KITSAP COUNTY

SUQUAMISH GENERAL SEWER PLAN UPDATE

January 2025

PREPARED BY:

Consor
Point of Contact: Erika Schuyler, PE
600 University Street, Suite 300
Seattle, WA 98101
p: 206.462.7030
e: erika.schuyler@consoreng.com

PREPARED FOR:

Kitsap County
Sewer Utility Division of Public Works Department
507 Austin Avenue
Port Orchard, WA 98366

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ECOLOGY DRAFT

Consor

600 University Street
Suite 300
Seattle, WA 98101

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Acronyms & Abbreviations

A	
AAF	Average annual flow
AACE	American Association of Cost Engineers
ADA	Americans with Disabilities Act
AGS	Aerobic Granular Sludge
AKART	all known and reasonable treatment
ANSI	American National Standards Institute
ASIL	Acceptable Source Impact Levels
ASST	Aerated Sludge Storage Tank
ATS	Automatic Transfer Switch
B	
BOD	Biochemical oxygen demand
C	
CBOD	Carbonaceous biochemical oxygen demand
CCTV	Closed circuit television
CFR	Code of Federal Regulations
CIP	Capital improvement plan/program
CMMS	Computerized maintenance management system
CMOM	Capacity Management Operations and Maintenance
CMU	Concrete masonry unit
COD	Chemical Oxygen Demand
CoF	Consequence of failure
County	Kitsap County
CPU	Central processing unit
CWA	Clean Water Act
D	
DCD	Department of Community Develop
DHI	Danish Hydraulic Institute
DMR	Discharge Monitoring Report
DO	Dissolved oxygen
DOH	Washington State Department of Health
E	
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
F	
FOG	Fats, Oils, and Grease
fps	feet per second

FRP	Fiber Reinforced Polymer/Plastic
FTE	Full-Time Equivalent
G	
GIS	Geographic Information Systems
GMA	Growth Management Act
gpcpd	Gallons per Capita Per Day
gpd	gallons per day
gpm	gallons per minute
H	
H/H	Hydraulic and hydrologic
HDPE	High-Density Polyethylene
HP	Horsepower
HPA	Hydraulic Project Approval
HVAC	Heating, ventilation, and air conditioning
I	
I&I	Infiltration and inflow
I/O	Input/output
IBC	International Building Code
IFC	International Fire Code
IMC	International Machine Code
IPS	Individual Pump Stations
K	
KCCP	Kitsap County Comprehensive Plan
KPUD	Kitsap Public Utility District
kV	Kilovolt
kVA	Kilovolt amperes
kW	kilowatt
L	
LAMIRD	Limited Area of More Intense Rural Development
LEL	Lower Explosive Limit
LUV	Land Use Vision
M	
MCC	Motor control center
MDP	Main Distribution Panel
mg/L	Milligrams per liter
MGD	million gallons per day
MLLW	Mean lower low water
MMDWF	Maximum month dry weather flow
MMWWF	Maximum month wet weather flow
N	
NASSCO	National Association of Sewer Service Companies
NEC	National Electrical Code

NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NOC	Notice of Construction
NPDES	National Pollutant Discharge Elimination System
O	
O&M	operation and maintenance
OCI	Overall Condition Index
OFM	Washington State Office of Financial Management
OIT	Operator interface terminal
OPPC	Opinion of probable project cost
Orange Book	Washington State Department of Ecology's Criteria for Sewage Works Design
ORP	Oxidation Reduction Potential
Ortho-P	Orthophosphate
P	
PDF	Peak day flow
PFAS	Per- and polyfluoroalkyl substances
PHF	Peak hour flow
Plan	General Sewer Plan Update
PLC	Programmable Logic Controller
POTW	Publicly Owned Treatment Works
ppcd	pounds per capita per day
ppd	pounds per day
PSCAA	Puget Sound Clean Air Agency
PSE	Puget Sound Energy
psi	pounds per square inch
PSNGP	Puget Sound Nutrient General Permit
PSRC	Puget Sound Regional Council
PVC	Polyvinyl Chloride
R	
RCW	Revised Code of Washington
RDT	Rotary Drum Thickener
S	
SBR	Sequencing batch reactor
SCADA	Supervisory Control and Data Acquisition
SCFM	standard cubic feet per minute
SEPA	State Environmetal Policy Act
SERP	Washington State Environmental Review Process
SF	Square foot
SHPO	State Historic Preservation Officer
SIU	Significant Industrial User
SOP	Standard Operating Procedure

SRT	Solids retention time
SSO	Sanitary Sewer Overflow
T	
TAZ	Traffic Analysis Zones
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
TSS	Total suspended solids
TSST	Thickened sludge storage tank
TWAS	Thickened waste activated sludge
U	
UBC	Uniform Building Code
UGA	Urban Growth Area
UOS	Unstable old landslides
UPC	Uniform Plumbing Code
UPS	Uninterruptible power supply
URS	Unstable recent slides
USACE	United States Army Corps of Engineers
Utility	Kitsap County Sewer Utility Division
UV	Ultraviolet
V	
VAC	Volts of alternating current
VFD	variable frequency drive
VHF	Very high frequency
VSS	Volatile suspended solids
W	
WAC	Washington Administrative Code
WAS	Waste activated sludge
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WWTP	Wastewater treatment plant

Executive Summary

ES.1 Introduction

Since the 1950s, Kitsap County (County) has worked to protect aquifers, surface water, and the Puget Sound by providing wastewater collection, treatment, and discharge. This Suquamish General Sewer Plan Update (Plan) provides a road map for the Suquamish service area's long-term wastewater infrastructure needs for the next 20 years. Planning the wastewater infrastructure needs of a dynamic and fast-growing region is challenging. Expanding populations in the County will require sewer service and the County will be responsible for appropriately collecting, conveying, and treating increasing wastewater flows. Infrastructure design and implementation will be strategically planned to maximize limited fiscal resources. Federal, State, and Local regulations all contribute to a need to be on the cutting edge of emerging technologies and require the utility to continually think ahead. Planning at this level involves weighing a complicated array of interconnected—and often conflicting—factors and variables. This Plan provides a framework for the County to continue to manage growth within the context of a countywide wastewater service network and achieve the overall goal of providing sewerage service to protect public health and the quality of Kitsap and the Puget Sound's water resources.

The State of Washington adopted the Growth Management Act (GMA) with the intent of creating a consistent and unified growth planning process. The GMA requires that the County create and enact a Comprehensive Plan to provide a 20-year blueprint for local policy, planning and capital facility investment. A Comprehensive Plan is used as a guide for local governments through the establishment of vision statements, goals, objectives, policies, and implementing actions. This Plan constitutes the sewer capital facilities element of the Kitsap County Comprehensive Plan (KCCP). At the time of adoption, this Plan is consistent with the other elements of the KCCP.

This Plan is based on planning horizons of a six-year period (2023 to 2028), and a 20-year period (2023 to 2042). An updated KCCP is currently in progress and will cover a 20-year planning period from 2024 to 2044. Therefore, the recommendations and conclusions presented in this Sewer Plan have been reviewed to confirm alignment with the 2044 planning horizon of the KCCP.

This Plan is also aligned with the County's *Water as a Resource* policy, adopted in 2009 and reaffirmed in 2016. One of the aims of *Water as a Resource* policy is to reduce water pollution. Implementation of the projects presented in this Plan are a direct expression of the County's guiding principle to view water as a valuable resource worthy of protection and careful stewardship.

This Plan meets the Washington State Department of Ecology (Ecology) regulations for general sewer plans contained in the Washington Administrative Code (WAC) 173-240-050.

Organization of the Plan

The Plan is organized into twelve sections that cover the Suquamish wastewater system:

- **Section 1: Introduction** provides an overview of the Suquamish service area, ownership of the system, and contents of the Plan.
- **Section 2: Service Area Characterization** reviews the physical and administrative characteristics of the Suquamish wastewater collection basin.

- **Section 3: Population, Flows, Load Projections** estimates the current sewer system population, analyzes the impact of projected population growth, and estimates future wastewater flows and loads within the Suquamish service area.
- **Section 4: Regulatory Requirements** identifies relevant federal, state, and local regulatory requirements that affect planning and operations of the wastewater system.
- **Section 5: Collection and Conveyance Existing Conditions** evaluates existing conditions of the system's gravity sewers, pump stations, and force mains based on site visits, video inspections of pipes, and discussion with County staff.
- **Section 6: Wastewater Treatment Plant Existing Conditions** evaluates existing conditions of the Suquamish Wastewater Treatment Plant (WWTP) facilities, processes, and equipment based on site visits, discussion with plant operators, historical plant performance, and modeling of the plant processes.
- **Section 7: Collection and Conveyance System Analysis** analyzes sewer system capacity and alternatives for improvements to the system using a hydraulic model and evaluating system performance during a 25-year, 24-hour storm event.
- **Section 8: Wastewater Treatment System Analysis** analyzes improvements needed to maintain and upgrade the Suquamish WWTP based on condition deficiencies, capacity inadequacies, and regulatory requirements.
- **Section 9: Recycled Water** evaluates opportunities for recycled water reuse so that water treated at the Suquamish WWTP can be used for beneficial purposes instead of discharged to the Puget Sound.
- **Section 10: Operations and Maintenance** documents the County's management structure, details the wastewater system operations and maintenance (O&M) practices, and makes suggestions to improve utility operation practices.
- **Section 11: Capital Improvement Plan** provides a 20-year plan for implementing capital improvement program (CIP) projects that improve the operation of the collection and conveyance system and Suquamish WWTP.
- **Section 12: Financial Strategy** identifies financial approaches to fund the CIP.

General Sewer Plan Requirements

This Plan meets the Ecology regulations for general sewer plans contained in WAC 173-240-050.

Table ES-1 summarizes the requirements and the sections in the 2024 CSP where the requirements are addressed.

Table ES-1 | WAC 173-240-050 Requirements

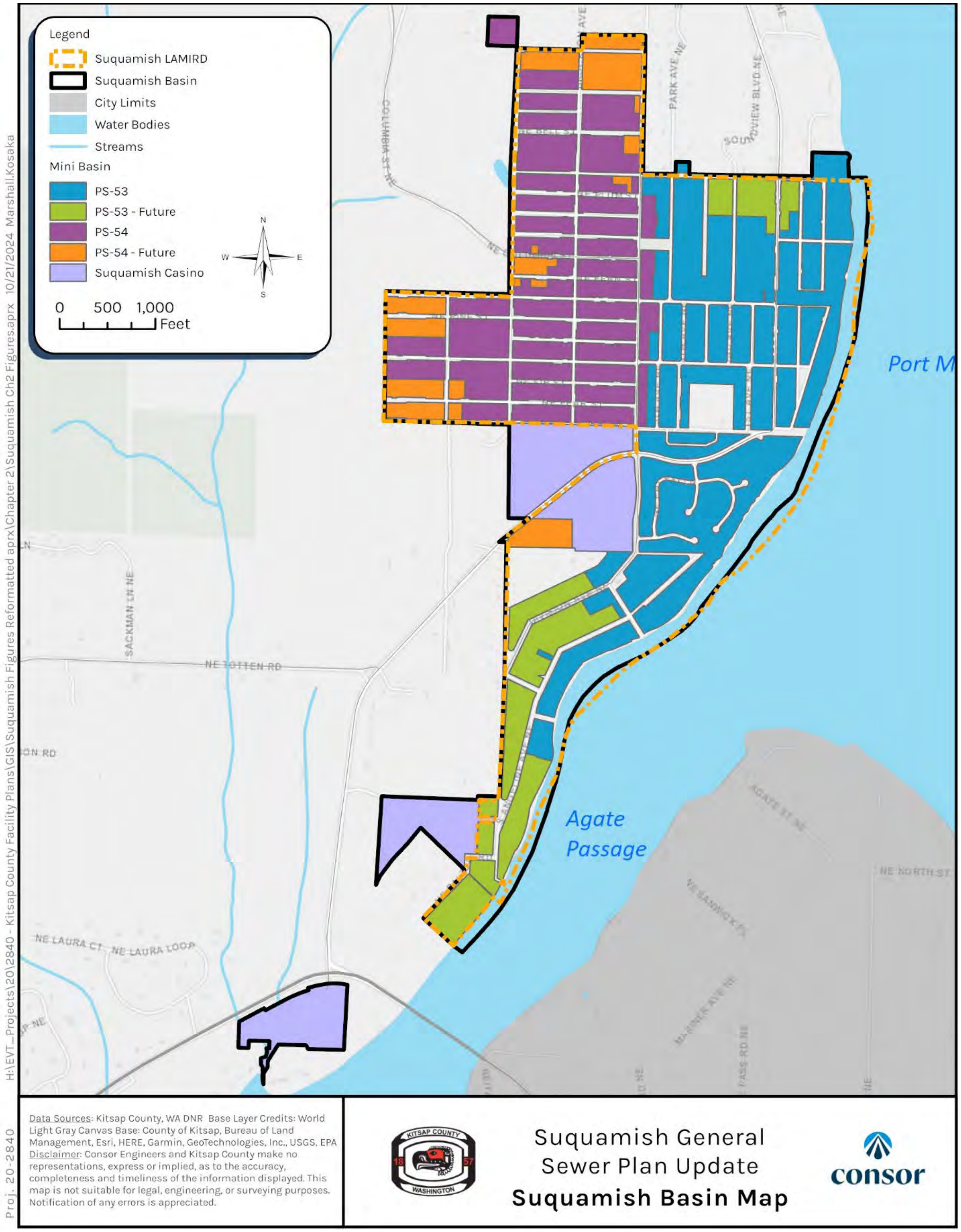
Section	Section Description	Location in Plan
3.a	The purpose and need for the proposed plan.	Section 1.2
3.b	A discussion of who will own, operate, and maintain the systems.	Section 1.5
3.c	The existing and proposed service boundaries.	Figure 2-1

Section	Section Description	Location in Plan
3.d.i	Boundaries. The boundary lines of the municipality or special district to be sewered, including a vicinity map;	Figure 2-1
3.d.ii	Existing sewers. The location, size, slope, capacity, direction of flow of all existing trunk sewers, and the boundaries of the areas served by each;	Section 5 and Section 6
3.d.iii	Proposed sewers. The location, size, slope, capacity, direction of flow of all proposed trunk sewers, and the boundaries of the areas to be served by each;	Section 11
3.d.iv	Existing and proposed pump stations and force mains. The location of all existing and proposed pumping stations and force mains, designated to distinguish between those existing and proposed;	Section 5, Section 11
3.d.v	Topography and elevations. Topography showing pertinent ground elevations and surface drainage must be included, as well as proposed and existing streets;	Figure 2-2
3.d.vi	Streams, lakes, and other bodies of water. The location and direction of flow of major streams, the high and low elevations of water surfaces at sewer outlets, and controlled overflows, if any. All existing and potential discharge locations should be noted;	Figure 2-4
3.d.vii	Water systems. The location of wells or other sources of water supply, water storage reservoirs and treatment plants, and water transmission facilities.	Figure 2-5
3.e	The population trend as indicated by available records, and the estimated future population for the stated design period. Briefly describe the method used to determine future population trends and the concurrence of any applicable local or regional planning agencies.	Section 3
3.f	Any existing domestic or industrial wastewater facilities within twenty miles of the general plan area and within the same topographical drainage basin containing the general plan area.	Figure 1-1
3.g	A discussion of any infiltration and inflow problems and a discussion of actions that will alleviate these problems in the future.	Section 3.4.3
3.h	A statement regarding provisions for treatment and discussion of the adequacy of the treatment.	Section 6
3.i	List of all establishments producing industrial wastewater, the quantity of wastewater and periods of production, and the character of the industrial wastewater insofar as it may affect the sewer system or treatment plant. Consideration must be given to future industrial expansion.	Section 4
3.j	Discussion of the location of all existing private and public wells, or other sources of water supply, and distribution structures as they are related to both existing and proposed domestic wastewater treatment facilities.	Figure 2-5
3.k	Discussion of the various alternatives evaluated, and a determination of the alternative chosen, if applicable.	Section 7 and Section 8
3.l	A discussion, including a table, that shows the cost per service in terms of both debt service and O&M costs, of all facilities (existing and proposed) during the planning period.	Section 10, Section 11, and Section 12
3.m	A statement regarding compliance with any adopted water quality management plan under the Federal Water Pollution Control Act as amended.	Section 4
3.n	A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act, if applicable.	Section 4

ES.2 Service Area Characterization

The County provides sewer service within the Suquamish basin. The Suquamish basin map is shown in **Figure ES-1**. The basin is approximately 470 acres. It is bounded on the east and south by Port Madison Bay and the Agate Passage and extends inland several blocks to encompass a few neighborhood developments.

Figure ES-1 | Suquamish Basin Map



The County has established Urban Growth Area (UGA) boundaries, land use designations, and zoning in accordance with the GMA. Urban level services, including sewer service, is not allowed outside of the UGA with limited exceptions, one of which is within a Limited Area of More Intensive Rural Development (LAMIRD). In these areas, sewers are allowed for the development of necessary public facilities and public services. Suquamish is recognized as a Type 1 LAMIRD.

The County owns and maintains the sewer collection system that provides service primarily to the northern portion of the LAMIRD with a small portion of the system served in the southern portion. The Suquamish Clearwater Casino Resort also pumps wastewater flows to Suquamish collection system. The system includes approximately 55,000 feet of gravity pipe, 9,400 feet of force main pipe, and two pump stations and the Suquamish WWTP. All sewer flows within the basin are conveyed and treated at the Suquamish WWTP.

ES.3 Population, Load, and Flow Projections

Current population and population growth are critical factors when considering required capacity and potential upgrades to the sewer system since sewer flows and population are closely linked.

The current sewered population in the Suquamish basin was estimated based on an average of 2.5 people per equivalent residential unit (ERU). An ERU is a system specific unit of measure used to estimate wastewater volumes in the system based on the flow produced by an average single-family household.

Growth is presumed to occur within the LAMIRD according to the land use designations and zoning in the 2016 KCCP. This plan, at the time of writing, is in alignment with the County's 2024 KCCP effort and is able to support the growth strategies described therein. The sewered population growth rate is estimated to be 0.63 percent based on the Puget Sound Regional Council (PSRC) and Washington State Office of Financial Management (OFM) information. The total current and projected populations for the sewered areas in Suquamish basin are summarized in **Table ES-2**. Additionally, the Kitsap County Department of Community Development (DCD) prepared population projections as part of their update to the KCCP. These were compared to and are consistent with the projections presented in this Plan

Table ES-2 | Suquamish Basin Current and Projected Sewered Population

Year	Sewered Population
2020	2,663
2028	2,814
2042	3,081
2044	3,102*

Note:
*Extrapolated from 2042 population, included for comparison to 2024 KCCP

Wastewater flows and loadings heavily influence WWTP facility design. Consequently, data related to wastewater characteristics and projected flows and loadings affect the selection of key criteria used to select project alternatives for further consideration. The existing flows and loads at Suquamish WWTP were evaluated from January 2018 through June 2020 and correlated to current population to develop per capita values. The existing and projected flows and loads for the Suquamish WWTP over the 20-year planning horizon are presented as **Table ES-3** and **Table ES-4**. Consistent with Ecology guidelines, flows are developed for average annual flow (AAF), maximum month wet weather flow (MMWWF), maximum month dry weather flow (MMDWF), peak day flow (PDF), and peak hour flow (PHF). Loads are developed for biological oxygen demand (BOD), total suspended solids (TSS), and total Kjeldahl nitrogen (TKN).

Table ES-3 | Suquamish WWTP Current and Projected Flows

Flow Event	2020	2028	2042
AAF (MGD)	0.23	0.24	0.26
MMWWF (MGD)	0.45	0.47	0.50
MMDWF (MGD)	0.30	0.31	0.33
PDF (MGD)	0.69	0.72	0.77
PHF (MGD)	0.97	1.00	1.07

Note:
MGD = million gallons per day

Table ES-4 | Suquamish WWTP Current and Projected Loads

Parameter	2020			2028			2042		
	AA	MMWW	MMDW	AA	MMWW	MMDW	AA	MMWW	MMDW
BOD (ppd)	445	604	528	470	638	558	514	699	611
TSS (ppd)	457	733	602	483	775	637	529	849	697
TKN (ppd)	81.3	109	112	85.9	115	119	94.1	126	130

Note:
ppd = pounds per day

ES.4 Regulatory Requirements

Collection, conveyance, and treatment facilities operation, design, and construction are regulated through federal, state, County, and local regulations. The regulations are detailed in **Section 4**.

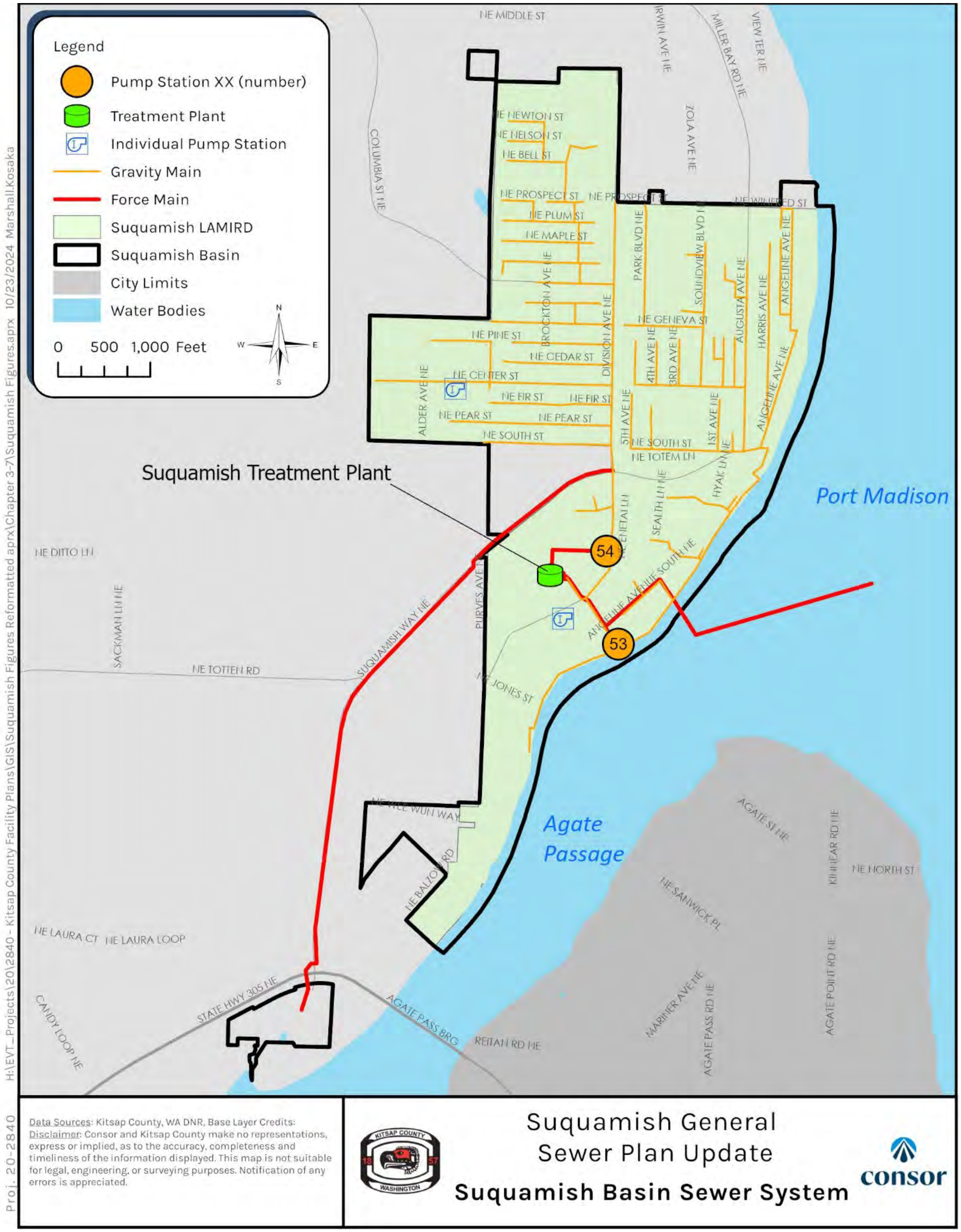
The National Pollutant Discharge Elimination System (NPDES) program, administered by the United States Environmental Protection Agency (EPA), is the primary permit for Suquamish WWTP, which has been issued NPDES Permit No. WA0023256. The permit went into effect in 2008, was set to expire in 2013, was administratively continued, and remains in effect as of the date of this Plan. The permit includes limits on plant capacity and treated effluent discharge, solids disposal requirements, monitoring requirements, recordkeeping and reporting criteria, and O&M requirements.

The EPA issued a draft permit in September of 2019 and re-issued a new draft in May 2024 with new and revised conditions. The re-proposed draft includes amendments and conditions from Ecology related to monitoring total inorganic nitrogen (TIN), planning for optimization of TIN removal, monitoring of per- and polyfluoroalkyl substances (PFAS) and monitoring enterococci bacteria. The re-proposed draft permit has not been finalized at the time of writing.

ES.5 Collection and Conveyance Existing Conditions

The Suquamish collection and conveyance system is comprised of sewer assets owned by the County within the Suquamish LAMIRD. The Suquamish collection and conveyance system is shown in **Figure ES-2.** A detailed review of the existing collection and conveyance system is provided in **Section 5**.

Figure ES-2 | Suquamish Basin Sewer System



Flows from the western portion of the Suquamish basin generally flow by gravity to PS-54 and flows from the eastern portion of the Suquamish basin generally flow by gravity to PS-53. The Suquamish Casino pumps wastewater, via a privately owned pump station and force main, to a gravity main within the Suquamish collection which is tributary to PS-54. Flows from PS-53 and PS-54 are then pumped to the Suquamish WWTP.

There is approximately 55,000 feet of gravity main in the Suquamish collection system. County owns most of the pipes, 87 percent of which are 8 inches in diameter. Approximately 2,000 feet of pipe are privately owned. There are approximately 9,400 feet of sewer force mains that convey pumped wastewater.

There are two pump stations within the Suquamish sewer system: PS-54 and PS-53. PS-54 has a firm capacity of 350 gallons per minute (gpm) and PS-53 has a firm capacity of 360 gpm. The County classifies their pump stations as Critical, Regional, Relay, or Satellite pump stations based on how many mini-basins (or upstream pump stations) discharge into the pump station. **Table ES-5** shows the classification and number of pump stations in the Suquamish basin.

Table ES-5 | Pump Station Type Consequence of Failure Definitions

Pump Station Type (from County)	Tributary Pump Stations	Number of Pump Stations in Suquamish Basin
Satellite	0	1
Relay	1	1
Regional	2-3	0
Critical	4+	0

The condition of each pump station was evaluated. To better inform the County's prioritization of future asset upgrades and replacements, an overall pump station "asset health" score was developed that synthesizes each pump station's existing likelihood of failure (condition) and consequence of failure (CoF). Each criterion is rated on a 1 to 5 scale where higher numbers indicate worse condition and high criticality, then the scores are multiplied together to get the overall Asset Health score (potential range from 1 to 25). PS-53 has an asset health score of 7 and PS-54 has a score of 7.4. This score is only indicative of the PS condition but does not factor in capacity, which is covered in **Section 7**.

The County has historically conducted pipeline condition assessments through video observation with the ability to examine the entire conveyance system in a 5-year cycle. This process entails inspecting pipes via closed circuit television (CCTV), storing the video in a database, reviewing the video, and assigning an Overall Condition Index (OCI) score based on the observations. The OCI score ranges from 0 to 100 with higher numbers indicating better condition.

The criteria that are scored for the OCI score are:

- Obstruction or Intrusion
- Worn surface
- Belly or sag in pipe
- Crack or fracture
- Break or failure
- Lining or repair failure
- Joint separation or offset

The lengths of pipe in each OCI range are summarized in **Table ES-6**. Overall, the system is in good condition, but one pipe is in poor condition with a score of 51.

Table ES-6 | Summary of Pipes OCI Scores

OCI Range	Length (ft)	Percentage of Total
0-20	-	0%
20-40	-	0%
40-60	212	<1%
60-80	-	0%
80-99	9,400	17%
100	45,200	83%

ES.6 Wastewater Treatment Facilities Existing Conditions

The Suquamish WWTP was constructed as an activated sludge process in 1975 but was reconstructed as a Sequencing Batch Reactor (SBR) system in 1997. A rotary drum thickener (RDT) system, thickened sludge storage tank (TSST), and sludge loadout facility were constructed in 2017. The plant was designed for a maximum monthly flow rate of 0.4 MGD and a peak flow of 1.0 MGD. The Suquamish WWTP site plan is shown in **Figure ES-3** with major structures and processes identified. The plant is accessed via a driveway that is shared with a homeowner from Division Avenue NE. The 7.6 acre lot is bordered by residential properties on the east, south and west sides, and an undeveloped lot owned by the Suquamish Tribal Housing Authority to the north. The lot has frontage along Purves Avenue NE, but this portion of the site has not been developed and is heavily wooded.

Plant treatment processes include preliminary screening and grit removal, biological treatment in two SBRs, an equalization basin, and ultraviolet (UV) disinfection. Waste activated sludge (WAS) is thickened with an RDT, stored at in the TSST, and sent to the County's Central Kitsap WWTP for further treatment and disposal. Treated effluent is discharged to Port Madison of the Puget Sound in accordance with the NPDES Permit.

An evaluation of the Suquamish WWTP was conducted that consisted of a site review of equipment, facilities, processes, discussions with WWTP staff to understand operational issues, and analysis and modeling to determine capacity. Overall unit process "asset health" scores were developed, using the same method as the pump stations, to synthesize the likelihood of failure (condition) and CoF (criticality). Each criterion is rated on a 1 to 5 scale where higher numbers indicate worse condition and high criticality, then the scores are multiplied together to get the overall asset health score (potential range from 1 to 25). Secondary treatment, disinfection and effluent, and power distribution scored higher than 10, which indicates these systems are generally in poor condition and require upgrades and/or rehabilitation to continue effective and reliable operation. Preliminary treatment and solids treatment scored between 5 and 10, indicating moderate upgrades may be necessary. Civil and support systems are in good condition and scored below 5.

A Visual Hydraulics© model was created to determine the hydraulic capacity and a Biowin© biological process model was used to evaluate the biological capacity of the existing Suquamish WWTP and unit processes. Hydraulic deficiencies were noted in the headworks, which does not have sufficient capacity to handle the peak instantaneous flows from both pump stations once upgraded as recommended in **Section 7**, and in the SBR decant mechanism, which does not allow the basins to be decanted quickly enough under peak flow conditions. The biological capacity of the secondary treatment system has the ability to meet current treatment requirements and those in the 2024 draft permit but is unlikely to be able to meet more stringent TIN removal requirements that are expected to be implemented in the future.

Figure ES-3 | Existing Suquamish WWTP Site Plan

Several unit processes will need significant improvements within the 20-year planning period to alleviate hydraulic or biological limitations and continue proper operation:

- The headworks requires additional capacity and a fine screen configuration that meets Ecology redundancy requirements.
- The SBR basins require additional redundancy to meet Ecology requirements.
- Secondary treatment process upgrades will be needed to improve TIN removal when dictated by permit requirements.

ES.7 Collection and Conveyance System Analysis

The Suquamish collection system was modeled using the Danish Hydraulic Institute's (DHI's) MIKE+ hydraulic and hydrologic (H/H) modeling platform to determine capacity deficiencies in the system. The projected population and increased rainfall due to climate change are the basis for establishing future system requirements. The model was developed using geographic information system (GIS) shapefiles, provided by the County, for the collection system, land use, contours, and soils in the Suquamish basin. The model was calibrated to data from flow monitors installed in the collection system. The meters collected flow data from October 2020 through April of 2021. Results were analyzed for the existing, 2042, and 2080 planning horizons using a 25-year 12-hour design storm.

Manholes, pipes, and pump stations were analyzed for deficiencies using the H/H model. Manholes are considered to have sanitary sewer overflows (SSOs) when the simulated water surface elevation in a manhole exceeds the rim elevation. Pipes are considered surcharged when the simulated water surface elevation in the upstream or downstream manhole connection exceeds the pipe crown. Pump stations are under capacity when the simulated flow to a pump station meets or exceeds the pump station firm capacity which is the station capacity with the largest pump out of service.

The total SSO count, surcharged gravity pipes, and velocity exceeded pipes are included in **Table ES-7.** Detailed maps can be found in **Section 7**.

The results indicate that both PS-53 and PS-54 are under capacity for all planning horizons. Discussion with the County indicates that they do experience excessive flows at each of these stations.

Table ES-7 | Pipe and Manhole Capacity Criteria

Scenario	Surface Sewer Overflows (SSO)	Number of Pipes Surcharged (Either end)
2022	0	11
2042	0	20
2080	0	45

ES.8 Wastewater Treatment System Analysis

The results in **Section 6** were used to identify processes that require improvement and define feasible alternatives for WWTP improvements for the 6-year, 20-year, and 40-year planning horizons. Minor maintenance, repairs, and direct replacements were not subject to a full alternatives analysis due to the relatively simple nature of replacements or expansions.

In 2022, the County began a project to replace the process piping system, evaluate the influent screen for replacement, and rehabilitate the aerated sludge storage tank (ASST) and effluent equalization basin. During preliminary design of these elements several challenges were identified that ultimately caused the project to be put on hold. Several additional items of work were identified that would be required to bring the plant up to the National Fire Protection Association (NFPA) 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities, it was found that the existing influent channel would not accommodate a fine screen with sufficient capacity to meet future peak instantaneous flows from PS-53 and PS-54, and the cost of the plant bypass during construction was much higher than expected. The progress on the project and the challenges encountered are detailed in the *Suquamish WWTP Improvements Design-to-date Summary Memorandum* (Consor, 2024, **Appendix A**). As of this writing, the project has ended and the County is assessing options to secure funding to enable some or all of the improvements identified to be implemented in future project(s). Each of these upgrades are also included in the projects identified in **Section 11**.

Preliminary Treatment

The headworks do not have adequate capacity to pass the peak instantaneous flowrate once PS-53 and PS-54 are upgraded as described in **Section 7**. The existing influent rotary fine screen and grit pumps are in poor condition. Additionally, the fine screen configuration does not provide adequate redundancy in accordance with Ecology requirements. The SBR's also lack adequate redundancy, which can be provided by adding an influent equalization basin. The following improvements are recommended:

- Replacing the entire headworks with a new structure.
- Construct an influent equalization basin.

Secondary Treatment

The secondary treatment was installed in 1997 and is generally in fair condition with adequate capacity. The recirculation piping is in poor condition. There are only two SBR basins and no influent equalization storage, which presents operational challenges if one basin must be removed from service and does not meet Ecology's current redundancy requirements for SBR systems. Additionally, further capacity improvements will be required to accommodate future TIN removal requirements. The following improvements are recommended:

- Replacing existing recirculation piping and electrical actuators.
- Installs dissolved oxygen (DO) and ammonia probes to improve process control.
- If TIN limits become more restrictive in the future, convert the existing SBR system to an aerobic granular sludge (AGS) system.

Disinfection

The UV equipment was installed in 1997 and is nearing the end of its typical design life. Additional control and monitoring capabilities beyond what the current basic controller can offer is desired by the plant staff and will improve energy efficiency. The following improvements are recommended:

- Replace the existing UV system with the upgraded Trojan UV3000Plus system.

Solids Treatment

The ASST was constructed in 1975 and retrofitted in 1997. The tank is in poor condition. The sludge storage blower was installed in 1997 and appears to be in fair condition. The thickened sludge pump is showing significant corrosion despite being installed in 2017. The following improvements are recommended:

- Repair or replace the ASST.
- Replace thickened sludge pump with a larger pump.
- Replace the sludge storage blower in the next 12 to 15 years.

Odor Control & Plant Support Systems

The odor control chemical scrubber was installed in 1997 and is in poor condition. It is only partially operational, and frequently breaks down. The plant's fire alarm system and combustible gas detection system are not functioning and fire protection does not meet NFPA 820 requirements. The process building drain piping has corroded and leaks in some areas. The following improvements are recommended:

- Replace the existing chemical scrubber with an activated carbon scrubber.
- Replace the plant drain piping.
- Implement improvements to ventilation, fire alarms, combustible gas detection, and fire protection to meet NFPA 820.

ES.9 Recycled Water

Recycling treated wastewater can provide numerous benefits, including conservation of limited groundwater resources, reduction of effluent discharge to the Puget Sound, and replenishment of streams and fish habitat. Use of recycled water to replace the use of potable water for non-potable purposes, such as irrigation, toilet flushing, reduces the stress on area groundwater and supports sustainable management of that limited resource. The County has not previously identified or proposed any cost-effective applications of recycled water if it were to be produced by the Suquamish WWTP.

Use of recycled water for managed aquifer recharge was considered as part of a watershed planning effort facilitated by Ecology for Water Resource Inventory Area (WRIA) 15, as directed by the Streamflow Restoration Act (Revised Code of Washington (RCW) 90.94). The evaluation identifies geographic locations that appear promising for both shallow aquifer infiltration and enhancement of stream baseflows, which in turn may provide water to offset to consumptive impacts of new permit-exempt domestic groundwater withdrawals, however no locations in the near vicinity of the Suquamish WWTP were identified. The County also coordinated with water providers and other potential stakeholders to determine if there were opportunities for irrigation recycled water use in the vicinity of the Suquamish WWTP but determined there we no suitable sites at the time of this Plan.

ES.10 Operations and Maintenance

Section 10 includes a summary of the O&M programs for the collection and conveyance system, and the Suquamish WWTP. A review of State and Federal requirements that impact the County's O&M program are also included in Section 10.

The Sewer Utility Division consists of four main work groups: Utilities O&M (WWTPs and pump stations), Field Operations (collection system piping), Engineering and Administration, and Construction Management. A total of 72 staff work in the Sewer Utility Division and oversee O&M across each of the County's four wastewater systems. O&M activities include regular inspection of pump stations, cleaning and inspection of pipes, preventative maintenance of WWTP equipment, ongoing records management for all components of the system, and review and updates to the WWTPs O&M manual.

A staffing analysis was conducted for the collection and conveyance system and Suquamish WWTP and determined that staffing levels and certifications are appropriate and adequate for current operations. No additional staff is expected to be required though the 20-year planning period.

Conclusions and recommendations based on a review of the County O&M practices are:

- Train and certify CCTV operators in National Association of Sewer Service Companies (NASSCO) assessment to improve the consistency of sewer inspecting rating.
- Review spare parts inventories and assess the need for additional spare parts due to supply chain challenges.
- Institute an annual valve exercising and maintenance program.
- Develop a training program to accelerate employees into Operator Certification Group III and prepare for anticipated Puget Sound Nutrient Reduction Goals and facility upgrades.
- Institute an Arc-Flash Analysis and Protection program and incorporate as capital projects are designed and constructed.

ES.11 Capital Improvement Plan

The CIP projects were developed to remedy existing system deficiencies, address regulatory requirements, and provide adequate capacity for projected flows and loads. CIP projects to address immediate needs are planned in a 6-year planning horizon (from 2023 to 2028) and future CIP projects are included in the 20-year planning horizon (from 2029 to 2042). A planning level cost opinion of CIP project implementation is provided. It is assumed that minor projects will be completed with O&M budget, therefore they are not included in the CIP. CIP projects for the 6-year and 20-year planning horizons are presented in **Table ES-8**, **Table ES-9**, and **Table ES-10**. A preliminary implementation timeline of the CIP is provided in **Section 11**.

Table ES-8 | 20-Year Suquamish Collection and Conveyance Capital Improvement Projects

CIP No.	Item	Total Project Cost
CIP-S-CC-CAP-1[1]	Replace PS-54 and Forcemain	$7,000,000
CIP-S-CC-CAP-2[1]	Replace PS-53 and Forcemain	$7,200,000
CIP-S-CC-OM-3	Annual Pipe Replacement	$1,860,000
CIP-S-CC-DEV-4	Extend Gravity Sewers Flowing to PS-53 from the South	$0
CIP-S-CC-DEV-5	Extend Gravity Sewers Flowing to PS-54	$0
CIP-S-CC-DEV-6	Extend Gravity Sewers Flowing to PS-53 from the Northeast	$ 0
CIP-S-CC-OM-7	Annual Pipe Replacement	$4,340,000
	Total	**$20,400,000**

Note:
1. If funding becomes available, this project should be considered in the 6-year CIP.

Table ES-9 | 6-Year Suquamish WWTP Capital Improvement Projects

CIP No.	Item	Total Project Cost
CIP-S-WWTP-CAP-1	New Influent Equalization Basin	$ 2,850,000
CIP-S-WWTP-OB-2	Replace Headworks	$ 2,090,000
CIP-S-WWTP-OB-3	Replace Odor Control System	$ 510,000
CIP-S-WWTP-OM-4	Replace Process Piping	$ 2,170,000
CIP-S-WWTP-OM-6	Replace Drain Piping	$ 190,000
CIP-S-WWTP-REG-8	NFPA 820 Upgrades	$ 2,300,000
	Total	$ 10,110,000

Table ES-10 | 20-Year Suquamish WWTP Capital Improvement Projects

CIP No.	Item	Total Project Cost
CIP-S-WWTP-OB-5[1]	SBR Improvements	$ 720,000
CIP-S-WWTP-OB-7[1]	Effluent Equalization and Sludge Storage Tank Rehabilitation	$ 860,000
CIP-S-WWTP-OB-9[1]	Replace UV System	$ 760,000
CIP-S-WWTP-REG-10[2]	Convert to AGS System	$ 8,120,000
CIP-S-WWTP-OB-11	Replace Thickened Sludge Pump	$ 50,000
	Total	$10,510,000

Note:

1. If funding becomes available, this project should be considered in the 6-year CIP.
2. Future nutrient requirements and timing are unknown. Based on the current permit cycle for the PSNGP, it is assumed that effluent TIN restrictions to values below 10 milligrams per liter (mg/L) will not be implemented until 2031 at the earliest.

ES.12 Financial Strategy

Section 12 consists of the financial analysis performed by FCS group to develop a funding plan ("revenue requirement") for the County's sewer utility for the 2024 to 2042 planning horizon. The revenue requirement was identified based on operating and maintenance expenditures, fiscal policies, and the capital funding needs identified in **Section 12**.

The County sewer system has four basins, each with a treatment plant and corresponding collection system: Central Kitsap, Manchester, Suquamish, and Kingston. While a General Sewer Plan has been developed separately for each basin (this focus of this document is the Suquamish basin), the County does not separate its sewer utility financial information by basin. As such, the information included in **Section 12** refers to the County sewer utility as a whole, unless explicitly stated otherwise. The result of the analysis indicates that a Countywide rate adjustment of 6.31 percent for 2025 and 6 percent per year through the remaining forecast period would be sufficient to support the capital program.

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SECTION 1

Introduction

1.1 Introduction

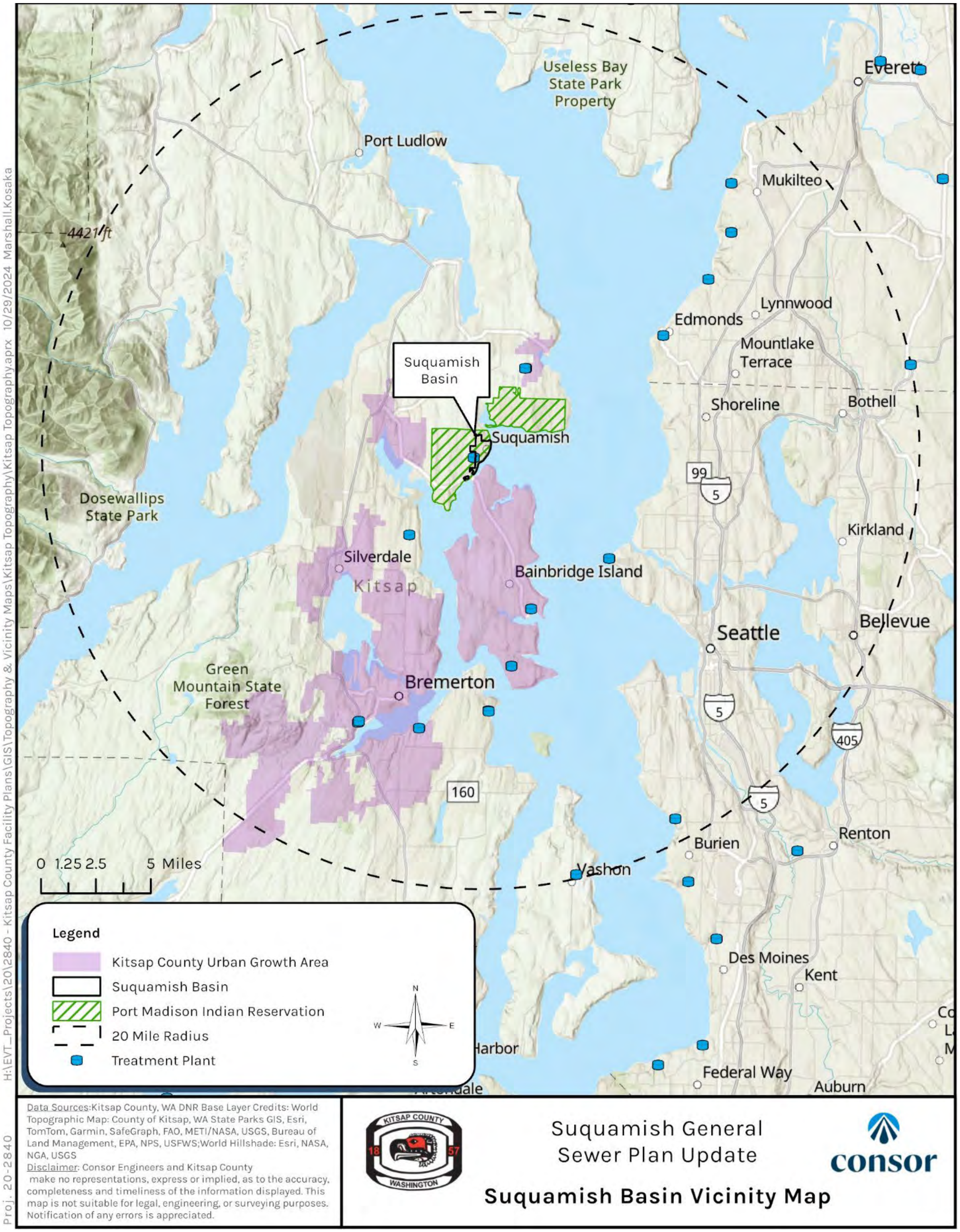
The Suquamish service area is in Kitsap County (County), Washington on the west side of the Puget Sound. It is a rural, historic waterfront community within the Port Madison Indian Reservation. This General Sewer Plan Update (Plan) provides the County with a 20-year plan (2022 to 2042) for the Suquamish basin sewer collection, conveyance, and wastewater treatment plant (WWTP) infrastructure. The Central Kitsap, Kingston, and Manchester basins sewer systems are covered under separate Plans.

A Suquamish basin vicinity map is shown in **Figure 1-1**. The Suquamish service area spans approximately 470 acres, and contains the Suquamish Nature Preserve, an elementary school, and neighborhood developments. Suquamish is classified as a Limited Area of More Intense Rural Development (LAMIRD).

The County owns, operates, and maintains the sewer facilities in the Suquamish area. The system consists of approximately 55,000 feet of gravity pipe, 9,400 feet of force main pipe, two pump stations and the Suquamish WWTP.

The current sewered population in the basin was estimated by an analysis of sewer permits, indicating there are 1,065 equivalent residential units (ERU) yielding a population of 2,663 people. The sewered population is expected to grow to 2,814 in 2028 and 3,081 in 2042.

Figure 1-1 | Suquamish Basin Vicinity Map



1.2 Purpose and Scope

This Plan evaluates the expected changes in the Suquamish sewer service area, reports the existing condition of the collection system and Suquamish WWTP, analyzes potential improvements to the system, and includes recommended and phased capital improvements that will provide service to the growing community over the planning horizon. The Plan was prepared to provide the County, the public, the Suquamish Tribe, and regulatory agencies with information on the County's plans for maintaining, upgrading, and expanding the system. The Plan provides the roadmap for the County to continue to provide high quality service to its customers while protecting environmental quality. The Plan complies with the Washington State Department of Ecology (Ecology) regulations for general sewer plans (Washington Administrative Code [WAC] 173-240-050).

The Plan is based on planning horizons of a six-year period, 2023 to 2028, and a 20-year period, 2023 to 2042. The Plan lays out a strategy to provide wastewater services that accommodate population growth, comply with environmental regulations and permits, assess existing conditions, and maintain collection/conveyance system and treatment plant reliability and longevity. The population projections are in line with those developed by the Kitsap County Department of Community Development (DCD) over the 2044 planning horizon, which corresponds to the Kitsap County Comprehensive Plan (KCCP) update. The recommendations presented here were made with consideration of the benefits of long-term investments that will continue to serve the community beyond the 20-year planning horizon.

Consor was contracted by the County in April 2020 to prepare the Plan and worked with the County to develop the Scope of Work, which provides guidance for decisions regarding the management and improvement of the County's wastewater treatment infrastructure.

1.3 Background

The County owns and operates the Suquamish wastewater system that consists of a collection and conveyance system, two pump stations, and the Suquamish WWTP with an outfall in Port Madison in the Puget Sound. The oldest parts of the Suquamish collection system were installed in the mid-1970s with growth of the collection system continuing through the early 1980s. During this period, PS-53 was installed (in 1977). Moderate growth occurred in the 1990s, including the installation of PS-54. Growth in the basin following the 1990s has been relatively minor until the late 2010s. The system now serves approximately 0.74 square miles of residential and commercial customers within the LAMIRD boundary. The sewer system is separate from the stormwater system and consists of gravity sewers, pump stations, and individual pump stations (IPS). Some properties within the service area have on-site septic systems that are not connected to the collection system.

The Suquamish WWTP was constructed in 1975 as an activated sludge process. The plant was reconstructed in 1997 with sequencing batch reactors (SBRs) process and upgraded in 2017. The liquid treatment process in the existing WWTP include headworks, two SBRs, and ultraviolet (UV) disinfection. Sludge from the SBRs is thickened with a rotary drum thickener (RDT), stored in a thickened sludge storage tank (TSST), and transported to the County's Central Kitsap WWTP for further treatment. The County operates the WWTP under National Pollutant Discharge Elimination System (NPDES) Permit WA-002325-6 that was renewed June 1, 2008, and expired on May 31, 2013. The County submitted the permit renewal application. The current permit was administratively continued and remains in effect as of this writing. In September of 2019, the Environmental Protection Agency (EPA) issued a draft permit and requested Ecology provide Clean Water Act (CWA) Section 401 Certification. In December of 2019, Ecology provided the 401 Certification. In May of 2024, the EPA reissued the draft permit.

The County has prepared several sewerage planning documents since the 1960s. The last wastewater/sewer facility plan for the Suquamish area was prepared in 2013. Since then, the Suquamish area, and the County as a whole, has grown substantially. With this growth, the need for a renewed evaluation of sewer service to the entire County became increasingly apparent. This Plan presents the findings and recommendations for the Suquamish basin sewer facilities.

1.4 General Sewer Plan Requirements

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, Revised Code of Washington (RCW) 90.71 established the need for a Puget Sound Water Quality Management Plan. The stated objective of this plan is to protect and restore Puget Sound through effective coordination among governments and private interests, and through use of an adaptive management approach.

This Plan is prepared for the County to fulfill the requirements of Chapter 173-240-050 of the WAC, Chapter 90.48 of the RCW, and RCW 36.70A (Growth Management Act). The Plan provides the County with a comprehensive guide for managing and operating the sewer system and coordinating expansions and upgrades to the infrastructure through buildout. The Plan serves as a guide for policy development and decision-making processes for the County. The WAC requirements are outlined in **Table 1-1**.

Table 1-1 | General Sewer Plan Requirements per WAC 173-240-050

WAC Reference Paragraph	Description of Requirement	Location in Document
3a	Purpose and need for proposed plan	Section 1.2
3b	Who owns, operates, and maintains system	Section 1.5
3c	Existing and proposed service boundaries	Figure 2-1
3d	Layout map showing boundaries; existing sewers; proposed sewers; existing and proposed pump stations and force main; topography and elevations; streams, lakes, and other water bodies; water systems	Figure 2-1, Figure 2-2, Figure 2-4, Figure 2-5, Section 5, Section 6, Section 7, and Section 11
3e	Population trends	Section 3
3f	Existing domestic and/or industrial wastewater facilities within 20 miles	Figure 1-1
3g	Infiltration and inflow (I&I) problems	Section 3.4.3
3h	Treatment systems and adequacy of such treatment	Section 6
3i	Identify industrial water sources	Section 4
3j	Discussion of public and private wells	Figure 2-5
3k	Discussion of alternatives	Section 7 and Section 8
3l	Define construction cost and O&M costs	Sections 10, Section 11, and Section 12
3m	Compliance with water quality management plan	Section 4
3n	State Environmental Policy Act (SEPA) compliance	Section 4

1.5 Ownership and Management

The County owns, operates, and maintains the sewer facilities in Suquamish.

The County's Sewer Utility Division (Utility) under the Department of Public Works is solely funded through fees from sewer ratepayers. The Utility does not receive funds from County tax revenue and cannot provide any financial assistance to other public works divisions or County departments. These revenues must provide for future capital improvements and cover the maintenance, operation, and replacement of sewer systems.

The operations and maintenance (O&M) of both the sewer collection system and the County's four WWTPs is provided by the Utility. The Utility consists of four main work groups:

- Utilities O&M (Plant and Pump Station).
- Field Operations (Collections System).
- Engineering and Administration.
- Construction Management.

The Utilities Operation Group is responsible for running the WWTPs and laboratory. The Utilities Maintenance Group is responsible for maintaining the equipment associated with WWTPs and pump stations. The Field Operations group is responsible to maintain, repair, replace, clean, and inspect the sewer utilities collection systems. The Engineering Group manages the design of capital work. The Administration Group manages the geographic information system (GIS) database and provides review efforts for developer proposed projects. The Construction Management Group manages the delivery of capital work.

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SECTION 2

Service Area Characterization

2.1 Introduction

The Suquamish wastewater system service area characteristics including geography, topography, water resources, general soil conditions, critical areas, endangered species habitats, the water supply system, and zoning designations are described in **Section 2**.

2.2 Growth Management Act

The State of Washington adopted the GMA with the intent of concentrating most new development and population growth within the urban areas of the more populous and rapidly growing counties. State and local governments are required to define an Urban Growth Area (UGA) boundary within which urban services like sewers are provided, and any new parcels created outside that boundary must be at a very low density with sufficient acreage to support on-site sewage disposal systems conforming to Washington State Department of Health (DOH) regulations.

The following exceptions to the prohibitions of sewers outside the UGA are recognized under state law (per RCW 36.70A.110(4), RCW 36.70A.070(5)(d), and WAC 365-196-320(1)(c)):

- Public schools outside the UGA can be served by sewers but are not required to be served.
- Areas of existing development outside the UGA where sufficient on-site sewage disposal systems have failed as to create a "severe public health hazard" can be served by sewers.
- Areas can be defined as a LAMIRD, within which the development of necessary public facilities and public services, such as sewer, is allowed.

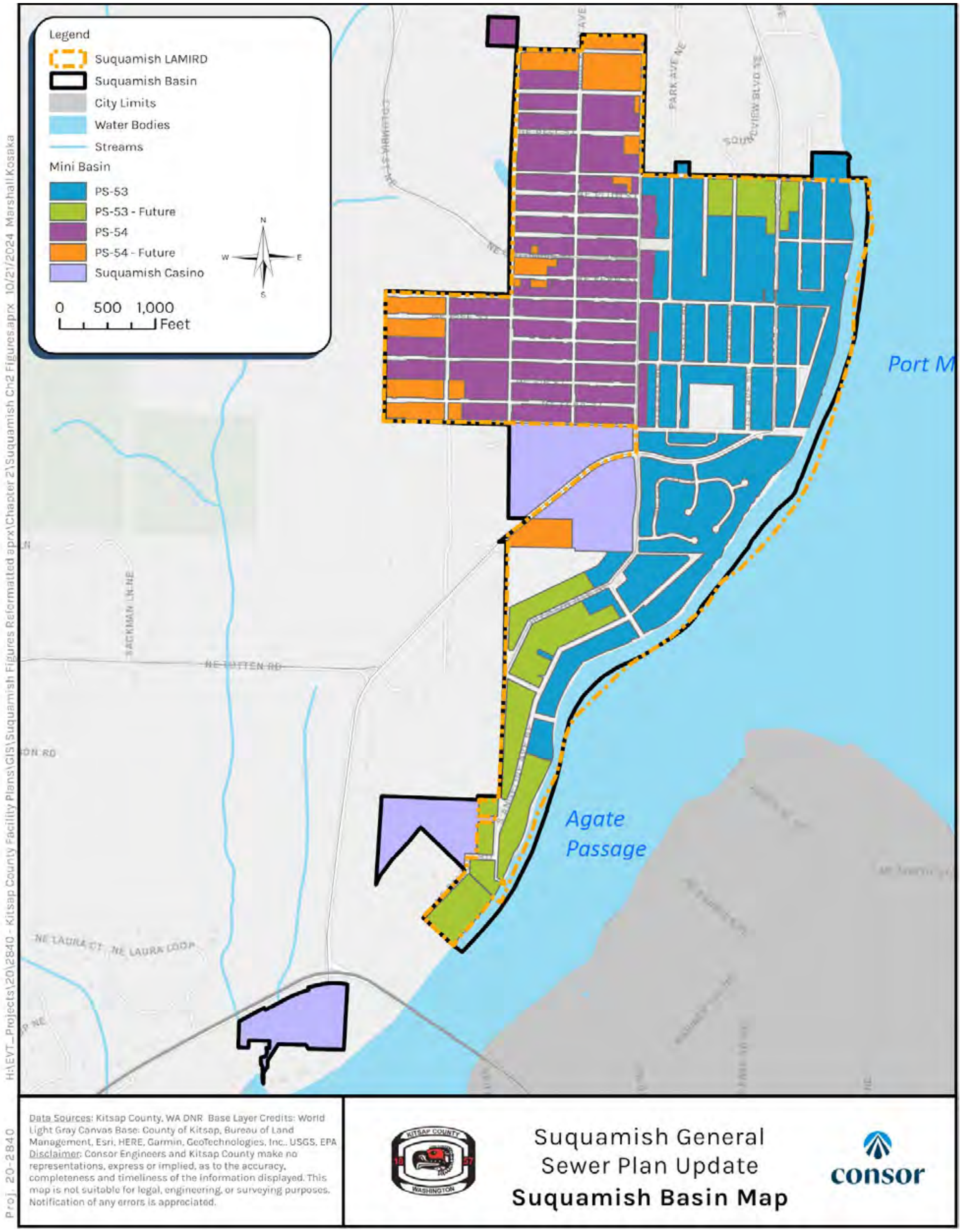
Sewers provided in these cases can be satellite systems limited to serving just the qualified and defined parcels, or a sewer extension can be 'tight-lined' to convey wastewater from the qualified and defined parcels into the UGA for connection to an existing sewer system.

Because these services and urban development are not otherwise allowed in rural areas, specific criteria must be met to establish the logical boundary of a LAMIRD and limit new patterns of low-density sprawl. Suquamish is recognized as a Type 1 LAMIRD under these regulations. Therefore, it is highly unlikely that the boundary and the zoning within Suquamish will change within the planning horizon for this Plan.

2.3 Service Area

The Suquamish service area is shown in **Figure 2-1**. The service area spans approximately 470 acres and is bounded to the north by NE Prospect Street and NE Winfred Street. It is bounded on the east and south by Port Madison Bay and the Agate Passage. The service area extends east to the edge of the neighborhood developments. The service area contains the Suquamish Nature Preserve, an elementary school, and neighborhood developments.

Figure 2-1 | Suquamish Basin Map



2.3.1 Topography

The topography of the service area is characterized as moderately hilly and sloping generally southeast towards Agate Passage and Port Madison Bay.

2.3.2 Water Resources

The primary water resource in the service area is groundwater. There are no named creeks within the service area listed in the United States Geologic Survey National Hydrography Dataset for Washington.

2.3.3 Puget Sound Water Quality Management Plan

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, RCW 90.71 established the need of a Puget Sound Water Quality Management Plan. The stated objective of this plan is to protect and restore Puget Sound through effective coordination among governments and private interests, and through use of an adaptive management approach. This Plan is consistent with the intended goals of the Water Quality Management Plan.

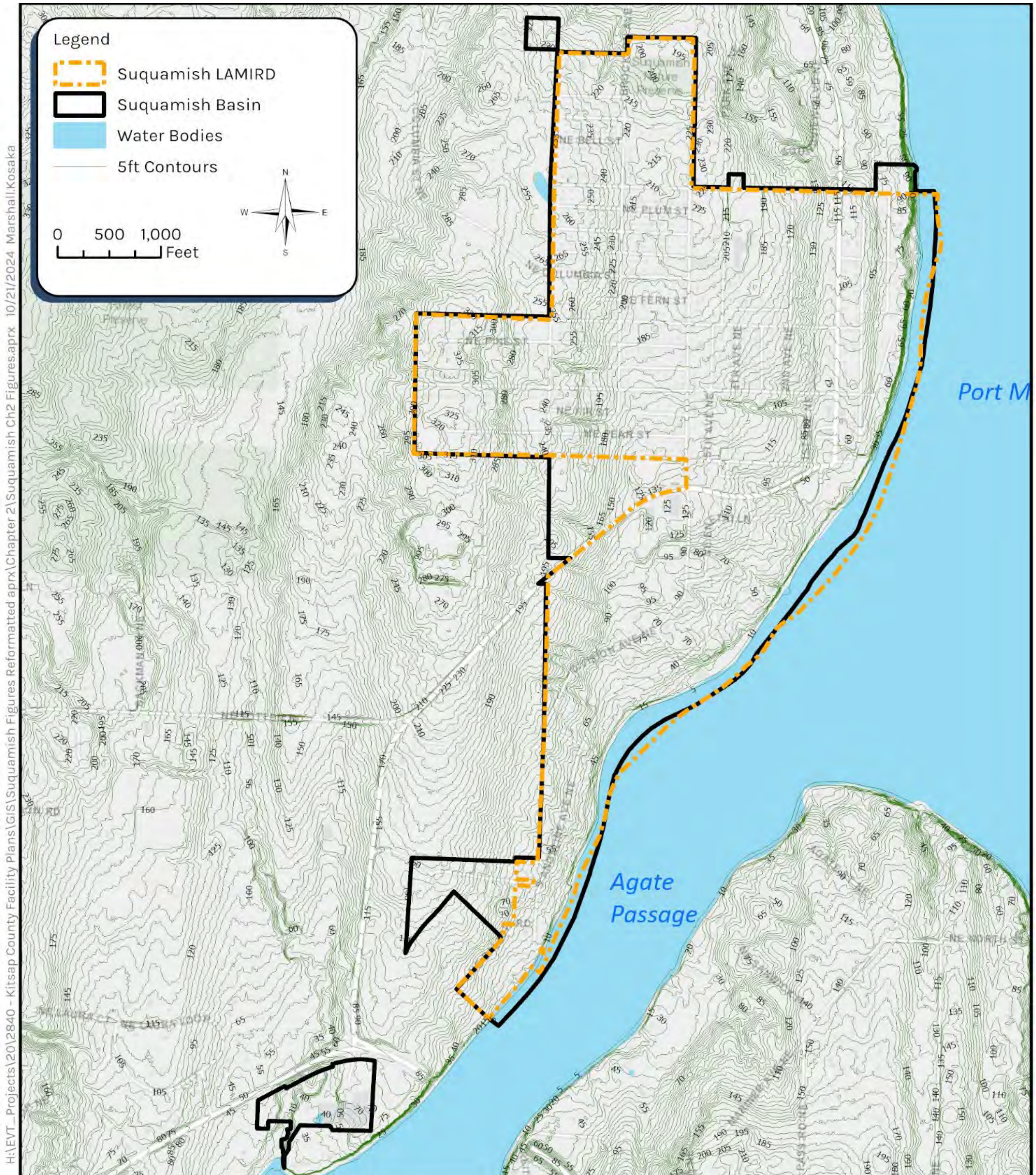
2.3.4 Geology

Soils and their distribution in the basin are shown in **Figure 2-3**. The soil descriptions are referenced from the Soil Survey of Kitsap County by the United States Department of Agriculture and the Soil Conservation Service in cooperation with the Washington State Department of Natural Resources and the Washington State University Agricultural Research Center. The soil distribution is based on GIS data derived from the Private Forest Land Grading System and the Soil Survey of Kitsap County.

Poulsbo soils are the most prevalent soil type in the basin. The soil is moderately well drained and has a depth to hardpan ranging from 20 to 40 inches. Permeability is moderately rapid in the upper stratum and very slow through the hardpan. This soil is found in broad uplands and formed in glacial till.

Dystric Xerorthents are the second most prevalent soil type in the basin. These soils are deep, moderately well drained to somewhat excessively drained with a depth to hardpan greater than 60 inches. These soils are found on sidewalls of river valleys and sidewalls of entrenched streams. These soils formed primarily in glacial till with some formed in sandy and gravelly outwash.

Figure 2-2 | Suquamish Basin Topography



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Data Sources: Kitsap County, WA DNR Base Layer Credits: World Light Gray Canvas Base: County of Kitsap, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, EPA
Disclaimer: Consor Engineers and Kitsap County make no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Suquamish General Sewer Plan Update

Suquamish Basin Topography

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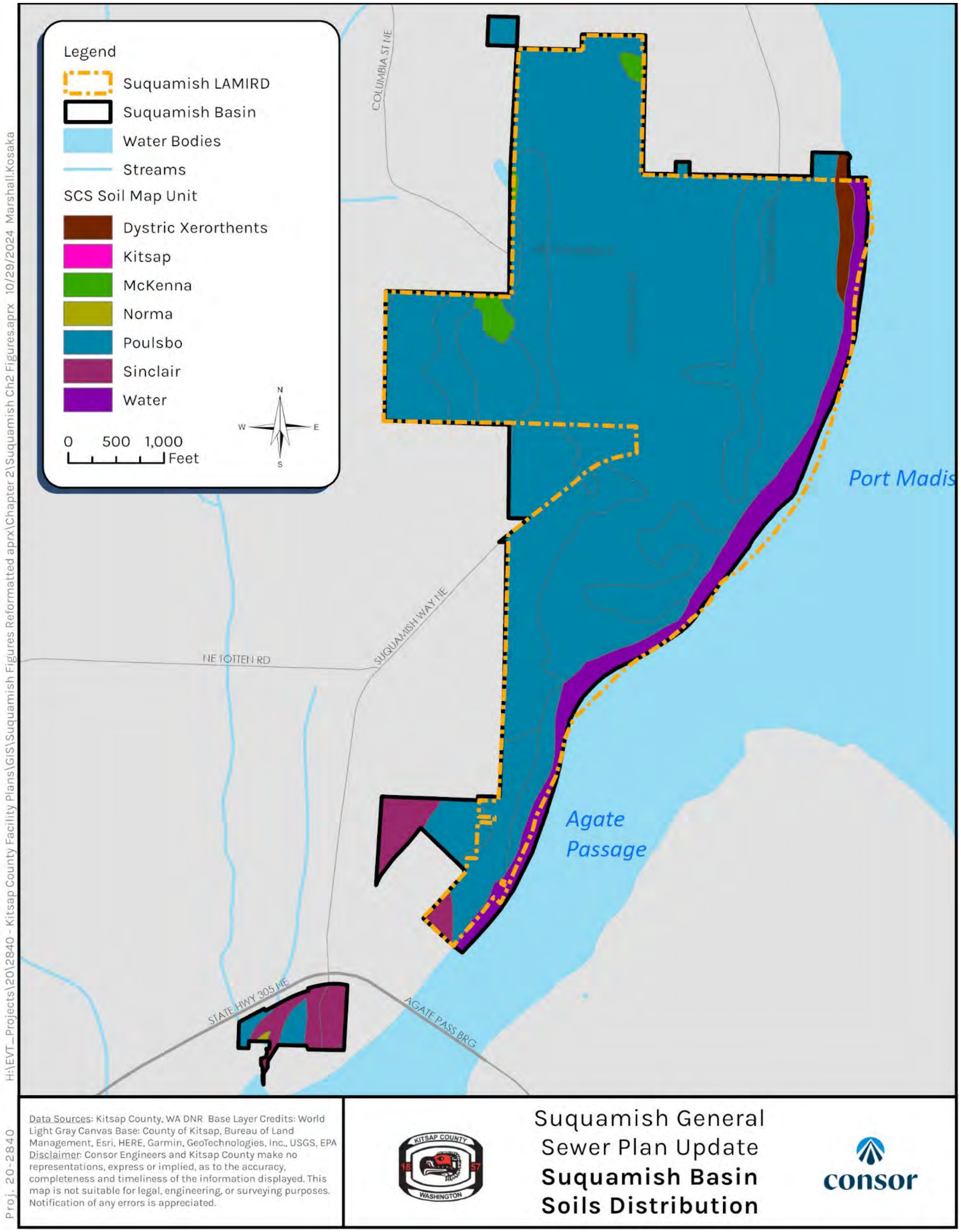
Figure 2-3 | Suquamish Basin Soil Distribution



2.3.5 Critical Areas

Critical areas are located throughout the Suquamish Basin, as shown on **Figure 2-4**. Development is limited in critical areas. The critical areas consist of wetlands which were identified from the Department of Natural Resources 2000 Hydrology data set, the National Wetlands Inventory data set, and survey delineated wetlands from the County's parcel maps. The critical aquifer recharge areas shown on the map are separated into Category 1 and Category 2 areas. Category 1 is defined as areas where the potential for certain land use activities to adversely affect groundwater is high. Category 2 is defined as areas that proved recharge effects to aquifers that are current or potentially will become potable water supplies and are vulnerable to contamination based on the type of land use activity. Geologic hazard areas are shown on the map and are categorized as areas of high concern and high hazard areas. High hazard areas are defined as areas with slopes greater than 30 percent and mapped by the Coastal Zone Atlas or Quaternary Geology and Stratigraphy of the County as unstable (U), unstable old landslides (UOS), or unstable recent slides (URS). Areas of concern are classified similar to the high hazard areas but with slopes between 15 percent and 30 percent and also includes areas that are classified as highly erodible or potentially highly erodible, and seismic areas subject to liquefaction.

2.3.6 Endangered Species Habitat

The Washington State Department of Fish and Wildlife (WDFW) does not list any endangered species in the basin, but WDFW does designate priority habitats and species within the area. The basin contains estuarine and marine wetlands which are habitat for species such as Surf Smelt and Pacific Sand Lance. Areas near the shoreline on the east of the service area are also home to Subtidal Hardshell Clam, Dungeness Crab, Pacific Geoduck, and Pacific Herring. Additionally, the area is considered habitat for the Little Brown Bat.

2.4 Water Supply System

Information regarding the basin's water system was taken from the Kitsap Public Utility District (KPUD) Water System Plan Part B, dated September 2011. The water supply system is mapped in **Figure 2-5**.

Water service for the basin is provided by KPUD's Suquamish Water System. There are six operational wells in the system; four are active production wells and two are reserved for emergency standby use. The system contains seven reservoirs totaling 721,000 gallons of usable volume. The water system was acquired by KPUD in 1976 and has not undergone any significant changes since 2002.

2.5 Land Use and Zoning

Land use and zoning within the Suquamish basin is currently established in the 2016 KCCP. Zoning in the Suquamish basin is shown on **Figure 2-6**. Future growth within the Suquamish basin is presumed to occur within the LAMIRD according to the land use designations and zoning in the KCCP.

Figure 2-4 | Suquamish Basin Critical Areas

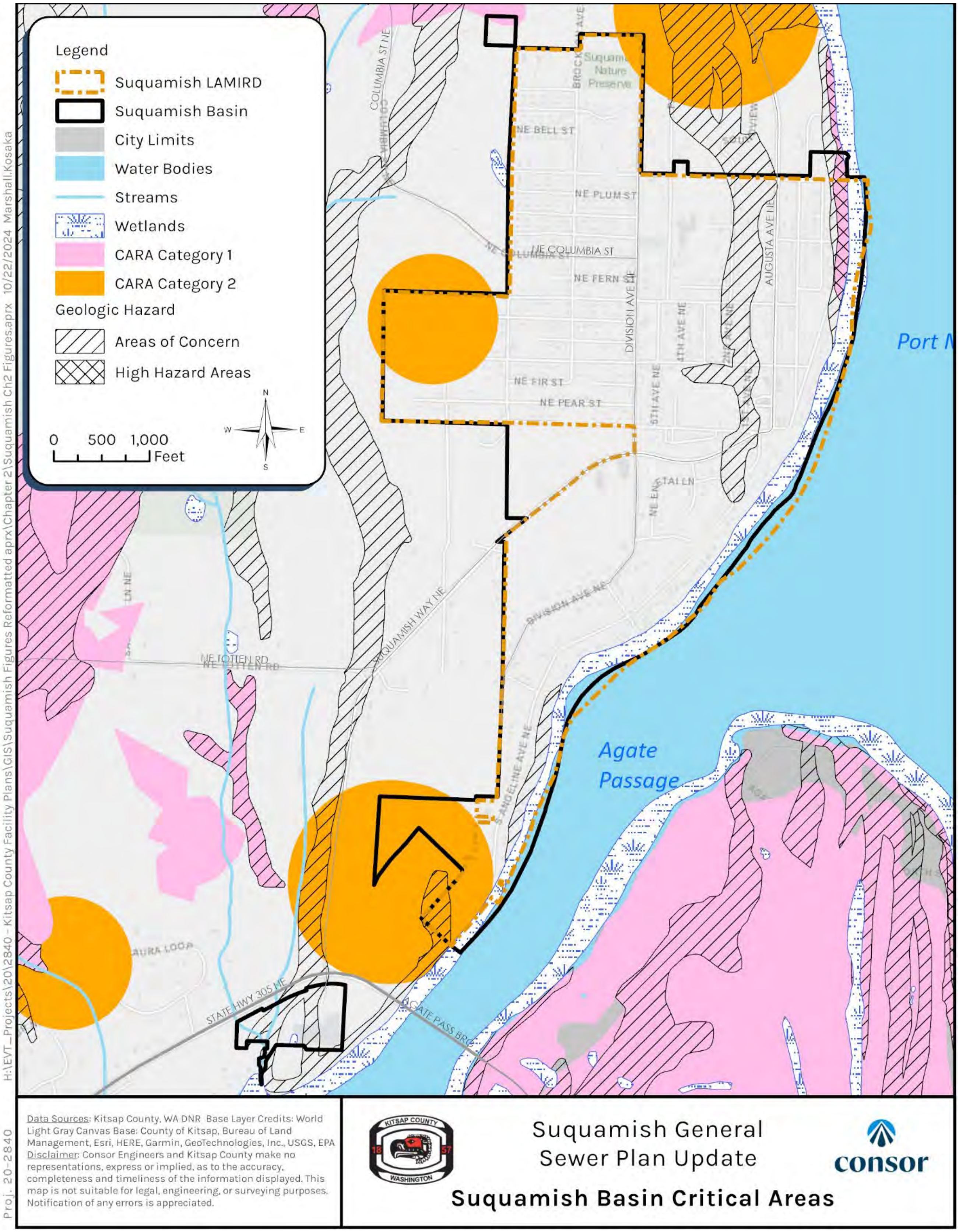


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Figure 2-5 | Suquamish Basin Water System

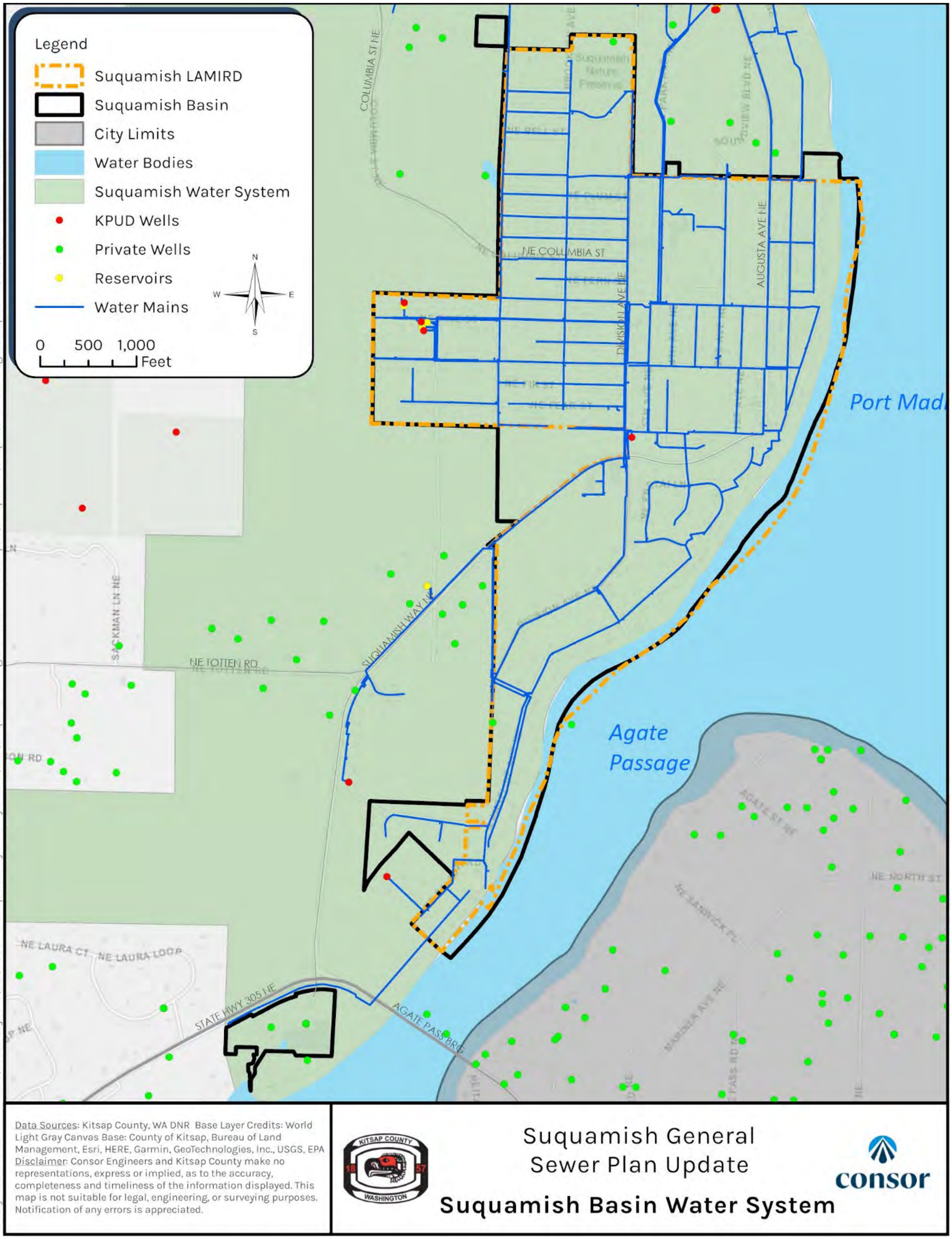

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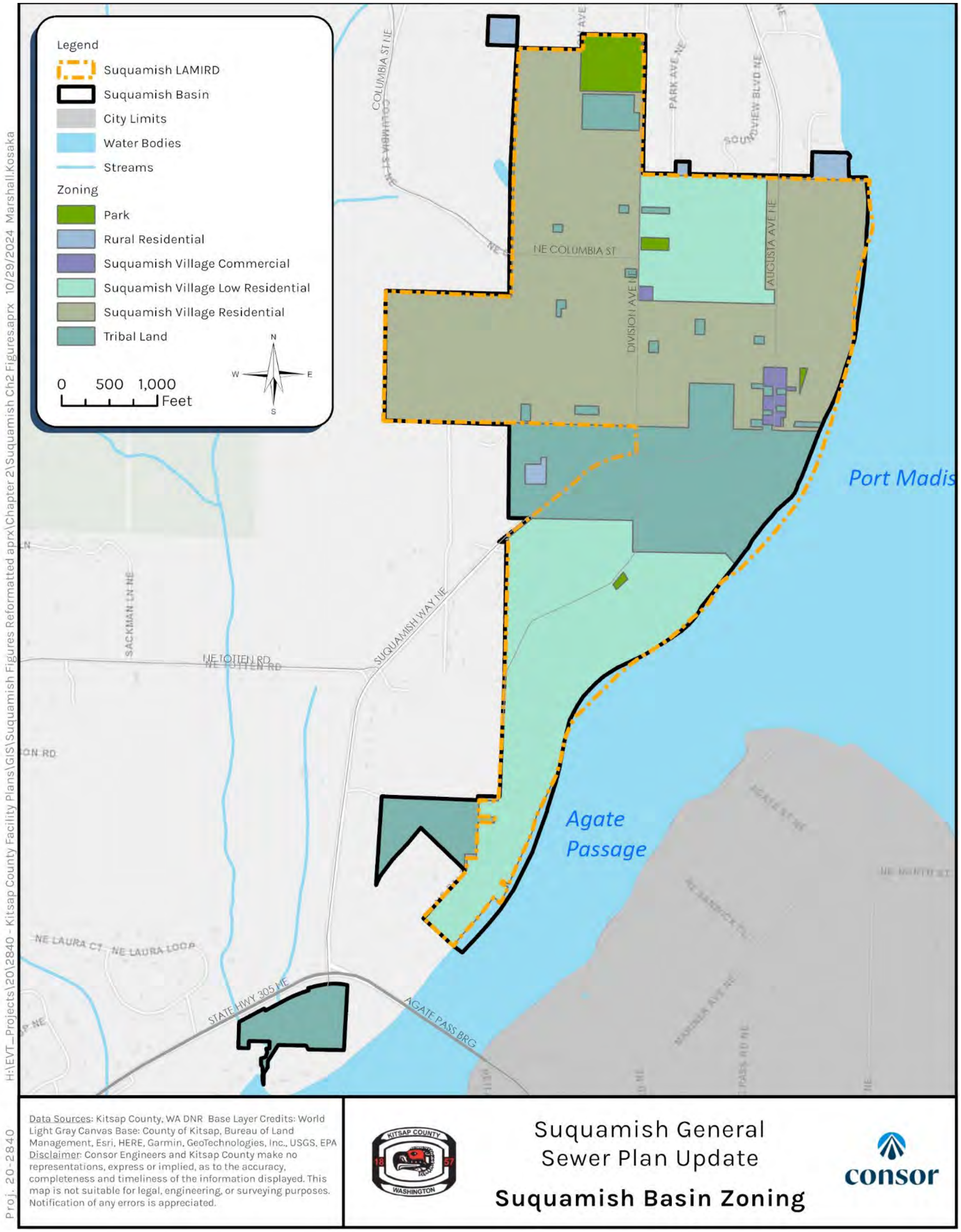
Figure 2-6 | Suquamish Basin Zoning Map



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SECTION 3

Population, Flow, and Load Projections

3.1 Introduction

The existing and projected populations and the methodology of determining the most appropriate sewered population and its growth rate to project future flows and loads for the Suquamish WWTP and the collection and conveyance system are described in **Section 3**.

The projections consider existing and future customers within the Suquamish basin in year 2028 (the 6-year projection) and year 2042 (the 20-year projection). Future flows are estimated and used as input into the hydraulic model to determine sewer system deficiencies and capital improvement projects for the 6-year and 20-year planning horizons.

3.2 Definitions

Evaluation Period: The flows and loads analyzed are based on discharge monitoring reports (DMRs) from January 2018 through June 2020.

Wet Weather Season: The wet weather season is November 1 through April 30 of the following year.

Dry Weather Season: The dry weather season is May 1 through October 31.

Average Annual Flow (AAF): The average daily flow for the calendar year.

Maximum Month Wet Weather Flow (MMWWF): The largest volume of flow during a continuous 30-day period in wet weather season, expressed as a daily average.

Maximum Month Dry Weather Flow (MMDWF): The largest volume of flow during a continuous 30-day period in dry weather season, expressed as a daily average.

Peak Day Flow (PDF): The largest volume of flow during a one-day period, expressed as a daily average.

Peak Hour Flow (PHF): The largest flow rate during a one-hour period, over the metered time-period.

3.3 Population Projections

3.3.1 General

The population forecasts for the sewer service areas were provided by the Puget Sound Regional Council (PSRC). The PSRC is a leading source of data and forecasting for regional and local planning in the Puget Sound area and develops policies and coordinates decisions related to regional growth and transportation and economic planning within Kitsap, King, Pierce, and Snohomish counties.

The PSRC's population projections are based on their Land Use Vision (LUV) forecast. The LUV dataset reflects the VISION 2040 Regional growth strategy, local policies, and each county's adopted growth targets. The LUV dataset projects population growth for the Central Puget Sound region in five-year increments from 2020 through 2040. The PSRC's Regional Macroeconomic Forecast is apportioned to cities and unincorporated areas using the VISION 2040 Regional Growth Strategy and local growth targets to create annual control totals. The PSRC's land use model, UrbanSim, then uses the annual control totals to determine projected growth on developable land. These results can then be reported for varying geographies like UGAs, LAMIRD, Census Tracts, or Traffic Analysis Zones (TAZ).

The projections used for this basis of planning are based on projected growth for the portions of TAZs within the Suquamish sewer service areas. The PSRC projections for residential population are defined by household population. Household population includes both single-family and multi-family units. The population was then extrapolated to 2042 based on the 2040 projection and the average yearly growth between 2035 and 2040.

As a reference, the 2019 population developed by the Washington State Office of Financial Management (OFM) was also obtained. The OFM 2019 number falls just slightly above the PSRC projection in year 2020, and therefore is considered a valid data point in this analysis. The detailed projection for the Suquamish basin is discussed in the following sections.

Additionally, population targets from the 2016 KCCP were compared with population projections received from the PSRC in five-year increments from 2020 to 2040. The targets included in the KCCP are broken down by City or UGA and areas outside of those categories are included in the broad categories of "Unincorporated UGA" and "Rural Non-UGA". The PRSC data was available at a higher resolution which was needed for the General Sewer Plans because the Suquamish sewer service areas needed more granularity to geographically distribute flows throughout their respective basins for modeling of the collection and conveyance system.

3.3.2 Residential

The OFM estimate of the residential population in the Suquamish basin was 2,453 for the year 2019. The 2042 projection for population in the Suquamish basin is 2,839 yielding a 16 percent increase from 2019 to 2042. The PSRC population projections for the period 2014 through 2040 in five-year increments and the 2019 OFM estimate of population and the extrapolated population in 2042 are shown in **Table 3-1**.

Table 3-1 | Suquamish Service Area Population Projections and Estimates

Year	Residential Population	Group Quarters	Total[5]
2014[1]	2,290	76	2,366
2019[2]	2,453	---	2,453
2020[1]	2,411	85	2,496
2025[1]	2,585	89	2,674
2028[3]	2,643	91	2,734
2030[1]	2,682	93	2,775
2035[1]	2,733	95	2,828
2040[1]	2,738	98	2,836
2042[4]	2,740	99	2,839

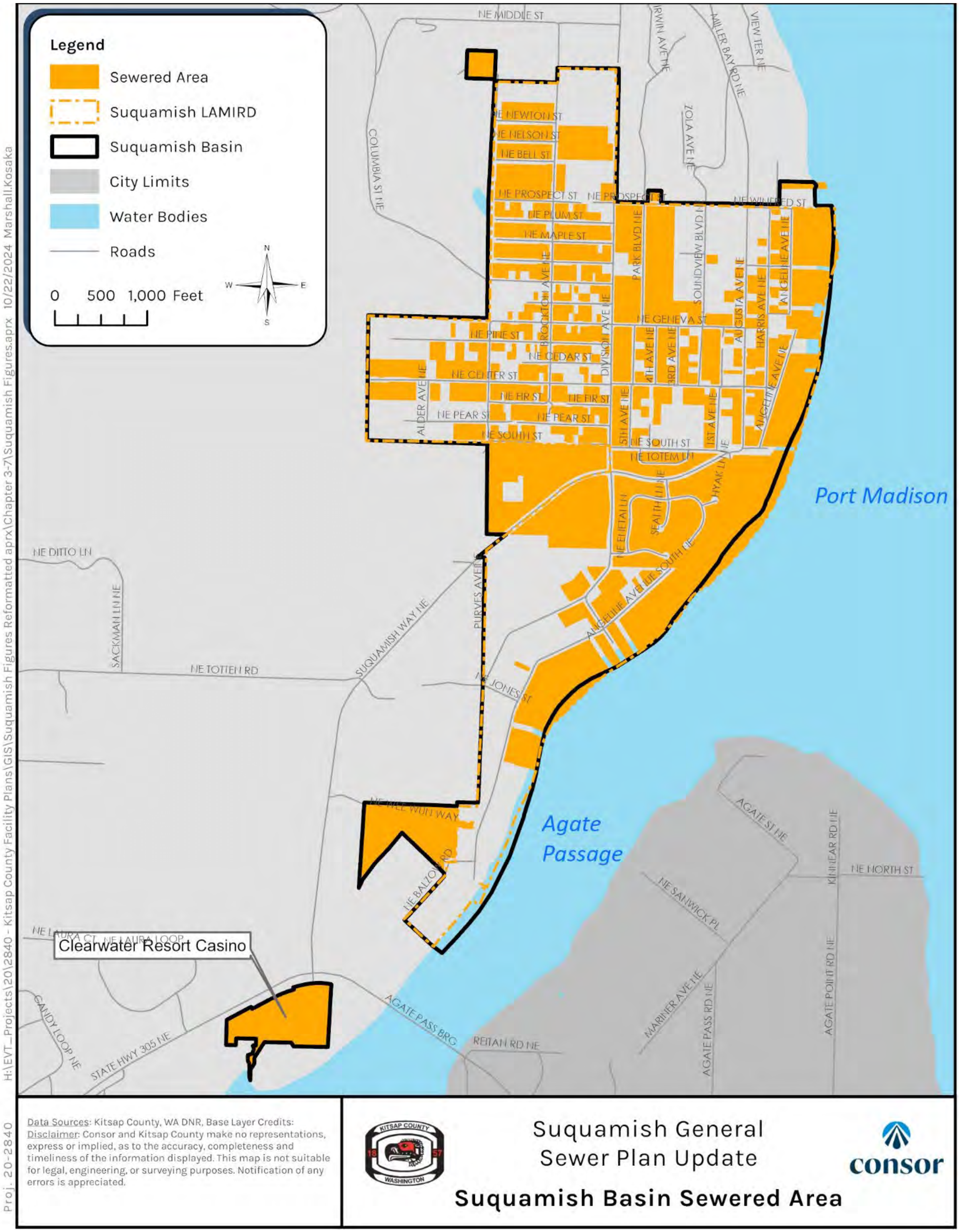
Notes:

1. PSRC projections
2. OFM estimates, group quarters population not reported separately
3. Interpolated from 2025 and 2030 PSRC projections
4. Extrapolated based on yearly growth between PSRC projections for 2035 and 2040
5. The total sewered population was computed using a different methodology which is described in the subsequent section

3.3.3 Current Sewered Population

The current sewer system in the Suquamish basin serves the majority of the LAMIRD while the population estimates and projections, presented above, represent the entire Suquamish LAMIRD. The current sewered population in the basin was estimated by an analysis of sewer permits using ERUs and assuming 2.5 people per ERU. The County's sewer permit data, provided in 2020, indicated there are 1,065 ERUs in the basin yielding a current sewered population of 2,663. This sewered population estimate is slightly larger than the 2019 OFM population for the entire LAMIRD of 2,453 as well as the 2020 PSRC projected population of 2,441. The difference is likely in the assumed 2.5 people per unit, but without a basis for modifying that ratio, the population of 2,663 will be used. It is assumed that in the future the sewered area will cover the entire LAMIRD as population in the basin increases. The Suquamish basin sewered area is shown in **Figure 3-1.** It includes some parcels that are sewered but are outside of the LAMIRD boundary. Although not typically allowed by the GMA, there are allowable exceptions described in **Section 2.2**, such as changes in the UGA boundary, public schools, failed septic systems that create a severe public health hazard.

Figure 3-1 | Suquamish Basin Sewered Area



3.3.4 Sewered Population Growth Rate

Two data sources were reviewed to determine the most appropriate sewered population growth rate as the basis for the Suquamish WWTP flow and load projection:

- Estimated total population projection as presented in **Table 3-1**, based on the PSRC and OFM information. This projection shows a 16 percent growth between 2019 and 2042 within the entire LAMIRD, which averages out to be an annual growth rate of 0.63 percent.
- Estimated population growth based on the County's communication with the Suquamish Tribal Government in December 2020. Note that this is a placeholder assumption based on high-level information provided by the Tribe regarding Tribal growth. It is subject to revision based on new data or communications with the County and the Suquamish Tribal Government. The anticipated development in the Tribe is four new homes each year along with a 50-lot subdivision to be developed sometime in the next 6 to 20 years. This projection shows 14 percent growth between 2019 and 2042 within the entire LAMIRD, which averages out to an annual growth rate of 0.59 percent.

The growth rates from the two data sources are nearly identical over the twenty-year planning horizon. PRSC projections were conservatively selected as the basis for the Suquamish WWTP flow and load projections because the growth rate is slightly higher.

Based on the estimated sewered population in **Section 3.3.3** and using the population growth rate from PSRC, the projected sewered population in 2028 and 2042 for the Suquamish basin is shown on **Table 3-2**.

Table 3-2 | Suquamish Basin Sewered Population Projections

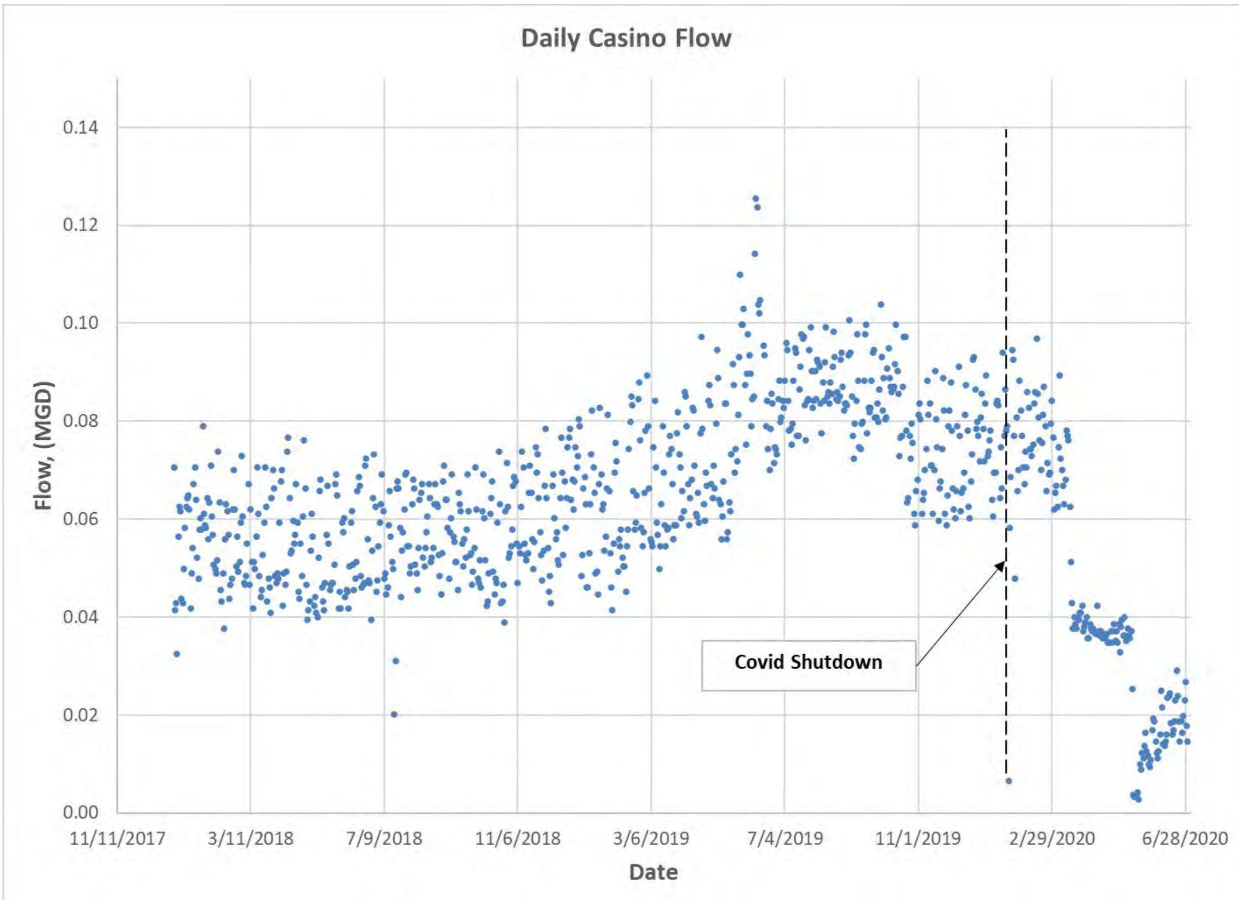
Year	Projected Sewered Population
2020	2,663
2028	2,814
2042	3,081

3.4 Wastewater Flows

Influent flow to the Suquamish WWTP is primarily domestic wastewater and a small amount of light commercial and minor industrial wastewater. Additionally, the WWTP treats wastewater from the Suquamish Clearwater Casino Resort (casino). The wastewater from the casino is pumped into the Suquamish collection system on Division Avenue through a force main. The average daily wastewater flowrate from the casino before the COVID-19 shutdown was approximately 70,000 gallons per day (gpd) with some fluctuation as seen in **Figure 3-2**. Based on the County's communication with Suquamish Tribe, the casino does not expect an increase in wastewater flows over the 20-year planning horizon.

The historical influent plant flow record has captured the casino and non-casino flows. To calculate future flow projections based on population growth, the average casino flow rate is deducted from the current annual average influent flow rate at the plant before calculating the non-casino per capita wastewater flow. The average casino flow rate is scaled for the remaining flow parameters (e.g., MMWWF) based on the observed peaking factors of the total plant flow to calculate the non-casino per capita flow under other flow conditions. The calculated per capita flow values are projected for future population growth to estimate the non-casino flows. The casino flow is added back to non-casino flow to estimate the future total flow to the Suquamish WWTP.

Figure 3-2 | Historical Casino Flow



3.4.1 Current Wastewater Treatment Plant Flow

Daily influent flow data were evaluated using DMR reports from January 2018 through June 2020 (the evaluation period) and are shown in **Figure 3-3**. Peak daily flows occurred during the wet weather winter months. Average daily flows are visibly lower during the dry weather months.

Figure 3-3 | Daily Flowrates

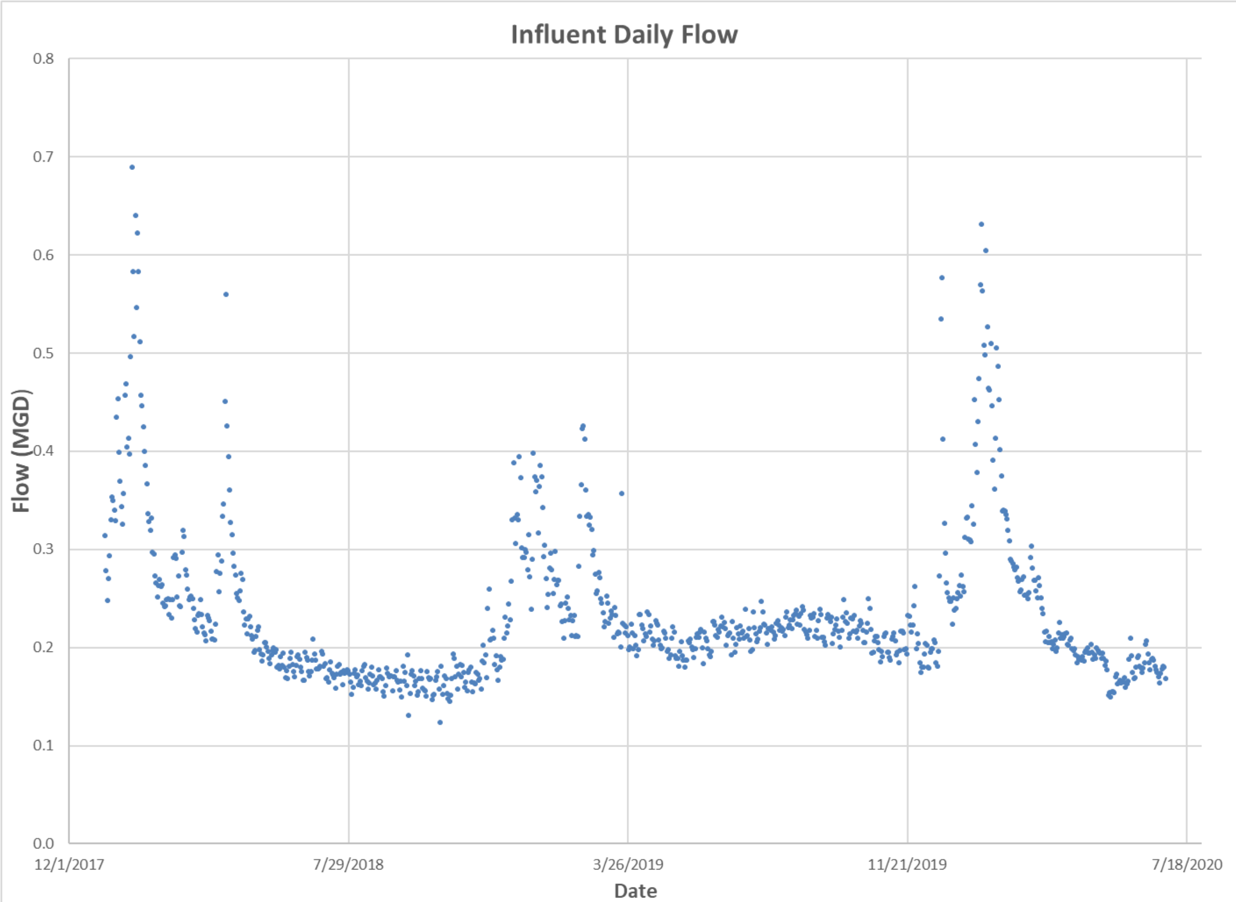


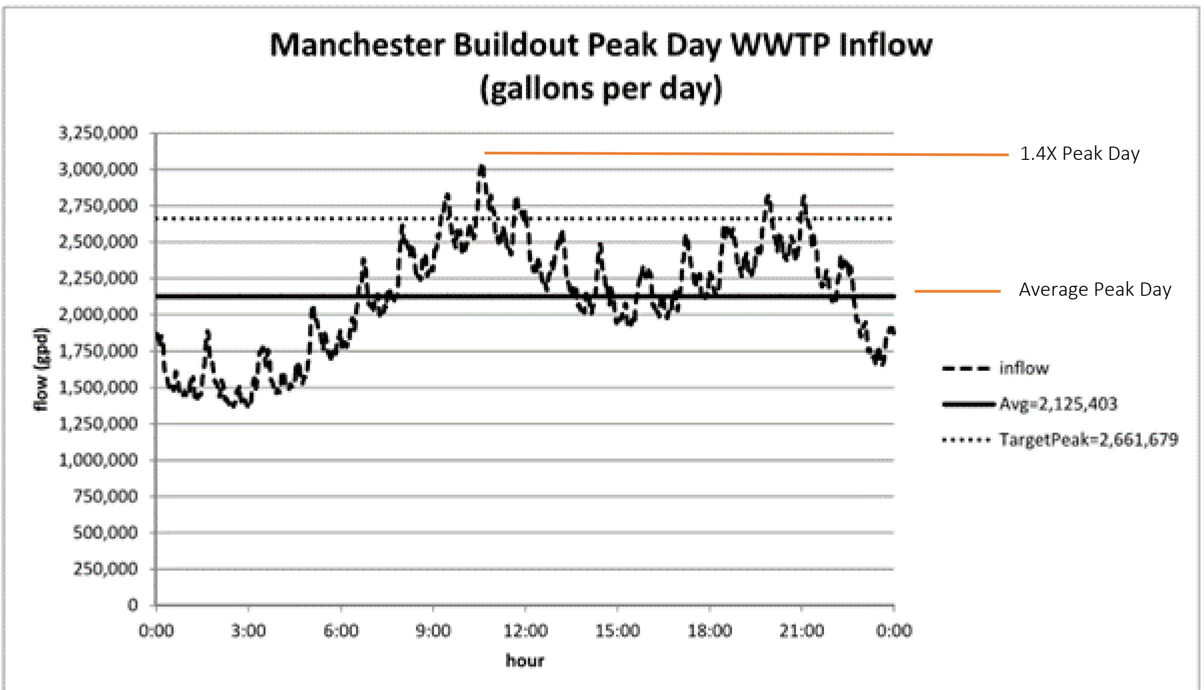
Table 3-3 provides a summaries of the current (2020) AAF, MMWWF, MMDWF, PDF, and PHF from the plant DMR data, the estimated casino and non-casino flow, and corresponding peaking factors and per capita values for non-casino flows based on the estimated current sewered population of 2,663. The per capita flow values are in the normal range for most plants. Hourly flow data are not available for Suquamish WWTP, so PHF was calculated using the peak day diurnal curve in Appendix C of the 2014 Manchester Sewer Facilities Strategy Plan as shown on **Figure 3-4**. The collection system and the WWTP at Suquamish and Manchester are similar in age and size, therefore it is assumed that their diurnal peak flow patterns are also similar. From the diurnal curve, the ratio of PHF to PDF of 1.4 was applied to the observed PDF to project the PHF. The peaking factor for PHF shown on **Table 3-3** is calculated by dividing the estimated PHF flow by the 2020 AAF flow.

Table 3-3 | 2020 Influent Flows at Suquamish WWTP

Flow Event	Total Flow (MGD)	Casino Flow (MGD)	Non-Casino Flow (MGD)	Non-Casino Flow Peaking Factor	Non-Casino Per Capita Flow (gpcpd)
AAF	0.23	0.07	0.16	1.0	62
MMWWF	0.45	0.13	0.32	1.9	119
MMDWF	0.30	0.09	0.21	1.3	78
PDF	0.69	0.21	0.48	2.9	182
PHF	0.97	0.29	0.68	4.1	254

MGD = million gallons per day
gpcpd = gallons per capita per day

Figure 3-4 | Manchester WWTP Peak Day Diurnal Curve



3.4.2 Wastewater Treatment Plant Flow Projection

The projected WWTP flows in year 2028 (6-year projection) and year 2042 (20-year projection), based on the 2020 flows and anticipated growth rate are summarized in **Table 3-4**.

Table 3-4 | Projected Influent Flows at Suquamish WWTP

Flow Event	2028	2042
Projected Sewered Population	2,814	3,081
AAF (MGD)	0.24	0.26
MMWWF (MGD)	0.47	0.50
MMDWF (MGD)	0.31	0.33
PDF (MGD)	0.72	0.77
PHF (MGD)	1.00	1.07

Projected flows generated in the collection system were developed using a hydraulic and hydrologic (H/H) model calibrated to observed flow data in the system. The model included increased DWF from population growth and used a 25-year 12-hour design storm which was scaled up to reflect the expected increase in precipitation due to climate change. The projected collection system flows are considered to be a conservative estimate of flows into the lift stations in the basin and do not necessarily correspond with flows seen at the WWTP. The model development and system analysis, including projected collection system flows, are described in greater detail in **Section 7**.

3.4.3 Infiltration and Inflow

The I&I is the wastewater component consisting of stormwater surface runoff entering the sewer system and infiltration from storm-saturated ground conditions. Inflow is runoff entering the sewer directly, typically from storm sewer connections, basement sump pumps, roof drains and submerged manholes. Infiltration occurs as groundwater leaks into the sewer system through cracked or broken pipes and manholes, or through loose joints and connections.

The I&I is important in determining the PDF and PHF through the system. They can vary significantly due to changes in groundwater tables, intensity of rainfall, duration of rainfall, and when the peak of the rain event occurs during the day.

The EPA publication 'Infiltration/Inflow – I/I Analysis and Project Certification' dated May 1985 was reissued by Ecology as Ecology Publication No. 97-03. This publication established the following thresholds for possibly excessive I&I:

- If average dry weather flow is less than 120 gpcpd, infiltration is non-excessive.
- If average wet weather flow is less than 275 gpcpd, inflow is non-excessive.

The average dry weather and wet weather flows are summarized in **Table 3-5**. The average dry weather flows indicate that infiltration is non-excessive. The average wet weather flows indicate that inflow is non-excessive.

Table 3-5 | EPA/Ecology Excessive I&I Criteria

Parameter	Value
Population	2,663
Average Dry Weather Flow (MGD)	0.286
Average Dry Weather Flow (gpcpd)	107
Average Dry Weather Dates[1]	1/16/2021-1/21/2021
Average Wet Weather Flow[2] (MGD)	0.686
Average Wet Weather Flow (gpcpd)	258

Notes:
1. Dry weather flows are the average flow on days where no rainfall has occurred during a season of high groundwater.
2. Wet weather flows are the average of the highest flow event per year from 2018 through 2021.

3.5 Wastewater Loads

3.5.1 Current Wastewater Loads

Wastewater loads to a treatment plant are used to evaluate different treatment alternatives and to determine the required treatment capacities. Current biological oxygen demand (BOD), total suspended solids (TSS), and total kjeldahl nitrogen (TKN) daily mass loads were derived from the 2018-2020 DMR Evaluation period data as well as monthly influent nitrogen data collected by plant staff. These daily mass loads were divided by the projected 2020 population to calculate per capita plant loads. These 2020 total and per capita loads for BOD, TSS and TKN during annual average, wet weather and dry weather flows are shown in **Table 3-6**. The load per capita values are typical of WWTPs.

Table 3-6 | 2020 Suquamish WWTP Influent BOD, TSS, and TKN Loads

Population	Parameter	Annual Average		Max Month Wet Weather		Max Month Dry Weather	
		Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd[2])	Load (ppd)	Load Per Capita (ppcd)
2,663	BOD	445	0.167	604	0.227	528	0.198
2,663	TSS	457	0.172	733	0.275	602	0.226
2,663	TKN	81.3	0.031	109	0.041	112	0.042

ppd = pounds per day
ppcd = pounds per capita per day

3.5.2 Influent Wastewater Loads Projection

Per-capita loading factors were multiplied by projected populations in 2028 and 2042 to project future plant BOD, TSS and TKN loading during average, wet weather, and dry weather conditions. Loading projections for 2028 and 2042 are shown in **Table 3-7** and

Table 3-8.

Table 3-7 | 2028 (6-Year) Suquamish WWTP BOD, TSS, and TKN Loading Projections

Population	Parameter	Annual Average		Max Month Wet Weather		Max Month Dry Weather	
		Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load (ppd)
2,814	BOD	470	0.167	638	0.227	558	0.198
2,814	TSS	483	0.172	775	0.275	637	0.226
2,814	TKN	85.9	0.031	115	0.041	119	0.042

Table 3-8 | 2042 (20-Year) Suquamish WWTP BOD, TSS, and TKN Loading Projections

Population	Parameter	Annual Average		Max Month Wet Weather		Max Month Dry Weather	
		Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load (ppd)
3,081	BOD	514	0.167	699	0.227	611	0.198
3,081	TSS	529	0.172	849	0.275	697	0.226
3,081	TKN	94.1	0.031	126	0.041	130	0.042

SECTION 4

Regulatory Requirements

The operation and construction of wastewater collection and conveyance systems and wastewater facilities are regulated through federal, state, and local regulations. Federal, state, County, and local government regulatory requirements applicable to the Suquamish collection and conveyance systems, WWTP, and other wastewater facilities are described in this section.

4.1 Federal Rules and Regulations

4.1.1 Federal Water Pollution Control Act (Clean Water Act)

The Federal Water Pollution Control Act, also known as the CWA, is a comprehensive framework for the regulating the discharge of pollutants into waters of the United States. Unlike the other WWTPs owned and operated by the County, the Suquamish WWTP, located on the Port Madison Indian Reservation, is directly regulated by the EPA. The EPA has authority to enforce the federal CWA through the NPDES permit program. The approval of this Plan is provided by the EPA, however, Ecology provides certification of the NPDES Permit pursuant to Section 401 of the CWA.

4.1.2 U.S. Army Corps of Engineers

The United States Army Corps of Engineers (USACE) has jurisdiction over waterways and wetlands of the United States. Modifications to the treatment plant outfall or development or construction in wetland areas may require a permit from the USACE. Permitting is reviewed by Federal, State, and local agencies as well as Tribal entities. Permits are contingent on certification from Ecology under that the project is consistent with the State of Washington Coastal Zone Management Plan.

4.1.3 Endangered Species Act

The National Marine Fisheries Service is directed under Section 4(d) of the Endangered Species Act (ESA) to issue regulations conserving species listed as threatened. The Section 4(d) rules apply to ocean and inland areas as well as any entity subject to U.S. jurisdiction. Species in the basin listed as threatened under Section 4(d) are listed in Section 2.3.6.

Section 9 of the ESA prevents “taking” or harm of threatened species and identifies some activities with a high risk of take. These activities include urban development in riparian areas and areas susceptible to erosion destruction or alteration of habitats, and violations of discharge permits.

4.1.4 Capacity Management Operations and Maintenance Programs

Capacity Management Operations and Maintenance (CMOM) is an anticipated regulation from the EPA related to control of sanitary sewer overflows (SSO) from sewer collection and conveyance systems or treatment facilities, which are prohibited under the Federal CWA. The EPA has prepared a draft rule titled “Sanitary Sewer Overflow Control Rule” which is intended to eliminate preventable SSOs through requiring owners and operators of sewer systems to develop and implement CMOM programs.

4.1.5 Puget Sound Water Quality Management Plan

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, RCW 90.71 established the need for a Puget Sound Water Quality Management Plan. The stated objective of this plan is to protect and restore Puget Sound through effective coordination among governments and private interests, and through use of an adaptive management approach.

4.1.6 EPA Plant Reliability Criteria

The Suquamish WWTP is required to meet the Reliability Class I standards, as defined in EPA's Technical Bulletin "Design Criteria for Mechanical, Electrical, and Fluid System Component Reliability," EPA 430-99-74-001. A summary of plant reliability criteria and requirements and current deficiencies at Suquamish WWTP are discussed in **Section 6** of this Plan.

4.1.7 National Historic Preservation Act

The National Historic Preservation Act (NHPA) established processes to assess, designate, and protect historic and cultural resources. It also established the National Register of Historic Places and the State Historic Preservation Officer (SHPO) to administer state historic preservation program and coordinate with federal agencies on their proposed actions, also known as undertakings. Section 106 of the NHPA requires coordination between federal, state, local, and tribal entities to review the impacts of any undertakings on historical properties listed or eligible for listing on the National Register.

4.1.8 Pretreatment Regulations & Industrial Users

According to 40 Code of Federal Regulations (CFR) Part 403 (General Pretreatment Regulations for Existing and New Sources of Pollution) all "significant industrial users" (SIUs), which are industrial users that discharged an average of 25,000 gpd or more to the publicly-owned treatment works (POTW) or makes up 5 percent or more of the average dry weather hydraulic or organic BOD or TSS capacity of the POTW, are required to be part of the National Pretreatment Program.

The National Pretreatment Program is charged with controlling toxic, conventional, and non-conventional pollutants from non-domestic sources that discharge into sewer systems, as described in CWA Section 307(a). Ecology has been given authority by the EPA to regulate the Pretreatment Program in Washington and is required to comply with the federal provisions of the National Pretreatment Program. The Pretreatment Program requires all large POTW that have a designed treatment capacity of more than 5 MGD to establish a Local Pretreatment Program.

Suquamish WWTP, with design flows less than 5 MGD, is only required to develop a formal Pretreatment Program if the nature or volume of the industrial influent are contributing to treatment process upsets, violations of NPDES Permit Limits or other circumstances that warrant the development of a program to eliminate those occurrences per 40 CFR 403.8 (a).

The majority of wastewater in the Suquamish basin is from domestic sewer, and no industrial or commercial discharges have been found to impact the plant performance. Suquamish WWTP also treats wastewater from the Suquamish Clearwater Casino Resort (casino) but the casino wastewater characteristics are still in line with domestic wastewater characteristics. Therefore, a Pretreatment Program is not required for Suquamish WWTP.

The County has not conducted an Industrial User Survey for the Suquamish WWTP. There is currently no SIU identified within the Suquamish service area. However, the staff is aware that the flow from the casino is high enough to be considered as a potential SIU. The Special Condition G.3 of the draft NPDES permit issued in 2024 requires Suquamish WWTP to develop and maintain a master list of the industrial users introducing pollutants to the POTW. The list will need to be submitted within two years following the effective date of the NPDES permit.

4.2 State Rules and Regulations

4.2.1 Department of Ecology

4.2.1.1 Section 401 Certification

In September of 2019, the EPA issued a draft permit and requested Ecology provide CWA Section 401 Certification. In December of 2019, Ecology provided 401 Certification which included a Total Inorganic Nitrogen (TIN) discharge load limit and associated monitoring and planning requirements, which mirror those found in the Preliminary Draft Puget Sound Nutrient General Permit (PSNGP) (January 2021). The County has appealed this Certification and results are outstanding. Because the appeal is pending, the 2008 NPDES permit remains in effect.

Ecology also included several planning requirements in the 401 Certification letter. The County must submit an Optimization Plan identifying improvements for maintaining compliance with the TIN cap within nine months of the permit issuance date. Additionally, if the TIN cap is exceeded, or within the next permit cycle, the County must conduct a Nutrient Reduction Evaluation to identify options and estimate implementation costs for treatment upgrades. Ecology has suggested in the Preliminary Draft PSNGP that the goal of these upgrades is to reduce TIN to 8-10 milligrams per liter (mg/L) and identify additional strategies to further reduce TIN to 3-4 mg/L. WWTPs may develop their own Nutrient Reduction Evaluation or participate in a broader regional study to collaboratively produce a regional Nutrient Reduction Evaluation. Finally, the 401 Certification letter includes a requirement that the County develop a formal engineering report including selection of a preferred design alternative within 18 months if Ecology receives a facility specific numeric water quality-based effluent limit for nitrogen during the first term. The County has appealed the Ecology certification and the resolution is outstanding as of writing. When Ecology released the Final Draft PSNGP, the TIN load action levels for small WWTPs were eliminated, so they may be willing to reduce the requirements in Suquamish's 401 Certification letter also.

4.2.1.2 Clean Water Act Section 303(d) list

Ecology conducts the water quality assessment based on Federal laws, state water quality standards, and Water Quality Assessment Policy 1-11 to track water qualities in the rivers, lakes, and marine waters in the state. The water quality assessment compares water data to requirements detailed in Policy 1-11. The assessed waters are placed into categories that describe the status of water quality, before being submitted to the EPA for approval of the category 5 listings, also called the 303(d) list. The water quality assessment divides water bodies into the following impairment categories:

- Category 1: Meets tested standards for clean waters
- Category 2: Waters of concern
- Category 3: Insufficient data
- Category 4: Impaired waters that do not require a total maximum daily load
- Category 5: Polluted waters that require a water improvement project

4.2.1.3 Infiltration and Inflow

Ecology can require reductions in I&I in situations where diluted influent affect the 85 percent BOD removal and the suspended solids minimum removal limit. State and Federal regulations also require that recipients of loan or grant money demonstrate that their sewer collections systems are not subject to excessive I&I. I&I is discussed in **Section 3.4.3**.

4.2.1.4 Engineering Design Criteria

Ecology's "Criteria for Sewage Works Design," also known as the Orange Book, identifies engineering criteria for design, construction, and operation of public sanitary sewer systems and wastewater treatment facilities.

4.2.2 Recycled Water Use

Recycled water is regulated by Ecology and the DOH, according to WAC 173-219. Ecology and DOH are both required to review recycled water proposals to determine if proposed treatment methods and uses will protect public health and the environment while not affecting existing water rights. The regulation also provides criteria to determine the lead agency based on the type of facility recycling the water. Requirements from both the lead and non-lead agency must be met as a condition of permitting. Recycled water from the Suquamish WWTP would be regulated with Ecology as the lead agency under WAC 173-219-050 as the source water is effluent from a facility permitted by Ecology.

4.2.3 State Environmental Policy Act

The SEPA is intended to help state and local agencies identify environmental impacts likely to result from a range or projects or decisions. Construction of public facilities such as sewer lines or WWTPs or adopting regulations or policies such as comprehensive plans often trigger a SEPA review.

4.2.4 State Environmental Review Process

The Washington State Environmental Review Process (SERP) is regulated according to WAC 173-98-720 and states all recipients of funding for water pollution control facility projects must comply with the SERP. SERP includes all provisions of SEPA. Mitigation measures identified in documents developed through the SERP become conditions of funding.

4.2.5 Puget Sound Clean Air Agency

The Puget Sound Clean Air Agency (PSCAA) has jurisdiction in the County and is responsible for regulating and permitting air emissions in the Puget Sound Region. Construction projects are often subject to regulation under PSCAA's Notice of Construction (NOC) Program. Projects that fall under the NOC program must not be subject to provisions of the Prevention of Significant Deterioration or the New Source Review programs, administered by Ecology. Determination of the regulatory pathway is dependent on the potential change in emissions resulting from the project and two categorizations: the source is either characterized as a major or non-major source and emissions from the project categorized as either significant or less than significant. Acceptable Source Impact Levels (ASIL) are defined in WAC 173-460 and regardless of regulatory pathway, toxic air contaminants emission increases must be compared to ASILs. Point sources such as waste gas burners, open tanks, and scrubber vents must be evaluated.

4.2.6 Washington State Department of Fish and Wildlife

The WDFW administers the State Hydraulic Code (WAC 220-660) which establishes regulations for the construction of hydraulic projects or work that will impact any salt or fresh waters of the state. It also sets forth procedures for obtaining Hydraulic Project Approval (HPA). Modification to the Suquamish WWTP outfall would likely require HPA.

4.3 Kitsap County and Local Government Requirements

The Suquamish sewer basin falls within unincorporated Kitsap County and the Port Madison Indian Reservation.

4.3.1 Kitsap County Codes

County Code Chapter 13.12 contains regulations governing public sewer systems. This chapter describes licensing and permitting of sewers, the locations of sewers and connections, and prohibited discharges and disposal of prohibited wastes. Specifications for sewers as well as standards for excavation and trenching are also included in Chapter 13.12.

County Code Chapter 18 contains the basic requirements that apply to the SEPA process and describes the sections of the SEPA that have been adopted by the County. Contents of Chapter 18 include, but are not limited to, designation of responsible officials and lead agency, exemptions and threshold determinations, an environmental checklist for applicants, rules for preparing environmental impact statements, rules for commenting on environmental documents under SEPA, rules governing public notices and hearings, and rules describing agency compliance with SEPA.

County Code Chapter 19 contains the County's Critical Areas Ordinance which identifies and protects critical areas as required by the GMA. Critical areas include but are not limited to wetlands, fish and wildlife habitat conservation areas, and geologically hazardous areas. Chapter 19 also outlines purposes and objectives for each critical area category and describes development standards, review procedures, and designation statuses.

County Code Chapter 22 contains the County's Shoreline Master Program which guides future development of the shorelines in the county consistent with the Shoreline Management Act. Chapter 22 describes shoreline jurisdiction and environment designations, goals and policies for the program, regulations, permit review and enforcement, and shoreline use and modification standards. This chapter also contains a section describing requirements for reports for critical areas including wetlands, habitats, geotechnical, and hydrogeological. This section addresses when reports are required, the qualifications of those preparing the reports, and timelines and schedules for the reports.

4.3.2 Growth Management Act

The GMA is a State, County, and City planning requirement which influences City and County plans for future growth. The GMA requires fast-growing cities and counties to develop a comprehensive plan to manage population growth. The GMA established a series of 13 goals under RCW 36.70A.020 as well as a 14th goal (RCW 36.70A.480) which adds the goals and policies from the Shoreline Management Act to those of the GMA. The County is subject to the full requirements of the GMA which requires planning for utilities including sewer service. This includes providing a capital facilities element in Comprehensive Land Use plans as well forecasting future needs for these facilities, proposed locations, and capacities of new or expanded facilities, and plans to fund these facilities into the future. The 2016 KCCP was prepared to satisfy the GMA requirements and describes the planned growth within the sewer service areas as well as plans to maintain and expand services within the sewer service area.

The GMA generally prohibits sewer service outside of designated UGAs. One exception to this prohibition is for areas defined as a LAMIRD. Because sewer service and urban development are not otherwise allowed in rural areas, specific criteria must be met to establish the logical boundary of a LAMIRD and limit new patterns of low-density sprawl. Suquamish is recognized as a Type 1 LAMIRD under these regulations.

Based on the requirements of the GMA, the County is required to review, and if necessary, revise the KCCP by June 30, 2024, and every eight years thereafter. As part of this review and revision, the County plans to revise its population and employment growth projections, which currently are projected to 2036, out to the year 2044. This revision began in 2022, thus revised growth projections were not available at the time of the development of this Plan.

4.3.3 Water as a Resource Policy

The County's Water as a Resource policy directs the County to treat water as a resource and not a waste stream. The policy focuses on improving water in the County through seven main guiding principles. While the guiding principles largely focus on controlling stormwater, guiding principle concerning conserving groundwater resources impacts the sewer system through use of recycled water or non-potable water for appropriate uses. The policy also contains guiding principles aimed at continual refinement of management tools. In addition to guiding principles, the policy directs the County to consider water as a resource when developing, re-developing, retrofitting, refurbishing, maintaining, and operating public assets. The policy also directs the County to consider water as a resource when developing or revising codes and regulations.

SECTION 5

Collection and Conveyance Existing Conditions

5.1 Introduction

The Suquamish collection and conveyance system is comprised of sewer assets owned by the County within the Suquamish LAMIRD.

The oldest parts of the Suquamish collection system were installed in the mid-1970s with growth of the collection system continuing through the early 1980s. During this period, PS-53 was installed in 1977. Moderate growth occurred in the 1990s, including the installation of PS-54. Growth in the basin following the 1990s has been relatively minor until the late 2010s. The system now serves approximately 0.74 square miles of residential and commercial customers within the LAMIRD boundary. The sewer system is separate from the stormwater system and consists of gravity sewers, pump stations, and IPS. Some properties within the service area have on-site septic systems that are not connected to the collection system.

5.2 Service Areas and Sewer Basins

The Suquamish basin collection and conveyance system is shown in **Figure 5-1**. The existing conveyance system provides service primarily to the northern portion of the LAMIRD with a small portion of the system served in the southern portion. The Suquamish Clearwater Casino Resort also pumps wastewater flows to Suquamish collection system. Wastewater within the Suquamish basin is ultimately conveyed to the Suquamish WWTP.

At the level of single pump stations, service areas are delineated as 'mini basins', defined as the area from which the collection system drains to a specified discharge point. Delineations of mini basins are based on existing sewer service and topography. Each portion of the system contributing to a lift station is delineated as a separate mini basin for this analysis.

5.2.1 Flow Routing

The service area's flows are routed through PS-53 and PS-54. Flows from the western portion of the Suquamish basin generally flow by gravity to PS-54 and flows from the eastern portion of the Suquamish basin generally flow by gravity to PS-53. The Suquamish Casino pumps wastewater, via a privately owned pump station and force main, to a gravity main within the Suquamish collection which is tributary to PS-54. There is a bypass at PS-54 which allows for excess flow to be conveyed to PS-53 via gravity conveyance. Flows from PS-53 and PS-54 are then pumped to the Suquamish treatment plant. Effluent from the Suquamish treatment plant is conveyed to Port Madison Bay where it discharges via a 12-inch diameter force main. **Figure 5-2** shows a flow schematic of the Suquamish sewer conveyance and pump stations.

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Figure 5-1 | Suquamish Basin Sewer System

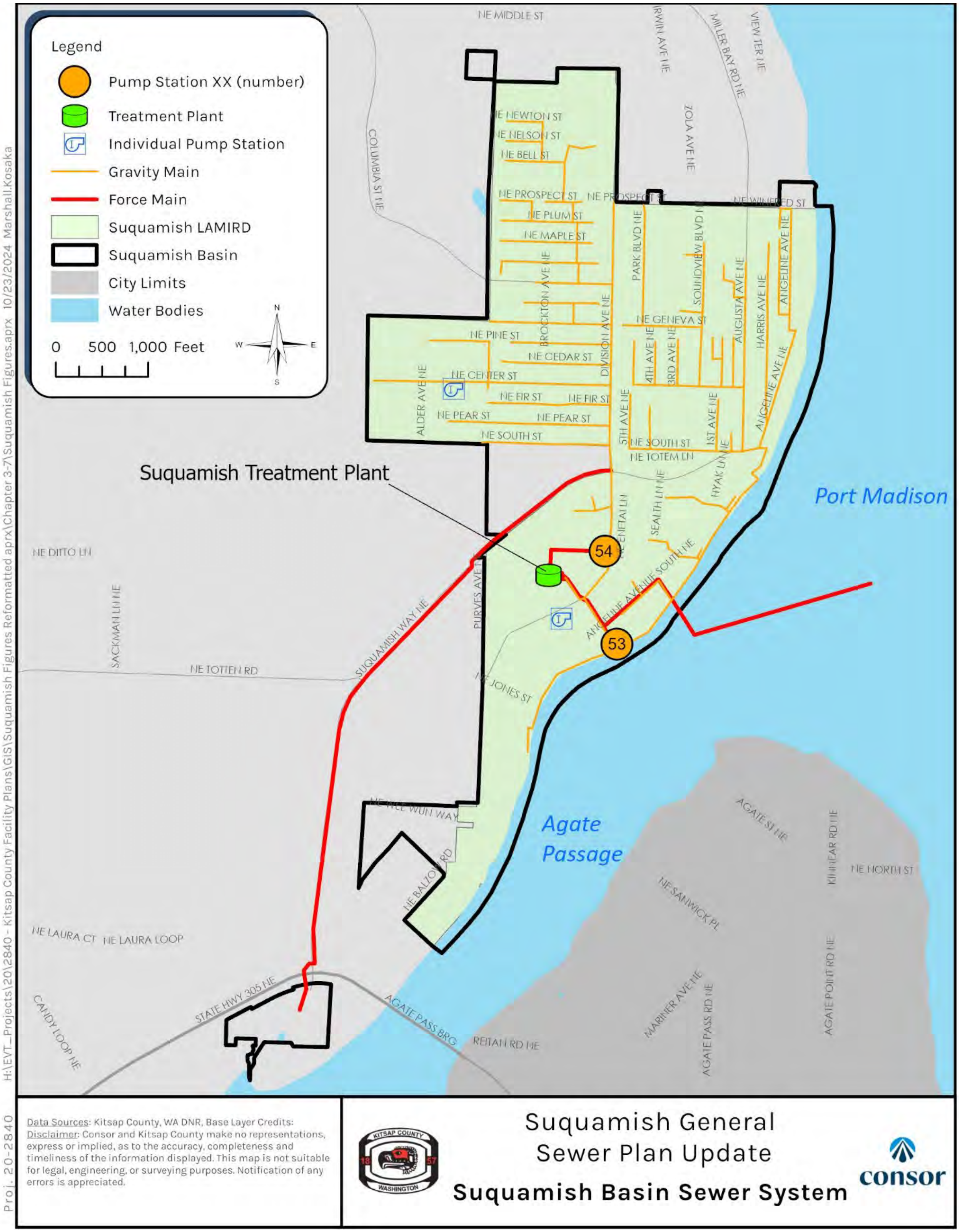
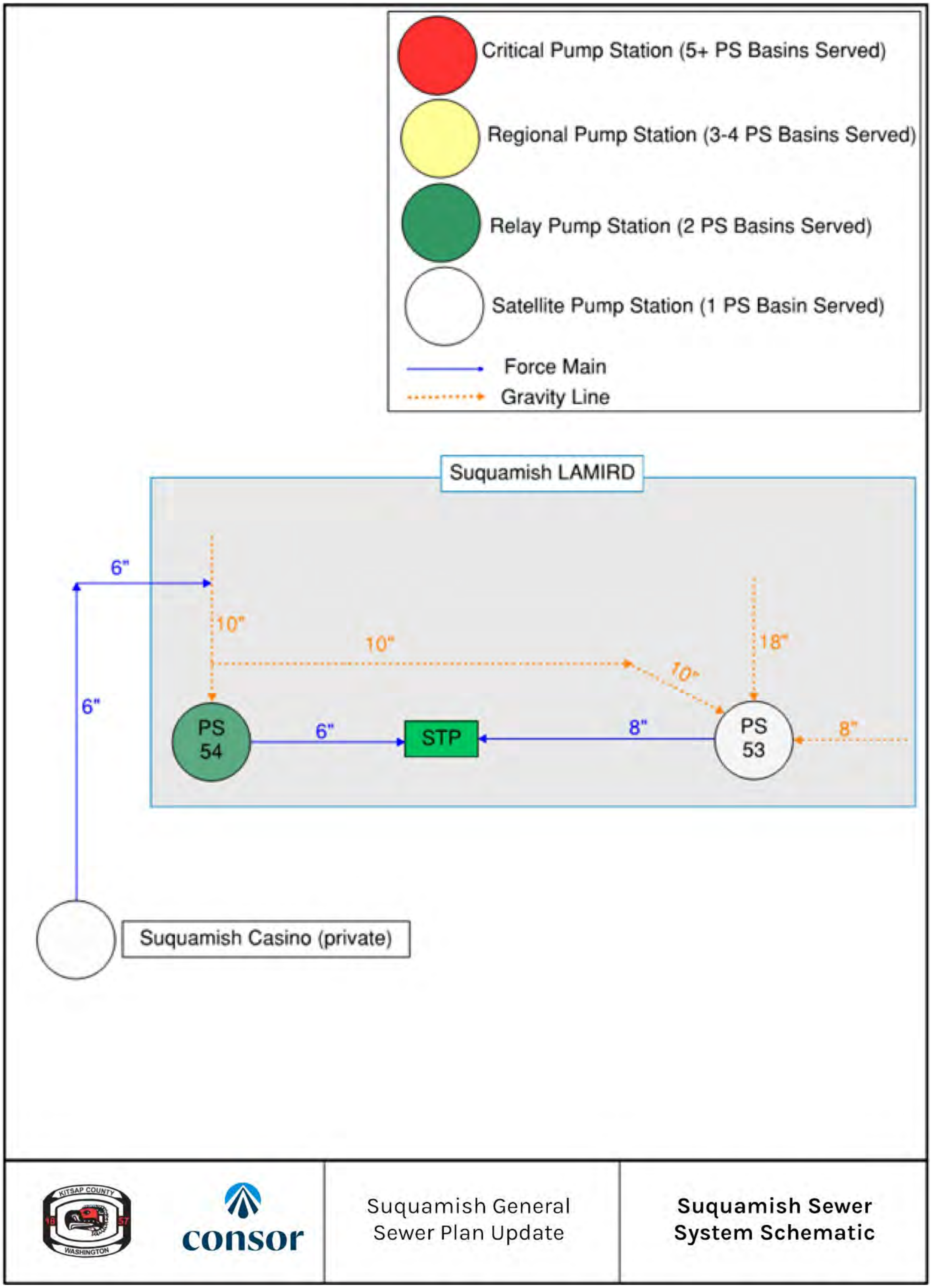


Figure 5-2 | Suquamish Basin



The Suquamish basin currently contains three mini basins: PS-53, PS-54, and Suquamish Casino. It is anticipated that sewer service will be expanded to cover the Suquamish LAMIRD with two additional basins: PS-53 – Future, and PS-54 – Future.

The PS-53 mini basin covers approximately 141 acres in the west of the basin. It receives flows via gravity conveyance including bypass flows from PS-54. It pumps flow via an 8-inch force main to the Suquamish Treatment Plant.

The PS-54 mini basin covers approximately 140 acres, primarily in the northwest of the basin. The pump station receives flow via gravity conveyance, including pumped flow from the Suquamish Casino mini basin. The pump station pumps flow via a 6-inch force main to the Suquamish Treatment Plant.

The Suquamish Casino mini basin covers approximately 27 acres to the southwest of the Suquamish LAMIRD. The basin pumps flow via a private force main which discharges to gravity conveyance upstream of PS-54.

The existing and anticipated mini basins are shown in **Figure 5-3**.

5.2.2 Gravity Sewer

There are approximately 55,000 feet of gravity sewer pipes in the Suquamish basin collection system ranging in size from 6 inches to 18 inches in diameter. The County owns most of the gravity pipe in the Suquamish collection system, approximately 87 percent of which is 8 inches in diameter. The gravity sewer pipe is primarily concrete pipe comprising approximately 75 percent of the system by length. There is also a significant amount of PVC piping, comprising approximately 23 percent. The high-density polyethylene (HDPE) and ductile iron pipe make up the reminder of gravity pipe in the collection system. An inventory of gravity sewer pipe is summarized in **Table 5-1**. Pipe lengths are calculated based on GIS data provided by the County in October 2023. An updated total length was also provided by the County's sewer asset count in March 2024.

Table 5-1 | Gravity Sewer Pipe Inventory

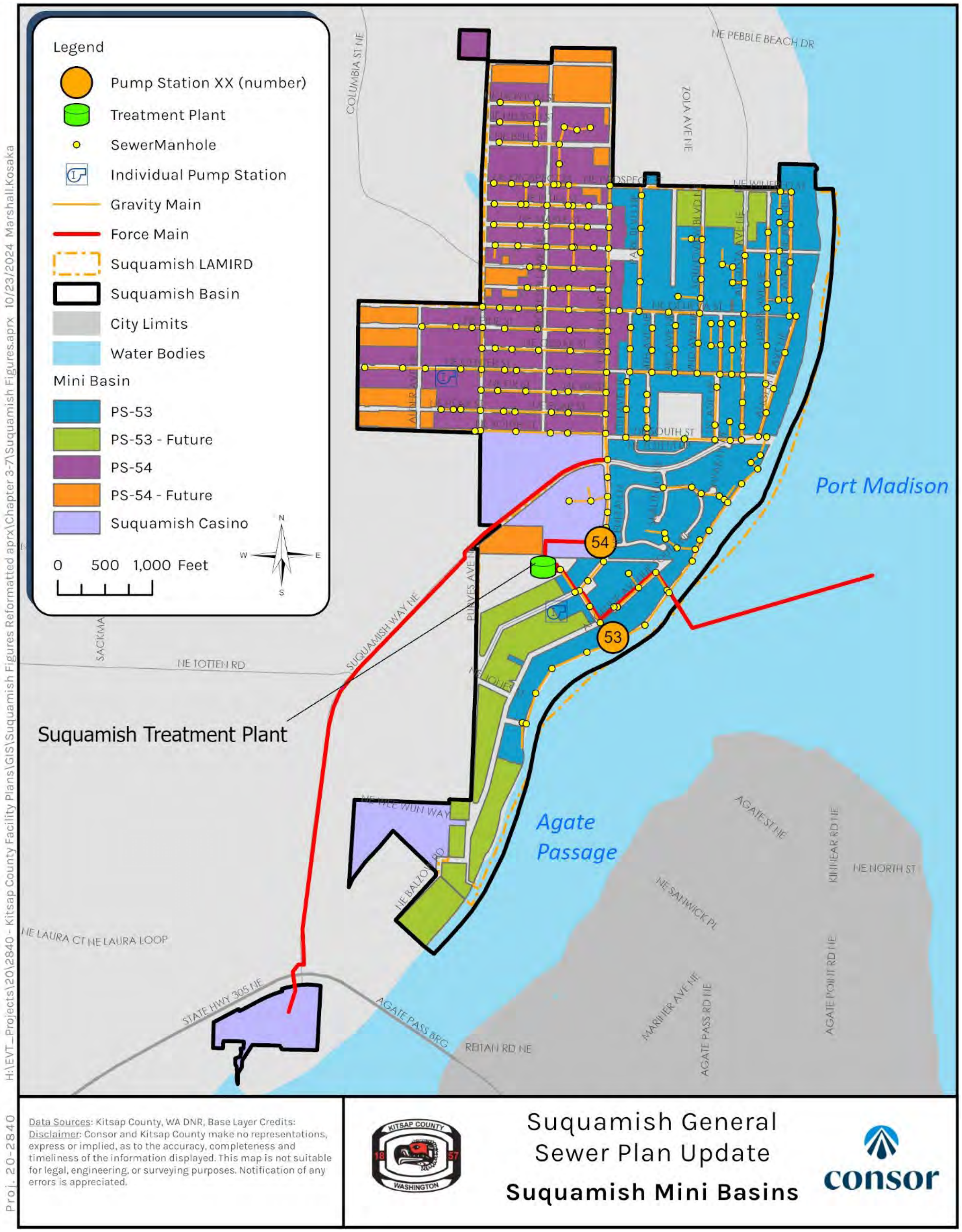
Pipe Diameter (in)	Total Length (ft)
6	243
8	45,372
10	2,341
12	1,755
18	2,403
Total Gravity (2023 GIS)	**52,114**
Total Gravity Including Private (2024 Sewer Asset Count)	**54,770**

In addition to the County owned gravity sewer pipes, there is also approximately 2,000 feet of privately owned gravity pipes in the Suquamish collection system. Private gravity sewer pipes are summarized in **Table 5-2**.

Table 5-2 | Private Gravity Pipe Inventory

Pipe Diameter (in)	Total Length (ft)
6	133
8	1,987
Total Private Gravity	**2,120**

Figure 5-3 | Suquamish Basin Mini Basins



5.2.3 Force Mains

The County owns approximately 2,000 feet of sewer force mains in the Suquamish basin. The force mains convey wastewater to downstream gravity conveyance or the WWTP. **Table 5-3** provides a summary of force mains in the Suquamish sewer system. There is approximately 7,000 feet of 8-inch diameter privately owned force main in the Suquamish basin. This privately owned force main serves the Suquamish Casino and conveys flow from the Casino to gravity conveyance within the basin which is tributary to LS-54.

Table 5-3 | Force Main Summary

Force Main Diameter (in)	Total Length (ft)
6	891
8	1,100
Total Force Main (2023 GIS)	**1,991**
Total Force Main Including Private (2024 Sewer Asset Count)	**9,413**

5.2.4 Individual Pump Stations

There are two IPS systems within the Suquamish basin which are shown on the map in **Figure 5-3**. These systems consist of a relatively small pump basin where the customer's waste stream is ground to a slurry and pumped through small diameter force mains to the gravity system. These systems are best used in gravity basins where individual or small groups of customers are unable to discharge directly to the gravity system because of their local topography. The IPS do not tend to develop significant odor problems due to the reduced residence time of the waste stream if force main lengths are relatively short and properly sized. However, the deposition of solids is a concern if scouring velocities are not reached on a regular basis.

5.2.5 Odor Control

Odor control facilities are not present at the pump stations in the Suquamish basin.

5.2.6 Pump Stations

There are two pump stations within the Suquamish sewer system, PS-53 and PS-54. PS-54 has a firm capacity of 350 gallons per minute (gpm) and PC-53 has a firm capacity of 360 gpm. **Table 5-4** summarizes the existing pump stations based on data provided by the County.

Table 5-4 | Pump Stations Summary

Pump Station	Location	Year Built/ Upgraded	VFD	Firm Capacity (gpm)	Static Head (ft)	Total Dynamic Head (ft)	No. of Pumps	Pump HP	Individual Force Main		Mini Basins Served	Generator
									Diameter (in)	Length[1] (ft)		
PS-53	Suquamish Waterfront	1977	N	360	100	108	2	25	8	1,100	PS-53	None; Power from WWTP
PS-54	18000 Suquamish Way NE Suquamish, WA 98392	1998	N	350	18	26	2	9.4	6	891	PS-54, Suquamish Casino	None; Power from WWTP

Note:

1. Length is length of force main from the pump station to the Suquamish WWTP

VFD: Variable Frequency Drive

HP: Horsepower

5.3 Pump Station Conditions Assessments

In September 2020, Murraysmith [now Consor] staff visited the pump stations in the Suquamish basin and conducted site assessments of each facility. During these site visits, staff documented each pump station's current components and systems and their condition. Subconsultant Industrial Systems, Inc. documented electrical equipment conditions and potential code violations. An assessment form was filled out for each pump station visited and is included as **Appendix B**.

5.3.1 Condition Summary Tables

To better organize the results of these assessments, the equipment and systems at the pump stations were arranged in several categories. While no two pump stations are identical, the stations are anatomically similar and can be characterized by a standardized set of component groupings. These component groupings are consistent with County Asset Functional Class Levels and are presented in **Table 5-5** along with definitions of the systems each comprises.

Table 5-5 | Component Group Definitions

Component Grouping	Constituent Systems and Components
Civil	Site, roadways, sidewalks, fencing
Structural	Buildings, tanks, vaults, wetwells, equipment pads, Parshall flumes
Pumping Systems	Pumps, suction, and discharge valves, check valves
Motors	Motors associated with pumps or rotating machinery.
Piping Systems	Suction piping, discharge headers, drain lines, backflushing lines, water lines, chemical dosing lines, segments of on-site force main
Valve Systems or Assemblies	Odor control system valves, washdown water valves
Support Systems	Compressed air systems, potable water, fire suppression, heating, ventilation, and air conditioning (HVAC)
Instrumentation	Level indicators, flow meters, pressure gauges, water quality analyzers, supervisory control and data acquisition (SCADA) systems, network hardware, panel views
Electrical and Power Distribution	Electrical systems between motor control center (MCC) and main power disconnect, standby generators, transfer switches, lighting

5.3.2 Pump Station Asset Health Score

A pump station 'Asset Health Score' was developed that synthesizes each pump station's existing likelihood of failure (condition) and consequence of failure (CoF). The score was developed to better inform the County's prioritization of future asset upgrades and replacements.

For structural components like buildings and wetwells, individual condition ratings generally apply to the physical integrity of these assets in the face of material degradation due to environmental forces such as corrosion, weathering, settling, and flooding. Individual condition scores for mechanical, electrical, and instrumentation systems consider each system's physical integrity and their current ability to perform as designed. General observations and historical accounts from County O&M staff were also used to inform the condition ratings for all pump station components to incorporate phenomena not observed by staff during the site visits. Examples of this historical information from O&M staff include, but are not limited to, observed high frequencies of check valve failures, power outages, pump ragging, and pump seal failures. Individual condition ratings range from 1 to 5, with a score of 1 representing the best condition and a score of 5 representing the worst. It is important to note that condition scores are not simply reflections of age as dissimilar environmental and operational factors among the County's pump stations necessitate differing rates of condition degradation. Although age/obsolescence is not accounted for in the condition assessment, it will be a consideration for development of the 20-year CIP so that replacement of aging infrastructure is accounted for and can be budgeted. **Table 5-6** presents the definition of the component condition scores.

Table 5-6 | Component Condition Scores Definitions

Condition Rating	Definition
1	Very Good, well maintained, expected to remain reliable for more than 90% of the expected life.
2	Good, some degradation but performance and reliability are not significantly affected. Performance and reliability expected to remain satisfactory for 50-90% of the expected life.
3	Fair, performance and reliability are still acceptable, but some rehabilitation or replacement will be needed in the 50% +/- of the expected life.
4	Poor, performance and/or reliability has significantly decreased, maintenance rehabilitation or replacement needed to restore performance or reliability to acceptable levels. Failure (no longer functions) is likely in 10-50% of the expected life if not rehabilitated or replaced.
5	Very poor, performance and/or reliability has significantly decreased, and failure is probable within 10% of the expected life if rehabilitation or replacement is not performed.

Individual CoF ratings for pump station components are based on a consideration of the effects of failure of each component within the context of the local pump station. Individual CoF ratings range from 1 to 5, with a score of 1 representing the lowest consequence and 5 representing the highest. **Table 5-7** presents the definition of the CoF scores.

Table 5-7 | Component Consequence of Failure Definitions

CoF Rating	Definition
1	Not Managed. Failure would not affect the pump station operation
2	Not Critical. Could marginally reduce the pump station capacity or performance
3	Important (critical but redundant). The pump station performance is significantly impacted without a currently installed redundant component
4	Critical. The pump station performance is significantly impacted upon failure.
5	Highly Critical. Failure will cause an immediate loss of hydraulic throughput.

To fully develop an overall pump station score, the individual condition and criticality scores of each pump station's systems and components were considered within the larger context of the Suquamish basin. To accomplish this, an overall pump station CoF score (from a system-wide perspective) is applied to an overall condition score for each station. This pump station criticality score is based on County conventions for pump station CoF rankings (Sheridan, Chris M. "FKC205-20 Pump Station Criticality Map 02272019", Message to Erika Schuyler. September 10, 2020. E-mail), in which a station's criticality is defined by the number of pump stations tributary to it. **Table 5-8** presents the overall criticality scores and ranking conventions.

Table 5-8 | Station Type Consequence of Failure Definitions

Station Type (from County)	Station CoF Score	Tributary Pump Stations	Total Station Flows Handled
Satellite	2	0	1
Relay	3	1	2
Regional	4	2-3	3-4
Critical	5	4+	5+

Overall condition scores for each station are weighted by component CoF and are defined as the quotient of the sum of the products of individual component condition and CoF scores and the sum of individual component criticality scores. This scoring is represented symbolically as follows:

$$Overall\ Condition\ Score\ \equiv \frac{\sum_{Components}(Condition\ Score\ \times Criticality\ Score)}{\sum Individual\ Criticality\ Scores}$$

This overall condition score is then scaled by the station CoF score to obtain the overall pump station score:

$$Asset\ Health\ Score\ \equiv Overall\ Condition\ Score\ \times Station\ Criticality\ Score$$

The results of the analysis described in the preceding paragraphs are summarized in **Table 5-9** and detailed in **Table 5-10**. Note that condition and CoF scores (columns 4 and 5, rows 2 through 10) are for individual components; overall condition and station CoF scores are presented in row 1 of columns 4 and 5, respectively. The Asset Health Score informs CIP ranking.

Table 5-9 | Station Asset Health Summary

Pump Station	CoF	Condition	Asset Health Score
53	2.0	3.5	7.0
54	2.0	3.7	7.4

Table 5-10 | Pump Station Condition Assessments

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
53	7.0	Overall	3.5	2.0	1977	➢ Occasional ragging has been observed. ➢ High I&I due to uplands, downspouts, and proximity to beach. ➢ Corrosion noted in dry can; likely due to saltwater as dry can has sprung leaks in the past ➢ County M&O staff have expressed desire to replace with a submersible pump station. ➢ Station is a Smith & Loveless style dry can configuration. ➢ The National Electrical Manufacturers Association (NEMA) 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to National Fire Protection Association (NFPA) 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards
		Civil	4.0	2.0	1977		
		Structural	4.0	5.0	1977		
		Pumping Systems	3.2	5.0	1977		
		Motors[1]	3.0	3.0	1977		
		Piping Systems	3.0	5.0	1977		
		Valve Systems or Assemblies	3.0	2.0	1977		
		Support Systems	3.0	1.0	1977		
		Instrumentation	3.0	5.0	1977		
		Electrical and Power Distribution	5.0	5.0	1977		
54	7.4	Overall	3.7	2.0	1998	➢ Station used to have VFDs which caused issues. They were replaced with constant speed starters which improved station operations. ➢ One pump is original, the other was replaced around 2018. ➢ Groundwater comes into the panel via conduit. The panel should be raised to avoid water entrance. ➢ Hatch is difficult to open. ➢ NEMA 12 rated enclosure is severely corroded from exposure to water which enters the cabinet through poorly sealed and potentially corroded conduits. This corrosion has, in the past impacted Pump Station operations. ➢ The wet well pump motor control panel according to NFPA 820 falls within the Wet Wells Class 1 Div 2 hazardous area classification boundary envelope of 36" horizontally from a vent originating from the Wet Well. ➢ This electrical enclosure and its conduits currently do not comply with proper installation in hazardous classified areas according to the current edition of the NFPA 820. Reference NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Replace starter panel with "Air Gap" style motor pump control panel. ➢ Electrical code violations will need to be brought up to current NFPA 70 (NEC) and NFPA 820 standards by moving electrical enclosure.
		Civil	4.0	2.0	1998		
		Structural	3.0	5.0	1998		
		Pumping Systems	3.8	3.0	1998/2018		
		Motors (greater than 25hp only)	3.8	3.0	1998		
		Piping Systems	4.0	5.0	1998		
		Valve Systems or Assemblies	3.0	2.0	1998		
		Support Systems	3.0	1.0	1998		
		Instrumentation	3.0	5.0	1998		
		Electrical and Power Distribution	5.0	5.0	1998/2004		

5.4 Pipeline Conditions Assessments

The County has historically conducted pipeline condition assessments through video observation. This process entails inspecting pipe pipes via closed circuit television (CCTV), storing the video in a database, reviewing the video, and assigning an Overall Condition Index (OCI) score based on the observations. The results of these assessments have been stored in their asset management database software, Cartegraph, since 2017. They are on a five-year inspection cycle with about 20 percent of the pipes inspected each year. As of this writing, 100 percent of the collection system has been inspected and an evaluation has been stored in Cartegraph.

The County uses a consistent scoring criterion when reviewing pipeline inspection videos with several criteria, which is summarized in **Table 5-11.** Each criterion has a defined score corresponding to the severity of the observed issue, if any. Lower scores indicate more severe issues based on this scoring methodology. Note that "Roots" and "I&I" have a weighting of zero which excludes these criteria from the OCI. The County captures information so that it can be filtered and viewed in Cartegraph, but other categories describe the actual pipe conditions. For example, a pipe with roots present would also be scored under the obstruction or intrusion category. The OCI is calculated by this equation:

$$OCI = \frac{\sum_{pipe}(Category\ Value\ x\ Calculation\ Weight)}{\sum_{pipe} Calculation\ Weight}$$

Table 5-11 | OCI Criteria and Weighting

Category	Value	Description	Calculation Weight
Roots	0	Blockage	0
	30	Heavy	
	50	Medium	
	80	Light	
	100	None	
I & I	40	Gushing or Spurting	0
	60	Running or Trickling	
	80	Weeping or Dripping	
	90	Stain, Possible I&I	
	100	None	
Obstruction or Intrusion	0	Severe or Impassable	1
	60	Moderate	
	80	Minor	
	100	None	
Worn Surface	40	Severe	1
	60	Moderate	
	80	Minor	
	100	None	
Belly or Sag	40	Severe (>30%)	1
	60	Moderate (10 to 30%)	
	80	Minor (<10%)	
	100	None	

Category	Value	Description	Calculation Weight
Cracks or Fractures	40	Severe Cracking	3
	60	Moderate Cracking	
	80	Minor Cracking	
	100	None	
Break or Failure	0	Collapse	5
	15	Hole Void Visible	
	30	Hole Soil Visible	
	100	None	
Lining or Repair Failure	40	Severe	1
	60	Moderate	
	80	Minor	
	100	None	
Joint Separation or Offset	40	Severe (> 1.5 Pipe Thickness)	2
	60	Moderate (1 to 1.5 Pipe Thickness)	
	80	Minor (< Pipe Wall Thickness)	
	100	None	

The County provided OCI scores for 18,017 feet of pipe in the Suquamish basin where issues were found. This data is included as **Appendix C**. Because only pipes with noted deficiencies were input into Cartegraph, it is assumed that inspected but unscored pipes have an OCI of 100. Discussions with County staff indicate that the pipes inspected and documented in Cartegraph are representative of the system as a whole. For planning purposes, the lengths of pipe in each OCI range have been extrapolated and are summarized in **Table 5-12**. The rankings of most of County-owned pipelines in the Suquamish basin are not below a threshold of an OCI score of 60, so there will be no prioritizations nor projected annual costs for pipeline replacement in the CIP for these pipelines. The only exception is pipe D23-2064-D23-2063 which has an OCI score of 51. It is an 8-inch diameter pipe located at NE Fir Street and Brockton Avenue NE.

Table 5-12 | Percentage of Pipes in OCI Condition Ranges

OCI Range	Length (ft)	Percentage of Total
0-20	-	0%
20-40	-	0%
40-60	212	<1%
60-80	-	0%
80-99	9,400	17%
100	45,200	83%

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SECTION 6

Wastewater Treatment Facilities Existing Conditions

6.1 Introduction

A description of the existing Suquamish WWTP field evaluation and condition assessment, the capacity analysis of the plant facilities and processes, and an evaluation of each process to identify any deficiencies is presented in **Section 6**. Recommendations are provided to address challenges impacting facility operations along with maintenance upgrades necessary to continue meeting NPDES Permit requirements.

6.2 Existing Wastewater Treatment Plant Description

The original Suquamish WWTP was constructed in 1975 as an activated sludge process with chlorination and had a capacity of treating 0.2 MGD. In 1997, the plant was reconstructed with a new headworks, two SBRs, a UV disinfection system, and solids thickening. It was designed for a maximum monthly flow rate of 0.4 MGD and a peak flow of 1.0 MGD. Much of the infrastructure constructed in 1997 remains in use today. The most recent treatment plant update occurred in 2017 when the sludge thickening equipment was replaced with an RDT system and a new TSST and loadout facility was constructed. Thickened biosolids are hauled to the Central Kitsap WWTP, which is also owned and operated by the County, for further treatment. Treated effluent is discharged to the Port Madison of the Puget Sound through the original outfall pipe and diffuser 2285 feet offshore and 43 feet deep to a depth of 43.4 feet below mean lower low water (MLLW) in accordance with the NPDES Permit requirements. The Suquamish WWTP site plan is shown in **Figure 6-1**. **Figure 6-2** shows the process schematic of the current Suquamish WWTP.

6.3 Wastewater Treatment Plant Condition Assessments

The Murraysmith [now Consor] team visited the Suquamish WWTP on September 17, 2020 to observe and document existing plant conditions and to have discussions with plant staff regarding operational and plant performance challenges. The group investigated facilities and unit processes for the liquid streams and solids streams by walking through each process to ascertain equipment condition and manufacturing information. WWTP electrical equipment and structures were observed. Plant staff provided information on the daily operations of the plant, and past and current operational challenges. The information gathered from the assessment was used to develop a list of recommendations for maintaining plant operations and performance. The major equipment information, photos and field notes are summarized as **Appendix D**.

Figure 6-1 | Existing Suquamish WWTP Site Plan

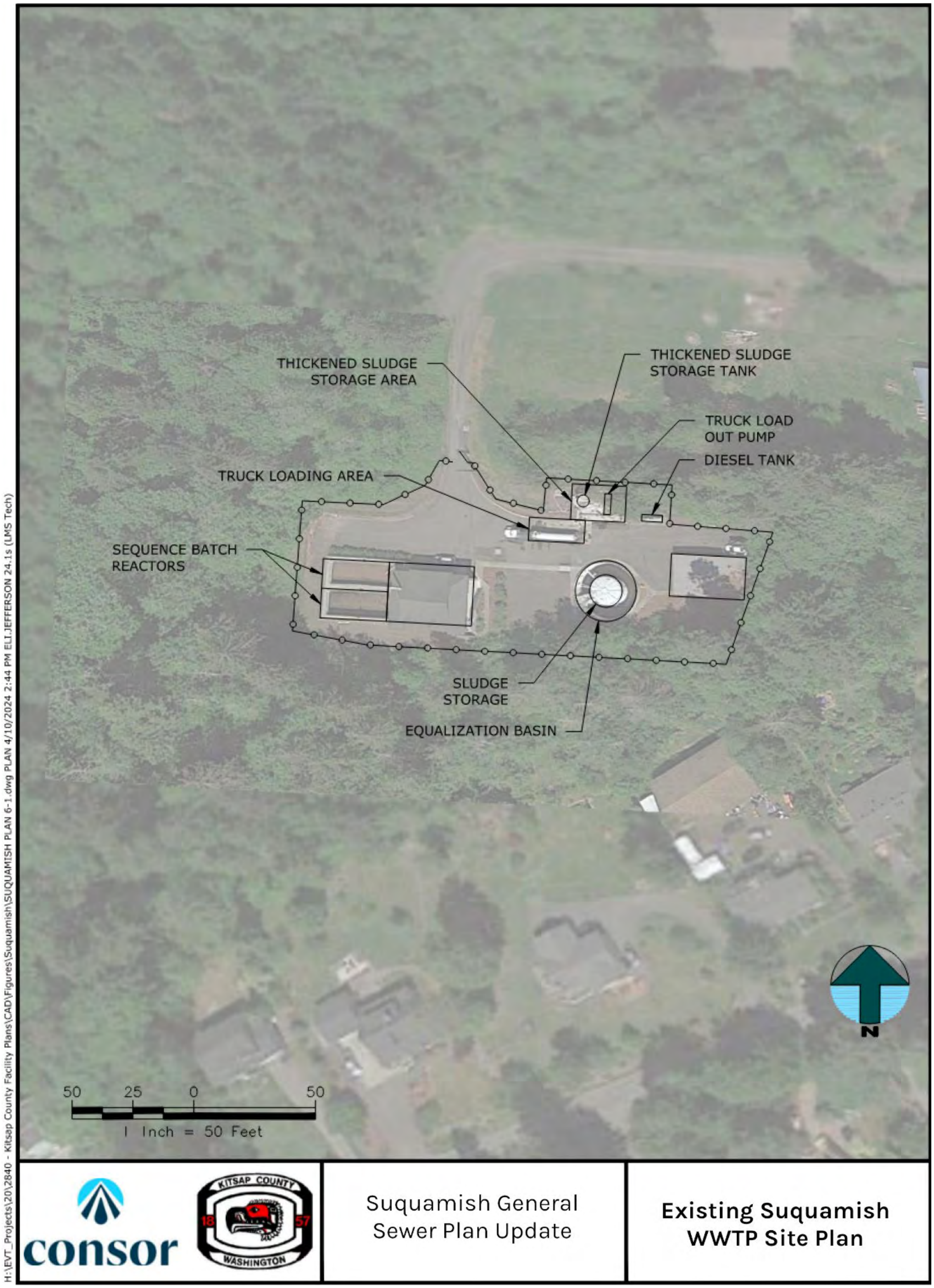
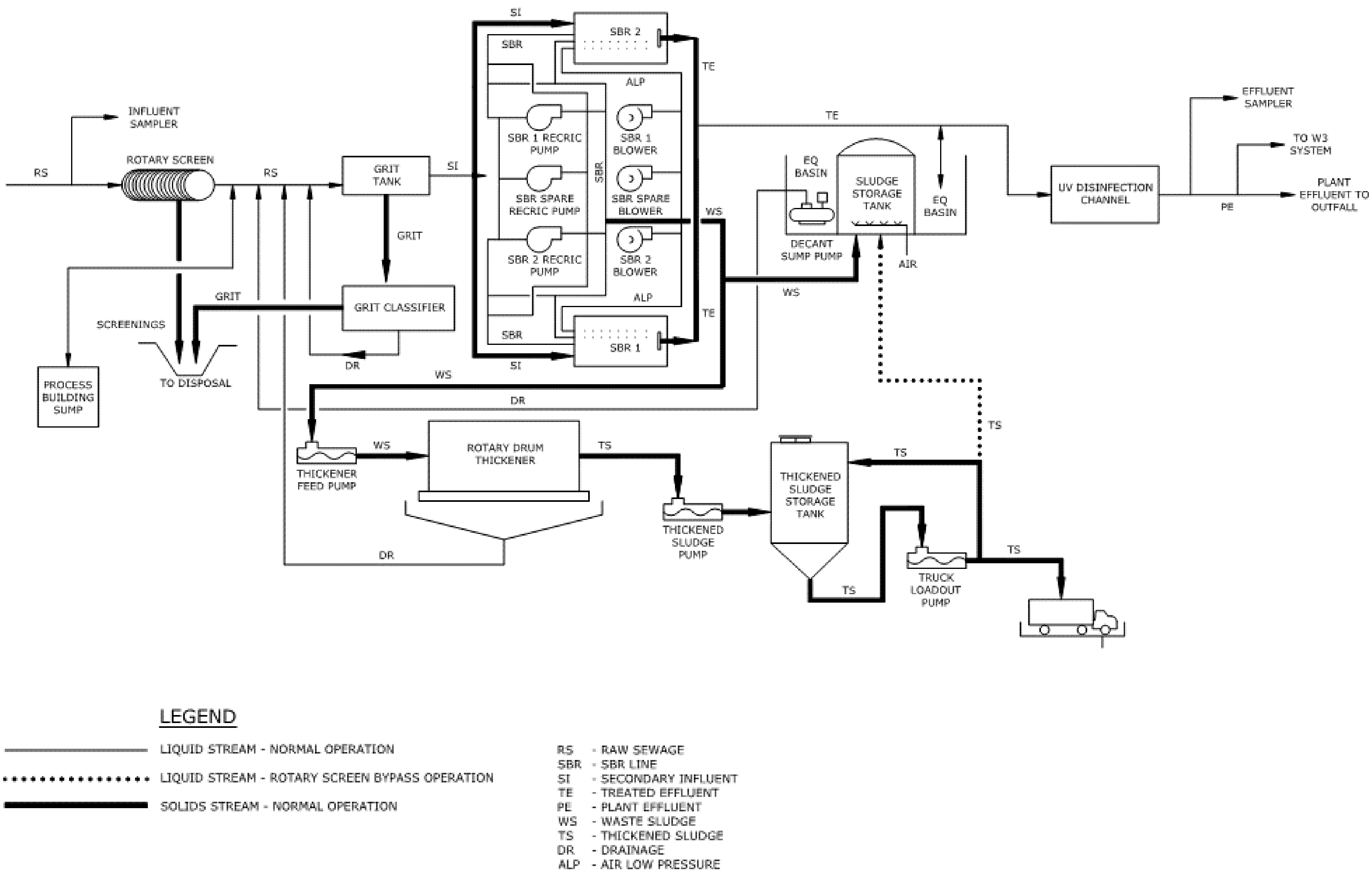


Figure 6-2 | Existing Suquamish WWTP Schematic



6.3.1 Condition Summary Tables

To better organize the results of the assessments at the Suquamish WWTP, major processes were grouped as presented in **Table 6-1**.

Table 6-1 | WWTP Process Group Definitions

Process	Components
Civil	Site, site security, roadways, sidewalks, fencing
Preliminary Treatment	Screens and grit removal and associated equipment and piping
Secondary Treatment	SBR basins and associated equipment and piping
Effluent and UV	Equalization basin and UV system
Solids Treatment	Aerated Sludge Storage Tank (ASST), TSST, RDT and associated equipment and piping
Support Systems	Odor control, plant water system and process building sump pumps
Power Distribution	Electrical services, transfer switches, standby generator, motor control centers and control panels

These processes were further broken down into several categories when appropriate. While no two processes are identical, the processes are anatomically similar and can be characterized by a standardized set of component groupings. These component groupings are consistent with County Asset Functional Class Level and are presented in **Table 6-2** along with definitions. Note that the Asset Functional Class Level has nine groups: Civil, Structural, Piping Systems, Pump Systems, Valve System or Assemblies, Equipment, Support Systems, Instrumentation, Power Distribution. However, for the WWTP conditions assessments, the components are narrowed down to four groups, which are more directly applicable to the wastewater treatment processes. Civil, Power Distribution and Support Systems are treated as processes; Piping and Valves are grouped together; Pumps are grouped with Equipment.

Table 6-2 | Component Group Definitions

Component Grouping	Definitions
Equipment	Mechanical equipment such as screens, pumps, and blowers. Equipment and motors are treated as one asset unless the motor is 25 HP or larger.
Instrumentation	Electrical and measuring devices such as flowmeters, transmitters, and indicators.
Structural	Concrete structures such as buildings, basins, and tanks.
Piping	A system of pipes and valves used to convey fluids such as influent, effluent, chemical, air and sludge.

6.3.2 Treatment Plant Process Asset Health Score

To better inform the County's prioritization of future asset upgrades and replacements, an overall treatment plant process "asset health" score was developed with County input that synthesizes each process's existing likelihood of failure (condition) and CoF.

Individual condition scores for equipment, instrumentation, and piping systems consider each system's physical integrity and their current ability to perform as designed. For structural components, individual condition ratings generally apply to the physical integrity of these assets in the face of material degradation due to environmental forces such as corrosion, weathering, settling, and flooding. General observations and historical accounts from County O&M staff were also used to inform the condition ratings for all treatment plant process components in an effort to incorporate conditions not observed by staff during the site visits. Examples of this historical information from O&M staff include, but are not limited to, challenges associated with equipment operation, lack of redundancy and lack of automation. Individual condition ratings range from 1 to 5, with a score of 1 representing the best condition and a score of 5 representing the worst. **Table 6-3** presents the definition of the condition scores. It is important to note that condition scores are not simply reflections of age as dissimilar environmental and operational factors among the Suquamish WWTP processes necessitate differing rates of condition degradation. Although age/obsolescence is not accounted for in the condition assessment, it will be a consideration for development of the 20-year CIP so that replacement of aging infrastructure is accounted for and can be budgeted.

Table 6-3 | Component Condition Scores Definitions

Condition Rating	Definition
1	Very Good, well maintained, expected to remain reliable for more than 90 percent of the expected life.
2	Good, some degradation but performance and reliability are not significantly affected. Performance and reliability expected to remain satisfactory for 50-90 percent of the expected life.
3	Fair, performance and reliability are still acceptable, but some rehabilitation or replacement will be needed in the 50 percent +/- of the expected life.
4	Poor, performance and/or reliability has significantly decreased, maintenance rehabilitation or replacement needed to restore performance or reliability to acceptable levels. Failure (no longer functions) is likely in 10-50 percent of the expected life if not rehabilitated or replaced.
5	Very poor, performance and/or reliability has significantly decreased, and failure is probable within 10 percent of the expected life if rehabilitation or replacement is not performed.

Individual CoF ratings for process components are based on consideration of the effects of failure of each component within the context of the local process. Individual CoF ratings range from 1 to 5, with a score of 1 representing the lowest consequence and 5 representing the highest. **Table 6-4** presents the definition of the CoF scores.

Table 6-4 | Component Consequence of Failure Definitions

CoF Rating	Definition
1	Not Managed. Failure would not affect the treatment plant operation.
2	Not Critical. Could marginally reduce the treatment performance
3	Important (Critical but redundant). The treatment plant performance is significantly impacted without a currently-installed redundant component.
4	Critical. The treatment plant performance is significantly impacted upon failure.
5	Highly Critical. Failure will cause an immediate loss of hydraulic throughput.

To fully develop an overall treatment plant process score, the individual condition and CoF scores of each unit process was considered within the larger context of the Suquamish WWTP. To accomplish this, an overall treatment plant unit process CoF score (from a plant-wide perspective) is applied to an overall condition score for each unit process. The definition of the overall unit process CoF scores are the same as the definition of the component CoF scores and are summarized in **Table 6-5** below.

Overall condition scores for each unit process are weighted by component CoF and are defined as the quotient of the sum of the products of individual component condition and CoF scores and the sum of individual component CoF scores. This scoring is represented symbolically as follows:

$$Overall\ Condition\ Score = \frac{\sum_{Components}(Condition\ Score\ \times CoF\ Score)}{\sum Individual\ CoF\ \ Scores}$$

This overall condition score is then scaled by the unit process CoF score to obtain the overall treatment process Asset Health Score:

$$Asset\ Health\ Score = Overall\ Condition\ Score\ \times Unit\ Process\ CoF\ Score$$

The results of the analysis described in the preceding paragraphs are summarized in **Table 6-5** and detailed in **Table 6-6**. The Asset Health Score will be used to rank the projects in the CIP.

Table 6-5 | Treatment Plant Process Asset Health Summary

Unit Process	Unit Process CoF Score	Overall Condition Score	Asset Health Score
Civil	1	2.0	2.0
Preliminary Treatment	3	3.1	9.3
Secondary Treatment	5	3.5	17.5
Disinfection and Effluent	3	3.4	10.2
Solids Treatment	3	2.0	6.0
Support Systems	3	1.3	3.9
Power Distribution	5	3.0	15.0

Table 6-6 | Treatment Plant Unit Process Condition Assessments

Unit Process[1]	Asset Health Score	Process Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
Civil	**2.0**	**Overall**	**2.0**	**1.0**	1997	➢ The fence is in good condition ➢ The site is remote and not visible from the roadway. Landscaping on the site is well-maintained	➢ Consider adding an automatically opening gate, intrusion alarms, and video surveillance
Preliminary Treatment	**9.3**	**Overall**	**3.1**	**3.0**		➢ The rotary screen is in poor condition with some visible exterior corrosion ➢ The grit pumps show signs of leaking and corrosion	➢ General maintenance practice to mitigate corrosion ➢ Prioritize replacement of the influent rotary screen and grit pumps in the next 5 years ➢ Keep screen channel cover plates on; air ventilation test and balance within the RDT room; install lower explosive limit (LEL) combustible gas detection in the RDT room
		Equipment	3.5	2.5	1997, 2018		
		Instrumentation	3.0	2.0	1997		
		Structural	2.0	4.0	1997		
		Piping	4.0	4.5	1997, 2018		
Secondary Treatment	**17.5**	**Overall**	**3.5**	**5.0**		➢ Many pipe and valve connections of the SBR recirculation piping show signs of leaking ➢ Many sections of the piping are field welded in place without sleeves or couplings for dismantling which makes repairs and replacement very difficult. ➢ Aeration system does not have necessary probes, blower VFDs, or SCADA for process control ➢ Existing SBR process does not have ability to allow one basin offline for an extended duration while maintaining normal operation	➢ Recoat SBR basins and replace piping and valves ➢ When the secondary process needs to be upgraded, replace blowers with variable speed blowers with continuous DO monitoring, replace jet system with fine bubbles, and replace pumping system ➢ Consider installing redundant SBR basin or influent storage to improve reliability of the secondary treatment
		Equipment	3.1	3.0	1997		
		Instrumentation	3.0	2.0	1997		
		Structural	2.0	4.0	1997		
		Piping	5.0	5.0	1997		
Disinfection and Effluent	**10.2**	**Overall**	**3.4**	**3.0**		➢ Outer and inner walls of the equalization structure are corroded. ➢ The effluent control valve is currently not functioning, a manual control valve is used now ➢ Due to the intermittent flows into UV disinfection, banks cycle on and off frequently resulting in increased lamp failure ➢ Effluent flow is limited to approximately 1 MGD	➢ Replace the equalization basin with a larger covered structure in the next 2 to 10 years ➢ Replace the effluent control valve ➢ Replace the entire UV system for improved control in the next 2 to 10 years ➢ Further investigate the effluent pipe to determine it's capacity
		Equipment	3.3	3.3	1997		
		Instrumentation	2.0	4.0	1997		
		Structural	4.0	4.0	1997		
		Piping	4.0	5.0	1997		
Solids Treatment	**6.0**	**Overall**	**2.0**	**3.0**		➢ ASST shows widespread interior and exterior corrosion, and the access hatch is broken ➢ The motor of the flocculation tank mixer and the flocculation lid show signs of corrosion ➢ The thickened sludge pump shows significant corrosion, and cannot pump due to high discharge pressure when the thickened waste activated sludge (TWAS) concentrations get over 5 percent	➢ Recoat the structure of ASST and repair the access hatch or replace the structure ➢ Monitor corrosion on flocculation tank and mixer; improve the ventilation within the RDT room ➢ Replace the current thickened sludge pump with a larger pump
		Equipment	2.5	2.9	2017, 1997		
		Instrumentation	1.0	2.1	2017, 1997		
		Structural	2.5	4.5	2017, 1975		
		Piping	1.5	3.0	2017, 1997		
Support Systems	**3.9**	**Overall**	**1.3**	**3.0**		➢ The odor control system is only partially operational and occasionally taken out of service; the chemical dosing system is not functional; the exhaust fan is unusually loud; equipment in the headwords/thickening room is showing signs of surface corrosion ➢ Staff report that the plant drain pumps show exterior corrosion, but have no operational issues ➢ Staff report that the fire detection system is not functional	➢ Repair or replace the odor control system to restore automatic operation and full functionality ➢ Add supports to reclaimed water pump volute and pipe ➢ Purchase a shelf spare for plant drain pumps ➢ Plan for replacement for plant drain sump and pumps in the next 2 to 10 years, due to age ➢ Repair or replace the fire detection system
		Equipment	2.6	2.1	2017, 1997		
		Instrumentation	N/A	1.0	1997		
		Structural	N/A	2.0	1997		
		Piping	1.7	2.4	1997		
Power Distribution	**15.0**	**Overall**	**3.0**	**5.0**		➢ The interiors to Panel CP-02 and CP-15 were not accessed and the installation of a controller (e.g., PLC) was not verified ➢ Panels CP-02 and 03 have explosion-proof enclosures that are missing bolts used to maintain their classification rating ➢ The interior of CP-13 was very dusty	➢ Plan to replace automatic transfer switch (ATS), generator and motor control center in the next 12-15 years ➢ Complete arc flash study ➢ Control panel housekeeping per **Section 6.3.3.8**
		Equipment	2.9	3.1	2016, 1998, 1997, 1996		
		Instrumentation	N/A	N/A	N/A		
		Structural	3.0	3.0	1997, 1975		
		Piping	3.0	3.0	1997		

Note:
1. See **Table 6-1** for major equipment included in each unit process

6.3.3 Evaluation of Components

The current treatment plant components are described in more detail in the following sections. Following the description of each major process component is an outline of the observations made by the Murraysmith [now Consor] team and a list of recommended improvements. The major unit process condition, capacity, and recommendations are summarized in **Table 6-18**.

6.3.3.1 Civil

The Suquamish WWTP is secured by a uniform chain link fence with a barbed wire. The site is accessed via a driveway that is shared with a private residence and secured by two manual gates. The first gate is also used by the private property owner, the second gate secures the plant only. There is no video surveillance onsite.

Observation: The fence is in good condition. The site is remote and not visible from the roadway. Landscaping on the site is well-maintained.

Recommendation: The County may want to consider adding an automatically opening gate, intrusion alarms, and video surveillance.

6.3.3.2 Preliminary Treatment

Raw sewage is pumped to the site through a 6-inch diameter force main from the north and an 8-inch diameter force main from the east. Both force mains combine outside the Process Building, which houses headworks, into a single 10-inch diameter force main which enters the Process Building in the northeast corner of the basement. A magnetic flow meter measures the influent flowrate before the influent pipe turns vertically to go up to the top floor.

The headworks is on the upper floor of the Process Building and consists of a ¼-inch opening rotary bar screen, a 1-inch opening manual bar screen, grit removal, and influent composite sampling.

Once the influent pipe reaches the top floor of the building flow discharges into the screening channel where a rotary bar screen removes debris. Influent screenings are collected in a hopper for offsite disposal. After mechanical screening, flow passes through a manual bar screen, then enters a vortex-type grit chamber. Bypass channels are available to bypass both screens and the grit chamber. Grit separated by the grit chamber is pumped to a grit cyclone and inclined screw grit classifier for disposal with the influent screenings. The de-gritted sewage is conveyed to the SBR basins on the west side of the Process Building.

Observations and recommendations for each major process component are outlined below:

6.3.3.2.1 Influent Rotary Fine Screen

Observation: The ¼-inch opening rotary screen was installed in 1997. The rotary screen is in poor condition with some visible exterior corrosion. The screening chute and dumpster are both in good condition with no visible corrosion or leaks. Plant staff reported that the rotary screen is not effectively capturing screenings, and that some screenings are captured at the downstream manual screen.

The influent rotary fine screen is 24 years old and is near the end of its typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have 10 to 50 percent of its expected serviceable life remaining (2 to 10 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: The corroded areas of the screen should be cleaned and coated to prevent further degradation. Prioritize replacement of the influent rotary screen in the next 5 years. Plan for increased maintenance requirements until the system is replaced.

6.3.3.2.2 Influent Manual Screen

Observation: The 1-inch opening manual bar screen was installed in 1997 and is in good condition. The plant staff reported no issues with it. Since it has no moving part, it is estimated that the equipment may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

Recommendation: None.

6.3.3.2.3 Grit Removal

Observation: The grit tank was installed in 1997. The exterior appears to be in good condition. No operational issues were reported by plant staff.

The grit classifier was replaced in 2018 and appears to be in good condition, with no operational issues reported by plant staff. The grit removal mechanism and classifier are expected to exceed their typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

The two grit pumps were installed in 1997. Both grit pumps appear to be in poor condition. The pumps show signs of leaking and corrosion. The grit pumps are 24 years old and are near the end of their typical expected lifespan of 25 to 30 years. It is estimated that the pumps may have 10 to 50 percent of their expected serviceable life remaining (2 to 10 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendations: The corroded areas of the pumps should be cleaned and coated to prevent further degradation. Prioritize replacement of the two grit pumps in the next 5 years. Plan for increased maintenance requirements until the pumps are replaced.

6.3.3.3 Primary Treatment

There is no primary treatment at the Suquamish WWTP. Primary effluent flows from the headworks directly to the SBR basins.

6.3.3.4 Secondary Treatment

Headworks effluent is conveyed through an 18-inch diameter pipe though the Process Building to the two SBRs. Motor operated valves control which basin receives the influent. The basins are operated as batch reactors, with a fill, react, settle, and decant cycle that repeats in coordination with the other basin so that one of the two basins is always filling with influent sewage.

The SBRs are equipped with a jet aeration system with air supplied by three 25-HP blowers in the lower floor of the Process Building. Three SBR recirculation pumps, also located in the lower floor of the Process Building, recirculate the mixed liquor through a jet header and are also used to pump sludge to the ASST. Both the pumps and blowers operate with one each per basin, with the third reserved for standby.

Each SBR has a volume of 0.39 MG which provides a 48-hour retention time at the design peak flowrate when both basins are in operation. The SBRs are operated with cycle times from 335 minutes (low flow mode) to 245 minutes (high-high flow mode), as shown in **Table 6-7**. During the aerated fill, the blowers are cycled on and off to avoid excess oxygen in the mixed liquor after the react mode. During the site visit, the blowers were set to run for 18 minutes and be off for 2 minutes. Dissolved oxygen (DO) is measured manually once daily; however, the County has plans to install permanent DO and ammonia probes. Additionally, operators have been experimenting with longer react times to improve ammonia removal.

Table 6-7 | SBR Basin Operating Cycle Time (min)

Stage	Low Flow Mode	Medium Flow Mode	High Flow Mode	High High Flow Mode
Static Fill	10	10	10	10
Mixed Fill	10	10	10	10
Aerated Fill	140	120	100	90
React	5	5	5	5
Settle	110	100	80	70
Decant	60	60	60	60
Total Cycle Time	335	305	265	245

Effluent from the SBR basins is decanted from the top of the settled basin and conveyed to the equalization basin, then the UV channel in the Process Building. The decant flows out of the SBR basin until the minimum level is reached and then the decant valve closes and the basin is idled until the fill cycle begins.

Waste sludge is withdrawn from the bottom of the settled SBRs and is pumped by the SBR recirculation pumps to the ASST.

Operators report that occasionally during high flow events, a basin will fill so quickly that the SCADA system has to switch influent to the other basin while it is still decanting. This situation occurs rarely and has not caused deterioration of effluent but is indicative of hydraulic limitation in the system.

Only having two SBR basins and no influent equalization storage also presents operational challenges if one basin must be removed from service. During planned basin shutdowns, the County draws water levels down in the on-line basin prior to shutdown and then sends all flow to that basin, gradually refilling it while the other basin is out of service. This operation is only feasible in the drier months and it is only possible to store approximately 24 hours of influent in this manner. These limitations greatly restrict the timing and duration of maintenance activities. In the event of an unplanned shutdown, the influent pump station wet wells can only provide a limited amount of storage before the plant is forced to begin flow through operation. The extent of sludge settling in a flow through basin is limited and the plant would have no way to prevent sludge in the effluent.

Observations and recommendations for each major process component are outlined below.

6.3.3.4.1 SBR Basins and Piping

Observation: The SBR basins were constructed in 1997 and appear to be in good condition. The coating is peeling on the south and west sides of both basins and has been temporarily repaired. The recirculation piping in the Process Building basement is in poor condition. Many pipe and valve connections have leaked. Many sections of the recirculation piping are field welded in place without sleeves or couplings for dismantling which makes repairs and replacement very difficult.

Recommendation: Recoat SBR basins with a high UV resistant coating. Replace the entire piping system. Existing piping has a combination of welded, Victaulic and flanged couplings. Replacement piping should be designed for easier disassembly and repair. Consider installing redundant SBR basins and associated piping or influent storage to improve the reliability of the process.

6.3.3.4.2 SBR Aeration Blowers

Observation: The SBR aeration blowers were installed in 1997 and appear to be in fair condition. They are currently operated on a time basis. DO is manually measured with a portable DO probe once daily at the end of the react period in each SBR. The target DO concentration at the end of the reaction period is 1.0 mg/L.

Staff reported that the SBR aeration blowers function properly and do not require excess maintenance. Automatic DO probes are on order for the plant. The SBR aeration blowers are 24 years old with no noted performance issues or significant visible degradation; therefore, they are expected to exceed their typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Replace the blowers with variable speed blowers with continuous DO and nutrient monitoring in the basin when the secondary process needs to be upgraded for nitrogen removal. Plan for increased maintenance requirements until the blowers are replaced.

6.3.3.4.3 Jet Aeration System

Observation: The jet aeration system was installed in 1997 and consists of low-pressure jet headers located near the bottom of each of the SBR basins. The aeration pipes could not be viewed during the condition assessment; however, operators did not report any problems with the aeration system.

The jet aeration system is 24 years old and is near the end of its typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have 10 to 50 percent of its expected serviceable life remaining (2 to 10 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Replace the jet system with fine bubble diffusers when the secondary process needs to be upgraded for nitrogen removal. Plan for increased maintenance requirements until the system is replaced.

6.3.3.4.4 SBR Recirculation/WAS Pumps

Observation: The SBR recirculation pumps were installed in 1997 and appear to be in fair condition. The SBR recirculation pumps are 24 years old with no noted performance issues or significant visible degradation; therefore, they are expected to exceed their typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Replace the pumping system when the secondary process needs to be upgraded for nitrogen removal. Plan for increased maintenance requirements until the pumps are replaced.

6.3.3.5 Disinfection and Effluent

The effluent equalization basin and sludge storage tank is one circular coated steel structure with a concrete floor to the east of the Process Building. The equalization basin is the outer ring of the structure.

The covered circular ASST sits in the center of the structure. There is an interconnecting piping between the equalization basin and decant piping between SBRs and UV. Decanted flow from the SBRs to the UV is controlled by a control valve and measured with a magnetic flow meter in the basement of the Process Building. The control valve modulates to match the influent flow rate. Decant flow rate is about 2,400 gpm, but the capacity of the UV system is about 800 gpm. Flow will back up to the equalization tank during decanting. After decanting effluent in the equalization tank will drain back to the interconnecting line leading to the UV disinfection. The decant sump pump was added in 1997.

The UV equipment was installed in 1997. The effluent is disinfected with UV light using a Trojan 3000B system configured in two banks equipped with 36 low pressure bulbs each. After UV disinfection, effluent flows into the final effluent trough, where the effluent composite sampler is located, before it flows by gravity to the effluent manhole and on to the outfall. Two reclaimed water pumps draw disinfected water from the effluent trough for use as process water.

Observations and recommendations for each major process component are outlined below:

6.3.3.5.1 Equalization Basin

Observation: The equalization basin was installed in 1975 and modified in 1997. The inner wall of the basin separates the equalization storage from the sludge storage. Both the outer and inner walls of the equalization structure are in poor condition and are very corroded. There is a high likelihood of contamination of the effluent with sludge if the inner wall of the structure begins to leak or fails. The equalization basin is open to the atmosphere. Operators report that it must be cleaned once to twice weekly with sodium hypochlorite solution to prevent algae growth.

Recommendation: Replace the equalization basin with a larger covered structure within the next 2 to 10 years.

6.3.3.5.2 Decant Sump Pump

Observation: The decant sump pump was installed in 1997. It is at the bottom of a deep sump in the equalization basin and was not observed during the site visit. Staff report that the decant sump pump is infrequently used to drain the basin to the head of the plant after heavy precipitation and has no operational issues.

The decant sump pump is 24 years old. It was not observed so the expected lifespan was not estimated. It may exceed its typical expected lifespan but will likely require rehabilitation to maintain performance during the period prior to replacement.

Recommendation: Plan for increased maintenance requirements, and plan for equipment replacement at the end of the typical expected lifespan of the equipment in 2 to 10 years.

6.3.3.5.3 Effluent Flow Meter and Control Valve

Observation: The effluent flow meter is a magnetic flow meter that was installed in 1997 and is in good condition. The effluent control valve was also installed in 1997 and is currently not functioning. Instead, the manual control valve is manually adjusted to throttle effluent flow.

Recommendation: Replace the effluent control valve.

6.3.3.5.4 UV Disinfection System

Observation: The concrete channel, grating, and UV equipment were installed in 1997. The concrete channel and grating appear to be in fair condition. Plant staff reported no performance or maintenance issues with the UV system, however, the sequencing of the SBR and limited equalization basin volume cause the UV banks to cycle on and off which results in increased frequency of lamp failures. Plant staff clean the UV channel weekly. The Trojan UV-3000B system was installed in 1997 and has a basic controller which can only automatically alternate the lead and lag UV banks, monitor the bank run time, bank on/off status, a common alarm and UV intensity.

Recommendation: The Trojan UV-3000B system is an old model using the manufacturer's low-pressure high output open channel technology. Although there were no performance or maintenance issues observed, additional control and monitoring capabilities beyond what the current basic controller can offer, e.g., tracking the individual lamp status and the UV transmittance, are desired by the plant staff. The basic controller can be replaced with the touch smart controller and a new UV transmittance probe can be installed to meet most of the monitoring requirements, except the individual lamp failure status. If the individual lamp failure status needs to be monitored, the entire Trojan 3000B UV system needs to be upgraded. The Trojan UV-3000B system life is typically 20 to 25 years, therefore the UV system at Suquamish WWTP is 24 years old and is nearing the end of its typical design life. It is recommended to upgrade the UV system to provide those monitoring capabilities within the next 2 to 10 years.

6.3.3.5.5 Effluent Sampling

Observation: The effluent sampler was installed in approximately 2016 and is in good condition.

Recommendation: None.

6.3.3.5.6 Outfall

The plant discharges through an outfall in Port Madison in the Puget Sound by gravity through a 12-inch diameter pipe that has diffuser with two 6-inch diameter ports, one 4-inch diameter port, and one 12-inch diameter port at the end of the pipe. The outfall and diffuser were constructed with the original plant construction in 1975. The outfall was last inspected in 2010 and was in good condition with minimal marine growth at that time.

The effluent pipe and outfall were not inspected for this report. Operators have noticed that following a high flow event a few years ago, the effluent flowrate now seems to plateau and begin to backup into the equalization basin at a flowrate of approximately 1 MGD.

Observation: The outfall was not observed.

Recommendation: Investigate the effluent pipe design and condition to determine what is causing effluent flowrate to be limited during high flow events.

6.3.3.6 Solids Treatment

Waste Activated Sludge (WAS) is thickened and stored at the Suquamish WWTP and then transported to the Central Kitsap WWTP for further treatment and ultimate disposal under the County's Class B biosolids program. WAS is pumped using the SBR Recirculation Pumps via the automatic WAS valves from the SBRs to the 32,000-gallon ASST. Sludge is normally wasted 4 days per week (currently Monday, Tuesday, Thursday, and Friday) for approximately 15 to 20 minutes during the idle phase of the SBR cycle. If needed, sludge can be wasted during the settling or decant phase of the SBR cycle if idle time is shortened due to high flows. The plant wastes an average of 25,000 gpd. The thickener feed pump on the ground floor of the Process Building pumps WAS from the ASST to the flocculation tank and RDT at the top floor of the Process Building. The RDT runs on the days when the sludge is wasted to empty the ASST, which normally takes about 4 hours at 100 gpm.

The TWAS from the RDT is pumped to the TSST by the thickened sludge pump. The truck loadout pump loads TWAS from the TSST to tanker trucks or recirculates sludge within the TSST to keep it from settling or becoming septic.

The thickener feed pump, RDT, thickened sludge pump, TSST, and loadout pump were all installed in 2017. When the new thickened sludge piping was installed in 2017, a cross connection was kept in place to allow the thickened sludge to be pumped back to the ASST for recuperative thickening. This cross connection can be used to load sludge directly from the ASST to trucks, bypassing the sludge thickening system, using the sludge truck loading pump.

Observations and recommendations for each major process component are outlined below:

6.3.3.6.1 Aerated Sludge Storage Tank

Observation: The ASST is a coated steel tank in the center of the flow equalization structure. It was constructed in 1975 and retrofitted in 1997. The tank is in poor condition and shows widespread interior and exterior corrosion, and the access hatch is broken.

Recommendation: Recoat the structure and repair the access hatch or replace the structure in the next 2 to 10 years.

6.3.3.6.2 Sludge Storage Blower

Observation: The sludge storage blower was installed in 1997 and appears to be in fair condition. Plant staff reported no performance or operational issues with the sludge storage blower.

The sludge storage blower is 24 years old with no noted performance issues or significant visible degradation; therefore, it is expected to exceed its typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: None.

6.3.3.6.3 Thickener Feed Pump

Observation: The thickener feed pump was installed in 2017 and is in very good condition with no operational issues reported by plant staff. The thickener feed pump is 4 years old and is expected to meet or exceed the typical expected lifespan of 25 to 30 years.

Recommendation: None.

6.3.3.6.4 Rotary Drum Thickener

Observation: The RDT and flocculation tank were installed in 2017 and are in good condition with no operational issues reported by plant staff. The motor of the flocculation tank mixer and the flocculation tank lid show the sign of corrosion. The RDT and flocculation tank are 4 years old and expected to have a service life of 25 to 30 years. The equipment is expected to meet its typical lifespan if the corrosion is mitigated.

Recommendation: Monitor corrosion on flocculation tank and mixer. Improve the ventilation within the room to reduce the corrosion potential. Inspect and ensure the proper operation of the fire detection system in the room.

6.3.3.6.5 Thickener Polymer System

Observation: The thickener polymer system was installed in 2020 and is in very good condition with no operational issues reported by plant staff.

Recommendation: None.

6.3.3.6.6 Thickened Sludge Pump

Observation: The thickened sludge pump is in fair condition. It is showing significant corrosion despite being installed in 2017. Operators report that the pump discharge pressure gets high and shuts off the pump when the TWAS concentrations get over 5 percent. This limits the efficiency of the thickening because the TWAS concentration must be controlled lower than the RDT could potentially produce, resulting in longer run times.

Recommendation: Replace the thickened sludge pump with a larger (higher horsepower) pump to overcome additional headloss when the TWAS solids concentration is high and becomes the non-Newtonian fluid.

6.3.3.6.7 Thickened Sludge Storage Tank

Observation: The concrete TSST was constructed in 2017 and is in very good condition with no operational issues reported by plant staff.

Recommendation: None.

6.3.3.6.8 Sludge Loadout Pump

Observation: The sludge loadout pump was installed in 2017 and is in very good condition with no operational issues reported by plant staff. It is expected that the equipment may have more than 90 percent of its expected serviceable life remaining (27+ years).

Recommendation: None.

6.3.3.7 Support Systems (Odor Control and Plant Water and Drainage Systems)

Suquamish WWTP has odor control systems to treat foul air from the headworks, thickening room, the ASST, and the TSST. Air from the headworks, thickening room and the ASST is treated by the odor control chemical scrubber located in the thickening room. The odor control chemical scrubber was installed in 1997.

Air from the TSST is treated with a carbon canister on the top of the tank which was installed in 2017.

The Suquamish WWTP has potable (W1), non-potable (W2), and reclaimed (W3) water systems. The W1 water is supplied by the utility water distribution network and supplies water for sinks, drinking fountains and eyewash stations. The W1 water also feeds an air gap tank which provides hydraulic separation for the

W2 system. The W1 backflow assembly and surrounding piping were replaced and a small hydropneumatic tank was added in 2017 to improve low flow problems. The remainder of the W1 system was installed in 1997.

The W2 system consists of a water pump and hydropneumatic tank, and provides water for polymer dilution systems, odor control water, trap primers, pump seal water, and an exterior hose station. The W2 system piping, air gap tank, and hydropneumatic tank were installed in 1997. In 2017, the W2 yard piping was extended to provide seal water for the new truck loadout pump and a hose station was added to the exterior of the Process Building on the east side. The non-potable water pump for the W2 system wase replaced in 2017.

Disinfected effluent is withdrawn from the effluent channel by the reclaimed water pumps for use as W3 water. A portion of the W3 water is brought to higher pressure (HP) with another hydropneumatic tank to create W3HP. The rotary bar screen, grit tank, RDT, and hose stations in the Process Building all use W3 water, while the hose stations in the SBR basins, sludge storage tank, and TSST use W3HP. The reclaimed water pumps that feed the W3 system were replaced in 2017. The W3 system piping and hydropneumatic tank were installed in 1997. The hose station in the truck loadout area was replaced 2017.

The plant drainage system collect drainage from the Process Building and pumps it back to the plan influent for treatment. The drain sump is in the bottom floor of the Process Building and contains two submersible sump pumps. The plant drain sump and sump pumps were installed in 1997 with the construction of the Process Building.

Observations and recommendations for each major process component are outlined below:

6.3.3.7.1 Odor Control Chemical Scrubber

Observation: The odor control system is only partially operational. The chemical dosing system for the scrubber is no longer functional and chemicals are added manually instead. The exhaust fan is unusually loud and requires frequent maintenance. The scrubber recirculation pumps are in fair condition. Staff noted that the odor control system is occasionally taken out of service. Equipment in the headworks/thickening room are showing surface corrosion, which indicates insufficient ventilation in the room.

As noted in **Appendix E** *Condition Assessment Red Flag Findings and Mitigation Recommendations* (Murraysmith [now Consor], October 2020), the headworks does not meet all NFPA 820 requirements. Strong hydrogen sulfide odor was observed in the headworks.

Recommendation: Keep screen channel cover plates on to reduce flammable gas migration from the headworks channel. Test and balance the air ventilation within the room to ensure at least 6 air changes per hour ventilation is provided. Install LEL combustible gas detection system in the room. Inspect and ensure the proper operation of the fire detection system in the room. Repair or replace the odor control system to restore automatic operation and full functionality.

6.3.3.7.2 TSST Carbon Canister

Observation: The carbon canister was installed in 2017 and is in very good condition.

Recommendation: None.

Observations and recommendations for each major process component are outlined below:

6.3.3.7.3 W1, W2, W3 System

Observation: The W1, W2 and W3 systems were not observed during the site visit. No issues were reported by operators.

Recommendation: None.

6.3.3.7.4 Reclaimed Water Pumps

Observation: The reclaimed water pumps were installed in 2017 and appear to be in very good condition. The pumps were mounted to the old pump bases without proper support of the pump volute and piping. Otherwise, the pumps are in good condition with no performance issues reported by plant staff. It is expected that the pumps may have more than 90 percent of their expected serviceable life remaining (27+ years).

Recommendation: Add pump volume and pipe supports.

6.3.3.7.5 Plant Drain Sump

Observation: The plant drain sump and pumps were not observed during the site visit. Staff report that the pumps show exterior corrosion, but there have been no operational issues.

Recommendation: Determine the existing pumps make and model, and purchase a shelf spare, if possible. Plan for replacement in the next 2 to 10 years, due to age.

6.3.3.8 Power Distribution

6.3.3.8.1 Utility Service Entrance

The utility service entrance is owned and provided by the local electric utility company, Puget Sound Energy (PSE). Electrical power service to the facility is provided from a 12,470-volt, 3-phase distribution line running underground to a 225 kilovolt amperes (kVA) three phase pad-mounted transformer located in the northeast area of the facility property just north of the Process Building. The utility owned three phase transformer steps the 12.47-kV transmission primary voltage down to 480-volt secondary utilization voltage for the facility. The utility service entrance secondary conductors continue underground from the pad-mounted transformer to the service switchboard inside the Process Building. This switchboard contains a utility current transformer section and the main circuit breaker. The utility revenue metering equipment is located outside of the Process Building on the north wall of the electrical room. The utility transformer, service conductors and power metering equipment are owned and maintained by PSE.

Observation: The utility service entrance equipment (transformer, service conductors, and power metering equipment) was installed in 1997 and is in fair condition. The estimated remaining service life is approximately 50 percent (12-15 years) of its 25 to 30 year expected lifespan.

Recommendation: None.

6.3.3.8.2 Main Power Distribution

The WWTP is served by a 480-volt, 3-phase, 3-wire electrical power distribution system. The main service and distribution equipment were installed in late 1997 and are in the main electrical room in the Process Building. The facility power distribution system consists of the utility service entrance and main circuit breaker switchboard, standby generator, ATS, metering, MCC, various 480-volt power panels, 480: 120/208 volts of alternating current (VAC) distribution transformers and 120/208 VAC lighting and power panels.

Observation: The main power distribution system including the service entrance rated 800 ampere main circuit breaker, distribution transformers, power panels and MCC, although installed in 1997, are in good condition.

The main distribution panel (MDP) also feeds two offsite lift stations, McKinstry PS (LS-53) and Division Street PS (LS-54).

No arc flash labeling was observed on any of the electrical equipment in this facility.

Recommendation: A complete arc flash study for the electrical infrastructure should be performed to comply with the Occupational Safety and Health Administration standard 1910.269 made mandatory and put into effect on July 10, 2014.

6.3.3.8.3 Generator and Automatic Transfer Switch

Standby emergency power is supplied by a 450-kilowatt (kW) diesel engine-generator. It is a non-enclosed generator located in the generator room in the Process Building. The standby generator was installed in 1997 and has an 800-ampere circuit breaker and is fueled by a day tank inside the room and an external diesel fuel storage tank on the north area of the facility just slightly northwest of the Process Building.

The 3-pole, 800-ampere, 480-volt, 3-phase, 3-wire ATS is located on the west wall in the main electrical room in the Process Building. It is fed from the 800-ampere service entrance main breaker (normal side) and standby generator (emergency side). The ATS load side connects to a 480V, 3-phase switchboard "MDP".

Observation: The generator and ATS were installed in 1997 and are in fair condition. The estimated remaining service life is about 50 percent (12-15 years) of its 25 to 30 year expected lifespan. The ATS and generator are sized to provide enough back-up power for all essential functions for the facility to continue operation in the event of a prolonged power outage.

The Cummins standby generator engine was last serviced in 2019 according to labeling on the installed filters.

Recommendation: None

6.3.3.8.4 Motor Control Centers (MCC)

There is one MCC in the plant. It has a 600-ampere main breaker and is fed from the ATS. The MCC was installed in 1997. **Table 6-8** below shows the MCC, its location, model, and rating.

Table 6-8 | MCC Locations, Models, and Rating

MCC	Location	Model	Rating [Amps]
MCC	Process Building Electrical Room	Square D Model 6	600

Observation: The MCC is in fair condition. The estimated remaining service life is about 50 percent (12-15 years) of its 25 to 30 year expected lifespan.

Most of the components in the MCC's individual buckets are consistent with industry standard and are readily available or could be replaced with similar manufacturer's devices.

Recommendation: None

6.3.3.8.5 Control Panels

The facility control system consists of control panels located throughout the facility with the main plant controller located in the office area of the Process Building and the main remote input/output (I/O) rack located in the electrical room. The Control Panels are comprised of Industry standard equipment including programmable logic controllers (PLCs), operator interface terminals (OITs), uninterruptable power supply (UPS), small digital readouts, and typical components including circuit breakers, relays, wiring, fuses, terminals, indicator lights, selector switches, etc. **Table 6-9** below shows the panels, their location, PLC and central processing unit (CPU) models and of an OIT is present. Local pushbutton, selector switch, and or indication stations are not listed.

Table 6-9 | Panel Locations and Models

Panel	Location	PLC Model	CPU Model	OIT
CP-01 Plant Main Ctrl Panel	Process Building Electrical Room	Allen-Bradley Compactlogix	1769-L33ER	N/A
CP-02 Rotary Screen Ctrl Panel	Process Building Headworks Area	See observation and recommendation	Unknown	N/A
CP-03 Grit Dewater Ctrl Panel	Process Building Headworks Area	N/A	N/A	N/A
CP-04 Grit Tank Ctrl Panel	Process Building Headworks Area	N/A	N/A	N/A
CP-05 SBR Ctrl Panel	Process Building Electrical Room	Allen-Bradley Compactlogix	1769 Remote I/O	N/A
CP-07 Odor Control Panel	Process Building Electrical Room	N/A	N/A	N/A
CP-13 Duct Heater #1	Process Building Electrical Room	N/A	N/A	N/A
CP-15 RDT	Process Building Headworks Area	See observation and recommendation	Unknown	Y
CP-21 Sludge Truck Loading	Sludge Loading Area	N/A	N/A	N/A
CP-22 Waste Thicken VFD Panel	Process Building Electrical Room	N/A	N/A	N/A

Observation: Overall, most of the control panels installed appear to be operating adequately and are in fair condition. Components installed are consistent with industry standard and are readily available or can be replaced with similar manufacturer's devices. The exception to this is the PLC system and OIT equipment, as each brand of PLC and OIT requires special programming.

The main facility PLC system with equipment located in the CP-01 and CP-05 panels was upgraded by L2 System, LLC. in 2016 as part of a facility thickening project.

The communication between the main and remote I/O panel is achieved via an ethernet link. The connection to SCADA is also via an ethernet link.

The interior to Panel CP-02 was not accessed and the installation of a controller (e.g., PLC) was not verified. It is likely the panel contains a PLC. The panel has an explosion-proof enclosure that is missing bolts and have bolts that are not tightened that are used to maintain its classification rating. The panels "power-on" indicator light was not illuminated and power was applied to the panel with other indicators lights active.

Panel CP-03 Grit Dewatering panel has an explosion-proof enclosure that is missing bolts used to maintain its classification rating.

CP-13 Duct Heater No.1 panel is operationally in good condition but the interior of the panel was very dusty.

The interior to Panel CP-15 was not accessed and the installation of a controller (e.g., PLC) was not verified. The panel was installed as part of the plant thickener project in 2016 and is likely to contain a PLC compatible with the facility PLC system.

Recommendation:

Verify back-up copies of all PLC and OIT programs have been created, and if not, have them created and stored in a safe place as soon as possible.

Spare parts for the PLC system including a CPU, power supply, communication module, and a minimum of one spare I/O module per type should be stored by the county in case of a failure.

Verify whether there is a PLC in the CP-02 panel. If a PLC exists, verify if it is still supported and if a back-up of its program has been saved. Given the apparent age of this panel, if a PLC exists it is likely outdated so we recommend a migration/replacement plan should be developed and executed as soon as possible. The missing bolts for the panel should be installed so that the enclosure can perform as intended in the event of an incident, and the "power-on" indication light should be fixed.

The missing bolts in panel CP-03 should be replaced so that the enclosure can perform as intended in the event of an incident.

Panel CP-13 should be thoroughly cleaned.

Verify whether there is a PLC in Panel CP-15 and if one exists, a back-up of the program should be created along with the OIT.

6.3.3.9 SCADA System

The SCADA system condition assessment and evaluation have been conducted as part of the County-wide SCADA master plan project. See **Appendix F** *Kitsap County Sewer Utility SCADA Master Plan Technical Memoranda* (Murraysmith [Now Consor]/HDR, 2021) for details.

6.4 Code Review

Code requirements for the Suquamish WWTP are summarized in **Section 6.4.1**. **Section 6.4.2** includes discussion of general code requirements that would be triggered should major upgrades be completed at the WWTP. Code requirements summarized in this report include:

- Washington State Building Code including the following adopted codes. The 2021 versions of the codes went into effect March 15, 2024 and are expected to be updated in approximately 2027.
  - International Building Code (IBC)
  - International Machine Code (IMC)
  - International Fire Code (IFC)
  - National Electrical Code (NEC) 70

- National Fire Protection Association (NFPA) 820
- Uniform Plumbing Code (UPC)

- Americans with Disabilities Act (ADA)

- Code of Federal Regulations (CFR)

6.4.1 Summary of Existing Buildings and Use

The Suquamish WWTP Site Plan is shown in **Figure 6-1**. There are two main buildings onsite, which are the Process Building and the Service Building.

6.4.1.1 Process Building

The Process Building is located between the SBR basins and the sludge holding and equalization storage tanks. It shares a wall with the SBR basins and contains many of the mechanical processes as well as the control room. Specifically, the following components are in the Process Building:

- Headworks and associated foul air system
- Dewatering system
- Electrical room
- Office/Control room
- Screenings and grit storage
- W2 and W3 systems
- SBR blower and recirculation/WAS pumps
- Sludge pumps and blower
- UV disinfection system
- Plant drain sump

The Process Building is a three-story, concrete, and concrete masonry unit (CMU) building that was constructed in 1997. The bottom floor is one large room below grade, accessed by an exterior personnel door at grade level and an interior stairway. The grade level has a plant water room, a screenings and grit room, and two landings area that allow equipment to be hoisted to the bottom and top floors, with each room accessed from its own exterior door. Additionally, there is a single interior door that connects the landing to the upper floor with the screenings and grit room. The electrical room, the office/control room, and the headworks and dewatering room are on the top floor, accessed by two exterior stairways.

- **Floor Area:** Approximately 3,600 square feet (SF) (24,000 allowable per 1991 Uniform Building Code (UBC) Table 5-C).

- **Height:** Approximately 31 feet with 2 stories above grade (2 stories, 40 feet allowable per 1991 UBC Table 5-D).

- **Construction Type:** Type V-N, constructed of non-combustible, non-fire rated materials. The Process Building is constructed of a concrete slab, reinforced concrete walls, CMU walls, and wood truss roof framing covered with metal Bermuda roofing panels.

- **Occupancy Group:** B-4 per 1991 UBC, where Section 701 defines Group B Division 4 occupancies as ice plants, power plants, pumping plants, cold storage and creameries.

- **Calculated Occupancy Load:** The occupant load factor of 100 for industrial areas per IBC Table 1001.1.2, therefore the occupancy load is 17 persons for the lower floor, three for the grade level, and 15 for the upper floor.

- **Fire Sprinklers:** Not required per IBC Section 903. Fire detection and portable fire extinguishers required per NFPA 820, see **Section 6.4.2.3**.

- **Safety Features:** Tepid eyewash/shower station required where the eyes or body of any person may be exposed to injurious corrosive materials per 29 CFR 1910.151 and the American National Standards Institute (ANSI) Z358.1.

6.4.1.2 Service Building

The Service Building is located on the east end of the site, next to the sludge storage and equalization basins. It is a multipurpose building with the following functions:

- Electrical room
- Backup generator
- Bathroom, shower, and lockers
- Laboratory
- Storage

The Service Building is a single-story, slab on grade, CMU building that was originally constructed in 1975 and modified in 1997. Separate sets of exterior double doors open into the generator and electrical rooms, and exterior single doors open into the laboratory and storage rooms. Interior doors connect all rooms except the storage room.

- **Floor Area:** Approximately 1,200 SF.

- **Height:** Approximately 12.5 feet with one story.

- **Construction Type:** Type V-N, constructed of non-combustible, non-fire rated materials. The Process Building is constructed of a concrete slab, CMU walls, wood truss framing, and roof deck covered with a modified bitumen membrane.

- **Occupancy Group:**

  - Laboratory/bathroom - Group B per UBC 1994, where Section 304.1 defines Group B as occupancies consisting of business functions.

  - Electrical Room/Generator Room – Group S-2 per UBC 1994, where Section 311.1 defines Group S-2 as occupancies consisting of low-hazard storage functions.

  - Storage – Group S-3 per UBC 1994, where Section 311.1 defines Group S-3 as occupancies consisting of repair garage functions.

- **Calculated Occupancy Load:** The occupant load factor of 100 for industrial areas per IBC Table 1001.1.2, therefore the occupancy load is 12 persons.

- **Fire Sprinklers:** Not required per IBC Section 903.

- **Safety Features:** Tepid eyewash/shower station required where the eyes or body of any person may be exposed to injurious corrosive materials per 29 CFR 1910.151 and ANSI Z358.1.

6.4.2 General Code Requirements

6.4.2.1 Accessibility

The Operations Building is required to comply with the accessibility requirements of Chapter 11 of the IBC. In general, this means that the building shall have an accessible parking stall and accessible path of travel from the accessible stall to the Operations Building entrance. Doors shall have lever hardware and accessible rooms shall meet the design and dimensional requirements of Chapter 11. Per the IBC, accessibility is not required for mechanical and process spaces.

6.4.2.2 Means of Egress

The Washington State Building Code mandates in Chapter 10 that in all buildings the means of exit discharge shall meet the following requirements:

- **Illumination Required**: Means of exit discharge shall be always illuminated by not less than 1-foot-candle (11 lux) at the walking surface per IBC 1008.2.

- **Egress Sizing**: The minimum width of each door opening shall be a minimum width of 32 inches and height of 80 inches, and sufficient for the occupant load thereof per IBC 1010.1.1.

6.4.2.3 NFPA 820

The NFPA 820 provides requirements for ventilation, electrical classification, materials of construction, and fire protection measures for the liquid stream treatment processes and the solids treatment processes in Table 5.2.2 and Table 6.2.2 respectively (NFPA 820, 2020). Applicable locations pertinent to the Suquamish WWTP are summarized in **Table 6-10**below.

Table 6-10 | NFPA 820 Requirements Pertinent to the Suquamish WWTP

Location	Fire and Explosion Hazard	Ventilation[1]	Extent of Classified Area	NEC Area Electrical Classification (All Class I, Group D)	Materials of Construction	Fire Protection Measures
Screen Channels	Possible ignition of flammable gases and floating flammable liquids	Continuously ventilated at 12 changes per hour	Enclosed – entire space	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable fire extinguisher and hydrant protection in accordance with NFPA 820 7.2.4.
Grit Removal Tank	Possible ignition of flammable gases and floating flammable liquids	Continuously ventilated at 12 changes per hour	Enclosed – entire space	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable fire extinguisher, hydrant protection in accordance with NFPA 820 7.2.4.
SBRs (not preceded by primary clarifier)	Possible ignition of flammable gases and floating flammable liquids	No ventilation, not enclosed	Interior of the tank from the water surface to the top of the tank wall. Envelope includes 18 inches above the top of the tank and extending 18 inches beyond the exterior wall; envelope 18 inches above grade extending 10 ft horizontal from the exterior tank walls	Division 2	Noncombustible, limited combustible, or low flame spread index material	Hydrant protection in accordance with NFPA 820 7.2.4
Equalization Tank	N/A	No ventilation	N/A	Unclassified	Not required	Hydrant protection in accordance with NFPA 820 7.2.4
UV Disinfection	N/A	No ventilation	N/A	Unclassified	Not required	Hydrant protection in accordance with NFPA 820 7.2.4
Sludge Storage Tanks (ASST & TSST)	Possible generation of methane gas in explosive concentrations; carryover of floating flammable liquids	Continuously ventilated at 12 changes per hour	Enclosed – entire space. Tank not enclosed in building	Division 2	Noncombustible, limited combustible, or low flame spread index material	Hydrant protection in accordance with NFPA 820 7.2.4
Room with Screening and Grit Handling, and Thickening RDT	Accumulation of methane gas	Continuously ventilated at 6 air changes per hour	Entire room	Unclassified [2]	Noncombustible, limited combustible, or low flame spread index material	Portable fire extinguisher, hydrant protection in accordance with NFPA 820 7.2.4, combustible gas detection system.and fire detection system.
Odor Control	Leakage and ignition of flammable gases and vapors	Continuously ventilated at 6 air changes per hour	Areas within 0.9 m (3 ft) of leakage sources such as fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels	Division 2	Noncombustible, limited combustible, or low flame spread index material	Combustible gas detector and fire detection system
			Area beyond 3 ft leakage sources	Unclassified		

Notes:

1. The ventilation values are the intended design values. Testing is needed to verify the actual ventilation during operation.
2. The screening channel and grit removal tank are in the same room, therefore it is recommended to treat the room as a classified space in case the odor control is turned off and flammable gases migrate from screening channel into the room.

6.4.2.4 NFPA 24

Fire suppression hydrants shall be installed in accordance with NFPA 24. Chapter 7 of NFPA 24, 2019 edition mandates hydrants to be located within 40 feet of the buildings to be protected. Section C.4.1.3 of NFPA 24 generally recommends a minimum residual pressure of 20 pounds per square inch (psi) should be maintained at hydrants when delivering fire flow. Currently, the closest fire hydrant is at the corner of McKinstry Street and Division Avenue, approximately 450 feet from the Service Building and 550 feet from the Process Building, however, access is through an overgrown easement and may not be viable for firefighting purposes. The nearest hydrant with unimpeded access is at the corner of Kaleetan Lane and Enetai Lane, approximately 1,100 feet from the Process Building and 1,200 feet from the Service Building.

6.4.3 Summary of Code Requirements

No code violation has been observed at Suquamish WWTP. The Service Building at Suquamish WWTP houses the bathroom and laboratory space. Although the Service Building does not comply with the latest IBC code on the accessibility requirement, such as the accessible parking stall and ADA bathroom, it is grandfathered in from the code when it was constructed. If the building is to be upgraded or modified, it will need to meet the current accessibility requirements. It is recommended to install or repair the combustible gas detection system and fire alarm system in the process room where screen and RDT are located and make sure functional fire extinguishers are available at all the locations listed in **Table 6-10**.

The following conditions require additional comprehensive analysis, beyond the scope of this review:

- HVAC compliance
- Seismic Anchoring

6.5 Existing Wastewater Treatment Plant Performance

The performance of the existing WWTP in terms of NPDES permit compliance, EPA's reliability requirement, and future nutrient removal requirement are summarized in this section.

6.5.1 Compliance to NPDES Permit

Suquamish WWTP NPDES Permit #WA0023256 was renewed June 1, 2008, allowing the discharge of treated effluent to Port Madison Bay in the Puget Sound. The NPDES Permit expired on May 31, 2013. The County submitted the permit renewal application six months before the expiration date per the permit requirement and the EPA determined the application was timely and complete, therefore the permit was administratively continued and remains in effect.

In September of 2019, the EPA issued a draft permit and requested Ecology provide CWA section 401 certification. In December of 2019, Ecology provided 401 certification which included a TIN discharge load limit and associated monitoring and planning requirements. The County appealed this certification and negotiated a resolution, but the permit has not been finalized. In May of 2024, the EPA reissued the draft permit, but the permit has not been finalized at the time of writing. A copy of the WWTP's 2008 NPDES Permit, 2019 Draft NPDES Permit, 2024 Draft NPDES Permit, and Ecology 401 Certification are included in **Appendix G**. Because the new permit is pending, the 2008 NPDES permit remains in effect.

Table 6-11 is a summary of waste discharge limitations allowed for the Suquamish WWTP Outfall 001 to the Puget Sound in the 2019 Draft NPDES Permit and Ecology 401 certification.

Table 6-11 | Outfall 001 NPDES Waste Discharge Limits[1]

Effluent Limits: Outfall 001		
Parameter	**Average Monthly**	**Average Weekly**
BOD	30 mg/L	45 mg/L
	100 ppd	150 ppd
	85% removal of influent BOD_5	
TSS	30 mg/L	45 mg/L
	100 ppd	150 ppd
	85% removal of influent TSS	
Parameter	**Annual Load Cap**	
TIN	14,691 lbs (pending)	
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0	9.0
Parameter	**Monthly Geometric Mean**	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200/100 mL	400/100 mL

Notes:
1. Suquamish WWTP NPDES Permit # WA0023256

mg/L = Milligrams per liter
ppd = Pounds per day
mL=milliliter

The current permit does not contain the plant capacity limits in terms of influent flow and loads. The Facility Planning Requirement is added to Section II of draft permit, where a maximum month flow of 0.4 MGD is listed as the design criterion. No influent BOD or TSS loadings are included in the design criteria. According to the draft permit, when the actual month flow for any three months during a 12-month period exceed this value, the County is required to develop a new or updated plan and schedule for continuing to maintain capacity and compliance with effluent limits.

Figure 6-3 through **Figure 6-6** show the 7-day and the 30-day rolling average concentrations and loads for both effluent BOD and TSS between January 2018 and June 2020. The corresponding NPDES permit limits are shown for comparison. These figures indicate Suquamish WWTP exceeded the average weekly BOD and TSS limits in December 2019 due to one extremely high effluent BOD and TSS data point on December 23rd, 2019, but not the average monthly limits during this period. In addition, the plant has not exceeded pH or fecal coliform limits during this same period based upon review of the monthly DMRs.

Figure 6-3 | 7-day Rolling Average Effluent BOD and TSS Concentrations

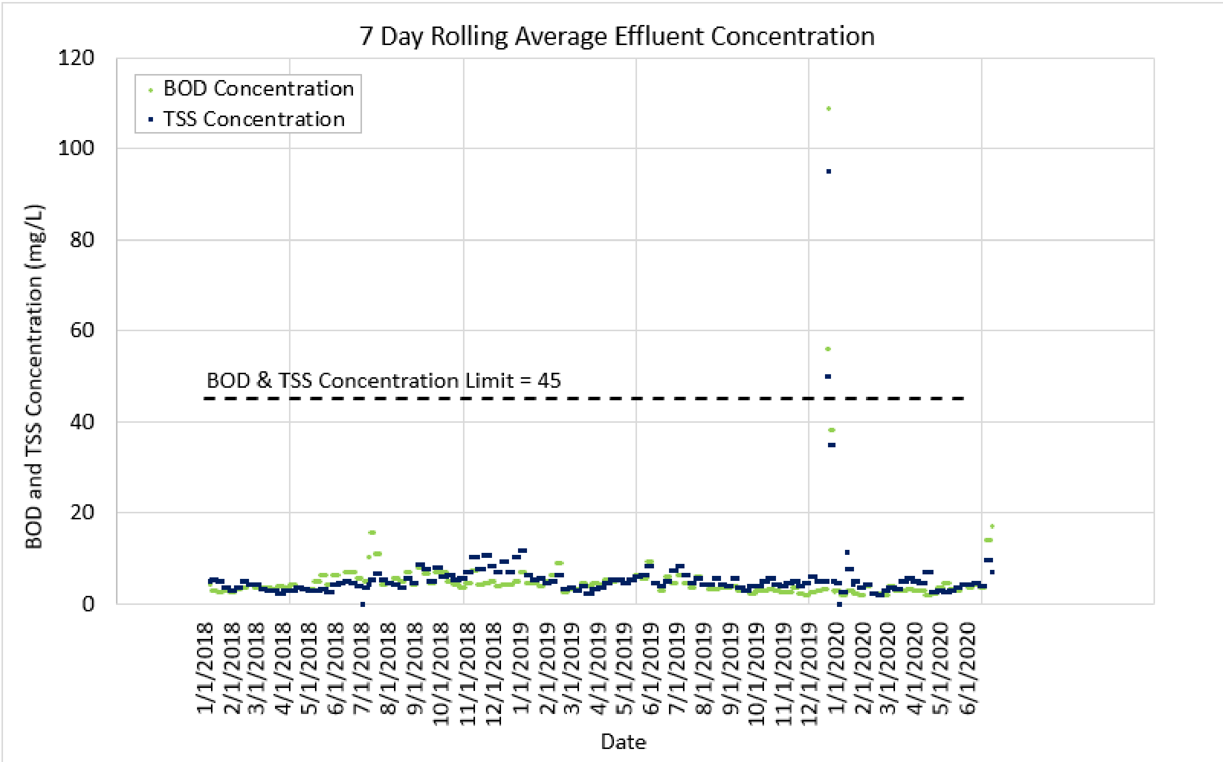


Figure 6-4 | 30-day Rolling Average Effluent BOD and TSS Concentrations

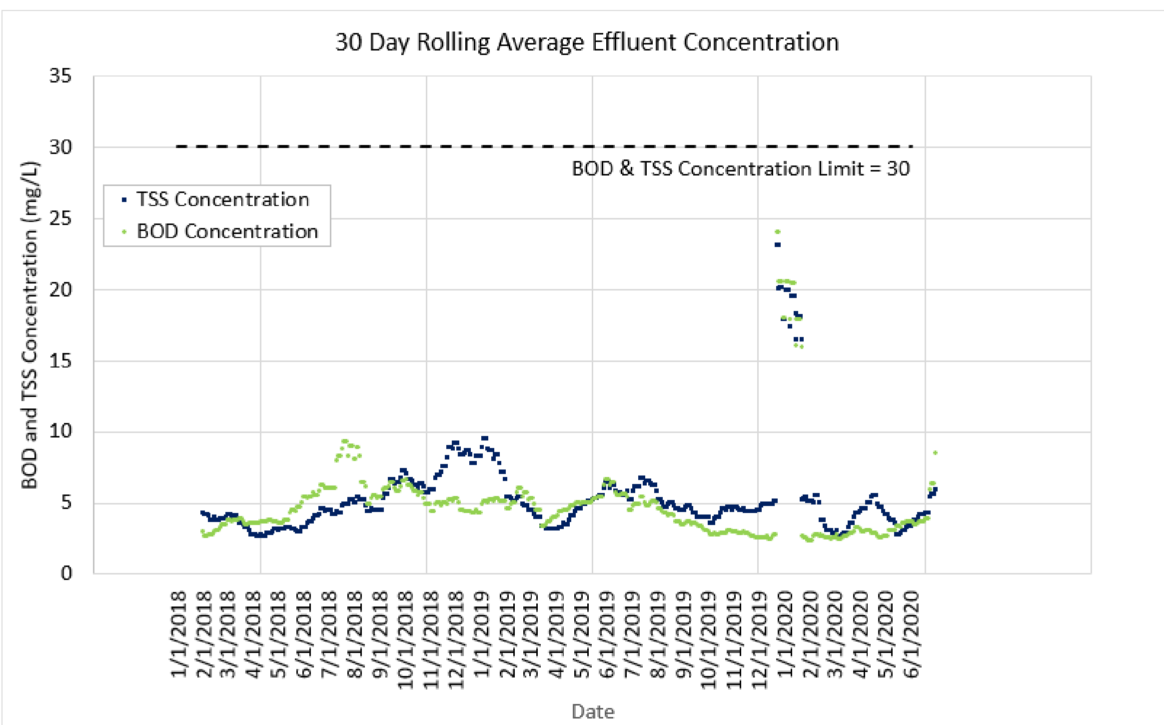


Figure 6-5 | 7-day Rolling Average Effluent BOD and TSS Loads

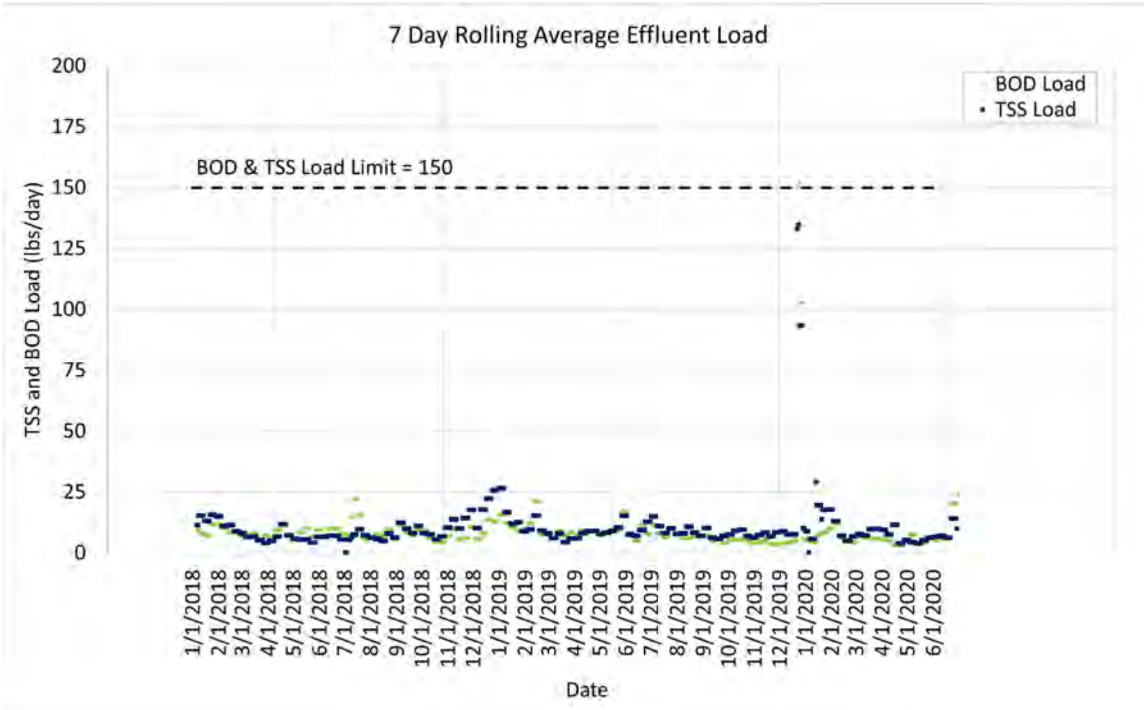


Figure 6-6 | 30-day Rolling Average Effluent BOD and TSS Loads

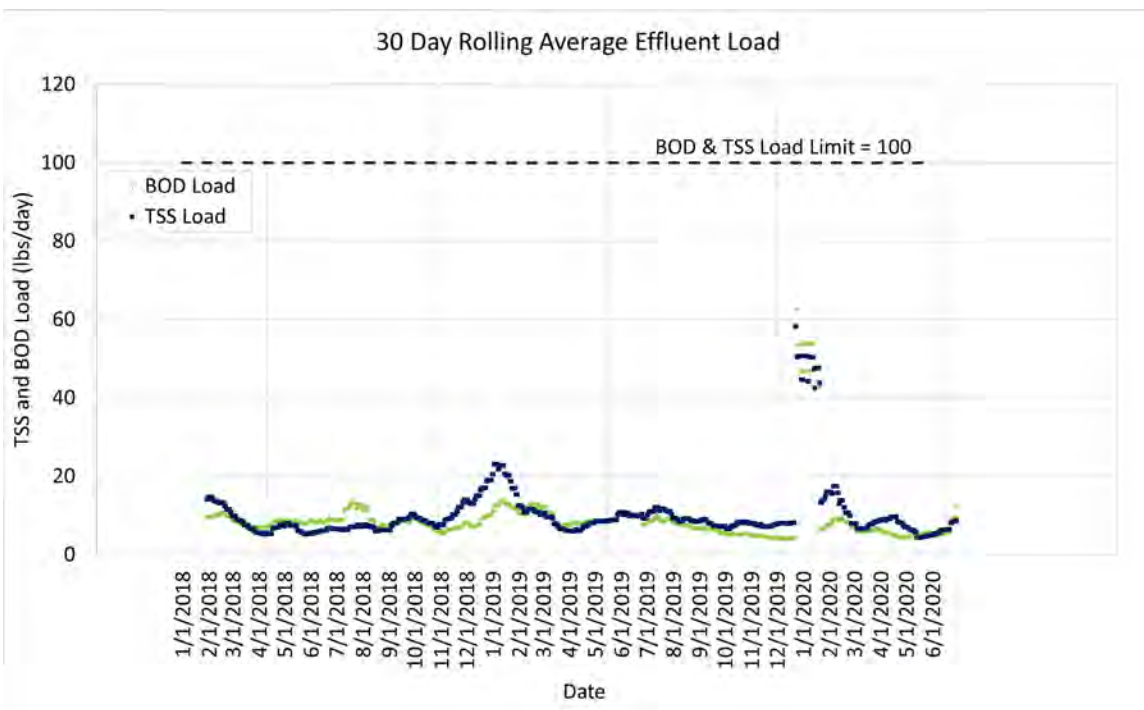
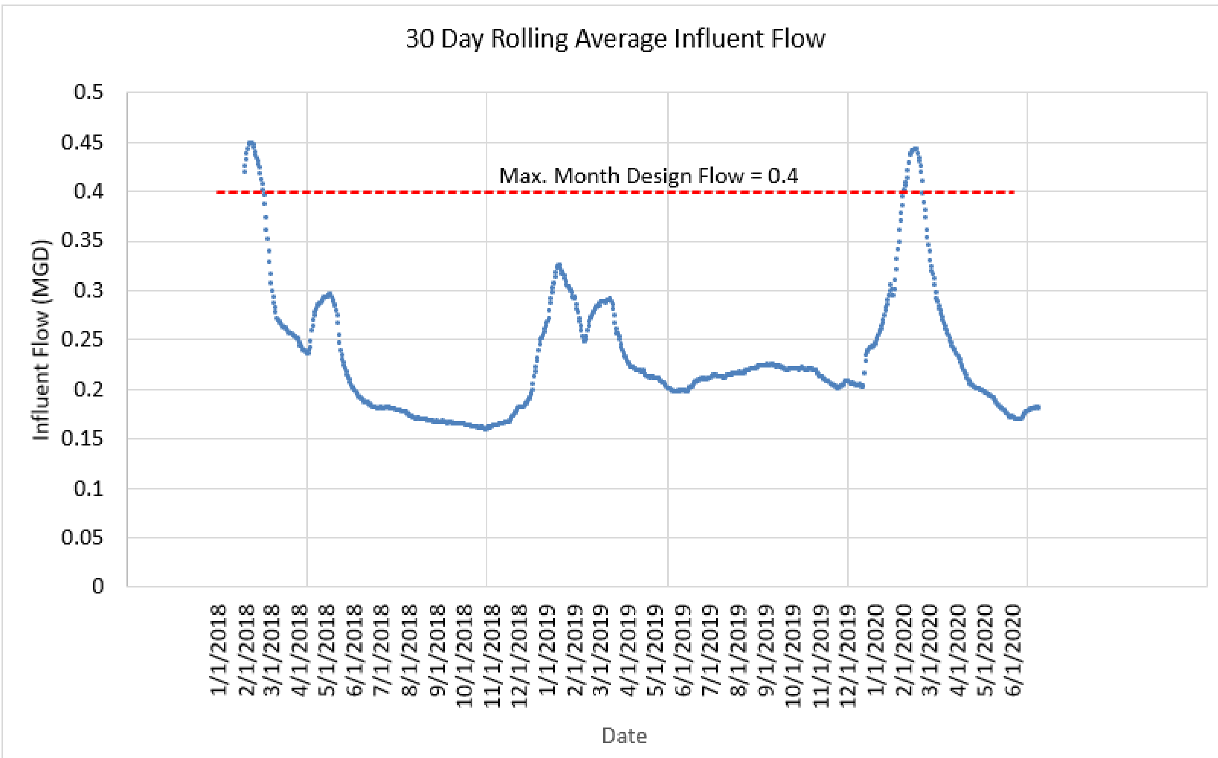


Figure 6-7 shows the plant 30-day rolling average influent flow to compare with the design criteria proposed in the draft permit. Between January 2018 and June 2020, Suquamish WWTP influent flow 30-day rolling average exceeded 0.4 MGD in winter 2018 and winter 2020. However, reviewing of the historical

The DMR data indicates that on the calendar month average basis, the plant influent flow only exceeded 0.4 MGD in the month of January 2018 during the last three years. It is apparent that the high flows occurred in winter times are results of high I/I in the basin. Suquamish WWTP monthly influent flows will unlikely sustain beyond 0.4 MGD for more than three months in a 12-month period to trigger the potential facility planning requirement described in the draft permit. However, I/I control measures should be considered to prevent extensive wet weather flows from entering the plant. Recommended improvements to reduce I/I are given in the Suquamish Wastewater Collection Facilities I&I Analysis (RH2, 2012).

Figure 6-7 | 30-day Rolling Average Influent Flow



6.5.2 EPA Plant Reliability Criteria

The Suquamish WWTP is required to meet the Reliability Class I standards, as defined in EPA's Technical Bulletin "Design Criteria for Mechanical, Electrical, and Fluid System Component Reliability," EPA 430-99-74-001. The EPA design criteria do not directly address SBRs, however, Ecology's "Criteria for Sewage Works Design" does include guidelines. **Table 6-12** includes a summary of the reliability criteria and requirements to be considered as part of **Section 8** and **Section 11** of the Plan.

Table 6-12 | EPA Class I Reliability Criteria

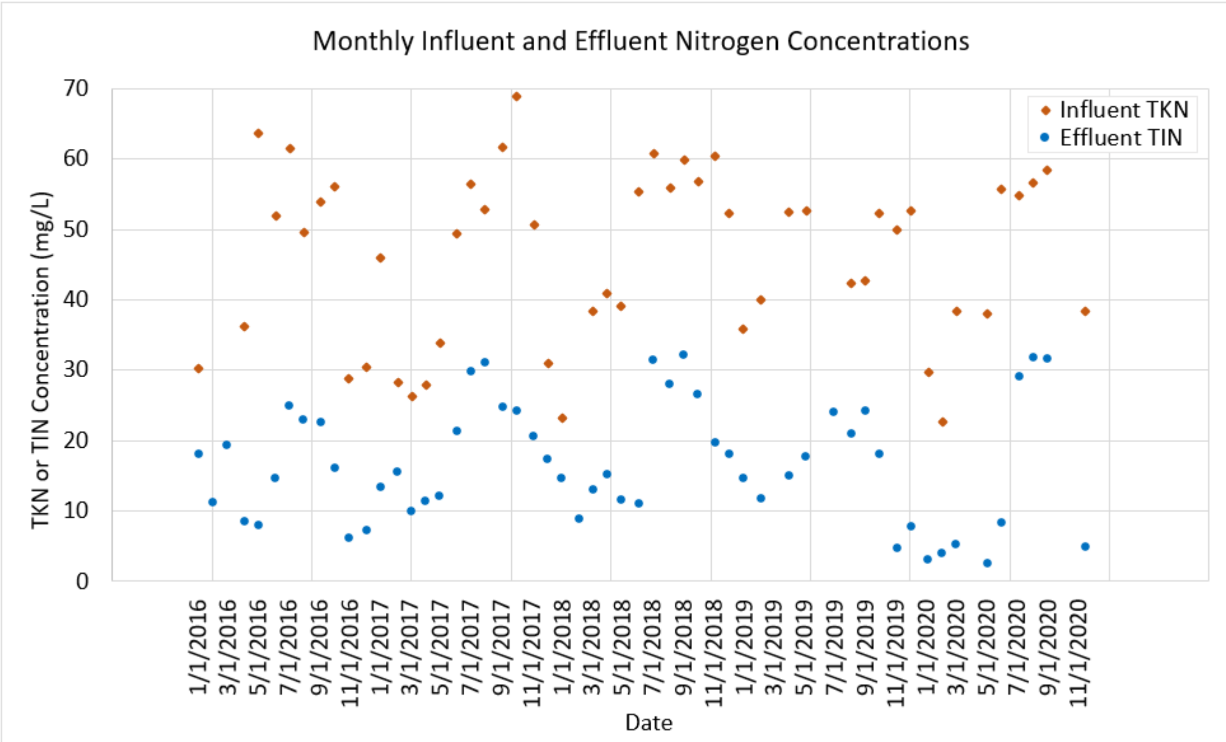
Treatment Unit Process	Reliability Class I Requirements	Current Deficiencies
Influent Screening	A backup bar screen designed for mechanical or manual cleaning shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.	None. A manual screen is provided to back up the mechanical screen.

Treatment Unit Process	Reliability Class I Requirements	Current Deficiencies
Pumps (Liquids, Solids & Chemical Feed)	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.	None. Backup is provided for the SBR recirculation pumps, grit pumps, and plant sump pumps.
SBRs	Designers must provide for more than two reactor vessels (basins) unless Ecology approves the system as a continuous flow-through system	Ecology approved the SBR design with two basins, however, this design presents operational challenges and may not provide adequate treatment as a flow-through system.
Aeration Blowers and/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.	None. Aeration blowers are designed to provide design airflow with one backup.
Disinfection	The units should be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 50 percent of the total design flow.	None. The UV channel has two banks. One of two UV banks will be able to handle more than 50% of the total design flow.
Sludge Storage Tanks	Holding tanks are permissible as an alternative to component or system backup capabilities for components downstream of the tank provided the volume of the holding tank shall be based on the expected time necessary to perform maintenance and/or repair and the capacity of sludge treatment processes downstream can handle the combined flow from the storage tanks and the working sludge treatment system	None. WAS holding tanks and TWAS holding tank are provided to back up the RDT and sludge pump.
Sludge Disposal	An alternative method of sludge disposal shall be provided for each sludge treatment unit process without installed backup.	None. If the RDT is down, WAS storage tank could store sludge for approximately three days, or un-thickened sludge could be trucked to Central Kitsap WWTP.
Electrical Power Supply	Two separate and independent power sources, either from two separate utility substations or from a single substation and an on-site generator. The backup power supply shall be sufficient to operate all vital components during peak wastewater flow conditions, including critical lighting and ventilation.	None. An on-site generator is provided.

6.5.3 Preliminary Nutrient Loading at Suquamish WWTP

The proposed TIN load limit in the Ecology 401 certification letter is 14,961 pounds/year. Since 2016, Suquamish WWTP staff has been conducting monthly testing of the influent and effluent for nitrogen species, shown in **Figure 6-8**. Average influent TKN was 46.1 mg/L while effluent TIN concentrations ranged from 2.6 to 32.1 mg/L, with an average concentration of 16.1 mg/L.

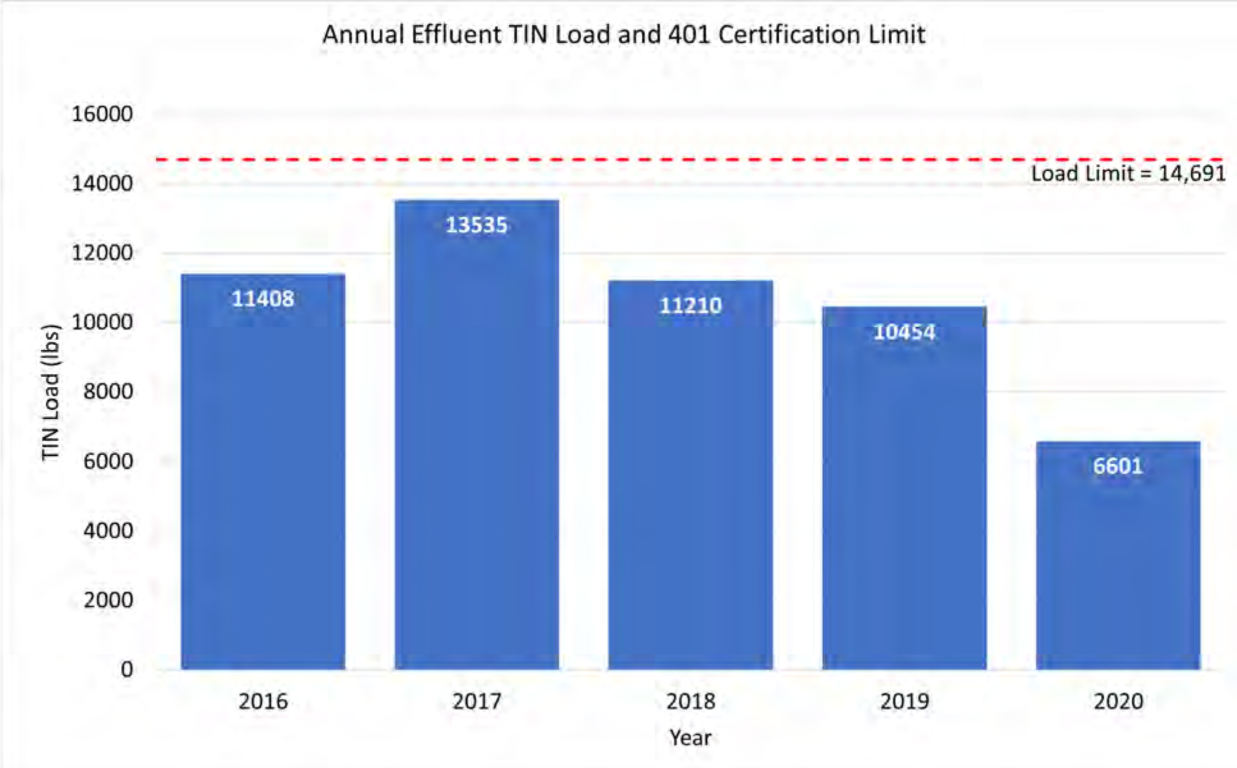
Figure 6-8 | Suquamish WWTP Influent and Effluent Nitrogen Concentrations



The preliminary data was used in conjunction with effluent flow data to estimate annual TIN loading for comparison with the proposed TIN load limit in **Figure 6-9**. In a few instances, monthly data was not collected, and the effluent TIN concentration was interpolated to estimate the load for that month. Between 2016 and 2020 the annual TIN loads were consistently below the load limit.

It may be feasible to further reduce TIN loading to the Puget Sound by implementing a recycled water program to divert effluent from the outfall. Suquamish WWTP does not currently produce effluent that meets reuse requirements or have a recycled water permit. The potential for a water reuse program is discussed in **Section 9**.

Figure 6-9 | Suquamish Annual Effluent TIN Loads



The data indicate that Suquamish WWTP has the capacity to meet the TIN load limit in the 401 certification and the new NPDES permit, but the effluent concentrations are higher than the 10 or 3 mg/L TIN target that the Ecology may impose on all the WWTPs in the future.

6.6 Existing Wastewater Treatment Plant Capacity Evaluation

This section of the Plan documents the capacity of the existing WWTP. Capacity at the treatment plant consists of equipment capacity, hydraulic capacity, and process capacity. The Suquamish WWTP is required to meet the treatment process capacity based on the MMWWF rate but must be able to hydraulically handle the PHF rate with enough freeboard to prevent a spill. Current and projected flows were developed in **Section 3**, and are shown in **Table 6-13**, below. The Suquamish WWTP was constructed in 1997 for a PHF of 1.0 MGD.

Table 6-13 | Existing and Projected Suquamish WWTP Flows (MGD)

Flow Description	Current Flows (Years 2018-2020)	2028 Projected Flows	2042 Projected Flows
Annual Average Flow (AAF)	0.23	0.24	0.26
Max Month Wet Weather Flow (MMWWF)	0.45	0.47	0.50
Max Month Dry Weather Flow (MMDWF)	0.30	0.31	0.33
Peak Daily Flow (PDF)	0.69	0.72	0.77
Peak Hour Flow (PHF)	0.97	1.00	1.07

6.6.1 Mechanical Equipment Capacity

The capacity of each existing major unit process is listed in **Table 6-14**.

Table 6-14 | Design Capacity of Unit Processes at Suquamish WWTP

System	Data/Type
Mechanical Fine Screen	
Quantity	1
Capacity	2.0 MGD
Grit Chamber	
Type	Vortex
Quantity	1
Diameter	7 feet
Capacity flow	2.0 MGD
SBR Basin	
Quantity	2
Volume (each)	390,000 Gallons (52,135 cubic feet)
Average Sidewater Depth	20 feet
Effluent Equalization Basin	
Quantity	1
Volume (each)	69,000 Gallons
UV System	
Type	Open Channel Horizontal Low-pressure Lamps
Quantity	2 banks in 1 channel; 36 lamps per bank
Dosage	33 milliwatt sec/sq cm
Capacity	1.0 MGD with two banks in service
ASST	
Quantity	1
Volume	32,000 Gallons
RDT	
Quantity	1
Capacity	125 gpm
TSST	
Quantity	1
Volume	11,250 Gallons

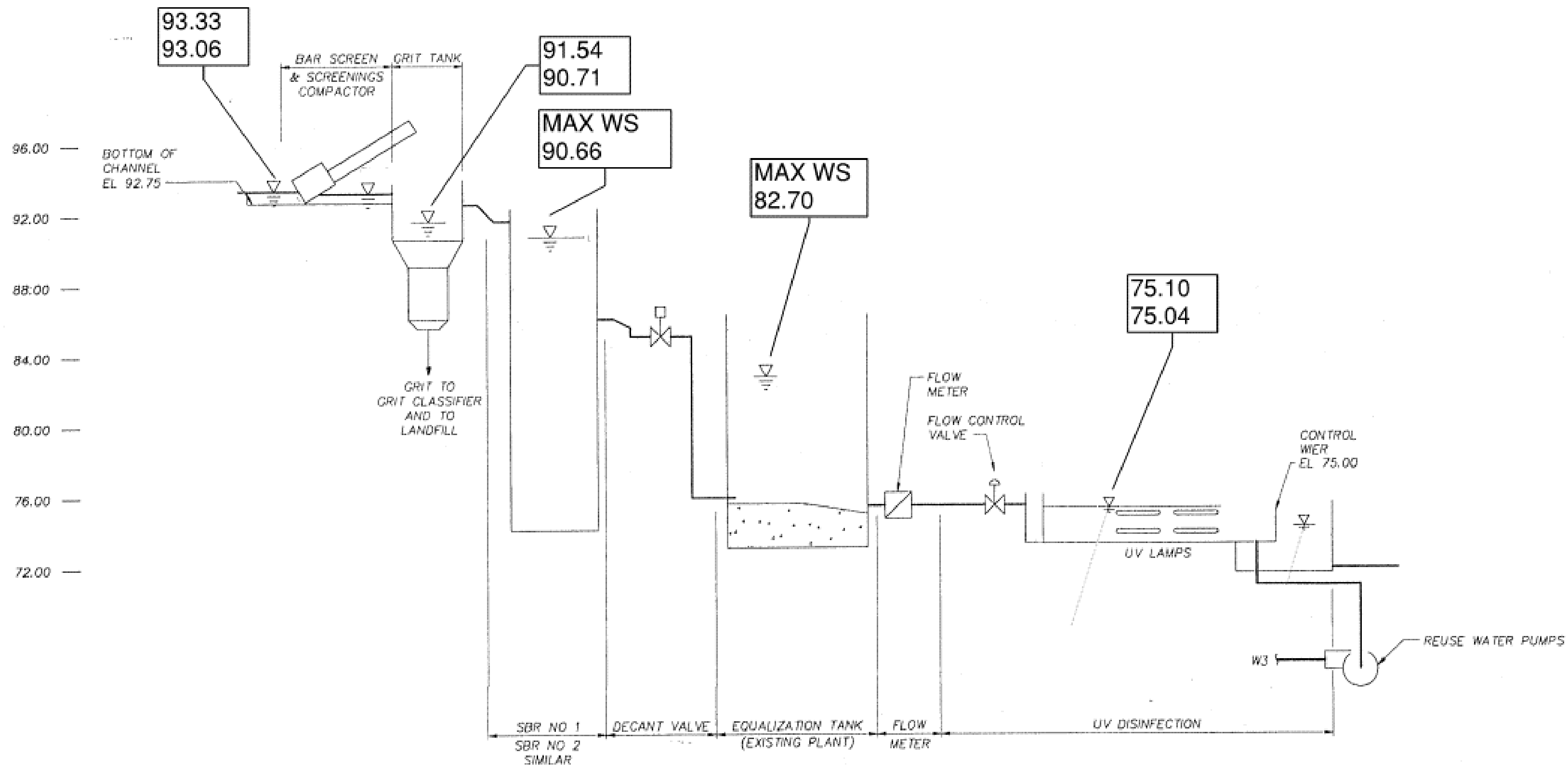
6.6.2 WWTP Liquid Stream Hydraulic Capacity

6.6.2.1 Hydraulic Capacity Analysis

To evaluate the process hydraulic capacity of the existing WWTP, the plant was modelled using Visual Hydraulics© based on the design and record drawings.

The hydraulic capacity was evaluated for flows up to the 2042 PHF of 1.07 MGD to determine how the existing plant will handle the future flowrates. As part of the analysis, hydraulic limitations were identified when the water level reached within 12 inches of freeboard below the top of a containment structure. The hydraulic profile at the 2042 AAF and PHF is shown in **Figure 6-10** below. A detailed summary of the input parameters used in the Visual Hydraulics Model is included as **Appendix H**.

Figure 6-10 | Suquamish WWTP Hydraulic Profile



WATER SURFACE ELEVATION KEY:

1) 2042 PEAK HOUR FLOW
INFLUENT = 1.07 MGD

2) 2042 AVERAGE ANNUAL FLOW
INFLUENT = 0.26 MGD

NOTES:

1. ELEVATIONS BASED OFF
1997 RECORD DRAWINGS

6.6.2.2 Headworks Facility Hydraulic Capacity

All headworks components (mechanical equipment, piping, and structures) have hydraulic capacity in excess of the 2042 PHF of 1.07 MGD per the model results and equipment design criteria.

6.6.2.3 Secondary Treatment Hydraulic Capacity

The as-built drawings do not show the details of the decant intake mechanism, which limits the ability to accurately model the SBR hydraulics. Operators report that at peak flows, they are not able to fully decant one basin before the other basin begins the fill cycle. This indicates that the decant mechanism is hydraulically restrictive for normal operations at current peak flows of approximately 1.0 MGD.

The hydraulic model was run with an open pipe decant intake to evaluate the capacity of the influent and effluent pipes, which have sufficient capacity to meet the 2042 flows.

6.6.2.4 UV Channel and Effluent Basin Hydraulic Capacity

The UV channel has sufficient hydraulic capacity to convey the 2042 flows.

The existing UV disinfection system has two UV banks each with 36 lamps and a total rated capacity of 1.0 MGD. The channel was designed with room for a third bank.

6.6.2.5 Summary

The hydraulic analysis indicates that the decant intake mechanism creates a hydraulic limitation, but all other Suquamish WWTP components have sufficient capacity to convey flows throughout the 20-year planning horizon.

6.6.3 Secondary Treatment System Process Capacity

6.6.3.1 BioWin™ Model Development

The existing SBR were modeled using BioWin™ software to determine the existing secondary process treatment capacity. The process model was evaluated under both current and future AAF, MMWWF, and MMDWF conditions.

6.6.3.2 Influent Wastewater Characterization

Following the sampling plan developed by Murraysmith [now Consor], County staff collected three wastewater characterization samples of influent and effluent composite samples in August and September 2020 including one on the weekend. The results of the wastewater characterization are summarized in **Table 6-15** and were included to develop the influent characteristics for the process model.

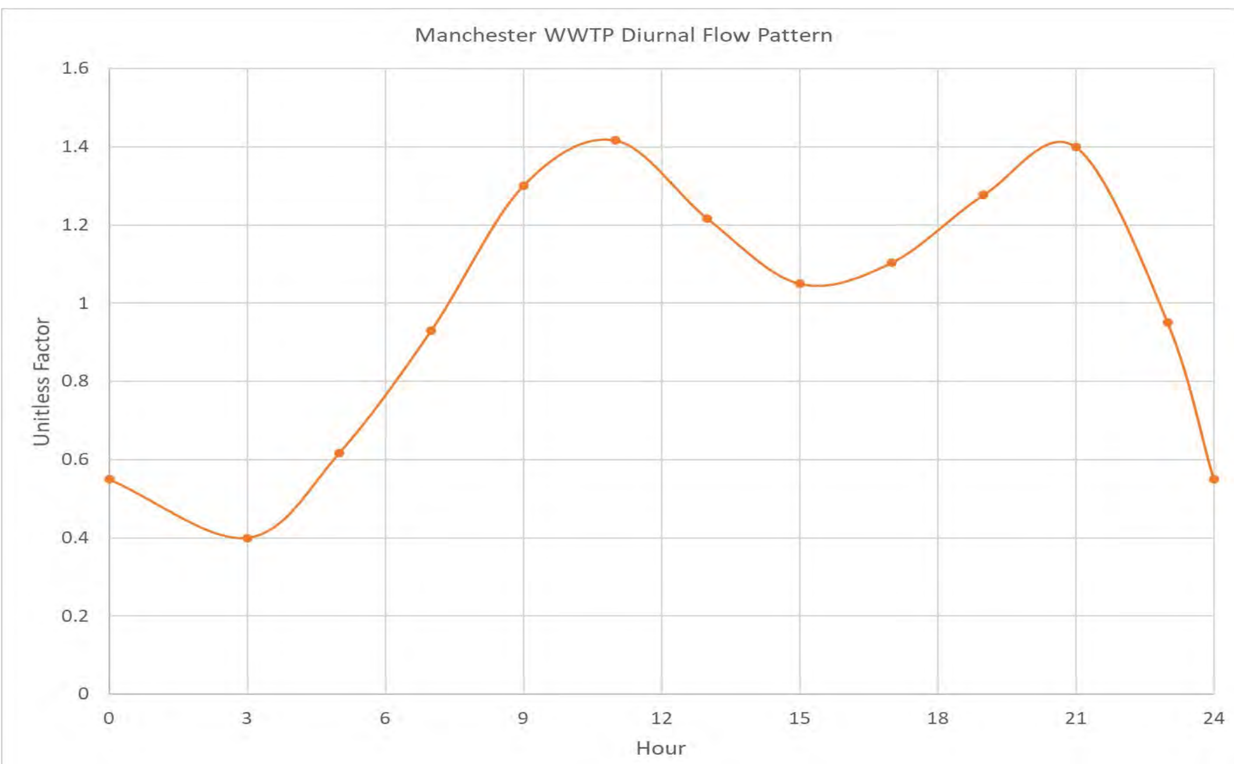
Table 6-15 | Average Influent and Effluent Wastewater Characteristics

Parameter	Influent Values (average)	Effluent Values (average)
Total Chemical Oxygen Demand (COD) (mg/L)	878	55
Filtered COD (mg/L)	273	44
Flocculated and Filtered COD (mg/L)	160	Not Determined
Carbonaceous Biochemical Oxygen Demand (CBOD) (mg/L)	271	Not Determined
Filtered CBOD (mg/L)	105	Not Determined
TSS (mg/L)	367	11

Parameter	Influent Values (average)	Effluent Values (average)
Volatile Suspended Solids (VSS) (mg/L)	340	10
NH_3-N (mg/L)	41	32
NO_3-N & NO_2-N (mg/L)	< 0.05	< 0.05
TKN (mg/L)	60	33
Total Phosphorus (TP) (mg/L)	8	2
Orthophosphate (Ortho-P) (mg/L)	3	2
Alkalinity (mg/L)	274	236
Calcium (mg/L)	29	Not Determined
Magnesium (mg/L)	39	Not Determined
pH	7.7	7.23
DO (mg/L)	0.2	2.6

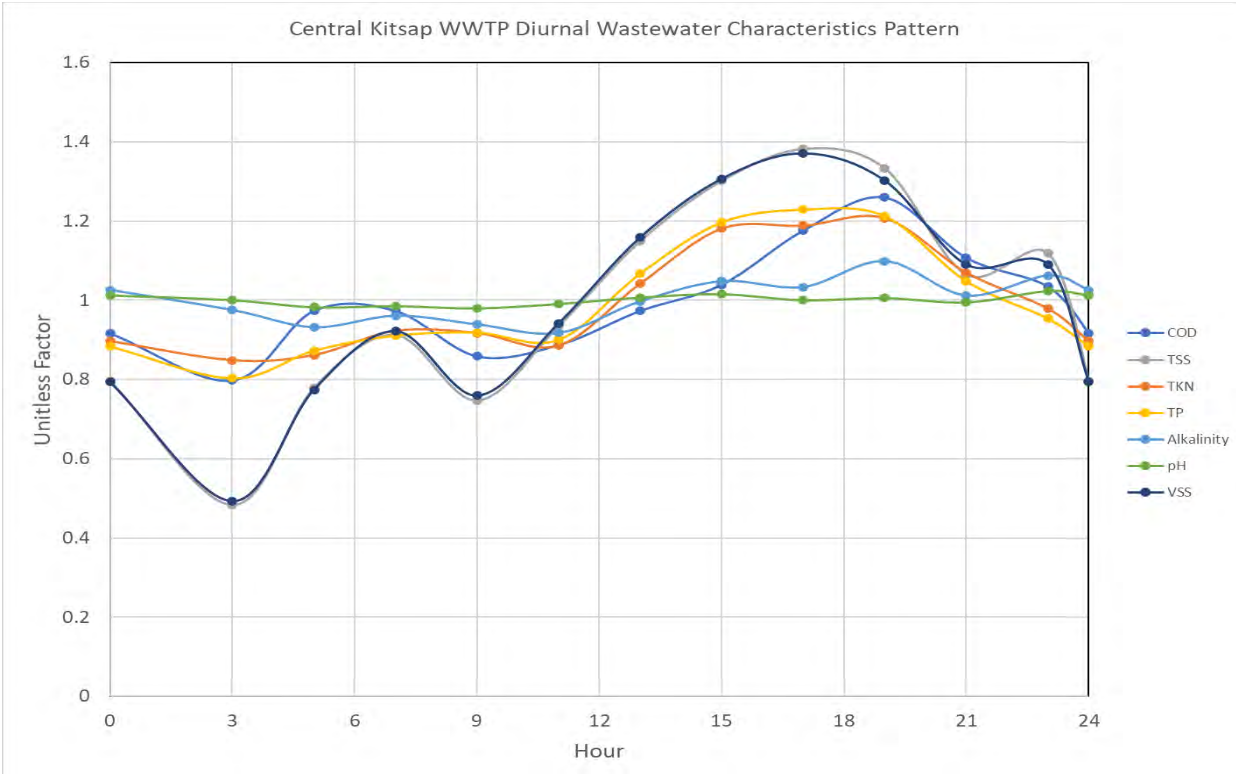
Since no hourly influent flow is recorded, the diurnal flow data from Appendix C of the 2014 Manchester Sewer Facilities Strategy Plan (BHC Consultants, October 2014) was used to simulate diurnal influent flow patterns. The County also operates the Manchester WWTP and it has a similar service area as the Suquamish WWTP. The diurnal influent flow pattern is shown on **Figure 6-11.** In addition, diurnal influent wastewater sampling for COD, TSS, VSS, TKN, TP, Ortho-P, Alkalinity, and pH was performed at Central Kitsap WWTP on October 21, 2020 and were used as the basis of Suquamish WWTP diurnal influent concentration pattern as shown on **Figure 6-12**. Both diurnal flow and concentration information was used in the process model dynamic simulations.

Figure 6-11 | WWTP Influent Diurnal Flow Pattern



Source: 2014 Manchester Sewer Facilities Strategy Plan

Figure 6-12 | WWTP Influent Characteristics Diurnal Pattern



Source: Central Kitsap WWTP Wastewater Sampling Results, 2020

6.6.3.3 Treatment Requirements

The Suquamish WWTP has an NPDES permit that sets the limit for BOD, TSS, pH, Fecal Coliform. It will likely have an annual TIN discharge limit of 14,691 pounds, or 40 ppd in the new permit based on the Ecology 401 certification. Ecology has also indicated the ultimate target for nutrient limits will likely be between 3 and 10 mg/L, and, although it does not apply to Suquamish, the Draft PSNGP includes a "Nutrient Reduction Evaluation" that includes consideration of technologies capable of achieving 3 mg/L. As part of the capacity evaluation for the exiting plant, in addition to meeting the BOD and TSS concentration limits of 30 mg/L, the plant was also evaluated for meeting a potential TIN limit of 10 mg/L. Potential alternatives to achieve as low as 3 mg/L will be discussed in the following section.

6.6.3.4 Secondary Treatment Process Capacity Results

The results of various simulations at AAF, MMWWF and MMDWF in 2020, 2028 and 2042 are shown in Table 6-16.

Under current 2020 flow and loads, the existing SBR operation procedure can meet all the treatment goals on BOD, TSS and annual TIN load. With an extended solids retention time (SRT), the plant can meet a potential TIN concentration less than 10 mg/L under 2020 AAF and MMDWF conditions, but not under 2020 MMWWF condition. This is supported by historical effluent nitrogen data that shows effluent TIN concentrations frequently above 10 mg/L.

As flow and loads increase over time, the plant will be able to meet the current BOD, TSS, and annual TIN load limit, but will not be able to meet the target effluent TIN concentrations under several conditions.

In a summary, the existing SBRs have sufficient capacity to treat the projected TSS and BOD loadings to meet the current NPDES permit limits and the annual TIN loading cap through the 20-year planning horizon. However, the plant will not be able to meet more stringent TIN effluent requirement when that comes into effect in the future. More detailed analysis on modifying the plant to meet more stringent nitrogen requirement will be discussed in the next section.

Table 6-16 | BioWin™ Process Model Simulation Results

Parameter	2020			2028			2042		
	AAF	MMW WF	MMD WF	AAF	MMW WF	MMD WF	AAF	MMW WF	MMD WF
Flow (MGD)	0.23	0.45	0.30	0.24	0.47	0.31	0.26	0.50	0.33
Temperature (°C)	15.00	10	22	15.00	10	22	15.12	10	22
Influent Alkalinity (mg/L)	275	275	275	275	275	275	275	275	275
Aeration Cycle (min)	18 ON/ 2 OFF	20 ON/ 5 OFF	20 ON/ 5 OFF	18 ON/ 2 OFF	20 ON/ 5 OFF	20 ON/ 5 OFF	18 ON/ 2 OFF	20 ON/ 5 OFF	20 ON/ 5 OFF
DO Target during ON Cycle (mg/L)	2	2	2	2	2	2	2	2	2
SRT (days)	14.50	7.75	13.50	16.75	8.75	15.50	14.50	6.80	15.00
MLSS (mg/L)	2,985	2,175	3,086	3,253	2,545	3,582	3,148	2,339	3,585
Effluent TSS (mg/L)	7.3	17.6	9.7	7.6	26.0	10.6	7.8	21.0	10.7
Effluent BOD (mg/L)	3.1	8.8	4.5	3.0	11.9	4.5	3.2	10.5	4.8
Effluent Ammonia (mg/L)	9.7	13.8	6.4	10.4	16.3	7.0	17.6	15.0	13.0
Effluent Nitrate (mg/L)	0	0	0	0	0	0	0	0	0
Effluent Nitrite (mg/L)	0.00	0.00	0.16	0.00	0.00	0.08	0.00	0.00	0.00
Effluent TIN (mg/L)	9.7	13.8	6.5	10.4	16.3	7.1	17.6	15.0	13.0
Annual Effluent TIN Load (ppd)	19	-	-	21	-	-	38	-	-
Effluent pH	6.9	7.0	6.9	6.9	7.0	6.9	7.0	7.0	6.9
Effluent Alkalinity (mg/L)	183	252	186	210	260	188	234	259	211
WAS Solids (ppd)	488	763	577	488	761	577	545	894	577
ASST Capacity (days)	2.5	1.6	2.1	2.5	1.6	2.1	2.3	1.4	2.1
Thickened Biosolids (% solids)	5.7	5.3	5.3	5.3	5.3	5.4	5.4	5.3	5.3
Thickened Biosolids (ppd)	337	542	411	343	547	419	386	644	421
TSST Storage Capacity (days)	16	9	12	15	9	12	13	8	12

6.6.4 Solids Stream Capacity

6.6.4.1 ASST Capacity

The ASST has a capacity of 32,000 gallons and will provide 2.5 days of WAS storage capacity at current AAF flows. The sludge thickening system does not have redundancy. If any of the thickening components were to break down, there is piping to bypass the thickening system and offload the ASST to a sludge loading truck. At 2042 MMWWF, the ASST provides 1.4 days of WAS storage based on **Table 6-15**. The RDT could be run more frequently under that condition prior to building additional WAS storage.

6.6.4.2 RDT Loading Rate

The RDT is currently operated 4 days per week, usually on Monday, Tuesday, Thursday, and Friday. **Table 6-17** summarizes the projected WAS production by the process model and the anticipated RDT operating hours in each week when run at 125 gpm. The RDT has sufficient capacity for greater runtime to meet existing and future plant capacity.

Table 6-17 | Projected RDT Operation

Parameter	AAF	MMWWF	AAF	MMWWF	AAF	MMWWF
Design Year	2020	2020	2028	2028	2042	2042
WAS Solids (ppd)	488	763	488	761	545	894
Assumed WAS Concentration (mg/L)	4,600	4,600	4,600	4,600	4,600	4,600
WAS Flow (gpd)	12,700	19,900	12,700	19,800	14,200	23,300
RDT Operating Hours (hours per week)	6.3	10.7	6.8	10.6	7.6	12.5

6.6.4.3 TSST Capacity

Thickened sludge from the RDT is stored in the 11,350-gallon TSST until it is hauled approximately twice a week to Central Kitsap WWTP for further treatment and disposal. WAS concentration can range from 4,000 mg/L to 9,000 mg/L and is thickened to about 5 percent solids. Current TSST storage capacity is approximately 16 days. The BioWin™ model projects TWAS storage capacity of approximately 8 days under 2042 maximum month flow conditions. Therefore, TWAS storage capacity is not a limiting factor at the Suquamish WWTP.

6.7 Summary of Deficiencies and Recommendations

Table 6-18 provides a summary of the main findings for each unit process based on the condition assessment, code review, hydraulic analysis, and treatment capacity analysis described above.

Table 6-18 | Overall Unit Process Capacity and Deficiencies

Unit Process	Physical Condition[1]	Capacity	Recommendation
Preliminary Treatment			
Fine Screen	Poor	2.0 MGD, peak	General maintenance practice to mitigate corrosion Plan equipment replacement in the next 2 to 10 years
Bar Screen	Fair	2.0 MGD, peak	None
Grit Chamber	Fair	2.0 MGD, peak	None
Grit Classifier	Fair	200 gpm	None

Unit Process	Physical Condition[1]	Capacity	Recommendation
Grit Pump	Poor	100 to 150 gpm	General maintenance practice to mitigate corrosion Plan equipment replacement in the next 2 to 10 years
Secondary Treatment			
SBR Basins	Fair	Over 0.50 MGD, maximum month	Add redundant SBR basin or influent storage to improve process reliability Upgrade the entire secondary process for future TIN requirement
SBR Blowers	Fair	264 standard cubic feet per minute (scfm), each	Replace blowers when the secondary process needs to be upgraded
SBR Piping	Very Poor	N/A	Replace the effluent control valve Replace entire piping
Sludge Recirculation Pumps	Fair	1,465 gpm, each	Replace pumps when the secondary process needs to be upgraded
Disinfection and Effluent			
Equalization Basin	Poor	69,000 gallons	Replace the equalization basin with a larger and covered structure
UV System	Poor	1.0 MGD, peak	Replace entire system for improved control in the next 2 to 10 years
Solids Treatment			
Sludge Storage Blower	Fair	200 scfm, each	Plan equipment replacement in the next 12 to 15 years
ASST	Poor	32,000 gallons	Recoat the structure and repair the access hatch or replace the structure
Thickener Feed Pump	Very Good	130 gpm at 100 psi	None
RDT	Very Good	125 gpm	Monitor corrosion on flocculation tank and mixer. Improve the ventilation within the room to reduce the corrosion potential
Thickened Sludge Pump	Fair	12 gpm at 100 psi	Replace with a larger pump to handle higher solids content
TSST	Very Good	11,250 gallons	None
Sludge Loadout Pump	Very Good	225 gpm at 100 psi	None
Support System			
Odor Control	Poor	5,000 cfm	Repair or replace the odor control system to restore automatic operation and full functionality
Process Building sump pumps	Not observed	280 & 300 gpm	Plan equipment replacement in the next 2 to 10 years
Process Water	Not observed	40 gpm, each	None
Reclaimed Water Pumps	Very Good	N/A	Add supports to pump volute and pipe
Power Distribution			
Electrical Service	Fair	225 kVA primary service and 480-volt secondary service	Plan equipment replacement in the next 10 to 12 years Complete arc flash study for the electrical infrastructure

Unit Process	Physical Condition[1]	Capacity	Recommendation
Generator	Fair	450 kW	Plan equipment replacement in the next 10 to 12 years
MCCs	Fair	N/A	Plan equipment replacement in the next 10 to 12 years
Control Panels	Fair	N/A	Housekeeping recommendations per **Section 6.3.3.8**
Buildings			
Service Building	Good	N/A	None
Process Building	Good	N/A	Keep screen channel cover plates on to reduce flammable gas migration from the headworks channel. Test and balance the air ventilation within the RDT room to ensure at least 6 air change per hour ventilation is provided. Install or repair the combustible gas detection and fire alarm system in the room

Notes:

1. Component condition rating based on **Table 6-3**

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SECTION 7

Collection and Conveyance System Analysis

7.1 Introduction

The Suquamish collection system was modeled using the Danish Hydraulic Institute's (DHI's) MIKE+ hydraulic and hydrologic (H/H) modeling platform to determine capacity deficiencies in the system. Results were analyzed for three scenarios:

- **Existing Conditions**: Existing population with 25-year 12-hour design storm rainfall.
- **2042 Conditions**: Projected 2042 population with the 25-year 12-hour design storm scaled for the projected 2042 climate conditions. This scenario is intended to represent the 20-year planning horizon.
- **2080 Conditions**: Projected 2042 population with the 25-year 12-hour design storm scaled for the projected 2080 climate conditions. This scenario is intended to represent a conservative estimate of the impacts to the collection system from increased rainfall due to climate change and roughly aligns with the expected useful life of a pipe.

Selection of the design storm and other model information is included in the technical memorandum *Kingston and Suquamish Design Storm, Model Loadings, and Future Condition Parameters* (Murraysmith [now Consor], February 2022), included as **Appendix I**.

7.2 Capacity Criteria

The following criteria were used to determine if a collection and conveyance facility was capacity limited and in need of upsizing:

- Manholes are considered to have SSOs when the water surface elevation in a manhole exceeds the rim elevation. SSOs at manholes and lift stations are public health hazards and a source of contaminants that adversely impacts the water quality of streams, lakes, marine waters, and groundwater.
- Pipes are considered surcharged when the water surface elevation in the upstream or downstream manhole connection exceeds the pipe crown. This condition indicates that the sewer has reached flow capacity and hydraulic flow characteristics have worsened.
- Pipes with velocities exceeding 7 feet per second (fps) are considered capacity limited. High velocities cause increased scouring, wear of pipe materials, and shorten the useful life of pipe. High velocities also cause turbulent flow conditions and higher energy requirements for pumping equipment. This is primarily a factor for force mains.

- Pump stations are under capacity when the flow to a pump station meets or exceeds the pump station firm capacity. The firm capacity of a pump station is the pumping capacity of the station when the largest pump is out of service.

7.3 Analysis Results

The results of the modeling analysis are summarized in this section. Assets that were modeled as failing the criteria for the planning horizons are shown in **Figure 7-1** and **Figure 7-2**, and the total counts of SSOs and surcharged gravity pipes are included in **Table 7-1**. The pipe surcharge shown in **Table 7-1** and **Figure 7-1** flags any gravity pipe where the simulated hydraulic grade line is greater than the crown of the pipe at either end of the pipe. Force mains are only considered under capacity if they fail the velocity criteria (shown in **Figure 7-2**).

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Figure 7-1 | Suquamish Capacity Deficiencies

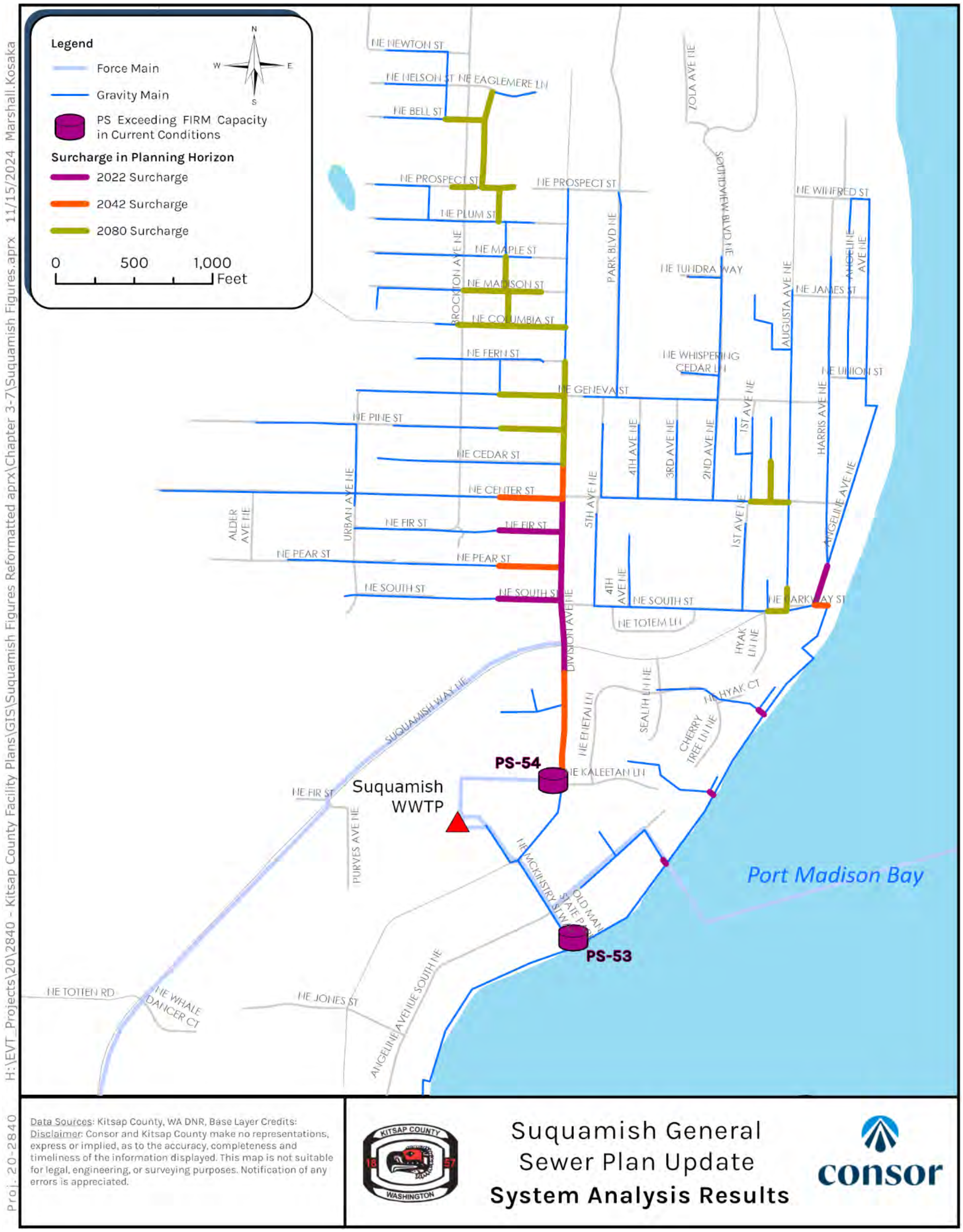


Figure 7-2 | Suquamish Velocity Deficient Pipes

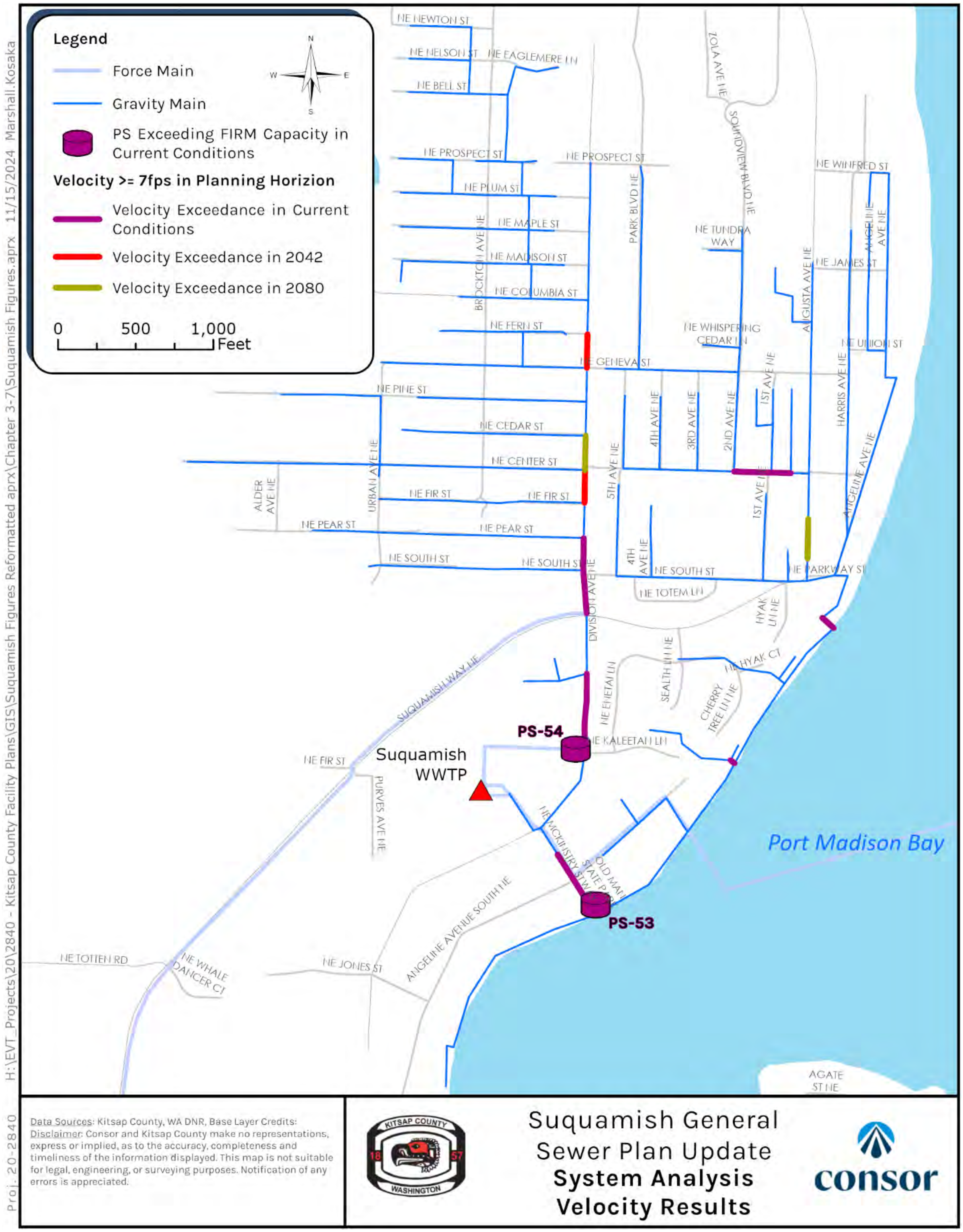


Table 7-1 | Pipe and Manhole System Analysis Results

Scenario	Surface Sewer Overflows (SSO)	Number of Pipes Surcharged (Either end)	Number of Pipes Velocity Exceeding 7fps
2022	0	11	13
2042	0	20	15
2080	0	45	17

Model results show several pipes along Division Avenue NE in the vicinity of NE South Street as being surcharged under the existing conditions. Additional surcharging in the existing conditions is shown near NE Parkway (at the Suquamish Dock) and up along Augusta Avenue NE. It is important to consider these results in the context of the model calibration. The model was calibrated using flow data from three flow monitors installed in the system between 10/1/2020 and 5/1/2021. The simulated peak flow for the December 21, 2020 storm event (which is similar to 25-year 12-hour design storm used in the system analysis) was approximately 30 percent higher, on average, than the observed peak flows across the three flow meters used for calibration. Simulated volume for this event was approximately 35 percent higher, on average, than the observed volume across the three flow meters. However, even with these conservative flow simulations, simulated surcharge was minor in the calibration period. The maximum simulated surcharge was, on average, approximately 0.1 feet for the surcharged pipes with none exceeding 0.25 feet of surcharge during the calibration period.

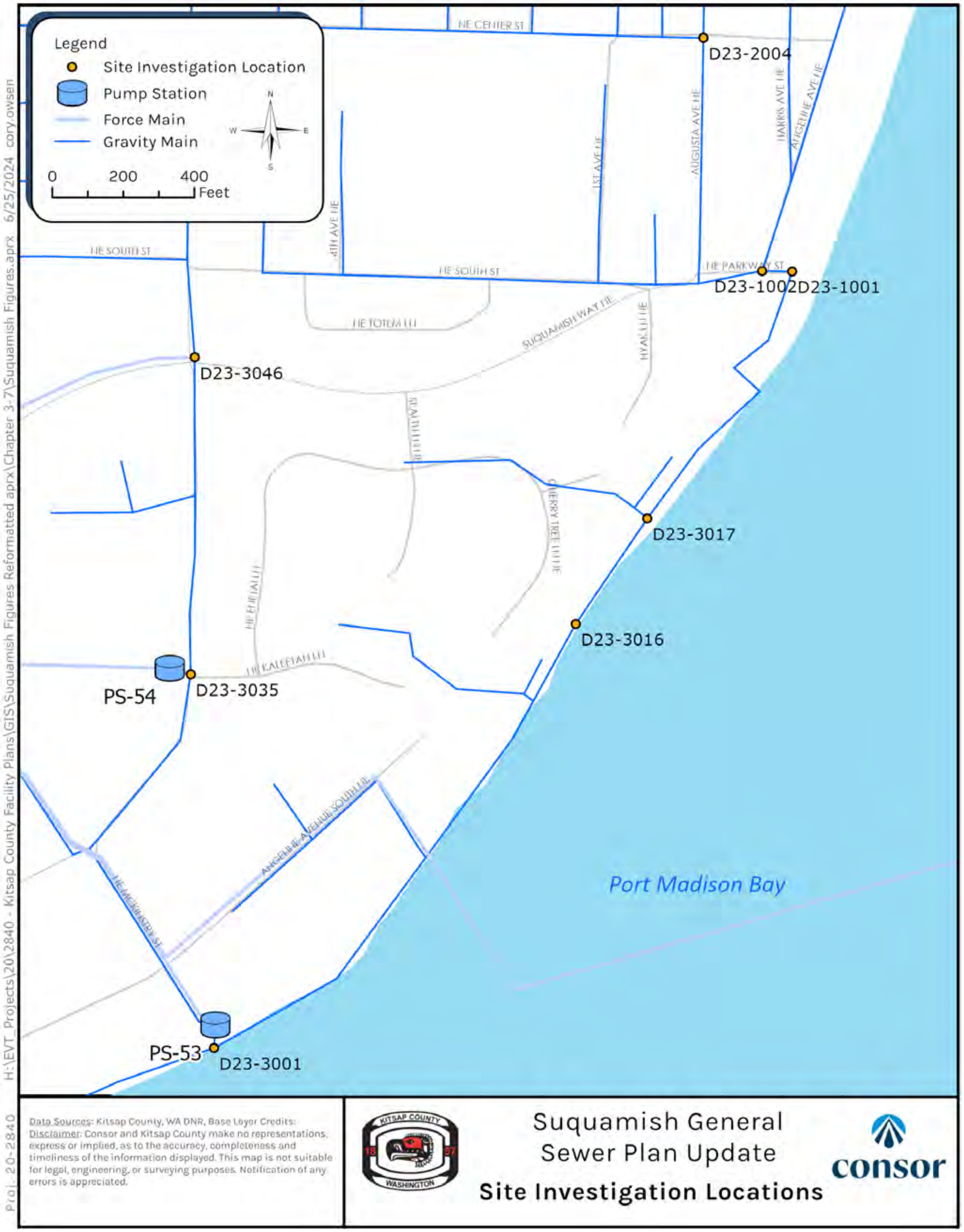
Considering model results for the calibration period and the design storm simulations, Murraysmith [now Consor] staff conducted a field investigation on 6/22/2022 with County staff to look for evidence of surcharge in the system to corroborate model results. Eight manholes, selected based on proximity of simulated surcharge, were investigated. Four of the eight exhibited signs of surcharge including the staining of walls or accumulated debris. This corroborates the model results somewhat. The results of the site visit are in **Table 7-2**. The locations are shown in **Figure 7-3**.

Considering the conservative model calibration and the field visit results, capital improvements to increase pipe capacity in the near-term planning horizon are not recommended. However, long-term capital improvement projects will be provided in **Section 11**. It is also recommended that the County continue to monitor these locations for signs of surcharge. See **Section 11** for more information on recommended capital improvement for pipes.

Table 7-2 | Site Visit Investigation Locations

MH ID	Location	Notes
D23-1002	Augusta Avenue NE & NE Parkway	No evidence of surcharge, Clean and no debris
D23-2004	Augusta Avenue NE & NE Center Street	Evidence of surcharge, possible backwatering of north/south line
D23-3035	Division Avenue NE & NE Kaleetan Lane	Evidence of surcharging up to crown and bench, overflow MH upstream of PS-54, some evidence of flow into the overflow
D23-3001	On beach at Old Man State Park	Inconclusive evidence of surcharge but very damp, south line is offset
D23-3046	Division Avenue NE & Suquamish Way NE	Evidence of surcharge, influent from Casino force main. MH lid said "DRAIN", but flow type confirmed by operations staff.
D23-3016	On beach south of NE Parkway	No evidence of surcharge
D23-1001	East end of NE Parkway	Evidence of surcharge, noticeably deeper flow than upstream MH. Near meter location.
D23-3017	On beach south of NE Parkway	Inconclusive evidence of surcharge, east/west line offset

Figure 7-3 | Site Investigation Locations



The model simulated PHF for each pump station in the Suquamish basin, assuming all growth occurs within the existing system, is shown **Table 7-3**. The firm capacity values match the analysis included in **Section 5** and the flows shown here are taken from the model simulations. Peak hour flows were calculated based on simulated inflows to the pump station wet wells.

Table 7-3 | Pump Station Capacity and Peak Hour Flows

Lift Station	Firm Capacity (gpm)	2022 PHF (gpm)	2042 PHF (gpm)	2080 PHF (gpm)
PS-53	360	***[834]***	***[973]***	***[1,065]***
PS-54	350	***[859]***	***[1,094]***	***[1,257]***

Note:
Flows exceeding the firm capacity are bracketed and in bold italics.

These results indicate that both PS-53 and PS-54 are under capacity for all planning horizons. As noted in **Section 7.1**, these results are generated from the model simulation using the 25-year 12-hour and the analysis. PS-53 and PS-54 both discharge to the Suquamish WWTP. It should be noted that the results shown in **Table 7-3** appear to be more conservative than those discussed in **Section 3**, which projected peak hourly flow at the WWTP in 2042 at 745 gpm (1.07 MGD). The collection system modeling analysis simulated flows for a 25-year design storm while the plant flows projection was based on the observed daily flow rate at the plant during 2018 to 2020 and an hourly peaking factor of 1.4 determined from the County's similar sewer system in the Manchester basin. Proposed improvements to the WWTP plant to accommodate higher influent flows, including an equalization basin, new headworks, parallel screening channels, fine screen, and grit tank, are described in **Appendix A.** These proposed improvements are consistent with the increased simulated flows in the collection system.

Discussion with the County indicates that they do experience excessive flows at each of these stations. As such, capital improvements are recommended to increase pump capacity. See **Section 11** for more information on recommended capital for pump station updates. Additionally, it is recommended that the County conduct additional flow monitoring at each pump station to confirm flow projections prior to design of new pump stations.

7.4 Capital Improvement Plan Model Runs

Model runs were performed to confirm project sizing for recommended capital improvements which include upsizing the pump stations and system expansion projects. Assumed growth occurs over the full LAMIRD including areas not currently served by the collection system.

Pipe sizes were increased in the model to remove flow restrictions to determine the required pump capacities for the CIP scenarios. The model simulated PHF for each pump station in the Suquamish basin for the CIP scenarios, without flow restrictions is shown **Table 7-4**. Recommended improvements are described further in **Section 11**.

Table 7-4 | Pump Station Capacity and Peak Hour Flows with System Expansion

Lift Station	Firm Capacity (gpm)	2022 PHF (gpm)	2042 PHF (gpm)	2080 PHF (gpm)
PS-53	360	***[834]***	***[1,191]***	***[1,304]***
PS-54	350	***[859]***	***[1,227]***	***[1,405]***

Note:
Flows exceeding the firm capacity are bracketed and in bold italics.

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SECTION 8

Wastewater Treatment System Analysis

The Suquamish WWTP improvement options and process alternatives considered for plant improvements for the 20-year and 40-year planning horizons are described in this section. Projected increases in flow and loading to the WWTP, aging equipment and the 401 certification requirement in the EPA NPDES permit are the primary drivers for the improvements to allow the plant to consistently achieve the required effluent quality. The evaluation takes into consideration plant deficiencies, upgrades required, the expected treatment performance, capital and life cycle costs.

8.1 Overview of Improvements

The results of the condition assessment, capacity analysis, regulatory requirements, and projected flows and loadings, were used to identify processes that require improvement and define feasible alternatives for the WWTP improvements. SBR basin, UV disinfection, and odor control were identified in the condition assessment (Section 6) as the primary processes requiring improvements due to the condition or performance deficiencies. In this section, two major options (upgrading the existing WWTP and abandoning the existing WWTP) were evaluated with multiple process alternatives analyzed as applicable for each option. The evaluated options are referred to as Option A and Option B.

Option A includes upgrades to the existing WWTP. In this option, deficiencies in the secondary treatment, disinfection, and odor control processes were reviewed, and alternatives for each of these unit processes were identified and analyzed to select a preferred alternative. Two secondary treatment alternatives (SEC-1 and SEC-2) were evaluated to improve or upgrade the SBR process. Two disinfection alternatives (DIS-1 and DIS-2) were evaluated to replace the existing UV disinfection system and its associated control system. Three odor control alternatives (OC-1, OC-2 and OC-3) were evaluated on various odor control technologies to replace the existing odor control system. The details of these alternatives are discussed in Section 8.3 below.

Minor maintenance, repairs, and direct replacements identified in the condition assessment Table 6-18 do not need alternative analysis and are not included in the alternatives analysis, but Class 5 opinions of probable project costs (OPPCs) of some items, such as replacing influent fine screen and grit pump, modifying effluent EQ basin, and constructing a new ASST are included in the cost analysis (designated as "Additional Improvements") to make sure all costs required to maintain ongoing operation of the Suquamish WWTP are accounted for when compared to Option B. These maintenance and repairs recommendations as well as other capital improvement recommendations listed in Table 6-18 are discussed briefly in the overview of Option A and categorized into near-term, medium-term, and long-term improvements in Section 11. Similarly, the opportunities and benefits of a reclaimed water program are discussed separately in Section 9.

Option B includes abandoning the existing Suquamish WWTP and diverts flow to the Central Kitsap WWTP for treatment. A new lift station at the Suquamish WWTP site and a 4.5-mile force main will be constructed to transfer the wastewater flows to the Central Kitsap collection system. Additional projects to increase capacity within the existing Central Kitsap WWTP collection system to accommodate the Squamish flow are also required. None of the deficiencies identified in **Table 6-18** would need to be addressed if the plant is abandoned.

8.2 Opinion of Probable Project Costs

To provide a more realistic lifecycle analysis for major abandonment and replacement of facilities, OPPCs for the 20-year and a longer term of view, 40-year planning period, are developed for each option and alternatives. Class 5 OPPCs were prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineering International (AACE) for planning-level evaluations with a range of -50 percent to +100 percent, based on the *AACE International Recommended Practice No. 18R-97 Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries – TCM Framework: 7.3 – Cost Estimating and Budgeting.*

The OPPCs were developed using RSMeans Heavy Construction Cost Data, recent County project bid tabs, County input, industry experience, and local contractor and supplier costs. All costs were developed based on the preliminary concepts and layouts of the system components in 2022 dollars should be escalated with the future Consumer Cost Index for use in project budgeting. The OPPC includes both construction and project costs. The construction costs include construction work and materials plus markups for mobilization, general contractor markups, overhead and profit, taxes, and a construction contingency of 30 percent. The project costs account for as a markup of 25 percent for engineering, legal, and administration costs associated with project delivery.

O&M costs, 20-year net present values and 40-year net present values were developed based on the following assumptions:

- Labor cost: $60/hour
- Electricity Cost: $0.10/kilowatt-hour
- Discount rate: 3 percent
- Inflation rate from 2023 to 2024: 12 percent
- Inflation rate from 2025 to 2026: 8 percent
- Long term inflation: 5 percent

8.3 Option A – Upgrade Existing WWTP

Option A is to continue operating the Suquamish WWTP by implementing upgrades identified in the condition assessment of **Section 6** to address deficiencies and replacing or rehabilitating equipment as needed.

Preliminary treatment components at Suquamish WWTP include the fine screen, bar screen, grit chamber, grit pump and classifier. The fine screen and grit pump are in poor condition and require some general maintenance and equipment replacement in the next 2 to 10 years. These items will be direct replacements with limited ability for different alternatives and therefore do not require alternative analysis, but are included in this section to make sure all costs required to maintain ongoing operation of the Suquamish WWTP are accounted for when compared to Option B. Other components are generally in fair condition and have sufficient capacity. No upgrades are required, and further analysis of alternative processes is not considered in this section. Equipment replacement will be further discussed in **Section 11**. Suquamish WWTP does not have any primary treatment processes.

Secondary treatment components at Suquamish WWTP include SBR basins, blowers, piping and sludge recirculation pumps. The piping is in very poor condition and the plant has started the piping replacement.

Ongoing sludge piping and valve replacement: The existing sludge recirculation piping is mostly welded steel pipe. Multiple welded connections have leaks and are very difficult to repair. The electrical actuators of the control valves are obsolete. The County contracted with Consor to complete the design of a process piping replacement project in late 2022 to address this urgent issue as soon as possible. As additional improvements are developed in this section, additional opportunistic upgrades may be added to the design.

The SBR basins are in fair condition but a redundant SBR basin or influent storage is recommended to improve process reliability. This item does not require alternative analysis, but is included in this section to make sure all costs required to maintain ongoing operation of the Suquamish WWTP are accounted for when compared to Option B. The PSNGP has introduced new secondary treatment requirements and further changes the permit system are expected. Therefore, the secondary treatment system was identified in the condition assessment, **Section 6**, as one of three primary processes requiring improvement, and the capacity will be examined more closely in this section.

Two alternatives were developed to address the deficiencies in secondary treatment process, each of which is designated with a code identifying the location and alternative number as SEC (Secondary Treatment)-#. The optimization and improvements of secondary treatment will occur in the SBR basins and in the area previously reserved for future SBR basins to the east of the Process Building.

- **Alternative SEC-1 SBR Improvement** builds an influent equalization basin to improve the plant reliability and redundancy replaces failing SBR process piping and valves and installs DO and ammonia probes to improve process control.

- **Alternative SEC-2 AquaNereda System** includes the improvements in SEC-1 and converts the existing SBR system to an aerobic granular sludge (AGS) technology with a new influent equalization basin. The AquaNereda system is described in greater detail herein.

The UV disinfection system condition is in poor condition and was identified in the condition assessment, **Section 5**, as one of three primary processes requiring improvement. The process was reviewed, and two alternatives were identified and analyzed to select a preferred alternative to address the observed problems.

Each alternative is designated with a code identifying the location and alternative number as DIS (Disinfection)-#. The optimization and improvements of disinfection will occur in the UV system in the Process Building.

- **Alternative DIS-1 Trojan UV3000B and Controller** replaces the existing Trojan UV3000B with a new version of the same system.

- **Alternative DIS-2 Trojan UV3000Plus and Controller** replaces the existing system with the upgraded Trojan 3000plus system which allows for greater operational control and monitoring.

No other UV manufacturers were considered in this analysis because the existing UV system is by Trojan. Replacing the existing UV system with Trojan system will require none to minimal modification to the existing UV channel.

Solids treatment at Suquamish WWTP is provided by an RDT and includes pumps to handle the sludge, ASST and TSST as well as sludge storage blower. ASST is in poor condition and requires replacement. This will be direct replacements with limited ability for different alternatives and therefore do not require alternative analysis, but are included in this section to make sure all costs required to maintain ongoing operation of the Suquamish WWTP are accounted for when compared to Option B. The thickened sludge pump is in fair condition and is recommended to be replaced with a larger pump. The blower is in fair condition and is recommended to be replaced in the next 12 to 15 years. The other components are in very good condition and have sufficient capacity, so further analysis of alternative processes is not considered in this section.

The odor control system at Suquamish WWTP is provided by a chemical scrubber. The system is in a poor condition and was identified in the condition assessment, **Section 5**, as one of three primary processes requiring improvement. The process was reviewed and three alternatives were identified and analyzed to select a preferred alternative to address the observed problems.

Each alternative is designated with a code identifying the location and alternative number as OC (Odor Control)-#. The optimization and improvements of odor control system will occur east of the Process Building.

- **Alternative OC-1 Chemical Scrubber** replaces the existing chemical scrubber with a new, similar chemical scrubber.
- **Alternative OC-2 Activated Carbon** replaces the existing chemical scrubber with an activated carbon scrubber.
- **Alternative OC-3 Engineered Biofilter** replaces the existing chemical scrubber with an engineered biofilter package.

The process water and Process Building sump pumps were not observed. The non-portable water and power distribution systems are in fair or good condition and have sufficient capacity, so no upgrades are required. Some equipment related to these systems will require in-kind replacements, but analysis of alternative processes is not considered in this section.

Figure 8-1 shows the site plan of the WWTP with the unit processes requiring improvement identified. **Table 8-1** provides a summary of the alternatives under Option A.

Figure 8-1 | Overview of Improvement Alternatives for Option A at Suquamish WWTP

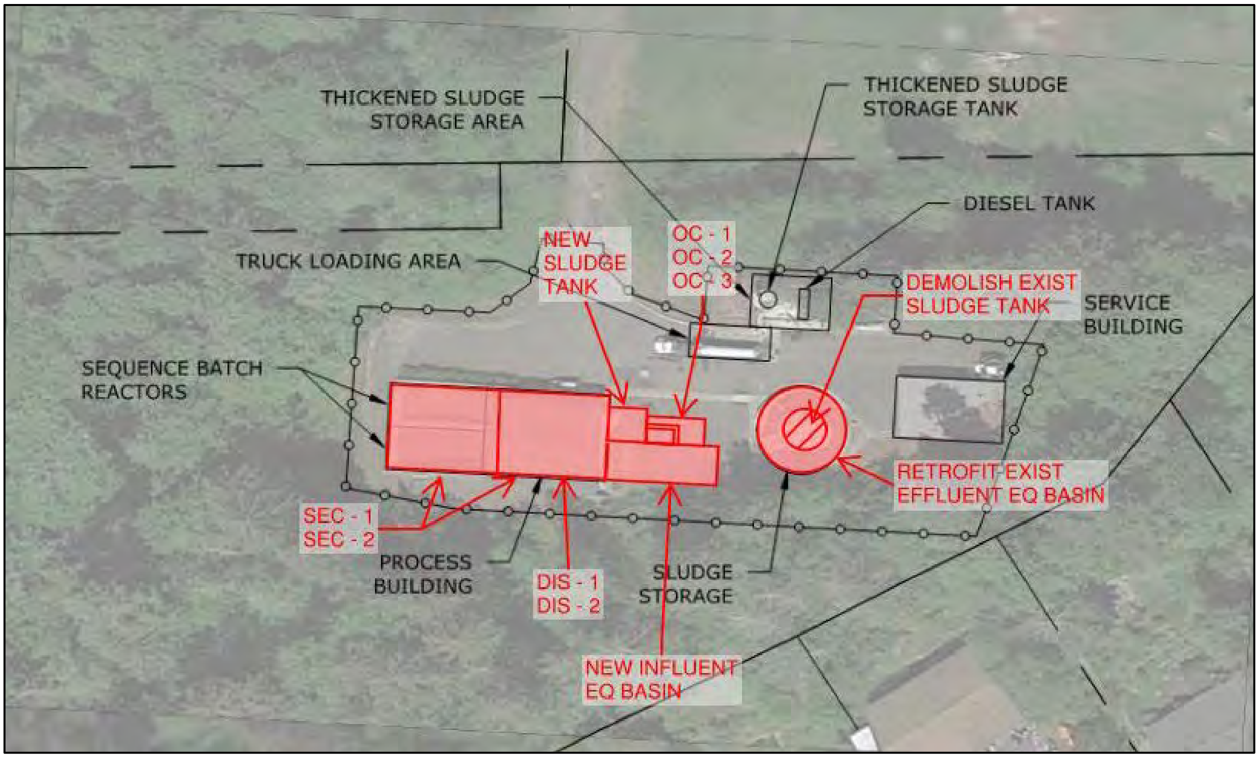


Table 8-1 | Option A Liquid Treatment Alternatives Summary

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
SEC-1	SBR Improvement	Replace piping and valves. Build influent equalization basin. Install DO and ammonia probes.	Secondary Treatment—reliability and nitrogen removal optimization
SEC-2	AquaNereda System	Convert SBR to AquaNereda AGS system.	Secondary Treatment — reliability and nitrogen removal
DIS-1	UV Disinfection – Trojan UV3000B and Controller	Replace the existing Trojan UV 3000B with a new unit; replace the basic controller with the touch smart controller; install a UV transmittance probe.	Disinfection
DIS-2	UV Disinfection – Trojan UV3000Plus and Controller	Replace the existing Trojan UV 3000B with an upgrade version – Trojan UV 3000Plus with touch smart controller and UV transmittance probe.	Disinfection
OC-1	Chemical Scrubber	Replace the existing chemical scrubber with a new chemical scrubber.	Odor Control
OC-2	Activated Carbon	Replace the existing chemical scrubber with an activated carbon system.	Odor Control
OC-3	Engineered Biofilter	Replace the existing chemical scrubber with an engineered biofilter.	Odor Control

8.3.1 Secondary Treatment Improvement Alternatives

8.3.1.1 Existing Condition Description

The two existing SBRs are equipped with a jet aeration system with air supplied by three blowers. Three SBR recirculation pumps recirculate the mixed liquor through a jet header and are also used to pump sludge to the ASST. One pump and one blower serve each basin, with the third as a shared standby.

As discussed in **Section 6**, the existing SBRs have sufficient capacity to meet the effluent TSS and BOD requirements as required in the current NPDES permit and the annual TIN loading cap as required in the CWA Section 401 certification through the 20-year planning horizon. However, the two-basin system does not meet current redundancy requirements in "Criteria for Sewage Works Design" by the Ecology. Additionally, the basin coating is beginning to fail and the plant does not have sufficient instrumentation to allow for nitrogen removal optimization.

8.3.1.2 Nitrogen Removal Criteria

Ecology provided permit requirements for the Suquamish WWTP in the CWA Section 401 certification when the NPDES permit was renewed by EPA in December 2019. The 401 certification requires an annual TIN load cap of 14,691 pounds, optimization plan, and nutrient reduction evaluation report, which is similar to but less specific than the PSNGP that was issued for other WWTPs in the Puget Sound later in December 2021. It is expected that the EPA and Ecology will keep treatment requirements for the Suquamish WWTP generally consistent with the PSNGP. The PSNGP requires an All Known and Reasonable Technologies (AKART) analysis for small WWTPs that cannot maintain an annual average TIN of less than 10 mg/L. Furthermore, the PSNGP requires a "Nutrient Reduction Evaluation" that includes consideration of technologies capable of achieving 3 mg/L seasonally for larger WWTPs, and Ecology has indicated that future permit limits will likely be somewhere between 3 and 10 mg/L. Therefore, the potential to meet both 10 mg/L and 3 mg/L of effluent TIN are discussed when evaluating the secondary treatment alternatives.

8.3.1.3 SEC-1 SBR Improvement

For SEC-1, new equipment, instrumentation, and basins will be installed to improve performance and reliability of the existing SBR process. The specific improvements are discussed in more detail below.

Influent equalization: Ecology's "Criteria for Sewage Works Design" Section T3-3.1.2.D.2 requires a minimum of three basins or an influent equalization basin for SBR systems for redundancy reasons. The Suquamish WWTP has only two basins and no influent equalization, so it does not meet either requirement. Therefore, an influent equalization basin will be built to bring the Suquamish WWTP into compliance.

The new influent equalization basin will be sized to match the existing SBR basins, at 195,000 gallons, which will provide sufficient storage to buffer the system at 75 percent of the maximum day flows through the 20 year planning period using the design decant times and current decant depths in accordance with Ecology reliability criteria detailed in Section T3-3.1.D.3.d of "Criteria for Sewage Works Design." Matching the existing SBR basin size will also allow the equalization basin to be converted to another SBR in the future, which would provide additional treatment capacity and redundancy. The influent equalization basin will be covered and vented to an odor control unit. It will include aeration (blowers and coarse bubble diffusers) to prevent sewage from going septic and two transfer pumps to transfer sewage from the influent equalization basin to the SBR.

SBR basins coating: The existing SBR basins coating have begun to fail, as noted in **Section 6**. They will be recoated when the basins are taken offline.

SBR aeration system: The existing jet aeration system will remain in place. Upgrading to a fine bubble diffuser system would provide energy savings but would not have a major impact on TIN performance.

Instrumentation: Online DO and ammonia/nitrate probes will be installed in each SBR basin to continuously monitor DO and ammonia/nitrate concentrations. These process parameters will help fine-tune the blower operation schedule for nitrogen removal optimization.

New ASST and effluent EQ: The existing 32,000-gallon steel ASST, which is within the existing 69,000-gallon effluent equalization basin, will be demolished to give more space to the existing effluent equalization basin. The existing effluent equalization basin will be retrofitted in the same footprint to provide approximately 98,000 gallons of storage volume. A new 32,000-gallon concrete ASST will be constructed adjacent to the influent equalization basin.

This alternative will allow the Suquamish WWTP to continue the existing SBR operation with improved redundancy and reliability to meet the current NPDES requirements. Based on the analysis in **Section 6**, the existing SBR process will be able to meet the annual effluent TIN load cap of 14,691 pounds but will not be able to achieve less than 10 mg/L of TIN.

8.3.1.4 SEC-2 AquaNereda System

SEC-2 includes retrofitting the existing SBR basins so that they can be operated with the AquaNereda® AGS system provided by Aqua-Aerobic Systems to increase the nitrogen removal. AquaNereda® is a proprietary AGS process that generates durable granules, a compact microbial structure with high bacterial density and large bacterial diversity. The process uses a fill-react-draw cycle similar to an SBR but with modified cycle times and a simultaneous fill-draw phase. **Figure 8-2** shows the phases of the treatment cycle and composition of granules. Since oxygen does not fully penetrate the granule, oxygen-rich and oxygen-poor zones are present, allowing for simultaneous biological processes to take place to remove nitrogen. The granular structure not only provides higher effluent quality, but also improves the rate of settling. The process uses the settling characteristics of AGS to operate at higher mixed liquor concentrations and allows for more treatment capacity with lower construction costs. The process also eliminates the need for mechanical mixing, recycle pumping and other aspects of conventional SBR operation.

Figure 8-2 | AGS Cycle and Sludge Granule Detail

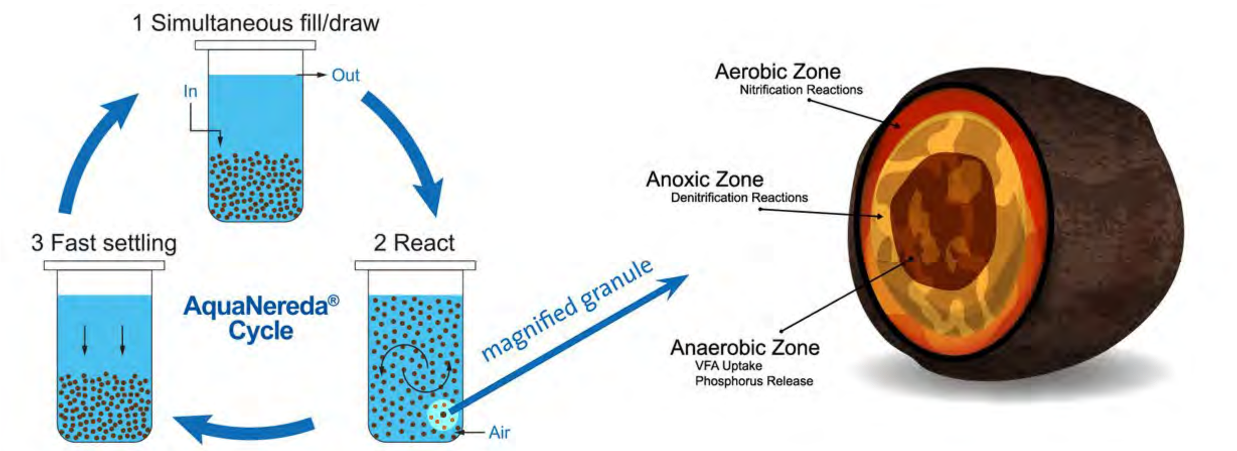


Image courtesy of AquaNereda

The AGS processes were developed at Delft University of Technology in the Netherlands and licensed as the Nereda process by Royal HaskoningDVH. Installation of Nereda processes began in 2003 and has now been implemented at dozens of WWTPs in Europe. Aqua-Aerobic System is the exclusive US licensee of the Nereda process, which they branded AquaNereda®, and they have several installations completed or in construction. Although it is technically feasible to grow AGS independently, Aqua-Aerobic Systems is the only vendor with experience in AGS growth and operation in the US and is the only vendor considered in this analysis.

The two existing SBR basins will be retrofitted to accommodate the AquaNereda® AGS system. The existing jet aeration system will be replaced with a fixed fine bubble diffuser system. The existing SBR blowers and associated piping will be replaced with three positive displacement blowers with VFDs and modulating valves. The existing sludge recirculation pumps and pipes will be removed and replaced with internal basin mixers and three new transfer pumps. A new MCC will be installed to house motor starters and VFDs.

A new influent equalization basin will be constructed on the east side of the process building, the existing SBRs will be recoated, new DO and ammonia/nitrate probes will be installed, a new ASST will be constructed, and the effluent equalization basin will be modified as discussed in SEC-1.

The anticipated effluent quality from AquaNereda® AGS system is summarized in **Table 8-2.**

Table 8-2 | Anticipated AquaNereda® AGS System Effluent Quality

Parameters	Anticipated Effluent Concentrations, mg/L
BOD	10
TSS	10
Ammonia (NH_3-N)	0.5
TIN	3
Total Phosphorus (TP)	1

This alternative is expected to reduce effluent TIN to below 3 mg/L throughout the 20-year planning period, which will exceed current requirements and should meet the strictest permit that can be anticipated in the future. Aqua-Aerobic Systems has noted that some supplemental carbon and/or alkalinity may need to be added to achieve the lowest possible TIN.

8.3.1.5 Secondary Treatment Cost Analysis

Class 5 OPPCs for the secondary treatment alternatives for 20 and 40-year planning periods were developed as described in **Section 8.2** and are summarized in **Table 8-3** and **Table 8-4**, respectively.

Table 8-3 | Secondary Treatment Alternatives Cost Estimate, 20-year Net Present Cost

Alternative Number	Alternative Name	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
SEC-1	SBR Improvement	$3,173,000	$3,878,000	$7,051,000
SEC-2	AquaNereda System	$9,507,000	$3,544,000	$13,051,000

Table 8-4 | Secondary Treatment Alternatives Cost Estimate, 40-year Net Present Cost

Alternative Number	Alternative Name	Project Cost	O&M 40-year Net Present Cost	Total 40-year Net Present Cost
SEC-1	SBR Improvement	$3,173,000	$9,872,000	$13,045,000
SEC-2	AquaNereda System	$9,507,000	$9,022,000	$18,529,000

8.3.2 UV Disinfection Alternatives

8.3.2.1 Existing Condition Description

The existing UV system is a two-bank Trojan UV3000B installed in 1997 and is near the end of the typical design life. This model has a basic controller which can automatically alternate the lead and lag UV banks and monitor the bank run time, bank on/off status, a common alarm, and UV intensity. The basic controller cannot turn off the bank based on the flow signal, and plant staff clean the UV lamps manually. It is recommended to replace the entire UV system with a new system that has additional monitoring and control capabilities, and cleaning capabilities.

8.3.2.2 DIS-1 UV Disinfection - Trojan UV3000B and Controller

For DIS-1, the existing Trojan UV3000B system will be removed and replaced with a new UV3000B system (**Figure 8-3**), the basic controller will be replaced with a touch smart controller, and a new UV transmittance probe will be installed. This alternative will be able to monitor and control several operational parameters requested by operators including tracking bank lamp life, switching banks/bringing them on and off, tracking and alarming on UV intensity, and monitoring UV transmittance. However, the UV3000B unit can only be controlled based on flowrate, not UV dose, and the touch smart controller of UV3000B does not monitor the individual lamp On/Off status. The effluent flow from the secondary treatment process is discharged in pulses. This cycling system reduces the lamp life, but the effect can be minimized by keeping one bank of lamps on and having it operate at the lowest lamp input power setting (60 percent).

The manufacturer Trojan provided the recommended system design based on the 2042 peak flow condition and the state disinfection requirements of one bank shall handle 50 percent of the design PHF. A new UV3000B system will have two banks in a lead/lag operation with a total 48 lamps. The new UV banks can be placed in the existing UV channel without any modification to the UV channel.

Figure 8-3 | DIS-1 Trojan UV3000B System

8.3.2.3 DIS-2 UV Disinfection - Trojan UV3000Plus and Controller

For DIS-2, the existing Trojan UV3000B will be replaced with an upgraded model, the Trojan UV3000Plus (**Figure 8-4**). This alternative will provide all the monitoring control functionality of alternative DIS-1 and will provide a flow rate adjustable intensity and additional monitoring capability including individual lamp failure status. It has a knob to adjust intensity and has an option for automatic cleaning system. With the touch smart controller, the system will be able to monitor the individual lamp status and dose pacing. The effluent flow from the secondary treatment process is discharged in pulses. This cycling system reduces lamp life, but the effect can be minimized by keeping one bank of lamps on and having it operate at the lowest lamp input power setting (60 percent).

The manufacturer Trojan provided the recommended system design based on the 2042 peak flow condition and the state disinfection requirements of one bank shall handle 50 percent of the design PHF. Under the 2042 peak flow design condition, two banks will be installed in the existing channel with two UV modules per bank and six lamps per UV module, equating to 24 lamps. The new UV banks can be placed in the existing UV channel with minor modifications to the baffles to adjust the channel width.

Figure 8-4 | DIS-1 Trojan UV3000Plus System

The comparison of the existing basic controller, touch smart controller for UV 3000B and touch smart controller for UV 3000Plus are summarized in **Table 8-5**.

Table 8-5 | UV System Controller Capability Comparison

Capabilities	Current: Basic Controller for UV 3000B	DIS-1: Touch Smart Controller for UV 3000B	DIS-2: Touch Smart Controller for UV 3000Plus
Configuration			
Max. # of Channels	1	2	2
Max. Modules/bank	20	20	32
Max. Banks/channel	3	3	3
Control			
Flow Pacing	Yes	Yes	No
Dose Pacing	No	No	Yes
Individual Lamp Status	No	No	Yes
Lead Bank Rotation	Automatic	Automatic or Manual	Automatic or Manual
Redundant Bank Logic	No	Yes	Yes
Multiple Lamp Failure	No	No	Yes
Module Failure Alarm	No	No	Yes
Bank Communication Alarm	No	No	Yes
USB Data Logging	No	Yes	Yes
Remote Control Capabilities			
Force System On/Off	No	Yes	No
Turn On Additional Bank (if available)	No	Yes	No

Capabilities	Current: Basic Controller for UV 3000B	DIS-1: Touch Smart Controller for UV 3000B	DIS-2: Touch Smart Controller for UV 3000Plus
Remote Monitoring Capabilities			
SCADA	No	Yes	Yes
Bank Status	Yes	Yes	Yes
Common Alarm	Yes	Major, Minor	Critical, Major, Minor
Low UV Intensity Alarm	No	Yes	Yes
Bank UV Intensity Alarm	No	Yes	Yes
Average UV Intensity	No	Yes	No

8.3.2.4 UV Disinfection Cost Analysis

Class 5 OPPCs for the UV disinfection alternatives in 20- and 40-year planning periods were developed as described in **Section 8.2** and are summarized in **Table 8-6** and **Table 8-7**, respectively. The capital cost for the UV3000B system is lower than the UV3000Plus system because the equipment is less expensive, however the annual operating costs are higher, so over the 20-year lifecycle the UV3000Plus system will cost approximately $51,000 less. Over the 40-year lifecycle the UV3000Plus system will cost approximately $337,000 less.

Table 8-6 | UV Disinfection Alternatives Cost Estimate, 20-year Net Present Cost

Alternative Number	Alternative Name	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
DIS-1	UV Disinfection – Trojan UV3000B	$ 556,000	$ 353,000	$909,000
DIS-2	UV Disinfection – Trojan UV3000Plus	$ 693,000	$ 165,000	$858,000

Table 8-7 | UV Disinfection Alternatives Cost Estimate, 40-year Net Present Cost

Alternative Number	Alternative Name	Project Cost	O&M 40-year Net Present Cost	Total 40-year Net Present Cost
DIS-1	UV Disinfection – Trojan UV3000B	$ 556,000	$ 893,000	$1,449,000
DIS-2	UV Disinfection – Trojan UV3000Plus	$ 693,000	$ 419,000	$1,112,000

8.3.3 Odor Control Alternatives

8.3.3.1 Existing Condition Description

Air from the headworks, thickening room, and ASST is treated by the existing odor control chemical scrubber, which is in poor condition, is only partially operational, and frequently breaks down. The scrubber is in the thickening room which also houses the screening channel, grit removal tank, and RDT. To simplify the area classification, it is recommended to install the new odor control unit outside of the process building on the east side.

8.3.3.2 Odor Control Design Criteria

The new odor control unit will also treat foul air from the new influent EQ basin. The estimated air flow rate of each source and the total flow to be treated are summarized in **Table 8-8**.

Table 8-8 | Estimated Total Air Flow Rate to Existing Chemical Scrubber

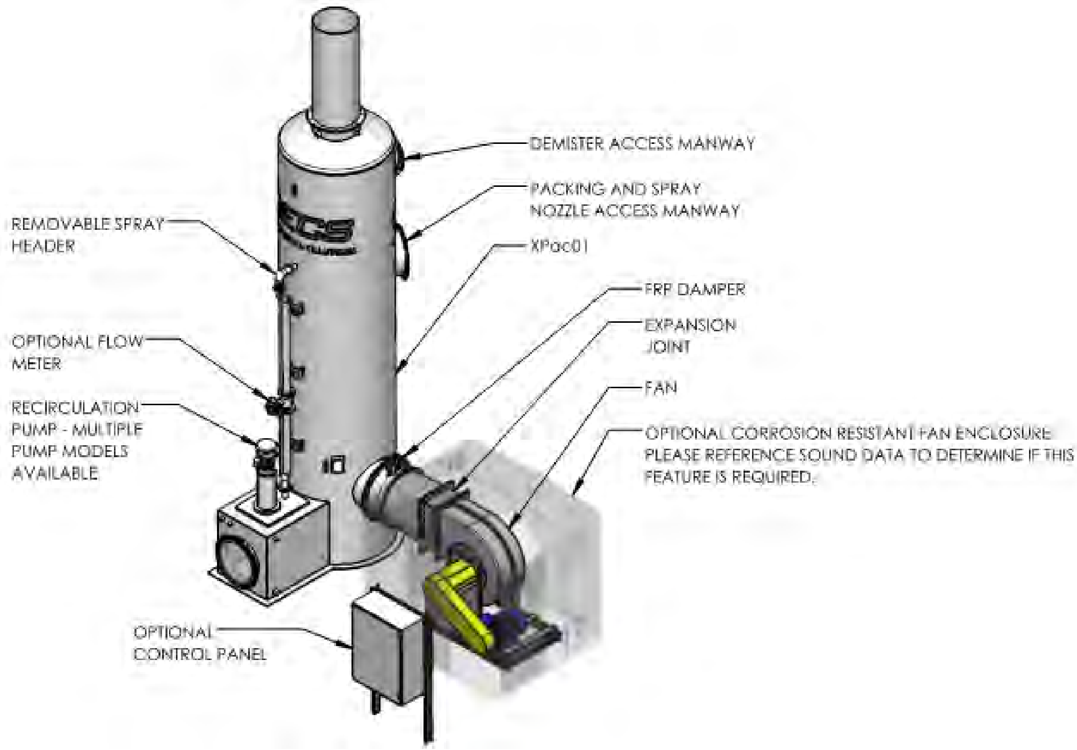
	Quantity	Area (ft2)	Depth (Air) (ft)	Volume (ft3)	ACH[1] (#)	Process Air (cfm)	Air Flow (cfm)
Rotary Screen Channel	1	84	2.02	170	12	-	34
Grit Tank	1	40	2.99	215	12	-	24
ASST tank	1	363	3	1,089	12	200	418
Thickener Room	1	1,247	11.67	14,552	12	-	2,911
Influent EQ Basin	1	1,334	3	4,002	12	-	800
Total Air Flow Rate with 10% factor of safety							**4,605**
Odor Control System Capacity							**5,000**

Note:
1. ACH: Air Change per Hour

8.3.3.3 OC-1 Chemical Scrubber

For OC-1, the existing chemical scrubber will be removed and replaced with a new chemical scrubber system. A chemical scrubber uses an oxidizing liquid such as sodium hypochlorite to absorb and oxidize odor causing sulfur compounds, which eliminates odor in the exhaust air. The new chemical scrubber system consists of the fiber reinforced polymer/plastic (FRP) scrubber vessel, recirculation pump, fan, ductwork, pH and oxidation-reduction potential (ph/ORP) monitoring, conductivity monitoring and control panel. In addition, it provides a fan enclosure that reduces the sound noise. The operation, configuration and footprint are similar to those of the current system. Chemical scrubbers have high removal efficiency, a small footprint, and the plant staff is familiar with the operation of this technology. However, delivery and handling of hazardous chemicals is required, and the O&M costs are relatively high due to chemical use. **Figure 8-5** shows the three-dimensional model of a new chemical scrubber system. The new system will be installed outside to the east of the Process Building on a concrete pad.

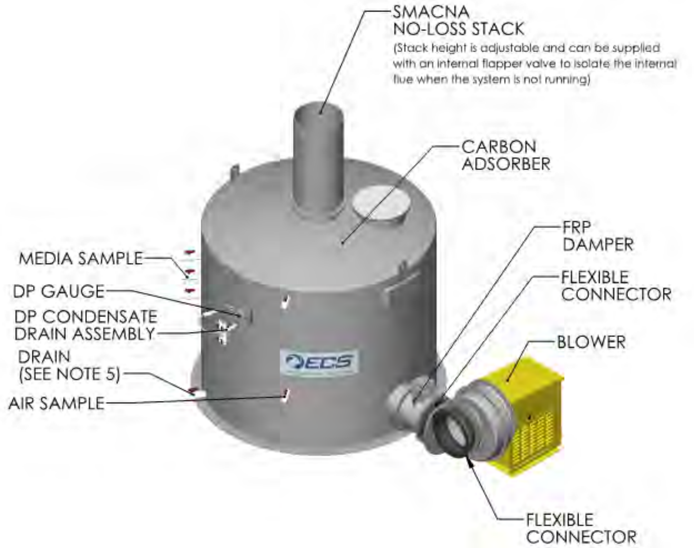
Figure 8-5 | OC-1 New Chemical Scrubber System



8.3.3.4 OC-2 Activated Carbon

For OC-2, the existing chemical scrubber will be removed and replaced with a new activated carbon system. Activated carbon removes odor by adsorption of odor causing compounds to the carbon media. Carbon adsorption can also provide for removal of a wide range of other odorous contaminants, such as organic compounds that are not as effectively removed by standard chemical scrubbers designed for hydrogen sulfide removal. No chemicals or additives are required. The proposed activated carbon system includes an FRP carbon adsorption vessel, an FRP blower, a motor starter, a sound absorbing enclosure, a pre-filter, and an epoxy coated steel skid. Regeneration of the carbon is time consuming and difficult, so it is usually replaced with new carbon which results in a higher operating cost. Figure 8-6 shows the three-dimensional models of the activated carbon system. The activated carbon system will be installed outside to the east of the Process Building on a concrete pad.

Figure 8-6 | OC-2 Activated Carbon System



8.3.3.5 OC-3 Engineered Biofilter

For OC-3, the existing chemical scrubber will be removed and replaced with a new engineered biofilter system. Biofilters utilize the growing microorganisms in media to oxidize odor and remove a wide range of odorous constituents. The media within the biofilter varies from wet compost, soil, wood chips used in the earth berm or concrete biofilters to the inert, proprietary materials used in the engineered biofilter systems. For efficient odor removal, the biofilter media must be moist and maintain a pH above neutral, so process water is required. The drain from biofilter will likely be acidic and should be collected and routed back to the plant for treatment. The advantages of biofilters are that they can provide effective treatment for a wide variety of odor causing compounds, and once constructed, they are easy to maintain and do not typically require chemical addition. However, they have a larger footprint than other odor control technologies. The conventional sand or organic media biofilters will require large footprints and cannot fit within Suquamish WWTP site. A packaged engineered biofilter which can operate at a much higher loading rate therefore provides a more compact footprint, which will fit within the Suquamish WWTP site.

Figure 8-7 shows a package engineered biofilter system. The system has a footprint of 30-foot long and 15-foot wide. The activated carbon system will be installed outside to the east of the Process Building on a concrete pad.

Figure 8-7 | OC-3 Engineered Biofilter

8.3.3.6 Odor Control Cost Analysis

Class 5 OPPCs for the odor control alternatives in 20- and 40- year planning periods were developed as described in **Section 8.2** and are summarized in **Table 8-9** and **Table 8-10**, respectively. Alternative OC-2 has the lowest capital and lifecycle costs.

Table 8-9 | Odor Control Alternatives Cost Estimate, 20-year Net Present Cost

Alternative Number	Alternative Name	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
OC-1	Chemical Scrubber	$ 1,627,000	$ 543,000	$2,170,000
OC-2	Activated Carbon	$ 492,000	$ 526,000	$1,018,000
OC-3	Engineered Biofilter	$ 1,782,000	$ 525,000	$2,307,000

Table 8-10 | Odor Control Alternatives Cost Estimate, 40-year Net Present Cost

Alternative Number	Alternative Name	Project Cost	O&M 40-year Net Present Cost	Total 40-year Net Present Cost
OC-1	Chemical Scrubber	$ 1,627,000	$ 1,383,000	$3,010,000
OC-2	Activated Carbon	$ 492,000	$ 1,338,000	$1,830,000
OC-3	Engineered Biofilter	$ 1,782,000	$ 1,337,000	$3,119,000

8.3.4 Option A Recommendations

This section provides a recommendation for each process in Option A (upgrade existing WWTP) based on the performance and cost analysis of alternatives which includes both capital costs and long-term O&M costs.

8.3.4.1 Secondary Treatment

SEC-1 has a lower project cost and 20- and 40-year net present value than SEC-2. It will improve the plant’s redundancy and reliability, extend the structure and equipment lifetime, help the plant meet the current

TIN loading cap. However, it will not achieve an effluent TIN concentration below 10 mg/L on an annual basis. SEC-2 will help the plant further improve the nitrogen removal performance and achieve an effluent TIN concentration of 3 mg/L but has a higher project cost and 20- and 40-year net present value.

Based on the current PSNGP, it is anticipated it will be at least ten years before the small loader plants, like the Suquamish WWTP, are required to meet any numerical TIN concentration limit. Therefore SEC-1 is recommended in the near term to keep the plant in compliance with moderate capital investment before any regulation changes. In the future, if TIN limits become more restrictive, the AGS system described in SEC-2 should be implemented in the existing basins to further upgrade the plant to meet the more stringent permit requirements. All the upgrades in SEC-1 are necessary and beneficial for SEC-2 so there will not be any wasted effort or sunk cost.

8.3.4.2 Disinfection

Alternative DIS-2 is recommended as the disinfection alternative because it provides greater functionality and efficiency. Although the capital cost is higher, the 20 and 40-year net present value is lower than DIS-1, and the increased efficiency and reduced maintenance makes this alternative more favorable. Although the cycling system will reduce the lamp life, DIS-2 can monitor and replace individual lamps rather than the entire bank.

8.3.4.3 Odor Control

Alternative OC-2 is recommended as the odor control alternative as activated carbon system has the lowest capital cost and net present value, and easier O&M because of no chemical handling and less mechanical equipment. The chemical scrubber in alternative OC-1 requires more complex equipment, instrumentation, and higher O&M due to the chemical handling. The biofilter in alternative OC-3 has a large footprint and will occupy more space.

8.3.5 Option A Cost Summary

Based on the above alternatives evaluation, the recommended approach to Option A, upgrading existing Suquamish WWTP, is to improve the existing SBR process, replace the existing UV system with the Trojan UV3000Plus system, and replace the existing odor control system with activated carbon system. Additionally, the influent fine screen and grit pump will be replaced, the effluent EQ basin modified, and a new ASST constructed. **Table 8-11** summarizes the capital, O&M, and net present costs of the recommended alternatives and other required improvements in 20-year planning period. **Table 8-12** summarizes the capital, O&M, and net present costs in 40-year planning period.

Table 8-11 | Recommended Option A Cost Estimate, 20-year Net Present Cost

Items	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
SEC-1 SBR Improvement	$ 3,173,000	$ 3,878,000	$7,051,000
DIS-2 Trojan UV3000Plus	$ 693,000	$ 165,000	$858,000
OC-2 Activated Carbon	$ 492,000	$526,000	$1,018,000
Additional Improvements[1]	$1,085,000	$5,621,000	$6,706,000
Total	**$ 5,443,000**	**$ 10,190,000**	**$15,633,000**

Note:

1 Additional improvements are those minor maintenance, repair, and direct replacement improvements described in **Section 8.1**, above, which are needed to keep the plant operational through the planning period, but are not included in the alternatives analysis.

Table 8-12 | Recommended Option A Cost Estimate, 40-year Net Present Cost

Items	Project Cost	O&M 40-year Net Present Cost	Total 40-year Net Present Cost
SEC-1 SBR Improvement	$ 3,173,000	$ 9,872,000	$13,045,000
DIS-2 Trojan UV3000Plus	$ 693,000	$ 419,000	$1,112,000
OC-2 Activated Carbon	$ 419,000	$1,338,000	$1,830,000
Additional Improvements[1]	$1,085,000	$14,309,000	$15,394,000
Total	**$ 5,443,000**	**$ 25,938,000**	**$31,381,000**

Note:

1 Additional improvements are those minor maintenance, repair, and direct replacement improvements described in **Section 8.1**, above, which are needed to keep the plant operational through the planning period, but are not included in the alternatives analysis.

8.4 Option B – Transfer Flow to Central Kitsap WWTP

Option B abandons the Suquamish WWTP and transfers flows in the Suquamish basin to the Central Kitsap WWTP for treatment. Capacities of the Central Kitsap WWTP processes were evaluated, along with improvements needed to convey the flows, including a new lift station and force main, and improvements to the existing pipelines and lift stations. Alternative alignments were not developed and analyzed for this option because much of the infrastructure is already installed, there are limited options for alternative routes or configurations, and a higher cost would be expected if building all-new infrastructure compared to using existing infrastructure where possible.

8.4.1 Capacity Analysis

8.4.1.1 Suquamish and Central Kitsap WWTP Projected Flows

Table 8-13 summarizes the projected flows at the Suquamish WWTP and Central Kitsap WWTP, based on the previous analysis. Suquamish WWTP flow is currently and will continue to be approximately 5 to 7 percent of Central Kitsap WWTP flow through the 2042 planning period.

Table 8-13 | Projected Flows

Flow Event	Suquamish WWTP		Central Kitsap WWTP		Combined	
Year	**2028**	**2042**	**2028**	**2042**	**2028**	**2042**
AAF (MGD)	0.24	0.26	4	5.4	4.24	5.66
MMWWF (MGD)	0.47	0.5	5.7	7.6	6	8.1
MMDWF (MGD)	0.31	0.33	4.6	6.2	4.91	6.53
PDF (MGD)	0.72	0.77	9.8	13.2	11	13.97
PHF (MGD)	1	1.07	16.2	21.6	17.1	22.67

8.4.1.2 Lift Station and Pipeline Evaluation

The Suquamish WWTP is approximately five miles from the Central Kitsap WWTP and three miles from the Lemolo Siphon, which carries wastewater from the City of Poulsbo and the Lemolo Shore Drive area underneath Liberty Bay towards the Central Kitsap WWTP. **Figure 8-8** shows the route to convey flows from the Suquamish WWTP to the Central Kitsap WWTP with key connections, pump stations, and other features identified. A Suquamish to Central Kitsap WWTP connection will convey flow from the Suquamish WWTP to the existing metering station at Johnson Way NE and State Highway 305 with new infrastructure, then via the existing collection system to the Central Kitsap WWTP. The required new and existing system improvements to make Option B feasible were evaluated to determine the extent and cost and are described below.

A new triplex lift station with a capacity of approximately 2,500 gpm would be needed to intercept flow at the existing Suquamish WWTP site and convey it to the Lemolo Siphon. Preliminary hydraulic analysis indicates the pumps will be approximately 170 horsepower and operate at 330-foot of total dynamic head. The pumps will be configured to operate as lead, lag, and spare.

From the WWTP site, approximately 4.5 miles of 18-inch HDPE force main would be needed from the new lift station to the Johnson Road Metering Station along State Highway 305. Flows from Suquamish would connect near the metering station, but not be routed through the meter which is for measuring City of Poulsbo flows only. A route along Totten Way was briefly considered to avoid construction in a state highway, however the highest elevation along that route is roughly 140-feet higher which would require larger, more expensive pumps compared to the State Highway 305 route.

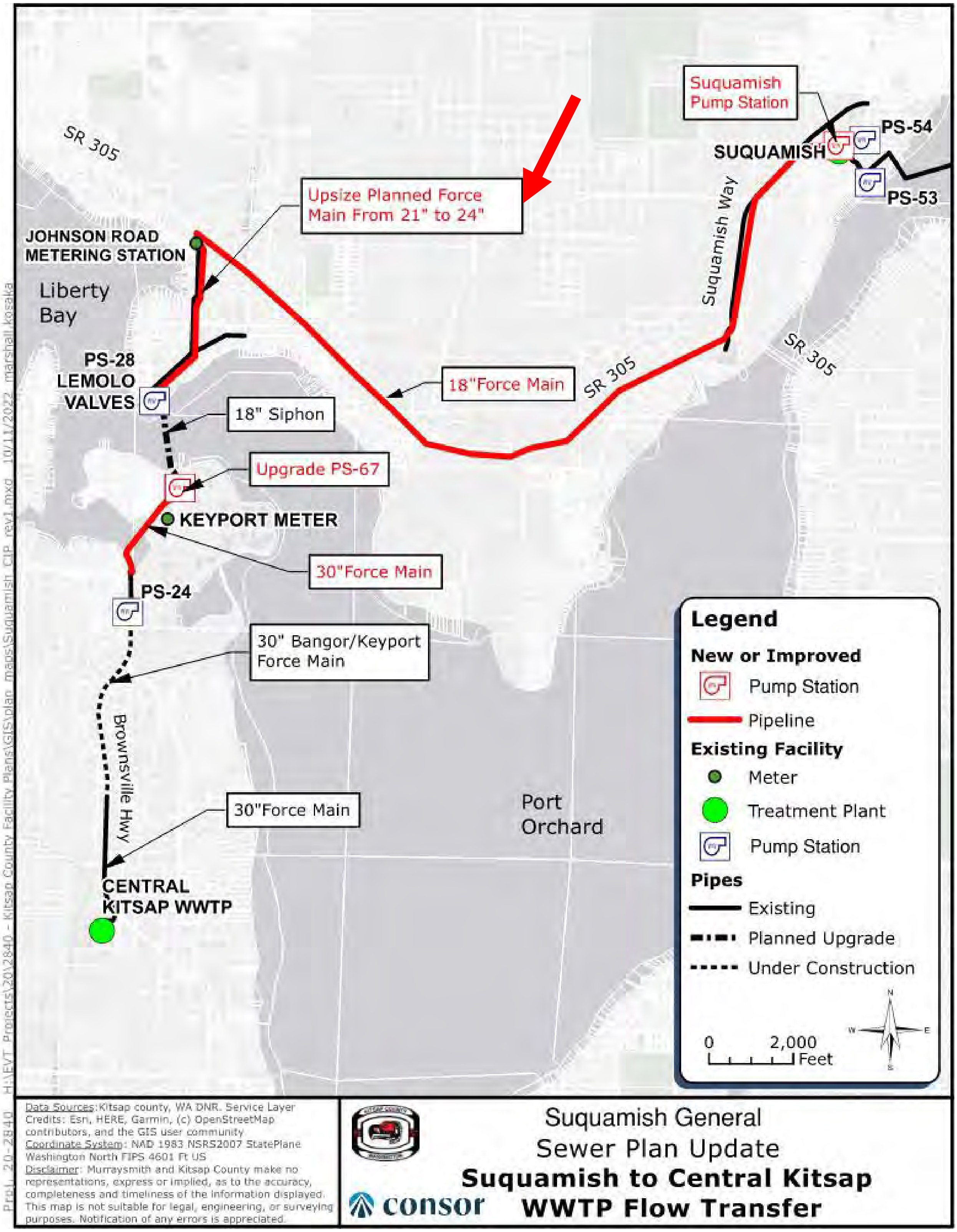
The City of Poulsbo has contracted with Consor to design a replacement of the existing 4,100-foot of sewer main between the Johnson Road Metering Station and the beginning of the Lemolo Siphon with a new 21-inch polyvinyl chloride (PVC) pipe. With the addition of Suquamish flows, the planned 21-inch force main does not have sufficient capacity and would need to be upgraded to 24-inch force main. It is assumed that the County would pay for additional costs for the project due to the change to a larger pipe.

The City of Poulsbo is also planning to construct an additional 18-inch siphon across Liberty Bay adjacent to the existing siphon. This pipe provides enough capacity to accommodate the additional flows from Suquamish, so no further improvements are required. This project is included in the City of Poulsbo's 20-year CIP, therefore there is no cost to the County.

The capacity at PS-67 is insufficient and would need to be increased to approximately 7,500 gpm to accommodate the additional Suquamish flows. The pumps, piping, and control panel would need to be upgraded to increase capacity. For the purposes of the OPPC, it was assumed the wet well and pump house can be reused. This assumption would need to be confirmed during more detailed planning and preliminary design efforts.

To accommodate flow rate of 7,500 gpm from PS-67, approximately 2,700-feet of new 30-inch HDPE force main would need to be constructed to replace the existing 16-inch force main between PS-67 and the intersection of Brownsville Highway NE and NE Tagholm Road, where the County has the new 30-inch HDPE Bangor-Keyport Force Main project under construction. The Bangor-Keyport force main conveys flows along the Brownsville Highway, through PS-24 and on towards the Central Kitsap WWTP. The final section of pipe between the end of the Bangor/Keyport Force Main project and the Central Kitsap WWTP was replaced with 30-inch pipe in 2021 in an emergency repair project. The 30-inch Bangor-Keyport force main, PS-24, and the newly replaced section of 30-inch force main all have sufficient capacity to accept flows from Suquamish, so no additional improvements are needed.

Figure 8-8 | Suquamish to Central Kitsap WWTP Flow Transfer



8.4.1.3 Central Kitsap WWTP Processes Capacities Evaluation

The capacity of each unit process at the Central Kitsap WWTP was analyzed to determine if addition of Suquamish flows would require additional upgrades. Existing condition assessment and capacity evaluation of each unit process in **Section 6** were used as the basis for this evaluation.

The influent screening and grit removal installed in 2011 has sufficient capacity to accommodate additional flow from Suquamish through the 20-year planning period without additional upgrades.

Both the primary clarifiers and secondary clarifiers do not currently have sufficient treatment capacity for 2042 Central Kitsap flows therefore additional clarifier was recommended in the Central Kitsap Plan. With the addition of Suquamish flow, the need for additional clarifiers will become more acute, but will not have a major impact on clarifier size, timing, or cost.

The biological treatment process upgraded in 2015 have sufficient hydraulic and treatment capacity to absorb additional flows from Suquamish through the 20-year planning period without additional upgrades.

The gravity thickeners at Central Kitsap provide primary sludge thickening and will be replaced due to their poor condition. The new primary sludge thickening process will be able to handle additional primary sludge transferred from Suquamish without a major impact on size, timing, or cost. The WAS thickening process was replaced in 2016 and has sufficient capacity for additional solids from Suquamish without a major impact on size, timing, or cost. Since thickened solids from Suquamish are already hauled to the Central Kitsap WWTP for stabilization and dewatering, there will be no change to the loading of the anaerobic digesters or centrifuges.

Overall, the addition of flows from Suquamish can be incorporated at Central Kitsap WWTP without any additional unplanned upgrades, therefore, no costs will be directly incurred at the Central Kitsap WWTP in Option B.

8.4.2 Option B Cost Analysis

Class 5 OPPCs for Option B in 20- and 40-year planning periods were developed as described in **Section 8.2** and are summarized in **Table 8-14** and **Table 8-15**. Assumptions for the cost estimate include:

- The existing plant will be mainly abandoned and left in place. Minimum effort is included to drain and clean the process tanks, to clean and prepare the site for the new lift station, and to remove major mechanical and electrical equipment.
- Upgrades to the Suquamish collection system, including PS-53 and PS-54, will be needed for both Option A and Option B, therefore they are not included in the alternatives analysis.
- Project cost difference to install a 24-inch Lemolo shoreline pipeline instead of a 21-inch pipeline is included.
- Project cost of replacing the existing 16-inch Keyport force main with a new 30-inch force main is included because it would be required solely due to the addition of Suquamish flow.
- Project cost of upgrading the existing PS-67 with larger pumps and electrical components is included because it would be required solely due to the addition of Suquamish flow.

- O&M cost at PS-67 improvement only accounts for the power consumption to pump the additional Suquamish flow.
- Project costs and O&M cost are County costs only based on cost sharing assumptions detailed previously in the description of the alignment and associated required upgrades.

Table 8-14 | Option B Cost Estimate, 20-year Net Present Cost

Items	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
Abandon Existing Plant	$363,000	$0	$363,000
Suquamish Lift Station	$6,102,000	$ 1,933,000	$8,035,000
Suquamish 18-inch Force Main	$29,793,000	$0	$29,793,000
Lemolo Shoreline Pipeline Upsize	$271,000	$0	$271,000
Keyport 30-inch Force Main	$4,057,000	$0	$4,057,000
LS-67 Improvements	$1,201,000	$129,000	$1,330,000
Total	**$41,787,000**	**$2,062,000**	**$43,849,000**

Table 8-15 | Option B Cost Estimate, 40-year Net Present Cost

Items	Project Cost	O&M 40-year Net Present Cost	Total 40-year Net Present Cost
Abandon Existing Plant	$363,000	$0	$363,000
Suquamish Lift Station	$6,102,000	$ 4,954,000	$11,056,000
Suquamish 18-inch Force Main	$29,793,000	$0	$29,793,000
Lemolo Shoreline Pipeline Upsize	$271,000	$0	$271,000
Keyport 30-inch Force Main	$4,057,000	$0	$4,057,000
LS-67 Improvements	$1,201,000	$328,000	$1,529,000
Total	**$41,787,000**	**$5,282,000**	**$47,069,000**

8.5 Recommendations

This section provides a recommendation for Suquamish WWTP based on the performance and cost analysis. **Table 8-16** and **Table 8-17** compare the costs for two options in 20 and 40-year planning horizons. The project costs and O&M costs of Option A, improving existing SBR system, replacing the UV system with the Trojan 3000Plus, replacing the odor control system with an activated carbon system, and completing all the other maintenance, repair, and direct replacement upgrades, are much lower than the costs of Option B for both the 20-year and 40-year analysis. Even if the AquaNereda upgrades in alternative SEC-2 are implemented to meet future nutrient regulations the cost to continue operating the WWTP will be less than Option B. Based on the above evaluation and cost analysis, Option A is recommended.

Table 8-16 | Option A and B Cost Comparison, 20-year Net Present Cost

Options	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
A. Upgrade Existing WWTP with SBR Improvement	$ 5,443,000	$ 10,190,000	$15,633,000
A. Upgrade Existing WWTP to AquaNereda System	$11,777,000	$9,856,000	$21,633,000
B. Transfer Flow to Central Kitsap WWTP	$41,787,000	$2,062,000	$43,849,000

Table 8-17 | Option A and B Cost Comparison, 40-year Net Present Cost

Options	Project Cost	O&M 40-year Net Present Cost	Total 40-year Net Present Cost
A. Upgrade Existing WWTP with SBR Improvement	$ 5,443,000	$ 25,938,000	$31,381,000
A. Upgrade Existing WWTP to AquaNereda System	$11,777,000	$25,088,000	$36,865,000
B. Transfer Flow to Central Kitsap WWTP	$41,787,000	$5,282,000	$47,069,000

Table 8-18 summarizes the recommended alternatives for option A and the reason why they are recommended.

Table 8-18 | Recommended Alternatives for the Suquamish WWTP

Recommended Alternative	Alternative Name	Project Cost	Benefit
SEC-1	SBR Improvement	$3,173,000	➢ Replace aging ASST and effluent EQ basins ➢ Replace failing SBR coatings ➢ Improves redundancy and meet's Ecology design criteria ➢ Improve process control ➢ Allow the plant to meet current TIN permit limit ➢ Able to be upgraded to SEC-2 in the future to meet more stringent TIN permit, if needed
DIS-2	UV Disinfection – Trojan UV3000Plus	$ 693,000	➢ Replace aging equipment ➢ Improve process control and equipment monitoring ➢ Reduce O&M effort
OC-2	Activated Carbon Odor Control	$ 845,000	➢ Replace faulty equipment to restore functionality ➢ Reduce O&M effort ➢ Lower costs and small footprint
Additional Improvements		$1,085,000	

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SECTION 9

Recycled Water

Recycled water provides multiple potential benefits from wastewater management, water supply, and environmental enhancement perspectives. Because of these benefits, the County identified recycled water as a key strategy in its Water as a Resource policy, adopted in 2009 and reaffirmed in 2016, which aims to conserve groundwater resources, restore the natural hydrologic flow in local streams and creeks, and reduce water pollution. In short, implementation of recycled water efforts would be a direct expression of the County's guiding principle to preserve water as a resource rather than treating it as a waste stream. This section summarizes the County's assessment to date of the potential for developing a recycled water program involving the Suquamish WWTP.

9.1 Recycled Water Regulatory Framework

Wastewater that is reused for beneficial purposes in a municipal context must meet certain regulatory and water quality requirements. In Washington, recycled water (also referred to as reclaimed water) is defined in WAC 173-219 as: "water derived in any part from a wastewater with a domestic wastewater component that has been adequately and reliably treated to meet the requirements of WAC 173-219, so that it can be used for beneficial purposes." As such, recycled water is no longer considered a wastewater once it is put to use.

WAC 173-219 defines the requirements and constraints pertaining to the use of recycled water for a wide range of purposes. Recycled water permits are issued by Ecology and the DOH. Ecology is generally the lead permitting agency, with the primary exception being when the source water is generated by an on-site sewage system with a design flow of less than or equal to 100,000 gpd.

There are three classes of recycled water defined in WAC 173-219: Class B, Class A, and Class A+. These are defined by varying degrees of treatment and water quality, and are each applicable for various uses, as summarized below.

- Class B (meets oxidation and disinfection requirements) recycled water can be used for some construction and industrial purposes, and certain irrigation uses where access to the general public is restricted.
- Class A (meets Class B requirements, plus coagulation and filtration, or use of membrane filtration) recycled water can be used for a wide range of commercial uses (such as toilet/urinal flushing and street sweeping) and irrigation of areas that have open access to the public. This can also be used for groundwater recharge, assuming additional requirements are met, such as nitrogen limits.
- Class A+ (meets Class A requirements, plus additional needs to be health protective, as defined on a case-by-case basis) is required for direct potable reuse (i.e., drinking or direct ingestion).

The public access restriction requirements for Class B are typically difficult to meet for a municipal entity like the County, whereas Class A does not require access restriction, so Class A has a wider range of potential uses. Therefore, it is water of this quality that is considered in this Plan when evaluating potential reuse opportunities. While opportunities for use of lower quality water may exist, they are anticipated to be few in number with very limited benefit being received, based upon the experience of other Puget Sound utilities.

9.2 Benefits and Potential Uses

Recycled water can provide numerous benefits, including those summarized below.

- **Conserve limited groundwater resources**. Water use in the area is sourced from groundwater pumped primarily from the sea-level aquifer. This is a limited resource, with aquifer levels susceptible to decline as local water demand increases. In addition, saltwater intrusion can occur if groundwater levels are withdrawn below certain thresholds. Use of recycled water to replace the use of potable water for nonpotable purposes, especially during peak use times (i.e., summer irrigation season), reduces the stress on area groundwater and supports sustainable management of that limited resource.

- **Reduce marine water discharge**. Recycled water is being increasingly explored around Puget Sound as a means to reduce wastewater discharge (and therefore reduce nitrogen loading) to marine waters and comply with more restrictive wastewater discharge permit requirements, such as those established by the recently enacted PSNGP. Such actions serve to protect and improve marine water quality, which in turn improves fish and shellfish habitat by reducing the overpopulation of phytoplankton and zooplankton and avoiding development of algal blooms.

- **Restore and replenish streams and fish habitats**. Recycled water can be used to directly augment streams and wetlands and can be used to indirectly influence them through recharge of groundwater that supports such features.

Though it recognizes benefits such as the above, the County has not previously identified any cost-effective applications of recycled water if it were to be produced by the Suquamish WWTP. As part of development of this Plan, a cursory review of potential uses of recycled water in the Suquamish area was conducted. A summary of this review is provided below, organized by use type. No other potential uses were researched, since the ones described below are typically the most cost-effective applications and represent the core elements of a recycled water program involving treatment facilities similar in size and locale to that of the Suquamish WWTP.

9.2.1 Irrigation

A common use of recycled water is for irrigation of turf and landscaped areas. The County coordinated with water providers and other potential stakeholders to determine if there were any such opportunities for this type of recycled water use in the vicinity of the Suquamish WWTP. Entities contacted were:

- **Kitsap Public Utility District (KPUD)**. The County discussed recycled water potential uses with KPUD staff in March 2023. KPUD has actively researched recycled water opportunities throughout portions of its service area and has implemented a system in Port Gamble. Key benefits of this resource to KPUD are the potential to relieve stresses on groundwater supplies during peak use periods and provide a tool for water rights mitigation efforts. While KPUD is open to exploring opportunities to realize these benefits, no such opportunities have been identified in the vicinity of the Suquamish WWTP.

- **Kitsap County Parks Department.** A discussion was held with County Parks Department staff in January 2022, regarding the possibility of irrigation of turf/landscaped areas managed by the

County. It was determined that, based on locations of other irrigable areas and their relatively small amount of associated water consumption, there are no sites where recycled water use would be cost-effective.

9.2.2 Aquifer Recharge and Streamflow Augmentation

The general concept of using recycled water for managed aquifer recharge was considered as part of a watershed planning effort facilitated by Ecology for Water Resource Inventory Area (WRIA) 15, as directed by the Streamflow Restoration Act (RCW 90.94). This activity is documented in the *WRIA 15 Watershed Restoration and Enhancement Plan* (March 1, 2022). The evaluation identifies geographic locations that appear promising for both shallow aquifer infiltration and enhancement of stream baseflows, which in turn may provide water to offset to consumptive impacts of new permit-exempt domestic groundwater withdrawals. The lack of such locations in the near vicinity of the Suquamish WWTP, coupled with the small discharge volume of the plant, yielded identification of no proposed recycled water infiltration projects associated with the plant.

9.2.3 Other Uses

The County also considered other potential uses that might exist in close proximity to the WWTP. Attempts were made to discuss potential recycled water use at Suquamish Tribe facilities and properties, such as the industrial park. No successful connections were made by the time this Plan was prepared; therefore, this represents a potential area of additional future research.

9.3 Future Steps

As the County continues future planning associated with recycled water at Suquamish WWTP and its other treatment plants, key implementation considerations that will be taken into account, beyond technical feasibility, costs, and water quantity/quality benefits, include those described briefly below. These items will be explored in greater depth as the County advances in its planning process.

- **Regulatory Requirements**. One of the more rapidly changing elements that will shape future recycled water programs are water quality requirements related to currently unregulated chemicals. In particular, the water industry's current focus on per- and polyfluoroalkyl substances (PFAS) will likely yield State or federal drinking water limits that are lower than the State Action Levels established for five PFAS compounds in 2021. This may lead to certain additional forms of treatment being required to produce recycled water suitable for purposes such as groundwater recharge or streamflow augmentation.

- **Funding**. The capital investment to implement reuse can be significant and is greater than what can be realistically recouped through recycled water rates. Most utilities seek low-interest loans or grant money from the State or federal government to support reuse implementation. At the State level, this includes funding through the Centennial Clean Water Fund, while at the federal level this can include funding through the WaterSMART Title XVI program.

- **Stakeholder and Public Outreach**. The County has had extensive coordination with the Suquamish Tribe during development of a proposed recycled water project at the Kingston Treatment Plant which is also owned and operated by the County. Continued collaboration with the Tribe, along with general public involvement, is critical to the success of recycled water efforts, largely in relation to the above two topics of water quality and funding. The public will want assurance that proposed reuse practices are protective of public and environmental health. In addition, the full range of benefits must be articulated so that the community can truly assess costs versus benefits and understand how investment in reuse relates or compares to other priorities the County is facing.

- Implementation Policies and Procedures. Recycled water programs require much more than the upfront capital infrastructure. County policies will be needed to establish when, where, and how recycled water can be used and what the applicable rates are for customers who would use the resource. Depending on the extent of infrastructure that would be needed for a recycled water project at the Suquamish WWTP, development standards may be required, including maintenance procedures specific to purple pipe distribution systems, water quality monitoring/reporting, and backflow prevention.

SECTION 10

Operations and Maintenance

10.1 Introduction

The County's Suquamish sewer collection and conveyance system, WWTP O&M program, and review of State and Federal requirements that impact the County's O&M program are summarized in this section. Current department organization and staffing is presented, and future staffing needs are also discussed. Comments, observations, and recommendations to improve the efficiency and effectiveness of the County's O&M program are provided at the end of this section. Key O&M elements that have the potential to impact the CIP are carried forward and further discussed in the following sections.

10.2 Utility Management and Structure

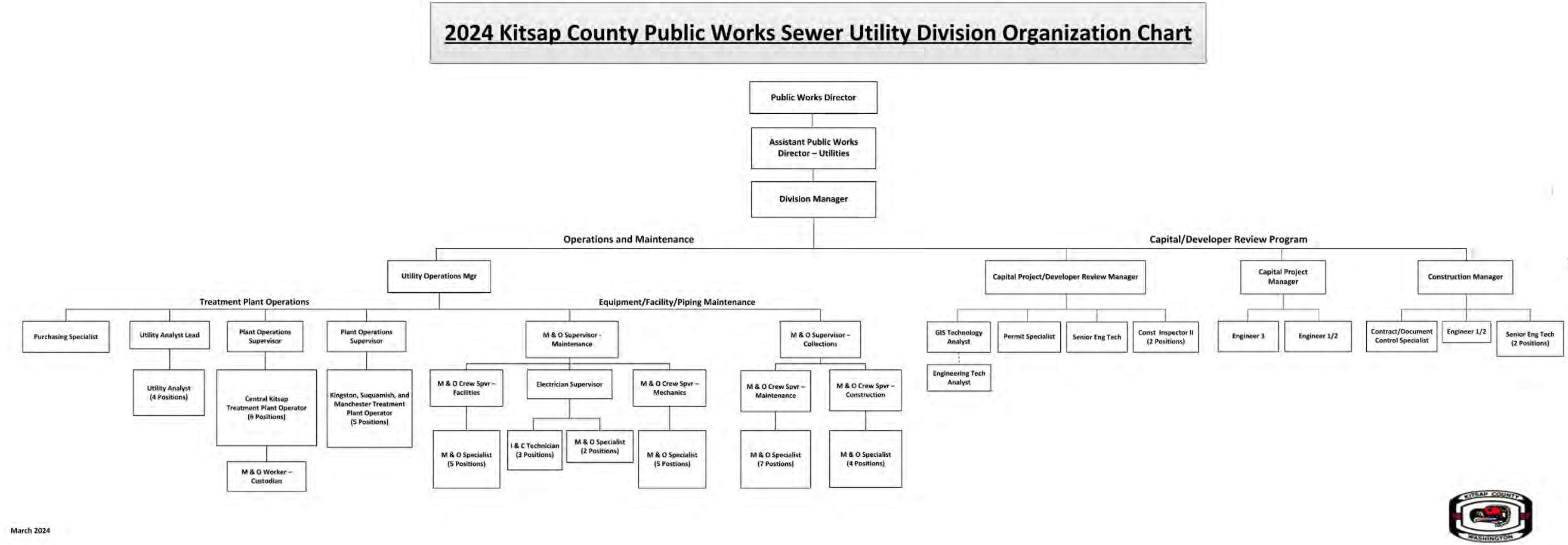
The County is managed by a three-person Board of County Commissioners, who are elected officials that represent one of three geographical districts. The County Department of Public Works is responsible for management of County roads, recycling and solid waste, sewer, and stormwater, with separate Divisions for each. The Sewer Utility Division is responsible for O&M of both the sewer collection system and the County's four WWTPs. The organizational chart for the Sewer Utility Division is shown as **Figure 10-1**.

The Sewer Utility is led by the Sewer Utility Senior O&M Manager, who reports to the Public Works Assistant Director. A total of 72 staff currently work in the Sewer Utility Division. The Sewer Utility Division consists of four main work groups: Utilities (Plant and Pump Station) O&M, Field (Collection) Operations, Engineering and Administration, and Construction Management.

The Utilities (Plant and Pump Station) O&M is led by the Utilities Operations Manager. The O&M of the plants and pump stations is run by the Sewer Utility O&M Supervisor who oversees two Maintenance Crew Supervisors, each with a five-person crew, and an Electrical Supervisor with a 5-person crew. The four WWTPs are managed by the two Plant Operations Supervisors: Outlying Plant Supervisor and Central Kitsap Treatment Plant Supervisor. The three smaller WWTPs, including Suquamish, each have a lead operator and share two additional operators who work on all plants as needed. Central Kitsap WWTP has six plant operators, and one worker. The County cross-trains operations staff so that they can fill in for other staff during absences or emergencies.

The Field (Collection) Operations is responsible to maintain, repair, replace, clean, and inspect the sewer utilities collection systems. It is managed by the Sewer Collections O&M Supervisor who oversees two O&M Crew Supervisors. Engineering efforts are managed by both the Sewer Utility Engineering and Construction Management Groups. The Construction Management Group manages the delivery of capital work while the Engineering Group manages the design, both groups consult the Facilities and Conveyance operation groups for project specific challenges that will impact day-to-day or future operations. The Administration portion of the Engineering Group manages the GIS database utilized by the Operations groups and provides review efforts for Developer proposed projects.

Figure 10-1 | Kitsap County Public Works Sewer Utility Organizational Chart



10.3 Operations and Maintenance Requirements

10.3.1 Regulatory Compliance

Under the Federal CWA of 1972 and amendments, the EPA has the authority to permit WWTPs on tribal land under the NPDES program, which includes Suquamish WWTP. EPA has issued NPDES Permit WA0023256 to the County for Suquamish WWTP, which includes operator certification and O&M requirements for both the WWTP and the collection system.

10.3.2 Operations and Maintenance Program

As required by the NPDES permit, the County has instituted an O&M program which consists of maintenance records for all major mechanical and electrical components for the WWTP, collection system, pump stations, and any other major facilities. The County uses a computerized maintenance management system (CMMS) to schedule and record all maintenance activities for plants and pump stations. The system identifies the frequency and type of maintenance recommended by the manufacturer and records the frequency and types of maintenance performed. The CMMS is available to all relevant County staff for review, update, and inspection. The County also uses a GIS system to inventory and record all maintenance and inspections of the conveyance pipe systems and is also used to populate downloadable asset layers accessible to the public.

10.3.3 Operations and Maintenance Manual

The Suquamish WWTP O&M Manual provides basic information for the plant in accordance with the NPDES permit, WAC 173-240-080, and Ecology's Orange Book. It describes the treatment process in sufficient detail to familiarize personnel with both the normal operation of the plant as well as the alternate methods of operation that are available. In addition, it provides an overview of all miscellaneous components and management systems in use at the plant. The intent of the manual is to assist operators and other personnel with learning the overall operation of the plant, to serve as a basic reference for operating any of the system's components and provide emergency response and safety guidelines.

Pump station specific O&M information is located on the County's Electronic O&M website. This includes information on critical pieces of equipment such as pumps, electrical, instrumentation, controls equipment, valves, and odor control systems. Newer stations have more complete O&M data than older stations.

10.4 Supervisory Control and Data Acquisition (SCADA)

The County employs a SCADA system to monitor and record the status of the pump stations and treatment plants. The SCADA system uses Aveva (previously known as Wonderware) software. The County recently completed a Sewer Utility SCADA Master Plan that evaluated the existing SCADA system, identified operational needs, determined preferred hardware and software, and presented recommended improvement projects. The Sewer Utility SCADA Master Plan is included as **Appendix F**. All the County pump stations are connected to the SCADA system, and new pump stations include force main pressure monitoring to provide greater remote insight into operating conditions.

The pump stations and treatment plants have a number of alarms that are linked to the County SCADA system that alert staff if a problem is occurring via either very high frequency (VHF) licensed radio network or 4G cellular network. These alarms include high wet well level alarms, intrusion alarms, pump fail alarms, and others. The alarm functionality at pump stations designated as 'critical' is checked weekly to ensure they are operational.

10.5 Collection System Operations and Maintenance Activities

10.5.1 Collection System Overview

The Suquamish conveyance system provides service primarily to the northern portion of the Suquamish LAMIRD with a small portion of the system served in the southern portion. The Suquamish Clearwater Casino Resort also pumps wastewater flows to Suquamish collection system. Wastewater within the Suquamish basin is ultimately conveyed to the Suquamish WWTP. The Suquamish collection and conveyance system is shown in **Figure 10-2**.

10.5.2 Pump Stations

County crews visit and inspect each pump station regularly to check on equipment, test alarms, and perform maintenance as needed. The inspection and testing frequency is determined by the criticality of the pump station and is completed as shown in **Table 10-1**. Criticality is determined by how many drainage basins (or upstream pump stations) discharge to the pump stations. A schematic of the conveyance system showing the pump station criticality is shown in **Figure 10-3**. Physical location of a pump station in relation to a water body or location that is difficult to access, may drive a higher criticality definition independent of number of contributing basins. Generator load exercise is completed with the pump station load at all critical stations and regional stations with loads greater than 200 kW. Stations with loads less than 200 kW are exercised with mobile load banks. Stations are checked if alarms are indicated.

Table 10-1 | Pump Station Inspection & Testing Frequency

Pump Station Type[1]	Threshold for Designation	Inspection Frequency	Alarm Check Frequency	Generator Load Exercise[2]
Critical	5+ Basins Served, or if specifically identified	1 x per week	bi-weekly	Annually
Regional	3-4 Basins Served	1x per week	bi-weekly	Annually
Relay	2 Basins Served	1 x per week	bi-weekly	Annually
Satellite	1 Basin Served	1x per week	bi-weekly	Annually

Notes:
1. Certain pump stations may serve fewer basins, yet the selection of type is driven by location.
2. Generators are run monthly, however load tested annually.

10.5.3 Sanitary Sewers

Gravity sanitary sewer pipes and manholes are regularly cleaned to clear them of debris, settled solids, and grease buildup and inspected with video equipment to evaluate pipe condition and identify any condition issues. Sewer cleaning and inspection are vital to maintaining a well working sewer collection system. Over time, deterioration, solids build-up, and blockages, can cause collapse and other pre-mature failures. Proactive maintenance through cleaning and inspection keeps the sewer collection system working efficiently and avoids many serious service disruptions from occurring.

The County performs pipe cleaning/jetting and CCTV inspection in-house. Reasons for inspection include routinely scheduled inspections, warranty inspections, new construction inspections and other special project inspection. The system is jetted prior to inspections to improve visibility by removing grease, roots by foaming, sand, grit, and debris, helping reduce blockages and odor issues.

Figure 10-2 | Suquamish Basin Sewer System

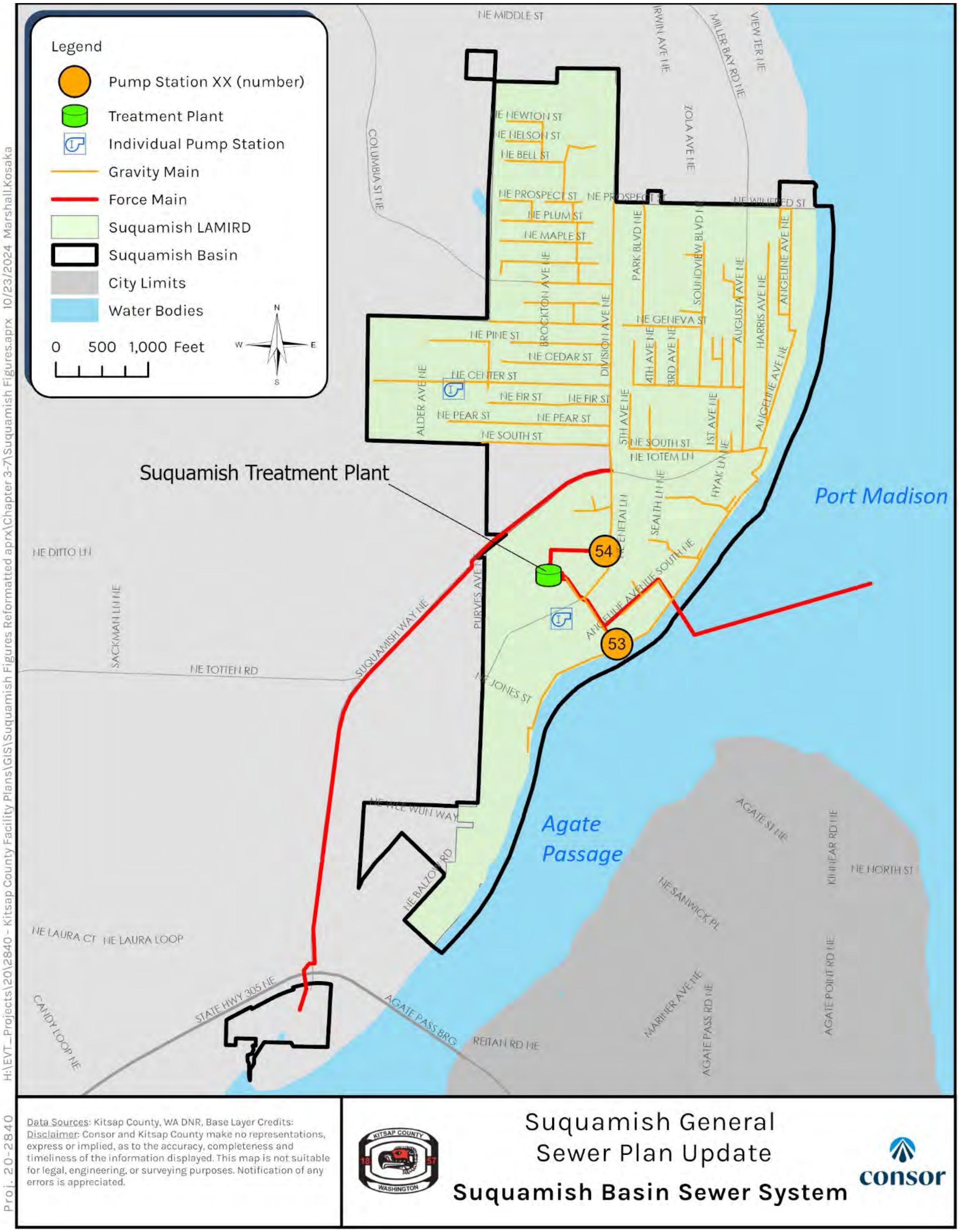


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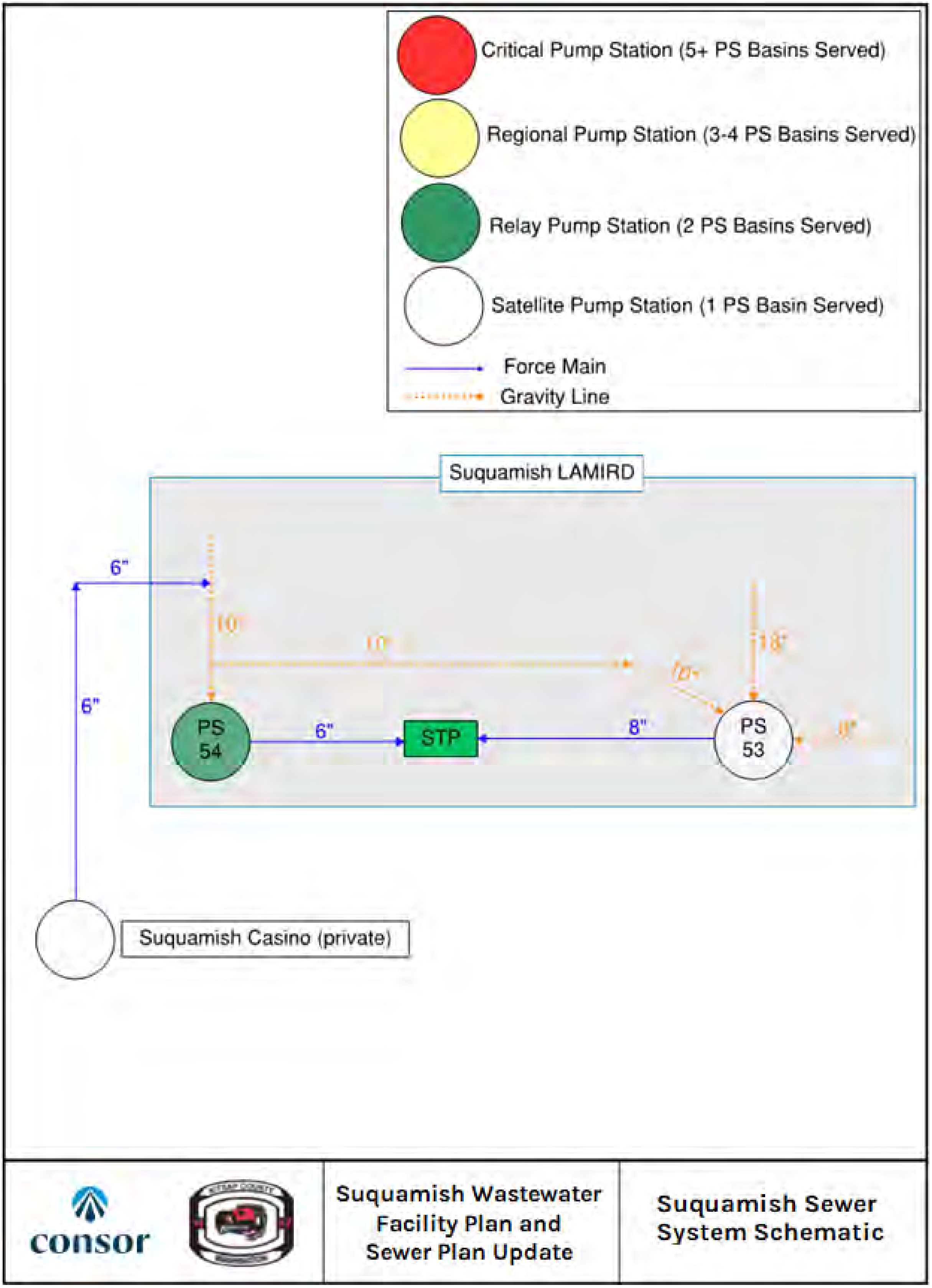
Figure 10-3 | Suquamish Sewer System Schematic



The County process consists of inspecting pipe via CCTV, storing the video in a database, reviewing the video, and assigning an OCI score based on the observations. Pipe condition is evaluated based on operator experience and flagged for further investigation if needed. The County does not currently use a condition rating system such as the National Association of Sewer Service Companies (NASSCO) standards to evaluate and record observed conditions. It is recommended that the County consider having CCTV operators trained and certified in NASCCO assessment to improve the consistency of sewer inspecting rating.

The results of these assessments have been stored in their asset management database software Cartegraph since 2017. The County has a target metric to complete inspection of all pipes in the system on a five-year cycle (approximately 20 percent of the pipes inspected each year). According to Standard Operating Procedure (SOP), in addition to CCTV every five years, flushing is performed annually unless identified as a hot spot. Frequency of flushing of identified hot spots then location dependent. At the time of this writing, all of the pipes have been inspected and an evaluation has been stored in Cartegraph.

The force mains and siphons are cleaned when needed. The County's force mains are designed to achieve scouring velocities that self-clean under normal system operation. If pipe conditions allow, pigging is performed annually. Destructive testing is only performed when lines are suspected of failure.

The Suquamish WWTP outfall is inspected by divers following the procedures required by the NPDES permit.

10.5.4 Pretreatment Program

The County is required by the NPDES permit to enact a pretreatment program to ensure all commercial and industrial customers comply with the pretreatment regulations in 40 CFP Part 403 through 471. The program is required to take continuous and routine measures to identify all existing, new, and proposed SIUs. The draft NPDES permit includes a requirement to develop and maintain a master list of the industrial users. The list shall be submitted within two years following the effective date of the NPDES permit. The County is aware that the flow from the Suquamish Clearwater Casino Resort is high enough to be considered as a potential SIU.

10.5.5 Odor and Corrosion Control Program

The County has several calcium nitrate (Bioxide™) solution dosing systems in the collection system to remove and prevent formation of hydrogen sulfide. The systems are located upstream of areas where odor complaints are common. These systems are set to dose automatically and are not connected to SCADA. Operators visit each system regularly to check on operation and refill on-site solution containers.

The County also utilizes hypochlorite dosing, charcoal filters, and organic biofilters at specific stations. Uses are prescribed based upon individual pump station characteristics.

10.5.6 Fats, Oils, and Grease Program

County Code 13.12.160 prohibits discharge of pollutants that will cause obstructions in the County sewer system. Businesses producing fats, oils, and grease (FOG) are required to have and maintain a grease removal system. Depending on the type and size of business, this may be a small grease trap maintained by employees or a large oil/water interceptor that is pumped out regularly by a permitted waste hauler. The County accepts hauled FOG waste at the Central Kitsap WWTP and is currently designing a dedicated FOG receiving station to improve ease of disposal for FOG haulers.

The County is considering implementing code through the use of inspection, enforcement, or other financial penalties to ensure FOG compliance.

10.6 WWTP Operations and Maintenance Activities

10.6.1 Preventative Maintenance

The County maintains the Suquamish WWTP to keep critical components in good operating condition. This includes inspecting machinery, cleaning tanks, and maintaining equipment. Maintenance is performed in accordance with the manufacturer's recommendations during the warranty period for equipment and maintenance intervals are adjusted based on operator experience after the warranty period expires. Spare parts for all equipment are tracked in the CMMS with critical spare parts identified. Key parts are kept on hand in instances where the part cannot be readily obtained from local suppliers.

It is recommended that the County develop a valve exercise program to minimize issues with infrequently used valves seizing as they age, and also review spare parts inventories and assess the need for additional spare parts due to supply chain challenges.

10.6.2 Laboratory Operation and Accreditation

The County maintains an accredited laboratory at the Central Kitsap WWTP (W660-21A) to provide analysis of a broad range of water quality parameters including those for reporting or permit monitoring data. The laboratory at the Suquamish WWTP is not certified, so samples required for reporting purposes are analyzed at the Central Kitsap WWTP lab. The County must maintain accreditation in accordance with WAC 173-50. Ecology's *Procedural Manual for the Environmental Laboratory Accreditation Program* provides details on requirements, fees, recommended practices, proficiency testing, and audit procedures.

In addition to completing water quality testing, the laboratory is responsible for recalibrating and maintaining process probes and mobile testing instruments.

10.7 Sewer Collection System Staffing Needs

The County operates and maintains all four of their sewer basins as a single utility, and all sewer collection staff work in all the basins. A comparison of County sewer collection operations staff with similar utilities in the area is shown in **Table 10-2**. The County numbers reflect all County owned sewer collection and conveyance facilities from all County basins. The County has slightly more staff per mile of pipe, but fewer staff per pump station than the average of the other utilities.

Table 10-2 | Sewer System Staffing Comparison

Agency	Personnel (FTE)	Miles of Pipe	Personnel per Mile of Pipe	No. of Pump Stations	Personnel per Pump Station
Kitsap County	18	215[1]	0.09	64[2]	0.3
City of Bellevue	25	520	0.05	36	0.7
City of Enumclaw	4	142	0.03	7	0.6
City of Kent	13	211	0.06	7	1.8
City of Kirkland	24	123	0.19	6	4.0
City of Lacey	14	236	0.06	48	0.3
City of Port Orchard	6.5	75	0.09	21	0.3

Agency	Personnel (FTE)	Miles of Pipe	Personnel per Mile of Pipe	No. of Pump Stations	Personnel per Pump Station
Silver Lake Water and Sewer District	33	207	0.16	22	1.5
West Sound Utility District	15	45	0.33	12	1.3
Alderwood Water and Wastewater District	11	440	0.03	12	0.9
Average			**0.11**		**1.25**

Notes:

1. Total miles of gravity sewer pipe and force main pipe in Central Kitsap, Kingston, Manchester, Suquamish, and Navy Yard City, provided by the County's sewer asset count in 2024.
2. Number of pump stations in Central Kitsap, Kingston, Manchester, Suquamish, and Navy Yard City.

10.8 WWTP Staffing Needs

The NPDES permit for the Suquamish WWTP does not require operator certification. If Ecology had jurisdiction, the plant would be classified per WAC 173-230-330 as a Class II plant, which would require the operator in charge to hold a Class II operator certification. Ensuring the operator has at least a Class II certification is recommended even in the absence of a permit requirement. Suquamish WWTP shares the operators with the other three WWTPs. Operator certification of all four WWTPs is shown in **Table 10-3**. In addition to the plant operators, there are 5 laboratory staff who are required to obtain an operator certification within two years of being hired.

Table 10-3 | Operator Certifications

Operations Certification	Number of Staff
Operator in Training	0
Group I	4
Group II	5
Group III	3
Group IV	4
TOTAL	**16**

Current staffing at Suquamish WWTP facility consists of one Lead Plant Operator specifically assigned to Suquamish and one Plant Operations Supervisor and two Rover Plant Operators who oversee operations at Suquamish WWTP, Manchester WWTP and Kingston WWTP. Thus, the total full-time equivalent (FTE) for Suquamish is approximately 2.0, with 1.0 FTE by the Lead Plant Operator and 1/3 FTE each by the Plant Operations Supervisor and Rover Plant Operators. During off hours, critical SCADA alarms from the plant are configured to ring through to an on-call operator. Maintenance at Suquamish WWTP is conducted by the Sewer Utility O&M group which is shared across all of the County's WWTPs and collection and conveyance systems.

As flows and loads increase at the facility and as improvements are undertaken, staffing levels may change. **Table 10-4** identifies potential staffing needs at existing and future planning horizon based on *Estimating Staffing for Municipal Wastewater Treatment Facilities* (EPA, 1973) and *The Northeast Guide for Estimating Staffing at Publicly and Privately-Owned Wastewater Treatment Plants* (New England Interstate Water Pollution Control Commission, Nov 2008). These estimates include supervisory, administrative, clerical, laboratory, yard work, site maintenance, and unit process O&M. All methods assume 1,500 working hours per employee after holidays, time off, training, etc. These estimates are intended to be guidelines only;

specific staffing levels must be determined by the County and reviewed regularly to adequately operate and maintain the facility.

Table 10-4 | Suquamish WWTP Staffing Comparison and Projection

Condition	AAF (MGD)	Current Staffing	EPA Method Staffing[1]	Northeast Guide Method Staffing
Staff at 2020 *(additional staff needed)*	0.23	2.00	1.26 *(0)*	2.18 *(0.2)*
Staff at 2042[2] *(additional staff needed)*	0.26	-	0.83 *(0)*	1.86 *(0)*

Notes:

1. The minimum plant capacity covered in the EPA Method is 0.5 MGD, therefore a flow of 0.5 MGD was used as the basis for staffing determinations.
2. Staff required in 2042 is lower for both methods due to the replacement of aging equipment and improved automation and controls as recommended in the CIP.

Based on both the EPA and Northeast Guide methods, the County's current approach of having one dedicated staff person for Suquamish with one additional FTE of shared support staff appears to be appropriate and adequate for current operations. There is a slight deficiency in staff using the Northeast Guide method. It is expected that if some additional effort is required it can be covered with assistance from other operating staff on an as-needed basis. There is little expected increase in flows and improvements at the plant are expected to improve staff efficiency, so no additional staff is expected to be required though the 20-year planning period. It is recommended that the County continue executing the Sewer Utility Plant Operator Qualification Program and additional external classroom training to accelerate employees into Operator Certification Group III and prepare for anticipated Puget Sound Nutrient Reduction Goals and facility upgrades.

10.9 Conclusions and Recommendations

Conclusions and recommendations based on a review of the County O&M practices are:

- Consider having CCTV operators trained and certified in NASCCO assessment to improve the consistency of sewer inspecting rating.
- Consider reviewing spare parts inventories and assessing the need for additional spare parts due to supply chain challenges.
- Institute and annual valve exercise and maintenance program.
- Consider developing additional classroom training to accelerate employees into Operator Certification Group III and prepare for anticipated Puget Sound Nutrient Reduction Goals and facility upgrades.
- Institute an Arc Flash Analysis and Protection program to identify deficiencies that can be mitigated through coordinated CIP projects.

SECTION 11

Capital Improvement Plan

11.1 Introduction

This section identifies CIP projects and O&M projects for the Suquamish collection system and WWTP. These improvements are required to remedy deficiencies identified in **Section 5**, **Section 7**, **Section 8**, and the Condition Assessment Red Flag Findings and Mitigation Recommendations technical memorandum (**Appendix E)**.

11.2 Capital Improvement Plan Criteria

CIPs are presented on a 6-year basis from 2023 to 2028 for immediate needs; and, for the 20-year planning horizon (from 2029 to 2042) for improvements that are anticipated but not pressing. A planning level cost opinion and a preliminary timeline of CIP project implementation is provided. It is assumed that minor projects will be completed with O&M budget and are listed separately. The methodologies for funding the CIP projects will be discussed in **Section 12**.

The Asset Health Scores discussed in **Section 5** and **Section 6** were used to identify the most critical projects across the County's system based on asset condition and the CoF. The CIP projects were prioritized based on the Asset Health Scores and factors including the extent and type of deficiency, customers impacted, environmental impacts, and capital and O&M costs.

In conjunction with the facility planning effort, the County has been working on a series of SCADA Master Plan TMs which include project identification, estimates, and capital improvement planning in Technical Memorandum No. 5. SCADA system improvements are not incorporated into this CIP because they are generally implemented across the entire sewer division, and not specifically to process improvements at the Suquamish WWTP. SCADA improvements were also included in a separate CIP.

Drivers of improvements are considered for five categories:

1. Capacity: An asset no longer has sufficient capacity when it cannot or is modeled in the future to not be able to meet the equipment, hydraulic, or process capacity requirements, as detailed in **Section 6** for the WWTP and **Section 7** for the collection and conveyance system. The proposed firm capacity is determined through H/H model simulations considering increased population for the 2042 planning horizon and a 25-year storm event. Capacity driven improvements are assigned the maximum asset health score of 25 as these projects are considered the most critical. Capacities are defined as follows:

    a. A gravity sewer pipe no longer has sufficient capacity when the flow in the pipe is greater than or equal to 80 percent of pipe flowing full ($d/D \geq 0.8$).

    b. A force main no longer has sufficient capacity when the velocity in the pipe is greater than 7 fps.

    c. A lift station is over capacity if the largest pump is out of service and the remaining pump(s) is (are) unable keep up with the inflow.

    d. An equipment/treatment process no longer meets the equipment, hydraulic, or process capacity requirements, discussed in detail in **Section 6**.

2. O&M: County staff indicate the asset requires excessive maintenance, using valuable time and money. O&M issues are primarily driven by condition. The project goal will be to improve reliability and reduce maintenance call outs.

3. Obsolescence: The asset is reaching the end of its service life. Life expectancy of piping, structures, and mechanical/electrical equipment varies depending on the treatment processes and is discussed in **Section 6**. For the collection system, life expectancy of pipes are 100 years, structures are 50 years, and mechanical/electrical equipment is 25 years.

4. Developer: A new development in the County necessitates new or upgraded infrastructure that would not be needed by the existing customers and would be funded and constructed by a developer.

5. Regulatory: Regulatory projects will address facilities that are currently out of compliance or expected to become incompliant with existing, pending, or anticipated regulations set by the State and Federal agencies, such as Ecology or the EPA.

Projects for the County's sewer systems are identified with a code that identifies the basin, system, driver of improvements, and a project number using the following identifiers (note that basin identifiers are used as General Sewer Plan Updates for the three other service areas are being completed concurrent to this Plan):

- Project Category:
    - Capital Improvement Plan = CIP
    - Operations and Maintenance = O&M
- Basin Abbreviations:
    - Central = CK
    - Kingston = K
    - Suquamish = S
    - Manchester = M
- System:
    - Collection and Conveyance = CC
    - Wastewater Treatment Plant = WWTP
- Driver:
    - Capacity = CAP
    - Op and Maintenance = OM
    - Obsolescence = OB
    - Developer = DEV
    - Regulatory = REG

AACE International Class 5 opinions of probable project costs with an anticipated accuracy range of -50 percent to +100 percent were developed using RSMeans Heavy Construction Cost Data, recent County project bid tabs, County input, industry experience, and local contractor and supplier costs. The total project costs include construction costs for work and materials plus markups for mobilization, general contractor markups, overhead and profit, taxes, and a construction contingency of 50 percent plus an additional markup of 50 percent for engineering, legal, administration costs, and construction management associated with project delivery. The OPPCs were developed in 2023 dollars.

There is a five-year moratorium on pavement excavation and trenching following the completion of a new road or road overlay. This requirement restricts all road trenching except in the event of an emergency repair or if all trenching is outside of the paved area. Projects should be coordinated with road paving projects to avoid this moratorium and reduce paving costs.

11.3 Suquamish Collection and Conveyance System Improvements

The collection and conveyance system includes pump stations, force mains, and gravity sewers. Proposed CIP projects address identified deficiencies for these assets. Projects are frequently combined for efficient project delivery. The projects components are broken down into pump stations, which include force mains, and pipeline projects, which include gravity sewers.

11.3.1 Recently Completed and Ongoing Suquamish Collection and Conveyance CIP

There are no known current on-going capital projects in the Suquamish collection and conveyance system at the time of this writing.

11.3.2 6-Year Collection and Conveyance CIP (2023 to 2028)

There are no projects in the Suquamish collection and conveyance system for the 6-year CIP. If funding becomes available, projects identified for potential near term implementation in previous Plan sections should be considered in the 6-year CIP.

11.3.3 20-Year Suquamish Collection and Conveyance CIP (2029 to 2042)

Each of the projects identified for the Suquamish collection and conveyance system 20-year CIP are summarized in **Table 11-1** and described in greater detail below. These projects are related to system expansion to new development or septic conversion. It is assumed that developer projects will be significantly funded by the developer and will be excluded from the financial analysis. The conveyance sizes and pump station firm capacities were sized considering increased population for the 2042 planning horizon and a 25-year storm event. The location of the 20-year CIPs are shown in Figure 11-1. See OPPCs for individual projects in **Appendix J** for more detail.

11.3.3.1 CIP-S-CC-CAP-1 – Replace PS-54 and Forcemain

This project will replace the existing PS-54 and forcemain that connects the Suquamish WWTP. It Is projected that wet weather flows to this station will exceed the exiting firm capacity for a 25-year storm event within the near-term planning horizon. The existing station is accessed by the WWTP access road near the intersection of Division Avenue NE and NE Kaleetan Lane. The station was originally constructed in 1998. The proposed firm capacity is determined through H/H model simulations for the 2042 planning horizon and a 25-year storm event assuming population growth occurs within the area served by the existing collection and conveyance system (e.g., no system expansion). It is recommended that the County confirm station sizing prior to implementing this CIP.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.2 CIP-S-CC-CAP-2 – Replace PS-53 and Forcemain

This project will replace the existing PS-53 and forcemain that connects the Suquamish WWTP. It Is projected that wet weather flows to this station will exceed the existing firm capacity for a 25-year storm event within the near-term planning horizon. The existing station is near the shoreline at the south end of a drive in Old Man House Park (the park is adjacent to the intersection of NE McKinistry Street and Angeline Avenue NE). The station was originally constructed in 1977 and is nearing the end of its useful life. The proposed firm capacity is determined through H/H model simulations for the 2042 planning horizon and a 25-year storm event assuming population growth occurs within the area served by the existing collection and conveyance system (e.g., no system expansion). It is recommended that the County confirm station sizing prior to implementing this CIP.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.3 CIP-S-CC-DEV-4 – Extend Gravity Sewers Flowing to PS-53 from the South

This project would include installing additional gravity sewers tributary to PS-53. Development in this area or potential septic conversion would trigger the need for this project. The proposed gravity main sizing is determined through H/H model simulations for the 2042 planning horizon and a 25-year storm event assuming development of the entire LAMIRD. It is assumed that this project would be significantly funded by development. See **Table 11-1** for project details.

11.3.3.4 CIP-S-CC-DEV-5 – Extend Gravity Sewers Flowing to PS-54

This project would include installing additional gravity sewers tributary to PS-54. Development in this area or potential septic conversion would trigger the need for this project. The proposed gravity main sizing is determined through H/H model simulations for the 2042 planning horizon and a 25-year storm event assuming development of the entire LAMIRD. It is assumed that this project would be significantly funded by development. See **Table 11-1** for project details.

11.3.3.5 CIP-S-CC-DEV-6 – Extend Gravity Sewers Flowing to PS-53 from the Northeast

This project would include installing additional gravity sewers tributary to PS-53. Development in this area or potential septic conversion would trigger the need for this project. The proposed gravity main sizing is determined through H/H model simulations for the 2042 planning horizon and a 25-year storm event assuming development of the entire LAMIRD. It is assumed that this project would be significantly funded by development. See **Table 11-1** for project details.

11.3.3.6 CIP-K-CC-OM-7 – Annual Pipe Replacement.

This project will be an annual program that the County will develop to provide ongoing funding to replace aging and deficient pipes not identified in other capital improvement projects. These pipes may include deficiencies related to root intrusion, high rates of I&I, deflected joints, cracked pipes, insufficient slopes, and high rates of O&M call outs. It assumes that one percent of the pipe in the Suquamish basin would be replaced each year. See **Table 11-1** for project details.

Table 11-1 | 20-Year Suquamish Collection and Conveyance Capital Improvement Projects

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Expansion[3]	Total Project Cost	Project Description
CIP-S-CC-CAP-1 [6]	25[4]	Replace PS-54 and Forcemain	X			$7,000,000	➢ Replace the pump station to increase firm capacity to approximately 1,200 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under a new canopy ➢ Construct new diesel generator set with Level 2 sound attenuating enclosure ➢ Replace 900 LF forcemain with 10-inch diameter
CIP-S-CC-CAP-2 [6]	25[4]	Replace PS-53 and Forcemain	X			$7,200,000	➢ Replace the pump station to increase firm capacity to approximately 1,200 gpm and replace forcemain with 8-inch diameter. ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under a new canopy ➢ Construct new diesel generator set with Level 2 sound attenuating enclosure ➢ Replace 1,100 LF forcemain with 10-inch diameter ➢ While this is a capacity driven project, this station was constructed in 1977 so it nearing the end of its useful life.
CIP-S-CC-DEV-4	n/a[4]	Extend Gravity Sewers Flowing to PS-53 from the South			X	$0	➢ Construct approximately 50 LF of 10-inch diameter gravity sewer ➢ Construct approximately 4,300 LF of 8-inch diameter gravity sewer ➢ Project would expand the area served by PS-53 ➢ Project expected to be paid for by developers. Estimated project cost is $7,700,000
CIP-S-CC-DEV-5	n/a[4]	Extend Gravity Sewers Flowing to PS-54			X	$0	➢ Install approximately 1,200 LF of 8-inch diameter gravity sewer ➢ Project would expand the area served by PS-54 ➢ Project expected to be paid for by developers. Estimated project cost is $2,400,000

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Expansion[3]	Total Project Cost	Project Description
CIP-S-CC-DEV-6	n/a[4]	Extend Gravity Sewers Flowing to PS-53 from the Northeast			X	$ 0	➢ Install approximately 1,300 LF of 8-inch gravity sewer ➢ Project would expand the area served by PS-53 ➢ Project expected to be paid for by developers. Estimated project cost is $2,800,000
CIP-S-CC-OM-7	20[5]	Annual Pipe Replacement		X		$4,340,000	➢ Replace deteriorated and aging pipe. ➢ Project costs assume $310,000 per year totaled over 14 years (CIP years 7-20). ➢ Replacement assumes 0.5 percent of total system (250 LF) is replaced per year.
					Total	**$18,540,000**	

Notes:
1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity.
4. Asset health score is not applicable for these projects that are development driven and do not exist.
5. An asset health score of 20 was selected to prioritize projects on an annual basis.
6. If funding becomes available, this project should be considered in the 6-year CIP.

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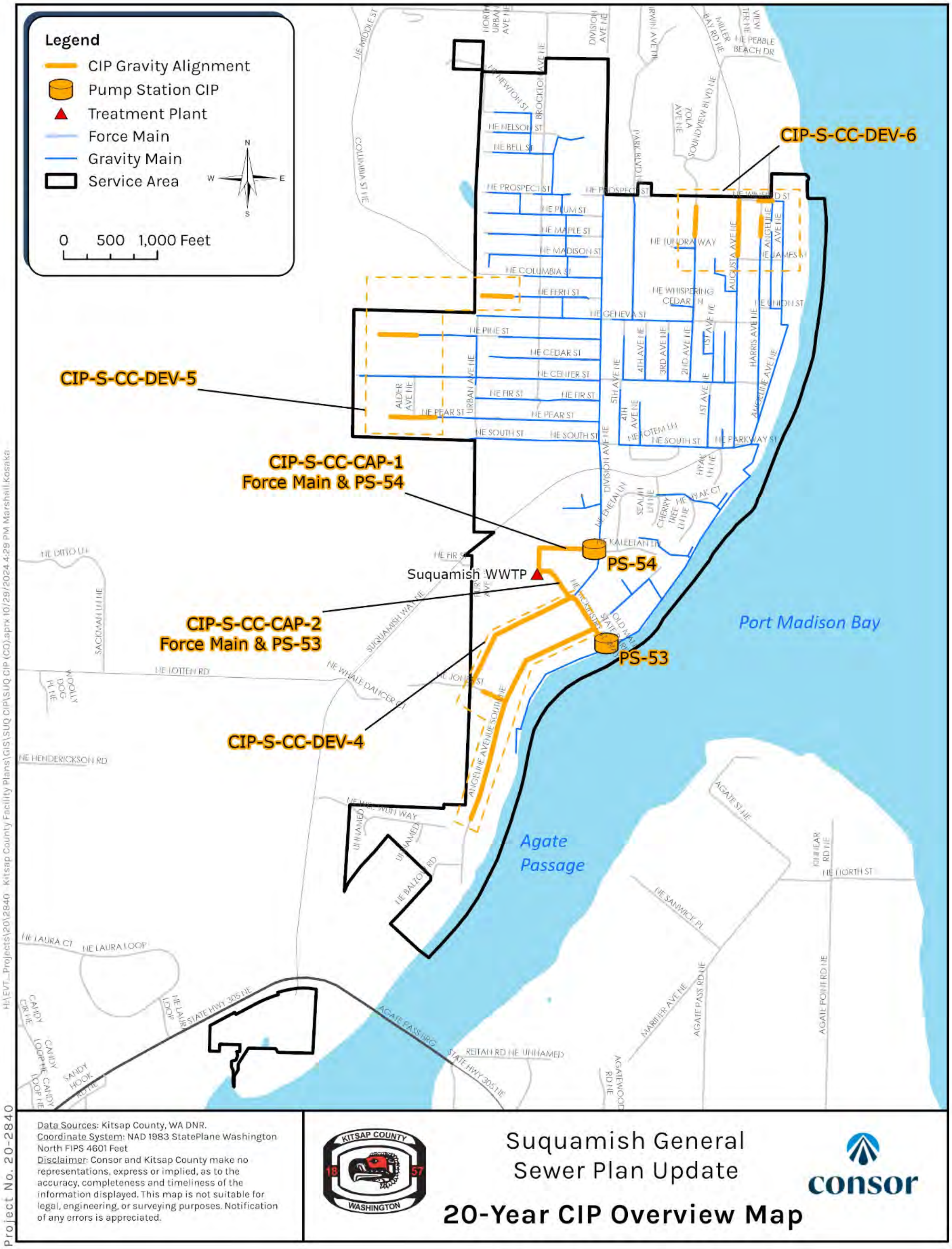
Figure 11-1 | 20-year Collection and Conveyance CIP (2029-2042)



11.4 Suquamish WWTP Improvements

As summarized in **Section 6** and **Section 8**, Suquamish WWTP has two SBRs that work well and can continue to provide treatment through the 20-year planning period. Much of the plant was installed or upgraded in 1997, so additional repairs, replacements, and improvements will be required for continuing operation. Additionally, implementation of the PSGNP and Ecology's 401 Certification Letter have added additional TIN removal optimization requirements, which will require some upgrades to the secondary treatment process.

11.4.1 Suquamish WWTP Alternatives Analysis

The alternatives analysis in **Section 8** evaluated different treatment technologies for key processes and recommended secondary treatment optimization, UV disinfection system upgrades, and a new activated carbon odor control system. In addition, several minor maintenance, repairs, and direct replacements are identified in **Section 6** and will be required to keep the WWTP operating reliably over the next 20 years. The urgency of each of these projects has been assessed to develop a project list of short-term CIP projects that should be addressed in the next 6-years and a long-term project list for those CIP projects that are not urgent but will need to be executed later in the 20-year planning period. The remaining projects that can be completed by the plant staff are categorized as O&M projects. These project lists, project descriptions, and costs are presented in the sections that follow.

11.4.2 Recently Completed and Ongoing Suquamish WWTP CIP

There are no known current capital projects at the Suquamish WWTP at the time of this writing.

11.4.3 6-Year Suquamish WWTP CIP (2023 to 2028)

Each of the projects identified for the Suquamish WWTP 6-year CIP are described below and summarized in **Table 11-2**. See OPPCs for individual projects in **Appendix J** for more detail.

11.4.3.1 CIP-S-WWTP-CAP-1: New Influent Equalization Basin:

The WWTP was constructed as a two-basin system with no influent equalization, which does not allow the basins to be isolated for maintenance. This project was discussed in **Section 8** and will construct an influent equalization basin to improve redundancy and allow for one basin to be taken offline for maintenance.

11.4.3.2 CIP-S-WWTP-OB-2: Replace Headworks:

The rotary screen is reaching the end of its expected lifespan and is in poor condition with some visible exterior corrosion. The existing fine screen channel has the manual bar screen in series after the rotary screen, which does not allow the screen to be maintained or replaced without a separate bypass as required by Ecology. This project was discussed in **Section 6** and will replace the headworks with a design that improves redundancy and meets Ecology design requirements to improve the plant operation reliability.

11.4.3.3 CIP-S-WWTP-OB-3: Replace Odor Control System:

The odor control system is only partially operational. Various alternatives for replacement were analyzed in **Section 6** and an activated carbon system was selected as the preferred alternative. A new activated carbon system will be installed to provide odor control for the headworks and ASST at low cost and low O&M requirement. The existing odor control system will be rehabilitated to provide odor control for the process room.

11.4.3.4 CIP-S-WWTP-OM-4: Replace Process Piping:

The existing SBR recirculation piping is in poor condition and has failed several times in recent years. The custom welded steel fittings make it difficult to repair and impossible to replace with standard fittings. Additionally, the motorized control valves are obsolete and some are not functional. This project was discussed in **Section 6** and will replace the piping with a more appropriate material to reduce the rate of failure and make replacement of piping components possible. The valves will be replaced to ensure operability and reliability.

11.4.3.5 CIP-S-WWTP-OM-6: Replace Drain Piping:

The drain piping in the process building has corroded and is leaking in some areas. This project will replace exposed portions of the drain piping to eliminate leaks and rust staining to reduce the maintenance that the drain system requires.

11.4.3.6 CIP-S-WWTP-REG-8: NFPA 820 Upgrades:

The process building does not meet NFPA 820 code requirements for ventilation, combustible gas detection, fire alarms, fire hydrant protection, and fire truck access. This project will replace or upgrade these items to meet code requirements.

Table 11-2 | 6-Year Suquamish WWTP Capital Improvement Projects

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost	Project Description
CIP-S-WWTP-CAP-1	14.5	New Influent Equalization Basin		X		$ 2,850,000	➢ Construct new influent equalization basin
CIP-S-WWTP-OB-2	8.1	Replace Headworks	X			$ 2,090,000	➢ Construct new headworks structure ➢ Relace fine screen and manual screen ➢ Replace grit removal tank
CIP-S-WWTP-OB-3[4]	3.9	Replace Odor Control System	X			$ 510,000	➢ Install new odor control system for headworks and sludge storage tank ➢ Rehabilitate process room odor control system
CIP-S-WWTP-OM-4	14.5	Replace Process Piping	X			$ 2,170,000	➢ Replace SBR recirculation piping ➢ Replace pump room sludge piping
CIP-S-WWTP-OM-6[4]	3.9	Replace Drain Piping	X			$ 190,000	➢ Replace the drain piping in the pump/blower room
CIP-S-WWTP-REG-8[4]	3.9	NFPA 820 Upgrades	X	X		$ 2,300,000	➢ Replace the fire alarm and combustible gas detection systems ➢ Extend the water main and install fire hydrant ➢ Upgrade site access to meet fire code
					Total	**$ 10,110,000**	

Notes:
1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity.

4. Asset health scores for the WWTP are grouped by process. This project has a low asset health score because of adequate health of other parts of the process, but the specific equipment addressed by the project is in need of improvement so it in included on the 6-year CIP.

11.4.4 20-Year Suquamish WWTP CIP (2029 to 2042)

Each of the projects for the 20-year CIP are described below and are summarized in **Table 11-3**. See OPPCs for individual projects in **Appendix J** for more detail.

11.4.4.1 CIP-S-WWTP-OB-5: SBR Improvements:

The coating in the SBR basins is beginning to fail and the basins currently do not have automatic probes for monitoring the process. This project was discussed in **Section 8** and will replace the coatings to extend the lifespan of the structure and add on-line DO and ammonia-nitrate probes to improve treatment monitoring and performance.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.4.4.2 CIP-S-WWTP-OB-7: Effluent Equalization and Sludge Storage Tank Rehabilitation:

The effluent equalization basin and sludge storage tank structure is in poor condition due to corrosion of the walls and settlement of the access stairway. This project was discussed in **Section 8** and will remove the existing coating, repair the metal walls as needed, replace the access stairs, and recoat the structure to extend the life. A ladder into the effluent equalization basin and davit crane mounts for both the effluent equalization basin and the ASST will also be installed to improve ease of access and safety.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.4.4.3 CIP-S-WWTP-OB-9: Replace UV System:

The existing UV system is approaching the end of its expected lifespan. Various alternatives for replacement were analyzed in **Section 6** and replacement with the Trojan UV3000Plus was selected as the preferred alternative. Replacing the UV system with this upgraded model will provide a system with advanced monitoring and control functionality which will reduce operating costs and O&M requirements.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.4.4.4 CIP-S-WWTP-REG-10: Convert to AGS System:

The existing SBR system is not expected to be capable of reducing effluent TIN to below 10 mg/L by the end of the 20-year planning horizon. The plant can meet the TIN limits in the current PSNGP, but the permit expires December 31, 2026 and future limits may be lower. It is assumed that effluent TIN restrictions to values below 10 mg/L will not be implemented until 2031 at the earliest. If effluent nitrogen limits become more restrictive, as discussed in **Section 8**, this project will be implemented to change the process to AGS and improve nitrogen removal to approximately 3 mg/L TIN. In order to convert to an AGS process the aeration system and process piping will be replaced, the effluent storage basin will be replaced, the ASST will be modified, and the process controls will be replaced.

11.4.4.5 CIP- S-WWTP-OB-11: Replace Thickened Sludge Pump:

The thickened sludge pump shows significant corrosion and cannot pump when the TWAS concentration gets over 5 percent. This project was discussed in **Section 6** and will replace the current thickened sludge pump with a larger pump to handle higher solids concentration.

Table 11-3 | 20-Year Suquamish WWTP Capital Improvement Projects

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost	Project Description
CIP-S-WWTP-OB-5[6]	14.5	SBR Improvements		X		$ 720,000	➢ Recoat the SBR basins ➢ Add DO and nitrogen probes to improve process control ➢ Project will improve TIN monitoring and control to ensure effluent TIN can be reduced to near or below 10 mg/L
CIP-S-WWTP-OB-7[6]	8.7	Effluent Equalization and Sludge Storage Tank Rehabilitation		X		$ 860,000	➢ Rehabilitate the effluent equalization basin and sludge storage tank
CIP-S-WWTP-OB-9[6]	8.7	Replace UV System	X			$ 760,000	➢ Replace obsolete UV system
CIP-S-WWTP-REG-10[4,5]	14.5	Convert to AGS System		X		$8,120,000	➢ Convert SBR basins to AGS process ➢ Install fine bubble diffuser system and replace blowers ➢ Replace recirculation pumps with new transfer pumps ➢ Replace PLC, sensors, and controls ➢ Replace Effluent Equalization Basin ➢ Retrofit ASST ➢ Replace Sludge Storage Blower ➢ Project will be implemented if needed to further reduce effluent TIN to approximately 3 mg/L.
CIP-S-WWTP-OB-11	6.0	Replace Thickened Sludge Pump	X			$50,000	➢ Replace thickened sludge pump
					Total	$10,510,000	

Notes:
1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity.
4. Asset health scores for the WWTP are grouped by process. This project has a high asset health score because of other health deficiencies in the process, but the specific equipment addressed by the project is not in urgent need of improvement.
5. Future nutrient requirements and timing are unknown. Based on the current permit cycle for the PSNGP, it is assumed that effluent TIN restrictions to values below 10 mg/L will not be implemented until 2031 at the earliest.
6. If funding becomes available, this project should be considered in the 6-year CIP.

11.4.5 Suquamish WWTP O&M Projects

Each of the O&M projects discussed in **Section 6** are summarized in **Table 11-4**. Costs and drivers of improvements are not included for O&M projects since these are relatively minor projects implemented by County staff and not included in the CIP budget.

Table 11-4 | WWTP O&M Projects

O&M Project No	Asset Health Score	Item	Project Description
O&M-S-WWTP-1	6.0	Flocculation Tank Corrosion Monitoring	➢ Monitor corrosion of the flocculation tank for the RDT
O&M-S-WWTP-2	3.9	Reclaimed Water Pump Supports	➢ Add supports to the reclaimed water pump volute and piping
O&M-S-WWTP-3	3.9	Control Panel Housekeeping and PLC Backup	➢ Verify if backup copies of all PLC and OIT programs exist and, if not, create backups ➢ Obtain spare parts for the PLC system ➢ Clean CP-13
O&M-S-WWTP-4	3.9	Replace Plant Sump Pumps	➢ Replace the plant drain sump pumps
O&M-S-WWTP-5	8.7	Replace Recirculation/WAS Pumps	➢ Replace the recirculation/was pumps when they reach the end of their useful lifespan (approx. 2035) ➢ This project is not needed if CIP-S-WWTP-REG-11 is implemented
O&M-S-WWTP-6	9.5	Complete WWTP Arc-Flash Study	➢ Complete arc-flash study and install signage as needed ➢ May be combined with similar projects at other WWTPs

11.5 Wastewater System 20-Year CIP

[NOTE TO COUNTY REVIEWER: The following paragraph and table will change when the plan goes final and will describe the prioritization process with final prioritization schedule provided in the table.]

The 20-Year CIP is summarized in **Table 11-5** along with the consultant proposed spend plan over the 20-year planning horizon.

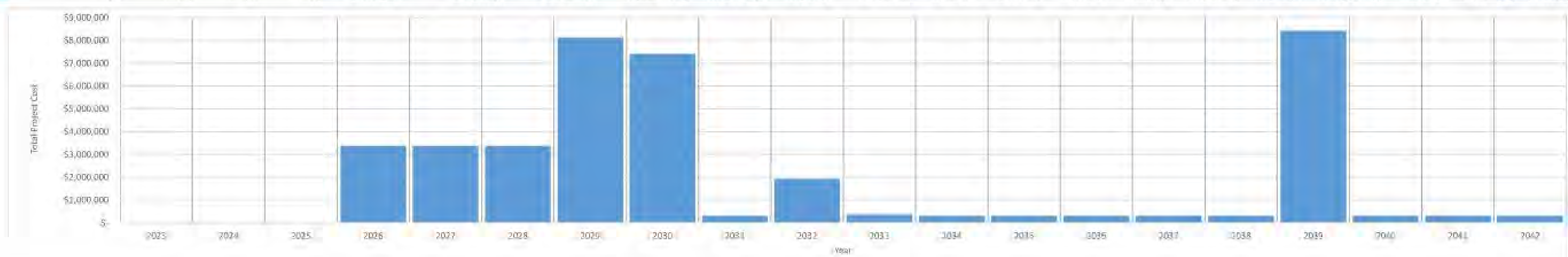
Table 11-5 | Recommended Capital Improvement Program Summary

Suquamish Basin CIP Plan

consor

6 or 20 Year CIP	CIP No.	Asset Health Score	Project Name	Total Project Cost	6-Year CIP 2023	2024	2025	2026	2027	2028
6	CIP-S-WWTP-CAP-5	14.5	Influent Equalization Basin	$ 2,850,000				$ 950,000	$ 950,000	$ 950,000
6	CIP-S-WWTP-OB-2	8.1	Replace Headworks	$ 2,090,000				$ 696,667	$ 696,667	$ 696,667
6	CIP-S-WWTP-OB-3	3.9	Replace Odor Control System	$ 510,000				$ 170,000	$ 170,000	$ 170,000
6	CIP-S-WWTP-OM-4	14.5	Replace Process Piping	$ 2,170,000				$ 723,333	$ 723,333	$ 723,333
6	CIP-S-WWTP-OM-6	3.9	Replace Drain Piping	$ 190,000				$ 63,333	$ 63,333	$ 63,333
6	CIP-S-WWTP-REG-8	3.9	NFPA 820 Upgrades	$ 2,300,000				$ 766,667	$ 766,667	$ 766,667
20	CIP-S-CC-OM-7	20	Annual Pipe Replacement	$ 4,340,000						
20	CIP-S-WWTP-OB-5	14.5	SBR Improvements*	$ 720,000						
20	CIP-S-CC-CAP-1	25	Replace PS-54 and Forcemain*	$ 7,000,000						
20	CIP-S-CC-CAP-2	25	Replace PS-53 and Forcemain*	$ 7,200,000						
20	CIP-S-WWTP-OB-7	8.7	Effluent Equalization and Sludge Storage Tank Rehabilitation*	$ 860,000						
20	CIP-S-WWTP-OB-9	8.7	Replace UV System*	$ 760,000						
20	CIP-S-WWTP-OB-11	6	Replace Thickened Sludge Pump	$ 50,000						
20	CIP-S-WWTP-REG-10	15.4	Convert to AGS System	$ 8,120,000						
			Total Project Cost (2023)	$ 39,160,000	$ -	$ -	$ -	$ 3,370,000	$ 3,370,000	$ 3,370,000
			Assumed Inflation Rate			12%	8%	8%	5%	5%
			Inflation Multiplier		1	1.12	1.21	1.31	1.37	1.44
			Future Value Cost		$ -	$ -	$ -	$ 4,402,460	$ 4,622,583	$ 4,853,712

CIP No.	20-Year CIP 2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
CIP-S-WWTP-CAP-5														
CIP-S-WWTP-OB-2														
CIP-S-WWTP-OB-3														
CIP-S-WWTP-OM-4														
CIP-S-WWTP-OM-6														
CIP-S-WWTP-REG-8														
CIP-S-CC-OM-7	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000
CIP-S-WWTP-OB-5	$ 720,000													
CIP-S-CC-CAP-1	$ 3,500,000	$ 3,500,000												
CIP-S-CC-CAP-2	$ 3,600,000	$ 3,600,000												
CIP-S-WWTP-OB-7				$ 860,000										
CIP-S-WWTP-OB-9				$ 760,000										
CIP-S-WWTP-OB-11					$ 50,000									
CIP-S-WWTP-REG-10											$ 8,120,000			
Total Project Cost (2023)	$ 8,130,000	$ 7,410,000	$ 310,000	$ 1,930,000	$ 360,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 310,000	$ 8,430,000	$ 310,000	$ 310,000	$ 310,000
Assumed Inflation Rate	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Inflation Multiplier	1.51	1.59	1.67	1.75	1.84	1.93	2.03	2.13	2.23	2.35	2.46	2.59	2.72	2.85
Future Value Cost	$ 12,294,871	$ 11,766,328	$ 516,861	$ 3,378,770	$ 661,749	$ 598,331	$ 628,248	$ 659,660	$ 692,643	$ 727,275	$ 20,766,055	$ 801,821	$ 841,912	$ 884,008



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SECTION 12

Financial Strategy

12.1 Introduction

This chapter documents the Sewer Financial Plan, which shows how the investments in the CIP can be funded by the County sewer utility.

This Sewer Financial Plan was written by FCS, a Bowman company, under subcontract with Consor, the County's consulting engineers who have prepared the other required elements of this Plan.

12.1.1 Four Basins, One Financial Entity

The County sewer system has four basins, each with a treatment plant and a corresponding collection system: Central Kitsap, Manchester, Suquamish, and Kingston. The capital planning has been performed separately for each basin. However, the County does not separate its sewer utility financial information by basin, so all information shown in this Sewer Financial Plan document—unless explicitly stated otherwise—refers to the County sewer utility as a whole.

This sewer financial plan document has been written so it can be included with each of the Wastewater Facilities and Sewer Plan documents: Central Kitsap, Manchester, Suquamish, and Kingston. At the end of this chapter, a table showing the allocation of costs and revenues across the four basins is included, so that the Plan documents will each contain the required elements needed for submission to Ecology.

12.1.2 Sequence of Topics

After reviewing the historical performance of the sewer utility, we describe the methodology and key assumptions underlying the financial forecast. The key assumptions address the assumed fiscal policies, economic assumptions, and data sources. This section also summarizes the CIP, expressing total project costs in both constant 2023 dollars and future inflated dollars.

After the key assumptions and data sources, this chapter then shows the results of the revenue requirement forecast. This is a two-step process. First, the capital funding strategy describes how the capital costs can be financed over time, using both debt and non-debt sources. The debt issues lead to annual debt service costs. The second step is the annual forecast, which incorporates the debt service and other annual costs into a forecast that is balanced against projected revenues. The forecast is tested assuming existing rates. If either the projected cash balances are insufficient or the required bonded debt service coverage is not achieved, then rates are adjusted until the forecast is balanced. In this forecast, the forecast can be balanced with overall rate increases of 6.31% in 2025 (already adopted by the County) and 6% per year from 2026 through 2042.

This document then shows the implications of these rate increases on several metrics and policy targets: reserve fund balances, rate-funded capital investment, bonded debt service coverage, outstanding debt as a percentage of total assets, annual debt service as a percentage of total revenue ("debt service load"), and the average single-family bill as a percentage of median household income.

The next section of this document allocates the forecast results to the four basins. Finally, **Appendix K** contains a list of loan and grant programs administered by State agencies.

12.2 Financial History

This section is a summary of historical financial performance as reported on the County sewer utility income statements.

Table 12-1 shows comparative financial statements for the six-year period 2018 through 2023. These statements summarize the revenues, expenses, and ending reserves for each year.

Table 12-1 | Sewer Utility Income Statement Summary

Kitsap County Sanitary Sewer Statement of Revenue, Expenses, and Changes in Fund Net Position	2018	2019	2020	2021	2022	2023
Operating Revenues						
Charges For services	$ 29,148,750	$ 22,655,426	$ 22,463,052	$ 29,309,413	$ 29,874,573	$ 33,131,359
Miscellaneous	8,186	1	1,830	(952)	29,607	26,281
Total Operating Revenue	29,156,936	22,655,427	22,464,882	29,308,461	29,904,180	33,157,640
Operating Expenses						
Personnel services	6,300,329	6,279,287	5,685,451	4,687,211	7,096,959	7,204,619
Contractual services	2,457,856	1,139,373	2,005,189	3,274,795	1,526,763	1,677,788
Utilities	1,730,524	1,572,611	1,629,789	1,658,245	1,829,897	2,031,543
Repair and maintenance	363,500	206,538	124,609	276,907	67,014	383,963
Other supplies and expenses	822,068	2,411,869	2,904,338	24,091	3,522,734	3,624,846
Insurance claims and other benefits	23,206	41,016	48,593	36,905	55,869	71,221
Depreciation	8,067,911	8,229,732	7,938,653	7,936,876	7,798,372	7,564,530
Amortization	-	-	-	-	18,185	43,554
Total Operating Expense	19,765,394	19,880,426	20,336,622	17,895,030	21,915,793	22,602,064
Operating Income (loss)	9,391,542	2,775,001	2,128,260	11,413,431	7,988,387	10,555,576
Nonoperating Revenues (Expense)						
Interest and investment revenue	557,566	992,414	501,061	(108,225)	(514,379)	1,599,427
Grant Revenue	-	-	-	-	12,077,611	1,617,967
Miscellaneous revenue	7,995,466	974,624	-	-	-	11,521
Interest expense	(2,332,621)	(2,574,476)	(1,774,693)	(1,663,145)	(1,534,251)	(1,592,572)
Miscellaneous expense	(2,362)	-	-	-	-	-
Total Nonoperating Revenue (Expense)	6,218,049	(607,438)	(1,273,632)	(1,771,370)	10,028,981	1,636,343
Income (loss) Before Contributions & Transfers	15,609,591	2,167,563	854,628	9,642,061	18,017,368	12,191,919
Capital contributions	1,746,374	1,079,087	3,304,592	358,850	8,815	3,378,392
Transfers in	133,903	2,116,097	-	-	-	-
Transfer out	(167,214)	(364,731)	(139,181)	(47,868)	(47,940)	(78,250)
Transfer to Fiscal Agent	-	(2,066,310)	-	-	-	-
Change in Net Position	17,322,654	2,931,706	4,020,039	9,953,043	17,978,243	15,492,061
Net Position - Beginning	92,589,114	109,914,129	104,363,824	108,683,150	118,636,193	136,614,438
Prior period adjustment	-	(8,482,011)	299,286	-	-	-
Net Position - Ending	109,911,768	104,363,824	108,683,149	118,636,193	136,614,436	152,106,499

Following are some observations about the sewer utility's historical financial performance:

- "Charges for services" revenue varies from year to year, with the total ranging from $22.4 million to $33.1 million over the past six years. While population growth and retail rate increases account for a general upward trend over time, the "up and down" variability from year to year is largely driven by changes in capital cost sharing from contract customers.

The three primary contract customers are the City of Poulsbo, U.S. Navy Keyport, and Bangor. All three contract customers pay for ongoing service at the commercial rate. Poulsbo and U.S. Navy Keyport have separate cost-sharing agreements for capital costs. In the County's accounting system, capital cost-sharing is included in the "charges for services" revenue category.

- In 2018, the County received $7,995,466 in miscellaneous revenue, with a smaller amount ($974,625) received the following year. The County's annual report showed this revenue in the "operating grants and contributions" category. While we did not determine the source, it is clearly a non-recurring revenue.
- Total operating expenses have increased over time, with an average increase of 2.3% per year. There was a temporary decrease from 2020 to 2021 followed by a rebound in 2022. This pattern may have been influenced by the COVID-19 pandemic.
- The County received approximately $13.7 million in grants over the last two years with the majority ($12.1 million) being accounted for in 2022.
- The financial statements suggest that the County utility has been drawing down its balance of outstanding debt through the six-year period, since interest expense decreased from $2.3 million in 2018 to $1.6 million in 2023.
- In the annual report, the term "net position" refers to the utility's total assets minus total liabilities. (It is analogous to "owner's equity" in private sector financial statements.) The Kitsap County sewer utility's net position has increased by $59.5 million (64%) from the beginning of 2018 to the end of 2023. This equates to an average increase of 8.6% per year during the period.

12.3 Methodology and Assumptions

12.3.1 Revenue Requirement Forecast Methodology

The revenue requirement forecast identifies the total revenue needed to fully fund the utility on a stand-alone basis considering current and future financial obligations. For this analysis, the resulting rate increases are assumed to be applied "across-the-board" to all customer classes; no rate design changes are proposed in this financial plan.

Table 12-2 shows that the forecast is a two-step process. The first step is the capital funding strategy, shown in the left column. We begin with the total capital program provided by Consor as part of the General Sewer Plan Updates for each of the County's four wastewater basins. We then subtract all of the non-debt funding sources. The remainder is the amount of borrowing needed. The number at the bottom of the first column—the debt needed to fund the remainder of the capital program—determines the amount of new debt service, which is an annual cost.

The second step is the annual forecast, shown in the column to the right. The fiscal policy targets include the minimum reserve balances that must be maintained in the forecast. To that number we add each year's projected operating costs, existing and new debt service, and the amount of current rate funding used for capital expenditures. After deducting non-retail revenue, we now know how much money is needed each year from rates.

Table 12-2 | Revenue Requirement Overview

	Capital Funding Strategy
	Total Capital Projects
-	Grants
-	Wholesale Contributions
-	Newcomer Fees
-	Rate-Funded Capital
-	Cash Reserves
=	Debt Funding (Loans or Bonds)

	Annual Forecast
	Fiscal Policy Targets
+	Operating Costs
+	Existing & New Debt Service
+	Rate-Funded Capital
=	Revenue Requirement
-	Offset Revenues
=	Revenue Required from Retail Rates

The rate revenue requirement is next compared with the revenue projected to be generated by current rates. In addition, we test the current rates against required "debt service coverage," which is an important fiscal policy explained below. If the current rates are insufficient—either because they do not generate enough cash or because the debt service coverage target is not met—then the forecast rates are adjusted to the degree necessary to balance the cash flow requirements and ensure that the coverage target is achieved.

12.3.2 Fiscal Policies

The fiscal policies that affect a rate forecast include the target operating reserve, minimum capital reserve, minimum operating and capital cash, debt service coverage, rate-funded capital reinvestment. Each type of policy is discussed below.

12.3.2.1 Target Operating Reserve

"Reserves" are another word for fund balance. An operating reserve is a liquidity cushion; it protects the utility from the risk of short-term variation in the timing of revenues or expenses.

For operating reserves, we often characterize the target with both a minimum and a maximum. For any given year, if the forecast shows an ending fund balance below the minimum, then rates need to be raised higher to replenish the reserve. If the forecast shows the ending balance above the maximum, then the excess cash is re-characterized as a capital reserve.

The most common operating reserve target for sewer utilities is between 45 days and 60 days (12%-16%) of annual operating expenses. However, Kitsap County sewer rates include a volume charge for non-residential and contract customers, which introduces more revenue variability. We therefore suggest a larger cushion—an operating reserve target of 90 days (25%) of annual operating expenses.

Recommended Policy: Achieve a year-end operating fund balance of 90 days (25%) of total annual operating expenses. Results: For 2024, this amount is forecasted to be about $4.1 million; it increases throughout the forecast period as operating costs increase with inflation.

12.3.2.2 Minimum Capital Reserve

The capital fund balance fluctuates naturally because it serves two functions. First, capital reserves are a capital funding tool, the means by which a utility saves up in advance of major capital projects and avoids overreliance on debt. Utilities tend to go through waves of capital investment, so the reserve balance tends to grow over time and then drop suddenly after a large capital project.

There is also a second function of a capital reserve. It also serves as a risk reserve just like the operating reserve, giving the utility the flexibility to respond to unanticipated needs. Such needs could include a capital cost overrun, or an unexpected failure of a major asset. It could be an unexpected regulatory requirement or simply an opportunity-driven capital improvement. A cash cushion gives the utility flexibility to address unforeseen capital needs in a logical way.

That cash cushion is achieved by having a minimum capital fund balance in the projections. In other words, when we forecast capital spending and the fund balance naturally goes up and down, we only allow it to go down so far—only as far as the target minimum—not all the way to zero.

The target minimum capital fund balance could be defined as a certain percentage of the average CIP, or as the projected replacement cost of specified high-value assets. However, a simple and common way to set a target minimum capital reserve is to define it as 1% of the original cost of fixed assets in the system. This minimum naturally increases over time since future capital investment leads to a growing inventory of assets. That is the approach we recommend in this financial plan.

Recommended Policy: Achieve a year-end minimum capital balance target of 1% of the original cost of plant-in-service. Results: This equates to roughly $2.9 million for year-end 2024 and increases to $9.0 million in 2042 as capital is constructed.

12.3.2.3 Minimum Operating and Capital Cash

In recent years, bond rating agencies have focused on the combined operating and capital cash balance. A favorable indicator is when a utility maintains a combined year-end cash reserve of at least 180 days (50%) of annual operating expenses. That is the policy target we recommend here.

Recommended Policy: Maintain a minimum year-end operating and capital balance of 180 days (50%) of annual operating expenses. Results: This equates to roughly $8.2 million for year-end 2024 and increases thereafter. In this forecast, the 180-day target is achieved in all years.

12.3.2.4 Debt Management

The sewer utility currently has three revenue bonds, two Public Works Trust Fund (PWTF) loans, and four Department of Ecology (DOE) state loans. Additionally, the County is in the process of selling additional revenue bonds and securing another DOE loan. In 2024, debt service is about $5.2 million. With existing debt and the new debt arrangements already underway, debt service will rise above $7 million per year for 2027-2040, dropping off after 2040. In addition, to address the capital needs identified in this plan, additional revenue bonds are forecasted to be issued in future years. Each bond issue is assumed to have a 20-year term, issuance cost of 1%, and an interest rate of 5%.

12.3.2.4.1 Debt Service Coverage

Debt service coverage is a requirement typically associated with revenue bonds and some state loans. It is also a useful benchmark to measure the riskiness of a utility's capital funding plans. Coverage is best understood as a factor applied to annual debt service. A typical requirement in selling revenue bonds is that bonded debt service coverage must be at least 1.25 throughout the life of the bonds. That means the County agrees to collect enough revenue each year to meet operating expenses and not only pay debt service but also an additional 25% above bonded debt service. This cushion makes bondholders more confident that debt service will be paid on time. The extra revenue can be used for capital expenditures, to build reserves, or for debt service on subordinate debt.

While the County's contractual minimum coverage is 1.25, achieving coverage greater than the minimum is a positive signal that bond rating agencies notice, and it can result in more favorable terms for future borrowing. For that reason, many utilities set a policy target higher than 1.25.

Recommended Policy: Set rates to achieve bonded debt service coverage of at least 1.50. Results: The utility is forecasted to achieve this policy in all years except 2032 and 2034, when coverage decreases to 1.38 and 1.49. That is still safely above the legal minimum of 1.25.

12.3.2.5 Rate-Funded Capital Investment

To avoid overreliance on debt, it is useful to have a target for the amount of capital investment that is funded by rates ("pay-as-you-go"). A common benchmark is to aim for rate-funded capital of at least 100% of original cost depreciation by the end of the forecast period. We recommend that approach.

Recommended Policy: Rate revenue should fund 100% of original cost depreciation expense by the end of the forecast period. Annual depreciation is $7.5 million in 2023, growing to $19.8 million by 2042. Results: In this forecast, rate-funded capital at 100% of depreciation is first achieved in 2039 and continues through the remainder of the forecast.

Table 12-3 provides a summary of the recommended fiscal policies for the sewer utility.

Table 12-3 | Summary of Fiscal Policies

Policy	Recommended Target
Operating Reserve	90 days (25%) of annual O&M expenses (initially, $4.1 million)
Minimum Capital Reserve	1% of original cost of plant-in-service (initially, $2.9 million)
Minimum Operating & Capital Cash	180 days (50%) of annual O&M expenses (initially, $8.2 million).
Debt Service Coverage	A policy target of at least 1.50 for bonded debt, which is higher than the contractual minimum of 1.25
Rate-Funded (Pay-as-You-Go) Capital Reinvestment	Rate-funded capital should equal 100% of original cost depreciation by the end of the study period ($19.8 million per year by 2042)

12.3.3 Key Assumptions and Data Sources

12.3.3.1 Economic & Inflation Factors

The operating expenditure forecast relies primarily on the County's 2024 adopted budget. The line items in the budget are then adjusted each year by one of the following factors:

- General Cost Inflation – After conversations with staff, we assumed 4% in 2024 followed by 3% per year thereafter.
- Construction Cost Inflation – Unless otherwise mentioned, all project costs were given in 2023 dollars, then escalated for construction inflation of 8% in 2024, 4% per year thereafter.
- Labor Cost Inflation – Assumed at 10% for 2025 to reflect the County's compensation study adjustments, followed by 3% per year based on the Employment Cost Indices for wages.

- Benefits Cost Inflation – Assumed at 5% per year, based on the Employment Cost Indices for benefits.
- Taxes – The State excise tax rate is 3.852%, the State Business and Occupation (B&O) tax rate is 1.75%. The State excise tax applies to rate revenue allocated to the collection system. The B&O tax applies to rate revenue allocated to treatment and transmission, as well as to system development charges and other miscellaneous fees.
- Fund Earnings – Assumed to be 4% in 2024 and decreasing one percentage point per year until 2027 and then remaining at 1% for the forecast period. Based on market conditions as well as historical Local Government Investment Pool (LGIP) returns.
- Customer Growth – Conservatively assumed to be 0.5% per year, based on discussion with staff. The assumed growth rate in sewered population varies for each of the County's four service areas, which are projected to be between 0.6%/yr and 4.8%/yr. Therefore, a 0.5%/year customer base growth rate represents a conservative estimate for the purposes of financial planning in the event assumed sewered population growth rates are not realized.
- Operating Budget Execution Factor – 95% in 2024 followed by 90% for all other years, based on discussions with staff and historical data on actual vs. budgeted spending.

12.3.3.2 Fund Balances

The County manages both an operating and capital fund related to the sewer utility. For the purpose of showing funds restricted for debt service repayment, the forecast contains a third category: debt reserves. These funds are assumed to come from the operating fund. **Table 12-4** shows the updated allocated cash balance for 2024 between operating, capital, and debt purposes for the financial modeling. It also shows the projected beginning fund balance for 2024, the beginning of the forecast period.

Table 12-4 | Cash Balances

Description	2024 Beginning Cash Balances
Operating Fund	$11,560,996
Capital Fund	$369,483
Debt Reserves	$6,827,376
Total Fund Balance	**$18,784,376**

While the capital fund reserves are below the initial target of $2.9 million for 2024 beginning balance, the operating fund balance more than covers the difference. In our forecast, any excess operating reserves are re-categorized as available for capital purposes.

12.3.3.3 Existing Debt

As stated previously, current outstanding debt for the sewer utility includes three revenue bonds, two Public Works Trust Fund (PWTF) loans, and four Ecology loans. Annual debt service payments are about $5.2 million in 2024. The County has opted to time the bonded debt service payments to smooth out year-to-year fluctuations in total debt service. The 2015 bond is retired in 2027 while the 2010C QECB loan is retired in 2028. Starting in 2028, the 2010B refunding bond starts to require principal payments. The two outstanding PWTF loans are fully repaid in 2031 and 2041. Two of the DOE loans are fully repaid in 2025 while the others are repaid gradually through 2038.

12.3.3.4 Near-Term Future Debt Obligations

Although not currently making payments on them, the County has begun the process of obtaining two additional debt issues. The first is a 20-year revenue bond which assumes repayment starting in 2025. The bond proceeds (including a bond premium) are assumed to be $32.5 million, requiring annual payments of $2.5 million once principal repayment begins in 2027.

The second loan in process is a $3.78 million DOE loan for the Capital Facility Plans update. Remaining draws on this loan are assumed to occur in 2024. Repayment starts in 2025, with annual payments of about $200,000 per year.

As of the time of writing, the County has also applied for other low-cost loans from State agencies. These additional loans will be described later in this document, under "Capital Funding Strategy."

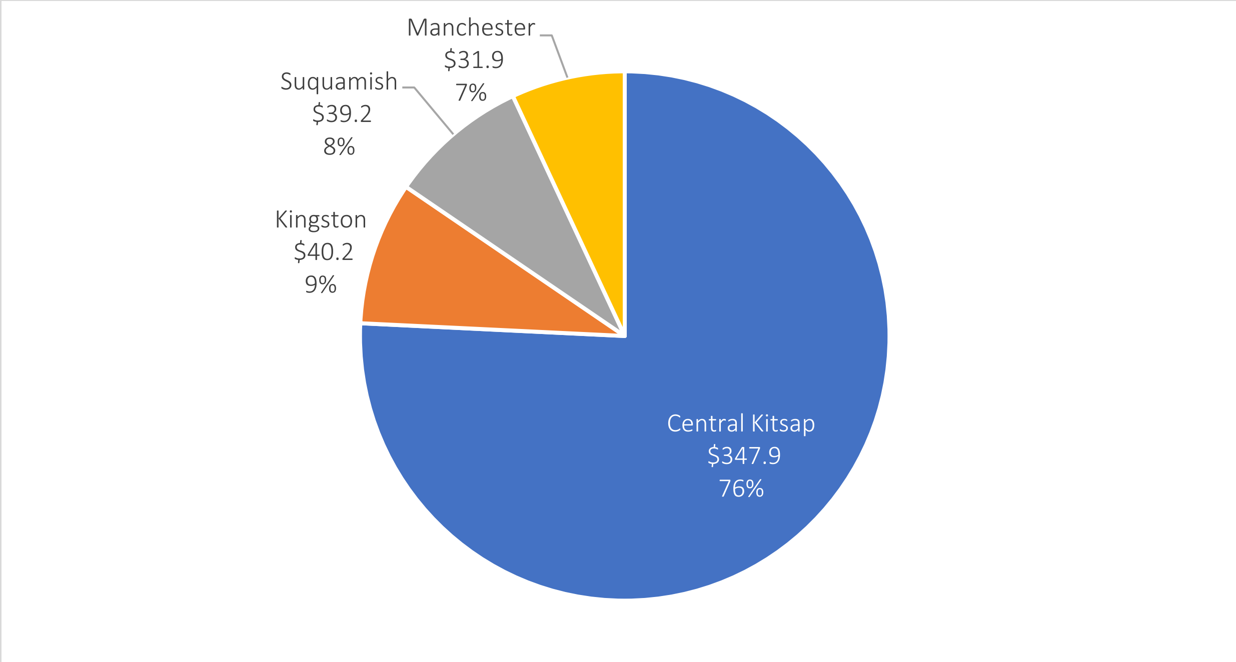
12.3.3.5 Capital Expenditure Forecast

12.3.3.5.1 Capital Projects Before Escalation

Capital project costs and timing were developed by Consor with County staff input. The resulting 2024-2042 capital improvement plan (CIP) shows estimated spending of about $459.2 million in 2023 dollars. Total capital costs in 2023 dollars by basin is shown in **Figure 12-1**. Central Kitsap is the largest treatment plant, and the Kitsap basin has 76% of the capital requirements.

The largest project in the early part of the CIP is the Solids and Liquid Hauled Waste Upgrades at the Central Kitsap treatment plant. Design for this project is currently underway, and its construction schedule is assumed to continue through 2028. (For convenience, it is sometimes referred to as the "digester project," even though it actually includes other elements besides new digesters.) Its total remaining cost (in escalated dollars) is assumed to be $140 million, and it dominates the early years of the forecast—much of the borrowing and resulting rate increases in the next few years are focused on financing the digester project. Because of the size of the project and the fact that its engineering is well advanced, its cost estimate is given in escalated dollars — no further inflation factor is applied to the $140 million cost. For the other projects, however, **Figure 12-1** shows cost estimates in 2023 dollars.

Figure 12-1 | Unescalated Capital Spending (Millions) 2024-2042



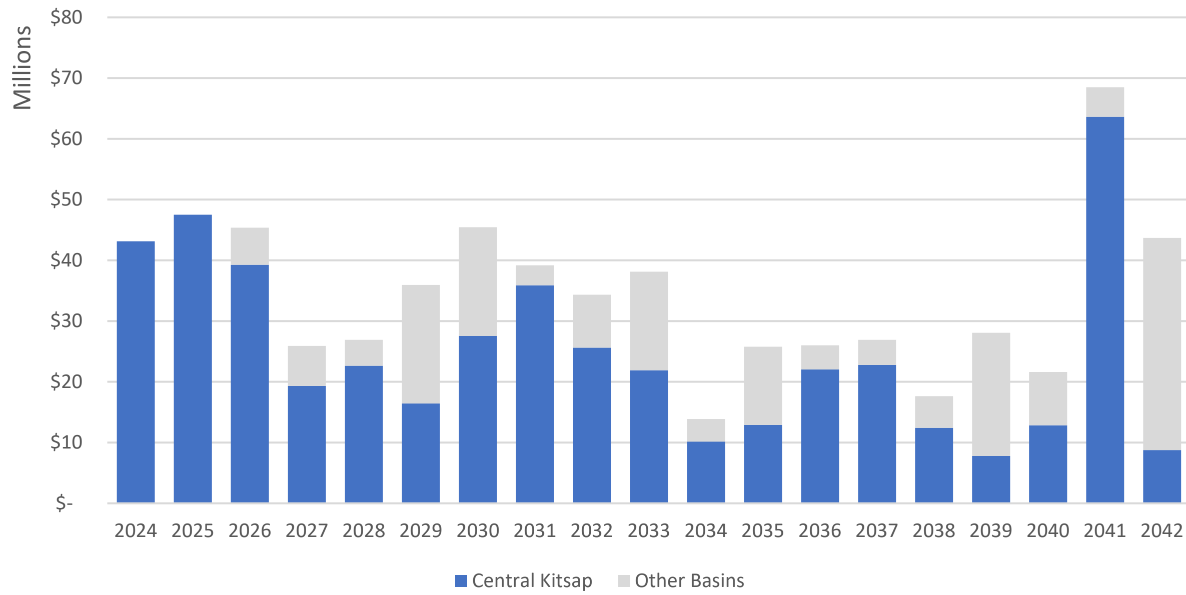
12.3.3.5.2 Projected Capital Expenditures after Cost Escalation

Figure 12-2 shows the year-by-year funding needs after applying the assumed inflation factors.

The digester project has expenditures extending from 2024 through 2028. After 2028, many of the identified capital projects are focused on the collection systems—the pipes and pumps that deliver wastewater to the four treatment plants. The 2029-2040 projects include needed improvements in the Kingston, Suquamish and Manchester basins in addition to the Central Kitsap basin.

In 2041, the CIP shows a major project ($50.3 million, in escalated dollars) to construct Aeration Basins 5 and 6 at the Central Kitsap plant, based on assumed requirements from the State. In 2042, a major upgrade (Class A Reclaimed Water Improvements, costing $29.9 million in escalated dollars) is shown for the Kingston plant. For these 2041 and 2042 projects, the nature of the regulatory requirements from the State are uncertain, but these estimates serve as a placeholder to flag the need for additional major investments in future years.

Figure 12-2 | Capital Expenditure Forecast 2024-2042 (escalated dollars) – Central Kitsap vs All Other Basins



The dark part of each column represents the Central Kitsap basin capital cost needs. The total escalated cost of capital improvements for the Central Kitsap basin is $472.6 million, about 72% of the total $654 million in escalated capital needs for the County.

12.4 County-Wide Revenue Requirement Results

The County currently has an adopted sewer rate increase for 6.31% in 2025. Following the adopted rate increase, the forecast shows that 6.0% annual rate increases would be necessary to continue to cover operations as well as fund the capital plan through a mix of cash funding and debt financing.

12.4.1 Capital Funding Strategy

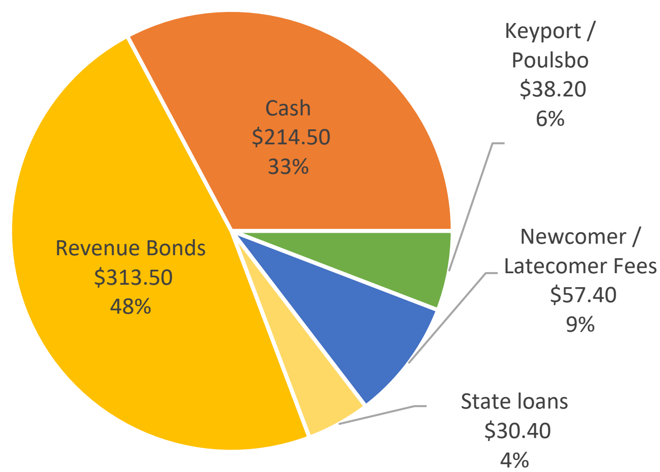
Over the full 19-year period from 2024 through 2042, the capital expenditure forecast (including inflation) contains $654 million of projects. In the capital funding strategy, our task is to identify where that $654 million will come from.

Figure 12-3 shows the forecasted sources of funding for this capital program.

- First is the capital cost sharing from U.S. Navy Keyport and Poulsbo. County staff provided estimates for 2024-2029, totaling $28.1 million for the 6-year period. We assumed that the cost share for 2029 ($778,000) continues in future years, so the total through 2042 is $38.2 million.
- Second, any available Newcomer or Latecomer revenue is applied to the capital program. The forecast assumes about $3,000,000 per year in revenue assuming no changes to the charge, or a total of $57.4 million.
- Next, we assume the low-interest loans that the County is currently pursuing from both Public Works and Department of Ecology. The assumed total is $30.4 million.

- The remaining capital funding need is balanced with a mix of cash vs. revenue bond debt. Each type of funding works to complement the other to fill the remaining funding gap. This includes:
  - Revenue bonds: issued in two-year cycles as needed, to cover capital costs for the year of issuance and the following year. Total debt proceeds are $313.5 million (48% of the total) through 2042. Except for the 2024/25 bond issue, we assumed 20-year bonds at 5% interest.
  - Cash funding: The covers the remaining $214.5 million (33% of the total). It is generated by the rate increases needed to repay revenue bonds and fund the remaining capital needs.

Figure 12-3 | Capital Funding Sources 2024 – 2042



12.4.1.1 Planned Low Interest Loans

The County has applied for low-interest State loans in the short term. The forecast assumes that the County receives the maximum $10 million in both 2025 and 2026 from the Public Works Trust Fund as well as an additional $9.85 million from the Department of Ecology. The total forecasted debt service on these loans is $1.8 million dollars.

12.4.1.2 Planned Revenue Bond Debt Issues

The first bond issue is currently in process as of 2024, but funding may not be available until 2025. After the first revenue bond debt issuance, additional issues are forecasted every two years as needed through 2041. **Table 12-5** shows the timing and magnitude of the bonded debt proceeds assumed in the financial plan, along with the annual debt service associated with each issue.

Table 12-5 | Planned Revenue Bond Issues in the Financial Plan

Year	Net Proceeds	Annual Debt Service
2024/2025	$32.5 million*	$2.5 million*
2026	$22 million	$1.9 million
2028	$42 million	$3.7 million
2030	$70 million	$5.9 million
2032	$58 million	$4.9 million
2034	$19 million	$1.6 million

Year	Net Proceeds	Annual Debt Service
2036	$25 million	$2.1 million
2039	$5 million	$0.4 million
2041	$40 million	$3.4 million
Total	**$313.5 million**	**$26.5 million**

Note:
*2024/2025 issue includes approximately $2.5m premium. Debt service is planned to have two years of interest-only payments in 2025 and 2026

12.4.1.3 Potential Grants and Other Low Cost State Loans

Due to the reliance on revenue bond funding for the capital program, the County should continue to pursue additional low-cost State loans. Grants and state loans provide two benefits. The first is the cost savings compared to the assumed alternative of issuing revenue bonds. In addition, by reducing its reliance on revenue bonds, the County improves its bonded debt service coverage calculation.

The following document is a helpful summary of the funding, eligibility, and contact details for water and sewer infrastructure assistance programs (both grants and low-cost loans) in Washington State: http://www.infrafunding.wa.gov/resources.html. This summary is updated each year by the Department of Commerce. The most recent version (September 17, 2024) is included as **Appendix K** to this report.

12.4.2 Annual Forecast

Figure 12-4 graphically represents the annual forecast through 2042. Total operating revenues are about $31.0 million in 2024 and $90.4 million in 2042. These figures exclude revenue restricted to capital purposes—debt proceeds, capital cost sharing from contract customers, or newcomer charges.

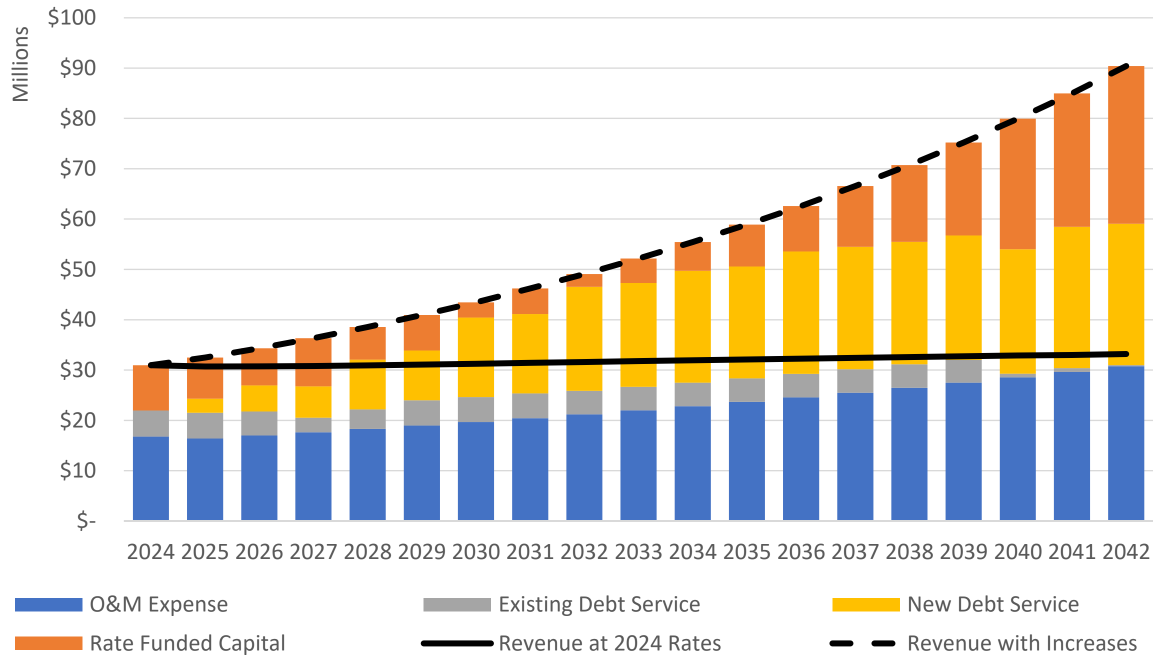
The stacked columns represent the costs of the utility, such as operating expenses, existing debt service, new debt service, and annual cash funding used for capital projects. The solid black line represents revenue at existing rates and the dashed line shows forecasted revenue with rate increases.

Below are further observations about these variables.

- Solid line: Revenue at existing rates.
  - Revenue is projected to increase with customer growth, even without future rate adjustments.
- Dashed line: Revenues with rate increases.
  - After the recommended rate increases, revenue is expected to grow to $90.4 million by 2042.
- Blue bar: Operating expenses.
  - Operating expenses increase with the annual cost escalation assumptions described earlier.
- Grey bar: Existing debt service.
  - Annual payments of about $5.2 million in 2024, declining to $214,000 by 2042.
- Yellow bar: New debt service.
  - New debt service begins in 2025. By 2042, it is about $28.1 million per year.

- Orange bar: Rate revenue available for capital projects.
    - This amount fluctuates year to year as the debt issues impact the difference between revenue collected and total other obligations.

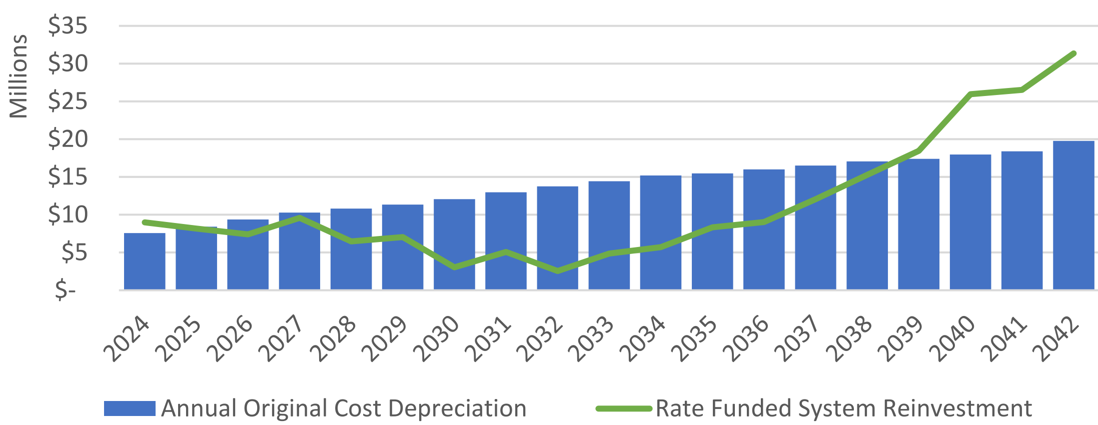
Figure 12-4 | Revenue Requirement Forecast



12.4.2.1 Rate-Funded Capital Investment

The green line in **Figure 12-5** shows the sewer utility's projected annual level of rate-funded capital investment in relation to annual depreciation.

Figure 12-5 | Annual Rate-Funded System Reinvestment



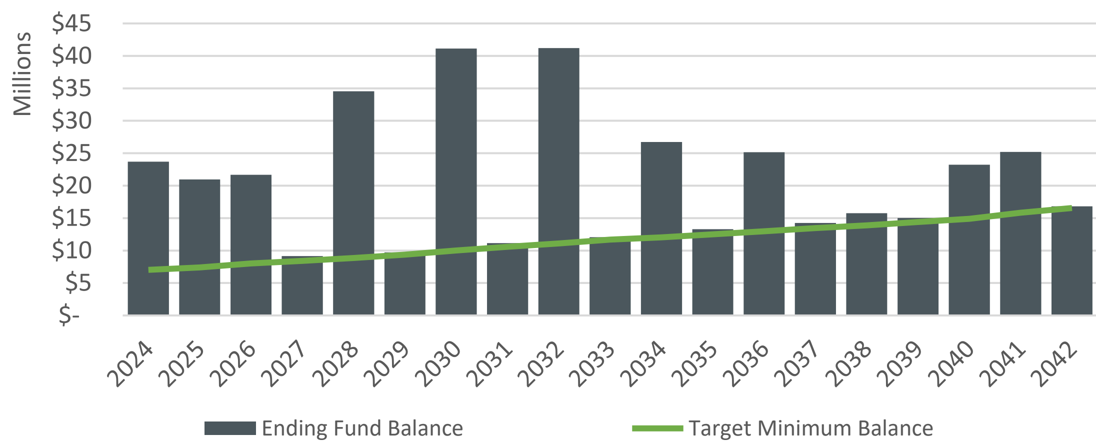
Over the forecast period, annual depreciation cost increases as the County completes capital projects. The blue line represents the same amount as the light green bar in **Figure 12-4**. Over this period, rate-funded system reinvestment reaches a low of 9% of annual depreciation in 2032. This coincides with the lowest bonded debt coverage (1.38) in the forecast. Beginning in 2039, rate-funded capital is projected to achieve the assumed policy target of at least 100% of annual depreciation cost.

12.4.2.2 Operating and Capital Reserve Level

The recommended minimum operating fund balance is 90 days of total annual operating expenses, and the recommended minimum capital fund balance is 1% of the original cost of assets. The sum of these two targets represents the combined minimum reserve balance—about $7.0 million in 2024. It grows to $16.6 million in 2042 as operating costs increase and the County adds assets to the system.

Figure 12-6 shows projected unrestricted fund balances through 2042 in relation to the reserve target (the green line). The utility is projected to achieve the reserve target each year.

Figure 12-6 | Operating and Capital Reserve Forecast

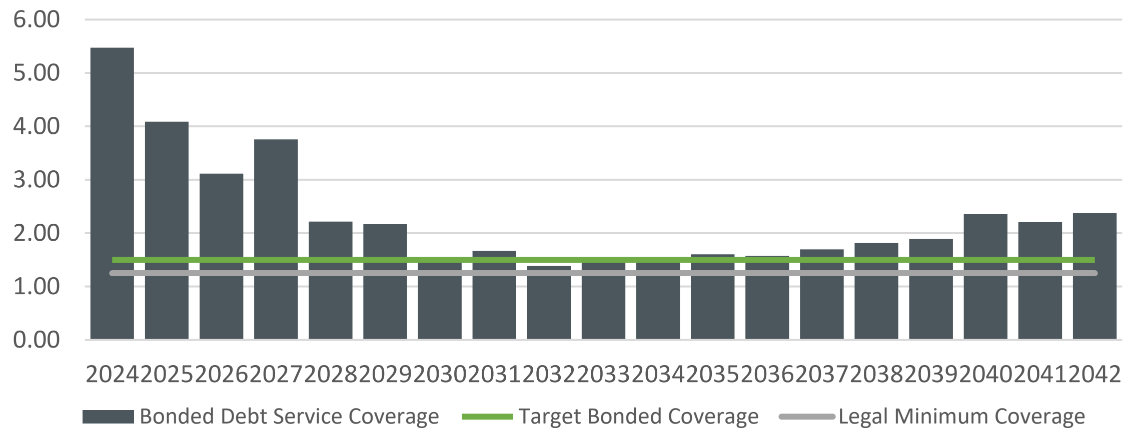


12.4.2.3 Bonded Debt Service Coverage

The legal minimum for revenue bond debt service coverage is 1.25 in each year in which bonds are outstanding. To enhance creditworthiness, many utilities set a policy target that is higher than the legal minimum. In this forecast, assumed a policy goal of at least 1.50 for bonded debt service coverage. However, we allowed exceptions to keep planned rate increases from going above 6% per year.

Figure 12-7 shows projected bonded debt service coverage through 2042 in relation to the assumed policy target of 1.50 and the legal minimum of 1.25. The utility is projected to achieve the policy target each year except for 2032 and 2034, when coverage drops to 1.38 and 1.49. The forecast stays above the legal minimum of 1.25 throughout the forecast period.

Figure 12-7 | Projected Bonded Debt Service Coverage in Relation to Target and Legal Minimum



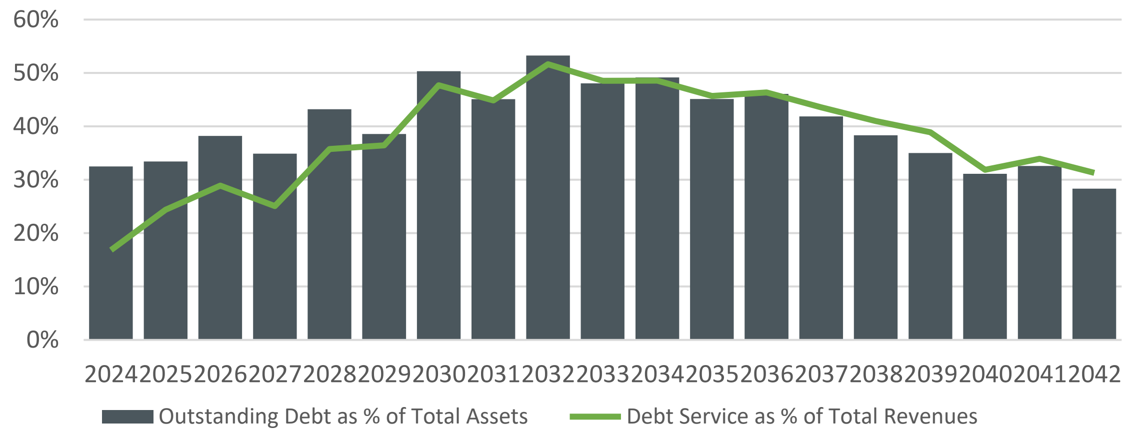
12.4.2.4 Analysis of Outstanding Debt and Debt Service Load

Because the County will need to borrow heavily to fund this CIP, two other debt-related metrics are relevant: the level of outstanding debt in relation to total assets (“debt-to-total assets ratio”), and the projected debt service as a percentage of total revenues (“debt service load”). Debt is a useful component in the capital funding toolbox, but it should not be overused. The cumulative effect of a series of borrowing decisions can be assessed by looking at these two metrics.

Figure 12-8 shows the projected debt-to-total assets ratio and the debt service load throughout the 2024-2042 forecast period. There is not a formal policy target to compare with, but we are aiming to keep both metrics below 50%. In this forecast, both metrics stay at or below 50% except in 2032, when outstanding debt is 53% of total assets and debt service is 52% of total revenue.

Based on these results, we observe that this forecast relies heavily on debt during the next 19 years, and we do not suggest greater borrowing. The significance of this finding comes from the fact that there is a tradeoff between rate increases and the level of borrowing. Higher rate increases allow more “pay-as-you-go” rate-funded capital funding (in lieu of debt), while higher levels of borrowing allow the rate impact to be pushed into future years. In this forecast, the recommended rate increases—6% per year after 2025—should not be ameliorated by more borrowing.

Figure 12-8 | Projected Debt-to-Total Assets Ratio and Debt Service as % of Total Revenue



12.4.2.5 Affordability

Since the inception of the Clean Water Act, the US Environmental Protection Agency (EPA) has provided some guidance on how to measure financial burdens. Called the residential indicator (RI), the EPA measure is the annual residential cost of utility service divided by the median household income (MHI) of the relevant service area. An RI of 2.0% or higher indicates a “high burden” according to the EPA standard for sewer utilities.

The median household income for Kitsap County is estimated to be $103,593 as of 2024. This is based on a survey from the Census Bureau 2023 American Community Survey plus one year of inflation.

Table 12-6 presents an average single-family sewer bill with projected annual rate increases for the forecast period, tested against the affordability threshold. We assumed that median household income increases at the same rate as general inflation, which after 2023 is 3.0% per year. Applying the 2.0% test, Kitsap County’s sewer rates are forecasted to remain within the EPA affordability range through 2042. Note that the median income benchmark does not measure the impact on low-income households; the forecasted rates could be a significant burden on households at the lowest income levels.

Table 12-6 | Affordability Table

Year	Inflation	Median HH Income	Projected Monthly Bill	Projected Annual Bill	% of Median HH Income
2023		$99,609	$92.24	$1,107	1.11%
2024	4.00%	$103,593	$98.06	$1,177	1.14%
2025	3.00%	$106,701	$104.25	$1,251	1.17%
2026	3.00%	$109,902	$110.51	$1,326	1.21%
2027	3.00%	$113,199	$117.14	$1,406	1.24%
2028	3.00%	$116,595	$124.17	$1,490	1.28%
2029	3.00%	$120,093	$131.62	$1,579	1.32%
2030	3.00%	$123,696	$139.52	$1,674	1.35%
2031	3.00%	$127,407	$147.89	$1,775	1.39%
2032	3.00%	$131,229	$156.76	$1,881	1.43%
2033	3.00%	$135,166	$166.17	$1,994	1.48%

Year	Inflation	Median HH Income	Projected Monthly Bill	Projected Annual Bill	% of Median HH Income
2034	3.00%	$139,221	$176.14	$2,114	1.52%
2035	3.00%	$143,397	$186.71	$2,241	1.56%
2036	3.00%	$147,699	$197.91	$2,375	1.61%
2037	3.00%	$152,130	$209.78	$2,517	1.65%
2038	3.00%	$156,694	$222.37	$2,668	1.70%
2039	3.00%	$161,395	$235.71	$2,829	1.75%
2040	3.00%	$166,237	$249.85	$2,998	1.80%
2041	3.00%	$171,224	$264.84	$3,178	1.86%
2042	3.00%	$176,361	$280.73	$3,369	1.91%

12.5 Basin-Specific Revenue Requirement Forecasts

While the previous section discussed the overall financial obligations of the County's sewer utility, this section focuses on the obligations as allocated to individual basins. Because the County provides system-wide rates rather than area-specific rates, all customers share the same level of support for funding the Countywide sewer utility. The capital planning is performed for individual basins, but the funding of capital projects—including all debt obligations—and the subsequent rate changes are applied to the County sewer utility as a whole, not for individual basins.

However, this financial plan is one chapter within a set of larger General Sewer Plan Updates documents, and those documents are specific to each basin. In order to meet the Department of Ecology requirements for the planning documents, this section provides information about costs and revenues as they are allocated for each of the four basins: Central Kitsap, Manchester, Suquamish, and Kingston.

12.5.1 Allocating Costs Across Basins

As part of the financial forecast, the County provided an estimated number of Residential Billing Equivalents served by each basin. A Residential Billing Equivalent is used as a metric to estimate the proportion of revenue each basin generates and is based on how much a non-single family residential customer pays compared to a residential customer. For example, based on the County's current billing structure, a multi-family customer bill is approximately 80% of a single-family bill and would be treated as 0.8 Residential Billing Equivalent. Of the approximately 28,000 equivalents, the Central Kitsap area serves the vast majority of customers, representing 89.5% of the revenue. Accordingly, we allocated 89.5% of the overall costs to the Central Kitsap Basin. The same approach is taken to the other basins—the cost of O&M, capital, debt service, and required reserves are allocated in proportion to each basin's share of the system-wide total Residential Billing Equivalents. The Residential Billing Equivalents and resulting allocation percentages are shown in **Table 12-7**.

Table 12-7 | Allocation to Basins

Basin	Residential Billing Equivalents	Percentage
Central Kitsap	25,011	89.46%
Manchester	1,026	3.67%
Suquamish	970	3.47%
Kingston	950	3.40%
Total	**27,957**	**100%**

12.5.2 Results by Basin

The allocation of the revenue requirement to individual basins is shown in **Table 12-8**. For simplicity in presentation, we show the allocated revenue requirement only for the years 2025 and 2030, but the same percentage allocations can be applied to any of the forecast years.

Table 12-8 | Projected Revenue Requirement by Basin – 2025 and 2030

	Total	Central Kitsap	Manchester	Suquamish	Kingston
Allocation Percentage		89.46%	3.67%	3.47%	3.40%
2025					
Revenues					
Rate Revenue after Rate Increases	$30,005,499	$26,843,636	$1,101,178	$1,041,075	$1,019,610
Non-Rate Revenue	2,479,539	2,218,255	90,997	86,030	84,257
Total Revenue	**$32,485,038**	**$29,061,255**	**$1,192,175**	**$1,127,105**	**1,103,866**
Requirements					
Cash Operating Expenses	$16,403,199	$14,674,694	$601,985	$569,128	$557,393
Existing Debt Service	5,114,100	4,575,196	187,683	177,440	173,781
New Debt Service	2,802,218	2,506,931	102,839	97,226	95,221
Rate Revenue Available for Capital	8,165,521	7,305,070	299,668	283,312	277,471
Total Requirements	**$32,485,038**	**$29,061,891**	**$1,192,175**	**$1,127,105**	**$1,103,866**
2030					
Revenues					
Rate Revenue after Rate Increases	$41,168,068	$36,829,937	$1,510,836	$1,428,373	$1,398,922
Non-Rate Revenue	2,291,740	2,050,245	84,105	79,515	77,875
Total Revenue	**$43,459,808**	**$38,880,182**	**$1,594,941**	**$1,507,888**	**$1,476,797**
Requirements					
Cash Operating Expenses	$19,681,630	$17,607,656	$722,300	$682,877	$668,797
Existing Debt Service	4,946,317	4,425,094	181,526	171,618	168,080
New Debt Service	15,786,416	14,122,905	579,349	547,728	536,434
Rate Revenue Available for Capital	3,045,444	2,274,527	111,765	105,665	103,486
Total Requirements	**$43,459,808**	**$38,880,182**	**$1,594,941**	**$1,507,888**	**$1,476,797**

The sewer rate increases needed to support the above revenue requirements are the same for all four basins: 6.31% in 2025 and 6% per year through the remaining forecast period. Similarly, the projected debt service coverage is the same for all basins, as are the assumed policies for cash reserves. While the CIP is differentiated by basin, the debt obligations that are needed to fund the capital projects are all incurred at the countywide level, and all financial obligations apply to the County sewer utility as a whole, not to individual basins.