation of Vernon Road.

The projects required for this scenario include the following:

- Construction of a New Lift Station (1,390 gpm, 12-foot diameter wet well, and two 85-horsepower pumps) – $2,000,000

- Install 2,750 Linear Feet of 15-Inch Diameter and Parallel 6-Inch Diameter Force Mains – $1,400,000

- New Submersible Pump Package at Lift Station 1C – $100,000

- Divert Flows from Lift Station 1C via New Gravity Mains – $200,000

- New Radiator for Lift Station 1C Generator – $5,000

The capacity above the existing tributary flow is 251 gpm (1,390 gpm of lift station capacity minus 1,139 gpm flow to the station). This extra capacity equates to 502 ERUs (251 gpm times 1 ERU per 0.5 gpm).

If the additional 1,660 feet of force main were installed past the low-capacity point in Vernon Road, the capacity of the new lift station could be increased to approximately 1,730 gpm before a new wet well would need to be installed.

Buildout Condition

Under the Buildout Condition, it is assumed that 3,461 gpm would be directed to the new lift station, which includes the following flows:

- 567 gpm from Lift Station 1C
- 2,250 gpm from Lift Station 2C
- 438 gpm from the area currently tributary to Lift Station 1C
- 206 gpm from the area currently tributary to Lift Station 8C

The following projects would be required in order to complete this project:

- Install 8,150 linear feet of 15-inch diameter force main from the new lift station site to approximately 300 feet south of the intersection of Vernon Road and Lundeen Parkway.

- Construct a new submersible lift station with three 160-horsepower pumps.

- Provide 694 cubic feet of wet well storage – two 12-foot diameter wet wells (assuming 6 minutes between pump starts and approximately 3 feet of operating depth in the wet well).

DOWNTOWN FRAMEWORK PLAN

The City of Lake Stevens prepared a Downtown Framework Plan in 2012.
Gray & Osborne prepared a Technical Memorandum dated January 16, 2013, to evaluate the sewer flows based on the City's Downtown Framework Plan. Those flows equate to 392 new ERUs within the downtown area as outlined in Table 3 below.

TABLE 3

Downtown Framework 2010 to 2030 New Development

	Retail	**Office/ Employment**	**Housing**	**Public**	**Total**
Gross Building Area (sf)	15,000	50,000	360,000	40,000	**465,000**
sf/ERU	3,394	3,394	1,000	3,394	
ERUs	5	15	360	12	**392**

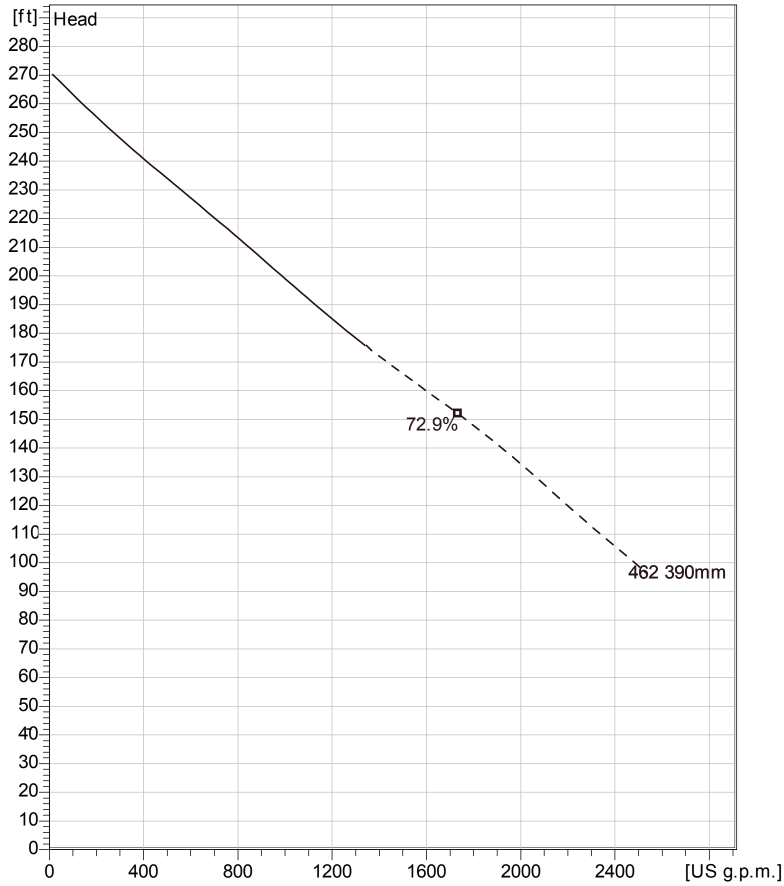
These areas in the Downtown Framework Plan are significantly smaller than the overall drainage basins that drain to Lift Stations 1C, 2C, and 8C; therefore, the timing of the development will affect whether capacity is available at the time of connection.

APPENDIX B

DESIGN CRITERIA

NP 3301 HT 3~ 462

Technical specification



Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

Installation: P - Semi permanent, Wet

Note: Picture might not correspond to the current configuration.

General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Hard-Iron ™
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	150 mm
Impeller diameter	390 mm
Number of blades	2

Motor

Motor #	N3301.095 35-25-4AA-W 85hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	85 hp
Rated current	101 A
Starting current	490 A
Rated speed	1775 rpm
Power factor	
1/1 Load	0.85
3/4 Load	0.82
1/2 Load	0.74
Efficiency	
1/1 Load	92.5 %
3/4 Load	93.5 %
1/2 Load	93.5 %

Configuration

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

xylem
Let's Solve Water

NP 3301 HT 3~ 462

Performance curve

FLYGT

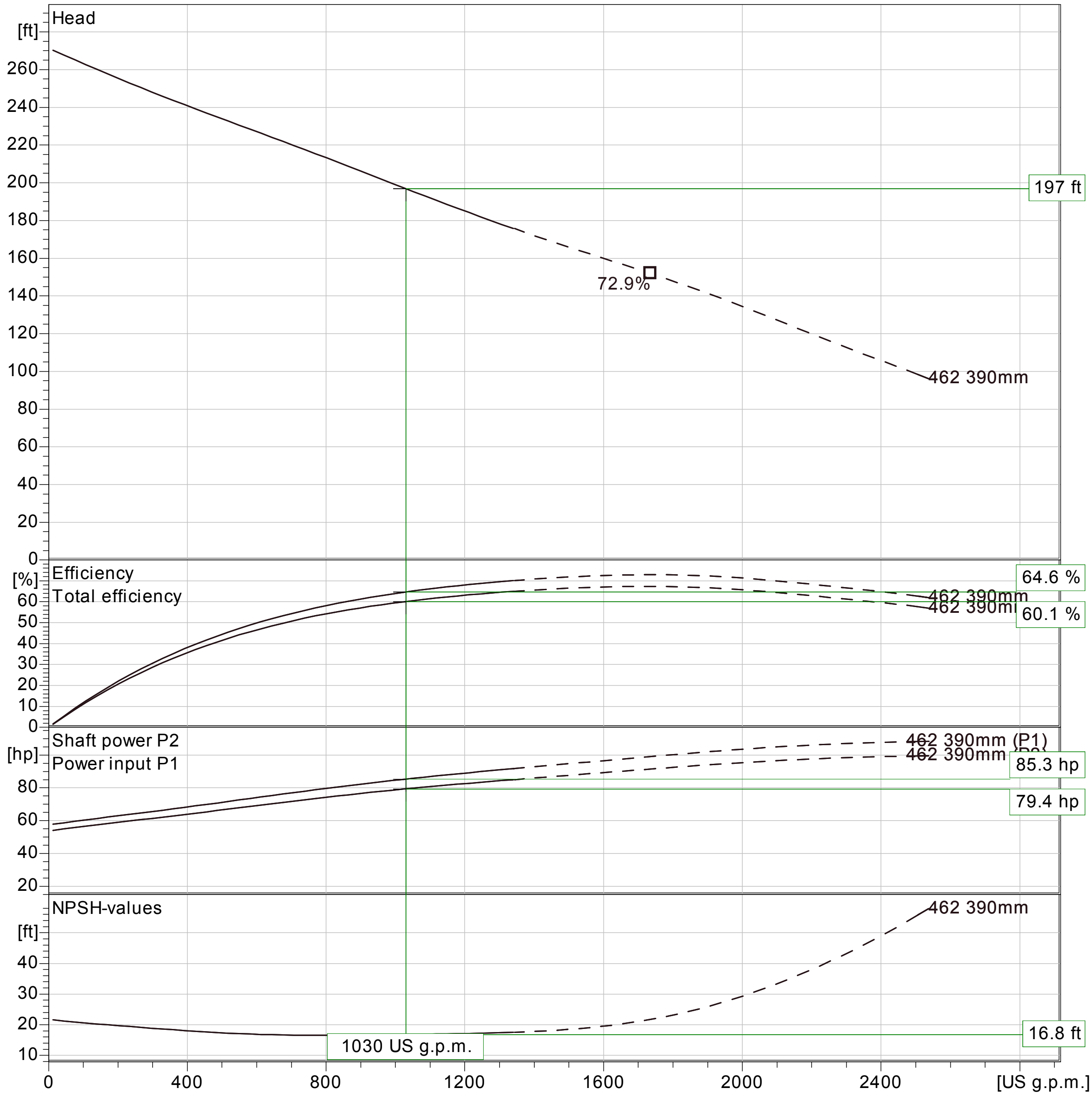
Pump

Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	150 mm
Impeller diameter	15 3/8"
Number of blades	2

Motor

Motor #	N3301.095 35-25-4AA-W 85hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	85 hp
Rated current	101 A
Starting current	490 A
Rated speed	1775 rpm

Power factor	
1/1 Load	0.85
3/4 Load	0.82
1/2 Load	0.74
Efficiency	
1/1 Load	92.5 %
3/4 Load	93.5 %
1/2 Load	93.5 %

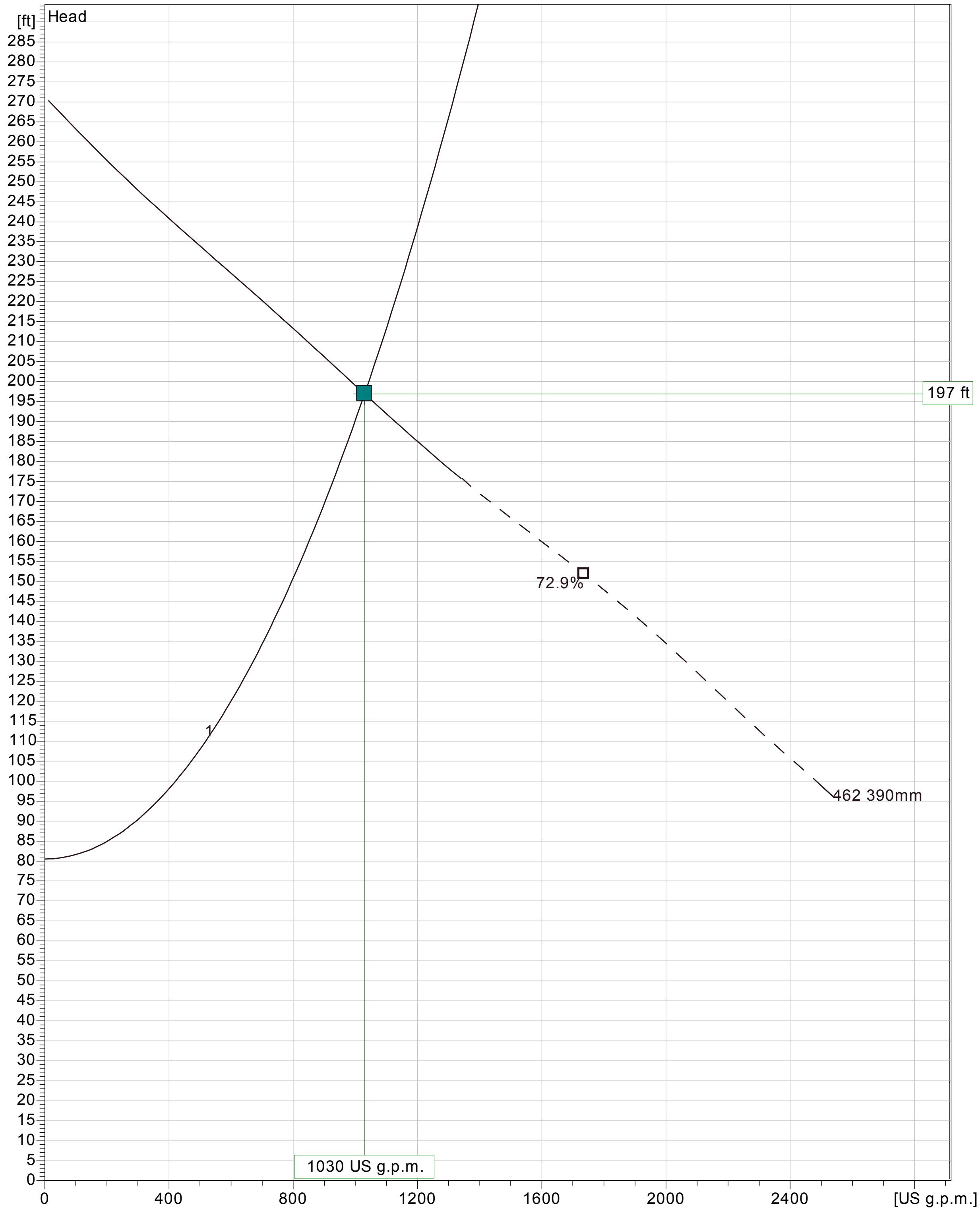


Water, pure *Curve according to: ISO 9906 grade 2 annex 1 or 2*

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

NP 3301 HT 3~ 462

Duty Analysis



Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

	Individual pump			Total					
Pumps running /System	**Flow**	**Head**	**Shaft power**	**Flow**	**Head**	**Shaft power**	**Pump eff.**	**Specific energy**	**NPSHre**
1	1030 US g.p.m.	197 ft	79.4 hp	1030 US g.p.m.	197 ft	79.4 hp	64.7 %	1030 kWh/US MG	16.8 ft

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

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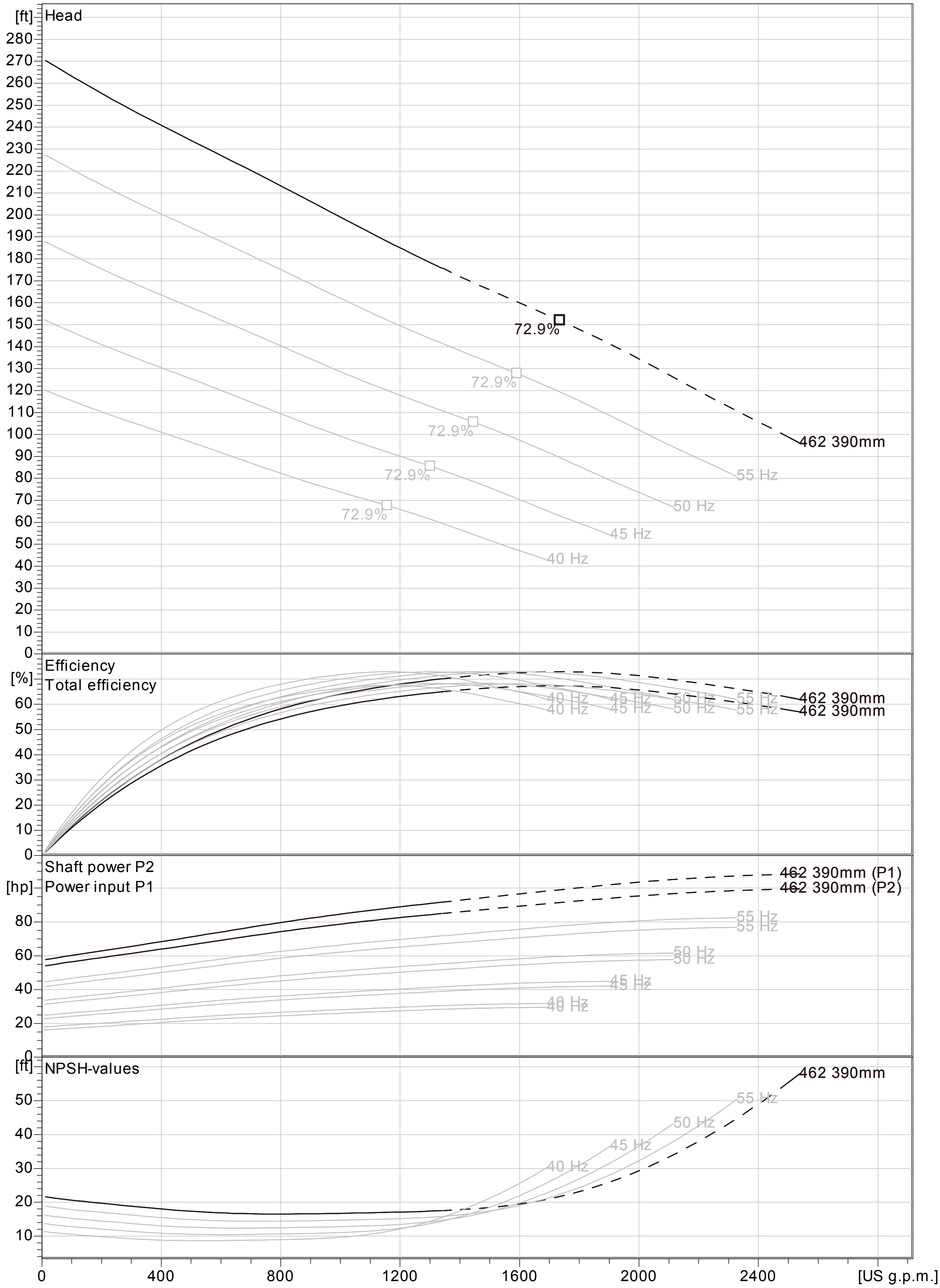
NP 3301 HT 3~ 462

VFD Curve

FLYGT



Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

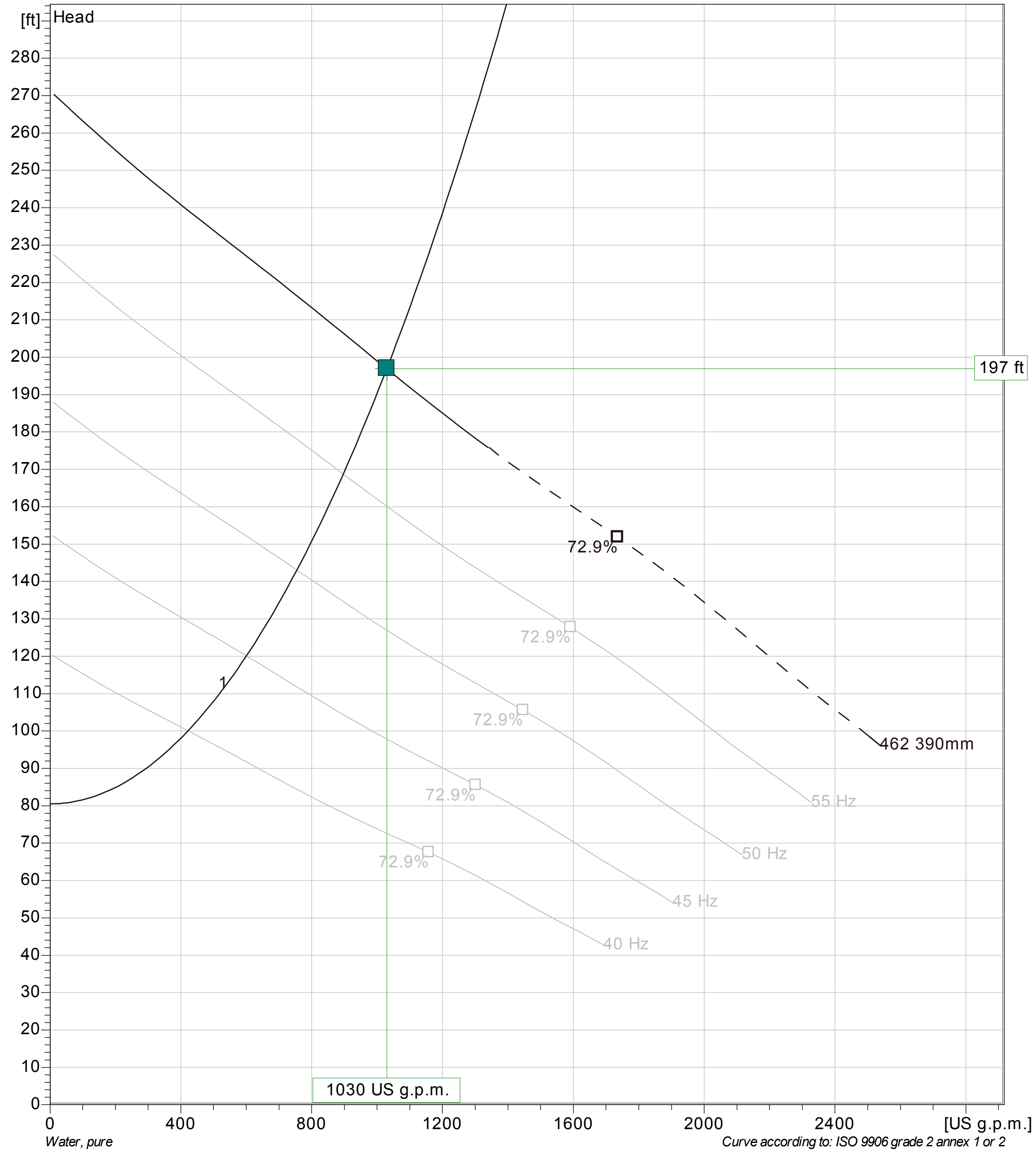
Project	Project ID	Created by	Created on	Last update
			2015-04-17	

xylem
Let's Solve Water

NP 3301 HT 3~ 462

VFD Analysis

FLYGT



	Individual pump				Total					
Pumps running /System	**Frequency**	**Flow**	**Head**	**Shaft power**	**Flow**	**Head**	**Shaft power**	**Hyd eff.**	**Specific energy**	**NPSHre**
1	60 Hz	1030 US g.p.m.	197 ft	79.4 hp	1030 US g.p.m.	197 ft	79.4 hp	64.7 %	1030 kWh/US MG	16.8 ft
1	55 Hz	897 US g.p.m.	169 ft	60.4 hp	897 US g.p.m.	169 ft	60.4 hp	63.4 %	894 kWh/US MG	14.5 ft
1	50 Hz	755 US g.p.m.	143 ft	44.5 hp	755 US g.p.m.	143 ft	44.5 hp	61.5 %	781 kWh/US MG	12.4 ft
1	45 Hz	600 US g.p.m.	120 ft	31.4 hp	600 US g.p.m.	120 ft	31.4 hp	58.2 %	697 kWh/US MG	10.4 ft
1	40 Hz	422 US g.p.m.	100 ft	20.8 hp	422 US g.p.m.	100 ft	20.8 hp	51.4 %	671 kWh/US MG	8.77 ft

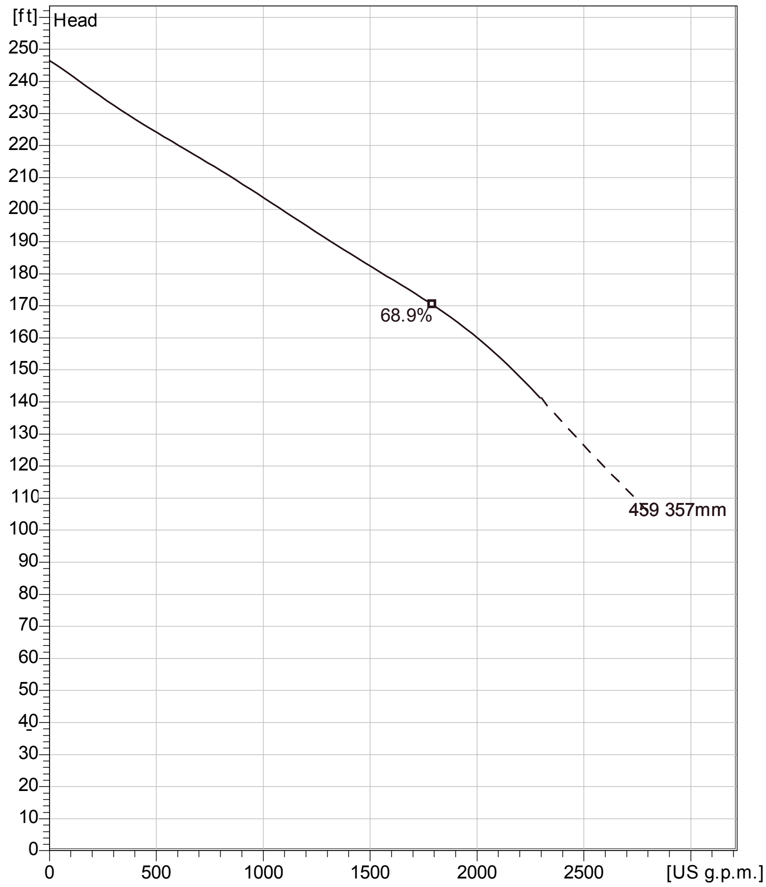
NP 3301 HT 3~ 462

Dimensional drawing

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

NP 3315 HT 3~ 459

Technical specification



Water, pure *Curve according to: ISO 9906 grade 2 annex 1 or 2*

Note: Picture might not correspond to the current configuration.

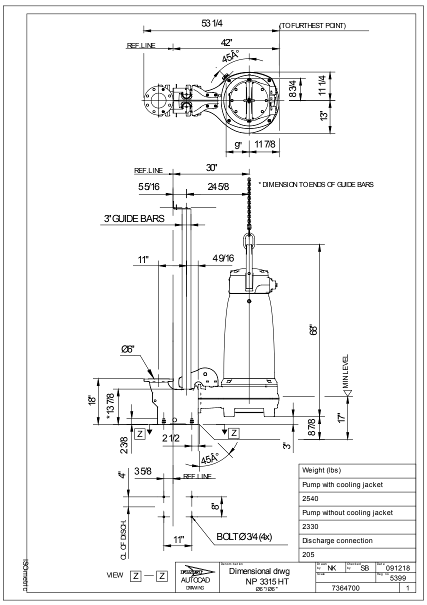
General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Hard-Iron ™
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	150 mm
Impeller diameter	357 mm
Number of blades	3

Installation: P - Semi permanent, Wet



Motor

Motor #	N3315.095 35-35-4AA-W 130hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	130 hp
Rated current	147 A
Starting current	820 A
Rated speed	1775 rpm
Power factor	
1/1 Load	0.88
3/4 Load	0.86
1/2 Load	0.79
Efficiency	
1/1 Load	93.9 %
3/4 Load	94.7 %
1/2 Load	95.1 %

Configuration

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

xylem
Let's Solve Water

NP 3315 HT 3~ 459

Performance curve

FLYGT

Pump

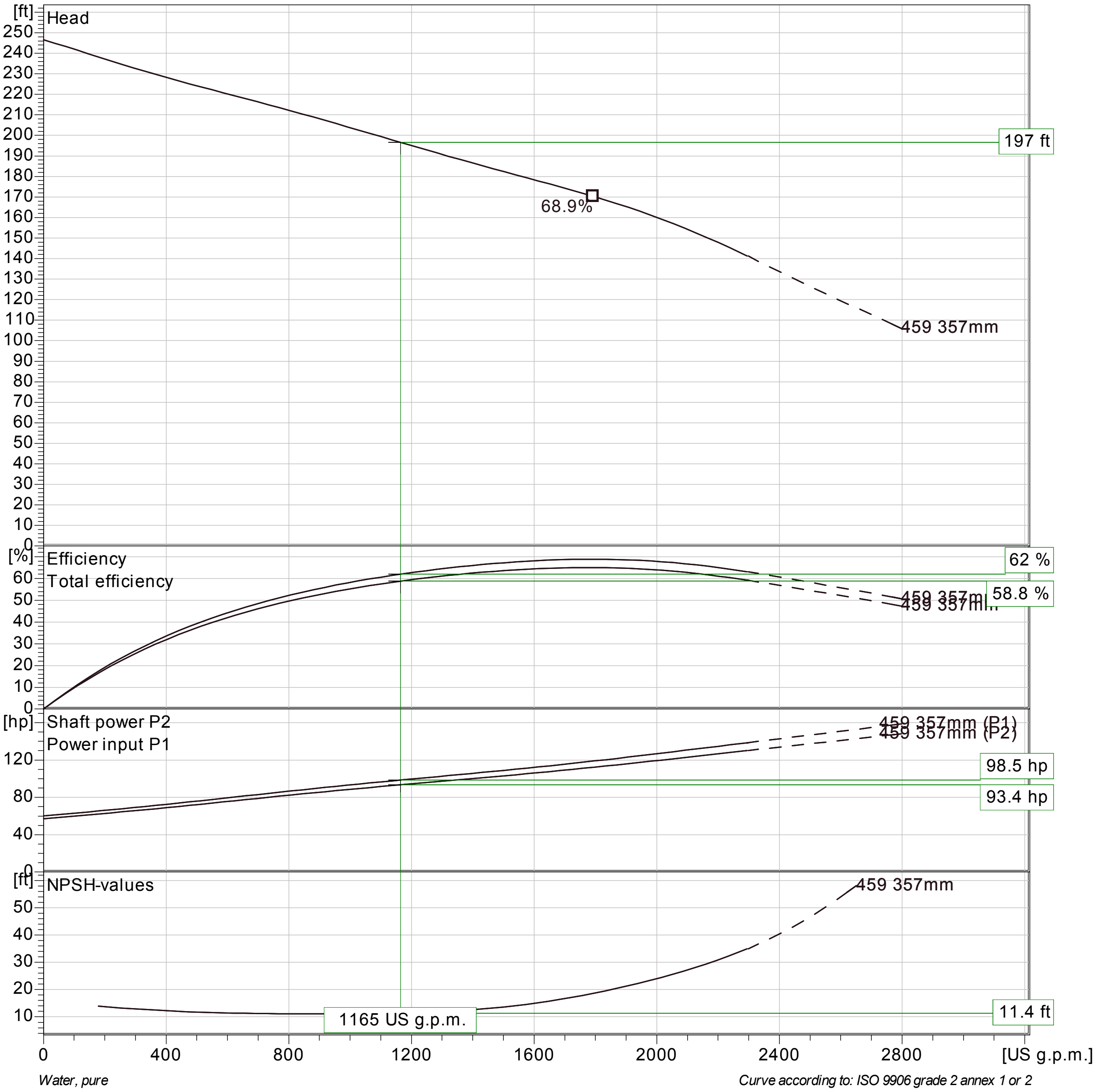
Discharge Flange Diameter	5 7/8 inch
Suction Flange Diameter	150 mm
Impeller diameter	14 1/16"
Number of blades	3

Motor

Motor #	N3315.095 35-35-4AA-W 130hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	130 hp
Rated current	147 A
Starting current	820 A
Rated speed	1775 rpm

Power factor	
1/1 Load	0.88
3/4 Load	0.86
1/2 Load	0.79

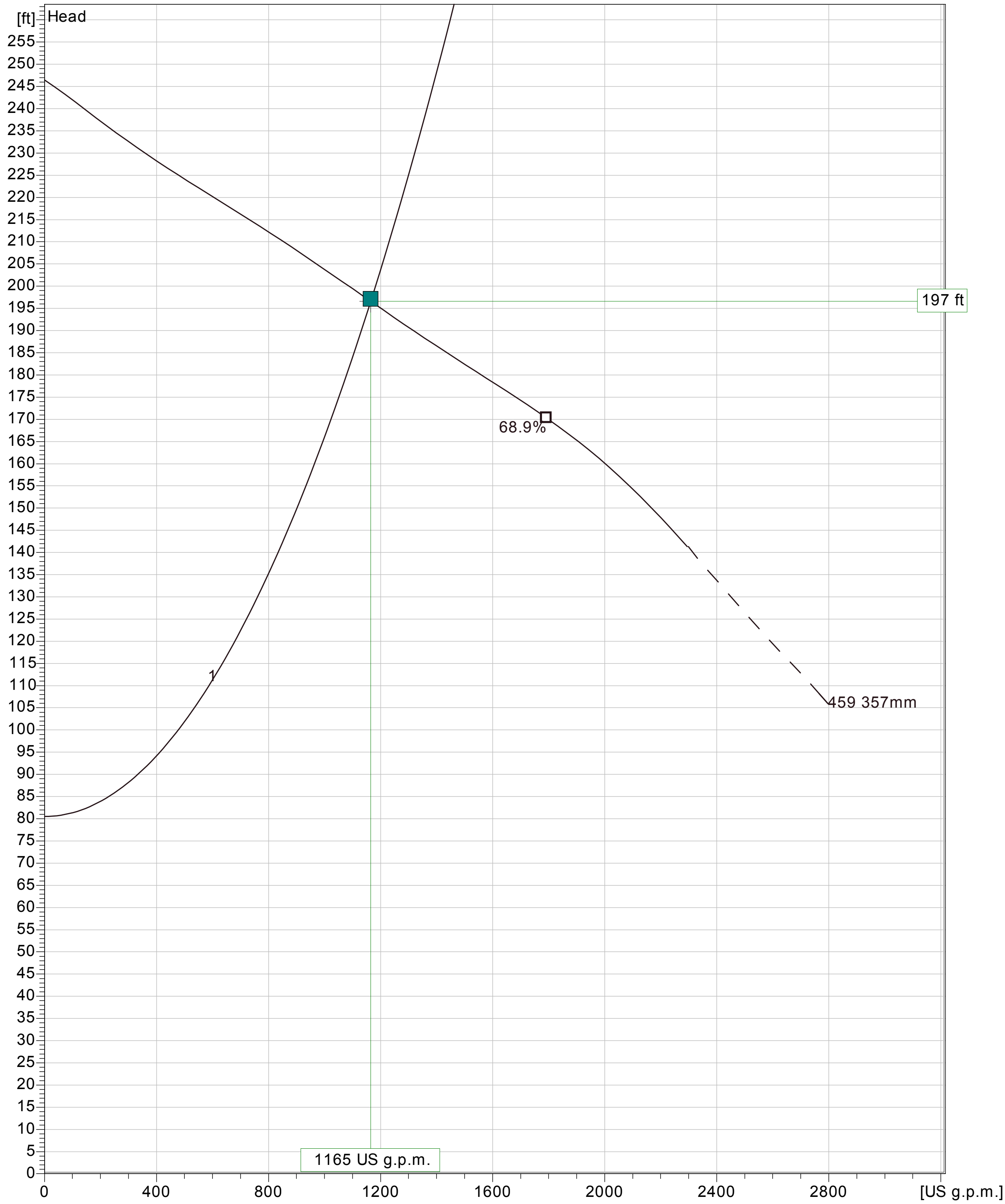
Efficiency	
1/1 Load	93.9 %
3/4 Load	94.7 %
1/2 Load	95.1 %



Project	Project ID	Created by	Created on	Last update
			2015-04-17	

NP 3315 HT 3~ 459

Duty Analysis



Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

Pumps running /System	Individual pump Flow	Head	Shaft power	Total Flow	Head	Shaft power	Pump eff.	Specific energy	NPSHre
1	1160 US g.p.m.	197 ft	93.4 hp	1160 US g.p.m.	197 ft	93.4 hp	62 %	1050 kWh/US MG	11.4 ft

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

xylem
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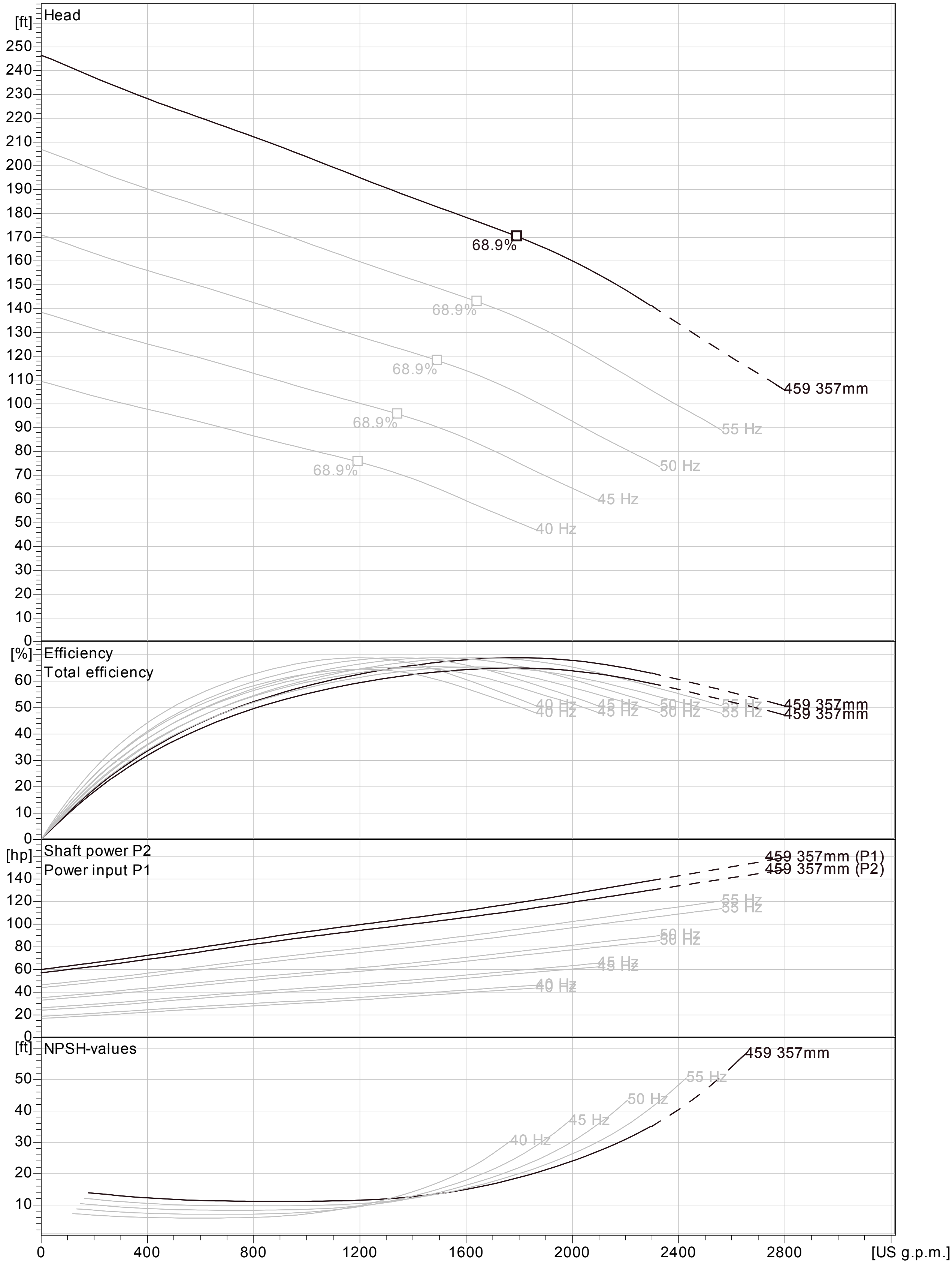
NP 3315 HT 3~ 459

VFD Curve

FLYGT



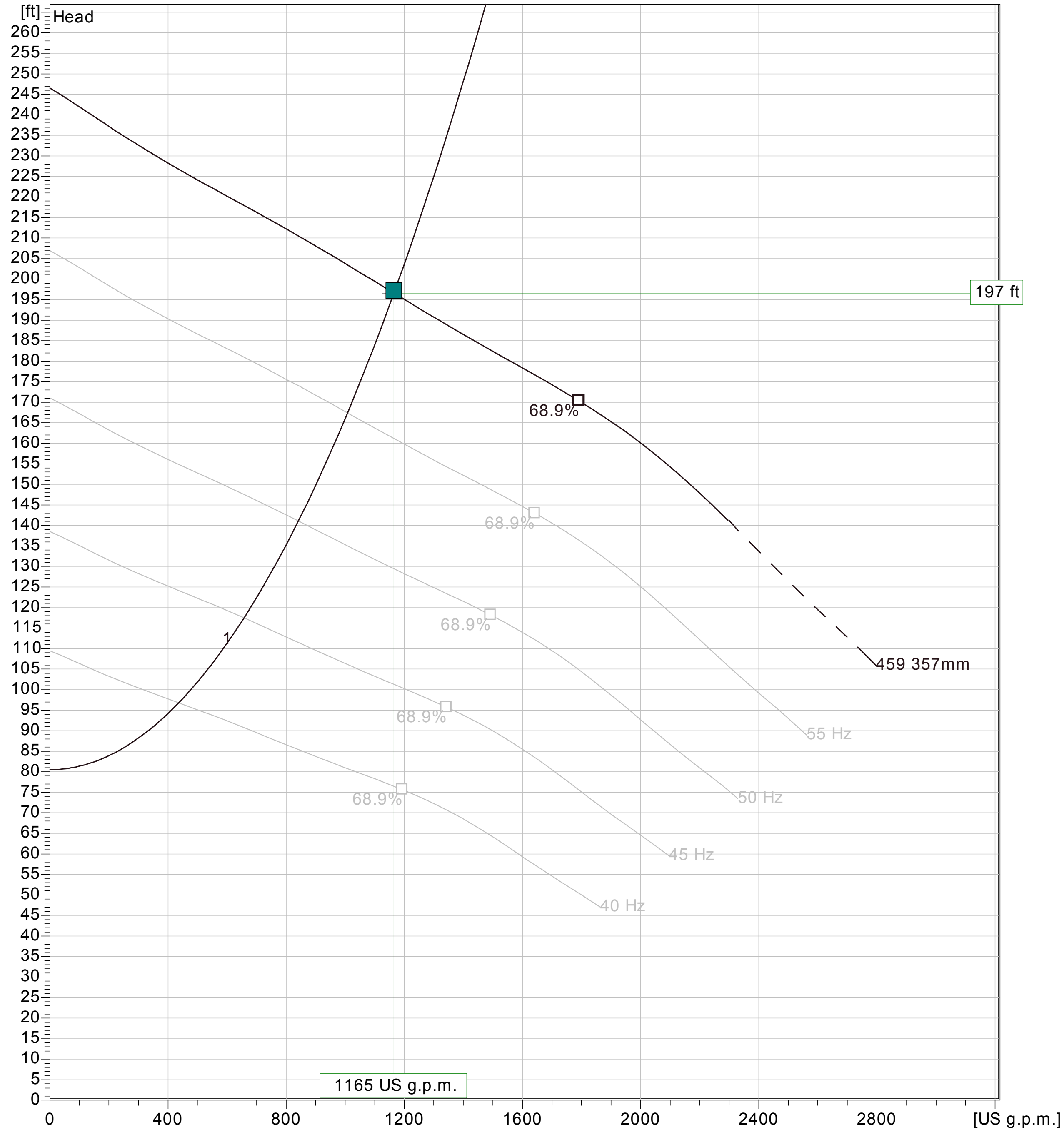
Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

NP 3315 HT 3~ 459

VFD Analysis



Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

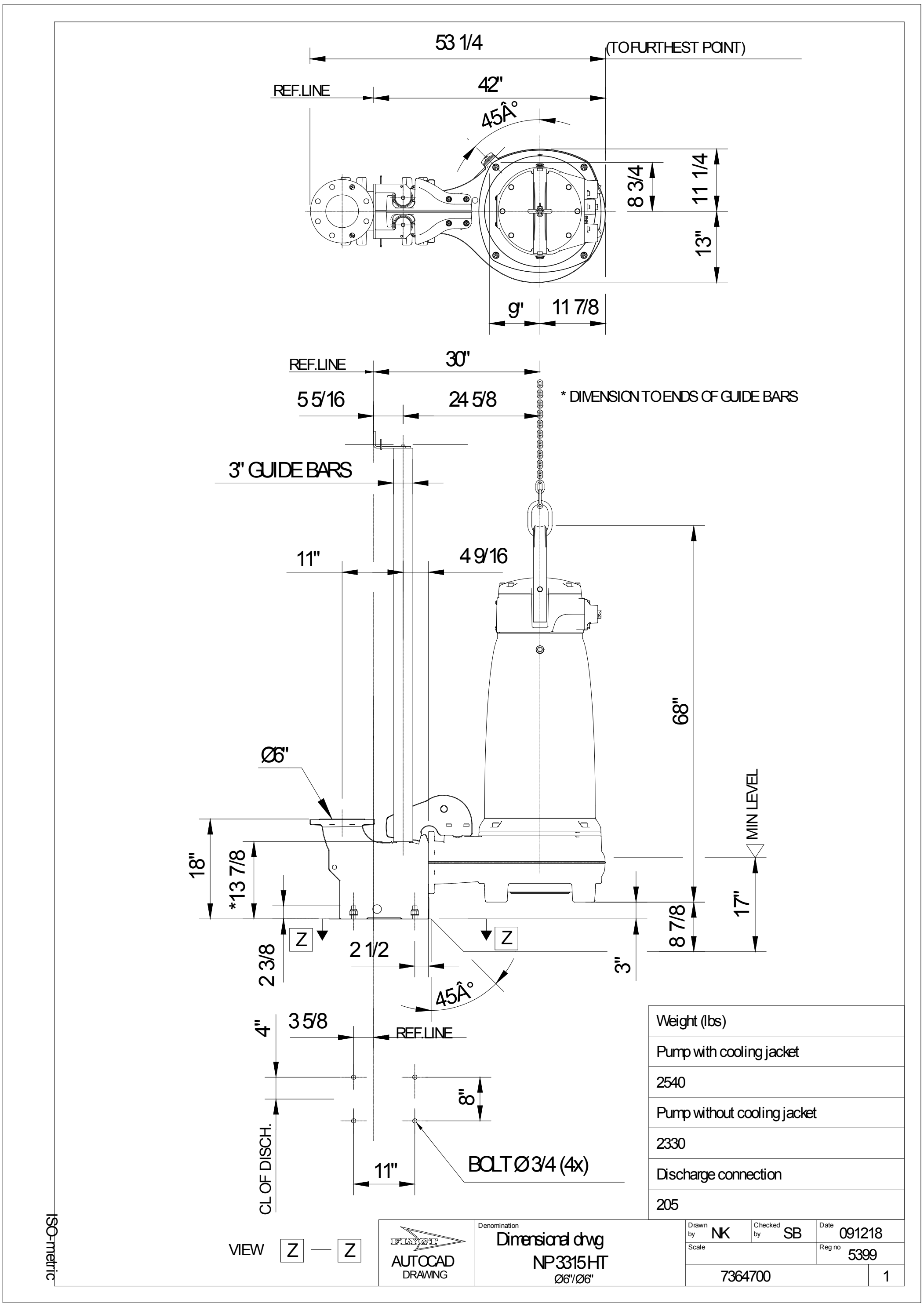
Pumps running /System	Individual pump Frequency	Flow	Head	Shaft power	Total Flow	Head	Shaft power	Hyd eff.	Specific energy	NPSHre
1	60 Hz	1160 US g.p.m.	197 ft	93.4 hp	1160 US g.p.m.	197 ft	93.4 hp	62 %	1050 kWh/US MG	11.4 ft
1	55 Hz	1010 US g.p.m.	167 ft	70.4 hp	1010 US g.p.m.	167 ft	70.4 hp	60.6 %	913 kWh/US MG	9.79 ft
1	50 Hz	842 US g.p.m.	141 ft	51.4 hp	842 US g.p.m.	141 ft	51.4 hp	58.5 %	799 kWh/US MG	8.33 ft
1	45 Hz	657 US g.p.m.	117 ft	35.7 hp	657 US g.p.m.	117 ft	35.7 hp	54.7 %	718 kWh/US MG	7.01 ft
1	40 Hz	437 US g.p.m.	96.8 ft	22.9 hp	437 US g.p.m.	96.8 ft	22.9 hp	46.7 %	711 kWh/US MG	5.91 ft

Project	Project ID	Created by	Created on	Last update
			2015-04-17	

xylem
Let's Solve Water

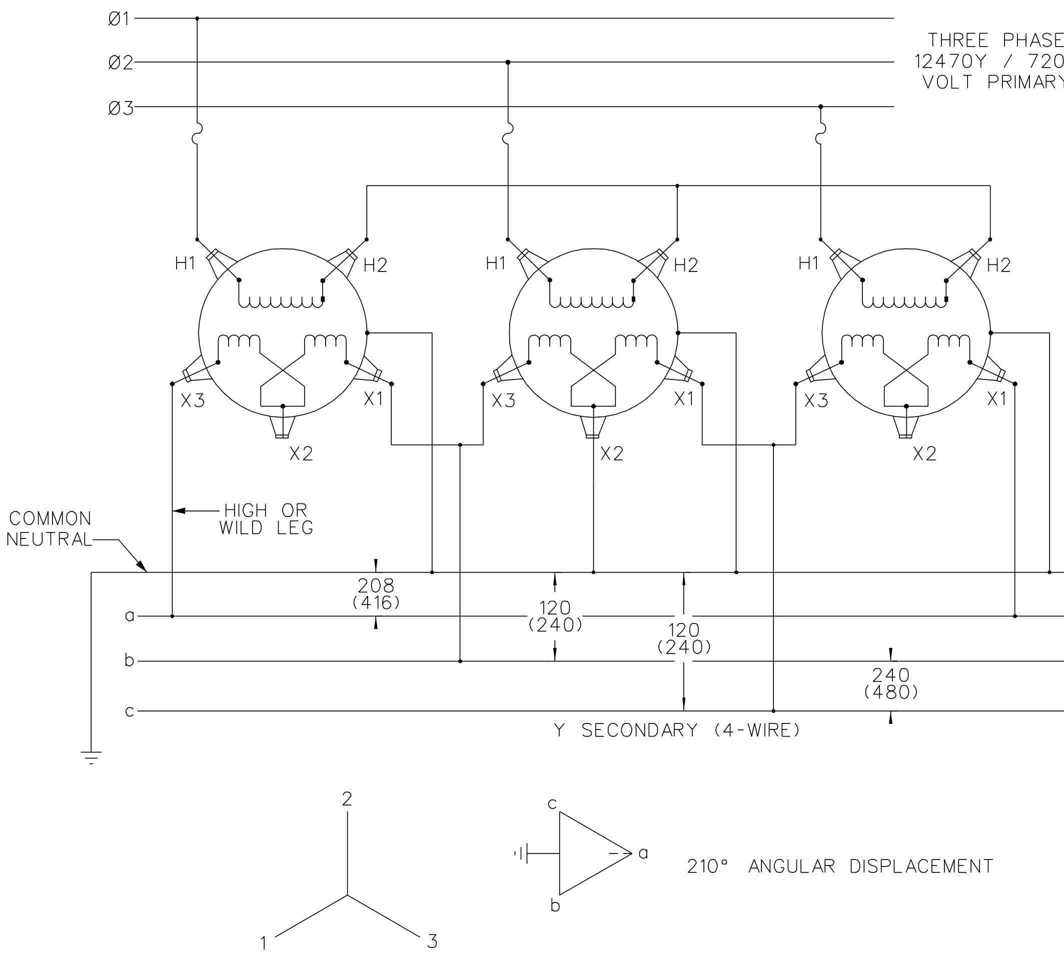
NP 3315 HT 3~ 459
Dimensional drawing

FLYGT



Project	Project ID	Created by	Created on	Last update
			2015-04-17	

Three Phase Wye - Delta for 4-Wire 240 (480) Volt Service



Notes:

1. Refer to Assembly Units 12F603, 12F604, 12F606, 12F621 and 12F631 for pole mounting details.
2. Refer to T&D Guideline 4-11-3.0 for overhead transformer fusing.
3. Refer to T&D Guideline 4-13-11.1 for sizing secondary lead conductors.
4. Mark high (wild) leg with orange tape (Cat. ID 819261) at any point where a connection is made if the neutral conductor is also present. The high leg is reserved for three-phase load only and cannot be used to supply 120/240 volt single phase load.

Where Used:

To supply single-phase 120/240 (240/480) volt and three-phase 240 (480) volt loads. No excessive circulating currents when transformers of unequal impedance and ratio are banked. No problem from third harmonic overvoltage or telephone interference. This standard is for maintenance only and should not be used for new construction.

Bank Rating:

The transformer with the midtap carries 2/3 of the 120/240 (240/480) volt single-phase load and 1/3 of the 240 (480) volt, three-phase load. The other units each carry 1/3 of both the single-phase and three-phase loads.

Caution:

1. The secondary neutral bushing can be grounded only on one of the three transformers.
2. Do not ground primary neutral conections. Fuse blowing and transformer overload may result from system unbalance or fault conditions.
3. Lighting transformer size must not exceed twice the power transformer size in order to prevent over-loading the power transformers.

ELECTRICAL LOAD STUDY REPORT

Title: 85 HP Load Study

Client:	Lake Stevens Sewer District	Job Number:	**14408**
Job Title:	Lift Station 2C Upgrade		

For this Load Study, Calculations for Ampacity are Based on a Bus Configuration of 460 Volts, 3 Phase

	Base Loading Calculations							
Total Connected Load:	176.3	kVA	221.3	Amps			
Peak Demand Loading:	173.3	kVA	217.5	Amps	25% of Largest Motor:	20.2 kVA	25.3 Amps
Anticipated Average Loading:	176.3	kVA	221.3	Amps			
Min. Feeder Ampacity:	243	Amps	*(Peak Demand + 25% of Largest Motor)*				
System Sized Selected at:	**400.0**	**Amps**	318.7	Equivalent kVA at 460 Volts, 3 Phase			

Bus-Connected Loads

	Load Calculations						
	Connected		Anticipated Average		Peak Demand		
Description	**HP**	**kVA**	**Usage**	**kVA**	**Usage**	**kVA**	**Notes:**
[01 MTR 01A], Motor, Pump No. 1 (85 HP Option)	85	80.7	100%	80.7	100%	80.7	VFD 6PLS
[01 MTR 02A], Motor, Pump No. 2 (85 HP Option)	85	80.7	100%	80.7	100%	80.7	VFD 6PLS
2 Motors, Load Total:	**170**	**161.3**		**161.3**		**161.3**	
[01 XFMR 01], Transformer, LV, 15 kVA, 480 - 208/120 V, 3 PH	Z	15.0	100%	15.0	80%	12.0	
1 Non-Motor Load, Load Total:		**15.0**		**15.0**		**12.0**	

* Value Includes Spare Design Capacity Adjustment.

ELECTRICAL LOAD STUDY REPORT

Title: 85 HP Load Study

System Load Summary

(Calculations based on 460 V) *D.F. = % Demand Factor*

Load Description	Connected Loads			Utility Load Demand		Generator Loads	
	STARTER	HP	kVA	D.F.	kVA	D.F.	kVA
[01 MTR 01A], Motor, Pump No. 1 (85 HP Option)	VFD 6PLS	85.0	80.7	100	80.7	100	80.7
[01 MTR 02A], Motor, Pump No. 2 (85 HP Option)	VFD 6PLS	85.0	80.7	100	80.7	0	0.0
[01 XFMR 01], Transformer, LV, 15 kVA, 480 - 208/120 V,			15.0	80	12.0	80	12.0
Total kVA:			176.3		173.3		92.7
Resulting Ampacity At 460 VAC, 3 PH:			221.3		217.5		116.3

Feeder Design Minimum Sizing:	25% of Largest Motor (in Amps):	25.3	
	Resulting Minimum Feeder Ampacities	242.8	141.6

System Sized At: 400 A Spare Capacity Over Peak Demand: 182.5 A, 45.6%

Notes:

Job Site Address: WA,

Utility of Jurisdiction:

$$kW = \frac{I * V * \Phi Mx * PF}{1000} = kVA * PF \qquad kVA = \frac{I * V * \Phi Mx}{1000} = kW / PF$$

$$HP = \frac{I * V * \Phi Mx * \%E * PF}{746} \qquad HP = \frac{kVA * \%E * PF}{0.746} = \frac{kW * \%E}{0.746}$$

Where:
ΦMx = 1 for 1 Phase
ΦMx = 2 for 2 Phase
ΦMx = SQRT(3) for 3 Phase

Calculations Made By	Calculations Approved By	Date
	, P.E.	May 6, 2015

* Value Includes Spare Design Capacity Adjustment.

ELECTRICAL LOAD STUDY REPORT

Title: 130 HP Load Study

Client:	Lake Stevens Sewer District	Job Number:	**14408**
Job Title:	Lift Station 2C Upgrade		

For this Load Study, Calculations for Ampacity are Based on a Bus Configuration of 460 Volts, 3 Phase

	Base Loading Calculations			
Total Connected Load:	249.7 kVA	313.4 Amps		
Peak Demand Loading:	246.7 kVA	309.7 Amps	25% of Largest Motor: 29.3 kVA	36.8 Amps
Anticipated Average Loading:	249.7 kVA	313.4 Amps		

Min. Feeder Ampacity: 346 Amps *(Peak Demand + 25% of Largest Motor)*

System Sized Selected at: 400.0 Amps 318.7 Equivalent kVA at 460 Volts, 3 Phase

Bus-Connected Loads

	Load Calculations						
	Connected		Anticipated Average		Peak Demand		
Description	**HP**	**kVA**	**Usage**	**kVA**	**Usage**	**kVA**	**Notes:**
[01 MTR 01], Motor, Pump No. 1 (130 HP Option)	130	117.4	100%	117.4	100%	117.4	VFD 6PLS
[01 MTR 02], Motor, Pump No. 2 (130 HP Option)	130	117.4	100%	117.4	100%	117.4	VFD 6PLS
2 Motors, Load Total:	**260**	**234.7**		**234.7**		**234.7**	
[01 XFMR 01], Transformer, LV, 15 kVA, 480 - 208/120 V, 3 PH	Z	15.0	100%	15.0	80%	12.0	
1 Non-Motor Load, Load Total:		**15.0**		**15.0**		**12.0**	

* Value Includes Spare Design Capacity Adjustment.

ELECTRICAL LOAD STUDY REPORT

Title: 130 HP Load Study

System Load Summary

(Calculations based on 460 V) *D.F. = % Demand Factor*

Load Description	Connected Loads			Utility Load Demand		Generator Loads	
	STARTER	HP	kVA	D.F.	kVA	D.F.	kVA
[01 MTR 01], Motor, Pump No. 1 (130 HP Option)	VFD 6PLS	130.0	117.4	100	117.4	100	117.4
[01 MTR 02], Motor, Pump No. 2 (130 HP Option)	VFD 6PLS	130.0	117.4	100	117.4	0	0.0
[01 XFMR 01], Transformer, LV, 15 kVA, 480 - 208/120 V,			15.0	80	12.0	80	12.0
Total kVA:			249.7		246.7		129.4
Resulting Ampacity At 460 VAC, 3 PH:			313.4		309.7		162.4

Feeder Design Minimum Sizing:	25% of Largest Motor (in Amps):	36.8	
	Resulting Minimum Feeder Ampacities	346.5	199.2

System Sized At: 400 A Spare Capacity Over Peak Demand: 90.3 A, 22.6%

Notes:

Job Site Address:
WA,

Utility of Jurisdiction:

$$kW = \frac{I * V * \Phi Mx * PF}{1000} = kVA * PF$$

$$kVA = \frac{I * V * \Phi Mx}{1000} = kW / PF$$

$$HP = \frac{I * V * \Phi Mx * \%E * PF}{746}$$

$$HP = \frac{kVA * \%E * PF}{0.746} = \frac{kW * \%E}{0.746}$$

Where:
ΦMx = 1 for 1 Phase
ΦMx = 2 for 2 Phase
ΦMx = SQRT(3) for 3 Phase

May 6, 2015

Calculations Made By

Calculations Approved By
, P.E.

Date

* Value Includes Spare Design Capacity Adjustment.

APPENDIX C

COST ESTIMATES

DRAFT

Lake Stevens Sewer District
Preliminary Cost Estimate
Lift Station LS 2C Upgrade
Force Main from LS 2C to Connect to Surplus LS 1C 8" FM

	Item	Quantity		Unit Cost	Total
1	Mobilization/Demobilization	1	LS	$ 99,000	$ 99,000
2	Surveying, Staking and As-Built Dwgs	1	LS	$ 19,000	$ 19,000
3	Environmental Controls	1	LS	$ 8,000	$ 8,000
4	Trench Excavation Safety Systems	1	LS	$ 10,000	$ 10,000
5	Dewatering	1	LS	$ 19,000	$ 19,000
6	Temporary Bypass Pumping	1	LS	$ 28,000	$ 28,000
7	Traffic Control	1	LS	$ 19,000	$ 19,000
8	Locate Existing Utilities	1	LS	$ 6,000	$ 6,000
9	12" Force Main (Including bedding, backfill	3,800	LF	$ 100	$ 380,000
	in ROW	3,800			
	in unimp easmnt	0			
10	Special Excavation of Unsuitable Material	710	CY	$ 40	$ 28,400
11	Connection to Existing Manhole	1	EA	$ 2,500	$ 2,500
12	Foundation Gravel	300	TN	$ 25	$ 7,500
13	Gravel Base	2,300	TN	$ 25	$ 57,500
14	Asphalt Treated Base	420	TN	$ 100	$ 42,000
15	Sawcutting	7,610	LF	$ 4	$ 30,440
16	Hot Mix Asphalt	1,620	TN	$ 100	$ 162,000
17	Hydroseeding	0	SY	$ 3	$ -
	Subtotal				$ 918,340
	Contingency (20%)				$ 183,668
	Subtotal				$ 1,102,008
	Sales Tax (8.5%)				$ 93,671
	Total				$ 1,195,679
	Total Construction Cost (Rounded)				**$ 1,200,000**
	All Overhead (30%)				$ 360,000
	Total Project Cost (Rounded)				**$ 1,560,000**

Whitney Equipment Company, Inc.

21222 30th Drive SE, Ste. 110 Bothell, WA 98021-7019 www.weci.com 800-255-2580

Quote #: 21192

Date: 4/17/15

To: Gray & Osborne
Attn: Leigh Nelson
Phone: 206-284-0860
Email: lnelson@g-o.com

From:
Whitney Equipment Company
Laura Haggard

Leigh,

Here is the price for options 1 and 2 for Lake Stevens Lift Station 2. I understand that the station will have 460V, 3ph power. The price for the pumps and accessories is as follows:

Option #1 1030 GPM at 197ft TDH with 80.5ft Static

NP-3301.095's

ITEM	QTY.	PART #	DESCRIPTION	UNIT PRICE	TOTAL
1	2	NP-3301.095	Flygt NP-3301.095-462 including:		
			85 HP explosion proof motors		
			Cooling Jackets		
			6" Discharge Elbows		
			460 volt, 3 phase submersible pumps		
			462 Hard Iron N Impellers		
			Fluid leak sensors		
			50ft power cables		
			Mini Cas and Sockets		
			80ft total of 3" Guide rails		
			3" Upper guide bar brackets		
			Pump lift assy systems		
			Grip eye lifting device		
			1 day start up assistance		105,142.00
			Estimated Freight to Lake Stevens, WA		3,200.00
				TOTAL	**$108,342.00**

Option #1 1750 GPM at 168ft TDH with 80.5ft Static

NP-3315.095's

ITEM	QTY.	PART #	DESCRIPTION	UNIT PRICE	TOTAL
1	2	NP-3315.095	Flygt NP-3315.095-459 including:		
			130 HP explosion proof motors		
			Cooling Jackets		
			6" Discharge Elbows		
			460 volt, 3 phase submersible pumps		

459 Hard Iron N Impellers	
Fluid leak sensors	
50ft power cables	
Mini Cas and Sockets	
80ft total of 3” Guide rails	
3” Upper guide bar brackets	
Pump lift assy systems	
Grip eye lifting device	
1 day start up assistance	131,209.00
Estimated Freight to Lake Stevens, WA	4,100.00
TOTAL	**$135,309.00**

Please make ensuing purchase orders to: Whitney Equipment Company, Inc.

FOB: Factory, **sales tax is not included above**
Terms: Net 30 days on approved accounts

This quote is valid for 30 days.
Lead Time: 14-16 weeks ARA

If you have any questions, please give me a call.

Thank you,

Laura Haggard
CC: Sharon Adler, Inside Sales

APPENDIX I

MORATORIUM RESOLUTIONS

RESOLUTION No. 772

A RESOLUTION OF THE BOARD OF SEWER COMMISSIONERS OF LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON, IDENTIFYING THE CIRCUMSTANCES FOR LIFTING THE SOUTH LAKE MORATORIUM .

WHEREAS, the Board of Sewer Commissioners has previously established a connection moratorium in the service area tributary to the District's Lift Station 14 (the "South Lake Moratorium") due to committed capacity limitations, which moratorium is consistent with the District's engineering standards as well as the District's policy of not allowing surcharging within the District's system of sewerage; and

WHEREAS, the District's consulting engineers have reviewed the flow analysis for the drainage basins tributary to South Lake Service Area, including data regarding obligated flow and existing flow tributary to Lift Station 12 (LS 12), Lift Station 2 (LS 2), Lift Station 14 (LS 14) and Lift Station 17 (LS 17), which analysis is summarized as follows:

> LS 12 is a regional station that has a capacity of 2,000 gpm and receives flow from its gravity basin along Davies Road between Chapel Hill Road and South Lake Stevens Road. In addition, LS 12 receives flow from LS 2, LS 8 and LS 14. LS 12 currently has adequate capacity for near term and ultimate development flows.
>
> LS 2 receives flow from the drainage basin along Stich Road and upland area south of South Lake Stevens Road. Although the system is currently not at capacity, obligation of capacity for service to currently vacant or underdeveloped property associated with ULID #1 results in the lift station and portions of the gravity line in Stich Road being at capacity. LS 2 has a capacity of 315 gpm. As part of the Fenner DEA, the station will be upgraded to 364 gpm which would leave 120 ERU's of capacity available. This upgrade will accommodate existing flows, DEA's for Lakeview Springs East and West, Fenner, Hisey and Arbaugh totaling 96 units. In addition, 1 side sewer permit has also been issued. Based on the Fenner DEA, 23 units of capacity should still be available. Subsequent to the Fenner DEA, Comprehensive Plan flows were calculated for this basin using a slightly higher diurnal peaking factor. With the new peaking factor , the basin is at capacity if ULID #1 obligated flows are included. LS 2 currently receives flows of 237 gpm, 391 ERU's, and has DEA and side sewer commitments of 53 gpm, 97 ERU's totaling 290 gpm, 488 ERU's. When the obligated capacity of ULID #1 flows of 93 gpm,

178 ERU's are added, the obligated total becomes 383 gpm, 666 ERU's. LS 2 should remain in moratorium until such time as improvements can be constructed to provide capacity for new connections. The improvements required to ensure adequate capacity for the ultimate build-out of LS 2 drainage basin include completion of a new lift station (and associated force main) near the intersection of Machias Cutoff and South Lake Stevens Road and construction of the Southwest Interceptor Phase II. The future Machias Cutoff Lift Station would intercept all the upland flow from south of South Lake Stevens Road, thereby freeing capacity in LS 2 and the gravity line along Stich Road.

LS 14 was constructed in 2000 as part of the South Lake Stevens Road development. It has a capacity of 480 gpm. It currently receives flows from a small gravity basin and from LS 17 totaling 307 gpm. This leaves 173 gpm of available capacity, which equates to 260 ERU's. LS 14 currently discharges to the gravity basin of LS 12. In the future it is planned that this lift station will discharge to the gravity basin of the Southwest Interceptor.

LS 17 was constructed in 2006 as part of the Pasadera development. It currently has a capacity of 290 gpm and discharges to LS 14. Ultimately, this station will discharge to the SW Interceptor Phase II. The station receives flow from LS 18, and its own gravity basin, totaling 274 gpm. This leaves only 16 gpm of available capacity, which for this basin equates to 42 units, per the Pasadera Phase 1 Developer Extension Agreement Addendum. Until the SW Interceptor Phase II is constructed, an interim solution is available which would allow an additional 150 ERU's by increasing the capacity of LS 17 by 100 gpm and also increasing the capacity of LS 14 by a like 100 gpm. Requiring the LS 14 capacity to be increased reserves the existing available capacity in the station for its own gravity basin.

WHEREAS, the Board of Commissions believes it is now appropriate to identify the circumstances under which the District's South Lake Moratorium may be lifted on either a full or a partial basis;

NOW THEREFORE, BE IT HEREBY RESOLVED by the Board of Sewer Commissioners of Lake Stevens Sewer District, Snohomish County, Washington, as follows:

1. Collectively, the following improvements (described in detail in the District's Comprehensive Plan) are identified as the South Lake Moratorium Projects: Southwest Interceptor Phase II; Machias Cutoff Lift Station; Machias Cutoff Force-main; LS 14 Force-main; LS 14 Pump Capacity Upgrade; LS 17 Pump Capacity Upgrade; LS 17 Force-main.

2. The District's South Lake Moratorium may be lifted when the following conditions have been met: (a) funding for the South Lake Moratorium Projects has been secured; (b) all necessary permits and governmental approvals have been obtained for the South Lake Moratorium Projects; (c) the District has obtained bids and given the necessary notice to proceed on the South Lake Moratorium Projects.

3. With regard to LS 14, the Board authorizes 250 ERU's within the LS 14 drain basin to be issued permits on a first come first served basis prior to construction of the Southlake Moratorium Projects, with 25 ERU's held in reserve for health emergency or hardship as determined by the District.

4. With regard to LS 17, of the existing 42 ERU's of available capacity, 25 are held in reserve for health emergency or hardship as determined by the District.

5. Interim improvements at LS 14 and LS 17 may allow for additional ERU's in the basin tributary to LS 17. Upon the interim upgrade of pumping capacity at LS 14 to 580 gpm and at LS 17 to 390 gpm, an additional 150 ERU's will be authorized in the LS 17 drain basin. However, as a condition of receiving permits to connect to the District's system of sewerage, any property receiving a permit as a result of the installation of interim improvements in the LS 17 basin and any property receiving a permit in the LS 14 basin shall, at the time of entering into a contract for connection, pay its proportionate share of the costs of the remaining future Southlake Moratorium Projects (the "Southlake Moratorium Projects Surcharge"), as set forth in the District's Comprehensive Plan. The moratorium shall automatically renew without further action of the Board following issuance of permits for the above-referenced number of connections allowed after construction of the interim improvements at LS 14 and LS 17.

Done at a regular open public meeting this 9th day of November, 2006, the following Commissioners being present and voting.

LAKE STEVENS SEWER DISTRICT

by: G W Wood
G.W. Wood, President & Commissioner

by: Jack B Hatlen
J.B. Hatlen, Secretary & Commissioner

by: ______________________
J.B. Mitchell, Commissioner

SUMMARY

Lift Station 2 is currently at capacity and should remain in moratorium. The existing commitments of sewer available will be honored.

The moratorium should be lifted for the LS-14 basin as 260 ERU's of capacity, less 25 held in reserve, are available. These ERU's could be required to pay a basin charge for the SW Interceptor Phase II.

The moratorium for LS-17 should be lifted. Upgrades of LS 14 and LS 17 will allow an additional 150 ERU's to connect to the system. This would bring the available capacity to 192 units, less 25 held in reserve. Any new ERU's could be required to pay a basin charge to the SW Interceptor Phase II.

It is recommended the District pay for upgrades to LS 14 and LS 17 to increase the capacity of each by 150 ERU's. This will allow the District to control the schedule of these improvements.

It is recommended the District establish a basin charge of $1,595 on the first 2012 ERU's in drainage basins for Lift Stations 14, 17, 8 and the Machias Cutoff Lift Station.

Station	Action	Potential Cost per ERU
LS 2	Remain in Moratorium	N/A
LS 14	Lift Moratorium for 260 ERU's (less 25 held in Reserve)	SWI charge $1595
LS 17	First 106 ERU's to connect	LS 17 Interim of $204 plus Regional Latecomer of $1,045 plus SWI charge of $1,595 for a total of $2,844.
	Next 150 ERU's (less 25 held in Reserve)	LS 17 Regional Latecomer of $1,045 plus SWI charge of $1,595, for a total of $2,640

RESOLUTION No. 782

A RESOLUTION OF THE BOARD OF SEWER COMMISSIONERS OF LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON, ADOPTING A MORATORIUM IN THE AREA TRIBUTARY TO LIFT STATIONS 7 AND 8 AND IDENTIFYING THE CIRCUMSTANCES FOR LIFTING THE LS-7 AND LS-8 SERVICE AREA MORATORIUM.

WHEREAS, the Lake Stevens Sewer District operates a system of sewerage in the vicinity of Lake Stevens, Snohomish County, Washington; and

WHEREAS, the Board of Commissioners previously imposed a study moratorium within the drainage basins tributary to the District's Lift Station 7 and Lift Station 8 to allow the District's consulting engineers to review the flow analysis for that service area including the capacity committed to properties that participated in ULID No. 3; and

WHEREAS, the Consulting Engineers (Gray & Osborne) prepared a report dated June 6, 2007 regarding Lift Stations 7 and 8, which is herein incorporated by reference. The report recommends that the gravity-service area tributary to LS 7 (the "LS-7 Service Area") go into moratorium (with the exception of properties that participated in ULID 3); and

WHEREAS, the Consulting Engineers also recommended that the gravity-service area tributary to LS 8 (the "LS-8 Service Area") go into moratorium with conditions for use of remaining allowed connections (also with the exception of properties that participated in ULID 3); and

WHEREAS, based upon the recommendations of the Consulting Engineers the Board of Commissions acted by motion to impose a connection moratorium in the LS-7 and LS-8 Service Areas and now deems it appropriate to ratify that motion and to identify the circumstances under which the moratorium may be lifted on either a full or a partial basis;

NOW THEREFORE, BE IT HEREBY RESOLVED by the Board of Sewer Commissioners of Lake Stevens Sewer District, Snohomish County, Washington, as follows:

1. The Board of Commissioners hereby ratifies the motion imposing a connection moratorium in the LS-7 and LS-8 Service Areas (with the exception of properties that participated in ULID 3) as follows: no further Equivalent Residential Units (ERUs) area

available in the LS-7 Service Area, and half of the available ERUs in the LS-8 Service Area shall be reserved by the District to be allocated on a discretionary basis in the interest of public health, safety and welfare; the remainder of the ERUs in the LS-8 Service Area shall be available for allocation on a first-come/first-served basis.

2. The LS-7 and LS-8 Service Area Moratorium may be permanently lifted when the following conditions have been met, as further set forth in the Consulting Engineers June 6, 2007 report: (a) funding for the Southwest Interceptor (Phase II) and Machias Lift Station has been secured; (b) all necessary permits and governmental approvals have been obtained for the Southwest Interceptor (Phase II) and Machias Lift Station; (c) the District has obtained bids and given the necessary notice to proceed on the Southwest Interceptor (Phase II) and the Machias Lift Station; (d) funding and all necessary permits have been obtained for required LS-7 and LS-8 improvements, respectively.

Done in a regular, open public meeting this 12th day of July, 2007, the following Commissioners being present and voting.

LAKE STEVENS SEWER DISTRICT

by: Jack B Hatlen
J. B. Hatlen, President & Commissioner

by: JB Mitchell
J.B. Mitchell, Secretary & Commissioner

by: Gary M Wood
G.W. Wood, Commissioner

Lake Stevens Sewer District

LS 7 & LS 8 Capacity Analysis

June 6, 2007

Gray & Osborne has been requested to analyze the current flows to Lake Stevens Sewer District's Lift Stations 7 and 8 to assess the number of new connections that could be made to each prior to institution of a moratorium that would be contingent upon necessary improvements. Currently the capacities of LS 7 and LS 8 are 200 gpm and 575 gpm, respectively.

Existing Flows

Using the following design criteria, the estimated peak wet weather flows under current conditions were calculated.

TABLE 1
Flow Criteria

Category	Criteria
Population Density	2.9 people/du (Single Family)
Sanitary Flow	70 gallons/capita/day (GPCD)
Peaking Factor	3
Infiltration and Inflow (I/I)	1,100 gallons/acre/day (GPAD)

From GIS records and LSSD account records, the number of connections within the LS 7 and LS 8 basins was calculated and is shown in Table 2. All existing connections within these basins are residential.

TABLE 2
Existing Sewered Parcels in LS 7 and LS 8 Basins

	LS 7	LS 8	Total
ERUs	141	462	**553**
Area (ac)	24.3	115.7	**138.8**

From Table 2, the existing flows tributary to each lift station were calculated using the assumptions as listed in Table 1. Lift Station 21, currently under construction, will discharge 120 gpm into the LS 7 basin. LS 7, LS 9 and LS 10 are tributary to LS 8.

Although LS 9 and LS 10 are both rated as 30 gpm pumps, operating record indicate that during winter months, they typically operate 0.7 hours and 0.2 hours per week, respectively. Using the standard District methodology as discussed above, tributary flow to LS 9 and LS 10 is 2.58 and 3.22 gpm, respectively for a total of 5.8 gpm. Because this is an order of magnitude less than the 60 gpm that would otherwise be calculated to flow to LS 8 from LSs 9 and 10, it is safe to decrease this flows when calculating overall LS 8 capacity. For this purpose, it will be assumed that 20 gpm is contributed to LS 8 from LSs 9 and 10.

Estimated Existing Flows:

= (ERUs x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (ac x 1,100 gpad)
+ (School Population x 16 gpcd) +Tributary LS Flow

LS 7 Flow

= (141 ERUs x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (24.3 ac x 1,100 gpad)
+ (120 gpm (LS 21) x 1,440 min/day)
= 285,399 gpd (198.2 gpm)

LS 8 Flow

= (462 ERUs x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (115.7 ac x 1,100 gpad)
+ ((200 gpm (LS 7) +20 gpm (LSs 9 and 10)) x 1,440 min/day)
= 778,553 gpd (503.8 gpm)

The Lake Stevens Sewer District shall provide capacity for the ULID 3 parcels up to the 1971 zoning requirements. The 1971 zoning requirements for this area is RR 9600 or one lot per 9,600 square feet. So, in addition to the existing flows, additional ERUs were calculated to account for the reserved capacity associated with ULID 3 parcels. Using the RR 9600 zoning criteria, the additional ERUs and I/I acreage associated with ULID 3 parcels were determined and tabulated in Table 3.

TABLE 3
Additional ERUs and I/I Acreage for ULID 3 Parcels

	ERUs	**I/I Acreage**
LS 7 Basin	39	6.06
LS 8 Basin	10	1.91
Total	**49**	**7.97**

Using the ERUs and I/I acreage noted in Table 3, the additional flow reserved for ULID 3 parcels tributary to each of the basins:

Additional Reserved ULID 3 Flows:

= (ERUs x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (ac x 1,100 gpad)

ULID 3 Flow to LS 7
= (39 ERUs x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (6.06 ac x 1,100 gpad)
= 30,417 gpd (21.1 gpm)

ULID 3 Flow to LS 8
= (10 ERUs x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (1.91 ac x 1,100 gpad)
= 8,191 gpd (5.7 gpm)

Note that additional I/I acreage is not included if a lot already connected to the sewer system can subdivide, thus explaining the discrepancy of scale between the number of ERUs remaining in ULID 3 and low amount of area for I/I purposes.

An estimated typical ERU, at a density of 6 units per acre, was also calculated as follows to help determine the estimated number of ERU capacity remaining:

Est. Typical ERU = (1 ERU x 70 gpcd x 2.9 persons/unit x 3.0 peak) + (0.167 ac x 1,100 gpad)
= 792 gpd ***(0.55 gpm)***

Using the estimated typical ERU, the number of available ERUs in each basin is calculated:

Remaining ERUS
= (LS Capacity - (Existing Flows + ULID 3 Reserved Flow)) / 0.55 gpm

LS 7 Remaining ERUS
= (200 gpm – (198.2 gpm + 21.1 gpm)) / 0.55 gpm
= - 35.1 ERUs ***= -36 ERUs***

LS 8 Remaining ERUS
= (575 gpm – (503.8 gpm + 5.7 gpm)) / 0.55 gpm
= 119.1 ERUs ***= 119 ERUs***

TABLE 4
Summary of Existing Flows and Capacities

	LS 7		LS 8	
	Flow (gpm)	**ERUs**	**Flow (gpm)**	**ERUs**
Existing	198.2	141	503.8	462
ULID 3	21.1	39	5.7	10
Total	219.3	180	509.5	472
LS Capacity	200		575	
Remaining Capacity	-19.3	-36	65.5	119

Future System

As proposed in the District's *Draft 2007 Sanitary Sewer Comprehensive Plan* (2007 Plan), in the future LS 7 will be upgraded to 240 gpm to handle Buildout flows within its basin. LS 7 will continue to flow through LS 8, which will be tributary to a new lift station to be located at the south end of Lake Stevens, near the intersection of Machias Cut Off and South Lake Stevens Road, identified as LS B7 in the 2007 Plan and elsewhere as the Machias Lift Station. This lift station will discharge to a 24-inch diameter pipe, identified as the Southwest Interceptor. The discharge will be located at the intersection of 20th Street SE and 99th Avenue SE. It is anticipated that this pipe may be completed as soon 2009 with non-gravity connections contingent upon operation of the District's new Wastewater Treatment Plant. LS 21 will be diverted to the gravity basin of LS 2C such that the projected Buildout flow to LS 7 is 240 gpm. LS 21 flows may not be diverted until such time that LS 2 C has capacity to handle this flow.

As proposed in the 2007 Plan, Lift Station 8 flows will be diverted from South Davies Road to the basin of LS B7/Machias Lift Station. The projected Buildout flow within the gravity basin of LS 8 is 670 gpm. The discharge conversion will lower the static head of the station such that the existing pumps will have capacity for this increased flow.

The improvement required to increase the capacity of LS 7 to 240 gpm involves replacing lift station motors and impellers and installing a new generator. The improvement required to increase the capacity of LS 8 to 905 gpm involves installing a new wet well to increase storage capacity and peak pumping rate and installing new motors and impellers, and other electrical components. Neither of these projects can be completed until the Machias Lift Station is completed.

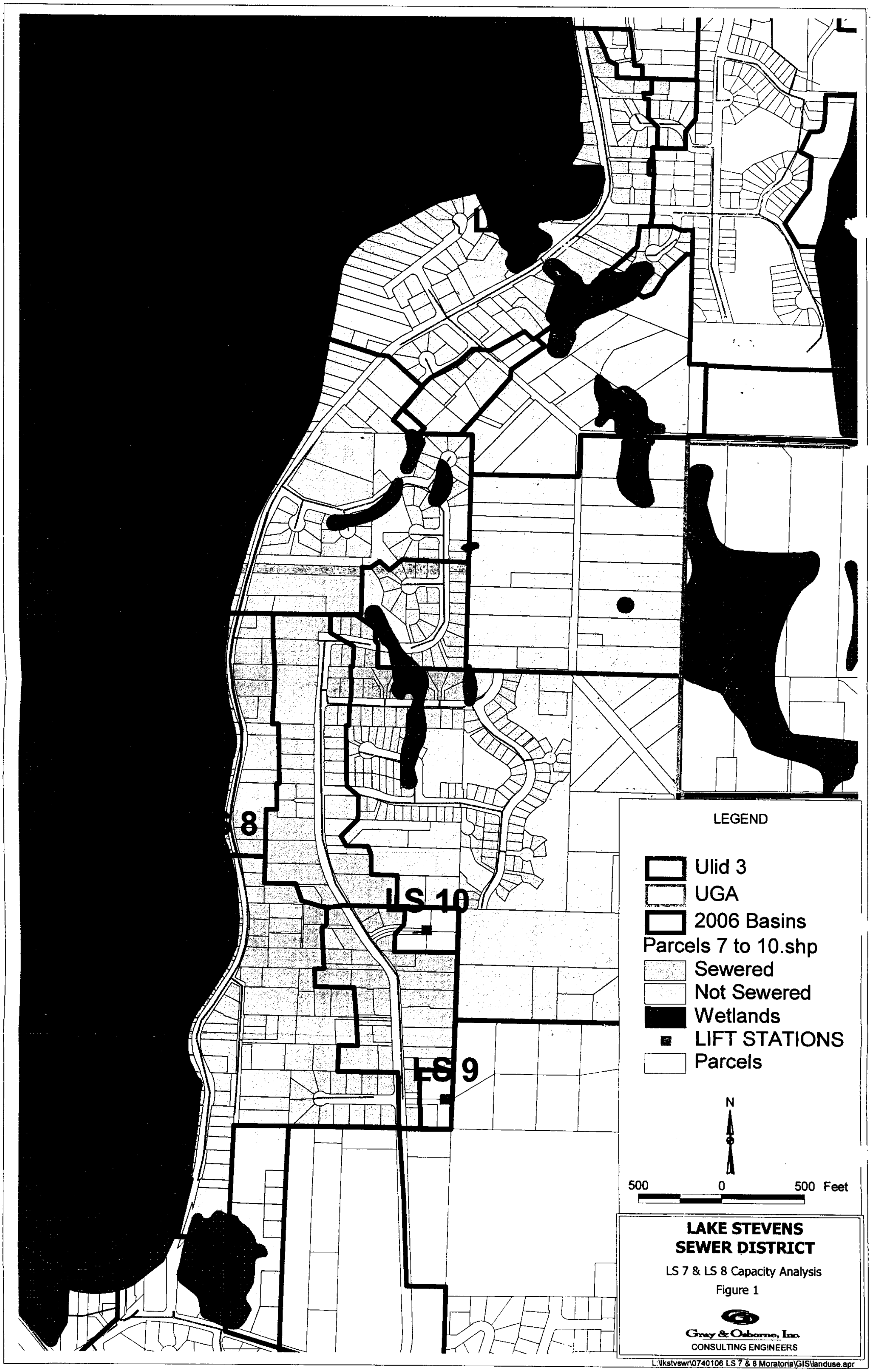
As an interim solution, it may be possible to increase the capacity of LS 8 from 575 gpm to 650 gpm by installing the facilities discussed above for increasing LS 8 to 905 gpm. This upgrade would involve overspeeding the motors, a deviation from District standard. It is estimated that this would cost $620,000. This would allow LS 7 to be upgraded ahead of construction of LS B7.

Any interim upgrade to LS 7 or LS 8 will need to address downstream conveyance impacts. For LS 7 this will include the decrease in remaining capacity for LS 8. For LS 8 this will include gravity conveyance within South Davies Road. Four non-contiguous portions of and 18-inch and 12-inch diameter pipe within South Davies Road, totaling 690 feet, would be under capacity if the capacity of LS 8 were increased to 650 gpm. It is estimated that it would cost $370,000 to replace these sections with 24-inch and 15-inch diameter pipe. Because this portion of the system has capacity in the future, this project would be solely Developer funded.

Recommendation

It is recommended that the LS 7 basin be put into a sewer moratorium pending the improvements discussed above.

It is recommended that no more than 119 sewer connection be allowed in the LS 8 basin prior to the basin being put into a sewer moratorium when the number of connections


8
LS 10
LS 9
LEGEND
Ulid 3
UGA
2006 Basins
Parcels 7 to 10.shp
Sewered
Not Sewered
Wetlands
LIFT STATIONS
Parcels
N
500 0 500 Feet
LAKE STEVENS
SEWER DISTRICT
LS 7 & LS 8 Capacity Analysis
Figure 1
Gray & Osborne, Inc.
CONSULTING ENGINEERS
L:\lkstvswr\0740106 LS 7 & 8 Moratoria\GIS\landuse.apr

APPENDIX J

MODEL CALIBRATION MEMO

MEMORANDUM

TO: FILE
FROM: KOTA NISHIGUCHI, E.I.T.
DATE: AUGUST 4, 2021
SUBJECT: LAKE STEVENS SUNNYSIDE WWTP MODEL CALIBRATION
G&O #20408.07

The GPS-X model described herein was developed for the Lake Stevens Sewer District General Sewer/WWTP Facility Plan (G&O 20408.07).

SUMMARY OF CALIBRATION PROCESS AND RESULTS

Summary of Calibration Process and Results

A GPS-X model was configured and calibrated to represent the liquid and solid stream processes at Lake Steven Sunnyside WWTP. Calibration of the model was based on average dry weather conditions between 2013 and 2020. Available records for the level of primary sludge bypass flow are qualitative in nature. Therefore, the model was calibrated upon a dry-weather period when there was no primary sludge bypass (July – September 2020). Model performance was measured against primary effluent and plant effluent data.

Solids handling processes were calibrated based on observed performance from average dry weather flow from the same periods with the exception of the anaerobic digesters. Digester performance was calibrated upon data from June through August of 2019 and 2020. These periods of data were chosen over other available data due to the apparent consistency of the digester performance data during these periods.

Calibration (ADWF 2020, No Primary Sludge Bypass)

Location	Parameter	Observed Value	Observed Standard Deviation*	Model Output	Percent Difference
Primary Effluent	BOD, mg/L	249	15%	260	5%
	TSS, mg/L	171	33%	198	16%
Plant Effluent	TSS, mg/L	0.25	69%	0.17	33%
	BOD_5 mg/L	0.56	16%	0.59	5%
	NH_3 mg-N/L	0.17	317%	0.31	86%
	NO_3^- mg-N/L	15.2	16%	15.8	4%

*Standard deviation presented as % of observed value.

Model Testing (ADWF 2013-2020, Observed Primary Sludge Bypass)

Location	Parameter	Observed Value	Observed Standard Deviation*	Model Output	Percent Difference
Primary Effluent	BOD, mg/L	218	27%	202	7%
	TSS, mg/L	152	76%	128	16%
Plant Effluent	TSS, mg/L	0.20	127%	0.15	26%
	BOD_5 mg/L	0.67	79%	0.53	22%
	NH_3 mg-N/L	0.61	172%	0.21	66%
	NO_3^- mg-N/L	13.7	30%	13.4	3%

*Standard deviation presented as % of observed value.

Discussion of Results

Plant process data was not available for influent wastewater alkalinity. However, it is known that local drinking water quality consists of low alkalinity (less than 50 mg-$CaCO_3$/L), which would result in low wastewater alkalinity. Rather than complicating the model with an alkalinity addition system, it was assumed that the influent wastewater would be supplemented with alkalinity up to a typical influent wastewater alkalinity of 225 mg-$CaCO_3$/L. The modeled final effluent provides the net alkalinity consumption by the system. This method of determining alkalinity consumption is also used for projected flows and loads.

The model configuration deviates from the WWTP process for the placement of the mixed liquor pumps. As noted later in this memorandum, the placement of the pumps is not expected to affect the performance of the model. Additionally, the modeled membrane basins utilize scouring air patterns that differ from those of the WWTP. It is noted that in this steady state model, these patterns are expected to have marginal impact on the model performance. The resulting DO from the scour air is consistent with anecdotal data on the WWTP membrane basin DO.

The resulting calibration and testing of the model show results that are consistent with WWTP data. Modeled primary effluent and plant effluent parameters are within half of a standard deviation for nearly all of the WWTP parameters of interest. One notable deviation between model results and WWTP parameters is the digester volatile solids reduction. As discussed in this memorandum, the type of model used within GPS-X biases toward higher VSRs than shown in WWTP data. Other alternative models biased towards lower VSRs and significantly higher solids concentration. Therefore, the applied anaerobic digester model remains the best alternative form modeling digestion. However, modelled VSR was above 60% whereas the expected VSR is closer to 55%, which suggests better performance than evidenced by the WWTP's digesters. This deviation implicates the modelled quality of centrate as well as loads onto the dewatering centrifuge. Therefore, modeled projections of centrate quality will likely provide conservatively high ammonia loads returning to secondary treatment. Conversely, modeled outputs for projected loading onto the dewatering system should be corrected with higher values to account for the bias from the digester model.

MODEL CALIBRATION

Model Calibration parameters

This section describes the settings used for each unit process and addresses the calibration goals for each process.

Global parameters

Temperature: 20.3°C
Elevation: 217 ft
Library: Carbon and Nitrogen Components only (no phosphorus or pH considerations)

Influent

The model was calibrated with influent values based on historical data representing a period when the plant was not using primary sludge bypass (July – September 2020). Influent values were computed with BOD-based influent advisor with ADWF flow, BOD, CBOD, NH3, and TSS from years 2013-2020.

Flow- 2.37 MGD
BOD – 6364 lb/d
TSS – 5633 lb/d
NH_3 – 764 lb/d

The calibrated model was tested with influent values computed with BOD-based influent advisor with ADWF flow, BOD, CBOD, NH3, and TSS from years 2013-2020.

Flow- 2.17 MGD
BOD – 5825 lb/d
TSS – 5100 lb/d
NH_3 – 644 lb/d

Values from Metcalf and Eddy were used to calculate nitrogen and carbon fractions.

Primary Clarifiers

Physical Setup:
Dimensions were set by combining the two equally sized clarifier surface areas (3,000 sf ea; 6,000 sf total) and setting the feed point depth at 9.5 ft.

Operational Setup:
The underflow was set at 440 gpm based on the flow requirement for the grit removal system for which there are two units that each require a flow of 220 gpm.

Performance Calibration:
The simple 1-D model was used to simulate primary sedimentation. The calibration data set consisted of an average primary effluent TSS concentration of 171 mg/L, resulting from an average solids removal efficiency of about 40% (not accounting for solids returned from the gravity thickener). No adjustments to settling characteristics were necessary to achieve a reasonable result for primary treatment.

Grit Removal
Physical Setup:
N/A

Operational Setup:
The empiric model was used for grit removal, which bases treatment process by lbs of grit removed per gallon of flow.

Performance Calibration:
There are no records of grit production available to use for calibration. However, anecdotal data suggests typical grit production is 40-60 lb/d. For the purposes of calibration, the models flow-based grit production was adjusted to 0.00017 lb/gal.

Primary Sludge Bypass
Physical Setup:
N/A

Operational Setup:
A control splitter is used to redirect a portion of primary sludge flow to be sent to the deoxygenation zone. Simulation is set up to allow this value to be changed.

Performance Calibration:
Qualitative records of primary sludge bypassing suggest that no bypass flow occurred for dry weather flow in 2020. Thus, this period was used to calibrate the downstream treatment processes without bypass.

Other records of primary sludge bypass suggest that typical values for bypass flow is between 30% to 50% of primary sludge flow. For testing the calibrated model, bypass flow was set to 176 gpm, which is 40% primary sludge flow.

Secondary Aeration Basins / Activated Sludge Control Splitter

Physical Setup:
The deoxygenation zone was set as a completely mixed anoxic tank. Aeration basins were set as plug flow reactors with two anoxic zones and three aerated zones. The deoxygenation zone receives the return sludge from the membrane basins in addition to centrate from dewatering and bypassed primary sludge. The aeration basins receive primary effluent and WAS thickening centrate. Dimensions were set as a function of volume of each tank, such that the number of basins can be adjusted; the deoxygenation zone is constant at 18,500 ft^3. For this ADWF condition, two of three aeration trains were in operation.

The mixed liquor pump was positioned downstream of the membrane system, as part of the membrane reactor unit. This configuration does not match the treatment plant in reality but was necessary due to limitations in GPS-X. It is understood that this change has little effect on the treatment process performance.

Operational Setup:
The three aerobic zones of each aeration train have a DO set point at 2 ppm. All other tanks are set as anoxic. A control splitter with a PID controller was set to pump WAS such that the aerobic zones have an MLSS of 4,200 mg/L which is consistent with the calibration data set. For the testing data set, this value was set at 3,700 mg/L based on historical ADWF operation. Notably, the design MLSS for Phase I design is 5,450 mg/L and Phase III is 7,000 mg/L.

Mixed liquor return pump at the membrane basins was bound between 1Q to 4Q of ADWF flow, which must be adjusted according to flow scenario. For the calibration condition and testing the calibrated model, the pump flow was set at 3Q.

Volume and aeration for each aeration basin zone were set as the following:

Tank	Volume per Basin (ft^3)	Aeration
Ax-1	11,167	0
Ax-2	11,167	0
Ox-1	19,389	2 ppm DO
Ox-2	19,389	2 ppm DO
Ox-3	19,389	2 ppm DO

<u>Performance Calibration:</u>
The aeration basins were calibrated to result in final effluent BOD and nitrogen (NH_4^+ and NO_3^-) concentrations similar to those in dry-weather conditions with no primary sludge bypass. To accomplish this, the heterotrophic maximum specific growth rate was increased from the default 3.2 d^{-1} to 5.5 d^{-1}, which increased BOD removal to better represent the calibration conditions.

Membrane Basins

<u>Physical Setup:</u>
The six membrane basins were set as a single mixed tank. Each basin has a volume of 47,000 gal and a surface area of 565 ft^2; therefore the combined volume and surface area were set as 282,000 gal and 3,390 ft^2, respectively. The membranes were set to have a solids capture rate of 0.9997 based on historical performance.

Scour air set-up mostly followed default conditions (i.e. alpha 0.65, SOTR 0.1).

<u>Operational Setup:</u>
The tank was set without diffused air. The process does include scour air which was set to 2800 scfm based on the plant's scour air system. Additionally, the recycle pump on the membrane basin was utilized in place of the WWTP's mixed liquor pumps (which pump flow between the aeration basin and membrane basin. This recycle pump was used to dictate the flow returning to the deoxygenation zone. The pumps were set with a PID controller that dictates flow based on the MLSS concentration inside of the membrane basins. For ADWF calibration, the MLSS concertation was set to 4,700 mg/L; the Phase III return sludge has a design concentration of 7,000 mg/L. As previously described, the pumps were bound between 1Q to 4.Q of ADWF flow, which must be adjusted according to flow scenario.

The unit process was set not to include TMP or fouling calculations.

<u>Performance Calibration:</u>
Typical membrane basin DO is 6 mg/L. Scour air flow rate was adjusted to 2800 scfm to meet this calibration standard. It is noted that the plant uses LEAPmbr to control scour air

flow. During high flow events, scour air pulsates 50% of the time (10-10 schedule) while typical low flow scour air pulsates 25% of the time (10-30 schedule).

In addition, kinetic factors adjusted for the aeration basins are also adjusted for the membrane basins.

Primary Sludge Thickener

Physical Setup:
Surface area was set at 962 ft^2 with a depth of 12 ft.

Operational Setup:
The model was set as the empiric model (simple mass balance).

Performance Calibration:
The underflow solids, thickened primary sludge, was set at 5.4% solids based on the consistent historical performance. The assumed solids capture rate was 85%.

Waste Activated Sludge Centrifuge

Physical Setup:
N/A

Operational Setup:
The unit process was set as a dewatering unit with the empiric model (simple mass balance).

Performance Calibration:
The thickened WAS solids concentration was set at 8.5%. The set removal efficiency was 90% based on thickener design criterium.

Anaerobic Digesters

Physical Setup:
Thickened WAS and primary sludge are combined ahead of the anaerobic digesters. The digesters are configured in series. Each are set with an active volume of 39,000 ft^3 and with mesophilic temperature (36^{o}C).

Operational Setup:
The processes were set as the Basic model, which consolidates the kinetics for acidogenesis, acetogenesis, and methanogenesis. The design SRT is 12.9 days. However,

since the digesters are continuously fed, the SRT is dependent on the volume of feed sludge from upstream processes.

<u>Performance Calibration:</u>
Selected dry-weather digester data was used to establish calibration standards; data was sourced from June-August of 2019 and 2020. These data suggest that a typical sludge TS for the lead digester was 3.4% (~2.8%) while the follow digester had sludge with 3.0% TS (~2.5% TSS). To calibrate the digesters, the rate constants for hydrolysis were adjusted from the default 0.045 d^{-1} to 0.06 d^{-1} for the first digester and 0.005 d^{-1} for the second digester in series. In addition, the overall maximum specific growth rate of the follow digester was adjusted from the default of 0.4 d^{-1} to 0.19 d^{-1}.

Notably, the basic model overestimates the volatile solids reduction, particularly the volatile fraction of digested sludge. Other models (ADM1 and MantisAD) result in more accurate volatile fractions but are substantially biased towards high solids concentrations resulting in lower volatile solids reduction values. For the purposes of this model, it is assumed that the basic model is more appropriate than other models because it better represents the quantity of solids discharged from the anaerobic digesters; these values are more useful for solids management. However, it is expected that the modelled high volatile solids destruction affects the modelled centrate quality and projected loads onto the dewatering centrifuge.

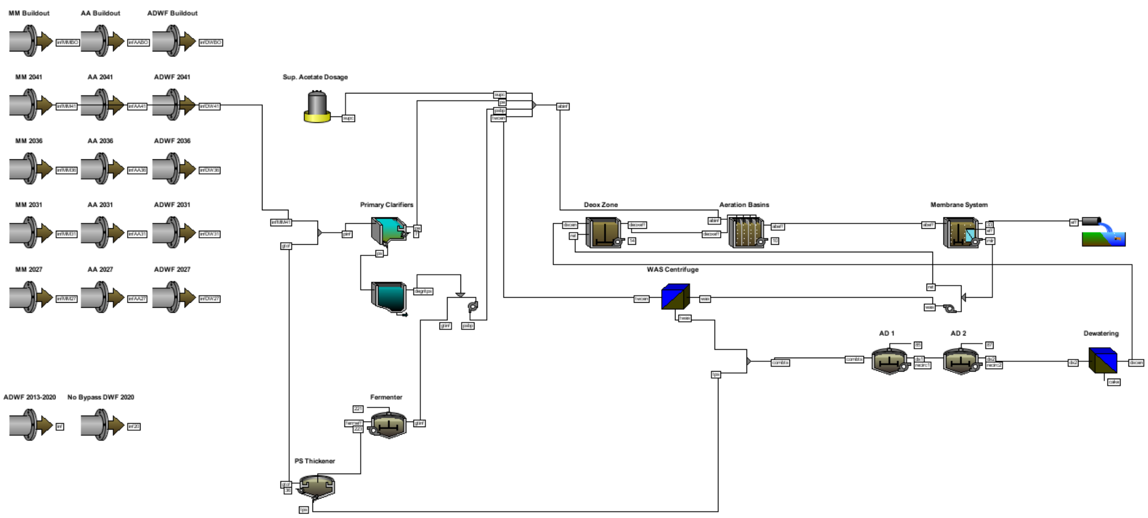
Dewatering

<u>Physical Setup:</u>
N/A

<u>Operational Setup:</u>
The unit process was set as a dewatering unit with the empiric model (simple mass balance).

<u>Performance Calibration:</u>
The cake solids were set at 16.7% based on historical data. The solids capture efficiency was set at 95% (design criteria).

FERMENTATION AT GRAVITY THICKER SETUP



<u>Physical Setup:</u>
The fermenter was set as a basic-model anaerobic digester with an SRT and temperature that limits the anaerobic process to only hydrolysis and fermentation. No other process unit on the GPS-X program is able to provide fermentation of primary sludge, as other process units either lack biological activity for fermentation or model biological activity only when preceded by an activated sludge model. By default, the model provides a well-mixed environment whereas a thickener-fermenter would be static. Consequently, the modeled fermenter is expected to have more efficient VFA production. Dimensions were set by providing the volume necessary to simulate a 3-day SRT for the primary sludge flow of 440 gpm. Notably, a thickener-fermenter would provide a 3-day to 5-day SRT by setting the sludge blanket through control of the underflow. The temperature was set to the same liquid temperature the influent.

<u>Operational Setup:</u>
The only operational setup required was alkalinity addition for the unit process. It is noted in the Plan that the requisite alkalinity for the mainstream is added to each influent condition. Consequently, the modeled primary sludge flow includes alkalinity that would not be present in reality at the WWTP. Given this, the modeled fermenter required additional alkalinity to avoid complete depletion of alkalinity and decreasing pH below the value of 4, which is necessary to avoid complete inhibition of fermentation. In addition to the alkalinity provided in the modeled influent, an additional 100 to 200 mg $CaCO_3$/L was added in the modeled fermenter. Thus, to calculate alkalinity consumption of this process, it is necessary to include the added alkalinity in the modeled influent as well as this additional alkalinity.

Performance Calibration:

Kinetic constants were set at the GPS-X default rates. In Metcalf & Eddy, it is suggested that an SRT between 3 and 6 days for primary sludge fermentation is reasonable to yield between 150 to 300 mg/L of VFAs in the fermenter effluent; the modeled results were between 120 mg/L and 224 mg/L. It is also asserted that 0.1 to 0.2 g VFA/ g VSS applied is possible, which would suggest higher VFA production is possible than modeled. However, based on the conditions of the WWTP influent alkalinity, this level of fermentation would require an unfeasible consumption of alkalinity.

APPENDIX K

NUTRIENT PERMIT ROADMAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

TO:	MARIAH LOW, GENERAL MANAGER JOHNATHAN DIX, ASSISTANT GENERAL MANAGER JAMES HEITZMAN, WWTP SUPERVISOR JEFF BAISCH, SENIOR WWTP OPERATOR
FROM:	JAY SWIFT, P.E. KOTA NISHIGUCHI, E.I.T.
DATE:	SEPTEMBER 30, 2021
SUBJECT:	NUTRIENT GENERAL PERMIT COMPLIANCE ROAD MAP LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON G&O #20408.07

This memorandum presents a roadmap for the Lake Stevens Sewer District (District) for activities necessary to comply with the new Puget Sound Nutrient General Permit. An updated draft of the permit (Draft Permit) was issued in June 2021, replacing a previous draft issued in March 2021 (March 2021 Draft Permit). Since a final permit has not been issued, this road map will likely need to be updated when the final permit comes out. Ecology plans to issue the final permit in the fall of 2021, probably in November based on discussions between the District and the Ecology Water Quality Program.

The memorandum includes the following sections:

- General Summary of the Draft Permit Requirements
- Timeline for Draft Permit Requirements
- New Testing Requirements
- Costs and Timelines Associated with Engineering Report(s) Required by the Draft Permit
- Discussion of Alternatives and Costs for Anticipated Capital Improvements Required for Compliance with the Draft Permit

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GENERAL SUMMARY OF THE DRAFT PERMIT REQUIREMENTS

The Draft Permit was established to limit existing dissolved oxygen (DO) impairments from excess nutrients discharged from municipal wastewater treatment plants (WWTPs or dischargers). The nutrients targeted with the Draft Permit are nitrate, nitrite, and ammonia, which summed together (and expressed as nitrogen), are called Total Inorganic Nitrogen (TIN). The Draft Permit designates dischargers as either "dominant" or "small" based on the magnitude of the total inorganic nitrogen loading to Puget Sound. The Lake Stevens Sunnyside WWTP is classified as a dominant loader, so this memorandum focuses on requirements for dominant loaders.

The Draft Permit includes the following major requirements for dominant loaders:

- Action Level
- Monitoring Requirements
- Documentation Requirements
- Nitrogen Optimization Plan
- Action Level Exceedance Corrective Action
- Nutrient Reduction Evaluation

Action Level

Dominant loaders have a facility-specific action level that is supposed to represent the current discharge condition and drive corrective actions when the level is exceeded for 2 consecutive years or three times during the permit term. If the dominant loader triggers the corrective action in a single year, they must reduce their effluent load by 10 percent. The March 2021 Draft Permit and Fact Sheet indicated that the calculated action level (AL) is meant to represent predicted 99th percentile plant effluent TIN loads based on historical observations. Calculation of AL assumes that if a facility behaves over the course of the permit cycle in a manner similar to its historical record, it can be assumed that as noted in the fact sheet, "there is only a 1% chance of exceedance for a given year."

There are flaws in Ecology's approach to statistical analysis for the District's action level (118,000 lb/yr) reported in the Draft Permit. Based on a review of the data and calculations, data-input assumptions appear to have misrepresented the distribution of historical loadings, which resulted in a lower proposed action level than appropriate. Gray & Osborne and the District have taken issue with the statistical approach in two letters written in response to both the March 2021 and June 2021 Draft Permits. These letters are attached to this memorandum in Attachment A. Calculations of annual effluent TIN load were separately determined using the more complete WWTP process data and show that annual loading has surpassed the proposed action levels for 3 of the past 4 years. This would appear to conflict with the intent of the action level determination (1 percent chance of exceedance) as described in the Draft Permit.

Two alternative approaches to data input, which rely on actual measurements and minimize assumptions in the data input, were presented in both letters. The latest letter, submitted with the District's official comments on the Draft Permit in August 2021, advocated a District AL of 141,000 lb/yr. (Based on feedback from Ecology, it is understood that Ecology may raise the District's action level to 123,000 lb/yr.) Ecology is obligated to respond to timely comments on draft permits and consider revisions to the permits. If Ecology does not accept the District's comments, the District would have the opportunity to appeal to the Pollution Control Hearings Board.

Monitoring Requirements

Implementation of the nutrients permit will mean increased monitoring requirements (as identified in Draft Permit Section S6.A) for the District. The requirements are summarized in District Staff Tasks Level of Effort and Requirements below.

Documentation Requirements

The District is obligated to have ready access to the following information at the WWTP site:

- S9.B.3 Original Sampling Records (field notes, as applicable and laboratory reports)
- S9.G.1.a Permit Coverage Letter
- S9.G.1.b Puget Sound Nutrient General Permit
- S9.G.1.c Discharge Monitoring Reports
- S9.G.1.d Attachment to the Annual or Single NOP Reports (as applicable)
- S9.G.1.e Nutrient Reduction Evaluation or AKART Analysis (as applicable)

Per Section S9.E of the Draft Permit, the District must retain records of all monitoring information (field notes, sampling results, etc.), optimization documents submitted with the annual or one-time report, and any other documentation of compliance with permit requirements ***for a minimum of 5 years following the termination of permit coverage.***

Nitrogen Optimization Plan

Per Section S4.C of the Draft Permit, the District is obligated to complete several tasks to "optimize treatment performance to stay below the action level" and "begin the actions described in Section S4 ***immediately upon permit coverage.***"

The Nitrogen Optimization Plan includes the following requirements:

- Treatment Process Performance Assessment
- Annual Nitrogen Optimization Implementation Reports
- Influent Nitrogen Reduction Measures/Source Control

<u>Treatment Process Performance Assessment</u>

- Treatment Process Performance Assessment:
  - Process Modeling (or equivalent):
    - Evaluate current (pre-optimization) process performance to determine the existing empirical TIN removal rate for the WWTP.
    - Develop an initial assessment approach to evaluate possible optimization strategies at the WWTP prior to and after implementation.
  - Identify and evaluate optimization strategies, with a focus on strategies that can be implemented in 1 year (includes an assessment of reasonableness for cost and time frame).
  - Initial selection required by May 1, 2022. (The expected percent TIN removal needs to be documented before implementation.)

<u>Annual Nitrogen Optimization Implementation Reports</u>

The District must submit an Optimization Implementation Report annually starting March 31, 2023. The report is required to include:

- **Strategy Implementation:** This task includes an assessment of costs, challenges, and impacts to the overall treatment process for the optimization approach implemented.

- **Load Evaluation:** This task includes quantification of influent and effluent nitrogen loads, and comparison of percent removal from that predicted by process modeling (or equivalent evaluation).

- **Strategy Assessment:** This task includes an assessment of the success of the optimization strategy and implementation of adaptive management. If changes in the strategy are warranted, an update to the process model (or equivalent) is required, along with updates to performance metrics.

Influent Nitrogen Reduction Measures/Source Control

Per the Draft Permit, the District "must develop an ongoing program to reduce influent TIN loads from septage handling practices, commercial, dense residential, and industrial sources and submit documentation with the Annual Report," and must:

- "Review non-residential sources of nitrogen and identify any possible pretreatment opportunities."

- "Identify strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings."

The impacts of these requirements are not entirely clear. It would not make sense for the District, given its limited industrial base, to conduct a significant commercial sampling program for nitrogen unless there was reason to suspect unusually high nitrogen discharges – for instance, if the ratio of TKN to BOD were higher than expected. It is recommended that the District conduct more TKN monitoring to verify ratios are in the typical range. Some limited sampling of dischargers or at manholes may be in order, for instance, if septage dumping is suspected.

It is also unclear what is meant by the requirement to "identify strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings," as pretreatment measures would not typically be employed for such customers. Based on information from Ecology, this may be additional smaller-scale wastewater treatment facilities required for dense/commercial developments. Also, eliminating septage receiving by some facilities that are covered by the permit.

Action Level Exceedance Corrective Action

After an action level is exceeded, with the next Annual Report the Permittee must submit for review a proposed approach to reduce the most recent calculated annual effluent nitrogen load by ***at least 10 percent.*** This must be an abbreviated engineering report or technical memo, unless Ecology has previously approved a design document with the proposed solution. The proposed approach must utilize solutions that can be implemented ***within 5 years*** (in addition to selecting a strategy to implement in the next year as required by S4.D.1.b).

If the District exceeds an action level 2 years in a row, or for a third year during the permit term, the Permittee must begin to reduce nitrogen loads by implementing the proposed approach. The District must submit an update to the District's Operation and Maintenance Manual no later than 30 days following implementation.

Nutrient Reduction Evaluation

A Nitrogen Reduction Evaluation (NRE) must be submitted to Ecology by December 31, 2025. The NRE must include:

- An AKART (***A***ll ***K***nown ***A***nd ***R***easonable means of prevention control and ***T***reatment) Analysis:

  The AKART Analysis must "present an alternative representing the greatest TIN reduction that is reasonably feasible."

  The AKART Analysis must include assessments of:

  - Other site-specific main stream treatment plant upgrades.
  - Side stream treatment opportunities.
  - Alternative effluent management options (e.g., disposal to ground, reclaimed water beneficial uses).
  - The viability of satellite treatment.
  - Other nutrient reduction opportunities that could achieve a final effluent concentration of ***3 mg/L TIN*** (or equivalent load reduction) on both an annual average and seasonal average basis.

The AKART Analysis must include:

- **Wastewater Characterization:** Including current flow rates and growth trends within the sewer service area and influent and effluent quality.

- **Treatment Technology Analysis:** Identification and screening of potential treatment technologies for meeting two different levels of treatment:

  - AKART for nitrogen removal (annual basis), and
  - 3 mg/L TIN (or equivalent load) as an annual average and seasonal average.

  For the District, achieving effluent TIN of less than 3 mg/L is expected to require extensive capital and operating costs, and may be deemed unaffordable in the economic evaluation (discussed below).

- **Economic Evaluation:** The economic evaluation must include capital, operation and maintenance costs, 20-year net present value, cost per pound of nitrogen removed, and rate structure evaluation. An assessment of affordability to fund potential alternatives for enhanced treatment will be a major part of the economic evaluation.

- **Environmental Justice (EJ) Review:** The EJ Review must evaluate impacts to communities of color, tribes, indigenous communities, and low-income populations, and assess mitigation of impacts.

- Selection of the most reasonable treatment alternative based on the AKART assessment and the selected alternative(s) for achieving an effluent concentration of 3 mg/L TIN.

- **Viable Implementation Timelines:** Viable implementation timelines that include funding, design, and construction for meeting both the AKART and 3 mg/L TIN preferred alternatives.

TIMELINE FOR DRAFT PERMIT REQUIREMENTS

Table 1 summarizes the timeline for activities required by the Draft Permit. As with all the information in this memorandum, this timeline should be reviewed and updated after the issuance of the final permit.

TABLE 1

Timeline for Draft Permit Requirements

Due Date	Permit Condition	Description
Fall 2021 (after permit issuance)	S4.C.1	Begin nitrogen optimization planning
Late 2021 (90 days after permit issuance)	S2.A.1	Notice of Intent (application) due
May 1, 2022	S4.C.1	Treatment Process Performance Assessment and Initial Selection of Optimization Strategy
March 31, 2023 (annual)	S4.C.2	Optimization Implementation Report
March 31, 2024 (annual)	S4.C.2	Optimization Implementation Report
March 31, 2025 (annual)	S4.C.2	Optimization Implementation Report
December 31, 2025	S4.E	Nutrient Reduction Evaluation

NEW REQUIREMENTS FOR DISTRICT STAFF

New Testing Requirements

The Draft Permit will add some monitoring requirements for the District. Table 2 summarizes the District's existing versus new/modified testing requirements mandated by the Draft Permit for both influent and effluent. (Only new or modified requirements are shown.)

TABLE 2

New or Modified Testing Requirements

Test	Current Frequency Required by District NPDES Permit	Future Minimum Required Frequency After Nutrients General Permit Issuance	Current Frequency Required by District NPDES Permit	Future Minimum Required Frequency After Nutrients General Permit Issuance
	Influent		Effluent	
Total Ammonia	None	**2/week**	1/month November–June 3/week July–October	**2/week November–June** **3/week July–October**
Nitrate + Nitrite Nitrogen	None	**1/month**	1/month	**2/week**
Total Kjeldahl Nitrogen (TKN)	None	**1/month**	1/month	1/month
Total Organic Carbon (TOC)	None	None	None	**1/month**

(1) TIN, calculated from Ammonia plus Nitrate + Nitrite Nitrogen, must be reported twice a week.

Other influent and effluent testing is mandated by the Draft Permit but incorporation of those requirements does not alter the District's existing monitoring frequency.

Some of these tests are already performed by the District or the third-party laboratories it uses. District staff routinely analyze effluent ammonia and nitrate concentrations in house and record this data on their plant process data sheets, but do not submit this nitrate data on their monthly DMRs. Effluent nitrate/nitrite concentrations are also analyzed once a month at the Everett WWTP laboratory and these data are reported on the District's DMRs.

The District's laboratory accreditation scope is limited to: turbidity, TSS, pH, ammonia, nitrite, orthophosphate, total phosphorus, BOD, CBOD, and fecal coliform. The District will either have to obtain accreditation for the other parameters or utilize third-party laboratories. Laboratory accreditation costs a minimum of $200 per test plus additional costs for all testing materials and laboratory supplies to validate testing parameters, write standard operating procedures (SOPs), and ongoing proficiency testing of laboratory analyst(s).

Assuming all the additional analyses are performed by third-party laboratories, the minimum additional annual analytical costs to comply with the permit are ***$9,200*** based on list prices provided by the District for their third-party laboratories. In the first year, given the lack of influent TKN data, it is recommended that the District conduct additional weekly TKN testing in WWTP influent beyond what is specified in the General Permit. This will add an ***additional $2,000*** to the first year's analytical costs.

Other Requirements for District Staff

In addition to increased costs for analytical testing, compliance with the new Draft Permit will require more labor from the District to meet documentation and reporting requirements. The District will need to support efforts by consultants with developing the Nitrogen Optimization Plan and Nutrient Reduction Evaluation. Finally, Action Level Exceedance Corrective Actions will require some effort by the District. The estimated additional annual costs for these activities are $5,000 to $20,000.

ENGINEERING REPORTS – COST AND TIMELINE

There are several engineering reports potentially necessary for compliance with the Draft Permit. These are described in more detail in the General Summary of the Draft Permit Requirements section.

- Treatment Process Performance Assessment and Initial Selection of Optimization Strategy:
    - Start in autumn 2021 (due May 1, 2022).
    - Estimated cost range is $20,000 to $30,000.
    - Much of the groundwork for this assessment will be completed as part of the Facility Plan. The estimated cost includes some money for contingency and revisions.
- Annual Nitrogen Optimization Implementation Reports:
    - Start January 1 each year from 2023 to 2025 (due annually in 2023 to 2025 on March 31).
    - Estimated average annual cost is $0 to $10,000.
    - The annual reports could potentially be completed by District staff, with reference to process modeling completed by consultants. However, if treatment modifications are warranted, the effort to complete the annual report will be significantly increased.
- Nutrient Reduction Evaluation:
    - Start January 1, 2025 (due December 31, 2025).
    - Estimated cost is $150,000 to $200,000.
    - Completion of the NRE is a significant effort for the District. The requirement to evaluate alternatives to meet 3 mg/L TIN, in particular, will be costly since it is expected to involve extensive process model calibration, additional treatment tankage, revisions to plant hydraulics, and consideration of small-footprint technologies. In addition, life cycle costs must be evaluated and detailed assessment of rate impacts on various groups must be completed.

DISCUSSION OF ALTERNATIVES AND ANTICIPATED CAPITAL IMPROVEMENTS

The Draft Permit limit for effluent TIN will require improvements that must be made prior to 2026 (5 years after permit issuance) and will also require assessment of long-term solutions for TIN reduction. Historical treatment plant performance indicates that the WWTP will not meet the annual effluent TIN load limit of 118,000 pounds per year in the Draft Permit. In fact, the WWTP effluent TIN loads have exceeded this proposed limit for 3 of the past 4 years. These exceedances are directly related to denitrification performance and effluent nitrate concentration. Consequently, the denitrification performance of the plant will need to improve once the Puget Sound Nutrient General Permit is issued in late 2021.

Certain optimization efforts, such as raising the anoxic zone walls or reducing dissolved oxygen concentrations in the third aerobic zone may marginally improve denitrification performance and reduce effluent TIN loads. However, additional improvements to the existing secondary treatment system will still be required to ensure the District reliably meets limits proposed in the Draft Permit. The recommended improvements consist of the installation of a supplemental carbon addition system that will provide the external carbon source necessary for improved denitrification in the existing treatment process. The process of denitrification not only requires biodegradable chemical oxygen demand (bCOD) to support denitrification but also specifically requires readily biodegradable COD (rbCOD) to provide nitrification at an effective rate. This limitation is kinetic and requires influent carbon sources like volatile fatty acids (VFAs), alcohols, or simple sugars, all of which are directly available to the microorganisms desired for the WWTP anoxic zones. With this objective, the carbon addition system will introduce rbCOD to the system to promote better kinetics for denitrification. It will require relatively minor modifications to the existing facilities, but will result in additional long-term operation and maintenance costs. (These modifications will not allow the District to reach the ultimate 3 mg/L TIN limit.)

The supplemental carbon addition system would be comprised of storage and peristaltic metering pumps with small-diameter feed piping. The initial assumption is that the external carbon source would be MicroC-2000 but the carbon addition system would also be capable of utilizing other external carbons sources, such as locally sourced glycerin or acetate. The external carbon source would be injected into the primary clarifier effluent channel upstream of the anoxic zones, ensuring that it is thoroughly mixed into the mixed liquor return stream prior to entering the anoxic zones. The GPS-X model, which was developed and calibrated as part of the Facility Planning effort, was used to develop preliminary sizing of this system and estimate the external carbon required to reliably meet the effluent permit limits at the projected year 2026 flows and loads, approximating conditions near the end of the proposed permit cycle. If a glycerin-based MicroC-2000 (1,100,000 mg-COD/L) carbon source is used, a minimum storage volume of 3,500 gallons is recommended. This storage would provide a 30-day supply for the maximum month demand to reduce effluent TIN loading to 258 pounds per day, which represents 80 percent of the average daily load for the proposed annual load of 118,000 pounds per year. One of the existing 16,000-gallon sodium hydroxide storage tanks could be repurposed for this use. The approximate cost of installing this system is provided in Table 3.

TABLE 3

Estimated Cost of Carbon Addition System Installation

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization and General Requirements				
Mobilization and Demobilization	%	8	$13,000	$13,000
Subtotal				$13,000
Process Equipment and Modifications				
Process Piping and Fittings	LS	1	$15,700	$15,700
Metering Pumps	EA	2	$15,000	$30,000
Inline Mixing Unit	LS	1	$3,500	$3,500
Subtotal				$49,200
Electrical				
Instrumentation	LS	1	$35,900	$35,900
Power Distribution, Integration, and Controls	LS	1	$65,000	$65,000
Subtotal				$100,900
Total				
Capital Cost Subtotal				$163,100
Preliminary Estimate Contingency (25%)				$41,000
Washington State Sales Tax (9%)				$18,400
Total Estimated Construction Cost				**$222,500**
Engineering (Design, Permitting, and Construction Management, 25%)				$55,600
Total Project Cost				**$278,100**

The existing storage volume was designed to provide surplus capacity for alkalinity demand. With the alkalinity credit provided by the carbon addition system, the existing alkalinity storage would be in excess of demand. Furthermore, the requisite reliability for the system would be provided by the redundant metering pump and by the ability to use totes for temporary storage of chemical alkalinity as a backup. To deliver external carbon from this location, a new set of metering pumps could then be installed near the existing sodium hydroxide metering pumps.

As previously mentioned, the carbon addition system affects future operation and maintenance costs. Specifically, the system will result in added costs for the external carbon source and biosolids hauling from additional sludge production. The increased denitrification will result in reduced alkalinity consumption and will reduce the annual cost of alkalinity addition. These cost effects have been estimated using results from the aforementioned GPS-X model and calculated with chemical costs collected for MicroC-2000 as well as sodium hydroxide (added as an alkalinity source). The resultant annual costs were estimated for 2026. For additional context, GPS-X modeling was repeated for 2041 to determine the carbon addition necessary to meet the proposed annual load of 118,000 pounds per year, though it seems likely that more stringent limits will be in place by 2041. Along with the annual costs in 2026, the estimated costs in 2041 are summarized in Table 4.

TABLE 4

Estimated Annual Costs from Carbon Addition System

Item	Unit	Quantity	Unit Cost/ Credit	Total Cost
Year 2026				
MicroC-2000 Consumption	GAL	27,900	$4.20	$117,180
Alkalinity Credit, 25% NaOH	LB	459,300	($0.13)	($59,709)
Additional Hauled Waste	TN (WET)	100	$68	$6,810
Total Annual Costs for Carbon Addition in 2026				**$64,281**
Year 2041				
MicroC-2000 Consumption	GAL	37,900	$6.40	$242,560
Alkalinity Credit, 25% NaOH	LB	585,600	($0.20)	($117,120)
Additional Hauled Biosolids	TN (WET)	110	$103	$11,319
Total Annual Costs for Carbon Addition in 2041				**$136,759**

Finally, the existing gravity thickener provides the opportunity to increase the readily biodegradable carbon from influent BOD through an on-site fermentation process and decrease the cost of external carbon addition. Specifically, static primary sludge can undergo fermentation to yield readily biodegradable carbon in the form of VFAs. This may be achieved by converting the existing gravity thickener into a fermenter and thickener, which would involve increasing the solids retention time (SRT, the average time solids remain in the tank) of the thickener to above 5 days by increasing the sludge blanket height and decreasing the sludge flow out of the thickener. Because fermentation produces additional odors, the system requires both covering and odor control. The existing gravity thickener is presently covered and is served by an 8-inch odor control duct. Given this, the existing gravity thickener includes most of the infrastructure necessary to accomplish fermentation. It is recommended that this method of yielding VFAs be pilot tested at the plant because of the potential savings in chemical costs. Such a trial would involve additional monitoring of sludge blanket levels as well testing of baseline and trial rbCOD in the overflow of the gravity thickener/fermenter.

APPENDIX L

WATER REUSE ANALYSIS

LAKE STEVENS SEWER DISTRICT

SNOHOMISH COUNTY WASHINGTON

WATER REUSE ANALYSIS

G&O #20408.07
MAY 2022

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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INTRODUCTION

This *Water Reuse Analysis* (Analysis) is prepared as part of the *General Sewer/Wastewater Facility Plan* (Facility Plan) and evaluates the feasibility for the Lake Stevens Sewer District (District) to reclaim and reuse water generated from their wastewater treatment facility (WWTF). The preparation of this Analysis is consistent with the requirements of the Revised Code of Washington (RCW) Chapters 90.46 *Reclaimed Water Use* and 90.48 *Water Pollution Control*; Washington Administrative Code (WAC) Section 173-240-060, WAC Chapter 173-219 *Reclaimed Water Rule*, and other Washington State Department of Ecology (Ecology) and Department of Health (DOH) regulations governing such analyses, including Ecology's *Criteria of Sewage Works Design* (Orange Book) and *Reclaimed Water Facilities Manual* (Purple Book).

This Analysis addresses, at a preliminary level, some of the key requirements for a Reclaimed Water Project Feasibility Study identified in the Purple Book and listed in WAC Section 173-219-180.

OWNERSHIP, OPERATION, AND MANAGEMENT

The District owns and operates a municipal sewer system within the Lake Stevens Urban Growth Area (UGA). The existing system consists of a gravity collection system, force mains, pump stations, the WWTF and outfall to Ebey Slough (part of the Snohomish Estuary).

The District would own, operate and manage any future reclaimed water treatment and reuse systems.

REGULATORY REQUIREMENTS

Various federal, state and local regulations affect system planning, construction and operation of water reuse facilities.

FEDERAL STATUTES, REGULATIONS AND PERMITS

The following federal laws and regulations that may affect water reclamation facility construction and operations:

- Federal Clean Water Act
- Federal Endangered Species Act
- National Environmental Policy Act
- Federal Safe Drinking Water Act
- Federal Guidance on Water Reuse

Many of these are discussed in detail in Chapter 2 of the Facility Plan. The impact of each of these laws and regulations is summarized below.

Federal Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) is established by Section 402 of the Clean Water Act (CWA) and subsequent amendments. The Department of Ecology (Ecology) administers NPDES permits for the United States Environmental Protection Agency (EPA) in Washington State. Most NPDES permits have a 5-year life span and place limits on the quantity and quality of pollutants that may be discharged. The District's current NPDES permit is No. WA0020893 and expires October 31, 2022.

The EPA, in consultation with Ecology, establishes and maintains a list of impaired water body segments, known as the 303(d) list. For water bodies that have impairments, Total Maximum Daily Load (TMDL) studies are conducted that identify the loading capacity of various contaminants to be discharged to a water body. Based on this loading capacity, "waste load allocations" (WLA) are established for different pollutant sources in the watershed.

The dissolved oxygen TMDL study for the Snohomish River Estuary recommended WLAs for carbonaceous and nitrogenous biochemical oxygen demand (CBOD and ammonia). The WLAs for the District WWTF are 283 pounds per day of ammonia and 174 pounds per day of CBOD.

Federal Endangered Species Act

Current Endangered Species Act (ESA) listings in the Snohomish River Estuary are presented in Table L-1, including whether there have been critical habitat designations for each species.

TABLE L-1

Species Affected By ESA in Snohomish River Estuary

Common Name	Evolutionary Significant Unit	Critical Habitat	Regulatory Agency Status
Chinook Salmon	Puget Sound Chinook	Yes	NMFS/Threatened/1999
Dolly varden/Bull trout	Puget Sound Dolly Varden/Bull Trout	Yes	USFWS/Threatened/1999
Steelhead trout	Puget Sound Steelhead	Yes	NMFS/Threatened/2007

Impacts to endangered species would need to be addressed before a reclaimed water project could go forward.

National Environmental Policy Act

If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued, otherwise an Environmental Impact Statement (EIS) is required. NEPA is not applicable to projects that do not include a Federal component that would trigger the NEPA process.

Federal Safe Drinking Water Act

The Safe Drinking Water Act (SDWA, 1974) is primarily concerned with the quality of drinking water. Because the analysis does not examine reclaimed water treatment for potable use, this law largely does not affect the analysis herein. However, the Wellhead Protection Program (42 U.S.C. § 300h–7) of this law is relevant to the application of reclaimed water. This part of SDWA makes states responsible for assigning the agency responsible for protecting underground water resources, defining wellhead area, and identifying potential sources of contaminants. Given this, the application of reclaimed water should be considered in relationship to nearby underground water resources.

Federal Guidance on Water Reuse

EPA issued its Guideline for Water Reuse in 2012, which include general water reuse guidelines. However, EPA does not require or restrict any type of reuse. Generally, states maintain primary regulatory authority over allocating and developing water resources (including reclaimed water) by using the Safe Drinking Water Act and the Clean Water Act as foundation.

STATE STATUTES, REGULATIONS AND PERMITS

Regulatory requirements for wastewater treatment and water reclamation are delegated to each state by the federal government, as discussed above. The following discussion of relevant regulatory requirements focuses on those for water reclamation and regulations that may affect the planning for water reclamation and reuse for the District.

State Reclaimed Water Rule

In 2018, Ecology adopted the Reclaimed Water Rule (Chapter 173-219). In general, the rule establishes requirements for the production, distribution, and use of reclaimed water as authorized by the Department of Ecology (Ecology) and Department of Health (DOH). The rule sets the framework for how state agencies regulate the following:

a) Planning, designing, constructing, operating, and maintaining reclaimed water facilities.

b) Permitting of reclaimed water facilities.

c) Technology-based treatment, operational storage and distribution, treatment reliability, and use-based requirements.

d) Preventing impairment of existing water rights.

For the water reuse implementation contemplated in this plan, the Ecology is the agency that sets the requirements for the above. For proposed water reclamation facilities that are originally wastewater facilities, Ecology is the primary lead with DOH as the secondary lead agency. DOH issues Waste Discharge Permits for reclaimed water use in conjunction with Ecology. In general, DOH is the lead agency or has greater involvement for industrial wastewater sources, when reclaimed water is proposed for eventual potable use, or for small systems. The following sections summarize the rule's requirements on each of the above.

Planing, Design, Construction, Operation and Maintenance

Potential generators must arrange and attend a preplanning meeting with the lead and secondary lead agency to determine the scope of the feasibility analysis, as well as other planning, permitting, or technical matters related to their intention to generate and distribute reclaimed water for use. If water reuse appears desirable for the District, and the District wished to move forward with implementation, a preplanning meeting would need to be held as part of a formal feasibility analysis. The feasibility analysis must consist of the following:

(i) Explanation of who will own, operate, and maintain the reclaimed water facility.

(ii) For a planning period of 20 years, projected capital and operational costs, in terms of total annual cost and present worth, and projected revenues from user fees and other sources, if applicable.

(iii) Estimate of the annual or seasonal volumes of wastewater required and available and proposed production (generation) rate of reclaimed water.

(iv) Description of the proposed level of reclaimed water quality the project will generate, along with general descriptions of the treatment systems and reliability features used by the proposed facility. The project proponent must demonstrate that the proposed facility concept is capable of meeting and ensuring the minimum requirements for water quality, treatment and reliability for the proposed uses.

(v) Description of plans for alternative use, storage, or release of any reclaimed water or inadequately treated water.

(vi) Initial assessment of potential water quality and quantity impairment and potential strategies to prevent, compensate, and/or mitigate for such impairment.

(vii) List of all public potable water suppliers that provide water to the reclaimed water generation, storage, and distribution facilities in addition to prosed reclaimed water use areas. Describe proposed methods to coordinate with potable water suppliers on reclaimed water service including cross connection prevention actions in design and operation of the reclaimed water system. Results of coordination with the listed potable water suppliers must be included in the engineering report under WAC 173-219-210 (2) (f).

(viii) Description of the contingency plan for both temporary and permanent reversion to domestic wastewater facilities and alternative water supply systems where applicable, if reclaimed water production (generation) is discontinued. Include the impact of increased demand to water purveyors.

(ix) A brief description of the community outreach and public involvement conducted or planned to be conducted, as you determine feasibility, to demonstrate awareness of and community support for the reclaimed water project.

(x) Identification of existing or proposed interlocal or interagency agreements related to reclaimed water, if any, with local governments or local potable water utilities within the area of existing or proposed distribution and use of reclaimed water.

(xi) Statement of compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), where applicable.

The analysis related to planning, design, construction, operation and maintenance would need to reasonably adhere to the guidelines presented in Ecology's guidance, *Criteria for Sewage Works Design* (Orange Book) and Ecology and DOH's guidance, *Reclaimed Water Facilities Manual (*Purple Book). The guidelines presented in the Orange Book and Purple Book form the basis of Ecology's review of the feasibility analysis.

Although the objective of this Analysis is to address key elements of a feasibility analysis, any construction and/or modification of a water reclamation facility must be preceded by Ecology's approval of an engineering report that represents the technical basis of the facility. The detailed requirements of this report are described in WAC 173-219-210 and the Purple Book, many of which are similar to the content of the feasibility analysis. As a summary of these requirements, the report must include the following key items:

- Proposed quantity and quality of the reclaimed water generated by the reclaimed water facility, including an assessment that the proposed water quality meets the requirements for all proposed beneficial uses (i.e., reclaimed water classifications, Table L-2 and Table L-3).

- The anticipated amount, characteristics, and strength of the source water to be treated, including BOD_5, DO, TSS, and nitrate levels, and the degree of treatment required to generate proposed reclaimed water quality, and other influencing factors.

- Descriptions of proposed treatment processes, including preliminary flow diagrams of critical reclaimed water unit processes, as well as anticipated reliability features and controls. The report must contain sufficient detail to verify that the proposed facility will comply with the water quality and reliability requirements of this chapter.

- Summary of preliminary engineering design criteria for reclaimed water treatment processes, including the technology-based treatment and reliability requirements discussed in a later section.

TABLE L-2

Minimum Biological Oxidation Performance Standards

Parameter(1)	**Minimum Biological Oxidation Performance Standard**	
Dissolved Oxygen	Must be measurably present	
BOD5	**Monthly Average**	**Weekly Average**
	30 mg/L	45 mg/L
CBOD5	25 mg/L	40 mg/L
TSS	30 mg/L	45 mg/L
pH	**Minimum**	**Maximum**
	6 s.u.	9.0 s.u.
pH (Groundwater recharge)	6.5 s.u.	9.0 s.u.

(1) The parameter must be measured at the end of the unit process or alternative monitoring location as set in a reclaimed water permit.

TABLE L-3

Class A and B Performance Standards

Parameter[1]	Class A Reclaimed Water		Class B Reclaimed Water	
	Coagulation/Filtration			
Turbidity[2]	Monthly Average	Sample Maximum	Monthly Average	Sample Maximum
	2 NTU	5 NTU	Not Applicable	Not Applicable
	Membrane Filtration			
Turbidity[2]	Monthly Average	Sample Maximum	Monthly Average	Sample Maximum
	0.2 NTU	0.5 NTU	Not Applicable	Not Applicable
	Disinfection			
Total Coliform	7-Day Median	Sample Maximum	7-Day Median	Sample Maximum
	2.2 MPN/100 mL	23 MPN/mL	23 MPN/mL	240 MPN/mL
Virus Removal	4 Log-Removal		Not Applicable	Not Applicable
	Nitrogen Removal[3]			
Total Nitrogen	Monthly Average	Weekly Average	Monthly Average	Weekly Average
	10 mg/L	15 mg/L	Not Applicable	Not Applicable

(1) The parameter must be measured at the end of the unit process or alternative monitoring location as set in a reclaimed water permit.
(2) Sample maximum for turbidity is the highest value for the day that lasts longer than 5 minutes.
(3) Total nitrogen standards apply to release to wetlands, surface water augmentation, groundwater recharge, and direct potable reuse.

<u>Permitting</u>

Applications for reclaimed water permits must be submitted to the lead agency no later than 180 calendar days before planned distribution of reclaimed water for use. Prior to the application submission, the feasibility analysis must be approved by Ecology. Similarly, the required engineering report must be submitted for approval prior to or in conjunction with the permit application.

<u>Technology-Based Treatment and Disinfection</u>

Depending on the classification of reclaimed water, certain technology-based treatment requirements apply to the generation of reclaimed water. Class B reclaimed water must include biological oxidation followed by disinfection. Class A water requires one of the following alternative treatment processes/technologies to meet the performance requirements listed in Table L-2 and L-3:

a) Biological oxidation, followed by coagulation, filtration, and disinfection, demonstrating at least a 4-log virus removal or inactivation.

b) Biological oxidation, followed by membrane filtration and disinfection, demonstrating at least a 4-log virus removal or inactivation.

c) Combination of biological oxidation and membrane filtration via a membrane bioreactor, followed by disinfection, demonstrating at least a 4-log virus removal or inactivation.

d) An alternative treatment method, that demonstrates to the satisfaction of the lead agency that it provides for equivalent treatment and reliability.

As a membrane bioreactor facility, the Lake Stevens WWTF would use method “c” above.

Disinfection may be accomplished by the methods described in the Purple Book, including ultraviolet, chlorine, or other chemical disinfection methods. However, a minimum chlorine residual of ≥0.2 mg/L free chlorine or ≥0.5 mg/L total chlorine is required in pipeline distribution systems conveying the reclaimed water from the facility to the point of use. Ecology may waive or modify this requirement if the generator demonstrates a benefit from reducing or eliminating the chlorine residual.

The Lake Stevens WWTF currently uses ultraviolet disinfection, and it is assumed that this disinfection method would be used if the generated reclaimed water.

<u>Storage and Distribution</u>

Storage and distribution systems for reclaimed water are governed by several regulations, all of which are detailed in the Purple Book. The following list of regulations and guidelines contains notable requirements that will affect the planning and design of the modifications to the existing wastewater treatment system to store and distribute reclaimed water:

- Reclaimed water distribution systems must provide adequate separation between the underground reclaimed water lines and sanitary sewer lines, storm sewer lines, potable water lines, and potable water wells.

- A minimum of 200 feet must separate reclaimed water storage and distribution from potable water supply intakes, including wellheads, springs, surface water, or designated groundwater under the influence of surface water.

- The design of storage ponds and reservoirs must prevent exchange with groundwater.

- The design and location of storage ponds or reservoirs must be protected from stormwater runoff from surrounding property.

- All water that enters the distribution system from open reservoirs should be filtered or screened to protect the system from algal growth or residual suspended solids.

- The installation of new or replacement distribution pipelines for reclaimed water distribution systems must comply with the most recent edition of *Planning for the Distribution of Reclaimed Water*, Manual M24, American Water Works Association, the most recent edition of the Department of Health *Water System Design Manual*, or equivalent standard engineering practices (WAC 173-219-360(3)). The distribution system must be able to provide positive pressure to the point of use at peak hour demand.

Treatment Reliability

Generators may not distribute water that has not received adequate and reliable treatment based on the requirements of the Reclaimed Water Rule and the facility's reclaimed water permit. Treatment reliability requirements are described in detail in the Purple Book. In general, these guidelines consist of the application of alarms and redundant or standby treatment equipment such that untreated or partially treated water does not enter the reclaimed water distribution system or at least indicates when water has not been adequately treated. The specific guidelines are detailed in Table 6-6 of the Purple Book.

Water that does not receive treatment meeting requirements in the Reclaimed Water Rule and reclaimed water permit must be diverted to temporary storage and re-treatment or discharged under authorization by a state waste discharge permit or NPDES permit. The method of handling partially treated water must be coordinated with Ecology. For this part of the Reclaimed Water Rule, Ecology has the authority to do the following:

- Require a reclaimed water generator to maintain either storage or disposal options for inadequately treated water sized to accommodate the full design flow.

- Specify when and how the reclaimed water treatment facility must cease or otherwise control the generation, distribution, and use of reclaimed water including, but not limited to, the reduction, loss, failure, or bypass of any unit processes of the reclaimed water facility.

- Specify procedures to establish when the treatment processes are sufficiently restored to allow the generation, distribution, or use of the reclaimed water.

- Prohibit bypassing of inadequately treated water from the approved reclaimed water facility to the distribution system or to the point of use.

Water Rights

Facilities that reclaim water must not impair any existing water right downstream from any freshwater discharge points of such facilities unless compensation or mitigation for such impairment is agreed to by the holder of the affected water right. To show how water rights may be affected, the feasibility analysis must include a water impairment assessment, as previously described.

Ecology and the District would need to jointly notify and consult with affected tribes and the Washington state Department of Fish and Wildlife (WDFW) before Ecology makes its final determination of compliance.

State Water Quality Standards for Groundwaters

The Water Quality Standards for Groundwaters of the State of Washington (WAC 173-200) apply to all groundwaters of the state that occur in a saturated zone or stratum beneath the surface of land or below a surface water body. This rule does not apply to any contaminants or nutrients applied to the land that do not travel deeper than the root zone. If the proposed application of reclaimed water includes groundwater recharge (direct or indirect) or is within 1,000 feet of potable water wellheads, critical aquifer recharge areas, and wellhead protection areas, this rule may apply. Guidance on defining wellhead protection areas and relevant contaminant sources is described in DOH's *Wellhead Protection Program Guidance Document*.

A large portion of this rule consists of the anti-degradation policy, which includes the following:

1. Existing and future beneficial uses shall be maintained and protected and degradation of groundwater quality that would interfere with or become injurious to beneficial uses shall not be allowed.

2. Degradation shall not be allowed of high quality groundwaters constituting an outstanding national or state resource, such as waters of national and state parks and wildlife refuges, and waters of exceptional recreational or ecological significance.

3. Whenever groundwaters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected, and contaminants that will reduce the existing quality thereof shall not be allowed to enter such waters.

In sum, existing groundwater quality must not change from water reclamation activities. The simplest method of adhering to the anti-degradation policy is to locate water reclamation facilities, pipes, and uses away from wellhead protection areas.

PROJECTED RECLAIMED WATER DEMAND AND DESIGN CRITERIA

Projections of WWTF flows and loads through the 20-year planning period are determined to estimate the volume of wastewater available for reclaimed water generation. There projections are provided in Chapter 5 of the Facility Plan and summarized below.

The following also addresses the existing WWTP treatment performance to characterize the level of treatment required for reclaimed water treatment.

AVAILABLE WASTEWATER FLOWS

Table L-4 shows the District's existing and 20-year projections of flow to the WWTF.

TABLE L-4

Existing (2021) and 20-Year (2041) Projected WWTF Flow

Flow Type	2021	2041
Average Dry Weather	2.42	3.40
Average Annual	2.92	3.98
Maximum Month	3.79	4.94
Peak Day	6.96	8.36
Peak Hour	9.17	11.28

As discussed below, the projected demand for reclaimed water is substantially less than the projected WWTF flows.

WASTEWATER QUALITY

Design criteria for reclaimed water generation will depend on the quality of the WWTF effluent. The WWTF liquid stream unit processes are discussed in detail in Chapter 7 of the Facility Plan. Table L-5 summarizes the 20-year projected WWTF effluent parameters.

The BOD and TSS standards shown in Table L-2 would be easily met, as evidenced by the data in Table L-5, as would the turbidity standards. Minor process modifications would be needed to provide the additional nitrogen removal that would be needed to reliably meet the 10 mg/L monthly /15 mg/L weekly total inorganic nitrogen limitations for reclaimed water. As discussed below, additional ultraviolet dose would be needed to meet pathogen reduction requirements.

TABLE L-5

20-Year (2041) Projected Effluent Parameters

Effluent Parameters	NPDES Permit Limit[(1)]	Maximum Month	Annual Average	Average Dry Weather Flow
$CBOD_5$, mg/L	25	0.71	0.62	0.47
$CBOD_5$, lb/d	1,045[(2)]	29.1	20.7	13.4
TSS, mg/L	30	0.20	0.15	0.14
TSS, lb/d	1,254[(3)]	8.41	5.12	4.03
NH_3, mg/L	-	0.70	0.73	0.35
NBOD + $CBOD_5$, lb/d	235[(4)]	90.0	71.3	34.1
Nitrate/Nitrite, mg/L	-	9.72	11.57	13.7
Net Alkalinity Consumption, lb-$CaCO_3$/d	-	5,729	5,317	5,681

(1) Average monthly limits.
(2) $CBOD_5$ effluent load is limited from November through June.
(3) TSS effluent load is limited from November through June.
(4) Combined NBOD and CBOD limited from July through October; NBOD = 2.1*NH_3.

POTENTIAL USES OF RECLAIMED WATER

Projections of reclaimed water demand require characterization of potential uses within and adjacent to the District.

Within the District, three potential uses for reclaimed water have been identified:

1. Irrigation/Landscaping – Water uses include irrigation of landscaping, play fields and school grounds. Because these areas are open to the public, reclaimed water for irrigation would need to meet Class A standards.

    - The District bills commercial connections based on metered water use. Commercial customers may install irrigation waters to remove that portion of the flow from their sewer bill during the summer months. The District currently has two connections with irrigation meters.

    - Within the UGA, there are 10 schools with a total of approximately 46 acres could be irrigated with reclaimed water.

    - The City of Lake Stevens currently has 6 parks with area that could be irrigated. These parks have a total of approximately 10 acres that could be irrigated with reclaimed water. Additionally, Snohomish County has preliminary plans to develop Cavalero Hill Park. Construction of the Park is not yet funded or scheduled. Those plans show approximately 7 acres of area that could be irrigated.

- There are not any other large properties nearby such as golf courses that could use reclaimed water for irrigation.

2. Flushing of Sanitary Sewers – Water would be used to flush sanitary sewers. The District has a vactor truck that is used to jet the approximately 665,000 feet of gravity sewer pipe that should be cleaned on a 4-year frequency. Assuming that approximately 4 gallons of water are required to clean each foot of pipe, this demand for reclaimed water would be 665,000 gallons per year. Reclaimed water for this use would need to meet Class B standards.

3. Industrial Use – Reclaimed water could be used for industrial processes including boiler feed or industrial cooling water. If water used for industrial purposes were exposed to workers, reclaimed water would need to meet Class A standards. Otherwise, it would need to meet Class B standards. The District does not have any potential industrial reclaimed water users.

The potential reclaimed water users are listed in Table L-6 and locations shown in Figure L-1. It should be noted that the demand for irrigation uses would be expected for only the months of June through September.

In addition, diversion of effluent from the slough to reclaimed water sites could reduce loading of nutrients to Puget Sound and assist the District in compliance with the new Puget Sound General Nutrient Permit.

There are no streams in the immediate area that would benefit from streamflow augmentation.

TABLE L-6

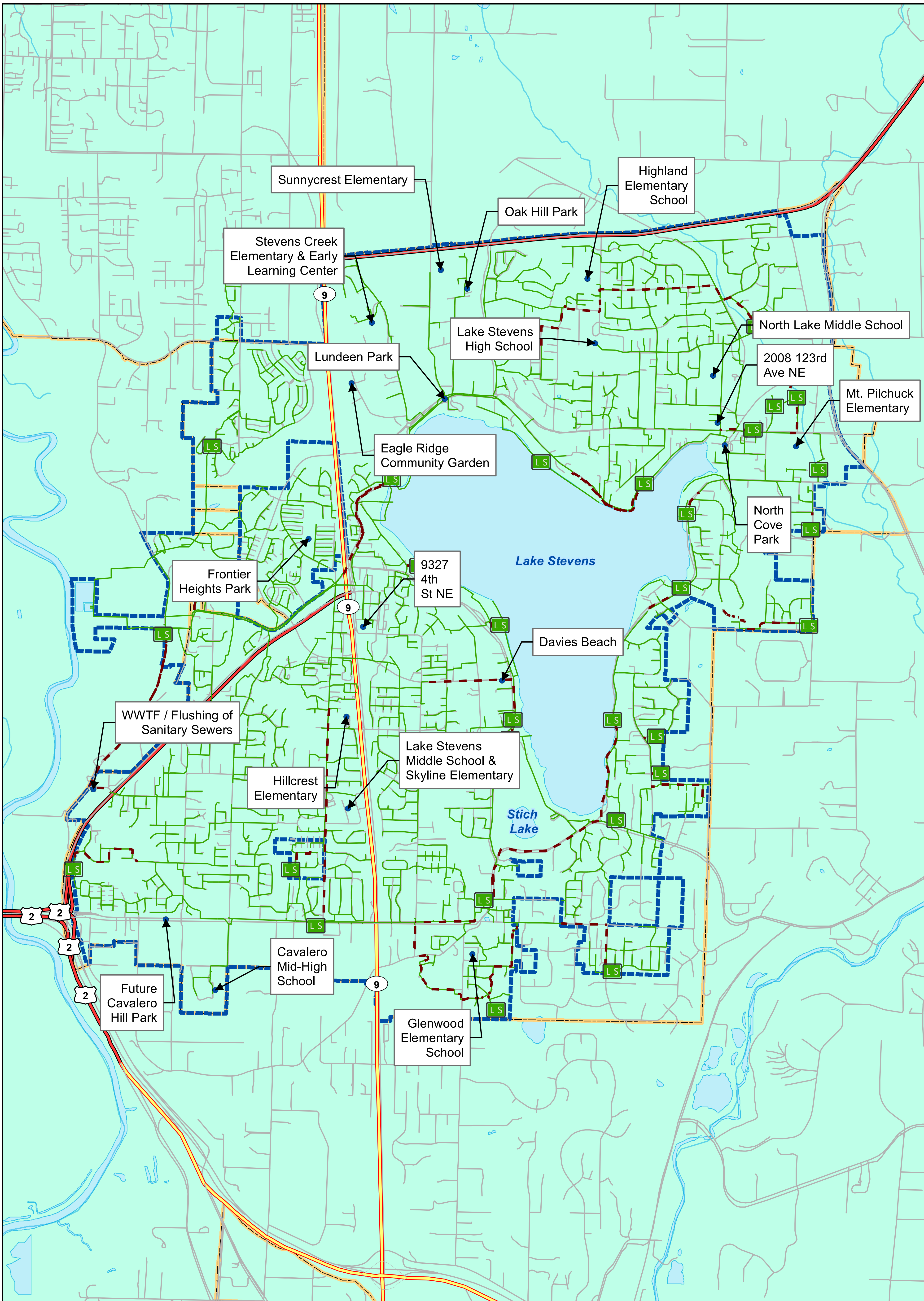
Potential Users of Reclaimed Water

Location	Approximate Acreage(1)	Annual Usage(2) (MG/year)	Peak Day(3) (gpd)	Distance from WWTF (miles)
Irrigation Meters				
9327 4th Street NE				2.0
2008 123rd Avenue NE				4.6
Schools				
Cavalero Mid-High School	7.2	2.91	27,750	1.6
Glenwood Elementary School	0.9	0.36	3,470	2.9
Highland Elementary School	2.6	1.05	10,020	4.5
Hillcrest Elementary	2.0	0.81	7,710	1.7
Lake Stevens High School	6.5	2.63	25,050	4.2
Lake Stevens Middle School and Skyline Elementary	7.8	3.16	30,060	1.5
Mt. Pilchuck Elementary	3.1	1.25	11,950	4.9
North Lake Middle School	10.5	4.25	40,470	4.7
Stevens Creek Elementary and Early Learning Center	3.5	1.42	13,490	3.7
Sunnycrest Elementary	2.5	1.01	9,640	3.7
Parks				
Davies Beach	0.2	0.08	770	2.8
Eagle Ridge Community Garden	0.4	0.16	1,540	3.2
Frontier Heights Park	5.5	2.23	21,200	1.9
Lundeen Park	1.5	0.61	5,780	3.2
North Cove Park	1	0.40	3,850	4.7
Oak Hill Park	1.4	0.57	5,400	3.8
Future Cavalero Hill Park	7	2.83	26,980	1.5
Flushing of Sanitary Sewers(4)	-	0.67	6,650	
Total Potential Reclaimed Water Usage		**26.40**	**251,780**	

(1) Potential Irrigation Areas for Schools and Parks were estimated based on publicly available aerial imagery.
(2) Washington State Irrigation Guide for Everett, Washington, pasture/turf requires 14.9 inches per year. Average Use listed for irrigation meters.
(3) Washington State Irrigation Guide for Everett, Washington, pasture/turf requires 4.4 inches in July. Peak month use listed for irrigation meters.
(4) Assumed 100 days of flushing per year.

WATER RIGHTS IMPACT

The Snohomish PUD No. 1 (PUD) is the water purveyor within the District. The PUD obtains potable water from the City of Everett for water rights and supply. The City of Everett has certified water rights of 246 mgd for its service area. Currently, the City of Everett peak day demand is less than 85 mgd. Accordingly, it has the ability to increase supply within its water right. Additionally, the PUD had two emergency wells within the City of Lake Stevens that have a combined peak capacity of 2,400 gpm.



Legend

Source: City of Lake Stevens

- Potential Reclaimed Water User
- Lift Station
- Forcemain
- Sewerline
- LSSD Border
- City Boundary
- Urban Growth Boundary

N

0 1,250 2,500 5,000 Feet

LAKE STEVENS SEWER DISTRICT
GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE L-1
POTENTIAL RECLAIMED WATER USERS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\lkstvswr\20408 General Engineering 2020\20408.07 Sewer Comp-Facility Plan\GIS\MXDs\Project MXDs\Fig L-1 Reclaimed Water Users.mxd

Because existing water rights are sufficient, use of reclaimed water would have a minimum impact in offsetting water rights limitations. Additionally, the District would need to perform a water rights impairment analysis to discontinue discharging any or all of its existing treated effluent into Ebey Slough. This analysis would need to demonstrate that withdrawing any portion of the effluent currently discharged into Ebey Slough would not have a detrimental impact on any water rights or the intended uses for the slough.

RECLAIMED WATER FACILITY REQUIREMENTS

RECLAIMED WATER DISTRIBUTION SYSTEM

If the District were to develop a reclaimed water system, it would need to construct a separate pumping and distribution system because mixing reclaimed water and potable water is not permitted. The distribution system would likely run along existing roadways for the distances indicated in Table L-6, which follow the likely routes of the reuse pipelines. It is estimated that the total length of the distribution system piping necessary to serve the majority of the potential users of reclaimed water is 20 to 25 miles. In addition, irrigation piping would be needed for all the facilities.

MODIFICATION OF TREATMENT FACILITIES TO PRODUCE RECLAIMED WATER

Since the majority of the potential uses of reclaimed water in the vicinity of the District would require Class A water, it is assumed that the existing WWTF facilities would be upgraded to Class A treatment. In order to generate Class A reclaimed water, the UV system would need to be upgraded to provide a dose of 80 mJ/cm^2 at a ultraviolet transmittance (UVT) value of 65 percent (based on the UVT testing discussed in Chapter 7). Since the reclaimed water demand is only a fraction of the total flow (0.25 mgd out of 3.40 mgd dry weather flow), it would be possible to provide the additional dose with an additional in-pipe UV system, or the entire UV system could be expanded to provide the necessary dose. No other process enhancements would be necessary, other than reliability/redundancy improvements and the previously planned carbon addition facilities to enhance nitrogen removal. (Reclaimed water facilities using membrane bioreactors for biological treatment are not required to provide coagulation as non-MBR facilities are.)

Per WAC-173-219, reclaimed water facilities must either store inadequately treated water for additional treatment or have authorization to discharge the wastewater to an NPDES outfall, or another permitted disposal location in accordance with a wastewater discharge permit. The diversion facilities are required to have power supply independent from the rest of the plant or be backed up by standby power. Since the District's WWTF has a permitted outfall, only diversion facilities are required.

COSTS

The combined total project cost of a reclaimed water pump station, distribution system, irrigation systems, and WWTF improvements is approximately $40 to $50 million. (The cost estimate is included in the appendix.) The vast majority (over 80 percent) of the cost is in the distribution system. If the size of the distribution system were decreased, the overall cost would decrease, but less water would be diverted and reused.

SUMMARY AND CONCLUSIONS

At approximately $40 to $50 million capital cost, the investment in a reclaimed water treatment, pumping and distribution system is substantial. Not included are the additional operation and maintenance expenses associated with the new pump station, increased ultraviolet dose, and maintenance of the reclaimed water distribution system.

As discussed above, a potential benefit of generating reclaimed water from a portion of effluent (in lieu of discharging all of it out of the outfall) would be to reduce nitrogen loading to the slough and Puget Sound. In theory, if more stringent total inorganic limits (e.g., 3 mg/L TIN) are ultimately imposed for discharges from the WWTF to the slough after the AKART analysis mandated by the new Puget Sound Nutrient General Permit, fully converting to water reuse (where the limit of 10 mg/L is required) and ceasing the slough discharge could reduce the level of treatment required for compliance with the nutrient permit. However, based on the $40 - 50 million capital cost, increased operating costs, and the fact that there is demand for less than 10 percent of the effluent generated, and just during the summer season, generation of reclaimed water is not expected to be cost effective no matter how stringent the total inorganic nitrogen limits are.

Given the estimated magnitude of the costs and lack of any real demand for reclaimed water to offset non-potable water needs, and lack of benefit from diversion of a small percentage of effluent, a reclaimed water project is not recommended for the District at this time.

APPENDIX M

FUNDING PROGRAM SUMMARY

Funding Programs for
Drinking Water and Wastewater Projects

Updated 2-14-22

You can find the latest version of this document at http://www.infrafunding.wa.gov/resources.html

Please contact Cathi Read at cathi.read@commerce.wa.gov if you would like to update your program information

PLANNING Programs	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
CDBG Community Development Block Grant – General Purpose Grant Fund – Planning-Only Activities	• Comprehensive plans • Non-routine infrastructure plans • Feasibility studies • Community action plans • Low-income housing assessments	Projects must principally benefit low- to moderate-income people in non-entitlement cities and counties. • Cities or towns with fewer than 50,000 people • Counties with fewer than 200,000 people	Grant • Up to $30,000 for a single jurisdiction.	2022 CDBG General Purpose application materials are due June 1, 2022. Grant awards early September. **Contact:** Jon Galow 509-847-5021 jon.galow@commerce.wa.gov Visit www.commerce.wa.gov/cdbg and click on the General Purpose grant menu for information and forms.
SOURCE WATER PROTECTION GRANT PROGRAM	Source water protection studies (watershed, hydrogeologic, feasibility studies). Eligible activities can lead to reducing the risk of contamination of a system's drinking water sources(s), or they can evaluate or build resiliency for a public water supply. They must contribute to better protecting one or more public water supply sources.	Non-profit Group A water systems. Local governments proposing a regional project. Project must be reasonably expected to provide long-term benefit to drinking water quality or quantity.	Grants • Funding is dependent upon project needs, but typically does not exceed $30,000.	Applications accepted anytime; grants awarded on a funds available basis. **Contact:** Derrick Dennis 360-236-3122 derrick.dennis@doh.wa.gov or Deborah Johnson 360-236-3133 Deborah.johnson@doh.wa.gov http://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/SourceWaterProtection.aspx Grant guidelines https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-552.pdf

PLANNING **Programs**	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
ECOLOGY: INTEGRATED WATER QUALITY FUNDING PROGRAM State Water Pollution Control Revolving Fund (SRF) Centennial Clean Water Fund	Planning projects associated with publicly-owned wastewater and stormwater facilities. The integrated program also funds planning and implementation of nonpoint source pollution control activities.	Counties, cities, towns, conservation districts, or other political subdivision, municipal or quasi-municipal corporations, and tribes	Loan: $10,000,000 reserved for preconstruction statewide Interest rates (SFY 2023) • 6-20 year loans: 1.1% • 1-5 year loans: 0.5% Preconstruction set-aside (Distressed Communities) 50% forgivable principal loan and 50% loan	Applications due October 12, 2022. **Contact:** David Dunn 360-515-8601 david.dunn@ecy.wa.gov https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Water-Quality-grants-and-loans
RD PRE-DEVELOPMENT PLANNING GRANTS (PPG) U.S. Dept. of Agriculture Rural Development – Rural Utilities Service – Water and Waste Disposal Direct Loans and Grants	Water and/or sewer planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Low-income, small communities and systems serving areas under 10,000 population.	Planning grant to assist in paying costs associated with developing a complete application for RD funding for a proposed project. Maximum $30,000 grant. Requires minimum 25% match.	Applications accepted year-round, on a fund-available basis. **Contact:** Marti Canatsey 509-367-8570 marlene.canatsey@usda.gov http://www.rd.usda.gov/wa
RD 'SEARCH' GRANTS: SPECIAL EVALUATION ASSISTANCE FOR RURAL COMMUNITIES U.S. Dept. of Agriculture Rural Development – Rural Utilities Service – Water and Waste Disposal Direct Loans and Grants	Water and/or sewer planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Low-income, small communities and systems serving areas under 2,500 population.	Maximum $30,000 grant. No match required.	Applications accepted year-round, on a fund-available basis. **Contact:** Marti Canatsey 509-367-8570 marlene.canatsey@usda.gov http://www.rd.usda.gov/wa

PLANNING Programs	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
CERB PLANNING AND FEASIBILITY GRANTS Community Economic Revitalization Board – Project-Specific Planning Program	Project-specific feasibility and pre-development studies that advance community economic development goals for industrial sector business development.	Eligible statewide • Counties, cities, towns, port districts, special districts. • Federally recognized tribes • Municipal corporations, quasi-municipal corporations w/ economic development purposes.	Grant • Up to $50,000 per application. • Requires 25% (of total project cost) matching funds.	Applications accepted year-round. The Board meets six times a year. **Contact:** Janea Delk 360-725-3151 janea.delk@commerce.wa.gov
RCAC Rural Community Assistance Corporation Feasibility and Pre-Development Loans	Water, wastewater, stormwater, and solid waste planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 or less if proposed permanent financing is through USDA Rural Development.	• Typically up to $50,000 for feasibility loan. • Typically up to $350,000 for pre-development loan. • Typically up to a 1-year term. • 5% interest rate. • 1% loan fee.	Applications accepted anytime. **Contact**: Jessica Scott 719-458-5460 jscott@rcac.org Applications available online at http://www.rcac.org/lending/environmental-loans/
DWSRF Drinking Water State Revolving Fund Preconstruction Loans	Preparation of planning documents, engineering reports, construction documents, permits, cultural reports, environmental reports.	Group A (private and publicly-owned) community and not-for-profit non-community water systems, but not federal or state-owned systems.	• $500,000 maximum per jurisdiction • 0% annual interest rate • 2% loan origination fee • 2-year time of performance • 10-year repayment period	On-line applications accepted year-round until funding exhausted. Approximately $3 million available to award each year. **Contact:** Corina Hayes 360-236-3153 Corina.hayes@doh.wa.gov For information and forms visit: http://www.doh.wa.gov/DWSRF

PLANNING **Programs**	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
Economic Development Administration (EDA) United States Department of Commerce **EDA Public Works Program:** Planning, Feasibility Studies, Preliminary Engineering Reports, Environmental Consultation for distressed and disaster communities.	Drinking water infrastructure; including pre-distribution conveyance, withdrawal/harvest (i.e. well extraction), storage facilities, treatment and distribution. Waste water infrastructure; including conveyance, treatment facilities, discharge infrastructure and water recycling.	Municipalities, counties, cities, towns, states, not-for-profit organizations, ports, tribal nations.	Grants: • EDA investment share up to $1M. • Cost sharing required from applicant **up to** 50% of total project cost. ○ Up to 100% for Tribal Nations	**Information:** EDA.gov **Contact:** Laura Ives 206-200-1951 lives@eda.gov **Apply at:** grants.gov

PRECONSTRUCTION ONLY **Programs**	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
ECOLOGY: INTEGRATED WATER QUALITY FUNDING PROGRAM State Water Pollution Control Revolving Fund (SRF) Centennial Clean Water Fund Stormwater Financial Assistance Program (SFAP)	Design projects associated with publicly-owned wastewater and stormwater facilities. The integrated program also funds planning and implementation of nonpoint source pollution control activities.	Counties, cities, towns, conservation districts, or other political subdivision, municipal or quasi-municipal corporations, and tribes.	Loan: $10,000,000 reserved for preconstruction statewide Interest rates (SFY 2023) • 6-20 year loans: 1.1% • 1-5 year loans: 0.5% Preconstruction set-aside (Distressed Communities) 50% forgivable principal loan and 50% loan	Applications due October 12, 2022. A cost effectiveness analysis must be complete at the time of application. **Contact:** David Dunn 360-515-8601 david.dunn@ecy.wa.gov https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Water-Quality-grants-and-loans
PWB PRE-CON Public Works Board Pre-Construction Program	Low-interest loans to fund pre-construction activities that prepare a specific project for construction. Water, sanitary sewer, stormwater, roads, streets, bridges, solid waste, and recycling facilities.	Counties, cities, special purpose districts, and quasi-municipal organizations that meet certain requirements. School districts and port districts are not eligible.	• Approximately $10 million available for preconstruction • Maximum loan amount $1 million per jurisdiction per biennium. • 5-year loan term. • Interest rates vary. • Pre-construction work must be completed within 2 years.	The next funding cycle is expected to be announced in early 2023. Check the Public Works Board website periodically at http://www.pwb.wa.gov to obtain the latest information on program details or to contact Public Works Board staff. **Contact:** Mark Rentfrow 360-529-6432 Mark.rentfrow@commerce.wa.gov

PRECONSTRUCTION ONLY **Programs**	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
RCAC Rural Community Assistance Corporation Feasibility and Pre-Development Loans	Water, wastewater, stormwater, or solid waste planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 or less if proposed permanent financing is through USDA Rural Development.	• Typically up to $50,000 for feasibility loan. • Typically up to $350,000 for pre-development loan. • Typically a 1-year term. • 5% interest rate. • 1% loan fee.	Applications accepted anytime. **Contact**: Jessica Scott 719-458-5460 jscott@rcac.org Applications available online at http://www.rcac.org/lending/environmental-loans/
Economic Development Administration (EDA) United States Department of Commerce **EDA Public Works Program:** Design and/or Construction for distressed and disaster communities.	Drinking water infrastructure; including pre-distribution conveyance, withdrawal/harvest (i.e. well extraction), storage facilities, treatment and distribution. Waste water infrastructure; including conveyance, treatment facilities, discharge infrastructure and water recycling.	Municipalities, counties, cities, towns, states, not-for-profit organizations, ports, tribal nations.	Grants: • EDA investment share up to $1M. • Cost sharing required from applicant **up to** 50% of total project cost. ○ Up to 100% for Tribal Nations	**Information:** EDA.gov **Contact:** Laura Ives 206-200-1951 lives@eda.gov **Apply at:** grants.gov

CONSTRUCTION AND DESIGN/CONSTRUCTION Programs	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
CDBG-GP Community Development Block Grant General Purpose Grants	• Final design and construction of wastewater, drinking water, side connections, stormwater, streets, and community facility projects. • Infrastructure in support of economic development or affordable housing. • Planning activities	Projects must principally benefit low- to moderate-income people in non-entitlement cities and counties. • Cities or towns with fewer than 50,000 people • Counties with fewer than 200,000 people	Maximum grant amounts: • $1,000,000 for construction and acquisition projects. • $500,000 for local housing rehabilitation programs. • $250,000 for local microenterprise assistance programs. • $30,000 for planning-only activities.	2022 CDBG General Purpose application materials are due June 1, 2022. Grant awards early September. **Contact:** Jacquie Andresen 360-688-0822 Jacquie.andresen@commerce.wa.gov Visit www.commerce.wa.gov/cdbg and click on the General Purpose Grants menu for information and forms.
PWB Public Works Board Construction Program	New construction, replacement, and repair of existing infrastructure for drinking water, wastewater, stormwater, solid waste, recycling, road or bridge projects.	• Counties, cities, special purpose districts, and quasi-municipal organizations. • No school districts, port districts, or tribes per statute.	• Approximately $114 million available for construction projects. • Maximum loan amount $10 million per jurisdiction per biennium. • 20-year loan term. • Interest rates vary. • Construction must be completed within 5 years.	The next funding cycle is expected to be announced in early 2023. Check the Public Works Board website periodically at http://www.pwb.wa.gov to obtain the latest information on program details or to contact Public Works Board staff. **Contact:** Mark Rentfrow 360-529-6432 Mark.rentfrow@commerce.wa.gov Please visit: http://www.pwb.wa.gov

CONSTRUCTION AND DESIGN/CONSTRUCTION Programs	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
DWSRF Drinking Water State Revolving Fund Construction Loan Program	Drinking water system infrastructure projects aimed at increasing public health protection. There is a limited amount of principal forgiveness for communities with high affordability index numbers and water system restructuring/ consolidation projects.	Group A (private and publicly-owned) community and not-for-profit non-community water systems, but not federal or state-owned systems. Tribal systems are eligible provided the project is not receiving other national set-aside funding for the project.	Loan • 1.0% loan fee (water systems receiving subsidy are not subject to loan fees). • 1.75% interest rate (final rate is set September 1, 2022). • Loan repayment period: 20 years or life of the project, whichever is less. • No local match required.	Online applications available and accepted October 1 through November 30, 2022. NOTE: The timeframe for applications may be modified to coincide with infrastructure stimulus funding. Check the DWSRF webpage for updates. **Contact:** Corina Hayes 360-236-3153 Corina.hayes@doh.wa.gov For information and forms visit: http://www.doh.wa.gov/DWSRF
ECOLOGY: INTEGRATED WATER QUALITY FUNDING PROGRAM State Water Pollution Control Revolving Fund (SRF) Centennial Clean Water Fund Stormwater Financial Assistance Program (SFAP)	Construction projects associated with publicly-owned wastewater and stormwater facilities. The integrated program also funds planning and implementation of nonpoint source pollution control activities.	Counties, cities, towns, conservation districts, or other political subdivision, municipal or quasi-municipal corporations, and tribes. Hardship Assistance Jurisdictions listed above with a population of 25,000 or less.	Loan: $250,000,000 available statewide. Interest rates (SFY 2023) • 21-30 year loans: 1.4% • 6-20 year loans: 1.1% • 1-5 year loans: 0.5% Hardship assistance for the construction of wastewater treatment facilities may be available in the form of a reduced interest rate, and up to $5,000,000 grant or loan forgiveness. Stormwater grant maximum award per jurisdiction: $5,000,000, with a required 25% match.	Applications due October 12, 2022. A cost effectiveness analysis must be complete at the time of application. **Contact:** David Dunn 360-515-8601 david.dunn@ecy.wa.gov https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Water-Quality-grants-and-loans

CONSTRUCTION AND DESIGN/CONSTRUCTION Programs	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
RD U.S. Dept. of Agriculture Rural Development - Rural Utilities Service Water and Waste Disposal Direct Loans and Grants	Pre-construction and construction associated with building, repairing, or improving drinking water, wastewater, solid waste, and stormwater facilities.	• Cities, towns, and other public bodies, tribes and private non-profit corporations serving rural areas with populations under 10,000.	Loans; Grants in some cases • Interest rates change quarterly; contact staff for latest interest rates. • Up to 40-year loan term. • No pre-payment penalty.	Applications accepted year-round on a fund-available basis. **Contact:** Marti Canatsey 509-367-8570 marlene.canatsey@usda.gov http://www.rd.usda.gov/wa
CERB Community Economic Revitalization Board Construction Program	Public facility projects required by private sector expansion and job creation. Projects must support significant job creation or significant private investment in the state. • Bridges, roads and railroad spurs, domestic and industrial water, sanitary and storm sewers. • Electricity, natural gas and telecommunications • General purpose industrial buildings, port facilities. • Acquisition, construction, repair, reconstruction, replacement, rehabilitation	• Counties, cities, towns, port districts, special districts • Federally-recognized tribes • Municipal and quasi-municipal corporations with economic development purposes.	Loans; grants in unique cases • Projects without a committed private partner allowed for in rural areas. • $3 million maximum per project, per policy. • Interest rates: 1-3% Based on Debt Service Coverage Ratio (DSCR), Distressed County, and length of loan term. • 20-year maximum loan term • Match for committed private partners: 20% (of total project cost). • Match for prospective partners: 50% (of total project cost). • Applicants must demonstrate gap in public project funding and need for CERB assistance. • CERB is authority for funding approvals.	Applications accepted year-round. The Board meets six times a year. **Contact:** Janea Delk 360-725-3151 janea.delk@commerce.wa.gov
RCAC Rural Community Assistance Corporation Intermediate Term Loan	Water, wastewater, solid waste and stormwater facilities that primarily serve low-income rural communities.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less.	• For smaller capital needs, normally not to exceed $100,000. • Typically up to a 20-year term • 5% interest rate • 1% – 1.125% loan fee	Applications accepted anytime. **Contact**: Jessica Scott 719-458-5460 jscott@rcac.org Applications available online at http://www.rcac.org/lending/environmental-loans/

CONSTRUCTION AND DESIGN/CONSTRUCTION Programs	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
RCAC Rural Community Assistance Corporation Construction Loans	Water, wastewater, solid waste and stormwater facilities that primarily serve low-income rural communities. Can include pre-development costs.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 populations or less if using USDA Rural Development financing as the takeout.	• Typically up to $3 million with commitment letter for permanent financing • Security in permanent loan letter of conditions • Term matches construction period. • 5% interest rate • 1.125% loan fee	Applications accepted anytime. **Contact**: Jessica Scott 719-458-5460 jscott@rcac.org Applications available online at http://www.rcac.org/lending/environmental-loans/
RURAL WATER REVOLVING LOAN FUND	Short-term costs incurred for replacement equipment, small scale extension of services, or other small capital projects that are not a part of regular operations and maintenance for drinking water and wastewater projects.	Public entities, including municipalities, counties, special purpose districts, Native American Tribes, and corporations not operated for profit, including cooperatives, with up to 10,000 population and rural areas with no population limits.	• Loan amounts may not exceed $100,000 or 75% of the total project cost, whichever is less. Applicants will be given credit for documented project costs prior to receiving the RLF loan. • Interest rates at the lower of the poverty or market interest rate as published by USDA RD RUS, with a minimum of 3% at the time of closing. • Maximum repayment period is 10 years. Additional ranking points for a shorter repayment period. The repayment period cannot exceed the useful life of the facilities or financed item.	Applications accepted anytime. **Contact**: Tracey Hunter Evergreen Rural Water of WA 360-462-9287 thunter@erwow.org Download application online: http://nrwa.org/initiatives/revolving-loan-fund/
Economic Development Administration (EDA) United States Department of Commerce **EDA Public Works Program:** Design and/or Construction for distressed and disaster communities.	Drinking water infrastructure; including pre-distribution conveyance, withdrawal/ harvest (i.e. well extraction), storage facilities, treatment and distribution. Waste water infrastructure; including conveyance, treatment facilities, discharge infrastructure and water recycling.	Municipalities, counties, cities, towns, states, not-for-profit organizations, ports, tribal nations.	Grants: • EDA investment share up to $3M. • Cost sharing required from applicant **up to** 50% of total project cost. ○ Up to 100% for Tribal Nations	**Information:** EDA.gov **Contact:** Laura Ives 206-200-1951 lives@eda.gov **Apply at:** grants.gov

CONSTRUCTION AND DESIGN/CONSTRUCTION Programs	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
Energy Retrofits for Public Buildings Program: Energy Efficiency Grant *(formerly Energy Efficiency & Solar)* Washington State Department of Commerce	Retrofit projects that reduce energy consumption (electricity, gas, water, etc.) and operational costs on existing facilities and related projects owned by an eligible applicant. Projects must utilize devices that do not require fossil fuels whenever possible.	• Washington State public entities, such as cities, towns, local agencies, public higher education institutions, school districts, federally recognized tribal governments, and state agencies. • Some percentage of funds are reserved for projects in small towns or cities with populations of 5,000 or fewer. • Priority will be given to applicants who have not received funding previously, and school districts that reduce PCB's through lighting upgrades.	2022: $1.5 million • Maximum grant: TBD • Minimum match requirements will apply. • Other State funds cannot be used as match. • Applications expected to open March 2022.	**Contact:** Kristen Kalbrener 360-515-8112 energyretrofits@commerce.wa.gov Visit https://www.commerce.wa.gov/growing-the-economy/energy/energy-efficiency-and-solar-grants/ for more information.
Energy Retrofits for Public Buildings: Solar Grants *(formerly Energy Efficiency & Solar)* Washington State Department of Commerce	Purchase and installation of grid-tied solar photovoltaic (electric) arrays net metered with existing facilities owned by public entities. Additional points for 'Made in Washington' components.	• Washington State public entities, such as cities, towns, local agencies, public higher education institutions, school districts, federally recognized tribal governments, and state agencies. • Minimum payback period of 35 years. Priority will be given to applicants who have not received funding previously.	2022: $1.1 million • Maximum amount per awardee: $250,000 • Minimum match requirements will apply. • Applications expected to open March 2022.	**Contact:** Jill Eikenhorst 360-522-0000 energyretrofits@commerce.wa.gov Visit https://www.commerce.wa.gov/growing-the-economy/energy/energy-efficiency-and-solar-grants/ for more information.

EMERGENCY **Programs**	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
RD – ECWAG U.S. Dept. of Agriculture Rural Development Emergency Community Water Assistance Grants	Domestic water projects needing emergency repairs due to an incident such as: a drought; earthquake; flood; chemical spill; fire; etc. A significant decline in quantity or quality of potable water supply that was caused by an emergency.	Public bodies, tribes and private non-profit corporations serving rural areas with populations under 10,000.	Grant; pending availability of funds • $150,000 limit for incident related emergency repairs to an existing water system. • $500,000 limit to alleviate a significant decline in potable water supply caused by an emergency.	Applications accepted year-round on a fund-available basis. **Contact:** Marti Canatsey 509-367-8570 marlene.canatsey@usda.gov http://www.rd.usda.gov/wa
DWSRF Department of Health – Drinking Water State Revolving Fund Emergency Loan Program	Will financially assist eligible communities experiencing the loss of critical drinking water services or facilities due to an emergency.	• Publicly or privately owned (not-for-profit) Group A community water systems with a population of fewer than 10,000. • Transient or non-transient non-community public water systems owned by a non-profit organization. Non-profit non-community water systems must submit tax-exempt documentation. • Tribal systems are eligible provided the project is not receiving other national set-aside funding for the project.	Loan • Interest rate: 0%, no subsidy available • Loan fee: 1.5% • Loan term: 10 years • $500,000 maximum award per jurisdiction. • Time of performance: 2 years from contract execution to project completion date. • Repayment commencing first October after contract execution.	To be considered for an emergency loan, an applicant must submit a completed emergency application package to the department. **Contacts:** Department of Health Regional Engineers or Corina Hayes 360-236-3153 Corina.hayes@doh.wa.gov For information and forms visit: http://www.doh.wa.gov/DWSRF
PWB Public Works Board Emergency Loan Program: Repair, replace, rehabilitate, or reconstruct eligible systems to current standards for existing users.	A public works project made necessary by a natural disaster, or an immediate and emergent threat to the public health and safety due to unforeseen or unavoidable circumstances. Demonstrate financial need through inadequate local budget resources.	Counties, cities, special purpose districts, and quasi-municipal organizations. No school districts, port districts, or tribes per statute. Water, sanitary sewer, storm water, roads, streets, bridges, solid waste, and recycling facilities.	• Approximately $5 million for emergency loan funding. • Maximum loan amount $1 million per jurisdiction per biennium. • 20-year loan term or life of the improvement, whichever is less. • Interest rates vary. • Application cycle is open until available funds are exhausted.	Check the Public Works Board website periodically at: http://www.pwb.wa.gov to obtain the latest information on program details or to contact Public Works Board staff. **Contact:** Mark Rentfrow 360-529-6432 Mark.rentfrow@commerce.wa.gov

EMERGENCY **Programs**	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
ECOLOGY – Clean Water State Revolving Fund Emergency Funding Program	Water quality-related projects that meet the definition of "environmental emergency" in WAC 173-98-030(27) and have received a Declaration of Emergency from the local government. Eligible projects may result from a natural disaster or an immediate and emergent threat to public health due to water quality issues resulting from unforeseen or unavoidable circumstances.	Counties, cities, towns, federally-recognized tribes, and special purpose districts serving a population of 10,000 or less.	Loan • 10-year loan term or the life of the project, whichever is less. • 0.0% interest rate. • $5,000,000 maximum total per year. • $500,000 maximum per jurisdiction per year. • 2 years to complete project after loan execution. • Repayment begins 1 year after completion.	Applications accepted any time. **Contact:** Daniel Thompson 360-407-6510 daniel.thompson@ecy.wa.gov Funding Guidelines and Applicant Prep Tool: https://apps.ecology.wa.gov/publications/documents/2010059.pdf
HAZARD MITIGATION GRANT PROGRAM FEMA/WA Emergency Management Division	Disaster risk-reduction projects and planning after a disaster declaration in the state.	Any state, tribe, county, or local jurisdiction (incl., special purpose districts) that has a current FEMA-approved hazard mitigation plan.	Varies depending on the level of disaster, but projects only need to compete at the state level. Local jurisdiction cost-share: 12.5%	Applications will be opened after a disaster declaration. **Contact**: Tim Cook State Hazard Mitigation Officer 253-512-7072 Tim.cook@mil.wa.gov
PUBLIC ASSISTANCE PROGRAM FEMA/WA Emergency Management Division	Construction, repair to, and restoration of publicly owned facilities damaged during a disaster. Debris-removal, life-saving measures, and restoration of public infrastructure.	State, tribes, counties, and local jurisdictions directly affected by the disaster.	Varies depending on the level of disaster and total damage caused.	Applications are opened after disaster declaration. **Contact:** Gary Urbas Public Assistance Project Manager 253-512-7402 Gary.urbas@mil.wa.gov
RURAL WATER REVOLVING LOAN FUND Disaster area emergency loans	Contact staff for more information on emergency loans.	Public entities, including municipalities, counties, special purpose districts, Native American Tribes, and corporations not operated for profit, including cooperatives, with up to 10,000 population and rural areas with no population limits.	90-day, no interest, disaster area emergency loans with immediate turn-around. Download application online: http://nrwa.org/initiatives/revolving-loan-fund/	Applications accepted anytime. **Contact**: Tracey Hunter Evergreen Rural Water of WA 360-462-9287 thunter@erwow.org

APPENDIX N

LSSD RATE MODEL

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Summary

Revenue Requirement	2021	2022	2023	2024	2025	2026	2027
Revenues							
Rate Revenues Under Existing Rates	$ 14,354,136	$ 14,506,905	$ 14,659,674	$ 14,792,073	$ 14,924,472	$ 15,056,872	$ 15,107,795
GFC Revenue Towards Debt	2,581,114	780,000	1,012,500	877,500	438,750	438,750	168,750
Transfer From Rate Stabilization Fund	-	-	-	-	-	-	-
Non-Rate Revenues	484,427	511,032	458,980	460,058	427,581	428,300	429,009
Total Revenues	**$ 17,419,677**	**$ 15,797,937**	**$ 16,131,153**	**$ 16,129,631**	**$ 15,790,803**	**$ 15,923,921**	**$ 15,705,554**
Expenses							
Cash Operating Expenses	$ 7,364,429	$ 7,765,724	$ 8,203,149	$ 8,250,885	$ 8,542,350	$ 8,830,016	$ 9,139,058
Existing Debt Service	7,394,708	7,380,109	6,934,888	6,920,752	6,913,616	6,744,355	6,327,262
New Debt Service	-	-	-	-	-	-	1,574,298
Rate Funded CIP	-	-	-	-	-	-	-
Rate Funded System Reinvestment	-	-	-	-	-	-	-
Total Expenses	**$ 14,759,137**	**$ 15,145,833**	**$ 15,138,037**	**$ 15,171,637**	**$ 15,455,966**	**$ 15,574,371**	**$ 17,040,618**
Net Surplus (Deficiency)	**$ 2,660,540**	**$ 652,104**	**$ 993,116**	**$ 957,994**	**$ 334,837**	**$ 349,550**	**$ (1,335,064)**
Additions to Meet Coverage	-	-	-	-	-	-	-
Total Surplus (Deficiency)	**$ 2,660,540**	**$ 652,104**	**$ 993,116**	**$ 957,994**	**$ 334,837**	**$ 349,550**	**$ (1,335,064)**
% of Rate Revenue	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**8.84%**
Annual Rate Adjustment	**0.00%**	**15.12%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**11.11%**
Cumulative Annual Rate Adjustment	**0.00%**	**15.12%**	**15.12%**	**15.12%**	**15.12%**	**15.12%**	**27.91%**
Rate Revenues After Rate Increase	$ 14,354,136	$ 15,968,841	$ 16,875,671	$ 17,028,084	$ 17,180,497	$ 17,332,911	$ 19,323,923
Additional Taxes from Rate Increase	$ -	$ 28,350	$ 42,972	$ 43,360	$ 43,748	$ 44,136	$ 81,758
Net Cash Flow After Rate Increase	**2,660,540**	**2,085,691**	**3,166,141**	**3,150,645**	**2,547,114**	**2,581,453**	**2,799,306**
Coverage After Rate Increases	**6.26**	**5.09**	**5.49**	**5.43**	**5.33**	**5.26**	**3.12**
Sample Residential Monthly Bill	**$ 86.00**	**$ 99.00**	**$ 99.00**	**$ 99.00**	**$ 99.00**	**$ 99.00**	**$ 110.00**
Monthly Average Increase ($)	$ -	$ 13.00	$ -	$ -	$ -	$ -	$ 11.00

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Summary

Fund Balance	2021	2022	2023	2024	2025	2026	2027
OPERATING FUND							
Beginning Balance	$ 4,459,563	$ 7,120,103	$ 1,914,836	$ 2,022,694	$ 2,034,465	$ 2,106,333	$ 2,177,264
plus: Net Cash Flow after Rate Increase	2,660,540	2,085,691	3,166,141	3,150,645	2,547,114	2,581,453	2,799,306
less: Transfer of Surplus to Capital Fund	-	(7,290,958)	(3,058,283)	(3,138,875)	(2,475,245)	(2,510,521)	(2,723,104)
Ending Balance	**$ 7,120,103**	**$ 1,914,836**	**$ 2,022,694**	**$ 2,034,465**	**$ 2,106,333**	**$ 2,177,264**	**$ 2,253,466**
Minimum Target Balance	*$ 1,815,887*	*$ 1,914,836*	*$ 2,022,694*	*$ 2,034,465*	*$ 2,106,333*	*$ 2,177,264*	*$ 2,253,466*
Days	*353*	*90*	*90*	*90*	*90*	*90*	*90*
CAPITAL FUND							
Beginning Balance	$ 12,788,928	$ 13,991,931	$ 9,625,279	$ 10,184,659	$ 8,778,983	$ 7,020,522	$ 6,112,769
plus: Rate Funded System Reinvestment	-	-	-	-	-	-	-
plus: Transfers from Operating Fund	-	7,290,958	3,058,283	3,138,875	2,475,245	2,510,521	2,723,104
plus: Transfers from Rate Stabilization Fund	-	-	-	-	-	-	-
plus: Grants/ Donations/ CIAC	1,580,000	2,572,500	374,850	1,554,112	-	-	1,746,921
plus: Additional Proceeds (Costs)	-	-	-	-	-	-	-
plus: General Facilities Charges	5,162,227	1,560,000	2,025,000	1,755,000	1,755,000	1,755,000	675,000
less: General Facilities Charges Towards Debt	(2,581,114)	(780,000)	(1,012,500)	(877,500)	(438,750)	(438,750)	(168,750)
plus: Direct Rate Funding	-	-	-	-	-	-	-
plus: Net Debt Proceeds Available for Projects	-	-	-	-	-	-	19,500,000
plus: Interest Earnings	127,889	139,919	96,253	101,847	87,790	70,205	61,128
Total Funding Sources	**$ 17,077,931**	**$ 24,775,309**	**$ 14,167,165**	**$ 15,856,992**	**$ 12,658,268**	**$ 10,917,498**	**$ 30,650,171**
less: Capital Expenditures	(3,086,000)	(15,150,030)	(3,982,506)	(7,078,009)	(5,637,747)	(4,804,730)	(15,918,675)
Ending Working Capital Balance	**$ 13,991,931**	**$ 9,625,279**	**$ 10,184,659**	**$ 8,778,983**	**$ 7,020,522**	**$ 6,112,769**	**$ 14,731,496**
Minimum Target Balance	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*

Notes:

Additional Proceeds (Costs) Consist of the following:	2021	2022	2023	2024	2025	2026	2027
[Extra line]	$ -	$ -	$ -	$ -	$ -	$ -	$ -
[Extra line]	-	-	-	-	-	-	-
[Extra line]	-	-	-	-	-	-	-
[Extra line]	-	-	-	-	-	-	-
[Extra line]	-	-	-	-	-	-	-

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Assumptions

Economic & Financial Factors		2021	2022	2023	2024	2025	2026	2027
General Cost Inflation		5.00%	5.00%	5.00%	5.00%	2.00%	2.00%	2.00%
Construction Cost Inflation		5.00%	5.00%	5.00%	5.00%	3.00%	3.00%	3.00%
Labor Cost Inflation		3.50%	3.50%	4.00%	4.00%	3.00%	3.00%	3.00%
Benefit Cost Inflation		12.00%	12.00%	12.00%	12.00%	12.00%	10.00%	10.00%
General Inflation plus Composite Growth		7.28%	6.12%	6.11%	5.95%	2.91%	2.90%	2.34%
Customer Growth		2.17%	1.06%	1.05%	0.90%	0.90%	0.89%	0.34%
No Escalation		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Labor & Industries (LNI)		0.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Admin Salaries & Benefits	5%	0.00%	4.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Admin Operating	2.80%	0.00%	4.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Taxes & Insurance	2.80%	0.00%	2.80%	2.80%	2.80%	2.80%	2.80%	2.80%
Advisors	2.80%	0.00%	2.80%	2.80%	2.80%	2.80%	2.80%	2.80%
Field Salaries & Benefits	6%	0.00%	3.50%	2.00%	2.00%	2.00%	2.00%	2.00%
Field Operating	2.80%	0.00%	3.50%	2.00%	2.00%	2.00%	2.00%	2.00%
Plant Salaries & Benefits	6%	0.00%	3.50%	2.00%	2.00%	2.00%	2.00%	2.00%
Plant Operating	2.80%	0.00%	3.50%	2.00%	2.00%	2.00%	2.00%	2.00%
Public Employee's Retirement System (PERS)		0.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Benefit - Med/Den/Vision		0.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%
Investment Interest		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
State Excise Tax		3.852%	3.852%	3.852%	3.852%	3.852%	3.852%	3.852%
B&O Tax		1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%
Treatment Portion		91.00%	91.00%	91.00%	91.00%	91.00%	91.00%	91.00%
Net Sewer Tax		1.94%	1.94%	1.94%	1.94%	1.94%	1.94%	1.94%

Accounting Assumptions		2021	2022	2023	2024	2025	2026	2027
FISCAL POLICY RESTRICTIONS								
Min. Op. Fund Balance Target (days of O&M expense)		90 Days	90 Days	90 Days	90 Days	90 Days	90 Days	90 Days
Max. Op. Fund Balance (days of O&M expense)		90 Days	90 Days	90 Days	90 Days	90 Days	90 Days	90 Days
Minimum Capital Fund Balance Target								
Select Minimum Capital Fund Balance Target	**2**	**User Input**						
1 - Defined as % of Plant								
Plant-in-Service in 2020	$ 230,823,531	Estimated Net Assets						
Minimum Capital Fund Balance - % of plant assets		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
2 - Amount at Right ==>		$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000
RATE FUNDED SYSTEM REINVESTMENT								
Select Reinvestment Funding Strategy	**4**	**System Reinvestment is not Funded**						
Amount of Annual Cash Funding from Rates								
1 - Equal to Annual Depreciation Expense		$ 6,703,913	$ 7,057,487	$ 7,145,887	$ 7,327,347	$ 7,440,006	$ 7,549,680	$ 7,967,926
2 - Equal to Annual Depreciation less Annual Debt Principal Payments		$ 1,166,459	$ 1,393,885	$ 1,781,852	$ 1,833,296	$ 1,803,921	$ 1,928,108	$ 1,886,156
3 - Equal to Amount at Right ==>		$ -	$ -	$ -	$ -	$ -	$ -	$ -
4 - Do Not Fund System Reinvestment								

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Assumptions

Capital Financing Assumptions		2021	2022	2023	2024	2025	2026	2027
General Facilities Charge (GFC)		**$ 10,400**	$ 10,400	**$ 13,500**	$ 13,500	$ 13,500	$ 13,500	$ 13,500
Total Equivalent Residential Units (Beginning of Year)		13,794	14,094	14,244	14,394	14,524	14,654	14,784
Additional Units Per Year		300	150	150	130	130	130	50
Total Equivalent Residential Units (End of Year)		14,094	14,244	14,394	14,524	14,654	14,784	14,834
GFC Revenues		$ 5,162,227	$ 1,560,000	$ 2,025,000	$ 1,755,000	$ 1,755,000	$ 1,755,000	$ 675,000
FUNDING SOURCES							5.3%	5.3%
Grants		$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Proceeds (Costs)								
[Extra line]		$ -	$ -	$ -	$ -	$ -	$ -	$ -
[Extra line]		-	-	-	-	-	-	-
[Extra line]		-	-	-	-	-	-	-
[Extra line]		-	-	-	-	-	-	-
[Extra line]		-	-	-	-	-	-	-
Total Additional Proceeds		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
REVENUE BONDS								
Term (years)		20	20	20	20	20	20	20
Interest Cost		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Issuance Cost		1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Revenue Bond Coverage Requirement	**1.25**							
District Policy Coverage Requirement (on All Debt)	**1.00**							
PWTF LOANS								
Term (years; no more than 20 years)		20	20	20	20	20	20	20
Interest Cost		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Required Local Match		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
OTHER LOANS								
Term (years)		10	10	10	10	10	10	10
Interest Cost		2.85%	2.85%	2.85%	2.85%	2.85%	2.85%	2.85%
Issuance Cost		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Operating Revenue and Expenditure Forecast

	FORECAST BASIS	Actual 2020	Budget 2021	Projection 2022	Projection 2023	Projection 2024	Projection 2025	Projection 2026	Projection 2027
Rate Revenue									
Sewer Rate Revenue	Customer Growth	$ 14,048,599	$ 14,354,136	$ 14,506,905	$ 14,659,674	$ 14,792,073	$ 14,924,472	$ 15,056,872	$ 15,107,795
[Extra]	Customer Growth	-	-	-	-	-	-	-	-
Total Rate Revenue		**$ 14,048,599**	**$ 14,354,136**	**$ 14,506,905**	**$ 14,659,674**	**$ 14,792,073**	**$ 14,924,472**	**$ 15,056,872**	**$ 15,107,795**
Non-Rate Revenue									
Permit Fees	No Escalation	$ 113,150	$ 99,500	$ 99,500	$ 99,500	$ 99,500	$ 99,500	$ 99,500	$ 99,500
Interest Charges on Late Sewer Fees	No Escalation	21,362	19,451	19,451	19,451	19,451	19,451	19,451	19,451
Late Fees & Penalties	No Escalation	154,560	166,811	166,811	166,811	166,811	166,811	166,811	166,811
Other Sewer Revenues	No Escalation	46,664	4,055	4,055	4,055	4,055	4,055	4,055	4,055
Rental Income - Vernon Business Center & Duplex	No Escalation	34,849	29,595	29,595	29,595	29,595	-	-	-
ULID #13 Assessment Revenue	No Escalation	-	3,000	3,000	3,000	3,000	-	-	-
FOG Program Fees	No Escalation	35,500	38,000	38,000	38,000	38,000	38,000	38,000	38,000
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
[Extra]	No Escalation	-	-	-	-	-	-	-	-
Total Non-Rate Revenue		**$ 406,084**	**$ 360,412**	**$ 360,412**	**$ 360,412**	**$ 360,412**	**$ 327,817**	**$ 327,817**	**$ 327,817**
TOTAL REVENUES		**$ 14,454,684**	**$ 14,714,548**	**$ 14,867,317**	**$ 15,020,086**	**$ 15,152,485**	**$ 15,252,289**	**$ 15,384,689**	**$ 15,435,612**

	FORECAST BASIS	2020	2021	2022	2023	2024	2025	2026	2027
Office & Admin Expenses									
Admin Medicare Taxes	Admin Salaries & Benefits	$ 9,890	$ 10,700	$ 11,500	$ 11,900	$ 11,500	$ 11,730	$ 11,965	$ 12,204
Admin FICA Taxes	Admin Salaries & Benefits	42,037	48,000	51,200	53,400	51,500	52,530	53,581	54,652
Merchant Services Fee	Admin Operating	10,394	12,000	12,480	12,730	12,984	13,244	13,509	13,779
Dist - Utilities Office	Admin Operating	5,165	6,000	6,240	6,365	6,492	6,622	6,754	6,889
Customer Records & Collection	Admin Operating	97,907	125,000	130,000	132,600	135,252	137,957	140,716	143,531
Lien Filing Expense	Admin Operating	-	100	104	106	108	110	113	115
Foreclosure Expenses	Admin Operating	-	2,500	2,600	2,652	2,705	2,759	2,814	2,871
Admin & General Regular Salaries	Admin Salaries & Benefits	688,412	698,100	736,100	752,800	742,200	757,044	772,185	787,629
Admin & General Comp Time	Admin Salaries & Benefits	297	7,600	8,300	8,400	7,200	7,344	7,491	7,641
Admin & General Holidays	Admin Salaries & Benefits	2,159	4,800	5,800	6,000	5,900	6,018	6,138	6,261
Admin & General Vacation	Admin Salaries & Benefits	1,188	7,000	7,300	23,400	5,900	6,018	6,138	6,261
Admin & General Certs	Admin Salaries & Benefits	-	-	-	-	-	-	-	-
Commissioners Salaries	Admin Salaries & Benefits	21,632	25,000	26,000	26,520	27,050	27,591	28,143	28,706
Administrative Supplies	Admin Operating	20,495	22,000	22,880	23,338	23,804	24,280	24,766	25,261
Employee Appreciation	Admin Operating	-	5,000	5,200	5,304	5,410	5,518	5,629	5,741
Election Costs	Admin Operating	-	10,000	-	10,608	-	11,037	-	11,482
Computer Maintenance Expense	Admin Operating	120,617	140,000	145,600	148,512	151,482	154,512	157,602	160,754
Office Furniture & Equipment	Admin Operating	12,976	15,000	15,600	15,912	16,230	16,555	16,886	17,224
Advertising/Promotion/Public Education	Admin Operating	13,598	4,000	4,160	4,243	4,328	4,415	4,503	4,593
Admin Computer Software Maintenance	Admin Operating	23,620	24,000	24,960	25,459	25,968	26,488	27,018	27,558
Admin Auto Expense	Admin Operating	400	910	946	965	985	1,004	1,024	1,045
Admin Conf/Travel/Mileage/Meals	Admin Operating	1,726	7,000	7,280	7,426	7,574	7,726	7,880	8,038
Dues Certs And Subscriptions	Admin Operating	26,475	34,000	35,360	36,067	36,789	37,524	38,275	39,040
Admin Training & Schooling Expense	Admin Operating	3,085	5,000	5,200	5,304	5,410	5,518	5,629	5,741
Admin Safety	Admin Operating	3,149	2,500	2,600	2,652	2,705	2,759	2,814	2,871
Admin Labor & Industries Tax	Labor & Industries (LNI)	2,723	4,300	4,700	5,200	5,700	6,270	6,897	7,587
Admin WA State Sick Leave Tax	Admin Salaries & Benefits	1,753	2,100	2,200	2,300	2,200	2,244	2,289	2,335
Admin Medical Insurance	Benefit - Med/Den/Vision	146,862	148,300	193,100	281,900	263,600	295,232	330,660	370,339
Admin PERS	Public Employee's Retirement System (PERS)	15,836	81,800	77,700	81,900	83,100	85,593	88,161	90,806
Misc General Expense	Admin Operating	12	50	52	53	54	55	56	57
Dist - Telephone Office	Admin Operating	6,355	4,500	4,680	4,774	4,869	4,966	5,066	5,167
Admin Cellular Phone	Admin Operating	685	1,000	1,040	1,061	1,082	1,104	1,126	1,148
Office Rent	Admin Operating	-	-	-	-	-	-	-	-
VBC Facility Maintenance	Admin Operating	27,713	27,000	28,080	28,642	29,214	29,799	30,395	31,003

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Operating Revenue and Expenditure Forecast

	FORECAST BASIS	Actual 2020	Budget 2021	Projection 2022	Projection 2023	Projection 2024	Projection 2025	Projection 2026	Projection 2027
Taxes & Insurance									
Excise Tax	*Calculation*	329,332	350,000	314,621	325,779	323,621	325,557	328,124	310,212
Property Tax & Fire District Fee	Taxes & Insurance	16,761	33,000	33,924	34,874	35,850	36,854	37,886	38,947
Operating Licenses & Permits	Taxes & Insurance	33,140	36,000	37,008	38,044	39,109	40,205	41,330	42,488
Dist - Property Insurance	Taxes & Insurance	201,674	203,000	208,684	214,527	220,534	226,709	233,057	239,582
Advisor Expense									
State Auditor	Advisors	31,782	28,500	29,298	30,118	30,962	31,829	32,720	33,636
CPA	Advisors	4,766	10,000	10,280	10,568	10,864	11,168	11,481	11,802
Human Resources	Advisors	5,565	2,000	2,056	2,114	2,173	2,234	2,296	2,360
Financial	Advisors	-	-	-	-	-	-	-	-
Legal	Advisors	82,782	183,005	188,129	193,397	100,000	102,800	105,678	108,637
Engineers	2% Increase per Year	86,942	36,000	40,000	40,800	41,616	42,448	43,297	44,163
Outside Help	Advisors	10,050	3,800	3,906	4,016	4,128	4,244	4,363	4,485
Bond Issuance Cost	Advisors	-	1,500	1,542	1,585	1,630	1,675	1,722	1,770
Field Maintenance & Operation									
Field Medicare Taxes	Field Salaries & Benefits	13,184	15,600	17,200	18,100	18,600	18,972	19,351	19,738
Field FICA Taxes	Field Salaries & Benefits	56,015	70,000	77,000	80,800	83,400	85,068	86,769	88,505
Dist - Maintenance Of Lines	Field Operating	11,315	10,000	10,350	10,557	10,768	10,984	11,203	11,427
Dist - I&I	Field Operating	-	5,000	5,175	5,279	5,384	5,492	5,602	5,714
Dist - Manhole Adjustments	Field Operating	8,834	7,000	7,245	7,390	7,538	7,688	7,842	7,999
Dist - Utilities Other LS	4% Increase per Year	61,497	68,000	63,957	66,516	69,176	71,943	74,821	77,814
Dist - Utilities LS 5	4% Increase per Year	5,881	7,155	6,116	6,361	6,615	6,880	7,155	7,441
Dist - Utilities LS 12	4% Increase per Year	14,065	24,386	14,628	15,213	15,821	16,454	17,112	17,797
City - Utilities Other	4% Increase per Year	12,791	14,310	13,303	13,835	14,388	14,964	15,562	16,185
Dist - Utilities LS 15	4% Increase per Year	34,120	42,929	35,484	36,904	38,380	39,915	41,512	43,172
City - Utilities LS 1	4% Increase per Year	16,756	17,888	17,427	18,124	18,849	19,603	20,387	21,202
City - Utilities LS 8	4% Increase per Year	20,515	26,234	21,335	22,189	23,076	23,999	24,959	25,958
Dist - Utilities LS 17	4% Increase per Year	9,101	13,000	9,465	9,844	10,237	10,647	11,073	11,516
Dist - Utilities - PUD Bldg	4% Increase per Year	10,640	15,000	11,066	11,508	11,969	12,447	12,945	13,463
Dist - Other LS Maintenance	Field Operating	47,025	49,000	50,715	51,729	52,764	53,819	54,896	55,993
Dist - LS 5 Maintenance	Field Operating	123	1,000	1,035	1,056	1,077	1,098	1,120	1,143
Dist - LS 12 Maintenance	Field Operating	12,289	6,000	6,210	6,334	6,461	6,590	6,722	6,856
Dist - LS 15 Maintenance	Field Operating	5,230	7,000	7,245	7,390	7,538	7,688	7,842	7,999
City - Other LS Maintenance	Field Operating	12,812	10,000	10,350	10,557	10,768	10,984	11,203	11,427
City - LS 1 Maintenance	Field Operating	24,111	30,000	31,050	31,671	32,304	32,951	33,610	34,282
City - LS 8 Maintenance	Field Operating	1,684	5,000	5,175	5,279	5,384	5,492	5,602	5,714
Dist - LS 17 Maintenance	Field Operating	781	2,000	2,070	2,111	2,154	2,197	2,241	2,285
Field Bldg Maintenance	Field Operating	2,010	3,000	3,105	3,167	3,230	3,295	3,361	3,428
Field Regular Salaries	Field Salaries & Benefits	824,177	981,300	1,074,500	1,125,700	1,162,500	1,185,750	1,209,465	1,233,654
Field General Comp Time	Field Salaries & Benefits	74,037	96,800	107,700	114,100	117,300	119,646	122,039	124,480
Field General Holidays	Field Salaries & Benefits	-	2,400	2,200	2,300	2,400	2,448	2,497	2,547
Field General Vacation	Field Salaries & Benefits	-	-	-	-	-	-	-	-
Field General Certs	Field Salaries & Benefits	23,550	27,000	28,200	30,000	30,000	30,600	31,212	31,836
Odor Control	Field Operating	44,170	45,000	46,575	47,507	48,457	49,426	50,414	51,423
System Expense - Collections	Field Operating	16,565	25,000	25,875	26,393	26,920	27,459	28,008	28,568
Field Supplies & Equip	Field Operating	4,313	5,500	5,693	5,806	5,922	6,041	6,162	6,285
Field Computer Software Maintenance	Field Operating	30,204	70,000	72,450	73,899	75,377	76,885	78,422	79,991
Field Vehicle Equipment	Field Operating	2,046	15,000	15,525	15,836	16,152	16,475	16,805	17,141
Auto Expense	Field Operating	21,234	24,000	24,840	25,337	25,844	26,360	26,888	27,425
Field Conf/Travel/Mileage/Meals	Field Operating	388	2,000	2,070	2,111	2,154	2,197	2,241	2,285
Field Training & Schooling Expense	Field Operating	2,897	15,000	15,525	15,836	16,152	16,475	16,805	17,141
Field Safety	Field Operating	14,776	25,000	25,875	26,393	26,920	27,459	28,008	28,568
Field Labor & Industries Tax	Labor & Industries (LNI)	14,916	24,800	30,000	33,000	36,300	39,930	43,923	48,315
Field WA State Sick Leave Tax	Field Salaries & Benefits	2,299	3,000	3,300	3,500	3,600	3,672	3,745	3,820
Field Medical Insurance	Benefit - Med/Den/Vision	189,813	216,100	265,700	297,600	329,900	369,488	413,827	463,486
Field PERS	Public Employee's Retirement System (PERS)	117,891	116,700	114,800	123,800	131,300	135,239	139,296	143,475
Dist - Telephone Field Bldg	Field Operating	3,182	3,785	3,917	3,996	4,076	4,157	4,240	4,325
Dist - Telephone LS 5	Field Operating	-	-	-	-	-	-	-	-
Dist - Telephone Other LS	Field Operating	-	-	-	-	-	-	-	-
Dist - Telephone LS 12	Field Operating	-	-	-	-	-	-	-	-
Dist - Telephone LS 15	Field Operating	-	-	-	-	-	-	-	-
City - Telephone All Ls'S	Field Operating	-	-	-	-	-	-	-	-
Field Cellular Phone	Field Operating	9,000	9,484	9,816	10,012	10,213	10,417	10,625	10,838
Facility Rent - PUD Building	Field Operating	36,698	37,740	39,061	39,842	40,639	41,452	42,281	43,126

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Operating Revenue and Expenditure Forecast

	FORECAST BASIS	Actual 2020	Budget 2021	Projection 2022	Projection 2023	Projection 2024	Projection 2025	Projection 2026	Projection 2027
Plant Maintenance & Operation									
Plant Medicare Taxes	Plant Salaries & Benefits	15,614	19,974	14,300	15,000	15,500	15,810	16,126	16,449
Plant FICA Taxes	Plant Salaries & Benefits	52,078	57,400	64,100	67,000	69,300	70,686	72,100	73,542
Utilities Old Plant	Plant Operating	7,580	2,900	3,002	3,062	3,123	3,185	3,249	3,314
Plant Regular Salaries	Plant Salaries & Benefits	781,821	786,300	870,200	900,600	932,600	951,252	970,277	989,683
Plant General Comp Time	Plant Salaries & Benefits	54,056	78,600	91,600	105,900	109,100	111,282	113,508	115,778
Plant General Holidays	Plant Salaries & Benefits	7,754	12,500	14,300	14,700	15,000	15,300	15,606	15,918
Plant General Vacation	Plant Salaries & Benefits	11,644	9,300	8,800	9,000	9,200	9,384	9,572	9,763
Plant General Certs	Plant Salaries & Benefits	14,750	16,700	18,600	19,800	19,800	20,196	20,600	21,012
Old Plant Maintenance	Plant Operating	45	-	-	-	-	-	-	-
Electricity	5% Increase per Year	398,693	465,088	488,342	512,760	538,397	565,317	593,583	623,262
Natural Gas	Plant Operating	11,154	17,306	17,912	18,270	18,635	19,008	19,388	19,776
Water	Plant Operating	2,223	3,245	3,359	3,426	3,494	3,564	3,635	3,708
Garbage	Plant Operating	6,420	9,194	9,516	9,706	9,900	10,098	10,300	10,506
Polymers	Plant Operating	97,359	110,000	113,850	116,127	118,450	120,819	123,235	125,700
Sodium Hydroxide	Plant Operating	142,536	195,000	201,825	205,862	209,979	214,178	218,462	222,831
Sodium Hypochlorite	Plant Operating	55,238	50,000	51,750	52,785	53,841	54,918	56,016	57,136
Citric Acid	Plant Operating	-	14,000	14,490	14,780	15,075	15,377	15,684	15,998
Hauling/Disposal	Plant Operating	121,024	154,000	159,390	162,578	165,829	169,146	172,529	175,979
Analysis	Plant Operating	3,137	3,600	3,726	3,801	3,877	3,954	4,033	4,114
Major Equipment Acquisition	2% Increase per Year	34,524	90,000	100,000	102,000	104,040	106,121	108,243	110,408
Maintenance & Operational Supplies	Plant Operating	90,649	120,000	124,200	126,684	129,218	131,802	134,438	137,127
Telephones	Plant Operating	5,290	6,490	6,717	6,851	6,989	7,128	7,271	7,416
Internet	Plant Operating	3,417	4,326	4,477	4,567	4,658	4,751	4,846	4,943
Telephones (Telemetry)	Plant Operating	3,792	4,160	4,306	4,392	4,480	4,569	4,661	4,754
Cellular Phones Treatment Plant	Plant Operating	4,433	11,000	11,385	11,613	11,845	12,082	12,323	12,570
ER Portal	Plant Operating	2,862	8,050	8,332	8,498	8,668	8,842	9,019	9,199
Leverage "Smart Net" (Network)	Plant Operating	-	-	-	-	-	-	-	-
Win 911 Alarm System'	Plant Operating	495	700	725	739	754	769	784	800
Rs View Hmi Support	Plant Operating	10,656	-	-	-	-	-	-	-
Zenon 24/7	Plant Operating	5,370	12,400	12,834	13,091	13,352	13,620	13,892	14,170
Millipore (Di Water System For Lab)	Plant Operating	7,783	5,000	5,175	5,279	5,384	5,492	5,602	5,714
Real Chem (Heating Water System)	Plant Operating	-	-	-	-	-	-	-	-
Cintas	Plant Operating	-	-	-	-	-	-	-	-
Janitorial	Plant Operating	-	3,720	3,850	3,927	4,006	4,086	4,168	4,251
Other Services	5% Increase per Year	58,028	100,000	65,000	68,250	71,663	75,246	79,008	82,958
Supplies	Plant Operating	18,596	25,000	25,875	26,393	26,920	27,459	28,008	28,568
QA/QC Samples	Plant Operating	770	1,600	1,656	1,689	1,723	1,757	1,793	1,828
Accreditation	Plant Operating	1,256	1,600	1,656	1,689	1,723	1,757	1,793	1,828
Outside Analysis	Plant Operating	5,733	25,000	25,875	26,393	26,920	27,459	28,008	28,568
Plant Safety	Plant Operating	5,492	20,000	20,700	21,114	21,536	21,967	22,406	22,854
Plant Conference/Travel/Mileage/Meals	Plant Operating	469	4,500	4,658	4,751	4,846	4,943	5,041	5,142
Plant Training & Schooling Expense	Plant Operating	2,942	3,000	3,105	3,167	3,230	3,295	3,361	3,428
Plant Other Supplies	Plant Operating	1,980	2,200	2,277	2,323	2,369	2,416	2,465	2,514
Plant Auto Expense	Plant Operating	3,947	3,500	3,623	3,695	3,769	3,844	3,921	4,000
Plant Labor & Industries Tax	Labor & Industries (LNI)	13,204	21,100	25,200	27,700	30,500	33,550	36,905	40,596
Plant Wa State Sick Leave Tax	Plant Salaries & Benefits	2,132	2,500	2,800	2,900	3,000	3,060	3,121	3,184
Plant Medical Insurance	Benefit - Med/Den/Vision	163,476	198,600	245,800	275,300	257,400	288,288	322,883	361,628
Plant PERS	Public Employee's Retirement System (PERS)	19,653	102,700	102,700	110,800	118,000	121,540	125,186	128,942
Other Rate Expenses									
City - Franchise Fee	No Escalation	-	-	-	-	-	-	-	-
City - Operating Fee	No Escalation	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Add'l O&M from CIP	*From CIP*	-	-	-	-	-	-	-	-
Total Cash O&M Expenditures		**$ 6,187,963**	**$ 7,364,429**	**$ 7,765,724**	**$ 8,203,149**	**$ 8,250,885**	**$ 8,542,350**	**$ 8,830,016**	**$ 9,139,058**

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Existing Debt Input

Existing Debt Service - PWTF Loans	2021	2022	2023	2024	2025	2026	2027
City - 2002 Cap Imp PW02-691-029							
Annual Interest Payment	$ 857	$ 428	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	85,691	85,691	-	-	-	-	-
Total Annual Payment	$ 86,548	$ 86,120	$ -	$ -	$ -	$ -	$ -
City - STP2 Design PW05-691-PRE-137							
Annual Interest Payment	$ 5,263	$ 4,211	$ 3,158	$ 2,105	$ 1,053	$ -	$ -
Annual Principal Payment	52,632	52,632	52,632	52,632	52,632	-	-
Total Annual Payment	$ 57,895	$ 56,842	$ 55,789	$ 54,737	$ 53,684	$ -	$ -
City - STP2 Const PW06-962-020							
Annual Interest Payment	$ 12,286	$ 10,238	$ 8,191	$ 6,143	$ 4,095	$ 2,048	$ -
Annual Principal Payment	409,539	409,539	409,539	409,539	409,539	409,539	-
Total Annual Payment	$ 421,826	$ 419,778	$ 417,730	$ 415,683	$ 413,635	$ 411,587	$ -
City - STP2 Const PC08-951-023							
Annual Interest Payment	$ 27,156	$ 25,647	$ 24,139	$ 22,630	$ 21,121	$ 19,613	$ 18,104
Annual Principal Payment	301,734	301,734	301,734	301,734	301,734	301,734	301,734
Total Annual Payment	$ 328,891	$ 327,382	$ 325,873	$ 324,365	$ 322,856	$ 321,347	$ 319,839
District - Lundeen PW02-691-030							
Annual Interest Payment	$ 2,169	$ 1,085	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	216,931	216,931	-	-	-	-	-
Total Annual Payment	$ 219,100	$ 218,015	$ -	$ -	$ -	$ -	$ -
District - STP2 Design PW05-691-PRE-107							
Annual Interest Payment	$ 1,316	$ 1,053	$ 789	$ 526	$ 263	$ -	$ -
Annual Principal Payment	52,632	52,632	52,632	52,632	52,632	-	-
Total Annual Payment	$ 53,947	$ 53,684	$ 53,421	$ 53,158	$ 52,895	$ -	$ -
District - STP2 Design PW05-691-PRE-133							
Annual Interest Payment	$ 1,334	$ 1,067	$ 800	$ 534	$ 267	$ -	$ -
Annual Principal Payment	53,363	53,363	53,363	53,363	53,363	-	-
Total Annual Payment	$ 54,697	$ 54,430	$ 54,163	$ 53,896	$ 53,629	$ -	$ -
District - STP2 Design PR08-951-054							
Annual Interest Payment	$ 2,105	$ 1,842	$ 1,579	$ 1,316	$ 1,053	$ 789	$ 526
Annual Principal Payment	52,632	52,632	52,632	52,632	52,632	52,632	52,632
Total Annual Payment	$ 54,737	$ 54,474	$ 54,211	$ 53,947	$ 53,684	$ 53,421	$ 53,158
District - STP2 Const PW07-962-013							
Annual Interest Payment	$ 13,825	$ 11,850	$ 9,875	$ 7,900	$ 5,925	$ 3,950	$ 1,975
Annual Principal Payment	395,005	395,005	395,005	395,005	395,005	395,005	395,005
Total Annual Payment	$ 408,830	$ 406,855	$ 404,880	$ 402,905	$ 400,930	$ 398,955	$ 396,980
District - STP2 Const PC08-951-024							
Annual Interest Payment	$ 27,156	$ 25,647	$ 24,139	$ 22,630	$ 21,121	$ 19,613	$ 18,104
Annual Principal Payment	301,734	301,734	301,734	301,734	301,734	301,734	301,734
Total Annual Payment	$ 328,891	$ 327,382	$ 325,873	$ 324,365	$ 322,856	$ 321,347	$ 319,839
TOTAL PWTF LOANS							
Annual Interest Payment	$ 93,468	$ 83,069	$ 72,670	$ 63,784	$ 54,899	$ 46,013	$ 38,709
Annual Principal Payment	1,921,893	1,921,893	1,619,271	1,619,271	1,619,271	1,460,645	1,051,106
Total Annual Payment	$ 2,015,361	$ 2,004,962	$ 1,691,941	$ 1,683,055	$ 1,674,169	$ 1,506,658	$ 1,089,815

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Existing Debt Input

Existing Debt Service - SRF & Other Loans	2021	2022	2023	2024	2025	2026	2027
STP2 Const L0800014							
Annual Interest Payment	$ 316,628	$ 292,730	$ 268,081	$ 242,657	$ 216,433	$ 189,385	$ 161,486
Annual Principal Payment	760,000	783,898	808,547	833,971	860,195	887,243	915,142
Total Annual Payment	$ 1,076,628	$ 1,076,628	$ 1,076,628	$ 1,076,628	$ 1,076,628	$ 1,076,628	$ 1,076,628
STP2 Const L0900004							
Annual Interest Payment	$ 485,131	$ 447,714	$ 409,275	$ 369,785	$ 329,215	$ 287,536	$ 244,718
Annual Principal Payment	1,368,736	1,406,152	1,444,592	1,484,082	1,524,652	1,566,331	1,609,149
Total Annual Payment	$ 1,853,867	$ 1,853,867	$ 1,853,867	$ 1,853,867	$ 1,853,867	$ 1,853,867	$ 1,853,867
STP2 Const L150112							
Annual Interest Payment	$ 93,577	$ 88,743	$ 83,778	$ 78,676	$ 73,435	$ 68,050	$ 62,519
Annual Principal Payment	176,825	181,659	186,625	191,727	196,968	202,352	207,884
Total Annual Payment	$ 270,403	$ 270,403	$ 270,403	$ 270,403	$ 270,403	$ 270,403	$ 270,403
2008 City GO							
Annual Interest Payment	$ 10,400	$ 5,200	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	130,000	130,000	-	-	-	-	-
Total Annual Payment	$ 140,400	$ 135,200	$ -	$ -	$ -	$ -	$ -
TOTAL OTHER LOANS							
Annual Interest Payment	$ 905,736	$ 834,388	$ 761,133	$ 691,117	$ 619,082	$ 544,971	$ 468,722
Annual Principal Payment	2,435,561	2,501,709	2,439,764	2,509,780	2,581,815	2,655,926	2,732,175
Total Annual Payment	$ 3,341,297	$ 3,336,097	$ 3,200,897	$ 3,200,897	$ 3,200,897	$ 3,200,897	$ 3,200,897

Existing Debt Service - Revenue Bonds	2021	2022	2023	2024	2025	2026	2027
Use Bond Reserve to Make Final Payments?	No						
If Yes, Enter Payment Amount:	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2019 Refunding Bonds/Refinanced BAB Bonds							
Annual Interest Payment	$ 858,050	$ 799,050	$ 737,050	$ 671,800	$ 603,550	$ 531,800	$ 456,550
Annual Principal Payment	1,180,000	1,240,000	1,305,000	1,365,000	1,435,000	1,505,000	1,580,000
Total Annual Payment	$ 2,038,050	$ 2,039,050	$ 2,042,050	$ 2,036,800	$ 2,038,550	$ 2,036,800	$ 2,036,550
TOTAL REVENUE BONDS							
Annual Interest Payment	$ 858,050	$ 799,050	$ 737,050	$ 671,800	$ 603,550	$ 531,800	$ 456,550
Annual Principal Payment	1,180,000	1,240,000	1,305,000	1,365,000	1,435,000	1,505,000	1,580,000
Total Annual Payment	$ 2,038,050	$ 2,039,050	$ 2,042,050	$ 2,036,800	$ 2,038,550	$ 2,036,800	$ 2,036,550
Use of Debt reserve for Debt Service	-	-	-	-	-	-	-
Annual Debt Reserve Target on Existing Revenue Bonds	2,042,050	2,042,050	2,042,050	2,038,550	2,038,550	2,036,800	2,036,550
Annual Debt Reserve Target on 2019 Bond							

Total Existing Debt Service	2021	2022	2023	2024	2025	2026	2027
Annual Interest Payment	$ 1,857,254	$ 1,716,507	$ 1,570,853	$ 1,426,701	$ 1,277,531	$ 1,122,784	$ 963,982
Annual Principal Payment	5,537,454	5,663,602	5,364,035	5,494,051	5,636,086	5,621,571	5,363,280
Total Annual Payment	$ 7,394,708	$ 7,380,109	$ 6,934,888	$ 6,920,752	$ 6,913,616	$ 6,744,355	$ 6,327,262

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Capital Improvement Program

Project Costs and O&M Impacts in Year:	2021

No	Description	% District-Funded	Useful Life (Years)	10-Year Project Cost	% To Be Capitalized	% Upgrade / Expansion	% R&R	$ Upgrade / Expansion (Utility Funded)	$ R&R (Utility Funded)	2021	2022	2023	2024	2025	2026	2027
1	**Years 1-6 CIP**															
2	Gravity Sewer System Repair and Replacement	100.00%	30 Years	$ 13,500,000	100%	0%	100%	$ -	$ 16,534,137	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000
3	Anoxic Zone Wall Improvements	100.00%	20 Years	$ -	100%	100%	0%	$ -	$ -	6,000	-	-	-	-	-	-
4	New LS 23 & FM	0.00%	50 Years	$ -	100%	100%	0%	$ -	$ -	1,580,000	-	-	-	-	-	-
5	TIN Optimization Report	100.00%	10 Years	$ 30,000	0%	100%	0%	$ 31,500	$ -	-	30,000	-	-	-	-	-
6	Backpulse Pipe Replacement	100.00%	50 Years	$ 25,000	100%	0%	100%	$ -	$ 26,250	-	25,000	-	-	-	-	-
7	20th St NE & Bus. Loop Rd to LS 2C	100.00%	50 Years	$ 1,150,000	100%	0%	100%	$ -	$ 1,207,500	-	1,150,000	-	-	-	-	-
8	Sewer System Comprehensive Plan / Facility Plan Update	100.00%	6 Years	$ 345,000	0%	67%	33%	$ 241,500	$ 120,750	-	345,000	-	-	-	-	-
9	SR 9 Gravity Crossing	100.00%	50 Years	$ 500,000	100%	100%	0%	$ 525,000	$ -	-	500,000	-	-	-	-	-
10	LS 2C Upgrade	100.00%	50 Years	$ 2,700,000	100%	100%	0%	$ 2,835,000	$ -	-	2,700,000	-	-	-	-	-
11	LS 2C Force Main	100.00%	50 Years	$ 2,730,000	100%	100%	0%	$ 2,866,500	$ -	-	2,730,000	-	-	-	-	-
12	LS 5C Decommission & LSs 4C & 6C Rehabilitation	100.00%	50 Years	$ 1,710,000	100%	100%	0%	$ 1,795,500	$ -	-	1,710,000	-	-	-	-	-
13	LS 8C Upgrade & Rehabilitation	0.00%	50 Years	$ 1,040,000	100%	100%	0%	$ -	$ -	-	1,040,000	-	-	-	-	-
14	Lift Station 11 Rehabilitation	100.00%	50 Years	$ 590,000	100%	0%	100%	$ -	$ 619,500	-	590,000	-	-	-	-	-
15	New LS G7 & FM	0.00%	50 Years	$ 1,410,000	100%	100%	0%	$ -	$ -	-	1,410,000	-	-	-	-	-
16	Process Blower Enclosure Cooling	100.00%	50 Years	$ 87,200	100%	50%	50%	$ 45,780	$ 45,780	-	87,200	-	-	-	-	-
17	Mixed Liquor Alkalinity Addition System Improvements	100.00%	50 Years	$ 130,300	100%	100%	0%	$ 136,815	$ -	-	130,300	-	-	-	-	-
18	Carbon Addition System	100.00%	50 Years	$ 231,100	100%	100%	0%	$ 242,655	$ -	-	231,100	-	-	-	-	-
19	District Office Upgrades - Generator	100.00%	50 Years	$ 250,000	100%	100%	0%	$ 262,500	$ -	-	250,000	-	-	-	-	-
20	WWTF Membrane Replacement	100.00%	20 Years	$ 3,858,000	100%	0%	100%	$ -	$ 4,809,362	-	-	482,250	482,250	482,250	482,250	482,250
21	LS 1 Rehabilitation	100.00%	50 Years	$ 779,000	100%	100%	0%	$ 901,790	$ -	-	-	-	779,000	-	-	-
22	LS 1C Rehabilitation	100.00%	50 Years	$ 740,000	100%	50%	50%	$ 407,925	$ 407,925	-	-	740,000	-	-	-	-
23	Lift Station 3C Rehabilitation	100.00%	50 Years	$ 550,000	100%	0%	100%	$ -	$ 606,375	-	-	550,000	-	-	-	-
24	New Gravity Line - Industrial Area	100.00%	50 Years	$ 520,000	100%	100%	0%	$ 601,965	$ -	-	-	-	520,000	-	-	-
25	Centennial Townhomes DEA	0.00%	50 Years	$ 340,000	100%	100%	0%	$ -	$ -	-	-	340,000	-	-	-	-
26	Lift Station 4 Rehabilitation	100.00%	50 Years	$ 902,000	100%	0%	100%	$ -	$ 1,075,503	-	-	-	-	902,000	-	-
27	Lift Station 6 Rehabilitation	100.00%	50 Years	$ 793,000	100%	0%	100%	$ -	$ 917,997	-	-	-	793,000	-	-	-
28	New LS H8 & FM	25.00%	50 Years	$ 1,790,000	100%	100%	0%	$ 518,037	$ -	-	-	-	1,790,000	-	-	-
29	District Office Upgrades - 2nd Floor	100.00%	50 Years	$ 250,000	100%	100%	0%	$ 289,406	$ -	-	-	-	250,000	-	-	-
30	Nutrient Reduction Evaluation	100.00%	10 Years	$ 200,000	0%	67%	33%	$ 158,981	$ 79,490	-	-	-	-	200,000	-	-
31	131st Ave NE	100.00%	50 Years	$ 1,020,000	100%	100%	0%	$ 1,216,201	$ -	-	-	-	-	1,020,000	-	-
32	Lift Station 3 Rehabilitation	100.00%	50 Years	$ 624,000	100%	0%	100%	$ -	$ 744,029	-	-	-	-	624,000	-	-
33	Lift Station 2 Rehabilitation	100.00%	50 Years	$ 780,000	100%	0%	100%	$ -	$ 957,937	-	-	-	-	-	780,000	-
34	New Gravity Line - Industrial Area	100.00%	50 Years	$ 970,000	100%	100%	0%	$ 1,191,281	$ -	-	-	-	-	-	970,000	-
35	LS 9 Decommissioning	100.00%	50 Years	$ 180,000	100%	0%	100%	$ -	$ 221,062	-	-	-	-	-	180,000	-
36	Vactor and CCTV Truck Replacement	100.00%	7 Years	$ 650,000	100%	0%	100%	$ -	$ 822,229	-	-	-	-	-	-	650,000
37	New LS E8 & FM	100.00%	50 Years	$ 2,360,000	100%	100%	0%	$ 2,985,325	$ -	-	-	-	-	-	-	2,360,000
38	Basin E8 Collection System (N Machias Rd)	100.00%	50 Years	$ 2,200,000	100%	100%	0%	$ 2,782,930	$ -	-	-	-	-	-	-	2,200,000
39	New LS E9 & FM	100.00%	50 Years	$ 1,710,000	100%	100%	0%	$ 2,163,095	$ -	-	-	-	-	-	-	1,710,000
40	26th, 27th & 28th Places NE	100.00%	50 Years	$ 1,590,000	100%	100%	0%	$ 2,011,299	$ -	-	-	-	-	-	-	1,590,000
41	New LS C4 & FM	25.00%	50 Years	$ 1,340,000	100%	100%	0%	$ 423,764	$ -	-	-	-	-	-	-	1,340,000
42	Lift Station 7 Rehabilitation & Upgrade	50.00%	50 Years	$ 752,000	100%	50%	50%	$ 237,814	$ 237,814	-	-	-	-	-	-	752,000
43				$ -		100%		$ -	$ -	-	-	-	-	-	-	-
44	**Years 7-10 CIP**			$ -		100%		$ -	$ -	-	-	-	-	-	-	-
45	Comprehensive Plan Update	100.00%	6 Years	$ 200,000	0%	67%	33%	$ 173,722	$ 86,861	-	-	-	-	-	-	-
46	Mitchell Road Main Replacement	100.00%	50 Years	$ 560,000	100%	0%	100%	$ -	$ 729,634	-	-	-	-	-	-	-
47	97th Drive SE & 99th Ave SE	100.00%	50 Years	$ 1,490,000	100%	100%	0%	$ 1,941,347	$ -	-	-	-	-	-	-	-
48	Lift Station 8 Rehabilitation	100.00%	50 Years	$ 554,000	100%	50%	50%	$ 360,908	$ 360,908	-	-	-	-	-	-	-
49	LS 15 Upgrade and Rehabilitation	100.00%	20 Years	$ 1,033,000	100%	50%	50%	$ 672,957	$ 672,957	-	-	-	-	-	-	-
50	LS 2C FM Extension	0.00%	50 Years	$ 1,680,000	100%	100%	0%	$ -	$ -	-	-	-	-	-	-	-
51	Hartford Road	100.00%	50 Years	$ 280,000	100%	100%	0%	$ 375,761	$ -	-	-	-	-	-	-	-
52	Dosing Station Reconstruction	100.00%	50 Years	$ 1,080,000	100%	100%	0%	$ 1,449,365	$ -	-	-	-	-	-	-	-
53	WAS Thickener	100.00%	50 Years	$ 668,800	100%	100%	0%	$ 924,459	$ -	-	-	-	-	-	-	-
54	UV System Addition	100.00%	50 Years	$ 986,000	100%	100%	0%	$ 1,362,913	$ -	-	-	-	-	-	-	-
55	Lift Station 5 Rehabilitation & Upgrade	100.00%	50 Years	$ 536,000	100%	50%	50%	$ 381,560	$ 381,560	-	-	-	-	-	-	-
56	Lift Station 12 Rehabilitation	100.00%	50 Years	$ 760,000	100%	0%	100%	$ -	$ 1,050,521	-	-	-	-	-	-	-
57	New LS E10 & FM	25.00%	50 Years	$ 1,600,000	100%	100%	0%	$ 552,906	$ -	-	-	-	-	-	-	-
58	New LS G6 & FM	25.00%	50 Years	$ 1,390,000	100%	100%	0%	$ 480,337	$ -	-	-	-	-	-	-	-
59	Lift Station 14 Rehabilitation	100.00%	50 Years	$ 386,000	100%	0%	100%	$ -	$ 549,561	-	-	-	-	-	-	-
60	Lift Station 10 Rehabilitation	100.00%	50 Years	$ 585,000	100%	0%	100%	$ -	$ 832,884	-	-	-	-	-	-	-
61				$ -		100%		$ -	$ -	-	-	-	-	-	-	-
	Total Capital Projects				**99%**	**65%**	**35%**			**$ 3,086,000**	**$ 14,428,600**	**$ 3,612,250**	**$ 6,114,250**	**$ 4,728,250**	**$ 3,912,250**	**$ 12,584,250**
	Total Upgrade/Expansion Projects									$ 1,586,000	$ 11,005,000	$ 710,000	$ 3,339,000	$ 1,153,333	$ 970,000	$ 9,576,000
	Total R&R Projects									$ 1,500,000	$ 3,423,600	$ 2,902,250	$ 2,775,250	$ 3,574,917	$ 2,942,250	$ 3,008,250
	Projects by Grants / Developer Donations									$ 1,580,000	$ 2,450,000	$ 340,000	$ 1,342,500	$ -	$ -	$ 1,381,000
	Projects by Enterprise Fund									$ 1,506,000	$ 11,978,600	$ 3,272,250	$ 4,771,750	$ 4,728,250	$ 3,912,250	$ 11,203,250

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Capital Improvement Program

	2021	2022	2023	2024	2025	2026	2027
Annual CCI	0.00%	5.00%	5.00%	5.00%	3.00%	3.00%	3.00%
Cumulative CCI	0.00%	5.00%	10.25%	15.76%	19.24%	22.81%	26.50%

			TOTAL FORECASTED PROJECT COSTS							
No	Description	TOTAL ESCALATED COSTS	2021	2022	2023	2024	2025	2026	2027
1	**Years 1-6 CIP**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Gravity Sewer System Repair and Replacement	$ 18,034,137	$ 1,500,000	$ 1,575,000	$ 1,653,750	$ 1,736,438	$ 1,788,531	$ 1,842,187	$ 1,897,452
3	Anoxic Zone Wall Improvements	$ 6,000	$ 6,000	$ -	$ -	$ -	$ -	$ -	$ -
4	New LS 23 & FM	$ 1,580,000	$ 1,580,000	$ -	$ -	$ -	$ -	$ -	$ -
5	TIN Optimization Report	$ 31,500	$ -	$ 31,500	$ -	$ -	$ -	$ -	$ -
6	Backpulse Pipe Replacement	$ 26,250	$ -	$ 26,250	$ -	$ -	$ -	$ -	$ -
7	20th St NE & Bus. Loop Rd to LS 2C	$ 1,207,500	$ -	$ 1,207,500	$ -	$ -	$ -	$ -	$ -
8	Sewer System Comprehensive Plan / Facility Plan Update	$ 362,250	$ -	$ 362,250	$ -	$ -	$ -	$ -	$ -
9	SR 9 Gravity Crossing	$ 525,000	$ -	$ 525,000	$ -	$ -	$ -	$ -	$ -
10	LS 2C Upgrade	$ 2,835,000	$ -	$ 2,835,000	$ -	$ -	$ -	$ -	$ -
11	LS 2C Force Main	$ 2,866,500	$ -	$ 2,866,500	$ -	$ -	$ -	$ -	$ -
12	LS 5C Decommission & LSs 4C & 6C Rehabilitation	$ 1,795,500	$ -	$ 1,795,500	$ -	$ -	$ -	$ -	$ -
13	LS 8C Upgrade & Rehabilitation	$ 1,092,000	$ -	$ 1,092,000	$ -	$ -	$ -	$ -	$ -
14	Lift Station 11 Rehabilitation	$ 619,500	$ -	$ 619,500	$ -	$ -	$ -	$ -	$ -
15	New LS G7 & FM	$ 1,480,500	$ -	$ 1,480,500	$ -	$ -	$ -	$ -	$ -
16	Process Blower Enclosure Cooling	$ 91,560	$ -	$ 91,560	$ -	$ -	$ -	$ -	$ -
17	Mixed Liquor Alkalinity Addition System Improvements	$ 136,815	$ -	$ 136,815	$ -	$ -	$ -	$ -	$ -
18	Carbon Addition System	$ 242,655	$ -	$ 242,655	$ -	$ -	$ -	$ -	$ -
19	District Office Upgrades - Generator	$ 262,500	$ -	$ 262,500	$ -				
20	WWTF Membrane Replacement	$ 4,809,362	$ -	$ -	$ 531,681	$ 558,265	$ 575,013	$ 592,263	$ 610,031
21	LS 1 Rehabilitation	$ 901,790	$ -	$ -	$ -	$ 901,790	$ -	$ -	$ -
22	LS 1C Rehabilitation	$ 815,850	$ -	$ -	$ 815,850	$ -	$ -	$ -	$ -
23	Lift Station 3C Rehabilitation	$ 606,375	$ -	$ -	$ 606,375	$ -	$ -	$ -	$ -
24	New Gravity Line - Industrial Area	$ 601,965	$ -	$ -	$ -	$ 601,965	$ -	$ -	$ -
25	Centennial Townhomes DEA	$ 374,850	$ -	$ -	$ 374,850	$ -	$ -	$ -	$ -
26	Lift Station 4 Rehabilitation	$ 1,075,503	$ -	$ -	$ -	$ -	$ 1,075,503	$ -	$ -
27	Lift Station 6 Rehabilitation	$ 917,997	$ -	$ -	$ -	$ 917,997	$ -	$ -	$ -
28	New LS H8 & FM	$ 2,072,149	$ -	$ -	$ -	$ 2,072,149	$ -	$ -	$ -
29	District Office Upgrades - 2nd Floor	$ 289,406	$ -	$ -	$ -	$ 289,406	$ -		
30	Nutrient Reduction Evaluation	$ 238,471	$ -	$ -	$ -	$ -	$ 238,471	$ -	$ -
31	131st Ave NE	$ 1,216,201	$ -	$ -	$ -	$ -	$ 1,216,201	$ -	$ -
32	Lift Station 3 Rehabilitation	$ 744,029	$ -	$ -	$ -	$ -	$ 744,029	$ -	$ -
33	Lift Station 2 Rehabilitation	$ 957,937	$ -	$ -	$ -	$ -	$ -	$ 957,937	$ -
34	New Gravity Line - Industrial Area	$ 1,191,281	$ -	$ -	$ -	$ -	$ -	$ 1,191,281	$ -
35	LS 9 Decommissioning	$ 221,062	$ -	$ -	$ -	$ -	$ -	$ 221,062	$ -
36	Vactor and CCTV Truck Replacement	$ 822,229	$ -	$ -	$ -	$ -	$ -	$ -	$ 822,229
37	New LS E8 & FM	$ 2,985,325	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,985,325
38	Basin E8 Collection System (N Machias Rd)	$ 2,782,930	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,782,930
39	New LS E9 & FM	$ 2,163,095	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,163,095
40	26th, 27th & 28th Places NE	$ 2,011,299	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,011,299
41	New LS C4 & FM	$ 1,695,057	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,695,057
42	Lift Station 7 Rehabilitation & Upgrade	$ 951,256	$ -	$ -	$ -	$ -	$ -	$ -	$ 951,256
43		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
44	**Years 7-10 CIP**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
45	Comprehensive Plan Update	$ 260,583	$ -	$ -	$ -	$ -	$ -	$ -	$ -
46	Mitchell Road Main Replacement	$ 729,634	$ -	$ -	$ -	$ -	$ -	$ -	$ -
47	97th Drive SE & 99th Ave SE	$ 1,941,347	$ -	$ -	$ -	$ -	$ -	$ -	$ -
48	Lift Station 8 Rehabilitation	$ 721,816	$ -	$ -	$ -	$ -	$ -	$ -	$ -
49	LS 15 Upgrade and Rehabilitation	$ 1,345,913	$ -	$ -	$ -	$ -	$ -	$ -	$ -
50	LS 2C FM Extension	$ 2,188,901	$ -	$ -	$ -	$ -	$ -	$ -	$ -
51	Hartford Road	$ 375,761	$ -	$ -	$ -	$ -	$ -	$ -	$ -
52	Dosing Station Reconstruction	$ 1,449,365	$ -	$ -	$ -	$ -	$ -	$ -	$ -
53	WAS Thickener	$ 924,459	$ -	$ -	$ -	$ -	$ -	$ -	$ -
54	UV System Addition	$ 1,362,913	$ -	$ -	$ -	$ -	$ -	$ -	$ -
55	Lift Station 5 Rehabilitation & Upgrade	$ 763,121	$ -	$ -	$ -	$ -	$ -	$ -	$ -
56	Lift Station 12 Rehabilitation	$ 1,050,521	$ -	$ -	$ -	$ -	$ -	$ -	$ -
57	New LS E10 & FM	$ 2,211,624	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58	New LS G6 & FM	$ 1,921,348	$ -	$ -	$ -	$ -	$ -	$ -	$ -
59	Lift Station 14 Rehabilitation	$ 549,561	$ -	$ -	$ -	$ -	$ -	$ -	$ -
60	Lift Station 10 Rehabilitation	$ 832,884	$ -	$ -	$ -	$ -	$ -	$ -	$ -
61		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Total Capital Projects	**$ 123,282,680**	**$ 3,086,000**	**$ 15,150,030**	**$ 3,982,506**	**$ 7,078,009**	**$ 5,637,747**	**$ 4,804,730**	**$ 15,918,675**
	Total Upgrade/Expansion Projects	$ 82,541,431	$ 1,586,000	$ 11,555,250	$ 782,775	$ 3,865,310	$ 1,375,181	$ 1,191,281	$ 12,113,334
	Total R&R Projects	$ 40,741,250	$ 1,500,000	$ 3,594,780	$ 3,199,731	$ 3,212,699	$ 4,262,565	$ 3,613,449	$ 3,805,340
	Projects by Grants / Developer Donations	$ 39,594,039	$ 1,580,000	$ 2,572,500	$ 374,850	$ 1,554,112	$ -	$ -	$ 1,746,921
	Projects by Enterprise Fund	$ 83,688,641	$ 1,506,000	$ 12,577,530	$ 3,607,656	$ 5,523,897	$ 5,637,747	$ 4,804,730	$ 14,171,754

	NEW ANNUAL DEPRECIATION EXPENSE						
No	2021	2022	2023	2024	2025	2026	2027
1	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	$ 50,000	$ 52,500	$ 55,125	$ 57,881	$ 59,618	$ 61,406	$ 63,248
3	$ 300	$ -	$ -	$ -	$ -	$ -	$ -
4	$ 31,600	$ -	$ -	$ -	$ -	$ -	$ -
5	$ -	$ 3,150	$ -	$ -	$ -	$ -	$ -
6	$ -	$ 525	$ -	$ -	$ -	$ -	$ -
7	$ -	$ 24,150	$ -	$ -	$ -	$ -	$ -
8	$ -	$ 60,375	$ -	$ -	$ -	$ -	$ -
9	$ -	$ 10,500	$ -	$ -	$ -	$ -	$ -
10	$ -	$ 56,700	$ -	$ -	$ -	$ -	$ -
11	$ -	$ 57,330	$ -	$ -	$ -	$ -	$ -
12	$ -	$ 35,910	$ -	$ -	$ -	$ -	$ -
13	$ -	$ 21,840	$ -	$ -	$ -	$ -	$ -
14	$ -	$ 12,390	$ -	$ -	$ -	$ -	$ -
15	$ -	$ 29,610	$ -	$ -	$ -	$ -	$ -
16	$ -	$ 1,831	$ -	$ -	$ -	$ -	$ -
17	$ -	$ 2,736	$ -	$ -	$ -	$ -	$ -
18	$ -	$ 4,853	$ -	$ -	$ -	$ -	$ -
19	$ -	$ 5,250	$ -				
20	$ -	$ -	$ 26,584	$ 27,913	$ 28,751	$ 29,613	$ 30,502
21	$ -	$ -	$ -	$ 18,036	$ -	$ -	$ -
22	$ -	$ -	$ 16,317	$ -	$ -	$ -	$ -
23	$ -	$ -	$ 12,128	$ -	$ -	$ -	$ -
24	$ -	$ -	$ -	$ 12,039	$ -	$ -	$ -
25	$ -	$ -	$ 7,497	$ -	$ -	$ -	$ -
26	$ -	$ -	$ -	$ -	$ 21,510	$ -	$ -
27	$ -	$ -	$ -	$ 18,360	$ -	$ -	$ -
28	$ -	$ -	$ -	$ 41,443	$ -	$ -	$ -
29	$ -	$ -	$ -	$ 5,788	$ -		
30	$ -	$ -	$ -	$ -	$ 23,847	$ -	$ -
31	$ -	$ -	$ -	$ -	$ 24,324	$ -	$ -
32	$ -	$ -	$ -	$ -	$ 14,881	$ -	$ -
33	$ -	$ -	$ -	$ -	$ -	$ 19,159	$ -
34	$ -	$ -	$ -	$ -	$ -	$ 23,826	$ -
35	$ -	$ -	$ -	$ -	$ -	$ 4,421	$ -
36	$ -	$ -	$ -	$ -	$ -	$ -	$ 117,461
37	$ -	$ -	$ -	$ -	$ -	$ -	$ 59,706
38	$ -	$ -	$ -	$ -	$ -	$ -	$ 55,659
39	$ -	$ -	$ -	$ -	$ -	$ -	$ 43,262
40	$ -	$ -	$ -	$ -	$ -	$ -	$ 40,226
41	$ -	$ -	$ -	$ -	$ -	$ -	$ 33,901
42	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,025
43	$ -	$ -	$ -	$ -	$ -	$ -	$ -
44	$ -	$ -	$ -	$ -	$ -	$ -	$ -
45	$ -	$ -	$ -	$ -	$ -	$ -	$ -
46	$ -	$ -	$ -	$ -	$ -	$ -	$ -
47	$ -	$ -	$ -	$ -	$ -	$ -	$ -
48	$ -	$ -	$ -	$ -	$ -	$ -	$ -
49	$ -	$ -	$ -	$ -	$ -	$ -	$ -
50	$ -	$ -	$ -	$ -	$ -	$ -	$ -
51	$ -	$ -	$ -	$ -	$ -	$ -	$ -
52	$ -	$ -	$ -	$ -	$ -	$ -	$ -
53	$ -	$ -	$ -	$ -	$ -	$ -	$ -
54	$ -	$ -	$ -	$ -	$ -	$ -	$ -
55	$ -	$ -	$ -	$ -	$ -	$ -	$ -
56	$ -	$ -	$ -	$ -	$ -	$ -	$ -
57	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58	$ -	$ -	$ -	$ -	$ -	$ -	$ -
59	$ -	$ -	$ -	$ -	$ -	$ -	$ -
60	$ -	$ -	$ -	$ -	$ -	$ -	$ -
61	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	**$ 81,900**	**$ 379,651**	**$ 117,651**	**$ 181,461**	**$ 172,930**	**$ 138,425**	**$ 462,991**

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Capital Improvement Program

		PROVISION FOR ASSET RETIREMENTS							
No	**Description**	**10-Year Total**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
1	**Years 1-6 CIP**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Gravity Sewer System Repair and Replacement	$ 6,319,720	$ 602,424	$ 621,082	$ 649,189	$ 673,755	$ 681,677	$ 700,491	$ 725,773
3	Anoxic Zone Wall Improvements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	New LS 23 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	TIN Optimization Report	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Backpulse Pipe Replacement	$ 3,640	$ -	$ 3,640	$ -	$ -	$ -	$ -	$ -
7	20th St NE & Bus. Loop Rd to LS 2C	$ 167,451	$ -	$ 167,451	$ -	$ -	$ -	$ -	$ -
8	Sewer System Comprehensive Plan / Facility Plan Update	$ 98,759	$ -	$ 98,759	$ -	$ -	$ -	$ -	$ -
9	SR 9 Gravity Crossing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	LS 2C Upgrade	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
11	LS 2C Force Main	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
12	LS 5C Decommission & LSs 4C & 6C Rehabilitation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	LS 8C Upgrade & Rehabilitation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
14	Lift Station 11 Rehabilitation	$ 85,910	$ -	$ 85,910	$ -	$ -	$ -	$ -	$ -
15	New LS G7 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
16	Process Blower Enclosure Cooling	$ 6,349	$ -	$ 6,349	$ -	$ -	$ -	$ -	$ -
17	Mixed Liquor Alkalinity Addition System Improvements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Carbon Addition System	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	District Office Upgrades - Generator								
20	WWTF Membrane Replacement	$ 2,509,835	$ -	$ -	$ 268,169	$ 285,003	$ 298,269	$ 310,496	$ 319,133
21	LS 1 Rehabilitation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22	LS 1C Rehabilitation	$ 58,240	$ -	$ -	$ 58,240	$ -	$ -	$ -	$ -
23	Lift Station 3C Rehabilitation	$ 86,572	$ -	$ -	$ 86,572	$ -	$ -	$ -	$ -
24	New Gravity Line - Industrial Area	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25	Centennial Townhomes DEA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
26	Lift Station 4 Rehabilitation	$ 165,729	$ -	$ -	$ -	$ -	$ 165,729	$ -	$ -
27	Lift Station 6 Rehabilitation	$ 133,055	$ -	$ -	$ -	$ 133,055	$ -	$ -	$ -
28	New LS H8 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
29	District Office Upgrades - 2nd Floor								
30	Nutrient Reduction Evaluation	$ 55,563	$ -	$ -	$ -	$ -	$ 55,563	$ -	$ -
31	131st Ave NE	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
32	Lift Station 3 Rehabilitation	$ 114,651	$ -	$ -	$ -	$ -	$ 114,651	$ -	$ -
33	Lift Station 2 Rehabilitation	$ 155,559	$ -	$ -	$ -	$ -	$ -	$ 155,559	$ -
34	New Gravity Line - Industrial Area	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
35	LS 9 Decommissioning	$ 35,898	$ -	$ -	$ -	$ -	$ -	$ 35,898	$ -
36	Vactor and CCTV Truck Replacement	$ 619,048	$ -	$ -	$ -	$ -	$ -	$ -	$ 619,048
37	New LS E8 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
38	Basin E8 Collection System (N Machias Rd)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
39	New LS E9 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
40	26th, 27th & 28th Places NE	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
41	New LS C4 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
42	Lift Station 7 Rehabilitation & Upgrade	$ 80,453	$ -	$ -	$ -	$ -	$ -	$ -	$ 80,453
43		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
44	**Years 7-10 CIP**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
45	Comprehensive Plan Update	$ 70,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
46	Mitchell Road Main Replacement	$ 129,126	$ -	$ -	$ -	$ -	$ -	$ -	$ -
47	97th Drive SE & 99th Ave SE	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
48	Lift Station 8 Rehabilitation	$ 63,871	$ -	$ -	$ -	$ -	$ -	$ -	$ -
49	LS 15 Upgrade and Rehabilitation	$ 356,516	$ -	$ -	$ -	$ -	$ -	$ -	$ -
50	LS 2C FM Extension	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
51	Hartford Road	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
52	Dosing Station Reconstruction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
53	WAS Thickener	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
54	UV System Addition	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
55	Lift Station 5 Rehabilitation & Upgrade	$ 78,692	$ -	$ -	$ -	$ -	$ -	$ -	$ -
56	Lift Station 12 Rehabilitation	$ 204,345	$ -	$ -	$ -	$ -	$ -	$ -	$ -
57	New LS E10 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58	New LS G6 & FM	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
59	Lift Station 14 Rehabilitation	$ 113,340	$ -	$ -	$ -	$ -	$ -	$ -	$ -
60	Lift Station 10 Rehabilitation	$ 171,772	$ -	$ -	$ -	$ -	$ -	$ -	$ -
61		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Total Capital Projects	**$ 11,884,093**	**$ 602,424**	**$ 983,190**	**$ 1,062,170**	**$ 1,091,813**	**$ 1,315,889**	**$ 1,202,443**	**$ 1,744,406**
	Total Upgrade/Expansion Projects								
	Total R&R Projects								
	Projects by Grants / Developer Donations								
	Projects by Enterprise Fund								

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Capital Funding Analysis

Summary of Expenditures	2021	2022	2023	2024	2025	2026	2027	2021 - 2041 TOTAL
CAPITAL PROJECTS								
Improvement Upgrades & Expansions	$ 1,586,000	$ 11,555,250	$ 782,775	$ 3,865,310	$ 1,375,181	$ 1,191,281	$ 12,113,334	$ 82,541,431
Repairs and Replacements	1,500,000	3,594,780	3,199,731	3,212,699	4,262,565	3,613,449	3,805,340	40,741,250
TOTAL CAPITAL EXPENDITURES	**$ 3,086,000**	**$ 15,150,030**	**$ 3,982,506**	**$ 7,078,009**	**$ 5,637,747**	**$ 4,804,730**	**$ 15,918,675**	**$ 123,282,680**

Capital Financing Plan	2021	2022	2023	2024	2025	2026	2027	TOTAL
Additional Proceeds (Costs)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Project Specific CIAC	1,580,000	2,572,500	374,850	1,554,112	-	-	1,746,921	39,594,039
Project to be Funded	**$ 1,506,000**	**$ 12,577,530**	**$ 3,607,656**	**$ 5,523,897**	**$ 5,637,747**	**$ 4,804,730**	**$ 14,171,754**	$ 83,688,641
OTHER FUNDING SOURCES [NOTE A]								
Other Outside Sources	$ -	$ -		$ -	$ -	$ -	$ -	$ -
Rate Funded System Reinvestment	-	-	-	-	-	-	-	-
GFC Revenue Towards Capital	2,581,114	780,000	1,012,500	877,500	1,316,250	1,316,250	506,250	8,734,114
PWTF Loans	-	-	-	-	-	-	-	-
Low Interest Loans	-	-	-	-	-	-	-	-
Capital Fund Balance	-	11,797,530	2,595,156	4,646,397	4,321,497	3,488,480	4,673,896	66,391,234
Revenue Bond Proceeds [Note B]	-	-	-	-	-		19,500,000	19,500,000
Rates	-	-	-	-	-	-	-	646,800
TOTAL CAPITAL RESOURCES	**$ 4,161,114**	**$ 15,150,030**	**$ 3,982,506**	**$ 7,078,009**	**$ 5,637,747**	**$ 4,804,730**	**$ 26,427,067**	**$ 134,866,187**
Info: Working Capital Contingency Deficit	-	-	-	-	-	-	-	-

New Debt Computations	2021	2022	2023	2024	2025	2026	2027	TOTAL
REVENUE BONDS								
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,500,000	$ 19,500,000
Issuance Costs	-	-	-	-	-	-	320,928	320,928
Reserve Required	-	-	-	-	-	-	1,574,298	1,574,298
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,395,227	$ 21,395,227
OTHER LOANS								
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PWTF LOANS								
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Debt Service Summary	2021	2022	2023	2024	2025	2026	2027	TOTAL
EXISTING DEBT SERVICE								
Annual Interest Payments	$ 1,857,254	$ 1,716,507	$ 1,570,853	$ 1,426,701	$ 1,277,531	$ 1,122,784	$ 963,982	$ 12,384,219
Annual Principal Payments	5,537,454	5,663,602	5,364,035	5,494,051	5,636,086	5,621,571	5,363,280	67,814,457
Total Debt Service Payments	$ 7,394,708	$ 7,380,109	$ 6,934,888	$ 6,920,752	$ 6,913,616	$ 6,744,355	$ 6,327,262	$ 80,198,676
Revenue Bond Payments Only	2,038,050	2,039,050	2,042,050	2,036,800	2,038,550	2,036,800	2,036,550	24,421,400
NEW DEBT SERVICE								
Annual Interest Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ 855,809	$ 9,227,743
Annual Principal Payments	-	-	-	-	-	-	718,489	14,386,731
Total Debt Service Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,574,298	$ 23,614,473
Revenue Bond Payments Only	-	-	-	-	-	-	1,574,298	23,614,473
TOTAL DEBT SERVICE PAYMENTS	**$ 7,394,708**	**$ 7,380,109**	**$ 6,934,888**	**$ 6,920,752**	**$ 6,913,616**	**$ 6,744,355**	**$ 7,901,560**	**$ 103,813,150**
Total Interest Payments	1,857,254	1,716,507	1,570,853	1,426,701	1,277,531	1,122,784	1,819,791	21,611,962
Total Principal Payments	5,537,454	5,663,602	5,364,035	5,494,051	5,636,086	5,621,571	6,081,770	82,201,188
Total Revenue Bond Payments Only	2,038,050	2,039,050	2,042,050	2,036,800	2,038,550	2,036,800	3,610,848	48,035,873

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Revenue Requirement Analysis

Cash Flow Sufficiency Test	2021	2022	2023	2024	2025	2026	2027
EXPENSES							
Cash Operating Expenses	$ 7,364,429	$ 7,765,724	$ 8,203,149	$ 8,250,885	$ 8,542,350	$ 8,830,016	$ 9,139,058
Existing Debt Service	7,394,708	7,380,109	6,934,888	6,920,752	6,913,616	6,744,355	6,327,262
New Debt Service	-	-	-	-	-	-	1,574,298
Rate Funded CIP	-	-	-	-	-	-	-
Rate Funded System Reinvestment	-	-	-	-	-	-	-
Transfer to Rate Stabilization Fund	-	-	-	-	-	-	-
Additions Required to Meet Minimum Operating Fund Balance	-	-	-	-	-	-	-
Total Expenses	$ 14,759,137	$ 15,145,833	$ 15,138,037	$ 15,171,637	$ 15,455,966	$ 15,574,371	$ 17,040,618
REVENUES							
Retail Rate Revenue	$ 14,354,136	$ 14,506,905	$ 14,659,674	$ 14,792,073	$ 14,924,472	$ 15,056,872	$ 15,107,795
Other Non Rate Revenue	360,412	360,412	360,412	360,412	327,817	327,817	327,817
GFC Revenue Towards Debt	2,581,114	780,000	1,012,500	877,500	438,750	438,750	168,750
Transfer From Rate Stabilization Fund	-	-	-	-	-	-	-
Operating / Rate Stabilization / Debt Reserve Fund Interest Earnings	124,015	150,620	98,568	99,646	99,764	100,483	101,192
Total Revenue	$ 17,419,677	$ 15,797,937	$ 16,131,153	$ 16,129,631	$ 15,790,803	$ 15,923,921	$ 15,705,554
NET CASH FLOW (DEFICIENCY)	**$ 2,660,540**	**$ 652,104**	**$ 993,116**	**$ 957,994**	**$ 334,837**	**$ 349,550**	**$ (1,335,064)**
% of Rate Revenue	-18.54%	-4.50%	-6.77%	-6.48%	-2.24%	-2.32%	8.84%

Coverage Sufficiency Test	2021	2022	2023	2024	2025	2026	2027
EXPENSES							
Total Cash Operating Expenses (less Capital Outlay)	$ 7,364,429	$ 7,765,724	$ 8,203,149	$ 8,250,885	$ 8,542,350	$ 8,830,016	$ 9,139,058
Transfer to Rate Stabilization Fund	-	-	-	-	-	-	-
Revenue Bond Debt Service	2,038,050	2,039,050	2,042,050	2,036,800	2,038,550	2,036,800	3,610,848
Revenue Bond Coverage Requirement at 1.25	509,513	509,763	510,513	509,200	509,638	509,200	902,712
Total Expenses	$ 9,911,992	$ 10,314,536	$ 10,755,711	$ 10,796,885	$ 11,090,537	$ 11,376,016	$ 13,652,618
ALLOWABLE REVENUES							
Rate Revenue	$ 14,354,136	$ 14,506,905	$ 14,659,674	$ 14,792,073	$ 14,924,472	$ 15,056,872	$ 15,107,795
Other Revenue	360,412	360,412	360,412	360,412	327,817	327,817	327,817
GFC Revenue	5,162,227	1,560,000	2,025,000	1,755,000	1,755,000	1,755,000	675,000
Transfer From Rate Stabilization Fund	-	-	-	-	-	-	-
Interest Earnings - All Funds	251,904	290,540	194,820	201,493	187,554	170,688	162,320
Total Revenue	$ 20,128,680	$ 16,717,856	$ 17,239,906	$ 17,108,978	$ 17,194,843	$ 17,310,377	$ 16,272,931
Coverage Realized	6.26	4.39	4.43	4.35	4.24	4.16	1.98
COVERAGE SURPLUS (DEFICIENCY)	**$ 10,216,688**	**$ 6,403,320**	**$ 6,484,195**	**$ 6,312,093**	**$ 6,104,306**	**$ 5,934,361**	**$ 2,620,313**

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Revenue Requirement Analysis

Maximum Revenue Deficiency	2021	2022	2023	2024	2025	2026	2027
Sufficiency Test Driving the Deficiency	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*
Maximum Deficiency From Tests	$ (2,660,540)	$ (652,104)	$ (993,116)	$ (957,994)	$ (334,837)	$ (349,550)	$ 1,335,064
less: Net Revenue From Prior Rate Increases	-	-	(2,215,997)	(2,236,011)	(2,256,025)	(2,276,039)	(2,283,736)
Revenue Deficiency	$ (2,660,540)	$ (652,104)	$ (3,209,113)	$ (3,194,005)	$ (2,590,862)	$ (2,625,589)	$ (948,672)
Plus: Adjustment for State Excise Tax	(52,613)	(12,896)	(19,639)	(18,945)	(6,621)	(6,912)	26,401
Total Revenue Deficiency	**$ (2,713,153)**	**$ (665,000)**	**$ (3,228,753)**	**$ (3,212,950)**	**$ (2,597,483)**	**$ (2,632,502)**	**$ (922,271)**

Rate Increases	2021	2022	2023	2024	2025	2026	2027
Rate Revenue with no Increase	$ 14,354,136	$ 14,506,905	$ 14,659,674	$ 14,792,073	$ 14,924,472	$ 15,056,872	$ 15,107,795
Revenues from Prior Rate Increases	-	-	2,215,997	2,236,011	2,256,025	2,276,039	2,283,736
Rate Revenue Before Rate Increase (Incl. previous increases)	$ 14,354,136	$ 14,506,905	$ 16,875,671	$ 17,028,084	$ 17,180,497	$ 17,332,911	$ 17,391,531
Required Annual Rate Increase	-18.90%	-4.58%	-19.13%	-18.87%	-15.12%	-15.19%	-5.30%
Number of Months New Rates Will Be In Effect	12 Months	8 Months	12 Months	12 Months	12 Months	12 Months	12 Months
Info: Percentage Increase to Generate Required Revenue	*-18.90%*	*-6.88%*	*-19.13%*	*-18.87%*	*-15.12%*	*-15.19%*	*-5.30%*
Monthly Rate per ERU	$86.00	$99.00	$99.00	$99.00	$99.00	$99.00	$110.00
Change from Prior Year		$13.00	$0.00	$0.00	$0.00	$0.00	$11.00
Percent Change from Prior Year	0.00%	15.12%	0.00%	0.00%	0.00%	0.00%	11.11%
ANNUAL RATE INCREASE	**0.00%**	**15.12%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**11.11%**
CUMULATIVE RATE INCREASE	**0.00%**	**15.12%**	**15.12%**	**15.12%**	**15.12%**	**15.12%**	**27.91%**

Impacts of Rate Increases	2021	2022	2023	2024	2025	2026	2027
Rate Revenues After Rate Increase	$ 14,354,136	$ 15,968,841	$ 16,875,671	$ 17,028,084	$ 17,180,497	$ 17,332,911	$ 19,323,923
Full Year Rate Revenues After Rate Increase	*$ 14,354,136*	*$ 16,699,809*	*$ 16,875,671*	*$ 17,028,084*	*$ 17,180,497*	*$ 17,332,911*	*$ 19,323,923*
Additional Taxes Due to Rate Increases	-	28,350	42,972	43,360	43,748	44,136	81,758
Net Cash Flow After Rate Increase	2,660,540	2,085,691	3,166,141	3,150,645	2,547,114	2,581,453	2,799,306
Coverage After Rate Increase (Parity Debt)	6.26	5.09	5.49	5.43	5.33	5.26	3.12
Coverage After Rate Increase (Total Debt)	1.73	1.41	1.62	1.60	1.57	1.59	1.43

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Fund Activity

Funds		2021	2022	2023	2024	2025	2026	2027	
OPERATING FUND	Perform Transfer?	**Yes**							
Beginning Balance		$ 4,459,563	$ 7,120,103	$ 1,914,836	$ 2,022,694	$ 2,034,465	$ 2,106,333	$ 2,177,264	
plus: Net Cash Flow after Rate Increase		2,660,540	2,085,691	3,166,141	3,150,645	2,547,114	2,581,453	2,799,306	
less: Transfer of Surplus to Capital Fund		-	(7,290,958)	(3,058,283)	(3,138,875)	(2,475,245)	(2,510,521)	(2,723,104)	
Ending Balance		**$ 7,120,103**	**$ 1,914,836**	**$ 2,022,694**	**$ 2,034,465**	**$ 2,106,333**	**$ 2,177,264**	**$ 2,253,466**	
Minimum Target Balance		*$ 1,815,887*	*$ 1,914,836*	*$ 2,022,694*	*$ 2,034,465*	*$ 2,106,333*	*$ 2,177,264*	*$ 2,253,466*	
Maximum Funds to be Kept as Operating Reserves		*$ 1,815,887*	*$ 1,914,836*	*$ 2,022,694*	*$ 2,034,465*	*$ 2,106,333*	*$ 2,177,264*	*$ 2,253,466*	
Info: No of Days of Cash Operating Expenses		*353*	*90*	*90*	*90*	*90*	*90*	*90*	
CAPITAL FUND									
Beginning Balance		$ 12,788,928	$ 13,991,931	$ 9,625,279	$ 10,184,659	$ 8,778,983	$ 7,020,522	$ 6,112,769	
plus: Interest Earnings		127,889	139,919	96,253	101,847	87,790	70,205	61,128	
plus: Rate Funded System Reinvestment		-	-	-	-	-	-	-	
plus: Transfers from Operating Fund		-	7,290,958	3,058,283	3,138,875	2,475,245	2,510,521	2,723,104	
plus: Transfers from Rate Stabilization Fund		-	-	-	-	-	-	-	
plus: Grants/ Donations/ CIAC		1,580,000	2,572,500	374,850	1,554,112	-	-	1,746,921	
plus: Additional Proceeds (Costs)		-	-	-	-	-	-	-	
plus: General Facilities Charges		5,162,227	1,560,000	2,025,000	1,755,000	1,755,000	1,755,000	675,000	
less: General Facilities Charges Towards Debt		(2,581,114)	(780,000)	(1,012,500)	(877,500)	(438,750)	(438,750)	(168,750)	
plus: Direct Rate Funding		-	-	-	-	-	-	-	
plus: Revenue Bond Proceeds		-	-	-	-	-	-	19,500,000	
plus: PWTF Loans		-	-	-	-	-	-	-	
plus: Other Low Interest Loan Proceeds		-	-	-	-	-	-	-	
Total Funding Sources		**$ 17,077,931**	**$ 24,775,309**	**$ 14,167,165**	**$ 15,856,992**	**$ 12,658,268**	**$ 10,917,498**	**$ 30,650,171**	
less: Capital Expenditures		(3,086,000)	(15,150,030)	(3,982,506)	(7,078,009)	(5,637,747)	(4,804,730)	(15,918,675)	
Ending Capital Fund Balance		**$ 13,991,931**	**$ 9,625,279**	**$ 10,184,659**	**$ 8,778,983**	**$ 7,020,522**	**$ 6,112,769**	**$ 14,731,496**	
Minimum Target Balance		*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	*$ 1,500,000*	
		1,046	*540*	*540*	*476*	*388*	*341*	*672*	
DEBT RESERVE									
Beginning Balance		$ 3,563,135	$ 7,941,919	$ 7,941,919	$ 7,941,919	$ 7,941,919	$ 7,941,919	$ 7,941,919	
plus: Reserve Funding from New Debt		-	-	-	-	-	-	1,574,298	
plus: Additions to Meet Minimum		4,378,784	-	-	-	-	-	-	-
less: Use of Reserves for Debt Service		-	-	-	-	-	-	-	
Ending Balance		**$ 7,941,919**	**$ 7,941,919**	**$ 7,941,919**	**$ 7,941,919**	**$ 7,941,919**	**$ 7,941,919**	**$ 9,516,217**	
Minimum Target Balance		*$ 3,216,593*	*$ 3,202,893*	*$ 3,054,372*	*$ 3,038,092*	*$ 3,017,741*	*$ 2,991,576*	*$ 4,530,987*	
RATE STABILIZATION FUND									
Beginning Balance		$ 4,378,784	$ -	$ -	$ -	$ -	$ -	$ -	
plus: Additions to Fund		-	-	-	-	-	-	-	
less: Transfer to Capital Fund		-	-	-	-	-	-	-	
less: Transfer to Debt Reserve Fund		(4,378,784)	-	-	-	-	-	-	
less: Transfer to Operating Fund		-	-	-	-	-	-	-	
Ending Balance		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
Minimum Target Balance		*$ 4,000,000*	*$ 4,000,000*	*$ 4,000,000*	*$ 4,000,000*	*$ 4,000,000*	*$ 4,000,000*	*$ 4,000,000*	

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				2021					Used for GFC Calculation	
Asset Number	Description	Date	Original Cost	Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Utility-Funded Plant	Allocable Interest
	Land									
1999.017	Land & Land Rights	9/9/99	$ 22,923	$ -	L	100%	5.43%	$ 12,441	$ 22,923	$ 12,441
1999.018	Land Pumping Plant	9/9/99	15,931	-	L	100%	5.43%	8,646	15,931	8,646
1999.019	Lift Station 12 (2A) Land	9/9/99	65,753	-	L	100%	5.43%	35,687	65,753	35,687
1999.020	Land Treatment Plant	9/9/99	34,069	-	L	100%	5.43%	18,491	34,069	18,491
2004.001	Vernon Business Center Land	1/1/04	240,000	-	L	100%	4.68%	112,260	240,000	112,260
2005.015	Land BRESKE Property	6/30/05	356,159	-	L	100%	4.40%	156,621	356,159	156,621
2005.016	Land PH 2 Acquistion	6/30/05	22,811	-	L	100%	4.40%	10,031	22,811	10,031
2008.013	STP 2 Carleton Land Purchase	6/30/08	274,640	-	L	100%	4.86%	133,498	274,640	133,498
2009.019	Carleton Acquistion Issues	12/31/09	20,189	-	L	100%	4.62%	9,329	20,189	9,329
	Building								-	
2004.002	Vernon Business Center	1/1/04	749,220	319,980	40 Years	100%	4.68%	350,448	749,220	350,448
2006.023	Office Leashold Improvements	12/31/06	19,442	7,331	40 Years	100%	4.40%	8,556	19,442	8,556
	Plant Building								-	
2012.007	NP-Headworks-Bldg	12/31/12	512,273	93,063	50 Years	100%	3.73%	171,932	512,273	171,932
2012.008	NP-Headworks-Electrical/HVAC	12/31/12	610,095	277,085	20 Years	100%	3.73%	204,763	610,095	204,763
2012.009	NP-Headworks-Finishes	12/31/12	77,567	46,971	15 Years	0%	3.73%	26,033	-	-
2012.010	NP-Headworks-Mechanical Piping	12/31/12	62,598	11,372	50 Years	100%	3.73%	21,009	62,598	21,009
2012.013	NP-Primary Clarifiers-Bldg	12/31/12	512,383	93,083	50 Years	100%	3.73%	171,968	512,383	171,968
2012.014	NP-Primary Clarifiers-Electrical/HVAC	12/31/12	658,500	299,069	20 Years	100%	3.73%	221,009	658,500	221,009
2012.015	NP-Primary Clarifiers-Finishes	12/31/12	83,747	50,713	15 Years	100%	3.73%	28,108	83,747	28,108
2012.016	NP-Primary Clarifiers-Mechanical Piping	12/31/12	78,113	14,191	50 Years	100%	3.73%	26,217	78,113	26,217
2012.019	NP-Primary Effluent Screening Bldg-Bldg	12/31/12	537,379	97,624	50 Years	100%	3.73%	180,358	537,379	180,358
2012.020	NP-Primary Effluent Screening Bldg-Electrical/HVAC	12/31/12	1,482,850	673,461	20 Years	100%	3.73%	497,682	1,482,850	497,682
2012.021	NP-Primary Effluent Screening Bldg-Finishes	12/31/12	107,617	65,168	15 Years	100%	3.73%	36,119	107,617	36,119
2012.022	NP-Primary Effluent Screening Bldg-Mechanical Piping	12/31/12	30,313	5,507	50 Years	100%	3.73%	10,174	30,313	10,174
2012.025	NP-Aeration Basins-Bldg	12/31/12	314,735	57,177	50 Years	100%	3.73%	105,633	314,735	105,633
2012.026	NP-Aeration Basins-Electrical/HVAC	12/31/12	362,322	164,554	20 Years	100%	3.73%	121,604	362,322	121,604
2012.027	NP-Aeration Basins-Finishes	12/31/12	95,598	57,890	15 Years	100%	3.73%	32,085	95,598	32,085
2012.028	NP-Aeration Basins-Mechanical Piping	12/31/12	109,821	19,951	50 Years	100%	3.73%	36,859	109,821	36,859
2012.031	NP-Equipment Bldg-Bldg	12/31/12	3,497,971	635,465	50 Years	100%	3.73%	1,174,007	3,497,971	1,174,007
2012.032	NP-Equipment Bldg-Electrical/HVAC	12/31/12	6,604,226	2,999,419	20 Years	100%	3.73%	2,216,543	6,604,226	2,216,543
2012.033	NP-Equipment Bldg-Finishes	12/31/12	1,606,190	972,637	15 Years	100%	3.73%	539,078	1,606,190	539,078
2012.034	NP-Equipment Bldg-Mechanical Piping	12/31/12	3,619,194	657,487	50 Years	100%	3.73%	1,214,692	3,619,194	1,214,692
2012.037	NP-Pipe Gallery-Bldg	12/31/12	35,809	6,505	50 Years	100%	3.73%	12,019	35,809	12,019
2012.038	NP-Pipe Gallery-Electrical/HVAC	12/31/12	126,270	57,348	20 Years	100%	3.73%	42,379	126,270	42,379
2012.039	NP-Pipe Gallery-Finishes	12/31/12	30,519	18,481	15 Years	100%	3.73%	10,243	30,519	10,243
2012.040	NP-Pipe Gallery-Mechanical Piping	12/31/12	611,914	111,165	50 Years	100%	3.73%	205,374	611,914	205,374
2012.043	NP-Gravity Thickener-Bldg	12/31/12	155,510	28,251	50 Years	100%	3.73%	52,193	155,510	52,193
2012.044	NP-Gravity Thickener-Electrical/HVAC	12/31/12	70,985	32,239	20 Years	100%	3.73%	23,824	70,985	23,824
2012.045	NP-Gravity Thickener-Finishes	12/31/12	16,456	9,965	15 Years	100%	3.73%	5,523	16,456	5,523
2012.046	NP-Gravity Thickener-Mechanical Piping	12/31/12	25,917	4,709	50 Years	100%	3.73%	8,698	25,917	8,698
2012.049	NP-Digester-Bldg	12/31/12	1,279,496	232,441	50 Years	100%	3.73%	429,431	1,279,496	429,431
2012.050	NP-Digester-Electrical/HVAC	12/31/12	2,148,680	975,859	20 Years	100%	3.73%	721,151	2,148,680	721,151
2012.051	NP-Digester-Finishes	12/31/12	277,641	168,127	15 Years	100%	3.73%	93,183	277,641	93,183
2012.052	NP-Digester-Mechanical Piping	12/31/12	550,600	100,026	50 Years	100%	3.73%	184,795	550,600	184,795
2012.055	NP-Admin Bldg-Bldg	12/31/12	350,518	63,678	50 Years	100%	3.73%	117,643	350,518	117,643
2012.056	NP-Admin Bldg-Electrical/HVAC	12/31/12	779,197	353,886	20 Years	100%	3.73%	261,518	779,197	261,518
2012.057	NP-Admin Bldg-Finishes	12/31/12	308,803	186,997	15 Years	100%	3.73%	103,642	308,803	103,642
2012.060	NP-Biofilter A-Bldg	12/31/12	14,024	2,547	50 Years	100%	3.73%	4,707	14,024	4,707
2012.061	NP-Biofilter A-Electrical/HVAC	12/31/12	248,526	112,873	20 Years	100%	3.73%	83,412	248,526	83,412
2012.062	NP-Biofilter A-Finishes	12/31/12	53,702	32,520	15 Years	100%	3.73%	18,024	53,702	18,024
2012.063	NP-Biofilter A-Mechanical Piping	12/31/12	57,107	10,375	50 Years	100%	3.73%	19,167	57,107	19,167

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Asset Number	Description	Date	Original Cost	Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Utility-Funded Plant	Allocable Interest
2012.066	NP-Generator Bldg-Bldg	12/31/12	91,475	16,618	50 Years	100%	3.73%	30,701	91,475	30,701
2012.067	NP-Generator Bldg-Electrical/HVAC	12/31/12	269,989	122,621	20 Years	100%	3.73%	90,615	269,989	90,615
2012.068	NP-Generator Bldg-Finishes	12/31/12	54,736	33,146	15 Years	100%	3.73%	18,371	54,736	18,371
2015.005	Equipment Shed	3/31/15	66,562	8,099	50 Years	100%	3.66%	14,607	66,562	14,607
	Plant								-	
1979.001	MAINS / MAINS	8/15/79	2,736,151	2,302,927	50 Years	100%	6.52%	1,783,058	2,736,151	1,783,058
1989.001	MAINS / LATERALS	11/20/89	12,333,950	7,918,624	50 Years	100%	7.23%	8,917,446	12,333,950	8,917,446
1999.002	LAKELINE WITHROW	6/30/99	270,437	119,444	50 Years	100%	5.43%	146,779	270,437	146,779
1999.003	LUNDEEN BYPASS PHASE 1	6/30/99	294,796	130,202	50 Years	100%	5.43%	160,001	294,796	160,001
1999.004	UPIS Vernon Place	6/30/99	157,402	69,520	50 Years	0%	5.43%	85,430	-	-
1999.005	UPIS Skyline Court	6/30/99	304,224	134,366	50 Years	0%	5.43%	165,117	-	-
1999.006	UPIS Jasmine Place	6/30/99	110,262	48,699	50 Years	0%	5.43%	59,845	-	-
1999.007	UPIS Lake Stevens Station	6/30/99	111,863	49,406	50 Years	0%	5.43%	60,714	-	-
1999.008	UPIS Ridgewood Park Div II	6/30/99	53,922	23,816	50 Years	0%	5.43%	29,266	-	-
1999.009	UPIS Lake Pointe	6/30/99	121,038	53,459	50 Years	0%	5.43%	65,694	-	-
1999.010	UPIS Quilceda Point West	6/30/99	158,318	69,923	50 Years	0%	5.43%	85,927	-	-
1999.011	UPIS Seimering Short Plat	6/30/99	11,536	5,095	50 Years	0%	5.43%	6,261	-	-
1999.012	UPIS Brothers	6/30/99	31,242	13,799	50 Years	0%	5.43%	16,957	-	-
1999.013	UPIS Alpine Mesa	6/30/99	100,831	44,534	50 Years	0%	5.43%	54,726	-	-
1999.014	UPIS Black Rock Hills Div 4	6/30/99	137,919	60,914	50 Years	0%	5.43%	74,855	-	-
1999.015	UPIS Meridian Street Plaza	6/30/99	99,784	44,071	50 Years	0%	5.43%	54,158	-	-
2000.002	UPIS Helena Manor	6/30/00	141,617	59,715	50 Years	0%	5.71%	80,852	-	-
2000.003	UPIS Pilchuck Meadows	6/30/00	236,250	99,619	50 Years	0%	5.71%	134,879	-	-
2000.004	UPIS Hawk Village	6/30/00	89,446	37,717	50 Years	0%	5.71%	51,066	-	-
2000.005	UPIS Irwin Short Plat	6/30/00	30,800	12,987	50 Years	0%	5.71%	17,584	-	-
2000.006	UPIS Quilceda Pointe	6/30/00	68,262	28,784	50 Years	0%	5.71%	38,972	-	-
2000.007	UPIS Mission Ridge Div 1	6/30/00	513,982	216,727	50 Years	0%	5.71%	293,441	-	-
2000.008	UPIS Vernon Grove	6/30/00	51,870	21,872	50 Years	0%	5.71%	29,613	-	-
2000.009	UPIS Black Rock Hills Div 6	6/30/00	115,056	48,515	50 Years	0%	5.71%	65,687	-	-
2000.010	UPIS Mission Ridge Div 2	6/30/00	78,690	33,181	50 Years	0%	5.71%	44,925	-	-
2000.011	UPIS Black Rock Hills Div 5	6/30/00	72,200	30,444	50 Years	0%	5.71%	41,220	-	-
2000.012	UPIS Village at Lake Stevens	6/30/00	139,839	58,966	50 Years	0%	5.71%	79,836	-	-
2000.014	UPIS Skyline Ridge	6/30/00	129,360	54,547	50 Years	0%	5.71%	73,854	-	-
2001.002	UPIS Target Store	6/30/01	35,560	14,284	50 Years	0%	5.15%	18,322	-	-
2001.003	UPIS Black Rock Hills Div 7	6/30/01	112,202	45,068	50 Years	0%	5.15%	57,812	-	-
2001.004	UPIS Cedar Winds	6/30/01	135,964	54,612	50 Years	0%	5.15%	70,055	-	-
2001.005	HP DOUSING TANK / LINE	6/30/01	23,910	9,603	50 Years	100%	5.15%	12,320	23,910	12,320
2001.006	SEWER LINES ULID 3 AREA	6/30/01	54,796	22,010	50 Years	100%	5.15%	28,234	54,796	28,234
2001.007	DIKE IMPROVEMENT DD#2	6/30/01	122,898	49,364	50 Years	100%	5.15%	63,323	122,898	63,323
2001.008	DEVELOPER LINE UPGRADE	6/30/01	2,005	805	50 Years	100%	5.15%	1,033	2,005	1,033
2002.001	UPIS - SOUNDVIEW ESTATES	6/30/02	436,800	166,712	50 Years	0%	5.04%	220,038	-	-
2002.002	UPIS - MSH SHORT PLAT	6/30/02	27,585	10,530	50 Years	0%	5.04%	13,896	-	-
2002.003	UPIS - CALVARY CHAPEL YOUTH BUILDING	6/30/02	27,485	10,491	50 Years	0%	5.04%	13,846	-	-
2002.004	UPIS - HELEENA HILLS	6/30/02	545,576	208,232	50 Years	0%	5.04%	274,834	-	-
2002.005	UPIS - MORNING VIEW ESTATES	6/30/02	144,480	55,145	50 Years	0%	5.04%	72,782	-	-
2002.006	UPIS - DAVIES ESTATES	6/30/02	173,945	66,388	50 Years	0%	5.04%	87,625	-	-
2002.007	UPIS - TEAM FITNESS	6/30/02	23,561	8,993	50 Years	0%	5.04%	11,869	-	-
2002.008	UPIS - NOBLE COURT	6/30/02	257,608	98,320	50 Years	0%	5.04%	129,770	-	-
2003.001	UPIS - MISSION RIDGE III	6/30/03	163,163	59,011	50 Years	0%	4.75%	77,475	-	-
2003.002	UPIS - FRONTIER VILLAGE EXPANSION	6/30/03	23,229	8,401	50 Years	0%	4.75%	11,030	-	-
2003.003	UPIS - STEVENS PLACE	6/30/03	50,145	18,135	50 Years	0%	4.75%	23,810	-	-
2003.004	UPIS - STEVENS VIEW	6/30/03	118,840	42,981	50 Years	0%	4.75%	56,429	-	-
2003.005	UPIS - EMERALD PLACE	6/30/03	19,243	6,959	50 Years	0%	4.75%	9,137	-	-

				2021					Used for GFC Calculation	
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2003.006	UPIS - VERNON ROAD ESTATES	6/30/03	387,419	140,117	50 Years	0%	4.75%	183,959	-	-
2004.005	UPIS - SOUTH LAKE CENTER II	6/30/04	32,161	10,988	50 Years	0%	4.68%	15,043	-	-
2004.006	UPIS - HEWITT HILLS DIV 1	6/30/04	124,558	42,558	50 Years	0%	4.68%	58,262	-	-
2004.007	UPIS - WESTLAKE POINTE	6/30/04	143,021	48,865	50 Years	0%	4.68%	66,898	-	-
2005.001	UPIS - DAVIS DEVELOPMENT	6/30/05	121,318	39,024	50 Years	0%	4.40%	53,349	-	-
2005.002	UPIS - CAMPUS PARK PH 1	6/30/05	501,280	161,245	50 Years	0%	4.40%	220,438	-	-
2005.003	UPIS - AUTUMN GLENN	6/30/05	91,064	29,292	50 Years	0%	4.40%	40,045	-	-
2005.004	UPIS - CUNNINGHAM	6/30/05	34,568	11,119	50 Years	0%	4.40%	15,201	-	-
2005.005	UPIS - SKYLINE PLACE	6/30/05	178,463	57,406	50 Years	0%	4.40%	78,479	-	-
2005.006	UPIS - MORRIS	6/30/05	87,918	28,280	50 Years	0%	4.40%	38,662	-	-
2005.007	UPIS - PARKWAY RIDGE PH 1	6/30/05	60,870	19,580	50 Years	0%	4.40%	26,768	-	-
2005.008	UPIS - PARKWAY RIDGE PH 2	6/30/05	116,709	37,542	50 Years	0%	4.40%	51,323	-	-
2005.009	LOWER CALLOW ROAD	6/30/05	230,111	74,019	50 Years	100%	4.40%	101,191	230,111	101,191
2005.010	91ST AVE LINE BREAK - EMERGENCY	6/30/05	181,038	58,234	50 Years	100%	4.40%	79,612	181,038	79,612
2006.006	UPIS - CAMPUS PARK PH 2	6/30/06	366,965	110,701	50 Years	0%	4.40%	161,495	-	-
2006.007	UPIS - TINGLEY LUND SHORT PLAT	6/30/06	60,092	18,127	50 Years	0%	4.40%	26,445	-	-
2006.008	UPIS - SCRUPPS	6/30/06	62,947	18,989	50 Years	0%	4.40%	27,702	-	-
2006.009	UPIS - NOBLE COURT 2	6/30/06	155,594	46,937	50 Years	0%	4.40%	68,474	-	-
2006.010	UPIS - GLENWOOD EAST	6/30/06	289,040	87,193	50 Years	0%	4.40%	127,202	-	-
2006.011	UPIS - OSBORNE PH 1	6/30/06	1,554,261	468,868	50 Years	0%	4.40%	684,004	-	-
2006.012	LUNDEEN BYPASS PHASE 2	6/30/06	5,668,551	1,710,012	50 Years	100%	4.40%	2,494,635	5,668,551	2,494,635
2006.013	UPIS 2006 PASADERA PHASE 2	6/30/06	250,135	75,457	50 Years	0%	4.40%	110,080	-	-
2006.014	UPIS 2006 SKYLIGHT	6/30/06	77,159	23,276	50 Years	0%	4.40%	33,956	-	-
2006.015	UPIS 2006 PASADERA PHASE 1	6/30/06	516,553	155,827	50 Years	0%	4.40%	227,326	-	-
2007.002	Sunnyside Treatment Plant Design	1/1/07	5,806,223	1,635,420	50 Years	100%	4.40%	2,552,319	5,806,223	2,552,319
2007.003	ULID 13	1/1/07	582,399	164,043	50 Years	100%	4.40%	256,013	582,399	256,013
2007.006	UPIS - L16 PASADERA LLC	1/24/07	3,181	896	50 Years	0%	4.40%	1,398	-	-
2007.007	UPIS - OSBORNE PH 2	1/31/07	197,035	55,498	50 Years	0%	4.40%	86,613	-	-
2007.008	UPIS - CEDAR HILL	2/28/07	101,294	28,530	50 Years	0%	4.40%	44,527	-	-
2007.009	UPIS - KNOWLES ADDITION	2/28/07	261,417	73,633	50 Years	0%	4.40%	114,915	-	-
2007.010	UPIS - SOUTHLAKE	2/28/07	103,452	29,139	50 Years	0%	4.40%	45,476	-	-
2007.014	UPIS - MYERS PH 1	3/31/07	236,625	66,650	50 Years	0%	4.40%	104,016	-	-
2007.015	UPIS - HAACK SHORT PLAT	3/31/07	73,270	20,638	50 Years	0%	4.40%	32,208	-	-
2007.016	UPIS - SW INTERCEPTOR - SUTHERLAND	3/31/07	2,521,560	710,239	50 Years	0%	4.40%	1,108,436	-	-
2007.017	UPIS - SUMMER HILL	3/31/07	125,459	35,338	50 Years	0%	4.40%	55,150	-	-
2007.018	UPIS - GREENWOOD VILLAGE PH 1	4/6/07	52,171	14,695	50 Years	0%	4.40%	22,934	-	-
2007.019	UPIS - CHAPEL RIDGE NORTH	4/24/07	288,103	81,149	50 Years	0%	4.40%	126,645	-	-
2007.020	UPIS - VINJE	5/31/07	73,576	20,724	50 Years	0%	4.40%	32,343	-	-
2007.021	UPIS - ANGELIA HEIGHTS	5/31/07	14,461	4,073	50 Years	0%	4.40%	6,357	-	-
2007.023	UPIS 2007 SYLVAN MEADOWS	6/30/07	63,847	17,983	50 Years	0%	4.40%	28,066	-	-
2007.024	UPIS 2007 MYERS PHASE 2	6/30/07	258,701	72,868	50 Years	0%	4.40%	113,721	-	-
2007.025	UPIS 2007 SW INTERCEPTOR MYERS PH 2	6/30/07	137,172	38,637	50 Years	0%	4.40%	60,299	-	-
2007.026	UPIS 2007 CAMPUS PARK PHASE 4	6/30/07	355,299	100,076	50 Years	0%	4.40%	156,184	-	-
2007.027	UPIS 2007 30TH STREET (KAINTZ)	6/30/07	103,833	29,247	50 Years	0%	4.40%	45,643	-	-
2007.031	UPIS - GREENWOOD VILLAGE PH 2	10/17/07	2,049,639	577,315	50 Years	0%	4.40%	900,987	-	-
2007.033	UPIS - GREENWOOD VILLAGE LS 21	10/26/07	970,140	273,256	50 Years	0%	4.40%	426,457	-	-
2007.034	UPIS - CAVALERO RIDGE	10/31/07	935,406	263,473	50 Years	0%	4.40%	411,189	-	-
2007.035	UPIS - EASTGATE HIGHLANDS	11/30/07	67,224	18,935	50 Years	0%	4.40%	29,551	-	-
2008.003	91st STREET LINE UPGRADE	6/30/08	15,539	4,066	50 Years	100%	4.86%	7,553	15,539	7,553
2008.004	UPIS SW INTERCEPTOR SUTHERLAND	6/30/08	1,307,595	342,155	50 Years	0%	4.86%	635,600	-	-
2008.006	UPIS EMILIE RIDGE	6/30/08	51,922	13,587	50 Years	0%	4.86%	25,238	-	-
2009.011	UPIS Campus Park Ph 5	12/31/09	157,940	38,169	50 Years	0%	4.62%	72,981	-	-
2009.012	UPIS Westview Ridge	12/31/09	1,253,812	303,005	50 Years	0%	4.62%	579,366	-	-

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Asset Number	Description	Date	Original Cost	Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Utility-Funded Plant	Allocable Interest
2009.013	UPIS 20th Street SE	12/31/09	562,110	135,843	50 Years	0%	4.62%	259,742	-	-
2009.014	UPIS Hillcrest Elementary	12/31/09	31,992	7,731	50 Years	0%	4.62%	14,783	-	-
2009.015	UPIS Cavelero Mid High	12/31/09	1,450,948	350,646	50 Years	0%	4.62%	670,459	-	-
2009.016	UPIS Chapel Meadows North	12/31/09	104,445	25,241	50 Years	0%	4.62%	48,262	-	-
2009.017	SHADOWOOD DETENTION PIPE REPLACEMENT	12/31/09	20,911	5,053	50 Years	100%	4.62%	9,663	20,911	9,663
2010.006	UPIS Boggs	12/31/10	162,048	35,921	50 Years	0%	4.29%	69,573	-	-
2010.007	UPIS Lee/Ingbretsen	12/31/10	10,324	2,289	50 Years	0%	4.29%	4,432	-	-
2010.008	UPIS Vine Maple	12/31/10	22,933	5,083	50 Years	0%	4.29%	9,846	-	-
2010.009	UPIS Fenner	12/31/10	202,499	44,887	50 Years	0%	4.29%	86,939	-	-
2010.010	UPIS 8th Street SE	12/31/10	16,846	3,734	50 Years	0%	4.29%	7,232	-	-
2010.011	UPIS Campus Park Ph 3	12/31/10	506,975	112,380	50 Years	0%	4.29%	217,661	-	-
2010.012	UPIS Sutherland	12/31/10	48,473	10,745	50 Years	0%	4.29%	20,811	-	-
2010.013	UPIS Osborne	12/31/10	4,277	948	50 Years	0%	4.29%	1,836	-	-
2010.014	UPIS Valterra View Estates	12/31/10	1,192,029	264,233	50 Years	0%	4.29%	511,778	-	-
2010.015	CWIP SWI Ph I (10704)	12/31/10	577,509	128,014	50 Years	100%	4.29%	247,944	577,509	247,944
2010.016	CWIP SWI Ph I (10704)	12/31/10	1,153,629	255,721	50 Years	100%	4.29%	495,291	1,153,629	495,291
2012.001	Vernon Rd Diversion PH I	12/31/12	5,445,077	989,189	50 Years	100%	3.73%	1,827,504	5,445,077	1,827,504
2012.002	Vernon Rd Diversion PH II	12/31/12	1,063,736	187,044	50 Years	100%	3.73%	357,016	1,063,736	357,016
2012.003	Southwest Interceptor PH IIA	12/31/12	2,321,535	421,745	50 Years	100%	3.73%	779,165	2,321,535	779,165
2012.004	Valterra Slide Emergency	12/31/12	787,818	143,120	50 Years	100%	3.73%	264,411	787,818	264,411
2012.005	NP-Headworks-Site Work	12/31/12	1,421,003	258,149	50 Years	100%	3.73%	476,924	1,421,003	476,924
2012.006	NP-Headworks-Concrete (Foundations/Walls)	12/31/12	237,056	43,065	50 Years	100%	3.73%	79,562	237,056	79,562
2012.011	NP-Primary Clarifiers-Site Work	12/31/12	1,541,341	280,010	50 Years	100%	3.73%	517,312	1,541,341	517,312
2012.012	NP-Primary Clarifiers-Concrete (Foundations/Walls)	12/31/12	1,231,936	223,802	50 Years	100%	3.73%	413,468	1,231,936	413,468
2012.017	NP-Primary Effluent Screening Bldg-Site Work	12/31/12	1,968,602	357,629	50 Years	100%	3.73%	660,712	1,968,602	660,712
2012.018	NP-Primary Effluent Screening Bldg-Concrete (Foundations/Wal	12/31/12	334,745	60,812	50 Years	100%	3.73%	112,349	334,745	112,349
2012.023	NP-Aeration Basins-Site Work	12/31/12	1,429,550	259,701	50 Years	100%	3.73%	479,793	1,429,550	479,793
2012.024	NP-Aeration Basins-Concrete (Foundations/Walls)	12/31/12	3,344,883	607,653	50 Years	100%	3.73%	1,122,626	3,344,883	1,122,626
2012.029	NP-Equipment Bldg-Site Work	12/31/12	16,135,667	2,931,313	50 Years	100%	3.73%	5,415,533	16,135,667	5,415,533
2012.030	NP-Equipment Bldg-Concrete (Foundations/Walls)	12/31/12	3,056,872	555,332	50 Years	100%	3.73%	1,025,963	3,056,872	1,025,963
2012.035	NP-Pipe Gallery-Site Work	12/31/12	535,477	97,278	50 Years	100%	3.73%	179,719	535,477	179,719
2012.036	NP-Pipe Gallery-Concrete (Foundations/Walls)	12/31/12	151,026	27,436	50 Years	100%	3.73%	50,688	151,026	50,688
2012.041	NP-Gravity Thickener-Site Work	12/31/12	328,909	59,752	50 Years	100%	3.73%	110,390	328,909	110,390
2012.042	NP-Gravity Thickener-Concrete (Foundations/Walls)	12/31/12	92,805	16,859	50 Years	100%	3.73%	31,148	92,805	31,148
2012.047	NP-Digester-Site Work	12/31/12	4,752,251	863,326	50 Years	100%	3.73%	1,594,974	4,752,251	1,594,974
2012.048	NP-Digester-Concrete (Foundations/Walls)	12/31/12	2,089,950	379,674	50 Years	100%	3.73%	701,439	2,089,950	701,439
2012.053	NP-Admin Bldg-Site Work	12/31/12	1,076,719	195,604	50 Years	100%	3.73%	361,374	1,076,719	361,374
2012.054	NP-Admin Bldg-Concrete (Foundations/Walls)	12/31/12	57,578	10,460	50 Years	100%	3.73%	19,325	57,578	19,325
2012.058	NP-Biofilter A-Site Work	12/31/12	216,774	39,381	50 Years	100%	3.73%	72,755	216,774	72,755
2012.059	NP-Biofilter A-Concrete (Foundations/Walls)	12/31/12	125,636	22,824	50 Years	100%	3.73%	42,167	125,636	42,167
2012.064	NP-Generator Bldg-Site Work	12/31/12	393,045	71,404	50 Years	100%	3.73%	131,916	393,045	131,916
2012.065	NP-Generator Bldg-Concrete (Foundations/Walls)	12/31/12	86,996	15,804	50 Years	100%	3.73%	29,198	86,996	29,198
2012.074	NP-Outfall	12/31/12	1,787,864	324,795	50 Years	100%	3.73%	600,052	1,787,864	600,052
2012.076	NP-Vernon Rd	12/31/12	294,592	53,518	50 Years	100%	3.73%	98,872	294,592	98,872
2012.077	NP-Other Costs-Legal, Eng, Permts, etc	12/31/12	8,906,014	1,617,926	50 Years	100%	3.73%	2,989,081	8,906,014	2,989,081
2014.002	Sunnyside Road Visibility Improvements	2/28/14	740,132	104,852	50 Years	100%	4.23%	219,283	740,132	219,283
2014.004	UPIS Hisey	3/27/14	191,702	27,158	50 Years	0%	4.23%	56,796	-	-
2014.006	UPIS North Star	7/1/14	216,983	30,739	50 Years	0%	4.23%	64,287	-	-
2015.003	SWI Ph II B	5/31/15	1,046,019	127,266	50 Years	100%	3.66%	229,549	1,046,019	229,549
2015.006	HDPE Bypass Piping	8/31/15	9,644	1,176	50 Years	100%	3.66%	2,116	9,644	2,116
2016.006	131st Ave (11403)	2/11/16	29,706	3,020	50 Years	0%	3.25%	4,825	-	-
2016.007	Holly Div I (10524)	3/4/16	199,549	20,287	50 Years	0%	3.25%	32,410	-	-
2016.008	Holly Div III (10644)	3/4/16	48,969	4,979	50 Years	0%	3.25%	7,953	-	-

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Asset Number	Description	Date	Original Cost	2021 Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Used for GFC Calculation: Utility-Funded Plant	Used for GFC Calculation: Allocable Interest
2016.009	Dunroven Ranch (11404)	4/28/16	88,360	8,983	50 Years	0%	3.25%	14,351	-	-
2016.010	Maple Rock II (11302)	12/15/16	346,740	35,252	50 Years	0%	3.25%	56,316	-	-
2016.011	2016 Comp Plan	12/31/16	352,249	223,825	8 Years	100%	3.25%	57,211	352,249	57,211
2017.001	Vernon Village - 325 LF 8" Sewer Line	4/28/17	42,573	3,477	50 Years	0%	3.67%	6,243	-	-
2017.002	Marion Dale - 3565 LF 8" Sewer Line	8/31/17	1,101,023	89,917	50 Years	0%	3.67%	161,467	-	-
2017.003	Clocktower - 68 LF 8" Sewer Line	10/12/17	39,454	3,222	50 Years	0%	3.67%	5,786	-	-
2017.004	Hawksbeard - 846 LF 8" Sewer Line	11/22/17	612,370	50,010	50 Years	0%	3.67%	89,805	-	-
2017.005	Nourse Callow Rd - 1760 LF 18" Sewer Line	12/20/17	1,258,985	102,634	50 Years	0%	3.67%	184,632	-	-
2018.001	C47-1 Tyler - 2730 LF 8", 2866 LF 6"	1/5/18	1,125,175	69,386	50 Years	0%	3.96%	133,579	-	-
2018.002	Chapel 5 - 918 LF 8", 1089 LF 6"	2/8/18	143,918	8,875	50 Years	0%	3.96%	17,086	-	-
2018.003	Eagle Glen N - 1395 LF 8", 1399 LF 6"	2/22/18	507,454	31,293	50 Years	0%	3.96%	60,244	-	-
2018.004	Stevens Ridge - 582 LF 8", 348 LF 6"	4/18/18	77,948	4,807	50 Years	0%	3.96%	9,254	-	-
2018.005	Westlake Crossing - 808 LF 10", 1668 LF	5/23/18	321,428	19,821	50 Years	0%	3.96%	38,160	-	-
2018.006	LKS Elem - 1331 LF 8" PVC, 220 LF 8"	7/19/18	449,045	27,691	50 Years	0%	3.96%	53,310	-	-
2018.007	The Refuge - 2255 LF 8", 2990 LF 6"	9/14/18	419,007	25,839	50 Years	0%	3.96%	49,744	-	-
2018.008	Turner - 176 LF 8", 140 LF 6"	10/2/18	51,606	3,182	50 Years	0%	3.96%	6,127	-	-
2018.009	Hartford Industrial - 1357 LF 8", 210 LF 6	11/8/18	135,400	8,350	50 Years	0%	3.96%	16,074	-	-
2018.010	O'Day - 212 LF 8", 50 LF 6"	11/21/18	22,823	1,407	50 Years	0%	3.96%	2,710	-	-
2018.011	LKS HS Mod - 268 LF 8"	12/19/18	75,757	4,672	50 Years	0%	3.96%	8,994	-	-
2019.001	Wagner Hills 951 LF 8", 3056 LF 6"	2/15/19	295,159	12,298	50 Years	0%	3.42%	20,182	-	-
2019.002	McKay 1595 LF 8", 1446 LF 6"	2/26/19	266,415	11,101	50 Years	0%	3.42%	18,217	-	-
2019.003	Lkvw Highlands, Springs E & W 1407 LF 8", 1193 LF 6"	4/15/19	231,642	9,652	50 Years	0%	3.42%	15,839	-	-
2019.004	Nourse I & II 5,237 LF 8", 622 LF 15", 5,273 LF 6"	4/25/19	1,329,869	55,411	50 Years	0%	3.42%	90,933	-	-
2019.007	Lyons Gate I 1314 LF 8", 1266 LF 6"	5/8/19	147,688	6,154	50 Years	0%	3.42%	10,099	-	-
2019.008	Lyons Gate II 873 LF 8", 1547 LF 6"	5/8/19	123,409	5,142	50 Years	0%	3.42%	8,438	-	-
2019.009	Fairview Terrace 1985 LF 8", 1605 LF 6"	7/10/19	355,340	14,806	50 Years	0%	3.42%	24,297	-	-
2019.010	Kane 899 LF 8", 1552 LF 6"	7/10/19	171,497	7,146	50 Years	0%	3.42%	11,727	-	-
2019.011	Autumn Crest 863 LF 8", 766 LF 6"	8/21/19	151,587	6,316	50 Years	0%	3.42%	10,365	-	-
2019.012	Belmark 16th Street 115 LF 8", 40 LF 6"	8/30/19	54,454	2,269	50 Years	0%	3.42%	3,723	-	-
2019.015	Ebey View 580 LF 8", 614 LF 6"	10/29/19	105,538	4,398	50 Years	0%	3.42%	7,216	-	-
2020.001	A &J SP 572 LF 8", 84 LF 6"	2/20/20	95,164	2,062	50 Years	0%	2.32%	2,211	-	-
2020.002	Pellerin I 1787 LF 8", 2628 LF 6"	2/20/20	729,988	15,816	50 Years	0%	2.32%	16,962	-	-
2020.003	Cavelero Mixed Use	3/10/20	77,177	1,672	50 Years	0%	2.32%	1,793	-	-
2020.004	Nourse III 1610 LF 15", 595 LF 8", 848 LF 6"	4/2/20	476,179	10,317	50 Years	0%	2.32%	11,065	-	-
2020.005	Hewitt Ave 602 LF 8", 434 LF 6"	4/27/20	113,074	2,450	50 Years	0%	2.32%	2,627	-	-
2020.006	2BR 3025 LF 8", 4030 LF 6"	5/5/20	440,030	9,534	50 Years	0%	2.32%	10,225	-	-
2020.007	Adkins-Strom 628 LF 8", 1197 LF 6"	5/15/20	145,396	3,150	50 Years	0%	2.32%	3,378	-	-
2020.008	Sunset Hills 2587 LF 8", 1512 LF 6"	6/12/20	663,659	14,379	50 Years	0%	2.32%	15,421	-	-
2020.009	Ihnot 504 LF 8", 28 LF 6"	7/29/20	38,933	844	50 Years	0%	2.32%	905	-	-
2020.010	Nourse III 4676 LF 8", 4069 LF 6"	11/20/20	870,549	18,862	50 Years	0%	2.32%	20,228	-	-
2017.012	2016AMT Pump & Trailer	1/18/17	10,647	2,218	50 Years	100%	3.67%	1,561	10,647	1,561
2019.016	Frontier Village Line Replacement	12/31/19	113,366	4,724	50 Years	100%	3.42%	7,752	113,366	7,752
2020.011	VBC Structural Repairs	12/31/20	440,620	9,547	50 Years	100%	2.32%	10,238	440,620	10,238
2020.012	VBC Parking Lot	12/31/20	463,262	10,018	50 Years	100%	2.32%	10,764	463,262	10,764
2020.013	Grace Lane	12/31/20	106,389	11,526	50 Years	100%	2.32%	2,472	106,389	2,472
2020.014	91st Ave Emergency Repair	12/31/20	354,270	7,676	50 Years	100%	2.32%	8,232	354,270	8,232
2020.015	CHS Comp Plan Amendment	12/31/20	66,163	35,838	50 Years	100%	2.32%	1,537	66,163	1,537
	Plant Lift Station								-	
1999.001	Lift Station 2A	1/5/99	2,776,015	1,226,073	50 Years	100%	5.43%	1,506,682	2,776,015	1,506,682
2000.013	UPIS LS 14 / S Lake Stevens Rd	6/30/00	328,201	138,391	50 Years	100%	5.71%	187,375	328,201	187,375
2001.001	UPIS LS 8 Upgrade & Force Main	6/30/01	930,797	373,870	50 Years	100%	5.15%	479,593	930,797	479,593
2006.016	Pasedera Lift Station	6/30/06	1,860,538	561,263	50 Years	100%	4.40%	818,792	1,860,538	818,792
2008.005	UPIS Cavalero Lift Staion 19	6/30/08	2,048,161	535,935	50 Years	0%	4.86%	995,577	-	-

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Asset Number	Description	Date	Original Cost	Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Utility-Funded Plant	Allocable Interest
2009.005	LS 3 Generator	5/31/09	17,747	17,747	10 Years	100%	4.62%	8,201	17,747	8,201
2009.009	LS 15 Oxygen System	10/15/09	13,528	13,528	7 Years	100%	4.62%	6,251	13,528	6,251
2012.069	NP-Lift Station 20-Site Work	12/31/12	3,317,319	602,647	50 Years	100%	3.73%	1,113,375	3,317,319	1,113,375
2012.070	NP-Lift Station 20-Concrete (Foundations/Walls)	12/31/12	194,946	35,415	50 Years	100%	3.73%	65,429	194,946	65,429
2012.071	NP-Lift Station 20-Bldg	12/31/12	1,352	245	50 Years	100%	3.73%	454	1,352	454
2012.072	NP-Lift Station 20-Electrical/HVAC	12/31/12	442,299	200,877	20 Years	100%	3.73%	148,447	442,299	148,447
2012.073	NP-Lift Station 20-Finishes	12/31/12	65,895	39,903	15 Years	100%	3.73%	22,116	65,895	22,116
2012.089	NP-Lift Station 20-Mechanical Equipment	12/31/12	707,221	428,262	15 Years	100%	3.73%	237,361	707,221	237,361
2013.008	Cathodic Protection LS 2	6/27/13	7,462	4,024	15 Years	100%	4.27%	2,550	7,462	2,550
2013.009	Cathodic Protection LS 3	6/27/13	8,409	4,534	15 Years	100%	4.27%	2,873	8,409	2,873
2013.010	Cathodic Protection LS 4	6/27/13	8,138	4,388	15 Years	100%	4.27%	2,781	8,138	2,781
2013.011	Cathodic Protection LS 6	6/27/13	7,938	4,280	15 Years	100%	4.27%	2,712	7,938	2,712
2017.010	LS 17 Force Main	12/12/17	543,113	44,354	50 Years	100%	3.67%	79,648	543,113	79,648
2017.011	Pasedera Latecomer - LS 14 Capacity	8/7/17	86,364	17,633	20 Years	100%	3.67%	12,665	86,364	12,665
2018.012	LS 17 Bulk Oxygen Tank	9/28/18	35,357	5,451	20 Years	100%	3.96%	4,198	35,357	4,198
2018.014	LS 15 Bulk Oxygen Tank	10/18/18	41,869	6,455	20 Years	100%	3.96%	4,971	41,869	4,971
2018.015	LS 17 Upgrade	12/31/18	536,897	165,543	10 Years	100%	3.96%	63,740	536,897	63,740
2020.016	LS 22	12/31/20	5,249,813	113,746	50 Years	100%	2.32%	121,986	5,249,813	121,986
	Plant City								-	
1971.001	PIPE & MANHOLES	12/31/71	807,622	807,622	50 Years	0%	5.47%	442,106	-	-
1977.001	PIPE & MANHOLES	12/31/77	127,764	112,645	50 Years	0%	5.68%	72,602	-	-
1978.001	PIPE & MANHOLES	12/31/78	330,057	284,399	50 Years	0%	6.02%	198,832	-	-
1979.002	PIPE & MANHOLES	12/31/79	35,040	29,492	50 Years	0%	6.52%	22,834	-	-
1980.001	PIPE & MANHOLES	12/31/80	42,465	34,892	50 Years	0%	8.59%	36,495	-	-
1983.001	PIPE & MANHOLES	12/31/83	19,013	14,482	50 Years	0%	9.51%	18,073	-	-
1984.001	PIPE & MANHOLES	12/31/84	93,839	69,597	50 Years	0%	10.00%	93,839	-	-
1985.001	PIPE & MANHOLES	12/31/85	131,644	95,003	50 Years	0%	9.10%	119,851	-	-
1988.001	PIPE & MANHOLES	12/31/88	334,359	221,235	50 Years	0%	7.68%	256,788	-	-
1989.002	PIPE & MANHOLES	12/31/89	285,498	183,195	50 Years	0%	7.23%	206,415	-	-
1990.001	PIPE & MANHOLES	12/31/90	879,684	546,870	50 Years	0%	7.27%	639,897	-	-
1991.001	PIPE & MANHOLES	12/31/91	379,958	228,608	50 Years	0%	6.92%	262,931	-	-
1992.002	PIPE & MANHOLES	12/31/92	159,616	92,844	50 Years	0%	6.44%	102,819	-	-
1993.002	PIPE & MANHOLES	12/31/93	140,840	79,105	50 Years	0%	5.60%	78,835	-	-
1994.001	PIPE & MANHOLES	12/31/94	339,309	183,793	50 Years	0%	6.18%	209,693	-	-
1995.001	PIPE & MANHOLES	12/31/95	220,374	114,962	50 Years	0%	5.95%	131,196	-	-
1996.002	PIPE & MANHOLES	12/31/96	419,559	210,479	50 Years	0%	5.76%	241,561	-	-
1997.001	PIPE & MANHOLES	12/31/97	1,289,867	621,286	50 Years	0%	5.52%	712,329	-	-
1998.003	PIPE & MANHOLES	12/31/98	527,249	243,413	50 Years	0%	5.09%	268,414	-	-
1999.021	PIPE & MANHOLES	12/31/99	134,358	59,341	50 Years	0%	5.43%	72,923	-	-
2000.018	PIPE & MANHOLES	12/31/00	1,381,516	582,539	50 Years	0%	5.71%	788,731	-	-
2002.011	PIPE & MANHOLES	12/31/02	518,918	198,053	50 Years	0%	5.04%	261,405	-	-
2003.009	PIPE & MANHOLES	12/31/03	84,347	30,506	50 Years	0%	4.75%	40,051	-	-
2004.010	PIPE & MANHOLES	12/31/04	736,143	251,516	50 Years	0%	4.68%	344,331	-	-
2005.017	PIPE & MANHOLES	12/31/05	714,017	229,676	50 Years	0%	4.40%	313,989	-	-
2006.017	UPIS CITY 2006 MONSON SHORT PLAT	6/30/06	182,953	55,191	50 Years	0%	4.40%	80,515	-	-
2006.018	UPIS CITY 2006 THE LOOP	6/30/06	29,749	8,974	50 Years	0%	4.40%	13,092	-	-
2006.022	CITY SYSTEM IMPROVEMENTS	7/1/06	141,427	42,664	50 Years	100%	4.40%	62,240	141,427	62,240
2007.022	UPIS LAKE VIEW PARK	5/31/07	279,839	78,821	50 Years	0%	4.40%	123,013	-	-
2007.028	UPIS CITY 2007 SHIREWOOD	6/30/07	500,237	140,901	50 Years	0%	4.40%	219,896	-	-
2008.007	UPIS CITY CATHERINE CREEK COTTAGES	6/30/08	51,418	13,455	50 Years	0%	4.86%	24,994	-	-
2008.008	UPIS CITY MACOMBER	6/30/08	132,181	34,587	50 Years	0%	4.86%	64,251	-	-
2009.006	UPIS Hawkins House	7/31/09	10,173	2,459	50 Years	0%	4.62%	4,701	-	-
2009.007	UPIS Colby Court	7/31/09	88,412	21,366	50 Years	0%	4.62%	40,854	-	-

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Plant

				2021					Used for GFC Calculation	
Asset Number	Description	Date	Original Cost	Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Utility-Funded Plant	Allocable Interest
2009.008	UPIS III Stars	9/30/09	48,155	11,638	50 Years	0%	4.62%	22,252	-	-
2010.002	UPIS Vernon Ridge Condo	7/31/10	27,145	6,017	50 Years	0%	4.29%	11,654	-	-
2010.003	UPIS Amber Skyline Ph 1-7	9/30/10	242,405	53,733	50 Years	0%	4.29%	104,073	-	-
2010.004	UPIS Horizon HilLS	10/31/10	142,075	31,493	50 Years	0%	4.29%	60,998	-	-
2011.001	UPIS Cascade Crest	4/30/11	40,744	8,217	50 Years	0%	4.51%	18,376	-	-
2011.002	UPIS Olympic View	9/30/11	56,846	11,464	50 Years	0%	4.51%	25,638	-	-
2012.078	UPIS Pacific Place	12/31/12	44,625	8,107	50 Years	0%	3.73%	14,977	-	-
2013.001	UPIS Sonterra Plat	8/16/13	263,108	42,536	50 Years	0%	4.27%	89,895	-	-
2013.002	UPIS Gilbertson Short Plat	9/17/13	13,234	2,141	50 Years	0%	4.27%	4,521	-	-
2013.003	UPIS Fairbrook Plat	9/18/13	83,452	13,492	50 Years	0%	4.27%	28,513	-	-
2013.004	UPIS Sutherland Ph I	11/18/13	363,607	58,783	50 Years	0%	4.27%	124,232	-	-
2014.003	UPIS Catherine Crest	2/28/14	183,274	25,964	50 Years	0%	4.23%	54,300	-	-
2014.005	UPIS Sutherland Ph II	7/1/14	646,903	91,644	50 Years	0%	4.23%	191,661	-	-
2014.007	UPIS Snowberry Court	7/1/14	87,262	12,362	50 Years	0%	4.23%	25,854	-	-
2014.008	UPIS Arcadia	7/1/14	83,894	11,885	50 Years	0%	4.23%	24,856	-	-
2014.009	UPIS Willow Road	7/1/14	31,775	4,502	50 Years	0%	4.23%	9,414	-	-
2015.008	Bayview Estates	5/28/15	94,517	11,500	50 Years	0%	3.66%	20,742	-	-
2015.009	Estates at Whispering Meadows	7/16/15	589,693	71,746	50 Years	0%	3.66%	129,408	-	-
2015.010	Holly Div IV	7/23/15	225,072	27,384	50 Years	0%	3.66%	49,392	-	-
2015.011	Maple Rock	9/29/15	433,888	52,790	50 Years	0%	3.66%	95,217	-	-
	Plant City LS								-	
1971.002	Lift Station City 1	12/31/71	69,362	69,362	50 Years	0%	5.47%	37,970	-	-
1971.003	Lift Station City 2	12/31/71	61,524	61,524	50 Years	0%	5.47%	33,679	-	-
1971.004	Lift Station City 3	12/31/71	55,908	55,908	50 Years	0%	5.47%	30,605	-	-
1978.002	Lift Station City 4	12/31/78	115,299	99,350	50 Years	0%	6.02%	69,458	-	-
1992.003	Lift Station City 6	12/31/92	197,084	114,637	50 Years	0%	6.44%	126,955	-	-
1993.003	Lift Station City 5	12/31/93	207,192	116,373	50 Years	0%	5.60%	115,976	-	-
1999.022	Lift Station City 9	12/31/99	314,956	139,106	50 Years	0%	5.43%	170,942	-	-
2000.001	City Lift Station Force Main	6/30/00	2,950	1,243	50 Years	0%	5.71%	1,684	-	-
2000.019	Lift Station City 8	12/31/00	657,681	277,322	50 Years	100%	5.71%	375,481	657,681	375,481
2007.029	LS City 1 Auxliary Generator	7/3/07	2,799	2,799	7 Years	100%	4.40%	1,231	2,799	1,231
2007.032	LS City 2 Auxliary Generator	10/22/07	22,810	22,810	7 Years	100%	4.40%	10,027	22,810	10,027
2011.003	City LS 8 Generator	11/1/11	11,239	11,239	10 Years	100%	4.51%	5,069	11,239	5,069
	Equipment								-	
1996.001	FEMA Repair	7/5/96	43,506	21,826	50 Years	100%	5.76%	25,049	43,506	25,049
1999.016	Mitsubishi Flatbed W/Hoist	6/30/99	39,903	39,903	7 Years	100%	5.43%	21,657	39,903	21,657
2000.016	2000 Dodge Dakota Pickup	6/30/00	21,617	21,617	7 Years	100%	5.71%	12,341	21,617	12,341
2005.014	Generator Upgrade	6/30/05	28,725	28,725	7 Years	100%	4.40%	12,632	28,725	12,632
2007.012	2007 Dodge Dakota	3/19/07	26,349	26,349	7 Years	100%	4.40%	11,583	26,349	11,583
2009.002	2009 Chevrolet Colorado Truck	4/30/09	23,237	23,237	7 Years	100%	4.62%	10,737	23,237	10,737
2012.079	NP-Headworks-Mechanical Equipment	12/31/12	1,363,257	825,528	15 Years	100%	3.73%	457,543	1,363,257	457,543
2012.08	NP-Primary Clarifiers-Mechanical Equipment	12/31/12	1,232,942	746,615	15 Years	100%	3.73%	413,806	1,232,942	413,806
2012.081	NP-Primary Effluent Screening Bldg-Mechanical Equipment	12/31/12	1,582,190	958,104	15 Years	100%	3.73%	531,023	1,582,190	531,023
2012.082	NP-Aeration Basins-Mechanical Equipment	12/31/12	796,201	482,144	15 Years	100%	3.73%	267,225	796,201	267,225
2012.083	NP-Equipment Bldg-Mechanical Equipment	12/31/12	15,201,081	9,205,099	15 Years	100%	3.73%	5,101,863	15,201,081	5,101,863
2012.084	NP-Pipe Gallery-Mechanical Equipment	12/31/12	171,336	103,754	15 Years	100%	3.73%	57,505	171,336	57,505
2012.085	NP-Gravity Thickener-Mechanical Equipment	12/31/12	259,934	157,405	15 Years	100%	3.73%	87,240	259,934	87,240
2012.086	NP-Digester-Mechanical Equipment	12/31/12	4,287,165	2,596,116	15 Years	100%	3.73%	1,438,880	4,287,165	1,438,880
2012.087	NP-Admin Bldg-Mechanical Equipment	12/31/12	639,520	387,265	15 Years	100%	3.73%	214,639	639,520	214,639
2012.088	NP-Generator Bldg-Mechanical Equipment	12/31/12	321,792	194,863	15 Years	100%	3.73%	108,001	321,792	108,001
2013.006	Toyota Forklift	10/28/13	24,008	18,864	7 Years	100%	4.27%	8,203	24,008	8,203
2013.007	ER Portal Software	12/31/13	10,225	10,225	5 Years	100%	4.27%	3,494	10,225	3,494
2014.001	2014 Dodge Ram Promaster	6/16/14	33,085	33,085	7 Years	100%	4.23%	9,802	33,085	9,802

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
Plant

				2021					Used for GFC Calculation	
Asset Number	Description	Date	Original Cost	Accumulated Depreciation	Useful Life	Utility Funded Portion	Interest Rate	Calculated Interest	Utility-Funded Plant	Allocable Interest
2015.001	2014 Envirosight Camera Van	11/24/15	203,130	176,529	7 Years	100%	3.66%	44,577	203,130	44,577
2015.002	GIS Program with Mobile App	12/31/15	85,747	49,752	10 Years	100%	3.66%	18,817	85,747	18,817
2015.004	Membrane Gate	1/22/15	20,608	6,269	20 Years	100%	3.66%	4,522	20,608	4,522
2015.007	Grit Classifier	10/31/15	109,855	33,414	20 Years	100%	3.66%	24,108	109,855	24,108
2016.002	2014 Camera Van Computer System	1/13/16	22,615	22,615	5 Years	100%	3.25%	3,673	22,615	3,673
2016.003	Real Time Alarm System	5/16/16	18,203	9,253	10 Years	100%	3.25%	2,956	18,203	2,956
2016.004	2017 Aquatech Vactor Truck	12/5/16	366,623	124,244	15 Years	100%	3.25%	59,546	366,623	59,546
2016.005	Vactor Truck Nozzels & Cutters	12/14/06	9,970	9,970	5 Years	100%	4.40%	4,388	9,970	4,388
2017.006	SCADA System	3/30/17	53,688	21,923	10 Years	100%	3.67%	7,873	53,688	7,873
2017.007	2017 Outback	5/18/17	26,611	10,866	10 Years	100%	3.67%	3,903	26,611	3,903
2017.008	LEAP System	8/25/17	321,742	131,378	10 Years	100%	3.67%	47,184	321,742	47,184
2017.009	Caselle Project Mgmt Software	12/12/17	13,250	10,821	5 Years	100%	3.67%	1,943	13,250	1,943
2018.013	Admin Server	9/30/18	14,779	6,509	7 Years	100%	3.96%	1,754	14,779	1,754
2007.005	CITY AUXILIARY GENERATOR	1/16/07	7,717	7,717	7 Years	100%	4.40%	3,392	7,717	3,392
2008.012	CITY AUX GENERATOR UPGRADE	6/30/08	63,480	63,480	10 Years	100%	4.86%	30,856	63,480	30,856
2019.005	2019 Chevrolet Express 3500 Cube Van	4/30/19	43,841	13,048	7 Years	100%	3.42%	2,998	43,841	2,998
2019.006	2019 Ford F550 Service Truck	5/1/19	138,688	28,894	7 Years	100%	3.42%	9,483	138,688	9,483
2019.013	2019 Hyundai Sonata Hybrid Silver	9/12/19	24,944	8,661	7 Years	100%	3.42%	1,706	24,944	1,706
2019.014	2019 Hyundai Sonata Hybrid Gray	9/12/19	25,429	8,830	7 Years	100%	3.42%	1,739	25,429	1,739
2019.017	TP 2019 Mixing Study	12/31/19	34,638	14,433	7 Years	100%	3.42%	2,368	34,638	2,368
2019.018	TP Biofilter Media	12/31/19	48,959	17,000	7 Years	100%	3.42%	3,348	48,959	3,348
2019.019	2019 Dell Servers	12/31/19	78,560	27,278	5 Years	100%	3.42%	5,372	78,560	5,372
2020.017	GIS Maintenance	12/31/20	6,583	1,426	10 Years	100%	2.32%	153	6,583	153
2020.018	Cityworks	12/31/20	165,848	35,934	20 Years	100%	2.32%	3,854	165,848	3,854
2020.019	2020 Ford Ranger	12/31/20	38,467	5,209	7 Years	100%	2.32%	894	38,467	894
2020.020	2020 Ford Ranger	12/31/20	38,801	5,254	7 Years	100%	2.32%	902	38,801	902
	Equipment City								-	
2006.002	85 KW HOBBS DIESEL GENERATOR	1/1/06	25,000	25,000	7 Years	0%	4.40%	11,002	-	-
2006.004	2001 GORMAN-RUPP PUMP	1/1/06	66,300	66,300	7 Years	0%	4.40%	29,178	-	-
[Extra]	[Extra]								-	
[Extra]	[Extra]								-	
	Total		**$ 230,823,531**	**$ 74,223,532**				**$ 86,315,079**	**$ 171,430,592**	**$ 63,301,411**

Asset Number	Construction Work in Progress	Original Cost	Utility Funded Portion	Function	Utility Funded Plants
	As of 12/31/2020				
10700	24th St & SR9 Sewer Crossing	$ 86,465	100%	Conveyance	$ 86,465
10700	Vactor/Decant Facility	816,052	100%	Conveyance	816,052
10700	LS 1C Electrical Update	1,356	100%	Conveyance	1,356
10700	LS 1C Design & CM	15,842	100%	Conveyance	15,842
10700	LS 2C Design & CM	37,932	100%	Conveyance	37,932
10700	LS 2C Force Main & CM	74,057	100%	Conveyance	74,057
10700	Main & 18th St Improvements/20th St NE Business Loop Design & CM	45,125	100%	Conveyance	45,125
10700	LS 4C & 6C Predesign	19,725	100%	Conveyance	19,725
10700	Lift Station 22 Odor Control	13,573	100%	Conveyance	13,573
10700	SR204 SR9 Intersection	3,288	100%	Conveyance	3,288
10711	City of Lake Stevens Downtown Plan - Pre Design of LS 2C	26,773	100%	Conveyance	26,773
10712	Vehicles	-	100%	General	-
10721	2022 Comp Plan	17,637	100%	General	17,637
	Total	**$ 1,157,826**			**$ 1,157,826**

Actual Spent to date 12/31/2020

Lake Stevens Sewer District
Sewer Comprehensive Plan Update
General Facilities Charge

Existing System	Total	Notes
Capital Assets	$ 230,823,531	
less: Donated Plant	(59,392,939)	
plus: Construction Work In Progress	1,157,826	
less: Provision for the Retirement of Existing Assets	(11,884,093)	
plus: Interest Accrued on Utility Funded Assets	63,301,411	
less: Grant Funding	-	
less: ULID Assessments	(18,664)	
less: Latecomer Payments	(2,031,518)	
less: Net Outstanding Debt Principal	(42,624,046)	
TOTAL EXISTING SYSTEM AVAILABLE CAPACITY COSTS	**$ 179,331,509**	
[a] Net Outstanding Debt Principal Calculation:		
Outstanding Debt Principal as of Year-End 2020	$ 67,814,457	
less: Cash Balances as of Year-End 2020	(25,190,411)	
Net Outstanding Debt Principal	$ 42,624,046	

Future System	Total	Notes
Total Utility-Funded Capital Improvement Program (2021 Dollars)	$ 67,647,324	
less: Non-Capitalizable Utility-Funded Projects	(892,804)	
TOTAL FUTURE SYSTEM CAPACITY COSTS	**$ 66,754,520**	

System Capacity	Total	Notes
Design Capacity	4.94 mgd	Maximum month flow in 2041
Probable Existing Utilization	3.79 mgd	Current maximum month flow
Percent of Capacity Available for Growth	30.34%	
Existing ERUs as of Mid-Year 2021	13,794	
Additional ERUs Capacity	4,186	
FUTURE AVAILABLE CAPACITY	**17,980**	

General Facilities Charge (GFC)	Total	Notes
Existing System Portion		
Existing System Costs	$ 179,331,509	
Total ERUs	17,980	
Existing System GFC Per ERU	**$ 9,974**	
Future System Portion		
Future System Costs Allocable to All Customers	$ 66,754,520	
Total ERUs	17,980	
Total Future System GFC Per ERU	**$ 3,713**	
TOTAL GFC PER UNIT	**$ 13,687**	
Existing GFC	$ 10,400	
Difference	*3,287*	

APPENDIX O

DRAFT REVIEW COMMENTS

LAKE STEVENS SEWER DISTRICT
2022 GENERAL SEWER/WASTEWATER FACILITY PLAN

The following summarizes the comments were received and corresponding responses or revisions for the 2022 General Sewer/Wastewater Facility Plan (Plan) dated July 2022.

The City of Lake Stevens provided no comments on the Plan.

FORMAT:
<u>Comment numbered</u>
SC#: Snohomish County comments
EC#: Department of Ecology comments

Italicized text: Response to comment, immediately following the comment.

SNOHOMISH COUNTY

SC1: The land use designations in the unincorporated areas are consistent with the county comp plan. However, the land use map in the sewer plan (Fig. 3-8 Land Use, pg. 3-9) does not match the city's plan in the SE portion of the city. Based on the map legend, it appears that county land use designations have been applied within the city boundary. The county designation is Urban Low Density Residential (6 units/acre) while the city plan shows Waterfront Residential and Medium Density Residential (4-12 units/acre) in the same area. Most of this same area is shown to be largely without side sewer. Using the County's designation instead of the City's may underestimate future re-development potential and future sewer service facility needs.

The land use designations shown in Table 3-8 are those in place when the Plan was prepared, prior to finalization of the City's Southeast Annexation. The densities assumed for future development are reflective of those for similar areas within the Lake Stevens Urban Growth Area (LSUGA)

SC2: Table 3-3 (pg. 3-7) does not accurately depict county land use areas. This table below shows the county designations and corresponding zoning within unincorporated portions of the Lake Stevens Urban Growth Area and rural/resource areas within the district. Text says data available as of March 2021, date on map says 2020.

County Zoning	County Designations
Business Park (BP)	Public Institutional, Urban Industrial
R-20,000	Urban Low Density Residential
R-7,200	Urban Low Density Residential
PRD-7,200	Rural Residential
R-5	Rural Residential
A-10	Riverway Commercial Agriculture

The areas within each land use listed in Table 3-3 are those in place when the Plan was prepared. Zoning designations were not used in the Plan. It should be noted that there are no rural or agricultural land use designations within the LSUGA.

SC3: At the bottom of page 1-6, regarding the 2020 Snohomish County Growth Monitoring Report, it says: "This report indicates that the average annual growth rate for the LSUGA between 2000 and 2010 was 16 percent and that that rate between 2010 and 2020 was 2 percent." It looks like this information is from page 4 of the 2020 GMR (https://snohomishcountywa.gov/DocumentCenter/View/77947/2020_GMR_Final_SCT-SC_Dec-2-2020_final), which, however, reports population change for cities (not UGAs), and includes population gains attributable to annexations over time. If the intent is to describe population growth over time in the entire Lake Stevens UGA, then page 25 of the 2020 GMR shows that the UGA population increased from 25,096 in 2000 to 32,896 in 2010 – an average annual increase of 2.7%, followed by a further increase to 39,629 by 2020 – an average annual increase of 1.9% since 2010.

The text on Page 1-6 has been revised to reflect the published LSUGA populations and growth rates.

SC4: On page 3-8, the first paragraph says: "The Washington State Office of Financial Management (OFM) provided a history of population for Lake Stevens from 2010 to 2020, as shown in Table 3-4. The UGA's population has grown by 6,081 people during that 10-year period." The second sentence should refer to the City's population, rather than the UGA's population. Since Table 3-4 includes city population gains attributable to annexations over the decade, the sentence "As such, they do not account for growth due to annexations to the City," which follows the table, appears to be incorrect.

The referenced sentence on Page 3-8 has been revised to, "As such, they do not correct for growth due solely to annexations to the City and do not directly correspond to grown in connections to the District's sewer system.

DEPARTMENT OF ECOLOGY

General

EC1: Table E-9 - Under the column of estimated year of completion, please recheck for those projects listed for 2022 if the information needs to be updated.

The Table has been updated to identify projects that have been recently completed.

EC2: Page 1-2, 2nd paragraph - "A State Environmental Policy Act (SEPA) checklist is provided in Appendix A." Please also include SEPA determination.

The Determination of Non-Significance has been included in Appendix A.

EC3: Page 2-23, Table 2-14: Per WAC 173-219, there are no Class C and Class D reclaimed water. This table includes out-of-date information. Please revise this.

Table 14 has been updated to remove references to Classes C and D reclaimed water.

EC4: Page 2-28 - 2nd paragraph: "Waters of the Snohomish River Estuary support a variety of fish and wildlife species, including the following eight that are currently listed as …" What does the word, "eight" means in this sentence? Was it a typo?

The typo was corrected.

EC5: Page 2-29 - '"Ecology issues permits for wastewater treatment facilities and land application of wastewater under WAC 246-271." It's an incorrect citation. Please update this.

The incorrect citation has been removed.

EC6: Page 2-29 - '"This State regulation defines a facility plan as an engineering report under federal regulations, 40 CFR Part 35." It's an incorrect citation. Please update this.

The incorrect citation has been removed.

EC7: Page 2-36 - The information presented in Table 2-19 was from the current Permit Fact Sheet. The current permit was issued on 10/6/17. It should be noted that on January 23, 2019, Ecology adopted amendments to Chapter 173-201A WAC Water Quality Standards for Surface Waters of the State of Washington (Rule Effective February 23, 2019). Please refer to WAC 173-201A-200 fresh water designated uses and criteria. For primary contact recreation, the bacterial indicator is E. coli. for freshwaters.

The information in Table 2-19 has been updated.

EC8: Page 2-39 - Please include a statement regarding compliance with SEPA in the final report when you complete the SEPA documentation and determination.

A reference has been added to the Determination of Non-Significance that has been included in Appendix A.

EC9: Page 6-7 - The page number was shown as "4-7". It should be "6-7".

The page number has been corrected.

EC10: Figure 7-1 - The facility name was shown as "DARWIN C. SMITH WASTEATER TREATMENT PLANT". It's incorrect. Please update this.

The figure has been updated.

EC11: Page 7-13 - "WEF Design of Wastewater Treatment Plants, Manual of Practice No. 8 (2010)". The latest version is 2018 6th Edition.

The reference has been updated.

EC12: Pages 7-64 through 7-66 - Per WAC 173-201A-200, the bacterial indicator of primary contact recreation is E. coli. for freshwaters. Please include discussions how the UV disinfection system and performance with bacteria criteria would be within the planning period.

Discussion about the bacteria criteria has been included.

EC13: Table 9-1: Under the column of estimated year of completion, please recheck for those projects listed for 2022 if the information needs to be updated.

The Table has been updated to identify projects that have been recently completed.

EC14: Appendix A, Please also include the SEPA determination document.

The Determination of Non-Significance has been included in Appendix A.