KITSAP COUNTY

CENTRAL KITSAP GENERAL SEWER PLAN UPDATE

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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 Central Kitsap General Sewer Plan Update (Plan) provides a road map for the Central Kitsap 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 Locate 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 (2029 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 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. The Water as a Resource policy aims to conserve groundwater resources, restore the natural hydrologic flow in local streams and creeks, and 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.

Organization of the Plan

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

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

- Section 3: Population, Flow, and Load Projections estimates the current sewer system population, analyzes the impact of projected population growth, and estimates future wastewater flows and loads within the Central Kitsap 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 Facilities Existing Conditions evaluates existing conditions of the Central Kitsap 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 Central Kitsap 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 Central Kitsap 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 operation and maintenance practices, and makes suggestions to improve utility operation practices.
- Section 11: Capital Improvement Plan provides a 20-year plan for implementing capital improvement plan (CIP) projects that improve the operation of the collection and conveyance system and Central Kitsap WWTP.
- Section 12: Financial Strategy identifies financial approaches to fund the CIP.

General Sewer Plan Requirements

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. **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

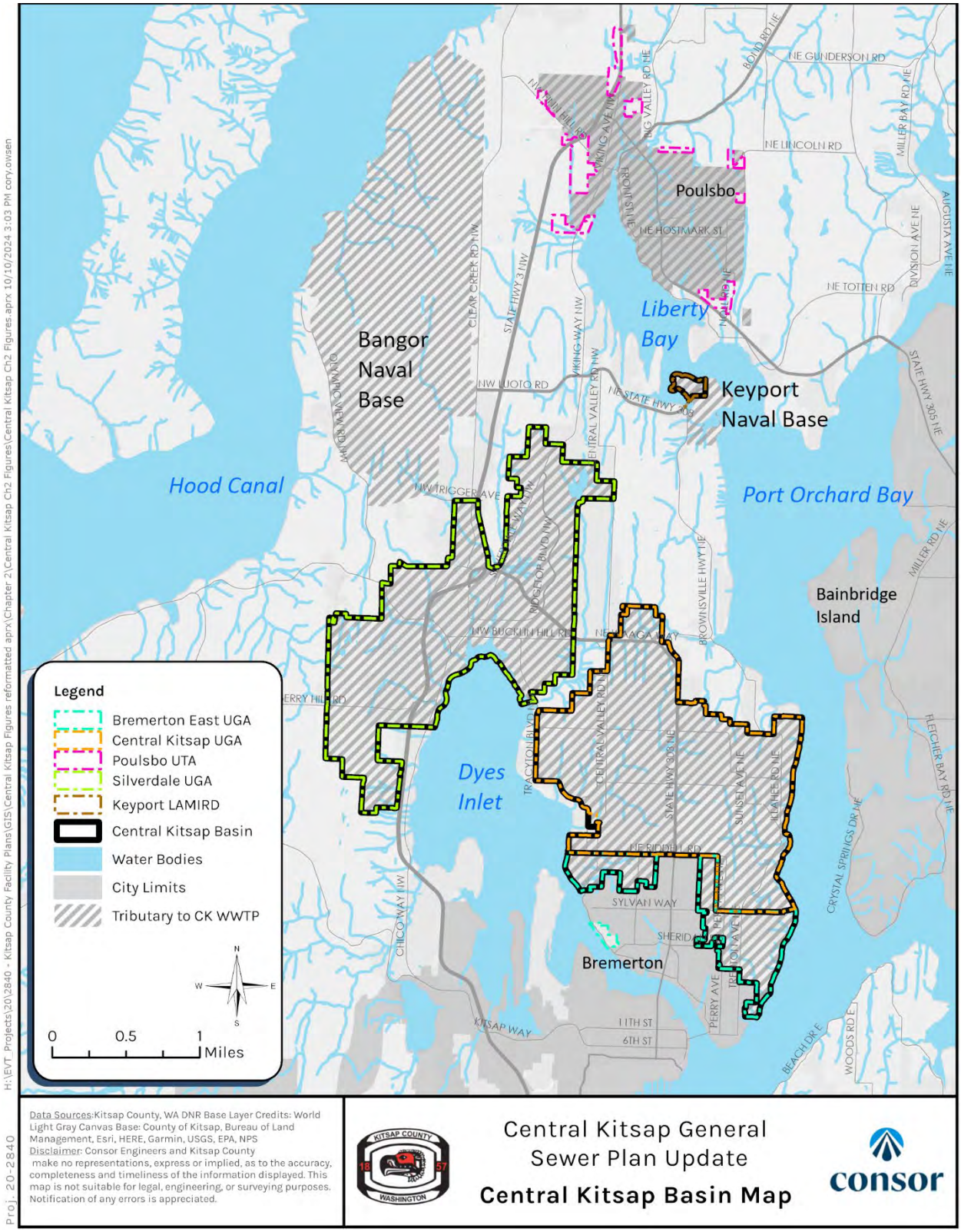
Section	Section Description	Location in Plan
3.a	The purpose and need for the proposed plan.	Section 1.2
3.b	A discussion of who will own, operate, and maintain the systems.	Section 1.5
3.c	The existing and proposed service boundaries.	Figure 2-1
3.d.i	Boundaries. The boundary lines of the municipality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

Section	Section Description	Location in Plan
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 operation and maintenance 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 (NEPA), if applicable.	Section 4

ES.2 Service Area Characterization

The County provides sewer service to several areas within the Central Kitsap basin. The Central Kitsap basin map is shown in **Figure ES-1**, with the sewer tributary areas identified. The Central Kitsap basin spans approximately 12,700 acres and is bounded on the east by Port Orchard Bay and on the southwest by Dyes Inlet. The basin is bordered to the north and west by unincorporated rural residential areas and parks. The primary land use in the basin is residential with some areas of commercial development.

Figure ES-1 | Central Kitsap 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, are not currently allowed outside of the UGA with limited exceptions. The County owns and maintains the sewer collection system that provides service to Central Kitsap UGA, Silverdale UGA, and a portion of Bremerton East UGA. The system also receives flows from the collection systems owned and operated by the City of Poulsbo, and the Bangor and Keyport United States Naval Bases. The County owned portions of the collection system include approximately 670,000 feet of gravity pipe, 189,000 feet of force main pipe, and 45 pump stations. All sewer flows within the basin are conveyed and treated at the Central Kitsap 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 Central Kitsap 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. Sewer permit and ERU data is not available in the Bangor Naval Base, Keyport Naval Base, and City of Poulsbo, so information from Puget Sound Regional Council (PSRC) and the City of Poulsbo was used to estimate the population for these areas.

Growth is presumed to occur within the UGAs and Urban Transition Areas (UTAs) according to the land use designations and zoning in the 2016 KCCP. This Sewer Plan, at the time of writing, is in alignment with the County's Comprehensive Plan and is able to support the growth strategies described therein. Future population growth for the City of Poulsbo is estimated to increase at a rate of 2.5 percent, based on planning data provided by the City from their draft 2024 Comprehensive Plan Update. The growth rate for all other areas within the Central Kitsap basin was provided by PSRC and is estimated at 3.3 percent. The total current and projected populations for the sewered areas in Central Kitsap 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 Comprehensive Plan. These were compared to and are consistent with the projections presented in this Plan.

Table ES-2 | Central Kitsap Basin Current and Projected Sewered Population

Year	Sewered Population
2020	57,939
2028	66,580
2042	89,508
2044	92,783*

Note:
*Extrapolated from 2042 population

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 sewer flows and loads at Central Kitsap WWTP were evaluated from January 2016 through June 2020 and correlated to current population to develop per capita values. Then, future flows and loads were estimated based on the anticipated population growth. The existing and projected flows and loads for the Central Kitsap 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 biochemical oxygen demand (BOD), total suspended solids (TSS), and total Kjeldahl nitrogen (TKN).

Table ES-3 | Central Kitsap WWTP Current and Projected Flows

Flow Event	2020	2028	2042
AAF (MGD)	3.50	4.0	5.4
MMWWF (MGD)	4.93	5.7	7.6
MMDWF (MGD)	4.00	4.6	6.2
PDF (MGD)	8.55	9.9	13.2
PHF (MGD)	14.0	16.2	21.6

Note:
MGD = million gallons per day

Table ES-4 | Central Kitsap WWTP Current and Projected Loads

Parameter	2020			2028			2042		
	AA	MMWW	MMDW	AA	MMWW	MMDW	AA	MMWW	MMDW
BOD (ppd)	8,817	10,116	10,128	10,132	11,624	11,638	13,622	15,627	15,646
TSS (ppd)	7,924	9,924	9,106	9,106	11,404	10,464	12,242	15,331	14,067
TKN (ppd)	1,421	1,635	1,586	1,634	1,879	1,823	2,197	2,526	2,450

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 Ecology, is the primary permit for Central Kitsap WWTP, which has been issued NPDES Permit No. WA0030520. The permit went into effect in 2017, was set to expire in 2022, 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 operation and maintenance requirements.

In addition, Ecology recently issued the first Puget Sound Nutrient General Permit (PSNGP), effective as of Jan. 1, 2022. The Central Kitsap WWTP is classified as a moderate total inorganic nitrogen (TIN) load plant and is required to implement nutrient monitoring and reporting, develop a nutrient optimization plan, conduct a nutrient reduction evaluation, and comply with action level exceedance corrective actions if nutrient discharge limits are exceeded. Ensuring compliance with the new PSNGP and developing options for anticipated future nutrient permit requirements is a key focus of the Central Kitsap WWTP condition assessment and alternative analyses.

Central Kitsap WWTP also has coverage under the Statewide General Permit for Biosolids Management as an 'Active Biosolids Management' program and an Industrial Stormwater Discharge General Permit for discharge of stormwater from the WWTP site.

ES.5 Collection and Conveyance Existing Conditions

The Central Kitsap basin collection and conveyance system is comprised of sewer assets owned and operated by the County within the Central Kitsap and Silverdale UGAs, and County facilities serving the City of Poulsbo, and the Bangor and Keyport Naval Bases. The Central Kitsap 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**.

The Central Kitsap collection and conveyance system is comprised of two service areas defined as the Northern and Southern Service Areas. The Northern Service Area consists of the Keyport Naval Base, Bangor Naval Base, and the City of Poulsbo. The Northern Service Area's flows are routed through PS-17, PS-24, PS-64, and PS-67. Flows from all pump stations combine into a 24-inch diameter force main and discharge at Central Kitsap WWTP.

The Southern Service Area is divided into two primary basins, each defined by the UGA for which they serve. The Silverdale basin includes 14 pump stations encompassed within the Silverdale UGA boundary and the outlying Pump Stations 13, 14, and 68. The Central Kitsap basin is defined by the Central Kitsap UGA boundary and includes 22 pump stations. Flows from all pump stations within the Southern Service Area ultimately combine into a 30-inch diameter pipe that discharges at Central Kitsap WWTP.

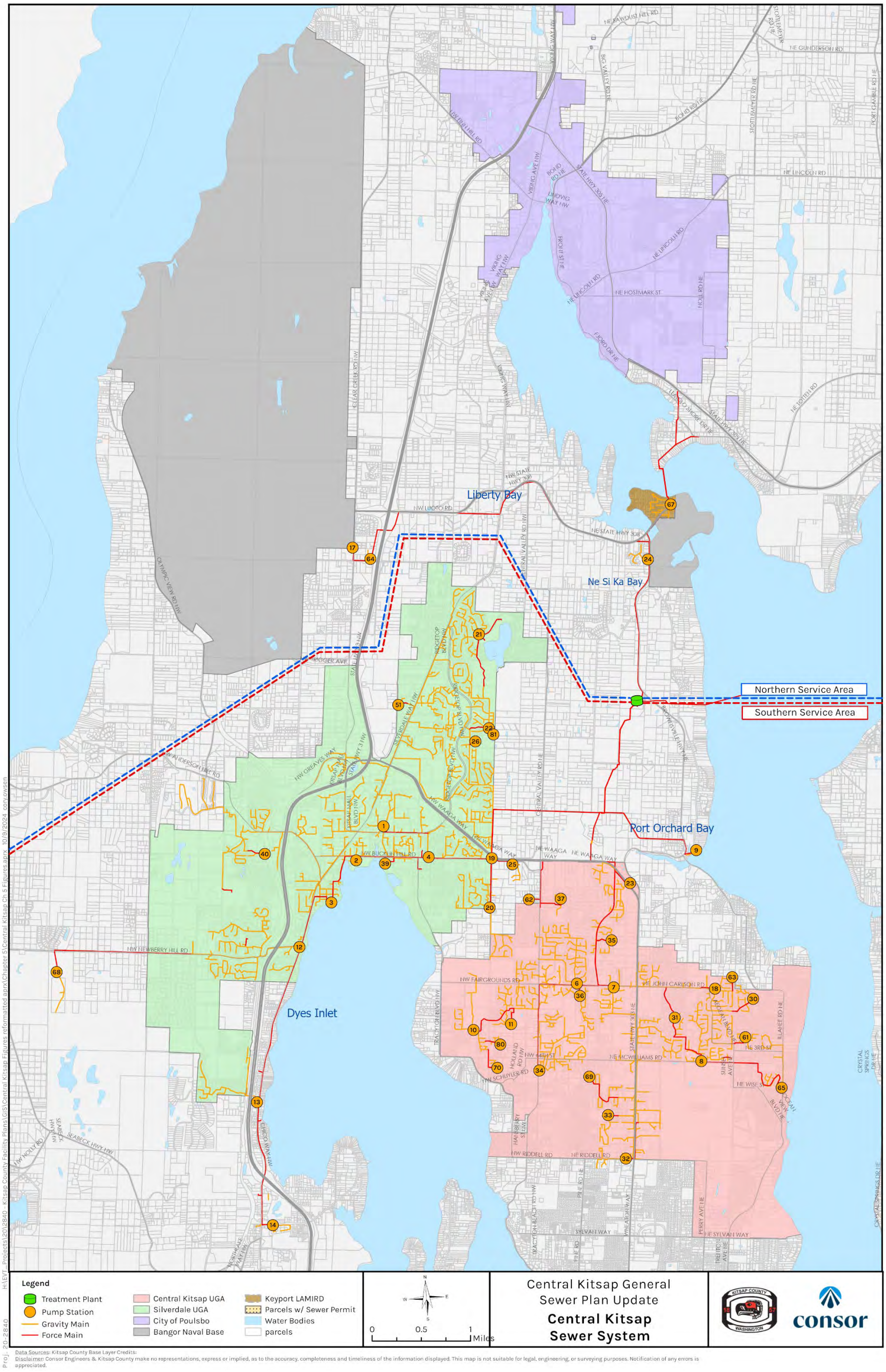
There is approximately 670,000 feet of gravity pipe in the Central Kitsap collection system, not including the upstream systems that are owned and operated by the City of Poulsbo, Bangor Naval Base, or Keyport Naval Base. The County owns most of the pipes, 91 percent of which are 8-inch diameter. Approximately 13,000 feet are owned by private users. There are approximately 189,000 feet of sewer force mains that convey pumped wastewater. The system also includes three inverted siphons.

There were 43 conventional pump stations owned and operated by the County within the Central Kitsap sewer system at the end of 2020 with flow capacity ranging from 40 to 6,400 gallons per minute (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 Central Kitsap basin. Pump station capacity typically increases from about 200 gpm for satellite stations to about 3,000 gpm for the critical pump stations.

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

Pump Station Type (from County)	Tributary Pump Stations	Number of Pump Stations in Central Kitsap Basin
Satellite	0	28
Relay	1	4
Regional	2-3	3
Critical	4+	8

Figure ES-2 | Central Kitsap Sewer System



A condition evaluation of all of the County owned pump stations was conducted. The evaluations did not include pump stations that are new, upgraded after 2020, or are currently in design or construction. 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) (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). The resulting scores ranged from 3.2 to 15.5, with five pump stations rating higher than 10, 23 pumps stations rated between five and 10, five pump stations rated below five, and 12 pump stations not rated due to recent or current rebuild or replacement activity.

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, most of the system is in good condition. There are approximately 12,200 feet of pipe with moderate or severe condition issues.

Table ES-6 | Summary of Pipes OCI Scores

OCI Range	Length (ft)	Percentage of Total
0-20	-	0%
20-40	-	0%
40-60	3,300	<1%
60-80	8,900	1%
80-99	81,800	12%
100	575,700	86%

ES.6 Wastewater Treatment Facilities Existing Conditions

The Central Kitsap WWTP is the sewer utility's flagship facility and it provides treatment of sewer flows for much of the Central Kitsap areas, as well as solids treatment from the Counties' three other WWTPs (Kingston, Suquamish, and Manchester WWTPs), and hauled septage and fats, oils, and grease (FOG) treatment from community members in the region who are not connected to the sewer system. The WWTP began operation in 1979 and portions of the plant were upgraded in 1996, 1999, 2009, and 2016, but many portions of the plant still rely on original equipment that is nearly 50 years old. The plant is a biological nutrient removal (BNR) facility with a rated maximum month flow rate capacity of 6.0 MGD. The Central Kitsap WWTP site plan is shown in **Figure ES-3** with major structures and processes identified. The plant is

located on Brownsville Highway NE, between State Route (SR) 303 and SR 308. In addition to the 49-acre lot that the Central Kitsap WWTP is located on, the Sewer Utility Division also owns undeveloped lots to the north and south, although development of the lots is limited by existing wetlands, and unconfirmed seasonal streams, particularly along the western boundary.

The Central Kitsap WWTP's liquid stream processes consist of headworks, primary clarifiers, aeration basins, secondary clarifiers, and ultraviolet (UV) disinfection. Solids, including those hauled from the County's other WWTPs, are thickened and digested anaerobically before dewatering and disposal. The Central Kitsap WWTP also receives a large quantity of hauled FOG from septic tank pumping companies and is the only WWTP in the County that accepts septage. These waste streams are incorporated with the solids treatment processes at the plan for treatment and disposal. The County currently works with the Kitsap Public Health District to provide a local option for treatment of septage at the Central Kitsap WWTP for residents with septic tanks, providing a reasonably accessible disposal option. CKTP is expected to remain a discharge location for the community however, may be re-evaluated during the defined planning period of this General Plan.

The treated effluent from the Central Kitsap WWTP is discharged to Port Orchard Bay in Puget Sound in accordance with the NPDES Permit. Treated solids from the plant are hauled to Natural Selections Farms in Yakima County, where they are land applied in accordance with beneficial reuse regulations.

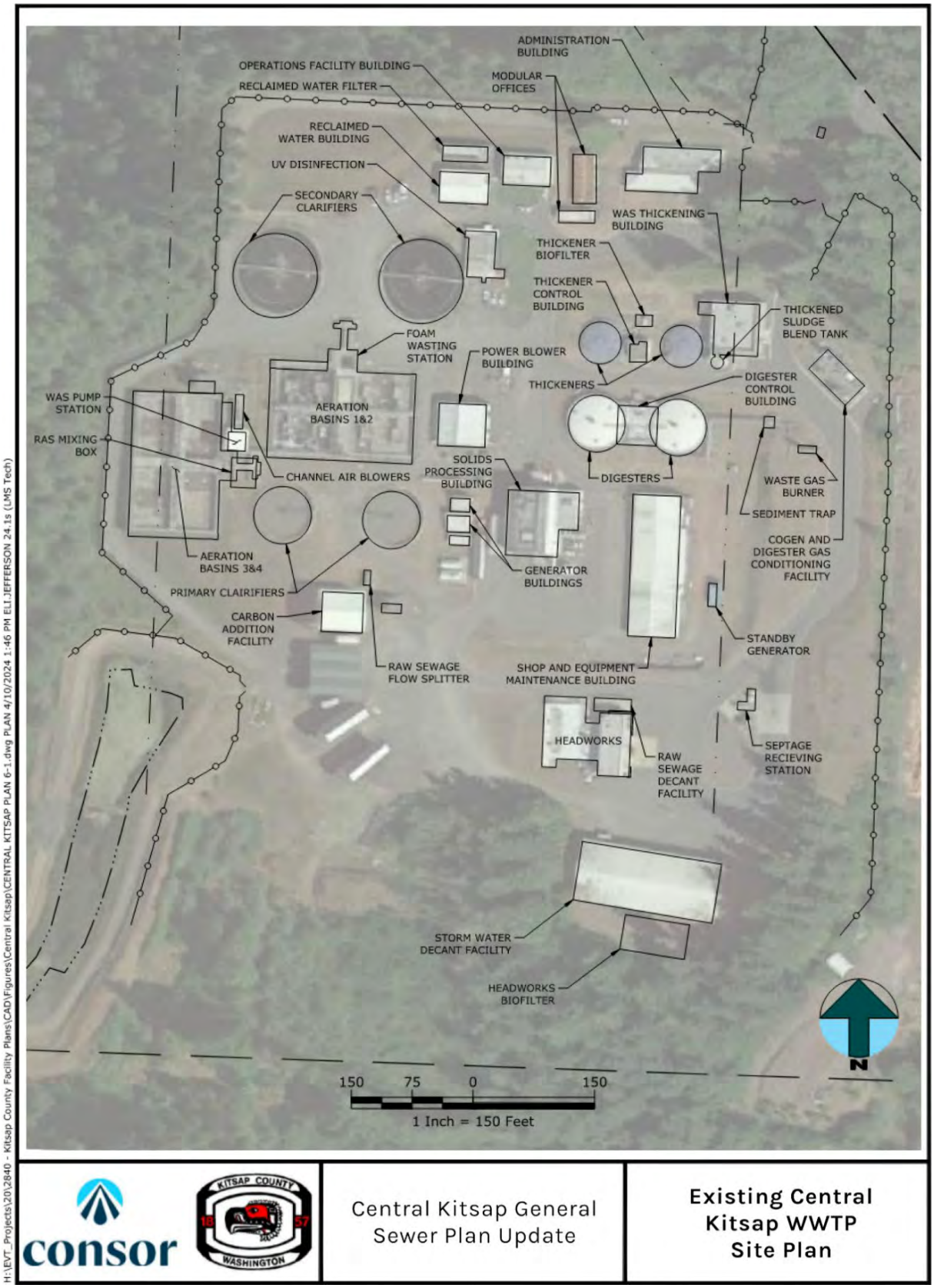
Evaluations of the capacity and condition of the Central Kitsap WWTP were conducted. The process involved a site review of equipment, facilities, processes, discussions with Central Kitsap WWTP staff to understand operational issues, and analysis and modeling.

The condition evaluation led to the development of overall unit process "Asset Health" scores, 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). Primary treatment scores ranged from 2 to 19. Gravity thickening and anaerobic digestion scored higher than a 10, which indicates these systems are generally in poor condition and require upgrades and/or rehabilitation to continue effective and reliable operation. Secondary treatment, septage, dewatering, power distribution, and miscellaneous support systems scored between 5 and 10, indicating moderate upgrades may be necessary. All other processes 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 of the existing Central Kitsap WWTP and unit processes. Model results indicated that several unit processes will need significant improvements within the 20-year planning period to alleviate hydraulic or biological limitations and continue proper operation:

- Additional primary clarifier capacity
- Additional secondary clarifier capacity
- Additional septage receiving capacity
- Replacement of gravity thickeners
- Additional anaerobic digester capacity and rehabilitation of existing digesters

Figure ES-3 | Existing Central Kitsap WWTP Site Plan



ES.7 Collection and Conveyance System Analysis

The Central Kitsap collection and conveyance system was previously modeled using the Danish Hydraulic Institute's (DHI's) MIKE URBAN 2019 and documented in the *Silverdale Pump Stations 3, 4, 19 and 31 Upgrades Preliminary Engineering Report* (PER) prepared by BHC Consultants (BHC, 2020) (Appendix A). The model was used to analyze the system capacity using a PHF condition of a 25-year, 24-hour storm for the 2017, 2038 and build-out planning horizons. Buildout assumed that all developable properties withing the UGA have developed per zoning and discharge to County sewer and is not assumed to occur within the 20-year planning horizon of 2044.

Manholes, pipes, and pump stations were analyzed for deficiencies using the results of the BHC 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 and surcharged gravity pipes are included in Table ES-7. Detailed maps can be found in Section 7. The results indicate that all pump stations have sufficient firm capacity in the 2017 model scenario, four pump stations (PS-4, PS-12, PS-24, and PS-65) have insufficient firm capacity in the 2038 planning horizon, and fourteen pump stations (PS-2, PS-3, PS-4, PS-10, PS-12, PS-21, PS-24, PS-31, PS-32, PS-34, PS-35, PS-36, PS-65, and PS-69) have insufficient firm capacity at build-out.

Table ES-7 | Pipe and Manhole Capacity Criteria

Scenario	Surface Sewer Overflows (SSO)	Number of Pipes Surcharged (Either end)
2017	0	76
2038	1	114
Build-Out	22	279

ES.8 Wastewater Treatment System Analysis

The results from the WWTP Existing Conditions analysis were used to identify processes that require improvement and define feasible alternatives for the 6-year and 20-year planning horizons. The primary alternative analyses of process improvements at Central Kitsap WWTP were completed as part of the Plan and summarized in two technical memoranda (TMs): *Central Kitsap WWTP Solids Handling Improvement Recommendations* (Murraysmith [now Consor], 2022, Appendix N) covers all of the solids treatment processes and *Summary of Field Testing of Biological Nutrient Removal Optimization* (HDR, 2022, Appendix K) covers the secondary treatment processes. Minor maintenance, repairs, and direct replacements are not subject to a full alternatives analysis due to the relatively simple nature of replacements or expansions.

Preliminary Treatment

The preliminary treatment system was put into service in 2011 and is generally in good condition with adequate capacity. The following improvements are recommended:

- Replacing the manual bar screen.

- Improving the heating, ventilation, and air conditioning (HVAC) system in the headworks facility to provide more ventilation.

Primary Treatment

The primary clarifiers were constructed in 1977, and the flow splitter structure and primary sludge pumps were replaced in 2011. The clarifiers are in fair condition and will require equipment replacement due to age and the need for additional capacity as flows to the plant increase. Installing an additional primary clarifier or replacing the existing clarifiers to provide additional capacity, installing associated primary sludge pump(s), and replacing aging scum pumps is recommended.

Secondary Treatment

The existing secondary treatment process was converted to a BNR process in 2016 but was not optimized for nitrogen removal and continued to operate as a conventional activated sludge process with simple aeration control and no nitrogen monitoring. The system was upgraded, 're-commissioned,' and optimized in 2022 as part of the work completed in support of this Plan to provide better nutrient removal and assess the ability to meet nitrogen removal requirements. This effort is documented in Appendix K. It was concluded that the secondary treatment process can meet current PSNGP requirements when fully optimized; therefore, it is recommended to continue optimization. Additionally, components of the secondary treatment will need to be replaced as equipment ages and/or expanded to provide additional capacity. The following secondary treatment improvements and optimization efforts are recommended:

- Continue BNR operation in warmer months through the next winter and summer to gain additional data and operational experience for refinement of operating protocols and control programming. Continue to test optimal ammonium/nitrate set points to determine optimal operating procedures.
- Construct a centrate flow equalization tank to more evenly meter loads to the aeration basins to provide stability to BNR operation and improve overall average effluent TIN.
- Further test the internal mixed liquor recycle (IMLR) and methanol automated feed methods to further optimize performance.
- Conduct an engineering study of the influent hydraulic box and implement modifications to facilitate adequate mixing of the return activated sludge (RAS) and primary effluent is achieved.
- Implement fully automated flow pacing of the RAS pumping system.
- Add a second methanol storage tank to provide greater flexibility and efficiency of methanol dosing.
- Conduct an engineering study of the aeration distribution system to review flow meters, control valve sizing and locations, and the air distribution network.
- Replace the existing centrifugal blowers with high-speed turbo blowers to provide additional capacity.
- Upgrade wet chemistry analyzers such as the Amtax and Nitratax (manufactured by Hach) to improve low TIN concentration resolution.
- Conduct step-feed field testing to determine if this will provide improved performance.

- Install Aeration Basins 5 and 6 if TIN permit requirements, recycled water use, and plant flows require additional capacity.
- Add sidestream treatment to provide greater TIN removal and improve process efficiency.
- Construct an additional secondary clarifier to provide sufficient capacity. Additionally, replace the existing secondary clarifiers' walkways and drives and RAS pumps at the same time.

Solids Treatment

The existing solid treatment infrastructure and equipment are aging and require replacement or rehabilitation, as reported in Section 6. Liquid hauled waste receiving, primary sludge and WAS thickening, anaerobic digestion, and dewatering were further discussed in Appendix N, which references two other TMs, the *Liquid Hauled Waste Study* (Murraysmith [now Consor], 2022, Appendix O) and the *Class A Biosolids Evaluation* (Murraysmith [now Consor], 2022, Appendix P).

As part of Appendix O, five alternatives were developed and analyzed for thickening, treatment, and dewatering of both LHW and waste activated sludge (WAS). LHW consists of thickened WAS (TWAS) from the County's Kingston, Manchester, and Suquamish WWTPs, septage, and FOG. Three alternatives were developed and analyzed for solids treatment and disposal as part of Appendix P.

Design is currently underway for replacement or expansion of several related components of the solids and LHW treatment processes, based on the approaches recommended in Appendix O and Appendix P. These improvements are being called the "Solids and Liquid Hauled Waste Upgrades" and include:

- Constructing a new FOG receiving station.
- Constructing a new septage receiving station and replacing the septage pumps.
- Replacing existing septage grit cyclone and classifier.
- Replacing primary sludge and septage thickening with new thickening equipment.
- Constructing new anaerobic digester(s) with approximately 1.3 million gallons (MG) of capacity.
- Replacing existing in-plant pump station.
- Replacing the existing digester hot water system in conjunction with the new digester construction.

The following solids treatment improvements are recommended for future implementation:

- Rehabilitating or replacing the existing anaerobic digesters after the new digesters are in operation.
- Replacing existing scum grinder and pumps.
- Replacing centrifuge sludge feed grinders.
- Restarting the biogas treatment and cogeneration system.
- Replacing centrate pumps.
- Replacing centrifuge feed pumps.
- Replacing digester withdrawal pumps.

Non-Potable Water System and Process Water Systems

Some equipment related to these systems will require in-kind replacement due to age and/or condition.

Odor Control System

The gravity thickener odor control system should be replaced opportunistically in conjunction with other work on the primary sludge and septage thickening processes. The preferred approach for odor control may vary depending on thickening process and should be evaluated during design of the process.

Electrical and Power Distribution System

Transformer repairs, replacement of the main switchgear, a process and load study, and replacement of select electrical panels are needed. Additionally, the County has recently completed a series of Supervisory Control and Data Acquisition (SCADA) Master Plan TMs (HDR, 2022) (Appendix D) that include an overview of the existing SCADA system, review of use and needs, selection of preferred technologies, and a project identification, estimate, and CIP.

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 nonpotable purposes, such as irrigation, toilet flushing, reduces the stress on area groundwater and supports sustainable management of that limited resource. Over the past decade, recycled water planning activities have been conducted and improvements have been made to the Central Kitsap WWTP that allow the plant to produce recycled water. The distribution system, however, has not been fully developed, therefore no recycled water is currently being produced.

Section 9 discusses and considers the following specific potential uses:

- Silverdale Water District (District) is a primary potential distributor of recycled water produced at the Central Kitsap WWTP. In total, the customers represent approximately 433,000 gallons per day (gpd) of use during the irrigation season. A 20-year forecast of District demands for these uses is approximately 520,000 gpd during peak irrigation season (433,000 gpd with 20 percent increase, assuming half of projected rate of growth in overall water demand). Many recent new construction projects have already installed recycled water infrastructure in anticipation of recycled water supply from the District. The District has plans to further explore a wider range of recycled water uses, including groundwater recharge to sustain the utility's underlying source of water supply.

- A potential year-round application of recycled water is stream augmentation through infiltration. In total, an estimated flow of 0.5 MGD could be used to provide 560 acre-feet per year of streamflow benefit to multiple creeks.

Other recycled water uses are considered, but at a high-level analysis indicated that none are currently feasible.

To support production of recycled water, a re-evaluation of chlorination and UV disinfection options to meet Class A recycled water performance standards was conducted. Based on the analysis, it is recommended that the County consider employing UV disinfection to meet long-term recycled water objectives. End users, e.g. the District, would then provide booster chlorination at distribution system

facilities to meet residual chlorine requirements. A phased approach is recommended for implementation, comprised of:

- Near-term (to meet demands in approximately five years). Use of chlorination, with recycled water generated when the Central Kitsap WWTP is operating in BNR mode and potentially only on non-dewatering days to avoid significant increases in ammonia concentration and support a 30-minute chorine contact time. Storage located in the distribution system would be constructed by the District to equalize the recycled water flow to the distribution system during times when recycled water is not being generated. Needed improvements implemented by the County include a short section of new recycled water piping, insertion of a motorized control valve, and an additional chlorine residual meter.

- Longer-term (to meet demands beyond five years). Implementation of UV disinfection to avoid the need for dechlorination and for additional contact time storage beyond that which can be provided by the existing transmission piping. Longer-term items are not recommended until the magnitude and timing of future demands are known.

The County and the District are now coordinating closely to prepare a joint Recycled Water Master Plan to provide the additional analysis needed to finalize the plan for the infrastructure needed by both the County and the District to complete the production and distribution of recycled water. This plan is expected to be completed by 2026.

ES.10 Operations and Maintenance

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

The County's 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 operation and maintenance manual.

A staffing analysis was conducted for the collection and conveyance system and Central Kitsap WWTP and determined that staffing levels and certifications are appropriate and adequate for current operations. As system flows increase, additional staffing may be needed.

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 ratings.

- 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 presented 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** through **Table ES-11**. A preliminary implementation timeline of the CIP is provided in **Section 11**.

Table ES-8 | 6-Year Central Kitsap Collection and Conveyance Capital Improvement Plan

CIP No.	Project	Total Project Cost
CIP-CK-CC-CAP-2	Replace PS-4 and Forcemain	$13,200,000
CIP-CK-CC-CAP-3	Upgrade PS-24	$7,300,000
CIP-CK-CC-CAP-8	Lemolo Inverted Siphon Upgrades	$0[1]
CIP-CK-CC-CAP-9	Johnson to Norum Pipeline	$0[1]
	Total	**$20,500,000**

Note:
1. The Lemolo Peninsula Sewer and Inverted Siphon Improvements ($8,100,000 in 2024 dollars) and Johnson to Norum Pipeline projects are funded entirely by the City of Poulsbo and are County owned projects. Therefore, they are not included in CIP.

Table ES-9 | 20-Year Central Kitsap Collection and Conveyance Capital Improvement Plan

CIP No.	Project	Total Project Cost
CIP-CK-CC-CAP-1[1]	Replace PS-3	$7,800,000
CIP-CK-CC-OM-4[1]	Replace PS-36	$1,900,000
CIP-CK-CC-OM-5[1]	Upgrade PS-11	$760,000
CIP-CK-CC-OM-6[1]	Upgrade PS-33	$240,000
CIP-CK-CC-CAP-7[1]	Northern Old Military Road Sewer Upgrades	$12,200,000
CIP-CK-CC-OM-11	Replace PS-13	$3,200,000
CIP-CK-CC-CAP-12	Replace PS-12	$7,600,000
CIP-CK-CC-CAP-13	Replace PS-34	$7,600,000
CIP-CK-CC-OM-14	Upgrade PS-22	$360,000
CIP-CK-CC-OM-15	Replace PS-32	$1,900,000
CIP-CK-CC-OM-16	Replace PS-2	$2,800,000
CIP-CK-CC-OM-17	Replace PS-37	$1,900,000
CIP-CK-CC-OM-18	Upgrade PS-40	$240,000
CIP-CK-CC-OM-19	Upgrade PS-35	$1,200,000
CIP-CK-CC-OM-20	Upgrade PS-9	$260,000
CIP-CK-CC-OM-21	Replace PS-65	$3,000,000
CIP-CK-CC-OM-22	Upgrade PS-26	$250,000
CIP-CK-CC-OM-23	Upgrade PS-30	$1,200,000

CIP No.	Project	Total Project Cost
CIP-CK-CC-OM-24	Upgrade PS-20	$660,000
CIP-CK-CC-OM-25	Upgrade PS-61	$1,090,000
CIP-CK-CC-CAP-26	Replace PS-69	$1,900,000
CIP-CK-CC-DEV-27	Anderson Hill Sewer Upgrades	$5,500,000
CIP-CK-CC-DEV-28	Dickey Road Sewer Upgrades	$3,800,000
CIP-CK-CC-CAP-29	Myhre Road Sewer Upgrades	$3,700,000
CIP-CK-CC-OM-30	Annual Pipe Replacement	$56,000,000
	Total	**$127,060,000**

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

Table ES-10 | 6-Year Central Kitsap WWTP Capital Improvement Plan

CIP No.	Project	Total Project Cost
CIP-CK-WWTP-CAP-1[1]	Solids and LHW Upgrades (in design)	$ 140,000,000
CIP-CK-WWTP-REG-2	Construct Third Secondary Clarifier and Replace RAS Pumps	$ 9,900,000
CIP-CK-WWTP-REG-3[1]	Centrate Equalization	$ 0
CIP-CK-WWTP-REG-5[1]	Methanol Storage	$ 0
CIP-CK-WWTP-OB-6[1]	Existing Anaerobic Digester Rehabilitation	$ 0
CIP-CK-WWTP-OB-7[1]	Replace Main Switchgear	$ 0
CIP-CK-WWTP-OB-8[1]	Replace SWGR-2960 ATS-1	$ 0
CIP-CK-WWTP-CAP-19[1]	Conduct Process Load Study and Assess Generator Needs	$ 0
CIP-CK-WWTP-OB-10[1]	Replace Utilidor Panel 1990 and Septage Panel 5012	$ 0
CIP-CK-WWTP-OM-11[2]	Evaluate Headworks Building HVAC	$ 2,200,000
	Total	**$ 152,100,000**

Notes:
1. All costs for several individual projects identified during the planning process were included in the Solids and Liquid Hauled Waste Project currently in design and have been rolled up into CIP-CK-WWTP-CAP-1 and the cost has been updated to reflect the most recent estimate.
2. After the development of the CIP list, the County conducted the described HVAC study and determined improvements would cost approximately $2.2 million dollars. For planning and budgeting purposes, this value will be used.

Table ES-11 | 20-Year Central Kitsap WWTP Capital Improvement Projects

CIP No.	Project	Total Project Cost
CIP-CK-WWTP-REG-4[2]	RAS Distribution Box Hydraulic Study & Improvements	$ 1,000,000
CIP-CK-WWTP-CAP-12	Install New Primary Clarifiers and Primary Sludge Pumps	$ 12,400,000
CIP-CK-WWTP-REG-13	Install a New Effluent Flow Meter	$ 1,000,000
CIP-CK-WWTP-OB-14	Replace Thickened Primary Sludge Grinders	$ 200,000
CIP-CK-WWTP-OB-15	Replace Scum Grinder and Pumps	$ 440,000
CIP-CK-WWTP-OB-16	Replace Centrifuge Sludge Feed Grinders & Pumps	$ 760,000
CIP-CK-WWTP-OB-17	Replace Centrate Pumps	$ 140,000
CIP-CK-WWTP-OB-18	Replace Blower Building Primary Power Switchgear and Transformers	$ 200,000
CIP-CK-WWTP-REG-19[1]	Aeration Basin Air Distribution Study	$ 1,300,000
CIP-CK-WWTP-REG-20[1]	Replace Aeration Blowers 1&2 and Channel Blowers 1&2	$ 1,600,000

CIP No.	Project	Total Project Cost
CIP-CK-WWTP-CAP-21[1]	Construct Aeration Basins 5 & 6	$ 23,900,000
CIP-CK-WWTP-REG-22[2]	Near-term Recycled Water Improvements	$ 600,000
CIP-CK-WWTP-REG-23	Long-term Recycled Water Improvements	$ 4,700,000
	Total	**$ 48,240,000**

Notes:

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

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 Central Kitsap 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.

Table 11-6 | Recommended CIP Summary

Central Kitsap Basin CIP Plan

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6 or 20 Year CIP	CIP No.	Asset Health Score	Project Name	Total Project Cost	6-Year CIP 2023	2024	2025	2026	2027	2028	20-Year CIP 2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
6	CIP-CK-CC-CAP-2	25	Replace PS-4 and Forcemain	$ 13,200,000		$ 6,600,000	$ 6,600,000																	
6	CIP-CK-WWTP-CAP-1	17.5	Solids and Liquid Hauled Waste Upgrades	$ 140,000,000		$ 28,000,000	$ 28,000,000	$ 28,000,000	$ 28,000,000	$ 28,000,000														
6	CIP-CK-CC-CAP-3	15.5	Upgrade PS-24	$ 7,300,000			$ 3,650,000	$ 3,650,000																
6	CIP-CK-WWTP-OM-11	6.9	Central Kitsap Buildings HVAC Improvements	$ 2,200,000					$ 1,100,000	$ 1,100,000														
6	CIP-CK-WWTP-REG-2	8.5	Construct Third Secondary Clarifier and Replace RAS pumps	$ 9,900,000						$ 4,950,000	$ 4,950,000													
20	CIP-CK-CC-OM-30	20	Annual Pipe Replacement	$ 56,000,000							$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000
20	CIP-CK-WWTP-OB-18	9.5	Replace Blower Building Primary Power Switchgear and Transformers	$ 200,000							$ 200,000													
20	CIP-CK-WWTP-REG-22	6.9	Near-term Recycled Water Improvements	$ 600,000							$ 600,000													
20	CIP-CK-CC-CAP-27	25	Anderson Hill Sewer Upgrades	$ 5,500,000							$ 2,750,000	$ 2,750,000												
20	CIP-CK-CC-CAP-7	25	Northern Old Military Road Sewer Upgrades*	$ 12,200,000								$ 6,100,000	$ 6,100,000											
20	CIP-CK-CC-CAP-28	25	Dickey Road Sewer Upgrades	$ 3,800,000								$ 1,900,000	$ 1,900,000											
20	CIP-CK-CC-OM-11	11.1	Replace PS-13	$ 3,200,000								$ 1,600,000	$ 1,600,000											
20	CIP-CK-CC-CAP-12	14.4	Replace PS-12	$ 7,600,000								$ 3,800,000	$ 3,800,000											
20	CIP-CK-CC-OM-5	7	Replace PS-31*	$ 760,000									$ 760,000											
20	CIP-CK-WWTP-REG-19	8.5	Aeration Basin Air Distribution Study	$ 1,300,000									$ 1,300,000											
20	CIP-CK-WWTP-REG-20	8.5	Replace Aeration Blowers 1&2 and Channel Blowers 1&2	$ 1,600,000									$ 1,600,000											
20	CIP-CK-CC-OM-4	7.4	Replace PS-36*	$ 1,900,000									$ 950,000	$ 950,000										
20	CIP-CK-CC-CAP-29	25	Myhre Road Sewer Upgrades	$ 3,700,000									$ 1,850,000	$ 1,850,000										
20	CIP-CK-CC-OM-16	6.6	Replace PS-2	$ 2,800,000									$ 1,400,000	$ 1,400,000										
20	CIP-CK-CC-OM-18	6.4	Upgrade PS-60	$ 240,000										$ 240,000										
20	CIP-CK-CC-OM-6	7	Upgrade PS-33*	$ 240,000										$ 240,000										
20	CIP-CK-CC-CAP-13	14.5	Replace PS-34	$ 7,600,000										$ 3,800,000	$ 3,800,000									
20	CIP-CK-CC-OM-17	8.6	Replace PS-37	$ 1,900,000										$ 950,000	$ 950,000									
20	CIP-CK-CC-CAP-1	25	Replace PS-3*	$ 7,800,000										$ 3,900,000	$ 3,900,000									
20	CIP-CK-WWTP-REG-4	8.5	RAS Distribution Box Hydraulic Study & Improvements*	$ 1,000,000											$ 1,000,000									
20	CIP-CK-CC-OM-19	6.4	Upgrade PS-35	$ 1,200,000											$ 600,000	$ 600,000								
20	CIP-CK-CC-OM-20	6.2	Upgrade PS-9	$ 380,000												$ 260,000								
20	CIP-CK-CC-OM-21	6.2	Replace PS-65	$ 3,000,000												$ 1,500,000	$ 1,500,000							
20	CIP-CK-CC-OM-15	6.8	Replace PS-32	$ 1,900,000													$ 1,900,000							
20	CIP-CK-CC-OM-14	8.1	Upgrade PS-22	$ 360,000													$ 360,000							
20	CIP-CK-WWTP-CAP-12	14.5	Install a New Primary Clarifiers and Primary Sludge Pumps	$ 12,400,000														$ 6,200,000	$ 6,200,000					
20	CIP-CK-WWTP-OB-14	14.5	Replace Thickened Primary Sludge Grinders	$ 200,000														$ 200,000						
20	CIP-CK-WWTP-OB-15	14.5	Replace Scum Grinder and Pumps	$ 440,000														$ 440,000						
20	CIP-CK-WWTP-OB-16	9	Replace Centrifuge Sludge Feed Grinders & Pumps	$ 760,000														$ 760,000						
20	CIP-CK-WWTP-OB-17	9	Replace Centrate Pumps	$ 140,000														$ 140,000						
20	CIP-CK-WWTP-REG-13	3	Install a New Effluent Flow Meter	$ 1,000,000														$ 1,000,000						
20	CIP-CK-CC-OM-22	6	Upgrade PS-26	$ 250,000															$ 250,000					
20	CIP-CK-CC-OM-23	6	Upgrade PS-30	$ 1,200,000															$ 600,000	$ 600,000				
20	CIP-CK-CC-OM-24	5.8	Upgrade PS-20	$ 660,000															$ 660,000					
20	CIP-CK-CC-CAP-26	4	Upgrade PS-69	$ 1,900,000															$ 950,000	$ 950,000				
20	CIP-CK-CC-OM-25	3.2	Upgrade PS-61	$ 1,090,000																$ 1,090,000				
20	CIP-CK-WWTP-REG-23	6.9	Long-term Recycled Water Improvements	$ 4,700,000																		$ 2,350,000	$ 2,350,000	
20	CIP-CK-WWTP-CAP-21	8.5	Construct Aeration Basins 5 & 6	$ 23,900,000																			$ 23,900,000	
			Total Project Cost (2023)	$ 347,900,000	$ -	$ 34,600,000	$ 38,250,000	$ 31,650,000	$ 29,100,000	$ 34,050,000	$ 12,500,000	$ 20,150,000	$ 25,260,000	$ 17,330,000	$ 14,250,000	$ 8,360,000	$ 7,760,000	$ 12,740,000	$ 12,660,000	$ 6,640,000	$ 4,000,000	$ 6,350,000	$ 30,250,000	$ 4,000,000
			Assumed Inflation Rate			12%	8%	8%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
			Inflation Multiplier	1		1.12	1.21	1.31	1.37	1.44	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		$ -	$ 38,752,000	$ 46,267,200	$ 41,346,547	$ 39,916,074	$ 49,041,218	$ 18,903,553	$ 31,996,154	$ 42,115,831	$ 30,338,904	$ 26,194,221	$ 12,275,439	$ 15,726,459	$ 27,109,902	$ 28,286,651	$ 15,577,767	$ 9,853,407	$ 16,424,397	$ 82,154,319	$ 11,406,550