LOTT

CAPACITY REPORTS 2025

FLOWS & LOADINGS

I&I/FLOW MONITORING

CAPACITY ASSESSMENT

LOTT Clean Water Alliance
Annual Waste Load Assessment Report

May 14, 2025

Introduction

The information included in this report is intended to meet the annual reporting requirement for the LOTT Clean Water Alliance's (LOTT) National Pollutant Discharge Elimination System (NPDES) Permit No. WA0037061, issued on February 16, 2018. Pursuant to section S4. Facility Loadings, subsection B. Plans for Maintaining Adequate Capacity, the report includes the following:

- A discussion on compliance with permit effluent limitations for the year 2024.
- A comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, Biological Oxygen Demand (BOD), Total Suspended Solids (TSS) and Total Nitrogen (TN) loadings, including a description of the percentage change in these parameters since the prior year.
- A statement of the present and design population equivalent, projected population growth rate and the estimated date at which the design capacity is projected to be reached, according to the most restrictive parameters.

As established in LOTT's original long-range Wastewater Resource Management Plan, also known as the Highly Managed Plan, LOTT is continuously planning and evaluating system demands and requirements. Population projections published by the Thurston Regional Planning Council (TRPC) in 2018, developments data and drinking water consumption data provided by the partner jurisdictions and flow monitoring data collected in 2024 were used to update LOTT's flows and loadings projections.

Permit Compliance

The Budd Inlet Treatment Plant (BITP) had four permit violations for marine discharge to Budd Inlet (outfall #001) during 2024:

- LOTT violated one part of the Chronic Toxicity test, which did not meet the growth rate for smelt. The test was conducted two additional times, passing both.
- On February 6^{th} LOTT violated the Influent and Effluent BOD sampling requirements. The samples were collected and analyzed but the results were read at the incorrect time and

results were not valid. The missing data was marked in the Discharge Monitoring Report as "LE-Laboratory Error."

- On September 19th LOTT violated the Fecal Coliform sample requirements. The lab personnel showed up the morning of September 20th to the incubator water temperature reading 45.1 degrees C. This caused an invalid sample.
- On October 17th LOTT violated the Influent and Effluent $CBOD^5$ Frequency sampling requirements. The quality control check standard for these tests did not pass the acceptance criteria and thus the test results could not be validated.

The Budd Inlet Reclaimed Water Plant (outfall #005) had one permit violation.

- On May 28th a Total Coliform sample exceeded the maximum limit of 2.2 MPN/100 mL with a concentration of 38.4 MPN/100mL.

Actual and Design Flows and Loadings Evaluation

Included in Table 1 is a comparison between the actual and design monthly average dry weather and wet weather flows, peak flows, influent Biological Oxygen Demand (BOD), Total Suspended Solids (TSS) and Total Nitrogen (TN) loadings, with a description of the percentage change in these parameters since the previous year (2023).

Table 1. 2024 BITP Influent Flows and Loadings

Parameter	Design	2024	% of Design	2023	% Increase
FLOWS (mgd)		(Current)		(Current)	2023 vs 2022
Annual Average	17	12.18	71.6%	11.76	4%
Maximum Monthly Average	28	16.45	58.8%	15.18	8%
Maximum Day	55	28.45	51.7%	44.18	-36%
Wet Weather Monthly Average (Nov-Mar)	22	14.49	65.9%	13.26	9%
Dry Weather Monthly Average (Jun-Sept)	15	10.17	67.8%	9.90	3%
Peak Hourly	64	52.90	82.7%	64.11	-17%
BOD LOADING (lbs/day)					
Annual Average	31,400	26,005	82.8%	26,519	-2%
Maximum Monthly Average	37,600	29,449	78.3%	30,093	-2%
Daily Maximum	75,300	49,449	65.7%	47,068	5%
TSS LOADING (lbs/day)					
Annual Average	29,200	26,529	90.9%	28,328	-6%
Maximum Monthly Average	35,100	31,332	89.3%	33,977	-8%
Daily Maximum	87,700	45,807	52.2%	63,100	-27%
TN LOADING (lbs/day)					
Annual Average	5,350	4,418	82.6%	4,518	-2%
Maximum Monthly Average	6,420	3,205	49.9%	3,120	3%
Daily Maximum	16,060	4,022	25.0%	3,652	10%

Present and Historical Sewered Population

Sewered population, including both residential and employment population, is expressed in terms of Equivalent Residential Units (ERUs). One ERU is the amount of wastewater presumed to come from an average sewer-connected single-family household. Over the last 17 years, the LOTT service area has generally experienced steady growth in ERUs, with an annual average increase of approximately 2.09% per year (Table 2). It is suspected that the fluctuations in 2020 and 2021 are likely due to the COVID pandemic.

Table 2. 16-Year ERU Summary

Year	Lacey	Olympia	Tumwater	Total	% Increase
2008	18,497	24,637	8,035	51,169	2.4%
2009	19,091	24,333	8,622	52,046	1.7%
2010	19,463	24,220	8,819	52,501	0.9%
2011	20,376	24,452	9,131	53,958	2.8%
2012	20,372	24,324	9,464	54,161	0.4%
2013	20,837	25,193	9,885	55,914	3.2%
2014	21,400	25,616	9,620	56,635	1.3%
2015	21,895	26,502	10,319	58,716	3.7%
2016	22,545	26,295	10,706	59,546	1.4%
2017	23,139	27,150	10,761	61,049	2.5%
2018	23,760	27,452	10,979	62,191	1.9%
2019	24,407	27,354	10,876	62,637	0.7%
2020	24,589	26,327	10,717	61,634	-1.6%
2021	25,501	27,378	11,169	64,048	3.9%
2022	26,532	27,751	11,629	65,912	2.9%
2023	26,299	28,341	11,744	66,384	0.7%
2024	27,947	28,612	12,166	68,725	3.5%
				17-Year Average	**2.09%**

ERU allocations were developed based on flow monitoring data gathered by LOTT, population and employment densities provided by TRPC and connections information obtained from the cities of Lacey, Olympia, and Tumwater (Table 3).

Table 3. Equivalent Residential Unit (ERU) Allocations

Jurisdiction	Residents/ERU	Employees/ERU
Lacey	2.34	7.18
Olympia	2.48	9.32
Tumwater	2.43	8.47
Weighted Average	2.42	8.39

Loading characteristics for both residential and employee populations were updated in 2024 based on BITP influent sampling data and calibrated with flow monitoring data and residential/employment densities (Table 4).

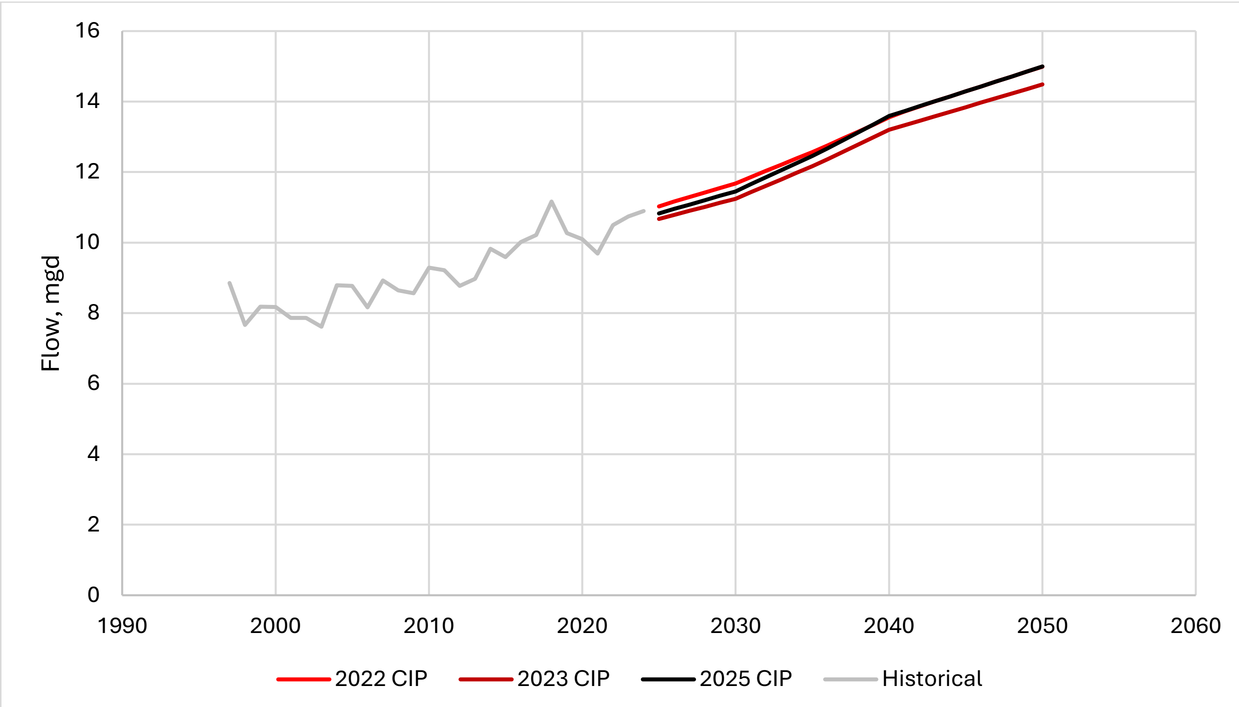
Table 4. Average Loading Generation Rate Profiles (lbs/person/day)

Residential		Employment	
BOD	TSS	BOD	TSS
.110	0.114	0.110	0.114

Population Growth Projections

Data used for the development of the population growth projections included wastewater flow monitoring data, sewered and non-sewered population projections, existing sewer lines, estimated timelines for sewering of non-sewered areas within the overall Urban Growth Area (UGA) and the average drinking water consumption data from July 2022 through July 2024. Flow data was collected at the BITP and at various flow monitoring locations throughout the collection system. Population projections were obtained from TRPC, in the form of projected residential and employment populations per parcel. The estimated sewering timelines, drinking water consumption data and existing collection system piping information were obtained from each of the partner jurisdictions (Lacey, Olympia and Tumwater). This information taken together was used to estimate the rate of increased flow to the BITP, as shown in Figure 1, and as estimated in LOTT's annual Capital Improvement Project (CIP) reports.

Figure 1. Estimated Base Flow to the BITP



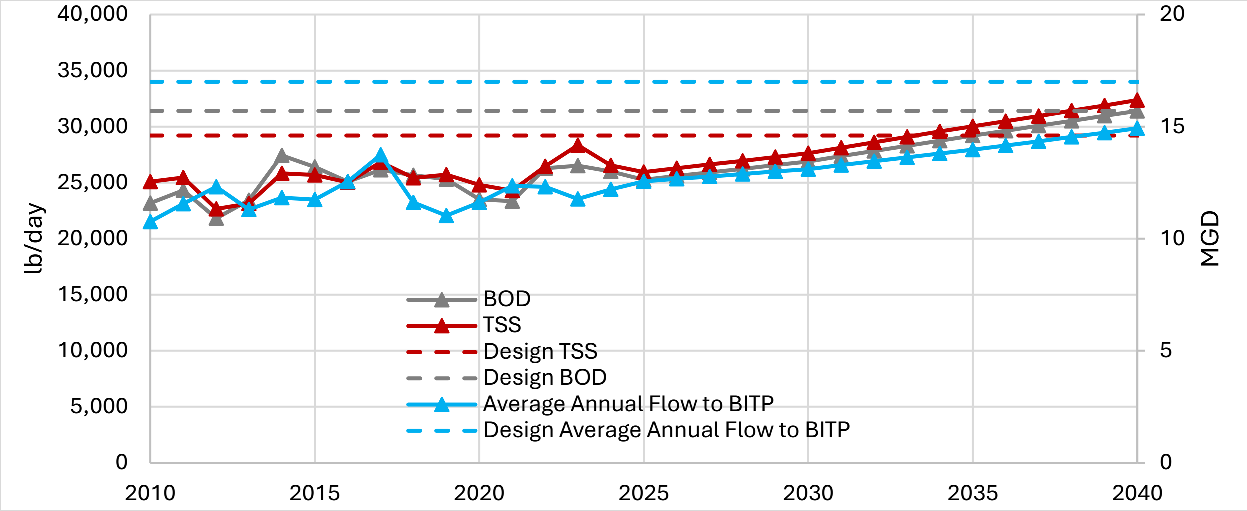
Capacity Assessment Analysis

Figure 2 illustrates the projected timeline for reaching the various annual average permit defined design criteria for BOD, TSS and flow at the BITP based on the updated ERU projections and the associated loading rates for BOD and TSS.

Included is the planned expansion at the Martin Way Reclaimed Water Plant (MWRWP), which will relieve hydraulic flow and loading limitations to the BITP. While on-line in 2024, the MWRWP diverted a daily average of 1.08 mgd of flow from the BITP, approximately 8.3% of the total system flow. Reclaimed water produced at MWRWP will continue to be utilized at the Woodland Creek Groundwater Recharge Facility, operated by the cities of Lacey and Olympia. Expansion of the MWRWP to 3 mgd is currently anticipated for late 2030s to early 2040s and is closely tied to the rate at which septic conversions happen in the northeast Lacey area, as well as an increase in desire for reclaimed water.

Based on these projections, the current rated design capacity for the BITP would be reached in the year 2034 for TSS. BOD and flow capacities would not be reached until after 2040.

Figure 2. Annual Average Projected Flows and Loadings at the BITP with Associated Design Capacity



Changes from Last Year

Although the BITP is approaching the rated TSS design loadings, there have been several major upgrades since these design capacities were established in the mid-1990s. These include a major renovation of the secondary clarifiers completed in 2008, and the addition of new primary sedimentation basins in 2013. With the new primaries, the original primaries were repurposed to manage centrate, providing the ability to more precisely meter centrate into the biological process. A project to rehabilitate the facility was completed in 2025, which reestablished the ability to route excessive storm related influent flows through the facility, augmenting primary treatment capacity.

The Biological Process Improvements project, completed in 2023, has also increased the ability to manage loadings to the BITP. The project removed the first anoxic basins from the biological treatment process allowing them to be available during wet weather events, adding an additional 2.3 million gallons of flow equalization storage.

LOTT's system-wide long-range planning efforts, completed in 2023, resulted in a shift in LOTT's capacity management strategy. Previously, new capacity was anticipated to come in the form of expanded reclaimed water production and groundwater infiltration. Due to the difficulty in finding viable infiltration properties, combined with the improved treatment performance resulting from the biological process improvements project, future capacity will be accommodated at the BITP. Reclaimed water will still play a part in LOTT's overall capacity; however it will now be driven more by demand rather than capacity expansion.

LOTT is evaluating advanced treatment technologies that could further reduce effluent nutrient concentrations and improve process resiliency and reliability. LOTT is planning additional piloting of chemically enhanced primary treatment to assess its effectiveness in increasing the overall treatment plant capacity as it relates to discharge concentrations.

LOTT will be seeking a formal rerating of the BITP from Ecology in the 2025/2026 timeframe with the hopes that it can be included in the anticipated NPDES permit renewal process.

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2024 Flows and Loadings Report

May 2025

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PREFACE

The Flows and Loadings Report is one of three related documents that are part of the process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on-line "just in time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared semi-annually and are used to help identify capital projects for inclusion in the Capital Improvements Plan.

- **Flows and Loadings Report** – analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

- **Inflow and Infiltration Report** – uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

- **Capacity Assessment Report** – uses flows and loadings data and inflow & infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge), determine when limitations will occur, and provide a timeline for new system components and upgrades.

As each report is published, it will be posted on LOTT's website – www.lottcleanwater.org.

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Executive Summary

In accordance with the Wastewater Resource Management Plan, also known as the "Highly Managed Plan", LOTT is continuously planning to ensure it maintains adequate operational capacity to meet community needs. The primary goal of the Flows and Loadings Report is to define the current and projected wastewater characteristics of the LOTT service area in terms of both wastewater flows and pollutant constituents (loads). The information in this report was used to develop the 2024 Capacity Assessment Report and the 2025-2026 Capital Improvements Plan.

The Thurston Regional Planning Council (TRPC) has historically updated its population and employment projections every five years. However, the latest update was published in 2018. These projections were used to develop the flows and loadings included in this report. Additional data included flow monitoring data collected as part of LOTT's inflow and infiltration evaluation program, timelines for sewering of non-sewered areas provided by each of the jurisdictions (Lacey, Olympia, and Tumwater) and updated current sewered areas.

Both flow and load projections are slightly lower (3-10%) than in the previous year's report. The reduction reflects a five-year trend in reduced loadings. This is likely related to a slight reduction in the per capita wastewater generation rates, mostly due to a revision in the handling of so-called vacant parcels.

Introduction

Purpose

Accurate projections of future wastewater flows and loadings are essential in planning for new treatment capacity. In accordance with the Highly Managed Plan, LOTT is continuously monitoring and planning to assure that adequate new wastewater treatment capacity is available “just in time.” The primary goal of the Flows and Loadings Report is to define the current and projected wastewater characteristics of the LOTT service area in terms of both wastewater flows and pollutant constituents (loads). Flows and loadings projections cover the 25-year planning cycle (2025-2050) and will be used to evaluate the existing LOTT Capital Improvements Plan and develop recommendations for the timing of capacity related projects.

Data Elements

Data used for the development of this report included wastewater flow monitoring data, sewered and non-sewered population projections, existing sewer lines, estimated timelines for sewering of non-sewered areas within the overall Urban Growth Area (UGA), and 2023-2024 drinking water consumption data. Wastewater flow data was collected at the Budd Inlet Treatment Plant and at various flow monitoring locations throughout the collection system. Population projections, last updated in 2018, were obtained from the Thurston Regional Planning Council (TRPC) in the form of projected residential and employment populations per parcel. A brief analysis of projections from the neighboring Puget Sound Regional Council suggests that forecasts have generally come down within the region. In that respect, the TRPC projections appear to be somewhat conservative, and have been applied without modification. Estimated sewering timelines, drinking water consumption data, and existing collection system piping information were obtained from each of the partner jurisdictions (Lacey, Olympia, and Tumwater).

Modeling Software

A multi-step process was used to develop flow and loading projections. Drinking water data from the cities was combined in Excel and uploaded to a map of the parcels in Thurston County in a geographic information system (GIS) database. The drinking water data was then allocated to its specific parcel which contained population data and projections provided by the TRPC. The combined drinking water and population data was grouped into sewer basins, exported, and manipulated in Excel to develop the flow and loading projections.

Changes from Previous Reports

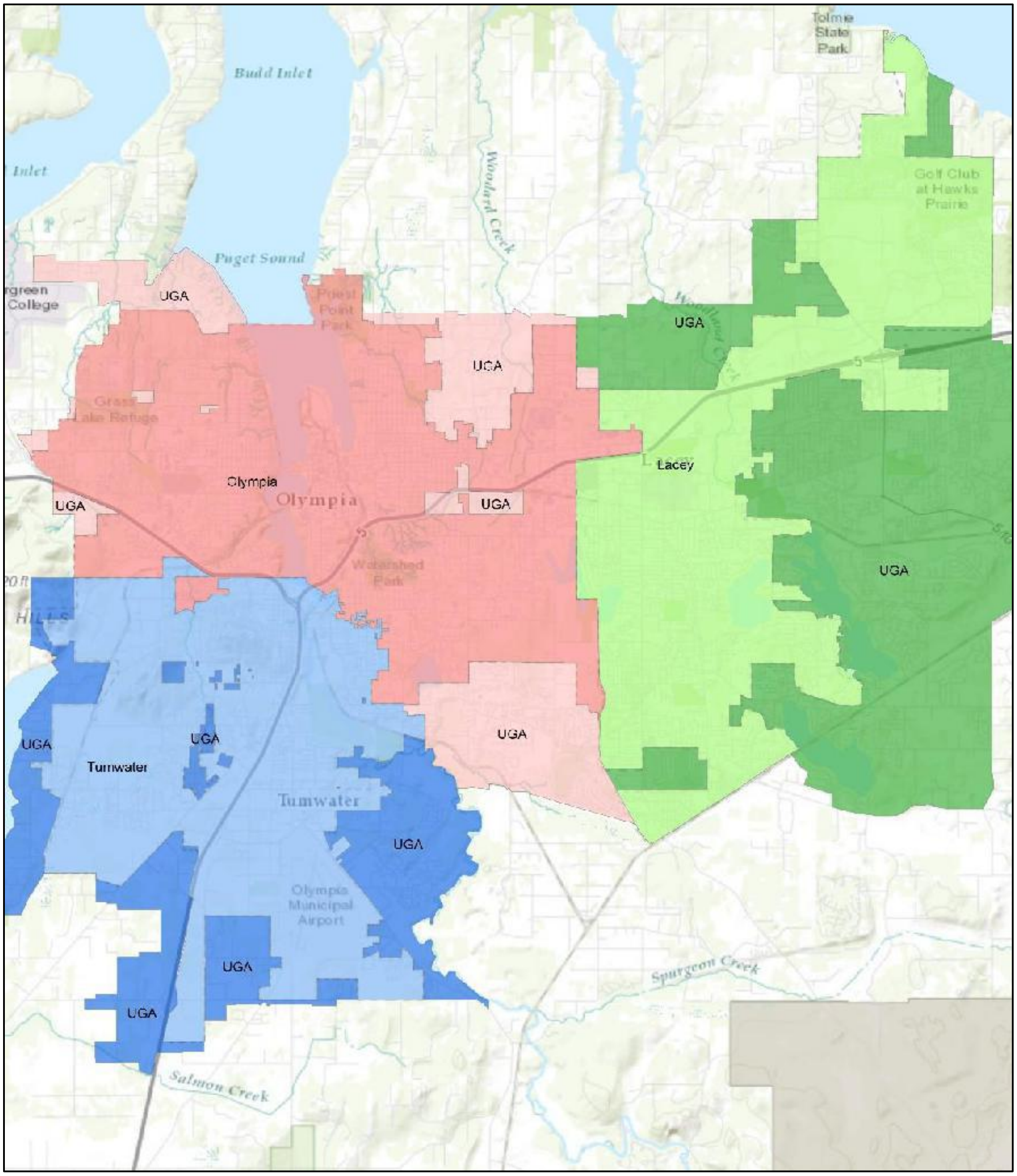
Changes from the 2022 Flows and Loadings Report include calibrating the wastewater flow generation rates based on updated drinking water consumption data from the cities of Olympia, Tumwater, and Lacey, flow monitoring data from 11 locations, updating the per capita wastewater load generation rates based on data collected at the Budd Inlet Treatment Plant and the Martin Way Reclaimed Water Plant, and updating the system-wide inflow and infiltration projections.

Study Area

Service Area

The LOTT service area includes the urban growth areas (UGAs) for the cities of Lacey, Olympia, and Tumwater. The current combined UGA encompasses approximately 52,276 acres, with a current residential population of 201,494 and an employment population of 131,920.

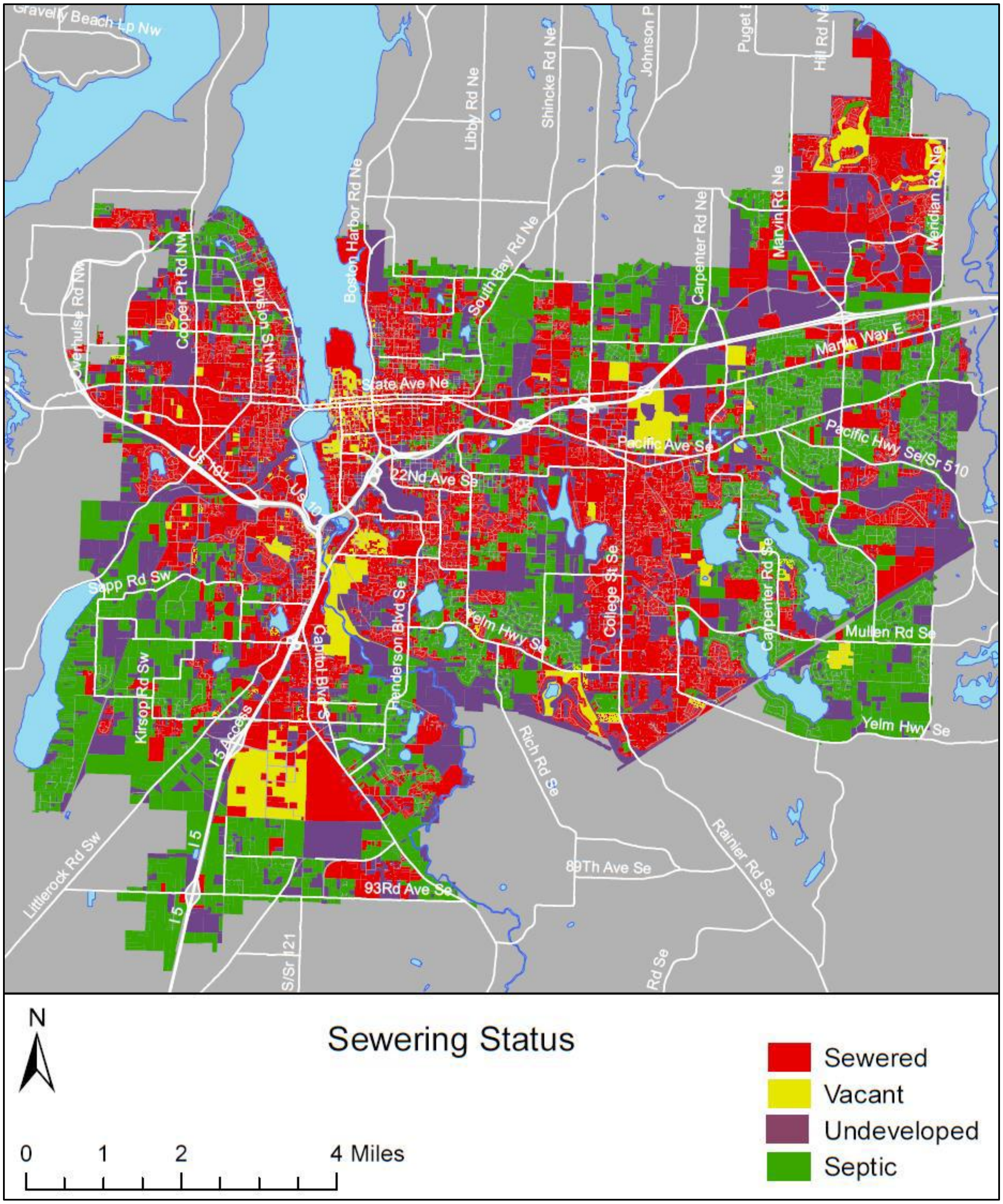
Figure 1. LOTT Service Area by Jurisdiction



Sewering Status

Within the LOTT service area, approximately 14,953 acres are sewered, serving a residential population of 133,401 and an employment population of 110,422. The currently sewered parcels, shown in red on Figure 2, indicate parcels which had drinking water consumption in the 2023-2024 period and were identified by LOTT's partners as active customers.

Figure 2. Sewering Status



The unsewered population within the service area has historically been divided into three categories. Vacant parcels are surrounded by sewered parcels but are currently designated as “unsewered” because they do not have any water consumption. Whether these are truly vacant or just represent missing data in the water consumption database, these parcels are assumed to be connected and are treated no differently from sewered parcels.

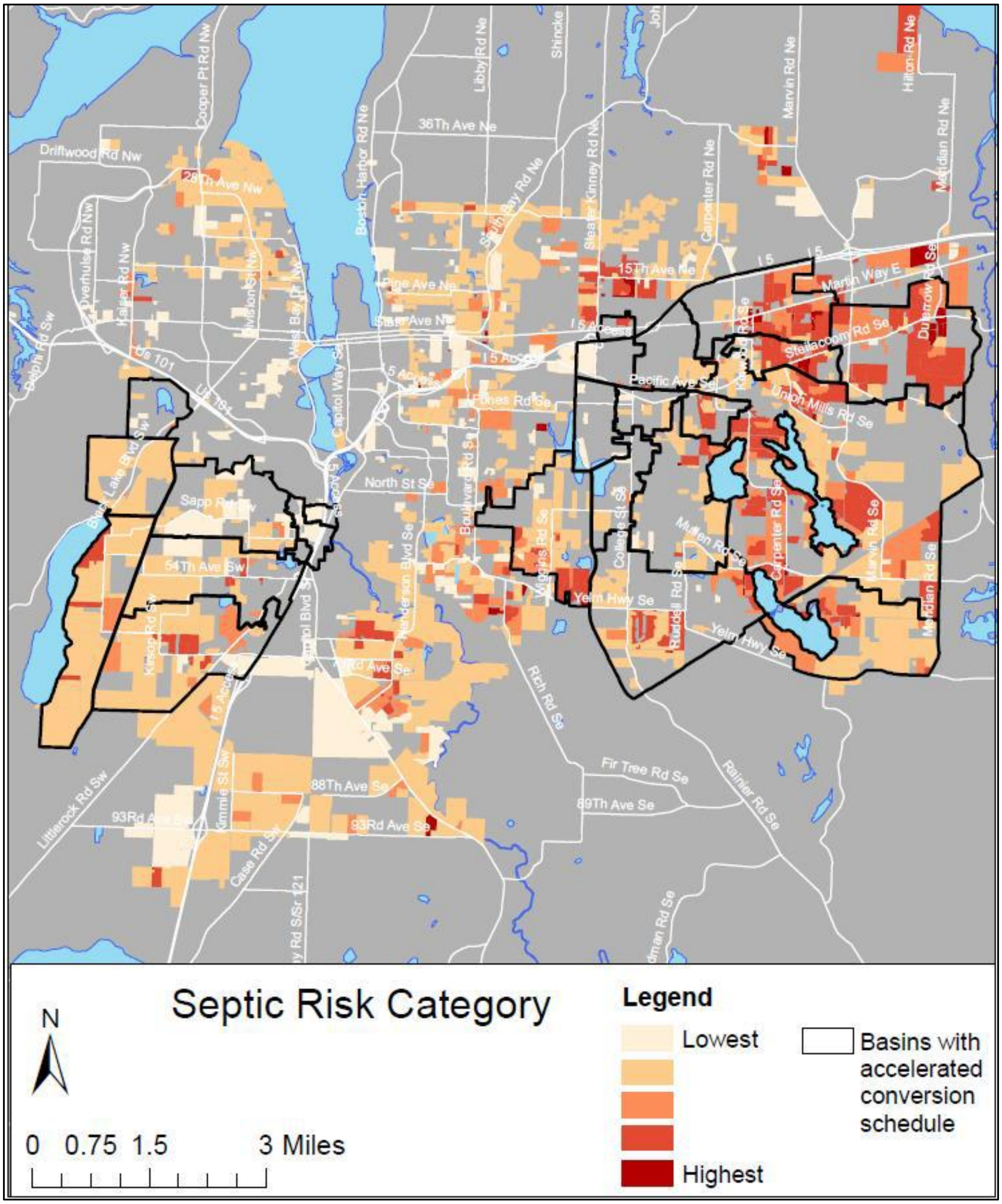
The second category are undeveloped parcels with no water consumption, and no known septic tank. This category (purple on Figure 2) includes 5,841 parcels, with a population of 15,628. In most instances, parcels with neither water consumption nor a septic tank would be assumed to be undeveloped, so the population of 15,628 is incongruous. It seems likely that, in places, TRPC allocated population regionally, without consideration of the status of individual parcels, leading to this disconnect. It is also likely that septic tanks have been undercounted, and a portion of these parcels are indeed on septic tanks. The latter point is borne out through inspection of satellite imagery, which shows development on many of these parcels.

The largest category of unsewered population are the parcels with known septic tanks, shown in green on Figure 2.

The latter two categories (purple and green parcels) are assumed to be sewered on a longer time frame, depending on location, proximity to the existing sewer system, and information obtained from the LOTT partners on future sewering efforts. In general, the undeveloped parcels are assumed to be connected earlier than the known septic tanks. Septic tank conversion has been prioritized in certain areas based on data generated by the Interjurisdictional Regional Septic Work Group. This data was obtained from the Thurston Geodata Center in the form of a GIS parcel file, which included an inventory of septic systems and associated risk scores based on environmental and health concerns. Basins with high environmental risk were projected to be connected earlier than those with lower risk. A map of the areas at risk is presented in Figure 3.

The 16,177 existing septic parcels represent a base flow of approximately 2.1 mgd. The current projection assumes sewering of 33% of those (5,266) by 2050, which would add a base flow of approximately 0.7 mgd to the system.

Figure 3. Septic Risk



The build out state, currently projected to occur in 2050 based on a linear regression analysis, is when all parcels within the UGA will have been developed. It should be noted that the build out state does not assume that all parcels will be connected to the sewer system by 2050. It is assumed that a certain percentage of new development within the UGA will include on-site septic systems, and that a certain percentage of existing septic systems will remain in place. The development density is projected by TRPC based on the current zoning and the previous development density corresponding to that zoning.

Population and Employment Forecast

Projections

In 2018 TRPC published population projections in the form of a GIS parcel file which included projected residential population for the years 2018, 2020, 2025, 2030, 2035, and 2040. The build out residential population projections were updated in 2013. Employment projections, also from TRPC, were published in 2013. Employment projections included the years 2010 and 2035 and build out projections expected to occur in 2050 based on a linear regression analysis.

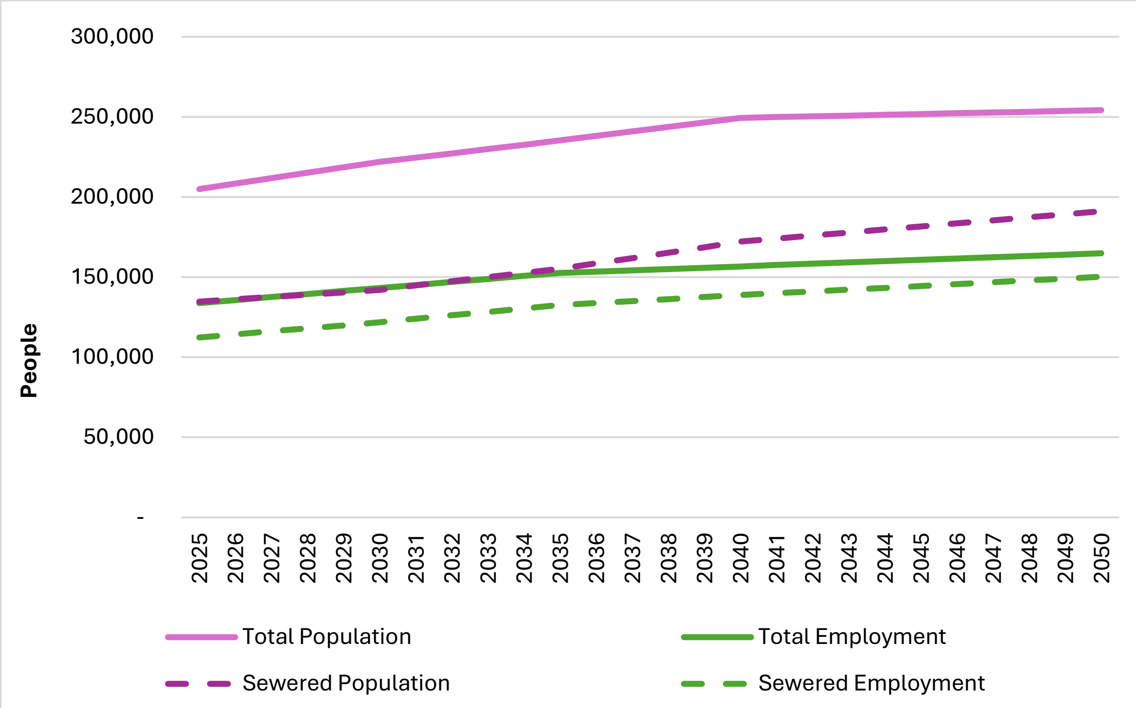
The future projections, shown in Table 1, were calculated through a linear extrapolation of the data provided by TRPC and the projected rate at which the sewered areas would expand, and septic tanks would be converted to sewer. The residential and employment populations include all persons and employees within the UGA. The sewered residential population and sewered employment population include only those contained within the sewered areas. Future expansion of the sewered areas is accounted for in the projections throughout the forecast period.

Table 1. Population and Employment Projections

Year	Residential Population	Employee Population	Sewered Residential Population	Sewered Employee Population
2025	204,964	133,803	134,712	112,318
2026	208,357	135,686	136,180	114,285
2027	211,751	137,569	137,604	116,180
2028	215,145	139,452	139,038	118,050
2029	218,538	141,335	140,491	119,909
2030	221,932	143,218	141,967	121,761
2031	224,608	145,101	144,748	123,998
2032	227,284	146,984	147,342	126,145
2033	229,961	148,867	149,949	128,285
2034	232,637	150,751	152,592	130,429
2035	235,313	152,634	155,282	132,581
2036	238,136	153,452	158,577	133,828
2037	240,959	154,270	161,913	135,076
2038	243,781	155,089	165,292	136,328
2039	246,604	155,907	168,715	137,584
2040	249,427	156,725	172,183	138,845
2041	249,908	157,544	174,070	139,956
2042	250,389	158,362	175,957	141,073
2043	250,870	159,180	177,845	142,198
2044	251,351	159,999	179,735	143,330
2045	251,832	160,817	181,627	144,470
2046	252,313	161,635	183,523	145,617
2047	252,794	162,454	185,423	146,772
2048	253,275	163,272	187,327	147,935
2049	253,756	164,090	189,236	149,106
2050	254,237	164,908	191,150	150,284
Full Sewering	254,237	164,908	254,237	164,908

Figure 4 displays the projected population and employment forecasts for the planning period (2025-2050).

Figure 4. Population and Employment Projections (2025-2050)



Equivalent Residential Units

For billing purposes, each customer connection to the sewered system is measured in terms of equivalent residential units (ERUs). One ERU is the amount of wastewater presumed to come from an average connected single-family household. For multi-family housing (apartments), each living unit is counted as 7/10 of an ERU. Commercial and industrial dischargers are billed on a volume basis using water consumption data, which is mathematically converted to ERUs.

Established in 1976 as part of the original LOTT Interlocal Agreement, LOTT has defined an ERU as 900 cubic feet of wastewater volume per month (224 gallons per day). Since that time, residential wastewater generation rates have decreased as a result of water conservation efforts. Estimates of current residents and employees per ERU are provided in Table 2.

Table 2. Jurisdiction ERU Summary 2025

Jurisdiction	Residents/ERU	Employees/ERU
Lacey	2.34	7.18
Olympia	2.48	9.32
Tumwater	2.43	8.47
Weighted Average	2.42	8.39

Table 3 displays the annual average number of ERUs for each of the jurisdictions over the last 28 years.

Table 3. ERU Totals 25-Year Comparison

Year	Lacey	Olympia	Tumwater	Total
1997	10,966	21,430	6,447	38,843
1998	11,363	21,860	6,845	40,068
1999	11,786	22,242	6,962	40,990
2000	13,356	22,398	6,625	42,379
2001	12,362	23,062	6,582	42,006
2002	13,493	23,142	6,667	43,302
2003	13,689	23,445	6,999	44,133
2004	14,206	23,552	7,161	44,919
2005	14,543	23,939	7,572	46,054
2006	15,326	24,575	7,808	47,709
2007	17,647	24,453	8,127	50,227
2008	18,497	24,522	8,441	51,460
2009	19,092	24,333	8,622	52,047
2010	19,463	24,220	8,819	52,502
2011	20,376	24,452	9,131	53,959
2012	20,372	24,324	9,464	54,160
2013	20,789	25,161	10,136	56,086
2014	21,000	25,100	9,600	55,700
2015	21,895	26,502	10,319	58,716
2016	22,545	26,295	10,706	59,546
2017	23,139	27,150	10,761	61,050
2018	23,760	27,452	10,979	62,191
2019	24,407	27,354	10,876	62,637
2020	24,589	26,327	10,717	61,634
2021	25,501	27,378	11,169	64,048
2022	26,532	27,751	11,629	65,912
2023	26,299	28,341	11,744	66,384
2024	27,947	28,732	12,171	68,850

New Connections

New connections to the system are billed a one-time connection fee, called a Capacity Development Charge (CDC). One CDC is assessed for each ERU connected to the system. Table 4 lists the number of CDCs collected over the last 28 years.

Table 4. New Connections 25-Year Comparison

Year	Lacey	Olympia	Tumwater	Total
1997	533	381	109	1,023
1998	663	1,361	429	2,453
1999	1,062	882	214	2,159
2000	316	301	144	761
2001	498	306	164	968
2002	489	410	130	1,029
2003	541	296	273	1,110
2004	750	580	414	1,744
2005	942	392	368	1,702
2006	1,888	488	208	2,584
2007	1,129	219	400	1,748

Year	Lacey	Olympia	Tumwater	Total
2008	688	201	288	1,178
2009	510	247	119	875
2010	436	346	192	974
2011	462	429	176	1,066
2012	385	336	187	908
2013	384	399	187	969
2014	398	421	163	983
2015	667	332	142	1,141
2016	986	642	243	1,871
2017	455	586	224	1,265
2018	905	266	155	1,325
2019	636	160	228	1,025
2020	454	648	308	1,410
2021	1,226	327	410	1,963
2022	584	302	280	1,166
2023	535	308	395	1,239
2024	368	211	159	739

Future connections are summarized in Table 5 and are based on population projections included in Table 1 and Table 2.

Table 5. New Connection Projections Through the Year 2050

Year	Lacey	Olympia	Tumwater	Total
2025	263	354	152	770
2026	354	341	154	848
2027	324	342	154	820
2028	320	346	155	821
2029	319	351	157	827
2030	320	357	159	836
2031	712	454	268	1,435
2032	660	431	254	1,345
2033	662	432	256	1,349
2034	669	436	260	1,365
2035	679	442	264	1,385
2036	803	429	300	1,532
2037	810	433	306	1,549
2038	818	437	313	1,567
2039	826	440	320	1,586
2040	834	445	327	1,606
2041	511	209	209	929
2042	511	209	210	930
2043	511	209	211	931
2044	512	209	212	933
2045	513	209	213	935
2046	514	209	215	937
2047	515	209	216	940
2048	516	210	217	943
2049	517	210	219	946
2050	519	210	220	949

Flows and Loadings

Permit Requirements

The National Pollutant Discharge Elimination System (NPDES) permit number WA0037061 for the Budd Inlet Treatment Plant was issued by the Department of Ecology on February 16, 2018, and became effective on April 1, 2018. The compliance is based primarily on loadings of biological oxygen demand (BOD), total suspended solids (TSS), and total inorganic nitrogen (TIN), rather than flow. Table 6 lists the loadings-based permit limitations.

Table 6. NPDES Permit Limitations

	Summer (Jun–Sep)	Shoulder (Apr, May, Oct)	Winter (Nov–Mar)
BOD	7 mg/L 671 lbs/d 85% removal	8 mg/L 900 lbs/d 85% removal	30 mg/L 5,640 lbs/d 85% removal
TSS	30 mg/L 5,265 lb/d 85% removal		
TIN	3 mg/L 288 lbs/d	3 mg/L 338 lbs/d	No limit
pH	6–9		
Fecal coliform bacteria	200/100 ml (monthly) 400/100 ml (weekly)		
Ammonia-N			26 mg/L (monthly) 36 mg/L (maximum day)
Additional limits for Fiddlehead Outfall			
Ammonia-N			22 mg/L (monthly) 31 mg/L (maximum day)
Total recoverable copper	6 µg/L (monthly) 7.5 µg/L (maximum day)		

µg/L = micrograms per liter
mg/L = milligrams per liter
ml = milliliter

Drinking Water Analysis

For this report, drinking water consumption data from August 2022 through July 2024 was collected from each of the jurisdictions. Drinking water consumption was reported monthly for each parcel. In order to determine the baseline drinking water consumption rate and minimize the effect of irrigation, only winter (November, December, January, and February) drinking water consumption data were used for sewered customers.

Consumption for each customer considers consumptions rates from the past five years. Consumption for all the sewered customers averaged 9.87 mgd. Including flow from The Evergreen State College (TESC), the total base consumption was 10.02 mgd.

The water consumption data were calibrated against measured wastewater base flows to determine the wastewater generation rate. Base flow across the entire system, measured as the sum of the flows at the Budd Inlet Treatment Plant (BITP) and the Martin Way Reclaimed Water Plant (MWRWP), is 10.6 mgd. The base wastewater flow was therefore 0.6

mgd higher than the total water consumption. Typically, wastewater base flows are expected to be lower than water consumption rates. Even during the winter, when irrigation uses are minimized, there are a number of water uses which don't show up in the wastewater flows. These include various types of cleaning, cooking, humidifying, plant watering, and other activities. The ratio of base wastewater flow to water consumption is typically 0.8 to 0.9. In this case, the base wastewater flow is 0.6 mgd higher than the water consumption.

Once the water consumption rates were calibrated against meter flow, the rates were divided by population and employment estimates to generate a set of wastewater generation rate profiles. Profiles were developed for 15 regions, with residential rates varying from 44 gallons per capita per day (gpcd) in the East Bay neighborhood to 107 gpcd in the Lacey and UGA septic areas. Employment rates varied from 12 gallons per employee per day (gped) in the Olympia STEP areas to 62 gped in the residential part of east Olympia. Rates are summarized, by location, in Table 7.

Table 7. Wastewater Generation Rates by Drinking Water Basin

	Population		Drinking Water Consumption[1]			Adjusted Wastewater Generation Rate	
Basin	**Sewered Residents**	**Sewered Employment**	**Total gpd**	**Residential gpd**	**Employee gpd**	**Residential gpcd[2]**	**Employee gpcd[3]**
Lacey							
Active developments	32,047	8,524	2,128,452	1,895,586	232,866	59.2	27.3
Southeast Lacey	4,513	3,836	607,643	482,027	125,616	106.8	32.7
Other Lacey	18,867	14,437	1,163,905	966,837	197,068	51.2	13.7
Average						60.3	20.7
Olympia							
Downtown	5,880	24,234	629,488	307,956	321,532	52.4	13.3
STEP area	4,176	730	220,069	211,464	8,605	50.6	11.8
West Bay	8,322	3,025	446,218	394,030	52,188	47.3	17.3
East Bay	5,673	942	262,835	251,143	11,692	44.3	12.4
West residential areas	4,504	593	378,240	350,187	28,053	77.7	47.3
West commercial areas	9,571	13,572	825,402	565,883	259,519	59.1	19.1
East residential areas	11,384	3,366	691,974	481,852	210,123	42.3	62.4
East commercial areas	4,795	11,318	497,270	260,318	236,952	54.3	20.9
Average						52.0	19.5
Tumwater							
Tumwater Hill	3,053	1,081	170,082	153,532	16,550	50.3	15.3
Mottman	4,094	3,846	312,277	249,907	62,370	61.0	16.2
Commercial Core	5,811	9,394	419,608	294,762	124,846	50.7	13.3
Outlying	9,350	9,486	669,717	511,209	158,508	54.7	16.7
Average						54.2	15.2

1. *Raw data, only a portion of total parcels accounted for. Data not adjusted for sewer base flows.*
2. *Gallons per capita per day*
3. *Gallons per employee per day*

The variance in drinking water consumption (and therefore, wastewater generation) between basins may be attributed to a number of contributing factors which include the predominant type of residential units in the basin (single-family, multi-family, senior housing, etc.), the predominant era of home construction, the average age of the residents, and the various commercial, industrial, or public-sector employers present in each basin.

On average, residential per capita usage increased by 2.3 gallons per person per day, and employment usage increased by 1.5 gallon per person per day, compared to the last report.

Base Sanitary Flow

In order to accurately forecast flows based on population changes within the service area, a base sanitary flow (BSF) must be established to calibrate residential and employee wastewater generation rates. The BSF is defined as the minimum average flow generated in the entire collection system registered over a 7-day period in each year and is assumed to have little to no influence from inflow and infiltration.

Base sanitary flow is measured at the influent of the Budd Inlet Treatment Plant. Reclaimed water produced by the Martin Way Reclaimed Water Plant, which is diverted to the Hawks Prairie and Woodland Creek infiltration basins, is added to the flow measured at the BITP to ensure that flows of the entire system are accounted for. The BSFs, measured in million gallons per day (mgd), from 2001 to 2024 are provided in Table 8.

Table 8. Base Sanitary Flow in LOTT Service Area

Year	Base Sanitary Flow (mgd)[1]
2001	7.94
2002	7.92
2003	8.12
2004	8.79
2005	8.77
2006	8.50
2007	8.40
2008	8.68
2009	8.77
2010	9.29
2011	9.21
2012	8.77
2013	8.94
2014	9.22
2015	9.59
2016	10.02
2017	10.22
2018	11.17
2019	10.27
2020	10.10
2021	9.69
2022	10.50
2023	10.74
2024	10.90

[1]*Equals the raw degritted sewage flow at the Budd Inlet Treatment Plant plus flow treated at the Martin Way Reclaimed Water Plant*

The current NPDES permit requires that the LOTT Clean Water Alliance conduct an annual infiltration and inflow evaluation such that the entire collection system is evaluated once every seven years. LOTT currently has a total of 11 permanent flow monitors. This, along with flows recorded during previous years, allows for a more detailed analysis of each jurisdiction's base flows. The BSF for each of the jurisdictions is provided in Table 9.

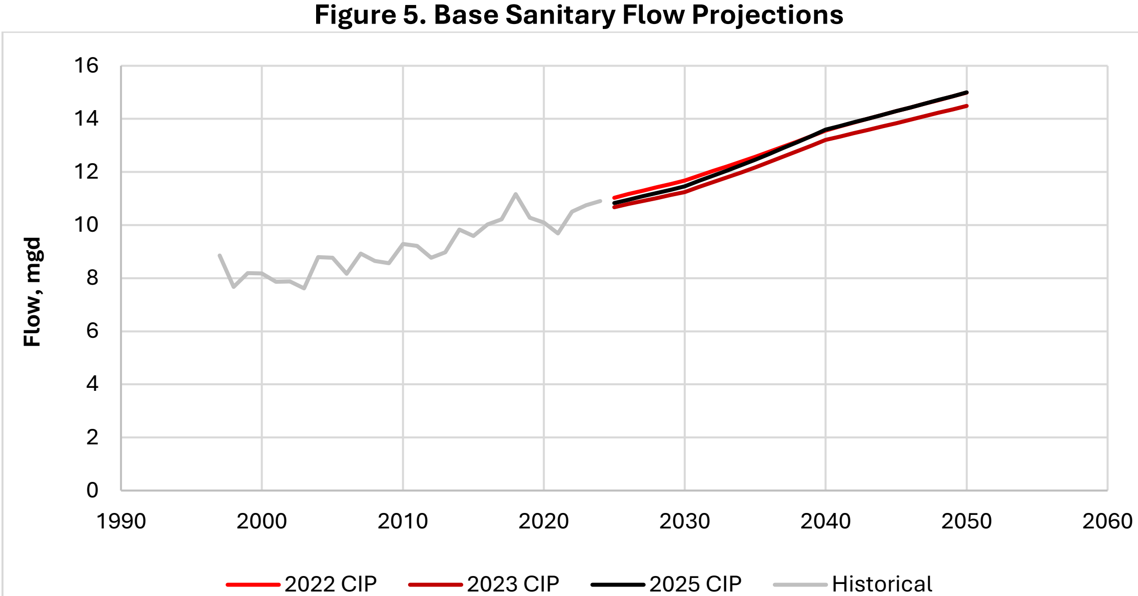
Table 9. Base Sanitary Flow by Jurisdiction (mgd)

Year	Lacey	Olympia	Tumwater	Point Sources (TESC[1], etc.)	Total
2006	2.63	4.31	1.73	0.05	8.27
2007	2.63	4.32	1.21	0.1	8.26
2008	2.94	4.02	1.14	0.48	8.58
2009	3.09	3.42	1.41	0.54	8.47
2010	3.14	3.56	1.19	0.45	8.34
2012[2]	3.28	4.11	1.37	0.42	9.18
2013	3.10	4.14	1.23	0.41	8.88
2014	3.16	4.31	1.21	0.54	9.22
2015	3.32	4.20	1.54	0.53	9.59
2016	3.43	4.58	1.43	0.58	10.02
2017	3.36	4.75	1.52	0.58	10.22
2018	3.21	5.82	1.61	0.53	11.17
2019	3.30	3.85	1.35	1.77	10.27
2020	3.13	3.61	1.48	1.87	10.10
2021	3.24	3.44	1.14	1.87	9.69
2022	2.33	4.61	1.98	1.57	10.50
2023	3.22	4.00	2.16	1.37	10.74
2023	3.33	4.48	1.92	1.18	10.90

[1] The Evergreen State College (TESC), Mottman Industrial area, and artesian wells
[2] June 2011 – May 2012 Average

The large reduction in Olympia base flow and increase in point source base flow between 2018 and 2019 reflects the adjustment to suspected artesian inflow. Figure 5 presents the base sanitary flow projections and compares them with those published in the 2020 and 2021 LOTT Flows and Loadings Reports, as well as historical observations since 1997.

Figure 5. Base Sanitary Flow Projections



Base flow projections move around slightly from year to year. This year's projection is slightly higher than the 2023 projection, but very similar to the 2022 projection. This variability is most likely due to water consumption and estimates of the current service population.

Comparison with Historical Wastewater Generation Rates

Historically, wastewater generation rates were developed for each city based upon flow monitoring data. Beginning in 2007, drinking water consumption data has been obtained directly from each of the jurisdictions, enabling a more precise estimation of the wastewater generation rate profiles as shown in Table 7. These profiles have been organized into city-specific profiles for comparison with previous estimates. Table 10 summarizes the historical rate profiles, along with the corresponding values developed in this report.

Table 10. Wastewater Generation Rate Gallons Per Capita Per Day (gpcd)

Source	Lacey	Olympia	Tumwater	Employment
1995-2002 CIP	66	85	73	40
2003 CIP	64	81	69	39
Budd Inlet Master Plan (2004)	64	75	69	35
2005 CIP	68	62	65	35
2006 Flows and Loadings	71	64	61	34
2007 Flows and Loadings	69	67	74	22
2008 Flows and Loadings	62	66	82	26
2009 Flows and Loadings	66	67	73	20
2010 Flows and Loadings	66	69	69	25
2012 Flows and Loadings	63	67	66	18
2013 Flows and Loadings	66	75	72	20
2014 Flows and Loadings	57	64	58	19
2015 Flows and Loadings	58	58	51	23
2016 Flows and Loadings	57	64	80	24
2017 Flows and Loadings	58	70	61	25
2018 Flows and Loadings	53	63	57	29
2019 Flows and Loadings	60	69	59	33
2020 Flows and Loadings	61	56	58	18
2021 Flows and Loadings	57	54	58	17
2022 Flows and Loadings	56	58	53	18
2024 Flows and Loadings	60	52	54	19

These values are extrapolated from the values in Table 7 though they were not used in the model. They are presented for the sake of comparison to previous years' profiles. Per capita rates for all three cities were relatively unchanged since last year's report.

Flow Projections

Flow projections are calculated by multiplying the projected sewered populations by the wastewater generation rate. The per capita generation rates are basin specific. The projected sewered population projections are dependent on whether the parcel is currently sewered, on a septic system, or undeveloped. The model assumes that these generation rates are constant throughout the simulation period (2025-2050). Each year these wastewater generation rates will be recalibrated based on ongoing flow monitoring and population estimates.

The impact of inflow and infiltration on projected flows was modeled using the projected inflow and infiltration rates as documented in the 2024 Inflow & Infiltration and Flow Monitoring Report. Projections were developed for the following risk-based inflow and infiltration scenarios: 1) annual average; 2) 10-year peak day; 3) 10-year peak hour; 4) 10-year peak month; 5) summer (June-September); 6) shoulder (April, May, and October); and 7) winter (November-March) time period flows. Flow projections are displayed in Figure 6 and listed in Table 11.

Figure 6. Flow Projections

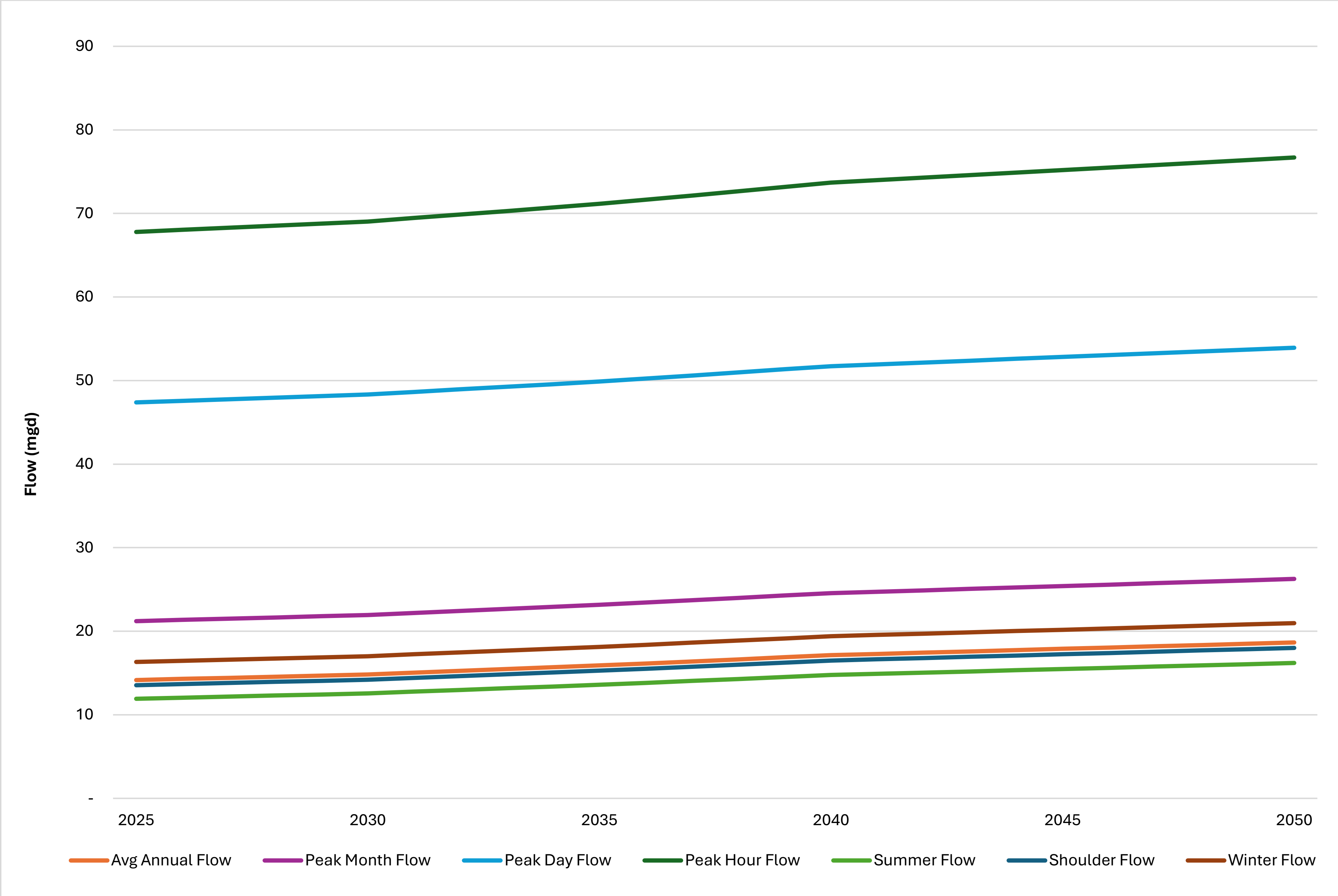


Table 11. Flow Projections (mgd)

Year	Base Sanitary Flow	Annual Average	Peak Month (10-year)	Peak Day (10-year)	Peak Hour (10-year)	Summer[1]	Shoulder[2]	Winter[3]
2025	10.83	14.16	21.21	47.39	67.78	11.92	13.54	16.33
2026	10.96	14.29	21.36	47.58	68.04	12.05	13.68	16.47
2027	11.08	14.43	21.50	47.76	68.28	12.18	13.81	16.60
2028	11.20	14.56	21.65	47.95	68.53	12.30	13.94	16.74
2029	11.33	14.69	21.80	48.13	68.77	12.43	14.07	16.87
2030	11.45	14.82	21.95	48.32	69.02	12.56	14.20	17.01
2031	11.66	15.05	22.20	48.64	69.46	12.77	14.43	17.24
2032	11.86	15.26	22.44	48.95	69.88	12.98	14.64	17.46
2033	12.06	15.47	22.67	49.25	70.29	13.18	14.85	17.68
2034	12.25	15.69	22.91	49.56	70.71	13.38	15.06	17.90
2035	12.46	15.90	23.16	49.88	71.14	13.59	15.28	18.13
2036	12.68	16.15	23.43	50.24	71.64	13.82	15.52	18.38
2037	12.90	16.39	23.71	50.60	72.15	14.05	15.76	18.63
2038	13.13	16.64	23.99	50.97	72.66	14.28	16.00	18.88
2039	13.36	16.89	24.27	51.35	73.17	14.52	16.25	19.14
2040	13.59	17.14	24.56	51.72	73.70	14.76	16.50	19.40
2041	13.73	17.29	24.73	51.94	74.00	14.90	16.65	19.56
2042	13.87	17.44	24.90	52.16	74.29	15.05	16.80	19.71
2043	14.01	17.59	25.07	52.38	74.59	15.19	16.95	19.87
2044	14.15	17.74	25.24	52.60	74.89	15.33	17.10	20.02
2045	14.29	17.89	25.41	52.82	75.19	15.48	17.25	20.18
2046	14.43	18.04	25.58	53.04	75.49	15.62	17.40	20.34
2047	14.57	18.20	25.75	53.26	75.79	15.77	17.55	20.49
2048	14.71	18.35	25.92	53.48	76.09	15.91	17.70	20.65
2049	14.85	18.50	26.09	53.70	76.39	16.06	17.85	20.81
2050	15.00	18.66	26.26	53.93	76.70	16.21	18.01	20.97
Full Sewering	20.18	24.21	32.44	61.76	87.18	21.52	23.52	26.68

1. June, July, August, and September
2. April, May, and October
3. November, December, January, February, and March

Loading Projections

Loading projections are updated each year based upon observed BOD and TSS loadings at the Budd Inlet Treatment Plant. In 2024, the average monthly BOD and TSS loads to the Budd Inlet Treatment Plant were 26,005 lbs/d and 26,529 lbs/d, respectively. Load removal at the Martin Way Reclaimed Water Plant is taken into account when estimating ERU generation rate profiles. In 2024, it is estimated that the Martin Way Plant removed approximately 1,915 lbs/d of BOD and 1,573 lbs/d of TSS.

Projected BOD and TSS loadings for this report are based on a correlation of loadings from 2003-2024, with the 2007 through 2024 values corrected to account for loadings removal at the Martin Way Reclaimed Water Plant. These values are broken down into blanket residential and employment generation rates based upon the latest population and employment projections. These rates are provided in Table 12.

Table 12. Wastewater Load Generation Rate Profiles (lbs per capita/employee day)

Residential		Employment	
BOD	TSS	BOD	TSS
0.110	0.114	0.110	0.114

Figure 7 displays the historical influent loading characteristics at the Budd Inlet Treatment Plant to include monthly averages for BOD and TSS. Loadings appear to have been declining slightly over the past few years, although the long-range trend continues to increase.

Figure 7. Historical Primary Influent Loads (Monthly Average)

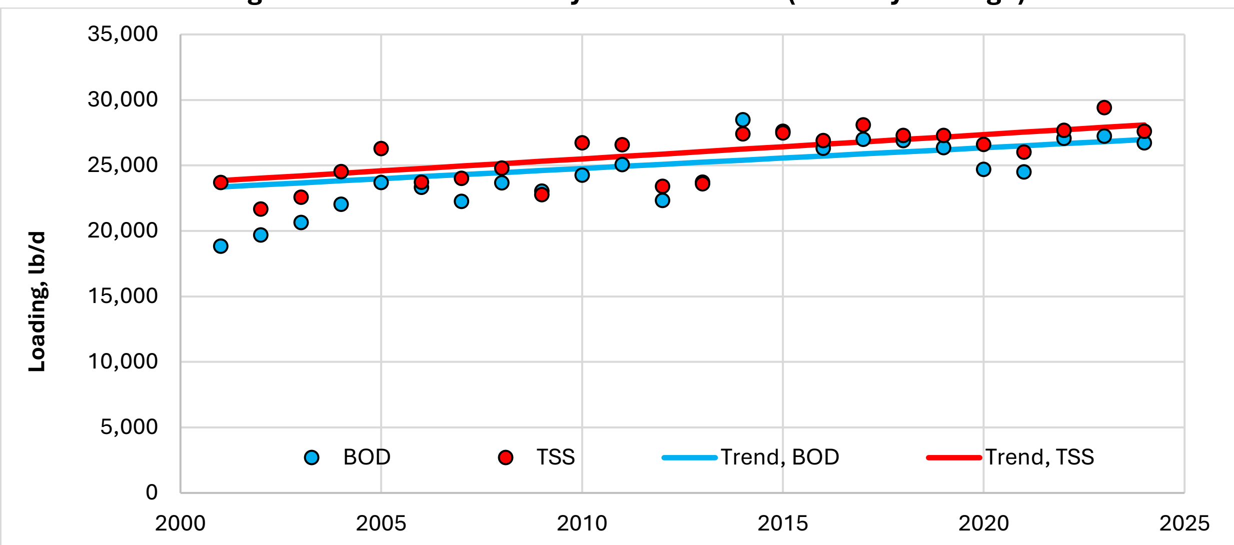


Figure 8 and Table 13 present the projected BOD and TSS loadings in the LOTT service area through 2050. These loading rates are calculated by multiplying the projected sewer populations by the per capita loading rates detailed in Table 12.

Figure 8. Projected Loadings

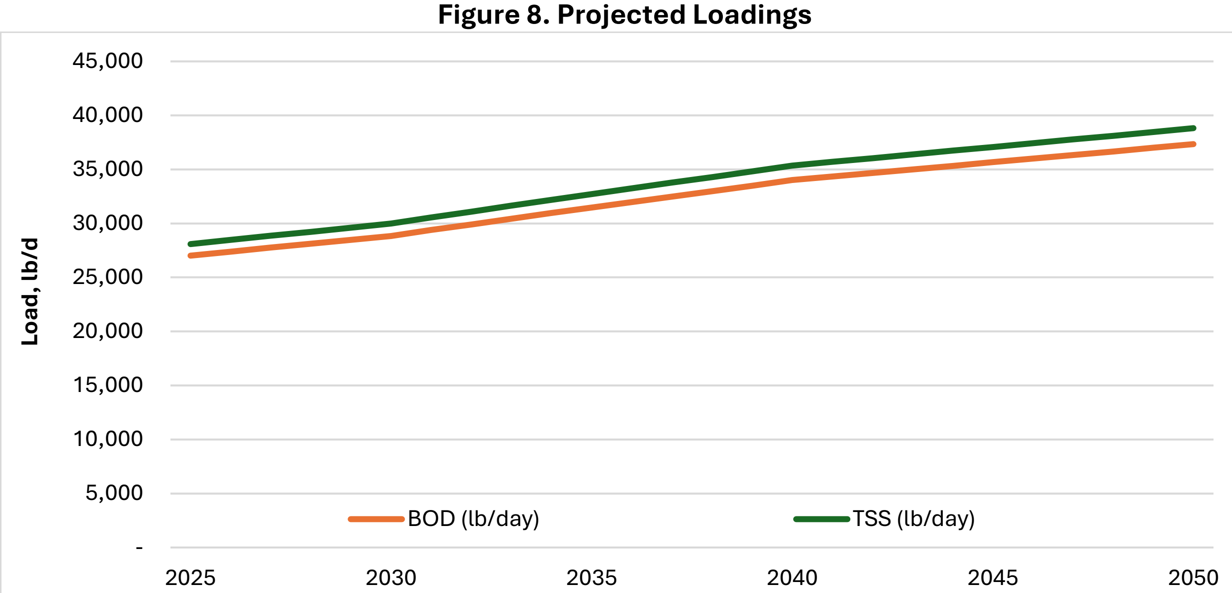


Table 13. Projected Loadings

Year	Average Day BOD (lbs/day)	Average Day TSS (lbs/day)
2025	27,017	28,087
2026	27,393	28,477
2027	27,756	28,855
2028	28,117	29,231
2029	28,479	29,607
2030	28,843	29,985
2031	29,392	30,556
2032	29,911	31,095
2033	30,430	31,635
2034	30,953	32,179
2035	31,483	32,729
2036	31,980	33,246
2037	32,481	33,767
2038	32,988	34,294
2039	33,499	34,826
2040	34,017	35,363
2041	34,344	35,704
2042	34,673	36,046
2043	35,003	36,388
2044	35,333	36,732
2045	35,665	37,077
2046	35,998	37,423
2047	36,332	37,770
2048	36,667	38,119
2049	37,004	38,469
2050	37,342	38,821
Full Sewering	45,841	47,656

Summary

The load projections have decreased compared to the previous projection. Since 2014, influent loadings of BOD and TSS have been relatively stable, which dampens the long-term increasing trend.

The information in this report was used to develop the 2024 Capacity Assessment Report and the 2025-2026 Capital Improvements Plan.

LOTT

CAPACITY REPORTS 2025

FLOWS & LOADINGS

I&I/FLOW MONITORING

CAPACITY ASSESSMENT

2024 Inflow & Infiltration and Flow Monitoring Report

(Data from April 2022 – December 2024)

May 2025

Prepared By:

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PREFACE

The Inflow & Infiltration and Flow Monitoring Report is one of three related documents that are part of the process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on-line "just-in-time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared semi-annually and are used to help identify capital projects for inclusion in the Capital Improvements Plan.

- **Flows and Loadings Report** – analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

- **Inflow and Infiltration Report** – uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

- **Capacity Assessment Report** – uses flows and loadings data and inflow & infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge), determine when limitations will occur, and provide a timeline for new system components and upgrades.

As each report is published, it will be posted on LOTT's website – www.lottcleanwater.org.

Introduction

The LOTT Clean Water Alliance flow monitoring program was initiated in 2003. In accordance with National Pollutant Discharge Elimination System (NPDES) Permit WA0037061, an inflow and infiltration (I&I) evaluation for all sub-basins within the LOTT system is required such that the entire system is evaluated once every seven years. The purpose of this program is to ensure permit compliance, characterize flows within the collection system, identify areas of concern for I&I, and aid in the prioritization of rehabilitation projects to reduce inflow and infiltration (I&I). The program is also intended to fulfill requirements of the Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning, originally dated March 27, 1995, as presented in Exhibit J to the LOTT Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance. The report includes an overview of the LOTT I&I program as well as the results and analysis of the monitoring program for the 2023-2024 monitoring period. The monitoring program has been in place for eighteen years.

Brown and Caldwell provides data quality assurance and control and assists in annual I&I analyses. LOTT has contracted with SFE Global NW to install flow monitors throughout the system (Table 1) and collect monitoring data. For 2023-2024, flow monitors include seven permanent monitoring sites and four pump station monitors.

This report covers the monitoring year 2023 through December 2024. The report is arranged as follows:

- Section 2 provides an overview of the program to include an inventory and assessment of the flow monitoring sites, equipment, and technology.

- Section 3 presents the results of the inflow and infiltration analyses.

- Section 4 summarizes the data collected in the new program and provides recommendations for the flow monitoring program.

Overview

Inflow is defined as surface water entering the sewer via maintenance holes, flooded sewer vents, illicitly connected storm drains, basement drains, and by means other than groundwater. Inflow is usually the result of rain and/or snowmelt events. *Infiltration* is defined as groundwater that enters the sewer, usually through leaky sewer pipe joints, maintenance holes, and service connections.

Program History

When the program was instituted in 2003, information on system-wide I&I was limited. I&I modeling was conducted on flows recorded at the Budd Inlet Treatment Plant (BITP) and then allocated across the system based upon assumptions involving the age of the pipe and a subjective assessment of flows measured at pump stations. A major goal of this program was to more accurately define the spatial distribution of I&I. This would help LOTT with capacity planning for both its collection system, as well as its treatment system, which includes both the BITP and the Martin Way Reclaimed Water Plant.

Another goal of this program was to assess changes in I&I over time, allowing LOTT to identify areas of concern and advise LOTT's partner jurisdictions of areas to focus on remediation efforts.

The first 15 years of this program featured rotating flow monitoring stations. Typically, a rotating flow monitoring station was set up for one calendar year, allowing for assessment of base flow during the summer, and I&I during the winter. A total of 73 sites were monitored as part of the program. Some of these sites were less useful than others in the sense that the data they provided were limited, either due to low flows, pump station impacts, or geometrical oddities which compromised the flow measurement. Others were monitored by LOTT partners for specific, short-term purposes. A total of 54 sites, plus the three LOTT pump stations and the Tumwater Hixon Street flow monitoring site are incorporated into LOTT's system-wide I&I model.

Starting in 2018, the program has shifted to monitoring 11 permanent locations. The rotating flow monitoring sites served their purpose and allowed for detailed allocation of I&I across the 88 sewer basins. Presently, a smaller number of permanent sites provide for long term tracking of I&I. Periodically, temporary monitoring will be performed at certain locations which have shown signs of deterioration over the course of the program, or where the permanent meters suggest that an upstream assessment is warranted.

Figure 1 shows the locations of the eleven current flow meters, and Figure 2 shows their connectivity. Table 1 lists the flow monitoring sites included in this program and the associated tributary sewer basins measured by each site.

Figure 1. Location of the Permanent Flow Monitoring Sites

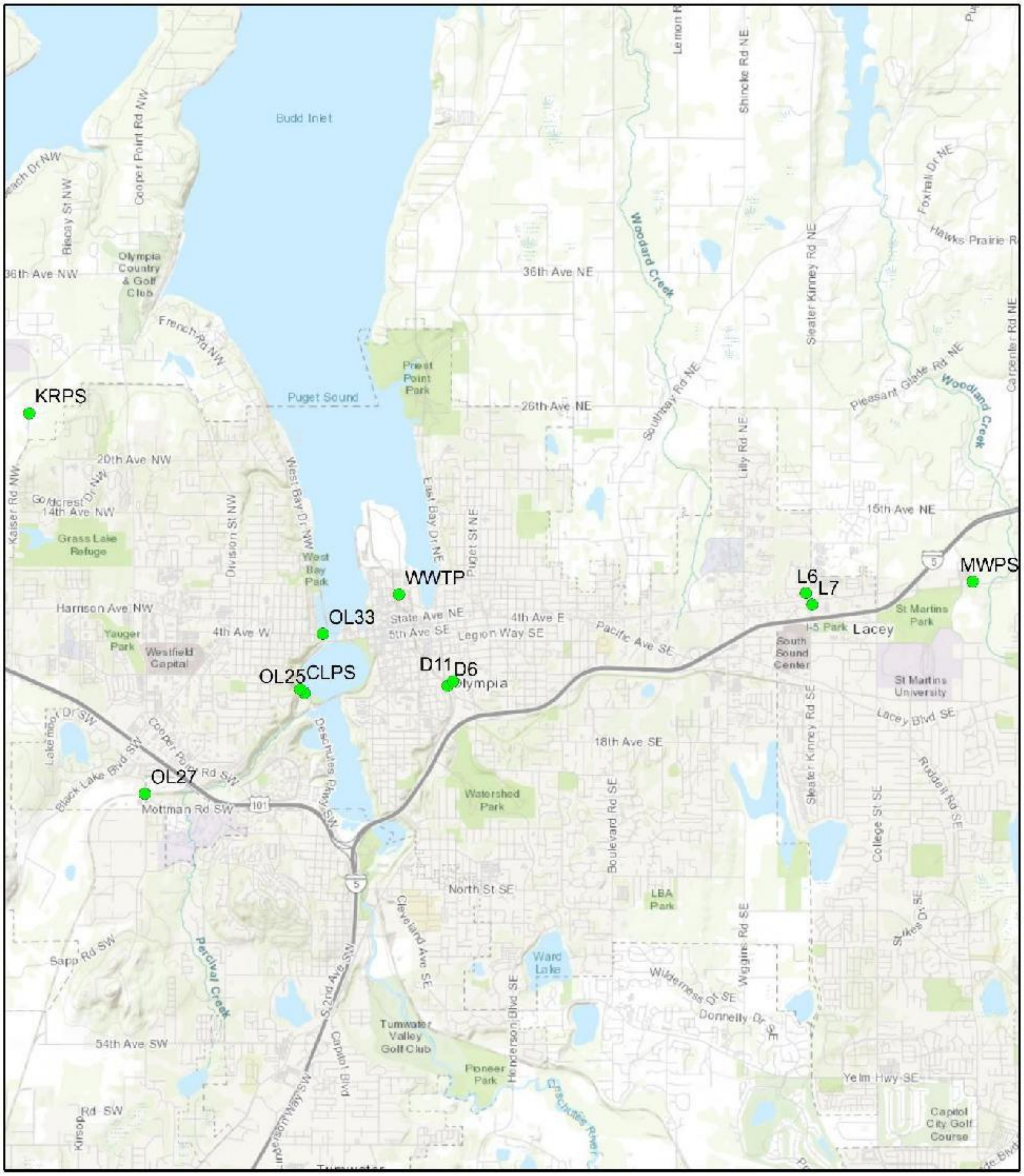
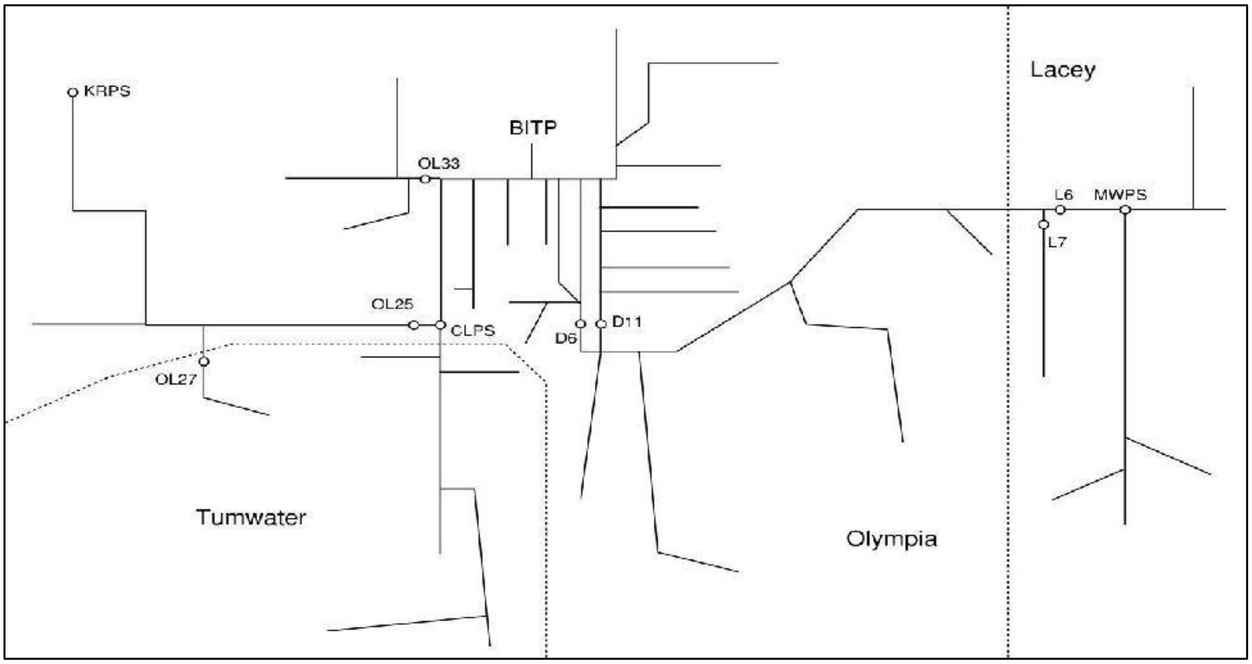


Figure 2. Connectivity of the LOTT Flow Monitoring Stations



Flows for each city were calculated using the seven permanent sites and four pump station sites as follows:

- Olympia = BITP – (OL27 + CLPS + L6 + L7) + OL25
- Tumwater = OL27 + CLPS – OL25
- Lacey = L6 + L7

Table 1. Flow Monitoring Sites, with Tributary Basins

Name	Maintenance Hole	Pipe Diameter	Location	Basins Served
OL25	MH70-246	30"	Private Drive off of Deschutes Parkway	54,55,57,58,64,65,66,67,68,69,70,71, TESC
OL33	SSMH9	24"	4th Avenue Bridge	56,59,60,61,62,63,
L6	MH70-200	30"	8468 Martin Way E. (Jack in the Box)	1,2,3,4,5,6,7,10,11,13,14,15,16,17
L7	MH70-205	24"	8503 Martin Way E. (Arco Station)	8,9,12
OL27	MH70-290	18"	Access Road East of Mottman Rd	69,70,71
D6	MH70-064	36"	1109 Plum St SE	These two pipelines are now connected, and combine to serve basins 1,2,3,4,5,6,7,8,9,10,11, 12,13,14,15,16,17,18,19,20,21,22,23,24, 25,26, 27,28,42
D11	MH70-041	36"	Plum and Union Parking Lot	
MWPS			Martin Way Pump Station	1,2,3,4,5,6,7,10,11,13,15,16,17
CLPS			Capitol Lake Pump Station	54,57,58,64,65,66,67,68,69,71,72,73,74, 75,76,78,79,80,81,82,83,85,86,TESC
KRPS			Kaiser Road Pump Station	54,TESC
WWTP			Budd Inlet Treatment Plant	1-22,24-54,56-69,71-76,78-3,85,86,TESC

Flow Measurement Methodology

The sewer flow monitoring sites installed by SFE Global consist of SFE Custom Compound Weirs or area-velocity meters. The SFE Weir is a variant of the V-notch type weir. Permanent flow monitoring sites feature a Lexan-bodied weir, while the rotating temporary sites contain weirs constructed of ¾-inch thick plywood. Flow was calculated by measuring the depth of water flowing over the weir, and then applying a rating curve, which was developed individually for each weir during installation and calibration. SFE Global maintains the sites on a monthly basis, during which time data is downloaded from on-site data logging equipment.

LOTT's Budd Inlet Treatment Plant (BITP) has both influent and effluent flow meters. The Martin Way Pump Station (MWPS) and Capitol Lake Pump Station (CLPS) have Doppler Ultrasonic, strap-on flow meters installed on the discharge piping. The Kaiser Road Pump Station (KRPS) monitors pump run-time, which is mathematically converted to gallons per minute (gpm) and ultimately to million gallons per day (mgd) ((gpm/60)*0.00144). These monitoring locations were integrated into the Budd Inlet Treatment Plant SCADA system in January 2005 and are now included in the I&I evaluation program.

Basin Summary

The 88 LOTT sewer basins were redefined as part of the 2014 Flows and Loadings Report based on sewer maps and basin realignments provided by the cities of Olympia, Lacey, and Tumwater. Seven basins are currently unsewered. Previously, of the sewered 81 basins, 27 were monitored with a single flow monitor located at a point downstream from all inputs into the basin, 32 were monitored by a flow monitor that gathers data from a group of several basins, and six were monitored individually with data gathered on the upstream and downstream ends of the basins, allowing for flow assessment by difference. I&I in the remaining basins was estimated through a system-wide regression model, which incorporated data from 58 temporary flow monitors and the four permanent flow monitors at the pump stations.

The current set of flow monitors is intended to track base flow and I&I in major interceptors. I&I in individual basins is estimated based on system connectivity and observations from the first 15 years of the flow monitoring program.

Flow Monitoring Site Summary

Table 2 lists attributes for the area served by each site monitored including the LOTT pump stations.

The equivalent residential units (ERU) values shown in Table 2 are based on 2023-2024 data and the inch-diameter-mile (IDM) values are based on 2021 data. IDM is a common way to express the relative size of a sewer system. It is calculated by multiplying the pipe length (in miles) by the pipe diameter (in inches).

Table 2. Flow Meter Basin Summary

Flow Monitor	Sewered Residents	Sewered Employees	ERU[1]	IDM[2]	Acres	% Sewered
OL25	18,332	18,281	9,437	842	5,817	84%
OL33	8,457	3,099	3,748	269	1,475	86%
L6	48,625	19,511	23,502	1,870	19,315	56%
L7	7,205	8,032	4,198	243	1,141	95%
OL27	4,128	3,876	2,156	172	2,047	82%
D6 + D11	76,789	45,251	38,064	3,304	28,132	60%
MWPS	47,832	18,738	23,056	1,837	18,157	59%
CLPS	36,781	38,634	19,431	1,524	18,142	71%
KRPS	1,729	160	715	37	294	81%
WWTP	133,401	110,422	68,350	5,767	50,577	66%

1. *ERU: Equivalent Residential Unit (see Flow and Loadings Report for more details)*
2. *IDM: Inch-diameter-mile of sewer pipe. The sum of each pipe segment of a particular diameter multiplied by its length (includes gravity and STEP sewers)*

Flow Monitoring Data

SFE Global's contracted data quality objectives were met 100% of the time during the 2023-2024 monitoring period. During this period, there was not a single data loss event resulting in a fee reduction.

Inflow and Infiltration Analysis

An I&I analysis was performed using the Capacity Assessment and Planning Environment (CAPE) modeling software, a wastewater forecasting and management tool provided by Brown and Caldwell. The record of observed flow data was plotted alongside a concurrent record of rainfall data. The model calculates flow based upon rainfall using a variety of hydrologic parameters. These parameters were calibrated until the model flows matched the observed flows over the period of record. Once calibrated, the model was applied to a long-term historical precipitation record (in this case, rainfall observed at the Olympia Regional Airport from 1955 to 2020). The long-term simulation produced risk-based estimates of the I&I flow over the full range of weather conditions contained in the historical rainfall record.

The CAPE calibration plot for the BITP is presented on Figure 3. This plot depicts flow monitored at the BITP (blue), rainfall (green), and modeled flow at the BITP (red). The model has been calibrated such that the modeled and observed flows match very closely.

Figure 3. BITP Model Calibration

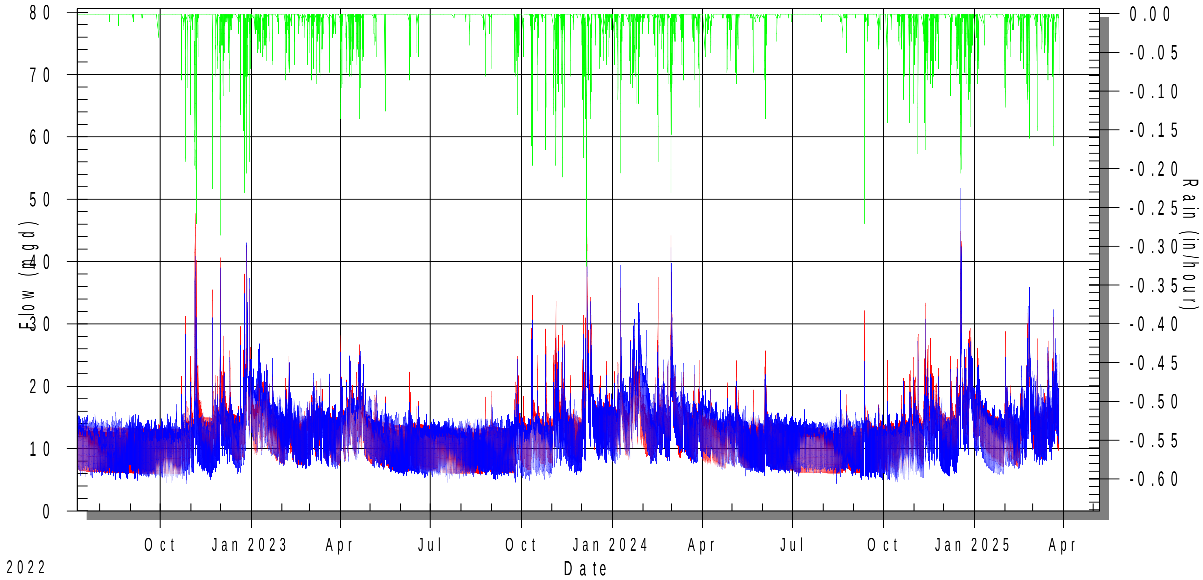
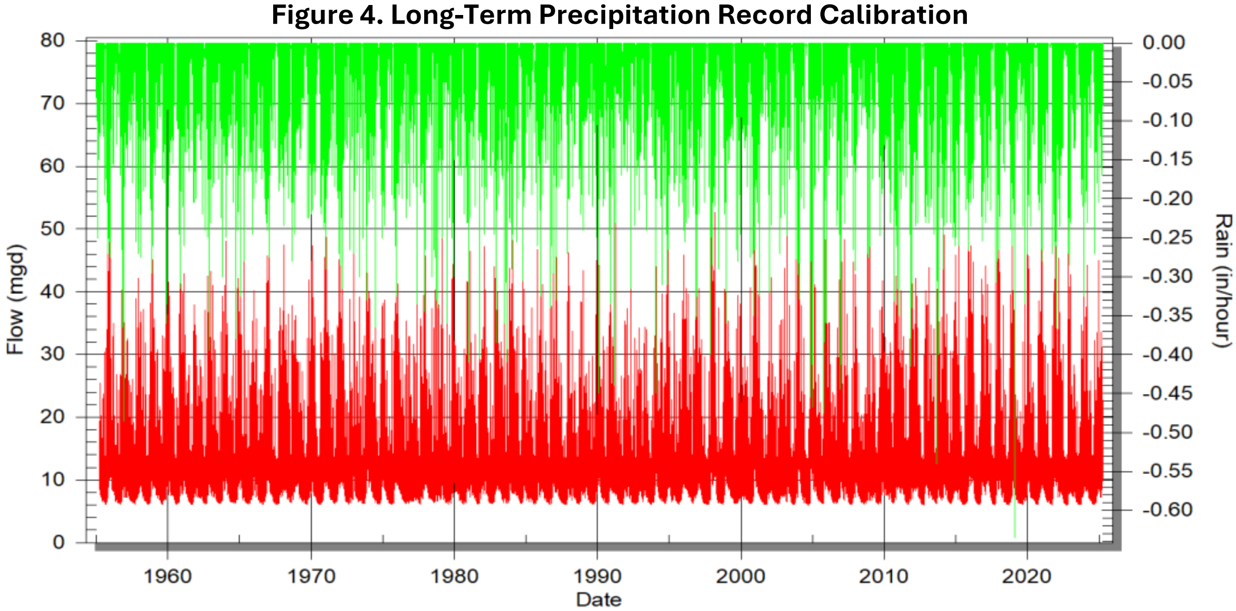


Figure 4 presents the model calibration from Figure 3 applied to the long-term precipitation record.

Figure 4. Long-Term Precipitation Record Calibration



The calibration data are used to calculate risk-based I&I estimates. LOTT uses a 10-year return period as the basis of its peak flow projections. A 10-year peak flow carries a 10% risk of being surpassed in any given year.

The CAPE model was used to calculate risk-based I&I for each of the flow monitoring sites and combinations presented in Table 3. These data are presented and analyzed in the next section.

Flow Data Analysis

This section describes the results of the analysis conducted using the flow data collected during the 2023-2024 monitoring season.

Summary of I&I Statistics for All Flow Monitoring Sites

A summary of the I&I results for each of the flow monitoring sites is provided in Table 3. The estimates show the amount over the base sanitary flow resulting from I&I.

Table 3. 2021-22 Flow Monitoring Sites Inflow and Infiltration Summary

Flow Monitor	Base Sanitary Flow (mgd)	Inflow and Infiltration (mgd)						
		Average Annual	10-year Peak Month	10-year Peak Day	10-year Peak Hour	Summer[1]	Shoulder[2]	Winter[3]
OL25	1.60	0.53	1.61	3.92	4.79	0.18	0.44	0.88
OL33	0.375	0.60	2.50	11.60	17.45	0.19	0.48	1.00
L6	2.60	0.23	0.63	2.07	4.49	0.09	0.20	0.37
L7	0.75	0.17	0.47	0.85	1.74	0.06	0.14	0.27
OL27	0.75	0.26	0.83	1.80	2.31	0.08	0.21	0.44
D6 + D11	5.25	0.25	0.64	3.52	7.18	0.10	0.22	0.38
MWPS	2.85	0.25	0.71	1.70	5.17	0.09	0.21	0.41
CLPS	2.80	0.84	2.48	6.29	7.82	0.29	0.69	1.37
KRPS	0.060	0.03	0.10	0.36	0.75	0.01	0.03	0.06
WWTP	10.60	3.32	10.36	36.50	56.84	1.09	2.71	5.49

1. *Summer (June-September)*
2. *Shoulder (April, May, and October)*
3. *Winter (November-March)*

Analysis of Inflow and Infiltration

There are a number of ways to assess the quality and integrity of the sewer system. Some of the most commonly used methods involve a calculation of I&I per inch-diameter-mile (IDM) of pipe, I&I per ERU, and the ratio of the peak hour flow to the base flow. The pipeline IDM calculations were updated in 2022 with geodata information received from the cities.

Statistics such as I&I per IDM are compared against benchmarks to determine the relative magnitude of I&I at each flow monitor, and within each sewer basin. The LOTT benchmarks were established in 2007 and represent the top 33rd percentile of I&I measures across all of the basins at that time. That is, two-thirds of the LOTT basins exhibited I&I parameters worse than these benchmarks in 2007.

Table 4. LOTT Sewer Basin I&I Benchmarks

Average Annual I&I per ERU	20	gpd/ERU
Peak Month I&I per ERU	50	gpd/ERU
Peak Day I&I per ERU	150	gpd/ERU
Peak Hour I&I per ERU	250	gpd/ ERU
Average Annual I&I per IDM	200	gpd/IDM
Peak Month I&I per IDM	500	gpd/IDM
Peak Day I&I per IDM	1,500	gpd/IDM
Peak Hour I&I per IDM	2,400	gpd/IDM
Peak Hour Flow to Base Flow Ratio	2.5	

I&I varies greatly between cities, and in different parts of the country. Arid locations often have very low levels of I&I, while areas near rivers may have very high I&I. There are relatively few nationwide or industry-standard benchmarks to offer a basis of comparison. EPA has established benchmarks for "excessive I&I", at 1,500 gpd/IDM for dry weather flow, and 275 gpd/person for wet weather flow (given household sizes in the LOTT service area, the latter would equate to approximately 638 gpd/ERU).

The LOTT benchmarks, intended to represent targets for a tight, relatively leak-proof system, are well below those levels. Table 5 summarizes these statistics for each of the flow monitors.

Table 5. Summary of I&I Statistics

Flow Monitor	Annual Average I&I/ERU (gpd)	Peak Day I&I/ERU (gpd)	Peak Hour I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Day I&I/IDM (gpd)	Peak Hour I&I/IDM (gpd)	Peak Hour Flow/Base Flow (mgd)	Benchmark Ratio[1]
OL25	57	416	508	635	4,656	5,693	4.0	170
OL33	159	3,095	4,657	2,217	43,143	64,916	47.5	668
L6	10	88	191	124	1,106	2,401	2.7	27
L7	40	203	414	684	3,503	7,159	3.3	113
OL27	122	834	1,070	1,524	10,456	13,412	4.1	384
D6 + D11	6	92	189	75	1,065	2,174	2.4	17
MWPS	11	74	224	138	927	2,815	2.8	31
CLPS	43	324	403	550	4,130	5,133	3.8	128
KRPS	49	498	1,055	943	9,663	20,486	13.6	142
WWTP	49	534	832	576	6,330	9,857	6.4	152
Benchmark[2]	20	150	250	200	1,500	2,400	2.5	1.0

1. *The benchmark ratio is the average value of seven ratios, corresponding to the first seven columns of the table (starting with average annual I&I/ERU and ending with the peak hour flow/base flow). The value in this table is divided by the benchmark. For example, the benchmark ratio at site OL25 is the average of the following values: {50/20; 404/150; 555/250; 537/200; 4,363/1,500; 5,987/2,400; 4.4/2.5} = 2.65.*
2. *I&I benchmarks were established in the 2007 LOTT Inflow and Infiltration Report.*

Table 6. Summary of I&I Statistics (Cities)

City	Annual Average I&I/ERU (gpd)	Peak Day I&I/ERU (gpd)	Peak Hour I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Day I&I/ID M (gpd)	Peak Hour I&I/IDM (gpd)	Peak Hour Flow/Base Flow (mgd)	Benchmark Ratio[1]
Olympia	83	1,032	1,589	842	10,504	16,171	8.8	265
Tumwater	47	343	439	663	4,886	6,249	4.3	140
Lacey	14	105	225	188	1,382	2,948	2.9	40
System	49	534	832	576	6,330	9,857	6.4	152
Benchmark	20	150	250	200	1,500	2,400	2.5	1.0

For existing pipe, the amount of I&I will vary widely depending on the age of pipe, local maintenance standards, and most importantly, the degree of sewer separation (i.e. whether downspouts are strictly disconnected or whether any sewer to storm pipe cross-connections exist) during the original design of the collection system. Benchmark values for the cities did not change from the previous analysis.

Site Assessments

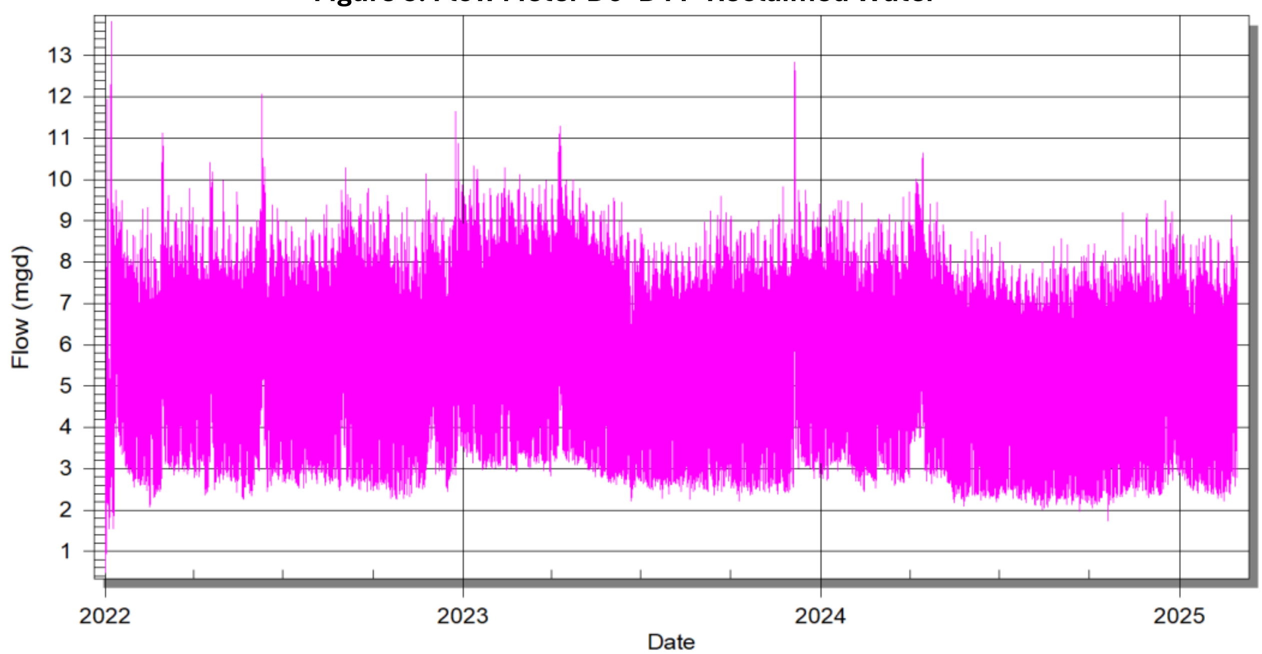
The following sections discuss the flow records and I&I model results at each site.

Sites D6 and D11

Flow from the Indian Creek Interceptor (all of Lacey and southeast Olympia) is mostly directed to the Cherry Street Interceptor, which is monitored at site D6. The Plum Street Interceptor is located nearby, conveying flow from Henderson Street and the North Avenue Basin in Southern Olympia. The Plum Street Interceptor is monitored at site D11. There is a 12-inch overflow connection which allows a small portion of flow from the Indian Creek Interceptor to flow into the Plum Street Interceptor. Because of this interconnection, flows from sites D6 and D11 cannot be considered separately.

Site D6 takes most of the flow, with a base flow averaging 3.3 mgd, compared to 0.70 mgd at site D11. Figure 5 shows the combined flow, plus the flow treated at the MWRWP, which comprised the full flow generated within the tributary basins.

Figure 5. Flow Meter D6+D11+Reclaimed Water



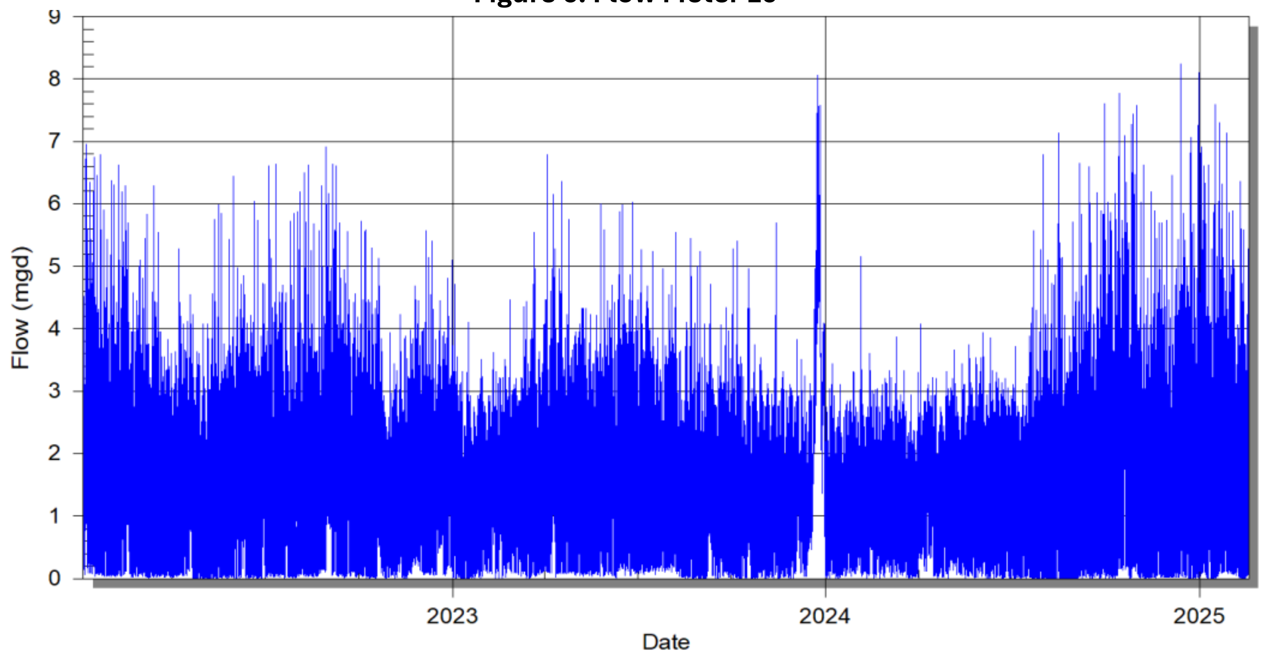
There is relatively little I&I in these basins, with an overall benchmark ratio of 0.60. The peaks and valleys observed in the dataset are mostly diurnal variation.

Site L6

The flow monitor at site L6 measures flows generated in east Lacey. This site's benchmark ratio is 0.72, indicating a tight sewer system with low I&I.

The flow record on Figure 6 features frequent spikes, much of which is related to weekend versus weekday peaking (weekend peak flows are 20-30 percent higher than weekday peak flows). Flow peaks are often rainfall-independent, and regular diurnal peaks are typically higher than rainfall-derived peaks. The large peak observed in December 2023 was related to weir blockage.

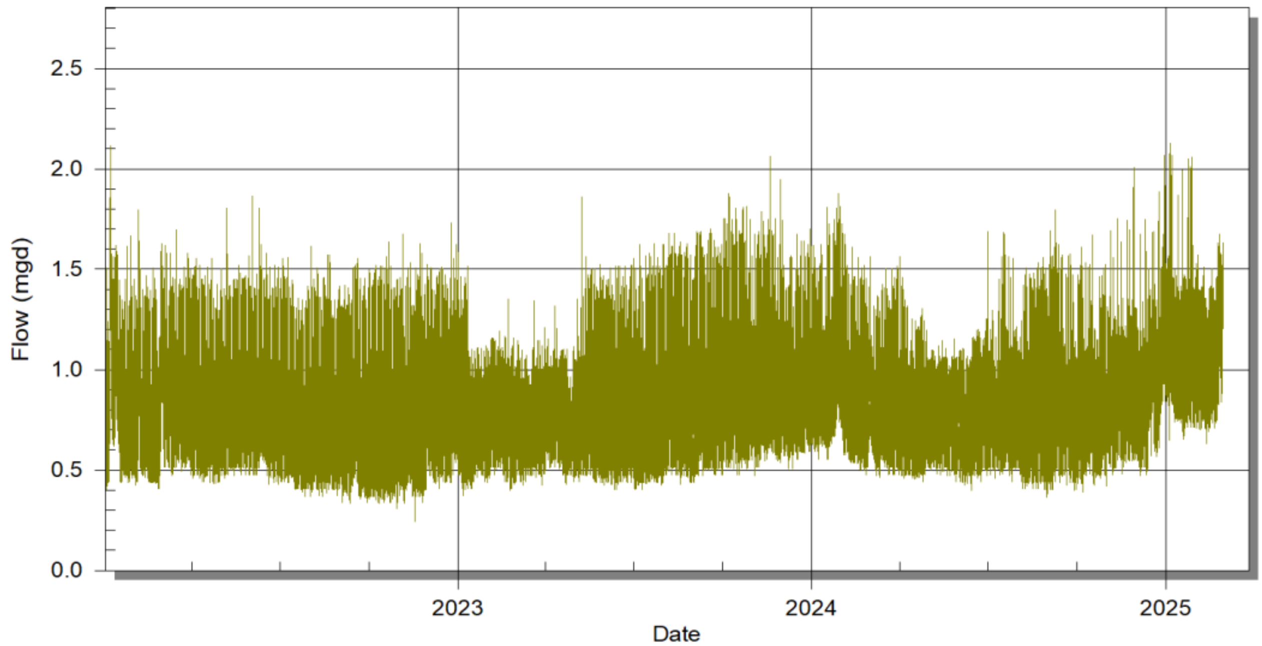
Figure 6. Flow Meter L6



Site L7

The flow monitor at site L7 measures flow generated in south Lacey. The benchmark ratio for this site is 2.4, higher than L6 but less than the overall system average of 3.3. The benchmark ratio for L7 increased slightly from the last report (2.1). This area of Lacey exhibits a substantial amount of I&I, strongly correlated to precipitation. The flow pattern is strongly influenced by upstream pumping, and changes to pump operation can result in noticeable changes in the flow pattern, as observed in early 2023.

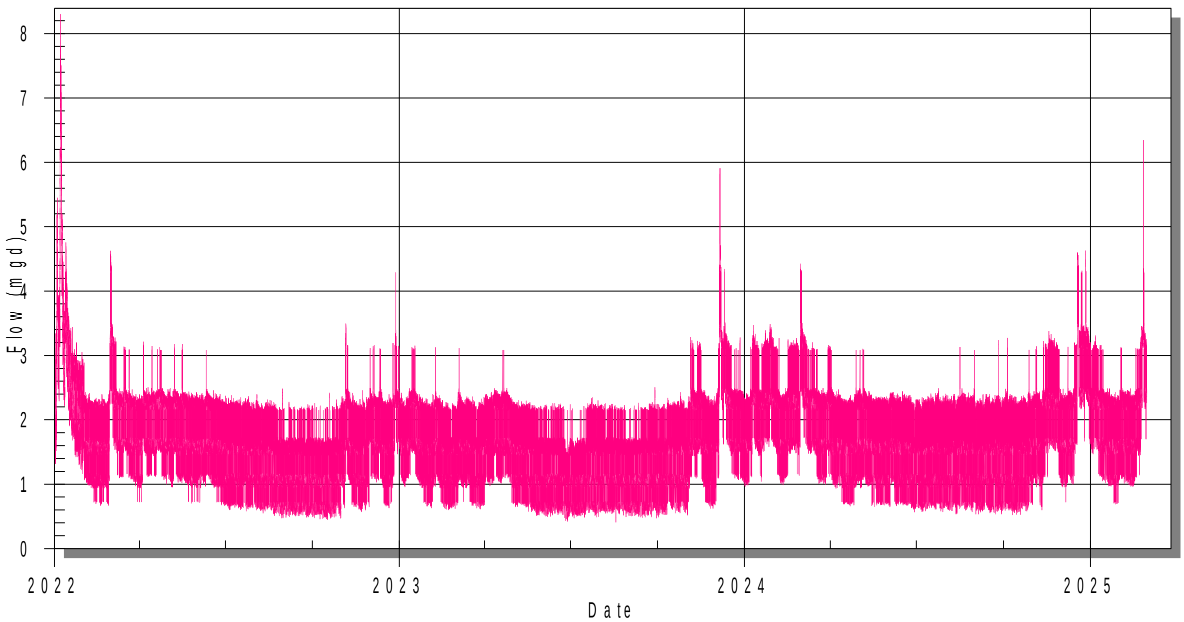
Figure 7. Flow Meter L7



Site OL25

Site OL25 monitors flow generated in west Olympia and northern Tumwater. The flow monitor is located on the Percival Creek Interceptor upstream of the Capitol Lake Pump Station. The benchmark ratio remained relatively unchanged at 2.8. As with other sites, this site is highly impacted by upstream pumps. This is demonstrated by the stepwise changes in flow observed during the winter months.

Figure 8. Flow Meter OL25

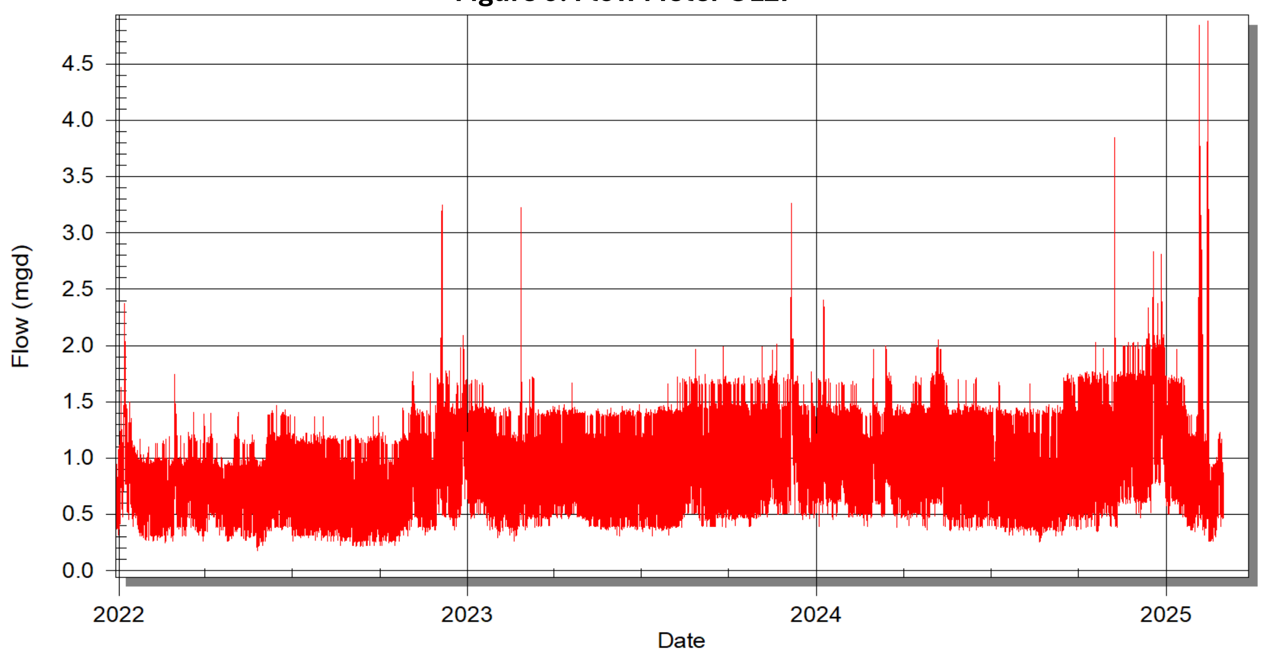


Site OL27

OL27 measures flow from Tumwater on the downstream end of the Mottman Road Interceptor. The benchmark ratio for OL27 increased sharply from 4.3 to 6.1. Base flow has been increasing as well, from 0.40 mgd in 2018-21 to 0.75 mgd in 2024, a 75% increase. Given that this site monitors flow generated in the Mottman Industrial Zone, it is likely that some of this flow is point source flow from local industry. Seasonal contributions from South Puget Sound Community College also complicate the I&I calculation in this basin.

The flow pattern at this site is unusual, in that weekend flows are 5 percent lower than weekday flows. This reflects the commercial/industrial nature of the basin. I&I in this basin is rainfall-dependent, with little evidence of rainfall-independent peaking. The flow record shows the gradual increase in I&I, much of which is tempered by upstream pump station operation. As those pumps have increased in size, the spikes observed at OL27 have increased accordingly. This may be described as “secondary I&I” or indirect I&I caused by pumping. Nevertheless, the increase in flow magnitude and frequency suggests that both base flow and I&I are increasing within this basin.

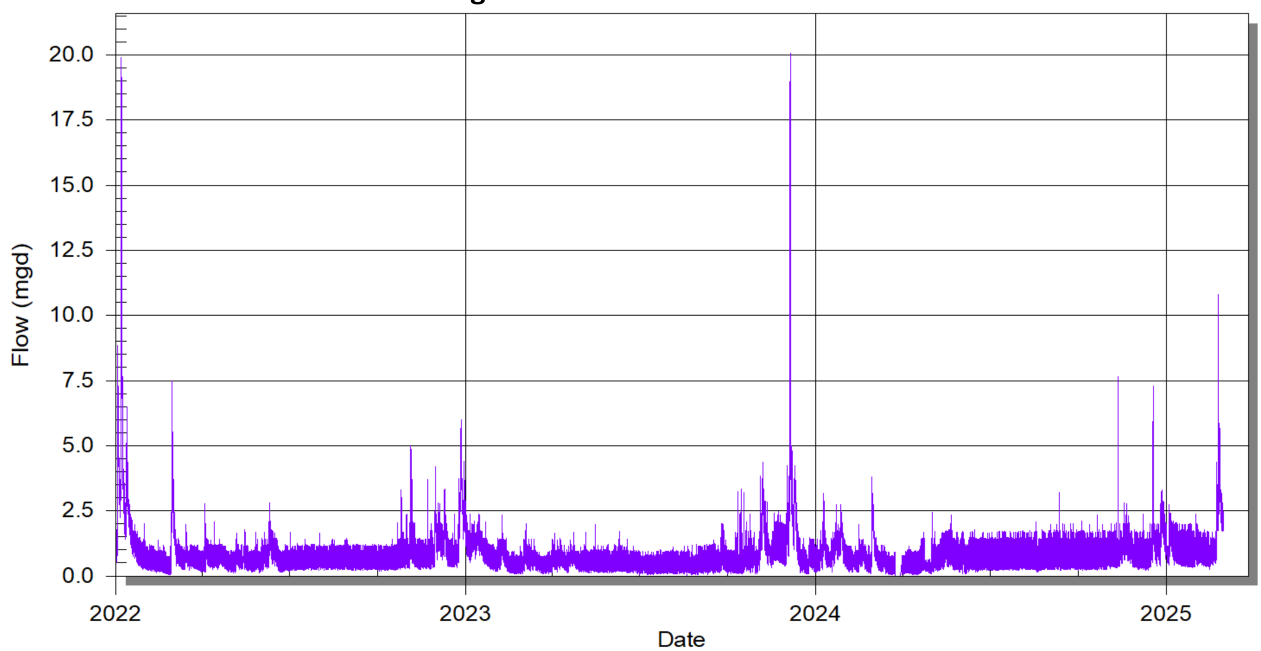
Figure 9. Flow Meter OL27



Site OL33

The OL33 flow meter is located at the 4th Avenue Bridge and measures flow from northwest Olympia. The benchmark ratio at this site was slightly higher, increasing from 17.3 to 18.4. This site historically has recorded high levels of I&I related to older clay pipes on the West Side. Flow during the January 2022 storm event peaked close to 20 mgd.

Figure 10. Flow Meter OL33



System-Wide

The system-wide I&I is largely a known quantity. Projections tend to vary slightly from year to year, which reflects some of the sensitivity of the model to variables such as groundwater which vary independently, or at least on a larger time scale, from I&I. In the big picture, system-wide I&I appears to be trending slightly upward, which is what one would expect as the service area expands and infrastructure ages. Figures 11 and 12 plot the system-wide I&I over the last 20 years.

Figure 11. System-wide I&I Trends

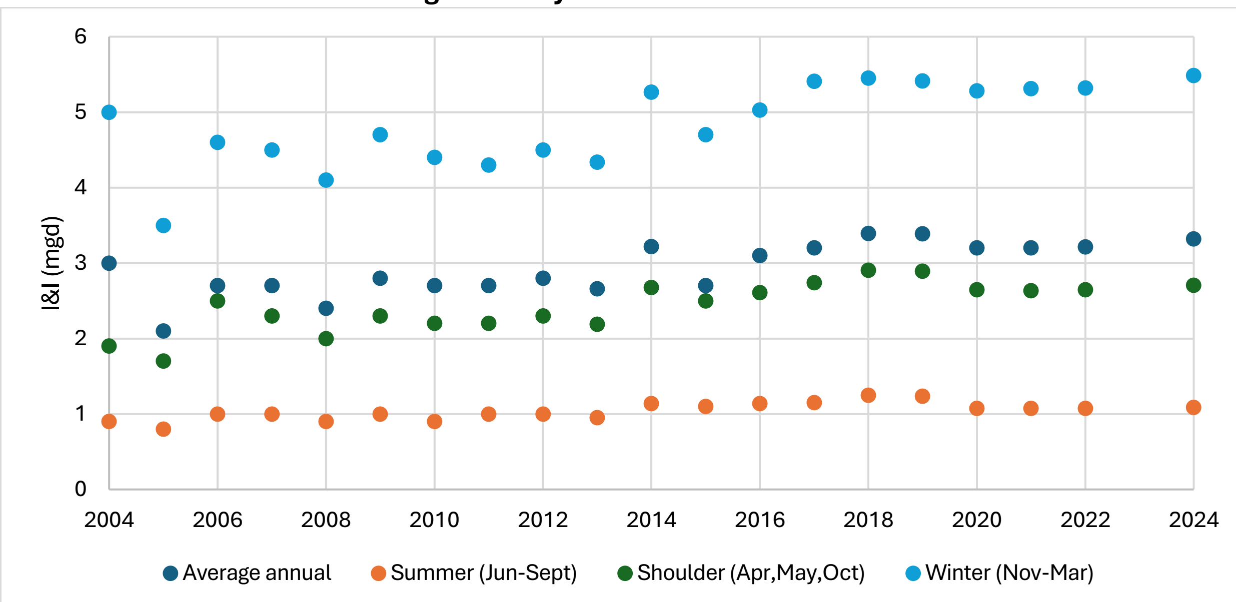
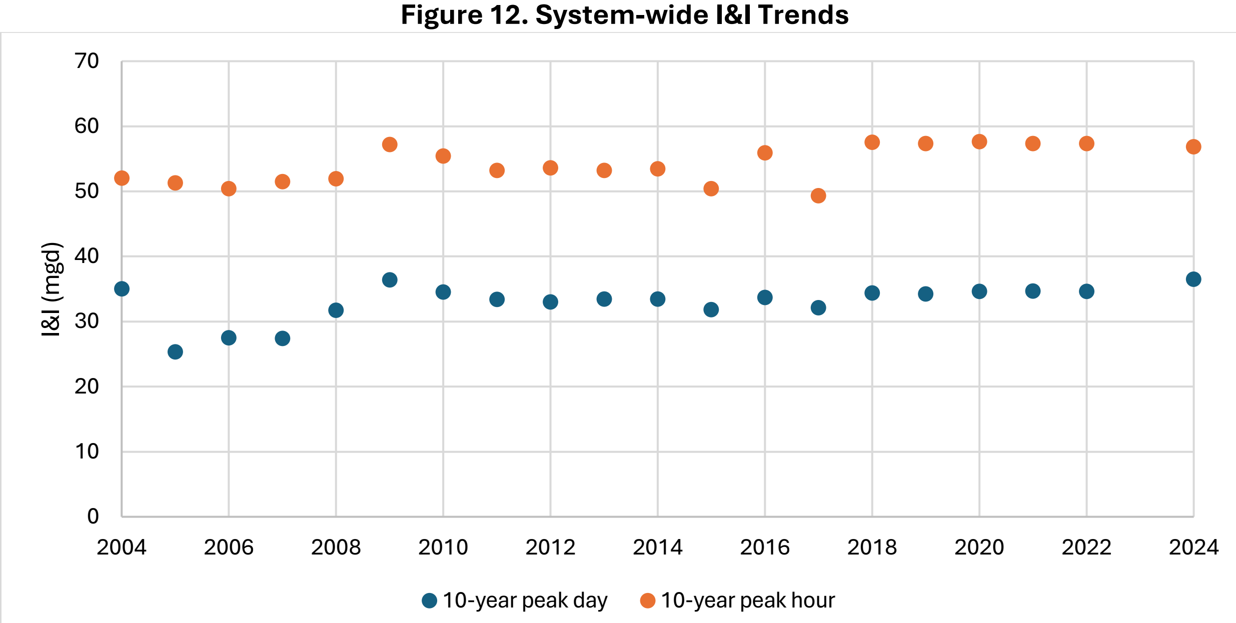


Figure 12. System-wide I&I Trends



Updated I&I Model

The first 15 years of rotating flow meters established a breakdown of how much I&I each sewer basin contributed to the whole city. The current position of flow meters strategically measures flow from each city. Using the previous modeling efforts and I&I approximations, individual basin I&I can be estimated from the total city I&I. Inflow and infiltration estimates for each flow meter are translated to basin I&I estimates by first calculating the percentage of I&I each basin contributes to each city. This percentage is then applied to this year's flow measurements resulting in an estimate of I&I from each basin. Table 7 summarizes the basin I&I statistics.

Table 7. Basin I&I (gpd)

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
1	L	Hawks Prairie	104,857	279,240	811,781	1,445,382	40,933	103,380	179,324
2	L	Meridian	18,781	62,229	165,140	336,976	9,676	22,342	34,986
3	L	Meadows	11,892	17,341	29,130	76,496	1,978	6,681	14,361
4	L	Lacey STEP	11,892	16,125	29,130	76,496	3,132	10,055	14,361
5	L	SE Corner	11,892	16,041	29,130	76,496	1,758	3,779	13,387
6	L	Horizon View	2,941	29,892	127,750	505,829	2,453	3,674	7,636
7	L	Ruddell	2,941	41,166	127,750	325,136	2,066	5,628	7,636
8	L	S Chambers Lake	16,120	74,280	224,647	522,294	3,979	10,301	28,547
9	L	N Chambers Lake	27,679	64,734	189,318	523,195	10,694	21,527	39,293
10	L	Lacey Blvd	14,946	48,012	243,877	567,003	4,795	11,549	23,576
11	L	Lacey Confluence	19,781	55,162	105,879	243,336	7,521	16,526	29,367
12	L	South Sound Center	91,529	263,787	445,725	754,744	33,143	70,203	145,519
13	L	St. Martins	11,892	17,484	29,130	76,496	4,286	9,987	14,361
14	L	Chinook	10,623	14,851	26,633	64,912	4,640	7,334	10,506
15	L	Britton Pkwy.	13,175	43,901	111,334	203,011	6,182	14,394	24,905
16	L	N Tanglewilde	13,175	30,038	111,334	189,076	3,805	6,909	24,905
17	L	S Tanglewilde	13,175	31,165	111,334	241,966	3,329	14,010	24,905
18	O	Motel 8	18,265	55,586	80,235	110,543	5,169	13,965	32,298
19	O	Lilly Rd.	18,265	55,586	80,235	110,543	5,169	13,965	32,298
20	O	South Bay Rd.	879	1,242	1,430	1,437	957	1,158	1,177
21	O	Fones	84,306	262,908	574,733	690,329	31,963	76,899	150,228
22	O	Boulevard	20,695	63,560	87,689	87,331	11,642	25,400	43,443
23	O	Wiggins	-	-	-	-	-	-	-
24	O	Indian Summer	8,900	20,065	104,610	175,112	4,536	8,828	15,420

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
25	O	South Boulevard	19,528	58,512	94,449	119,705	8,191	18,180	34,365
26	O	Henderson	8,900	33,759	104,610	146,075	3,299	8,397	15,420
27	O	North St.	28,103	87,742	383,023	659,797	10,665	25,308	49,280
28	O	Indian Creek	8,488	28,044	76,870	109,339	3,090	7,605	15,409
29	O	SE Downtown	100,768	276,471	410,155	565,084	32,426	77,807	152,996
30	O	Priest Point	219,756	397,915	902,331	1,243,170	46,669	111,984	220,202
31	O	San Francisco	154,829	529,093	1,613,300	2,120,596	54,995	136,020	280,590
32	O	NE Downtown	8,013	41,888	445,754	2,000,470	2,651	3,873	15,117
33	O	Bigelow	28,637	81,827	235,238	305,017	12,268	27,027	48,260
34	O	Puget St.	6,095	17,973	163,731	304,930	1,859	4,208	8,288
35	O	Bigelow Springs	6,095	17,973	163,731	304,930	1,859	4,208	8,288
36	O	State Ave.	6,095	18,062	164,994	307,235	1,957	4,300	8,373
37	O	Lybarger	8,013	30,647	426,695	593,113	2,141	8,284	15,117
38	O	4th Ave. E	11,583	39,547	185,895	339,427	4,177	10,228	20,920
39	O	5th Ave. E	8,013	49,311	519,266	719,602	2,753	7,638	15,117
40	O	Pear	13,767	40,573	369,371	687,936	4,306	9,606	18,797
41	O	Plum	142,049	498,787	1,727,766	2,369,116	50,139	121,986	252,169
42	O	I-5 Interchange	7,101	25,638	150,359	409,818	2,720	7,557	15,531
43	O	Stevens Field	62,131	232,274	1,689,609	3,975,550	21,815	54,552	110,901
44	O	S Capitol 24th	14,506	44,147	276,289	583,635	3,225	24,030	28,288
45	O	S Capitol 22nd	8,257	61,087	478,910	1,288,660	920	5,134	17,449
46	O	S Capitol 17th	16,859	33,429	310,853	625,545	9,259	12,177	18,499
47	O	State Capitol	15,977	60,278	310,853	571,799	9,571	13,362	28,076
48	O	N Capitol Campus	16,075	50,408	282,852	337,705	3,641	9,590	26,381
49	O	State Offices	22,927	80,648	475,608	912,098	8,463	20,571	41,413
50	O	Central Downtown	102,343	335,708	1,834,278	3,679,362	38,378	91,473	180,511
51	O	Sylvester	129,448	434,647	2,989,792	4,893,303	51,335	120,398	231,365
52	O	Heritage Park	125,575	504,582	2,859,749	3,079,966	11,419	53,994	268,203
53	O	Port Peninsula	13,767	40,573	369,371	687,936	4,306	9,606	18,797
54	O	Cedrona	9,771	20,697	38,853	58,898	5,633	8,080	12,224
55	O	Westwood	-	-	-	-	-	-	-
56	O	Old Port	80,407	267,019	787,963	940,918	31,233	74,990	147,854
57	O	Cooper Point	58,913	185,423	320,804	412,708	9,609	48,532	107,441
58	O	Goldcrest	42,571	125,389	285,002	401,384	5,012	22,811	52,994
59	O	West Bay	16,903	63,404	148,367	204,410	3,261	12,818	34,132
60	O	West Side	53,231	168,891	748,374	1,031,059	15,633	56,927	73,465

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
61	O	Jefferson	243,925	861,429	2,619,600	3,072,365	101,651	227,267	420,131
62	O	Harrison	18,209	84,697	498,646	687,001	5,864	14,783	34,199
63	O	Decatur Woods	53,131	179,988	549,007	665,323	19,561	47,389	96,484
64	O	Grass Lake	39,437	45,276	157,607	217,140	5,310	12,742	25,056
65	O	West Olympia	2,790	7,650	14,110	23,880	1,157	2,127	4,189
66	O	Capital Mall	37,603	146,008	446,231	494,249	7,893	28,298	54,709
67	O	Percival Creek	15,349	72,655	214,403	251,914	3,987	16,141	28,863
68	O	Ken Lake	109,361	351,931	814,260	789,102	41,953	96,426	197,868
69	O	Mottman	93,640	305,367	696,142	736,988	23,632	74,285	165,045
70	T	N Black Lake	-	-	-	-	-	-	-
71	T	Sapp	223,459	613,145	1,202,735	1,405,625	89,964	197,070	378,683
72	T	Tumwater Hill	130,462	424,362	1,174,673	1,402,454	36,093	100,789	213,223
73	T	E Street	8,405	26,461	60,667	67,118	2,661	6,239	14,941
74	T	H Street	6,758	23,593	50,084	65,595	2,284	4,926	12,130
75	T	Barnes Lake	17,973	61,973	123,318	164,736	5,853	14,032	29,554
76	T	NE Tumwater	33,987	100,782	218,295	341,931	10,292	27,205	53,734
77	T	Tumwater Valley	172	558	1,408	1,955	48	134	281
78	T	Southgate	96,953	272,554	762,939	1,139,193	28,876	79,314	149,177
79	T	Trosper	3,791	12,279	46,134	59,384	2,387	2,957	6,175
80	T	Littlerock	7,792	24,349	64,022	116,334	2,376	6,214	12,867
81	T	Tumwater City Hall	7,195	28,864	93,368	113,970	1,709	5,103	11,850
82	T	Trails End	7,195	28,864	93,368	113,970	1,709	5,103	11,850
83	T	Hwy 99	7,195	28,864	93,368	113,970	1,709	5,103	11,850
84	T	Airport	-	-	-	-	-	-	-
85	T	S Airport	7,195	28,864	93,368	113,970	1,709	5,103	11,850
86	T	Kimmie	7,195	28,864	93,368	113,970	1,709	5,103	11,850
87	T	Salmon Creek	-	-	-	-	-	-	-
88	T	Black Lake	-	-	-	-	-	-	-
TESC		The Evergreen State College	16,260	50,718	128,794	177,444	4,122	9,634	24,561

I&I Benchmarks and Basin Ranking

The intergovernmental agreement which established the LOTT I&I program includes a non-degradation clause. Based upon this clause, LOTT will annually evaluate I&I in each of its sewer basins. If the amount of I&I in a basin is found to be significantly increasing, LOTT and its partners will prioritize work in that basin to remedy the situation. In order to provide a measure which can be tracked on an annual basis, LOTT established its I&I benchmarks in 2007 (Table 4).

Each city served by LOTT is compared with the benchmark in each of the nine categories. A benchmark average is then calculated, which provides a representation of how each city compares to the benchmark. Table 8 compares the last three years of benchmarks for Olympia, Tumwater, Lacey, and the system as a whole.

Table 8. City Benchmarks

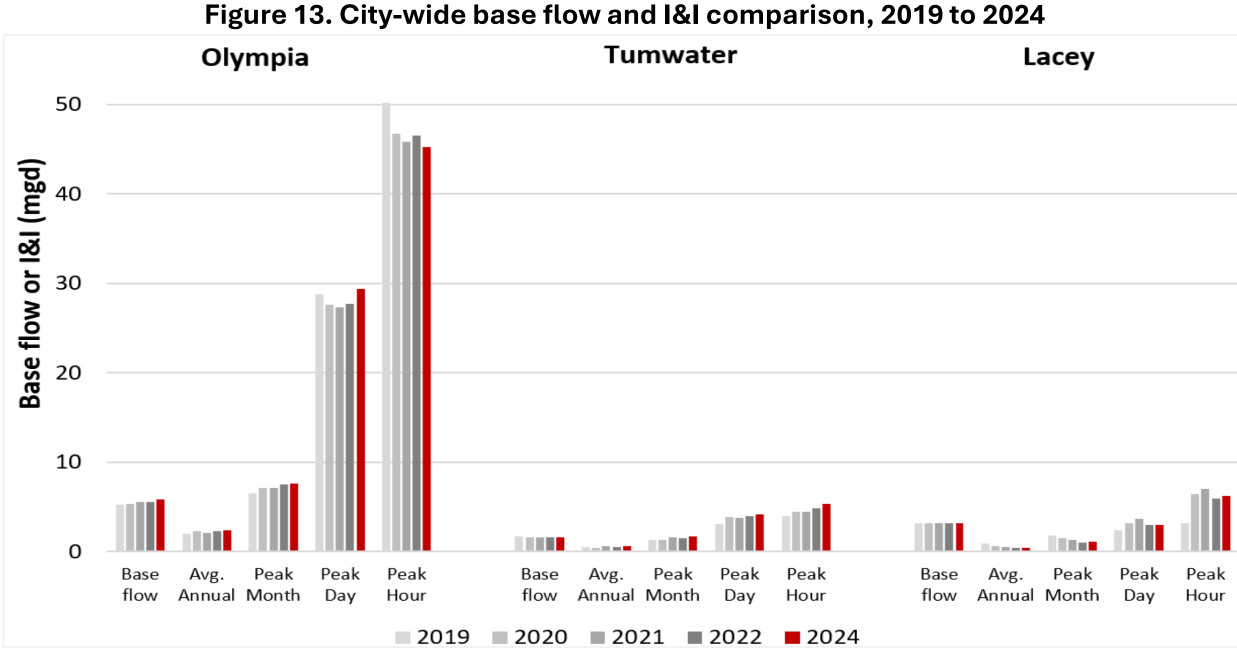
Flow Monitor	2015	2016	2017	2019	2020	2021	2022	2024
Olympia	5.9	6.0	6.4	5.4	5.4	5.4	5.6	5.5
Tumwater	2.2	2.1	2.3	2.2	2.2	2.6	2.5	2.7
Lacey	0.9	1.0	1.2	1.1	1.1	1.1	0.9	0.9
System	3.5	3.5	3.8	3.3	3.3	3.3	3.3	3.3

Overall, the system benchmark ratio was 3.3, which has not changed since 2019. In general, the benchmarks remained relatively unchanged since the last analysis.

Comparison of base flow and I&I from 2019 to 2024

Figure 13 compares the city-wide flows and I&I projections.

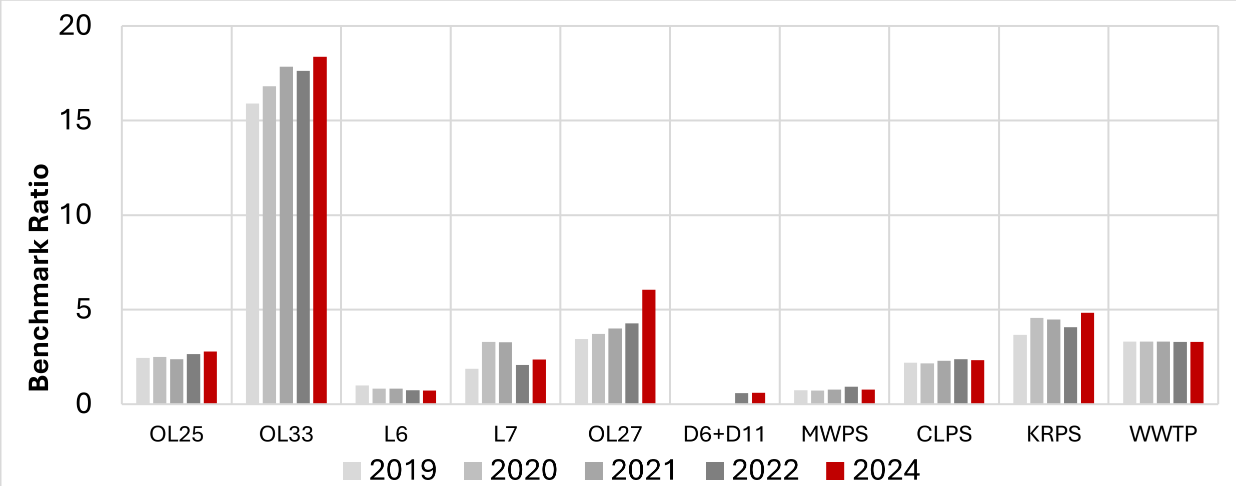
Figure 13. City-wide base flow and I&I comparison, 2019 to 2024



The year-to-year changes from city to city were relatively small. Total I&I recorded in the three cities remains stable.

Figure 14 presents the change in the I&I benchmark ratio between the 11 specifically monitored sites between 2019 and 2022.

Figure 14. Change in I&I, 2019 through 2024



I&I benchmarks have remained stable at most sites. The main change was observed at OL27. This appears to be largely related to changes in upstream pump stations. As those pump stations increase pump capacity, the spikes at OL27 have increased. Clearly, flow and I&I in the basin drained by OL27 have been increasing. I&I at site OL33 also shows an increasing trend, which will need to be monitored.

Analysis

This section provides analysis of flows at selected sites, particularly those which exhibited changes from previous reports, or those which experienced notable events.

MWPS

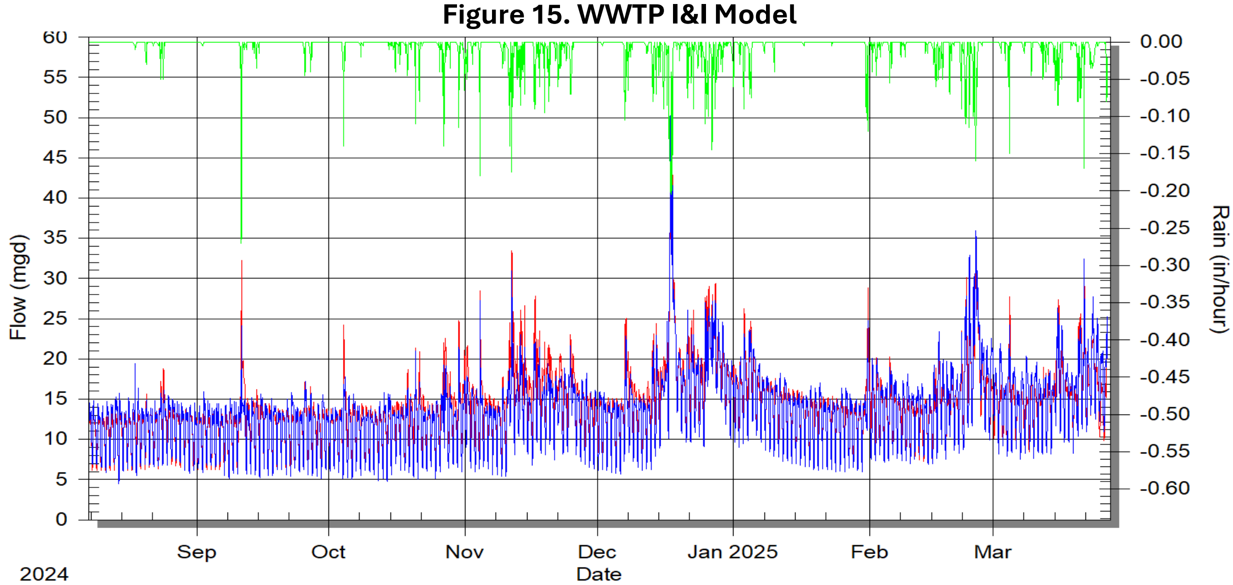
The 2020 I&I Report included an extensive analysis of I&I at the MWPS. The conclusion was that both rainfall-induced I&I and rainfall-independent peaking contribute to peak flows at this location. Rainfall-independent peaking is generally associated with operation of fill-and-draw lift stations, and the likelihood of multiple upstream pump stations pumping at the same time. An analysis of 10 years of historical data determined that the peak hour flow at the MWPS was approximately 6.3 mgd, as measured in both February 2019 and October 2015—periods with high rainfall totals.

Since that time, several larger flow events have been confirmed at the MWPS. These include a flow of 7.9 mgd on 1/6/22 and 8.5 mgd on 10/10/23. A peak hourly flow of 8.0 mgd is being used to project pump station flows into the future.

WWTP

The I&I pattern at the BITP tends not to vary much from year to year. The model fit remains very good. There were relatively few major storm events from 2023-2024, so most of the I&I models are still largely based on the 2021-22 season storms. Figure 15 shows the model fit for the most recent period. The model tends to overestimate I&I peaks in the early wet season but is very accurate for larger peaks. As the intent of the model is to be conservative, this is acceptable.

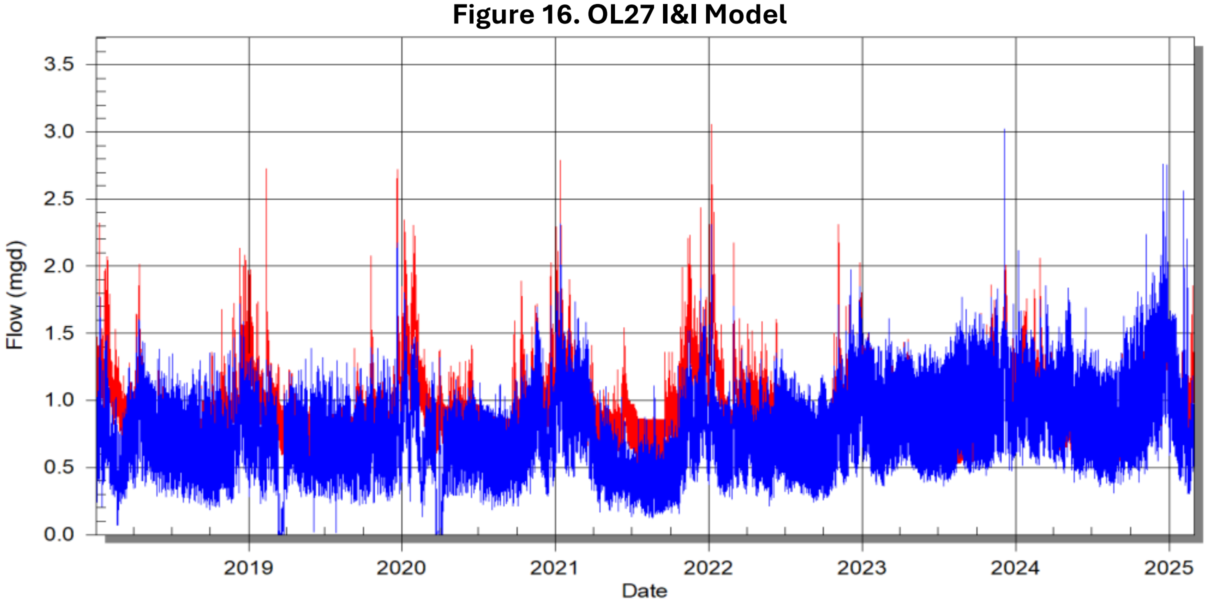
Figure 15. WWTP I&I Model



OL27

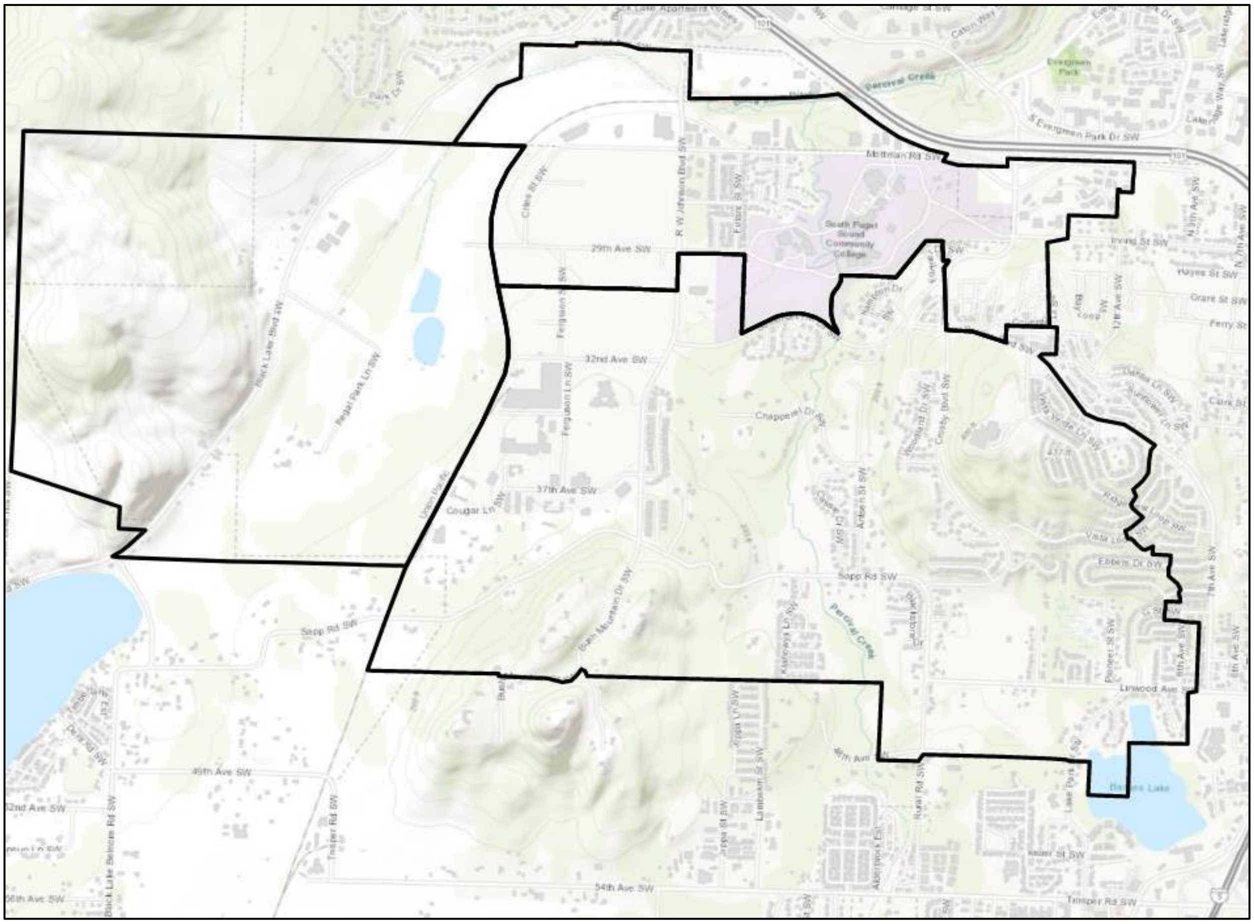
I&I at site OL27 appears to be increasing. Figure 16 uses the current model to predict flows from 2018-24. Notice how much the current model over-predicts flows in the 2018-2022 period, shown by the preponderance of red. The same projection made using the 2019 model, for example, would provide a good match to 2019 flows, but would underpredict current flows. The model has changed to simulate increased amounts of I&I. This is quantified by the increase in the benchmark ratio from 3.4 in 2019 to 4.3 in 2022 and 6.1 in this report.

Figure 16. OL27 I&I Model



The OL27 basin serves most of northwest Tumwater north of 54th/Trosper but excludes the northeast slopes of Tumwater Hill (Figure 17).

Figure 17. OL27 Tributary Area



Conclusions and Recommendations

1. I&I benchmarks in the three cities are very similar to those reported in last year's report.

2. The City of Tumwater should be aware of increasing I&I in this basin. It is unclear if the increase is related to new or existing pipe. I&I analysis in this basin is complicated by the presence of the industrial district, SPSCC, and a rapidly expanding population.

CAPACITY REPORTS 2025

FLOWS & LOADINGS

I&I/FLOW MONITORING

CAPACITY ASSESSMENT

LOTT Clean Water Alliance

2024 Capacity Assessment Report

May 2025

Prepared by:

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PREFACE

The Capacity Assessment Report is part of reporting requirements under LOTT's National Pollutant Discharge Elimination System (NPDES) Permit No. WA0037061 for the Budd Inlet Wastewater Treatment and Water Reclamation Facility. The report and the latest Capital Improvements Plan (CIP) must be submitted to the Department of Ecology semi-annually to demonstrate LOTT's plans for maintaining adequate capacity.

The report provides an overview of the ongoing planning processes for monitoring, evaluating, and responding to capacity needs in the entire LOTT system, including wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity. The accompanying CIP provides a schedule of infrastructure upgrades to maintain existing system capacity and accommodate system growth to preserve LOTT's ability to achieve effluent limitations, reclaimed water standards, waste load allocations, and other conditions of the NPDES permit. The Capacity Assessment Report is supported by data from two additional reports completed every two years – the Flows and Loadings Report and an Inflow & Infiltration and Flow Monitoring Report.

- **Flows and Loadings Report –** analyzes residential and employment population projections within the Urban Growth Area and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

- **Inflow and Infiltration Report –** uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

- **Capacity Assessment Report –** uses flows and loadings data and inflow and infiltration evaluation results to analyze system components (i.e., conveyance, treatment, and discharge) to determine when limitations will occur, and provide a timeline for new system components and upgrades.

As each report is published, it will be posted on LOTT's website – www.lottcleanwater.org.

Table of Contents

Executive Summary

For the 2024 Capacity Assessment Report, updated flows and loadings projections, along with inflow and infiltration and flow monitoring data, and drinking water consumption data were used to evaluate the current and projected capacity limitations within the LOTT system. The flow and loading projections are slightly lower compared to previous years' reports. Overall, however, the changes are fairly small, with most projections within 3-10% of the previous set of projections.

Much of the capacity discussion is centered on the Budd Inlet Treatment Plant's (BITP) National Pollutant Discharge Elimination System (NPDES) Permit, which limits discharge to a fixed load of biological oxygen demand (BOD) and total inorganic nitrogen (TIN) in pounds per day. The discussion also addresses updated waste load allocations identified in the Department of Ecology's (Ecology) Budd Inlet Dissolved Oxygen Total Maximum Daily Load Water Quality Improvement Report and Implementation Plan. In general terms, LOTT's Budd Inlet Treatment Plant discharge capacity correlates to LOTT's ability to reduce its effluent concentration of BOD and TIN. The more LOTT can reduce these concentrations, the more flow it can discharge to Budd Inlet. The proposed waste load allocation would reduce LOTT's current BOD discharge capacity by 30% and TIN by 12%.

Effective operational capacity equals the minimum combination of treatment, discharge, and conveyance capacity. Discharge capacity analysis considers two modeled flow projections – average flows and 10-year-return peak flows. All three seasonal conditions (summer, shoulder, and winter) were taken into account, with the summer and shoulder conditions being the most limiting. The newly renovated biological nutrient removal process is performing well, however additional time is needed to establish a firm understanding of the performance levels that can be consistently attained. LOTT is continuing to evaluate options to improve the process resiliency and its ability to mitigate slug loads to the treatment plant that can disrupt the process.

Since the previous capacity assessment, LOTT has completed major planning initiatives that provide new updated information to consider as part of the overall system capacity analysis. Most notably, LOTT completed master planning work in 2023 that resulted in the 2050 LOTT System Plan. This planning effort was undertaken in recognition of the many changes since LOTT's original Wastewater Resource Management Plan (WRMP) was developed in the late 1990s. The 2050 System Plan assessed all that had been accomplished under the management strategies identified in the original WRMP, changes in conditions since that plan was developed, and options and opportunities to refine LOTT's long-range plan to meet the needs of the future. The 2050 System Plan estimated that LOTT may need up to 10 million gallons a day (mgd) of additional discharge capacity by 2050. The plan identifies new opportunities to significantly expand capacity at the BITP through enhanced tertiary treatment. Capacity needs would also be met in part through expansion of reclaimed water production, reuse, and recharge at LOTT's existing reclaimed water facilities. These and other findings from the 2050 System Plan are incorporated in this Capacity Assessment Report.

Introduction

Purpose

In accordance with the original Wastewater Resource Management Plan and the updated long-range 2050 LOTT System Plan, LOTT is continuously monitoring system demands and planning for future capacity on a "just in time" basis. The primary purpose of this document is to evaluate system capacity requirements based on projected demands and identify and evaluate capital improvement projects to meet these requirements.

Current and Projected Flows and Loadings

For this report, county-wide population projections are based on data developed by the Thurston Regional Planning Council (TRPC). TRPC has not updated these projections since 2018, however, this data is the most recent that is available. The projections include residential population estimates for the years 2018, 2020, 2025, 2030, 2035, and 2040. The 2024 Flows and Loadings report compiled these data along with drinking water consumption data from the past two years, and flow monitoring data to update the flows and loadings projections. LOTT's service area includes the urban growth areas (UGAs) of Lacey, Olympia, and Tumwater.

Figure 1. LOTT Service Area by Jurisdiction

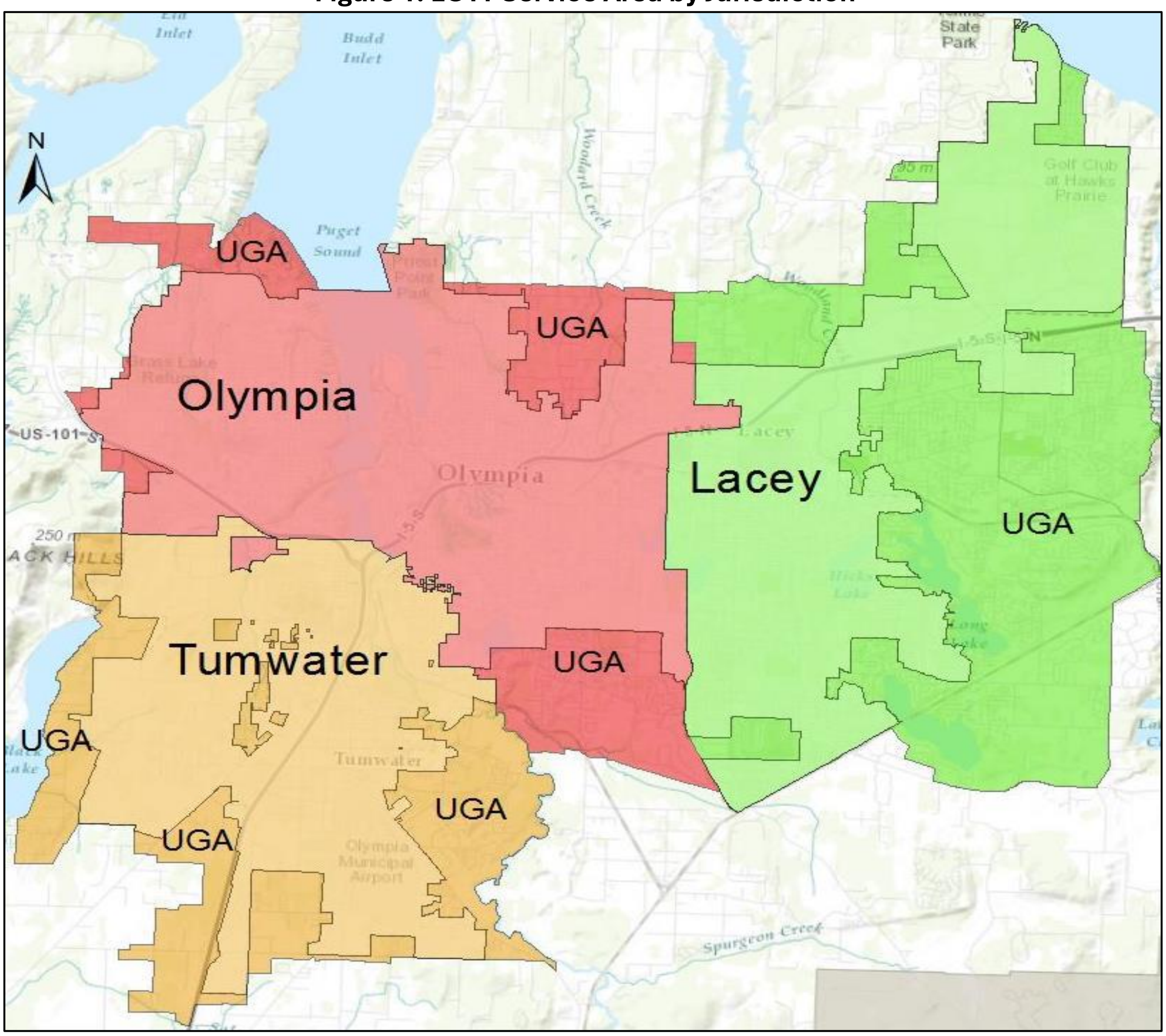


Figure 2 compares the projected base sanitary flows against projections from the past few years. The base sanitary flow is defined as the minimum average flow registered over a 7-day period in each year and is assumed to have little influence from inflow and infiltration. For additional details on per capita wastewater generation rates, refer to the 2024 Flows and Loadings Report. Figures 3 and 4 present the projected biological oxygen demand (BOD) and total suspended solids (TSS) loadings in the LOTT service area through 2050. These loading rates are calculated by multiplying the projected sewer populations by the per capita loading rates.

Figure 2. Base Sanitary Flow Projection Comparison

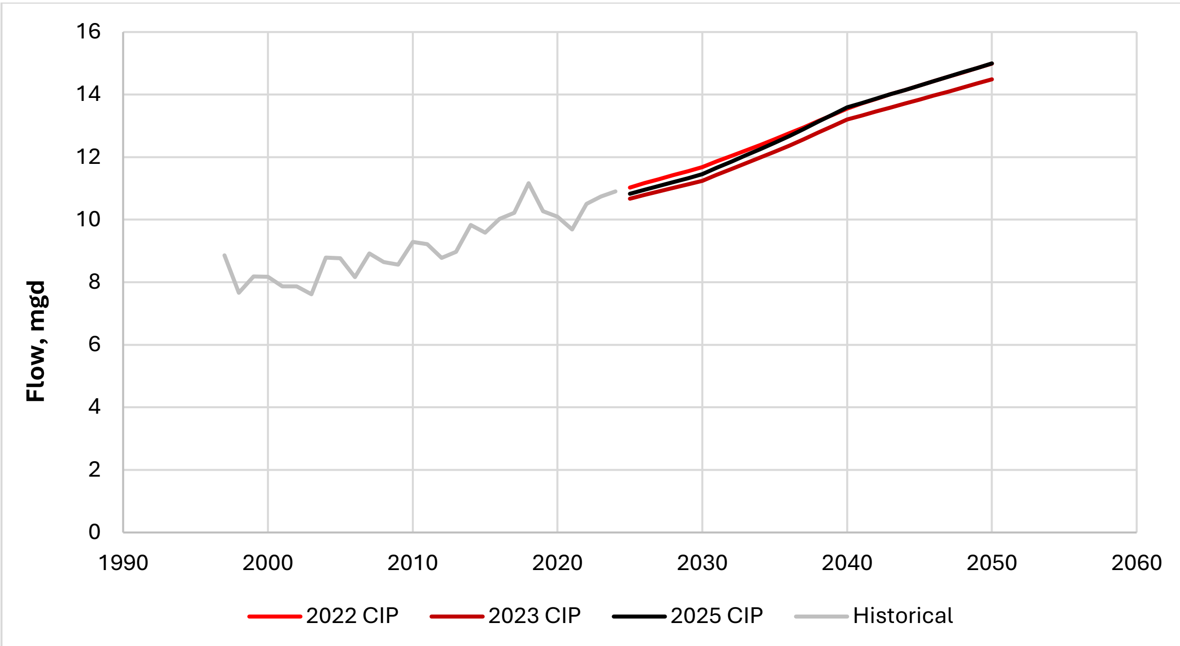


Figure 3. Projected BOD Loadings

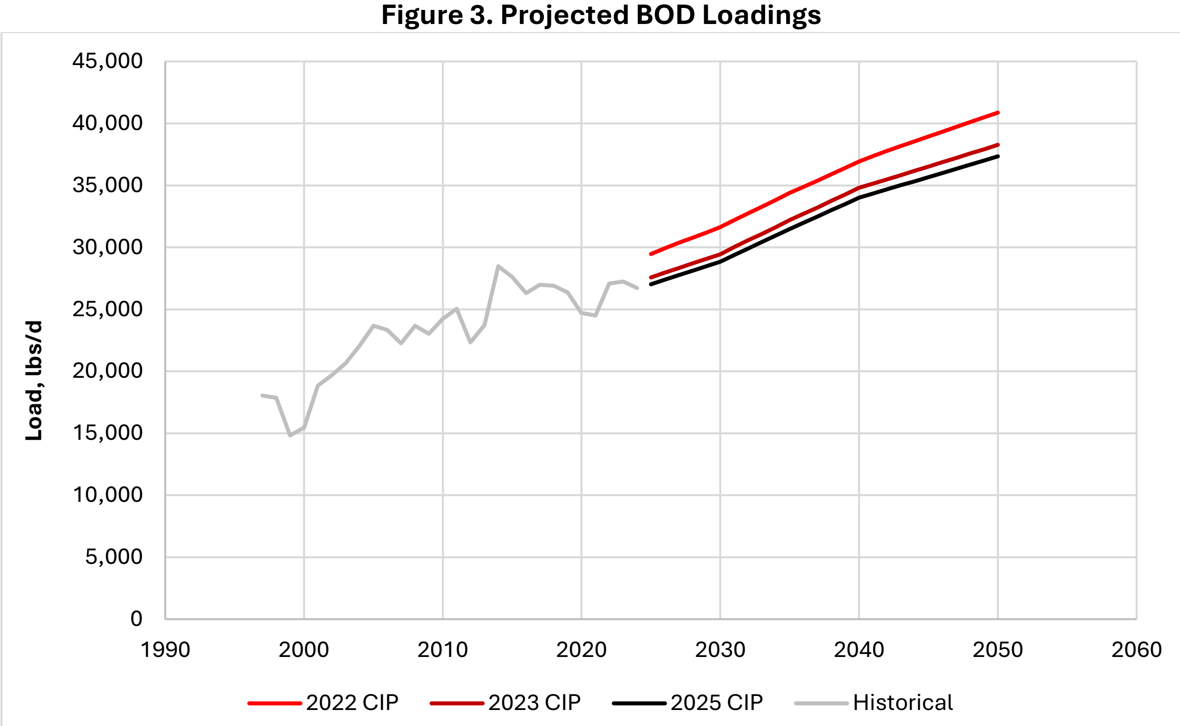


Figure 4. Projected TSS Loadings

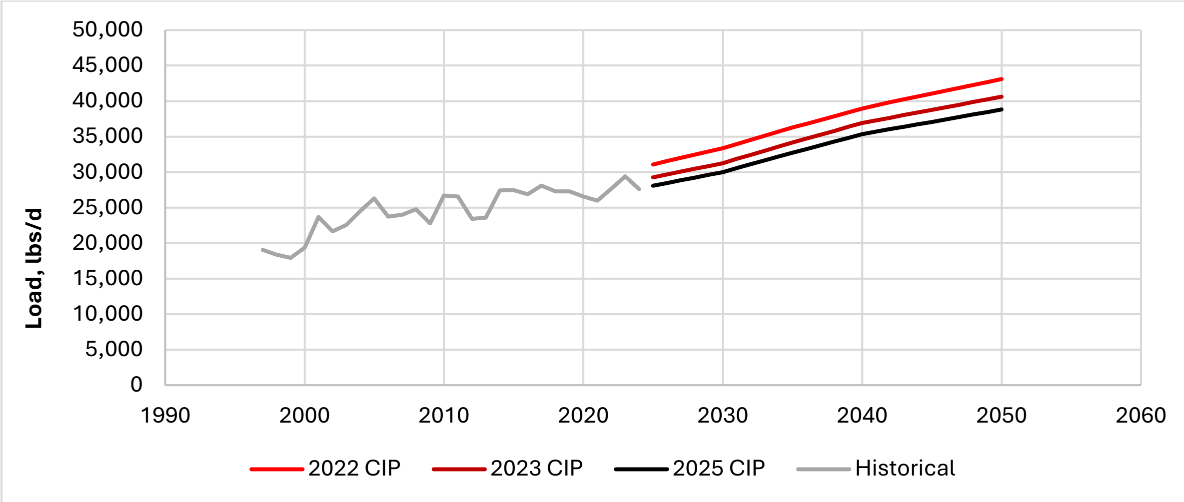


Table 1 lists the projected flows generated in the LOTT service area in millions of gallons per day (mgd). The summer and shoulder compliance periods represent the average monthly values. The 10-year peak values are based on the 10-year return period flows. In any given year, there would be a 10% chance of averaging the projected flow for each period.

Table 1. LOTT Service Area Projected Flows (mgd)

Year	Base Sanitary Flow	Annual Average	Peak Month (10-year)	Peak Day (10-year)	Peak Hour (10-year)	Summer2	Shoulder1	Winter3
2025	10.83	14.16	21.21	47.39	67.78	11.92	13.54	16.33
2026	10.96	14.29	21.36	47.58	68.04	12.05	13.68	16.47
2027	11.08	14.43	21.50	47.76	68.28	12.18	13.81	16.60
2028	11.20	14.56	21.65	47.95	68.53	12.30	13.94	16.74
2029	11.33	14.69	21.80	48.13	68.77	12.43	14.07	16.87
2030	11.45	14.82	21.95	48.32	69.02	12.56	14.20	17.01
2031	11.66	15.05	22.20	48.64	69.46	12.77	14.43	17.24
2032	11.86	15.26	22.44	48.95	69.88	12.98	14.64	17.46
2033	12.06	15.47	22.67	49.25	70.29	13.18	14.85	17.68
2034	12.25	15.69	22.91	49.56	70.71	13.38	15.06	17.90
2035	12.46	15.90	23.16	49.88	71.14	13.59	15.28	18.13
2036	12.68	16.15	23.43	50.24	71.64	13.82	15.52	18.38
2037	12.90	16.39	23.71	50.60	72.15	14.05	15.76	18.63
2038	13.13	16.64	23.99	50.97	72.66	14.28	16.00	18.88
2039	13.36	16.89	24.27	51.35	73.17	14.52	16.25	19.14
2040	13.59	17.14	24.56	51.72	73.70	14.76	16.50	19.40
2041	13.73	17.29	24.73	51.94	74.00	14.90	16.65	19.56
2042	13.87	17.44	24.90	52.16	74.29	15.05	16.80	19.71
2043	14.01	17.59	25.07	52.38	74.59	15.19	16.95	19.87
2044	14.15	17.74	25.24	52.60	74.89	15.33	17.10	20.02
2045	14.29	17.89	25.41	52.82	75.19	15.48	17.25	20.18
2046	14.43	18.04	25.58	53.04	75.49	15.62	17.40	20.34
2047	14.57	18.20	25.75	53.26	75.79	15.77	17.55	20.49
2048	14.71	18.35	25.92	53.48	76.09	15.91	17.70	20.65
2049	14.85	18.50	26.09	53.70	76.39	16.06	17.85	20.81
2050	15.00	18.66	26.26	53.93	76.70	16.21	18.01	20.97
FC	20.18	24.21	32.44	61.76	87.18	21.52	23.52	26.68

1. June, July, August, and September

2. April, May, and October

3. November, December, January, February, and March

Operational Capacity

LOTT considers three types of capacity when describing operational capacity – treatment capacity, discharge/use capacity, and conveyance capacity. Treatment capacity is defined as the amount of wastewater that can be treated within permit limitations. Discharge/use capacity is a combination of the amount of treated wastewater that can be discharged into the environment within permit limitations (i.e. Budd Inlet outfall), the amount of Class A reclaimed water that can be infiltrated into the ground (i.e. Hawks Prairie Ponds and Recharge Basins), and the amount of Class A reclaimed water that can be utilized for other beneficial uses (i.e. reclaimed water customers). Conveyance capacity represents the hydraulic capacity of both: 1) sewer lines to convey wastewater from the point of collection to the point of treatment; and 2) reclaimed water lines to convey Class A reclaimed water from the point of treatment to the point of discharge/use.

Budd Inlet Treatment Plant Capacity

The Budd Inlet Treatment Plant rated influent flows and loadings capacities included in Table 2 were established as part of the last major facility upgrade, which occurred in the mid-1990s and are included in LOTT's NPDES permit .

Table 2. NPDES Influent Flow and Loading Design Criteria

Parameter	Design
Maximum Month Design Flow (Average	28 mgd
Maximum Day	55 mgd
Peak Hourly	64 mgd
BOD Loading Maximum Monthly Average	37,600 lbs/day
TSS Loading Maximum Monthly Average	35,100 lbs/day

Although the rated capacity serves as the basis for this capacity assessment, it should be acknowledged that many system upgrades have occurred since they were established, increasing the overall capacity of the treatment plant. New primary sedimentation basins were constructed in 2013 and upgrades to the biological nutrient removal process were completed in 2022. Over the last three years, LOTT has established a better understanding of performance levels for the biological nutrient removal process and will discuss with Ecology whether a re-rate of the plant is appropriate prior to the issuance of the new permit.

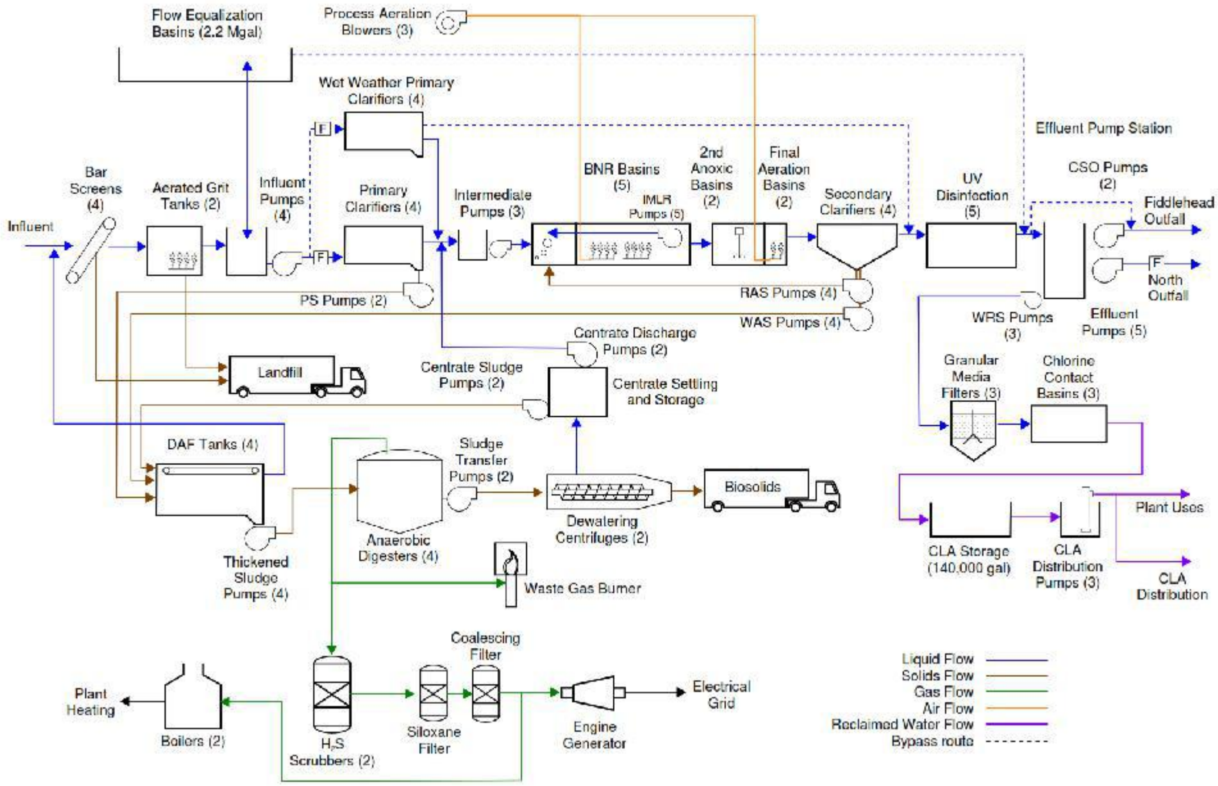
System Capacity Review

The treatment capacity of the Budd Inlet Treatment Plant is tied to the capacity of each individual system within the plant. These capacities are assessed based on updated flows and loadings projections. The following sections are included in the overview of each system:

- **System Profile** – General description of the system and its purpose.
- **System Schematic** – Schematic depicting the various components and flow paths.
- **Capacity Analysis** – Discussion of the various capacities as they relate to projected flows and loadings.
- **Completed and Planned Improvements** – List of completed and planned improvement projects.

Figure 5 provides an overview of the Budd Inlet Treatment Plant and the various supporting systems.

Figure 5. Budd Inlet Treatment Plant Process

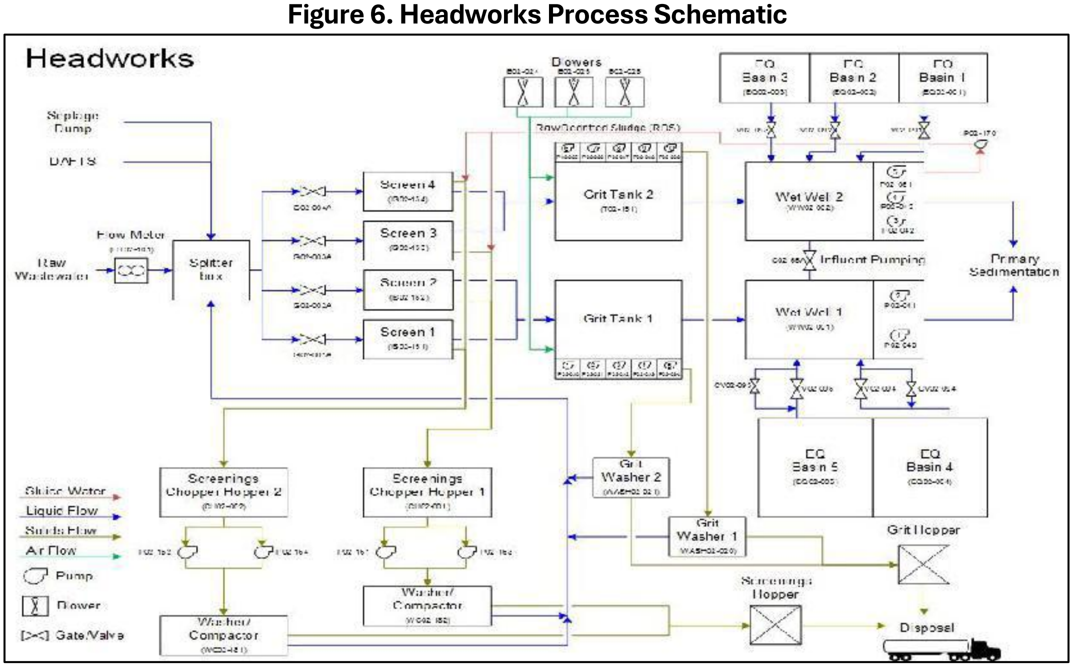


Headworks

The headworks facility consists of preliminary treatment (screens and grit removal) and influent pumping. Flow enters the plant via a 60-inch plant influent pipe. A splitter box directs flow through four influent channels. Motor-operated sluice gates at the head of each channel control the flow to four mechanically cleaned screens that remove large debris from the influent wastewater. Screenings are conveyed to two screenings pits where chopper pumps convey ground-up screenings to two washer/compactor units. Dewatered screenings are collected and hauled to the Thurston County Waste and Recovery Center for disposal.

After screening, wastewater enters two aerated grit channels that remove large inorganic and organic particles. Grit collects in hoppers at the bottom of each tank and is removed by 10 grit pumps. Grit is conveyed to the grit screening/handling room where the grit is processed through two cyclone separators and grit washer/classifiers to remove organic material and return it to the process via the influent splitter box. Washed grit is stored in hoppers and then hauled to the Waste and Recovery Center for disposal. Liquid supernatant from the separator and classifier is recycled to the plant influent splitter box. Degritted sewage overflows from the grit tanks into two influent wet wells. Four variable speed 200-horsepower (hp) pumps provide the influent pumping capacity. The influent pumping system conveys raw degritted sewage to the primary sedimentation tanks.

Figure 6. Headworks Process Schematic



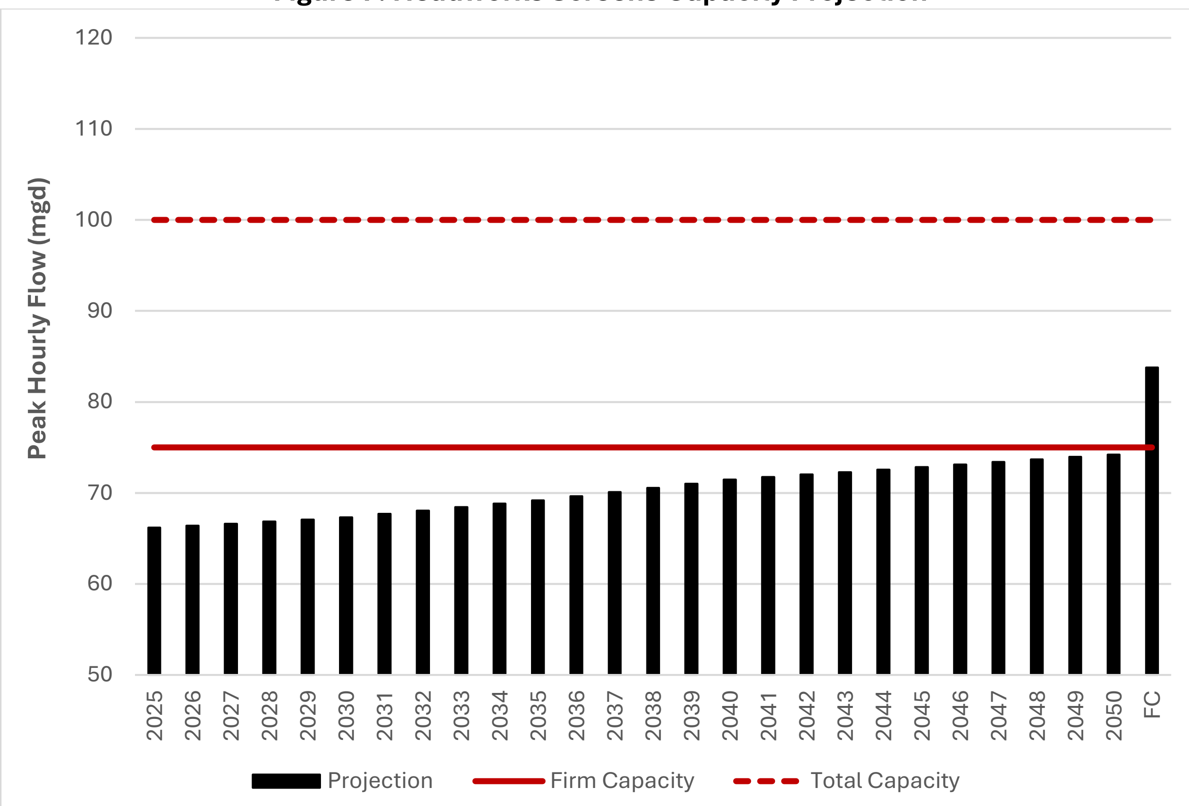
Five equalization basins (EQs) provide up to 2.5 million gallons of storage. As the water level rises in the wet wells during peak flows, the tanks fill in series as determined by elevation of the internal weirs. After the headworks upgrade of 2012, the addition of control valves on the lines to the north EQs allows the option of filling from the bottom of the wet wells rather than over the weirs. This change adds flexibility for flow pace during the summer months, reducing the impact of fluctuating flows on the biological treatment process.

Capacity Analysis

Headworks Screens

Each of the existing headworks screens have a rated peak hour influent flow capacity of 25 mgd. With four screens, the total capacity of the screening facility is 100 mgd and the firm capacity is 75 mgd. Because the plant has the ability to bypass excessive peak flows around the screens, the screening system is evaluated based upon the total, rather than the firm capacity. Figure 7 shows the projected 10-year peak hourly flow and rated capacities.

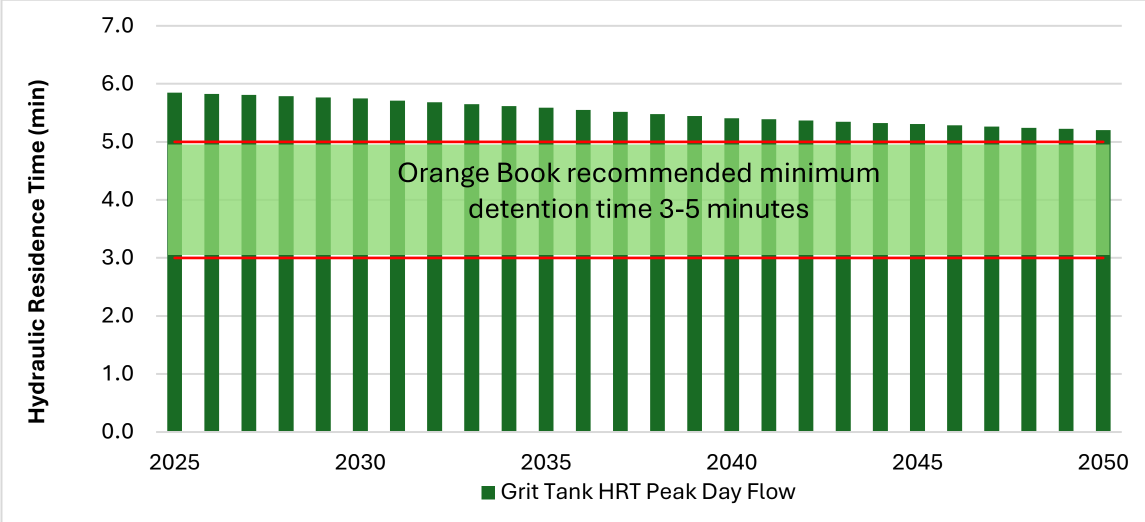
Figure 7. Headworks Screens Capacity Projection



Aerated Grit Tanks

There are two aerated grit tanks which remove heavy, inorganic solids like sand, gravel, and small rocks from wastewater. Each tank has a hydraulic capacity of 50 mgd. Ecology's Orange Book recommends that aerated grit tanks be designed to maintain a minimum hydraulic retention time (HRT) of three to five minutes in order to effectively remove grit during peak day wet weather flows. The retention time with both aerated grit tanks in service is projected to remain above this range through 2050. Therefore, no capacity-related projects are planned for the aerated grit tanks.

Figure 8. Aerated Grit Tanks Capacity Projection

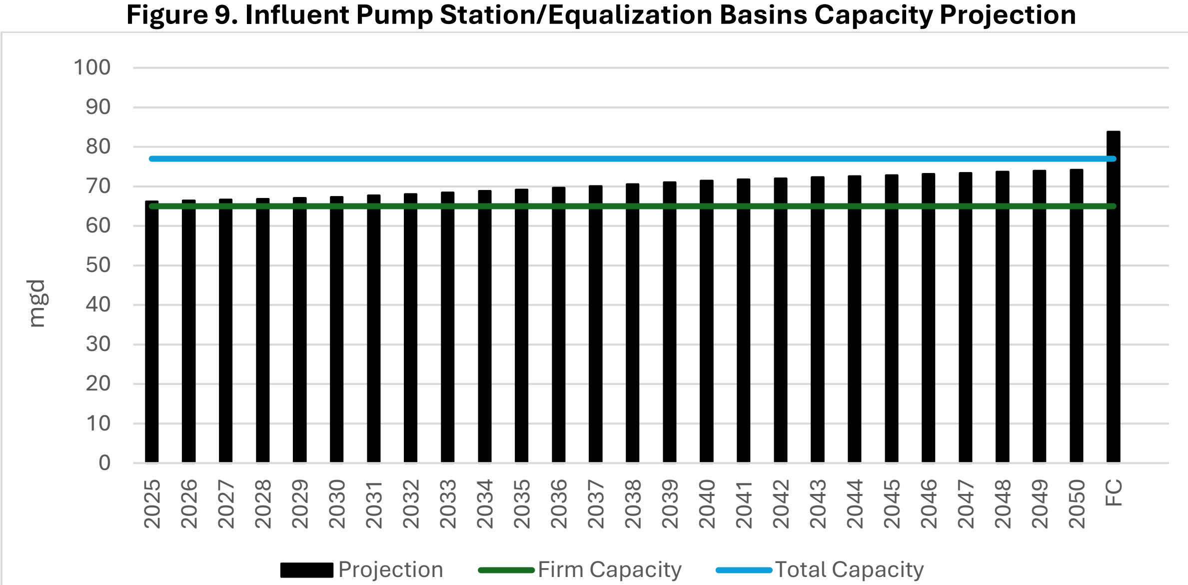


Influent Pump Station/Equalization Basins

The influent pump station has four influent pumps, each rated at 18 mgd. Due to friction loss in the pipe valving configuration and forcemain, the total pumping capacity is limited to 67 mgd and the firm capacity (one pump out of service) is limited to 55 mgd. A hydraulic analysis was conducted to determine the impact of the existing 2.5-million-gallon equalization (EQ) basins on flow through the influent pump station. This analysis projected that the EQ basins could buffer approximately 10 mgd of peak hour flow, resulting in a current equalized capacity of approximately 77 mgd and 65 mgd firm capacity respectively. The influent 60-inch sewer line into the treatment plant begins to experience restrictions at flows between 60-70 mgd, and reaches a maximum capacity of 80-90 mgd depending on the pressure condition within the system.

Figure 9 plots the projected 10-year peak hourly influent flow against the estimated equalized firm and total capacity of the influent pump station including the buffering capacity of the equalization basins. The figure includes a projected peak flow at full connection (FC), when all potential customers within the service area are connected to the system.

Figure 9. Influent Pump Station/Equalization Basins Capacity Projection



Headworks System Capacity Summary

Table 3 provides a summary of the capacity analysis and assumptions for the headworks system. This includes the influent pump station and equalization basins, the headworks screens, and the aerated grit tanks.

Table 3. Headworks System Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity Basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
Influent pump station	Peak hour flow with equalization	mgd	Total	77	65.8	74.7	86%	96%
Headworks screens	Peak hour flow	mgd	Total	100	65.8	74.7	66%	75%
Aerated grit tanks	Peak day HRT	min	Total	4	6.2	5.5	64%	73%

Completed and Planned Projects

A project to replace and upsize the influent pumps is in the preliminary design phase and will increase the firm pumping capacity to 76 mgd. The project will also replace and upsize the emergency backup generators located in the headworks area. Construction is projected to be complete in 2029. In the near term, a portable backup pump has been installed to provide redundancy during peak events.

Additional flow equalization is not projected to be needed prior to 2050. However, given changing weather patterns and potential impacts related to climate change and sea level rise, LOTT maintains the flexibility to expand equalization capacity as needed. Completed and planned projects for the headworks system are listed in Table 4.

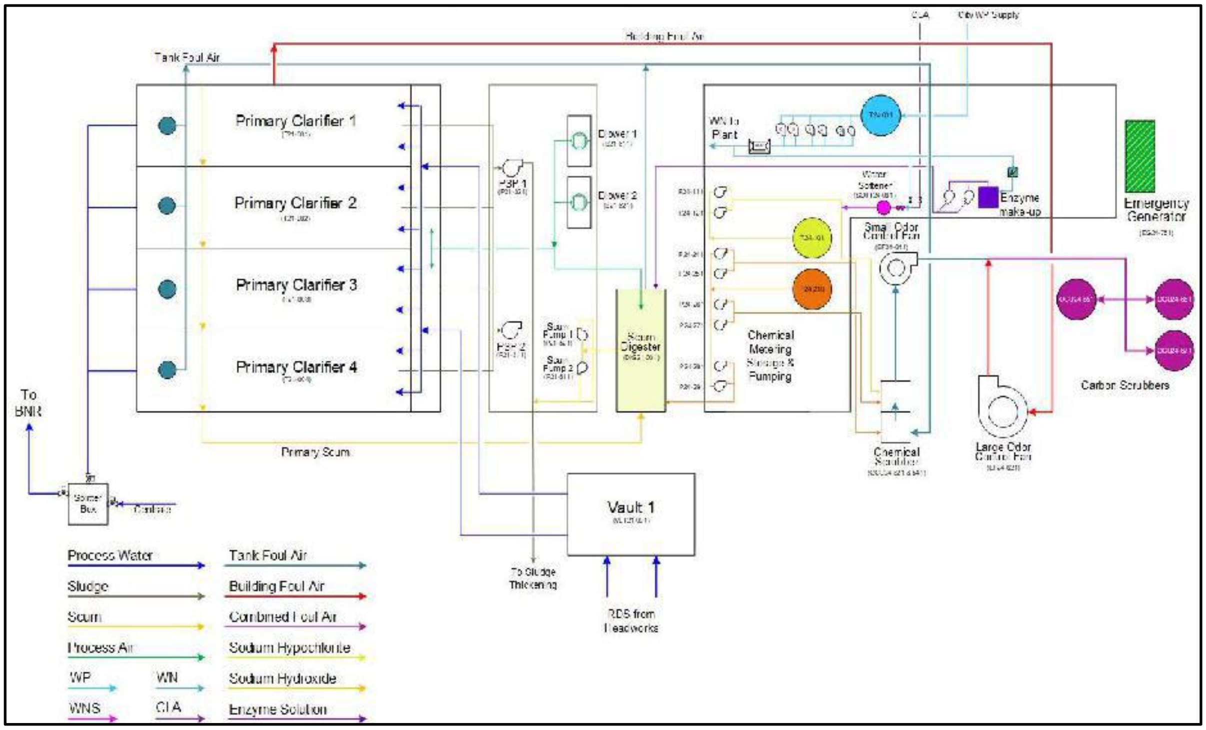
Table 4. Completed and Planned Projects: Headworks

On-line	Name	Cost/Estimate	Status	Description
2013	Screenings Pumps	$270,513	Complete	Additional screening pumps to ensure process redundancy and reliability
2013	Grit Blower Replacement	$183,509	Complete	Two new grit channel blowers
2014	Headworks Improvements	$1,024,025	Complete	Includes replacement of the grit channel diffusers, influent wet well transfer gates, EQ valves, and basin and channel coatings
2016	Influent Screen #1 Refurbishment	$51,082	Complete	Included refurbishment of the #1 influent screen
2019	Influent Pump Station Valve and Piping Improvements	$548,222	Complete	Replace suction and discharge isolation gates, and check valves for four influent pumps
2020	Washington Street Property Improvements	$1,585,000	Complete	Demolish building, pave and fence site, and use for contractor staging
2022	Headworks Solids Handling Improvements	$400,000	Complete	Replaced grit washer/separators
2029	Pumping and Emergency Power Improvements	$23,600,000	Planning	Upgrade and expand influent pumping and standby emergency power capacity
2030	Headworks and Solids Air Handling Improvements	$2,167,731	Planning	Improve ventilation and odor control at Headworks and Solids Handling Buildings

Primary Treatment

The primary treatment process removes easily settleable material from the screened and degritted wastewater. The system includes two sets of primary clarifiers totaling four basins, brought into service in 2013. The primary treatment system includes magnetic flow meters, which provide an estimate of primary influent flow. This flow measurement is used to control influent gates and the pump speed for influent pumping, return activated sludge, waste activated sludge, and internal mixed liquor recycle pumping.

Figure 10. Primary Treatment Process



Each of the primary clarifiers include scum collectors, surface return flight sludge collectors, and primary sludge pumps. Primary sludge removed from the primary sedimentation tanks is pumped to the dissolved air flotation thickeners (DAFT). Primary scum is sent to an aerated tank for pre-anaerobic digestion and then pumped to the DAFTs as well.

Primary effluent is routed from the clarifiers to an effluent diversion structure. With completion of the biological process improvements project, flow from the diversion structure is now conveyed directly to the effluent channel of the first anoxic basins under normal operation, bypassing the basins. Under emergency conditions, flow can be diverted to the first anoxic basins for flow equalization or can be sent via a 48-inch pipeline to either first aeration or the ultraviolet disinfection system.

The primary clarifiers include an odor control facility and chemical building, which have been sized to accommodate a potential primary sedimentation basins expansion. The primary odor control facility receives foul air from the primary clarifiers and treats it with a chemical (sodium hydroxide) scrubber, followed by a set of carbon scrubbers. The chemical building includes space and conduit for chemically enhanced primary treatment in the event that LOTT elects to augment solids removal in the future.

Capacity Analysis

Primary Clarifiers

The capacity of the primary treatment system may be defined as either hydraulic capacity or treatment capacity. The primary clarifiers can hydraulically pass up to 60 mgd of flow without flooding, though they are designed to treat flows up to 37.5 mgd. The latter condition corresponds to a surface overflow rate of 4,716 gpd/ft^2, with all four basins in service. Stress testing in conducted 2021 achieved a surface overflow rate of 5,000 gpd/ft^2 before solids capture began to drop off.

While higher than Orange Book recommendations, long term operational data supports operation at these higher flow rates, though as the surface overflow rate (SOR) increases, the performance of the primary clarifiers will degrade, and total suspended solids (TSS) and biochemical oxygen demand (BOD) removal rates will decrease. This will increase loadings to the secondary biological process and secondary clarifiers and will have a cascading effect on the capacity of downstream systems. LOTT will continue to monitor this relationship between SOR and performance and how it informs the timing of capacity related projects.

Chemically enhanced primary treatment (CEPT) is another option to potentially improve the capacity of the existing primary clarifiers. This process uses chemicals, like coagulants and flocculants, to improve the removal efficiency of suspended solids, organic matter, and nutrients. Provisions for CEPT were included in the original design and space is reserved in the chemical building for dosing pumps. A pad and secondary containment for chemical tanks was also included, as well as the necessary conduit and piping. LOTT conducted a pilot in the winter of 2020, which demonstrated that CEPT is a viable option. However, the costs associated with chemical dosing were high.

For the purpose of this capacity assessment, the capacity of the primary clarifier will be based on a peak overflow rate of 3,750 gpd/ft^2. This criterion will be applied to a maximum month flow condition, as single day exceedances of the criterion would not be expected to impact permit compliance. Table 5 includes a summary of the various capacity parameters assessed and the related assumptions.

Primary Sludge Pumping

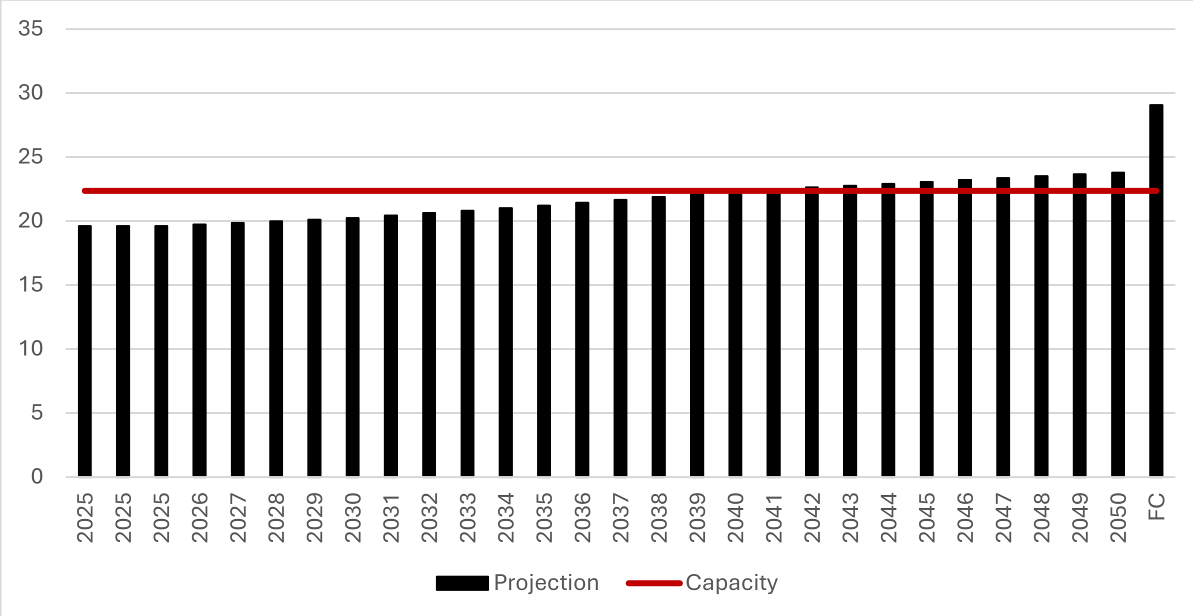
The primary sludge pumps are responsible for conveying primary sludge to the sludge thickening process. There are two pumps, one being redundant. A pilot is underway to assess a new gearmotor which is rated at 300 gpm.

Table 5. Primary Clarifiers Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity Basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
Primary clarifiers	Peak month SOR	gpd/ft^2	Total	3,750	2,465	2,993	65.7%	79.8%
Primary sludge pumping	Peak day	gpm	Firm	230	178	244	77%	106%

While the average day SORs are higher than Orange Book standards, the system has performed well since its construction. The average TSS removal rate in 2024 was 71.4%.

Figure 11. Primary Treatment Capacity Projection Monthly Maximum Average



Completed and Planned Projects

Construction of the primary clarifiers was completed in 2013 and included new odor control and chemical storage facilities sized to meet build out conditions. An in-kind expansion has been projected to cost between $30-50 million, depending on the scope and degree to which design details from the 2013 expansion are applied. Based on the performance of the existing primaries and the potential of supplementing wet weather flow management elsewhere, the second phase may not be needed. Additionally, the recently completed Centrate Building Rehabilitation project has reestablished the ability to route excess flows to two of the four tanks to act as wet weather primary clarifiers, augmenting LOTT's overall primary treatment capacity.

Table 6. Completed and Planned Projects: Primary Treatment

On-line	Name	Cost/Estimate	Status	Description
2010	Port of Olympia Land Purchase	$2,156,297	Complete	Purchased property to locate the new primaries
2013	Primary Sedimentation Basins	$58,957,736	Complete	Project added new primary clarifiers, odor control, and chemical feed and storage facilities
2025	Interim Primary Sludge Pumping Capacity Expansion	$50,000	Piloting	Replaced sludge pump gearmotors, increasing pumping capacity to 300 gpm
*>2050	Primary Sedimentation Basins Phase II	$49,700,000	Future	Project adds new primary clarifiers, if needed

** May not be needed depending on implementation of other supplemental wet weather flow management strategies.*

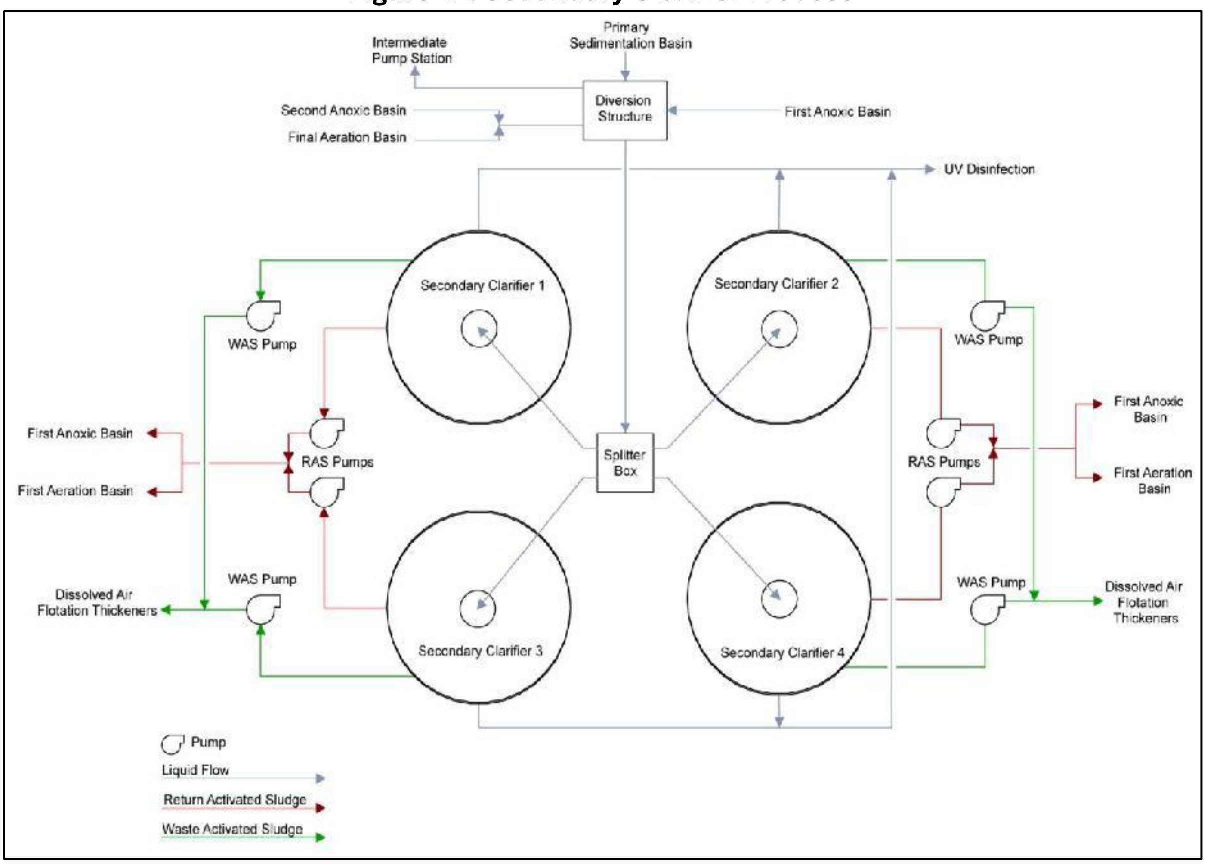
Secondary Clarifiers

The purpose of the secondary clarifiers is to retain the activated sludge bacteria within the secondary process and discharge clean effluent to the disinfection system. The clarifiers receive flow from the final aeration basin, and clarified effluent from the clarifiers flows to the ultraviolet disinfection system. There are four clarifiers at the plant with a diameter of 120 feet and a 14.5-foot side water depth. A project to upgrade the secondary clarifiers was completed in 2007. The project included the replacement of the clarifier mechanisms, and both the waste activated sludge (WAS) and return activated sludge (RAS) pumping systems.

Each clarifier is equipped with two RAS pumps and one WAS pump. Settled sludge is withdrawn from each clarifier through dedicated RAS pumps that are connected to a manifold of pipes located on the clarifier's rotating sludge collector rake arms.

A magnetic flow meter measures the flow from each pair of pumps. RAS is recycled back to the first aeration basin. The pumping rate is adjusted to maintain a blanket of settled sludge in the clarifier.

Figure 12. Secondary Clarifier Process



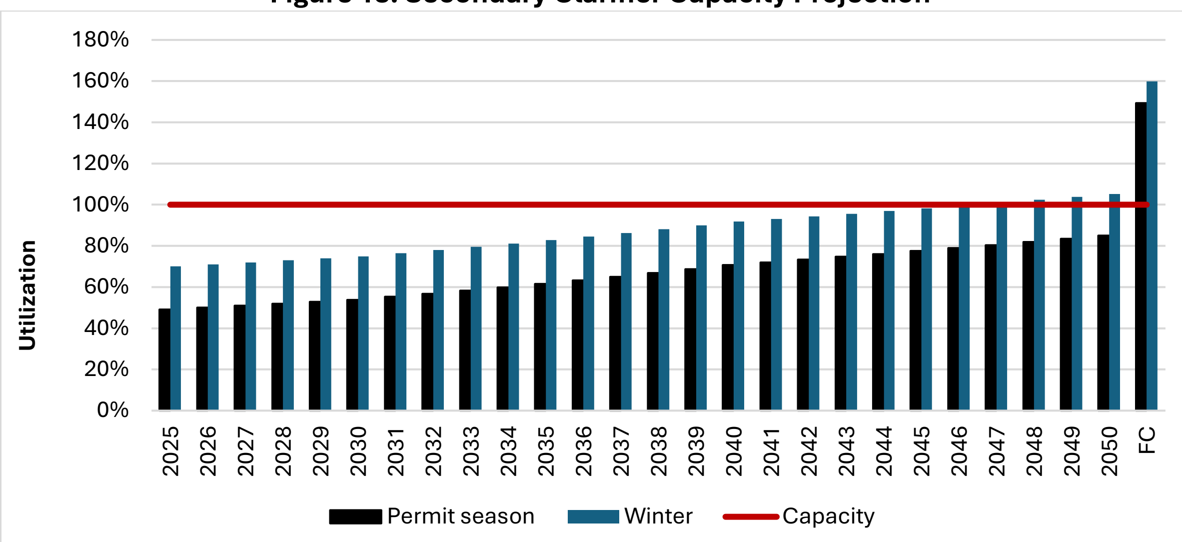
WAS is withdrawn from each RAS wet well and directed to the dissolved air flotation thickeners for solids processing. The WAS pumps are used to maintain the desired solids inventory in the system and the solids retention time in the secondary treatment process to allow the biological treatment process to operate correctly. The WAS pumps are operated continuously to even out the load to the dissolved air flotation thickeners.

Capacity Analysis

The capacity of the secondary clarifiers was established through stress testing and fluid dynamic modeling in late 2008, and an analysis of historical data from that time forward. Unit capacity is a function of the mixed liquor suspended solids (MLSS) concentration in the aeration basins and the mixed liquor stirred sludge volume index (SSVI). MLSS is a function of the BOD loading to the aeration basins and the total aeration basin volume. In addition, the BOD loading to the aeration basins is itself a function of both satellite plant diversion and primary sedimentation performance.

Figure 13 plots the projected utilization of secondary clarifier capacity. This assumes a mixed liquor SSVI of 140 mL/g, with four clarifiers in service during the permit season (April through October) and three clarifiers in service during the winter.

Figure 13. Secondary Clarifier Capacity Projection



Secondary clarifier capacity is influenced by a number of factors. Two projects likely to impact capacity are the CEPT application described in the previous section, and centrate treatment. If such projects, and operational adjustments are not enough to extend the capacity of the existing system, a secondary clarifier expansion project is currently included in the long-range CIP. Both RAS and WAS pumping are considered integral to clarifiers and are sized appropriately to service the range of hydraulic flows considered.

Table 7. Secondary Clarifiers Simplified Capacity Summary

					Utilization	
Unit Process	Capacity Basis	Units	Redundancy Basis	Capacity	Current	2050
Clarifiers	Model	%	Total[1]	Varies	70%	105%
RAS Pumps	Flow	mgd	Total	23	N/A	N/A
WAS Pumps	Flow	mgd	Total	3.5	N/A	N/A

1. Utilization is based on four clarifiers during permit season, and three clarifiers in winter

Completed and Planned Projects

Secondary clarifier capacity will continue to be monitored as additional operational data is collected following the Biological Process Improvements project. Additional technologies to address potential future capacity limitations were identified as part of LOTT's master planning update for the footprint of the Budd Inlet Treatment Plant and will be further evaluated as necessary. LOTT intends to conduct additional CEPT pilot testing within the next couple of years. In the worst-case scenario, two additional secondary clarifiers may be required by 2050.

Table 8. Completed and Planned Projects: Secondary Clarifiers

On-line	Name	Cost/Estimate	Status	Description
2007	Clarifier upgrades	$6,075,037	Complete	Upgraded clarifier mechanisms, RAS and WAS Pumping
2028	Secondary Clarifier Refurbishment	$1,460,000	Future	Project provides for general system renewal
TBD	Secondary Clarifier Expansion	$32,350,000	Future	Adds additional clarifiers, if needed

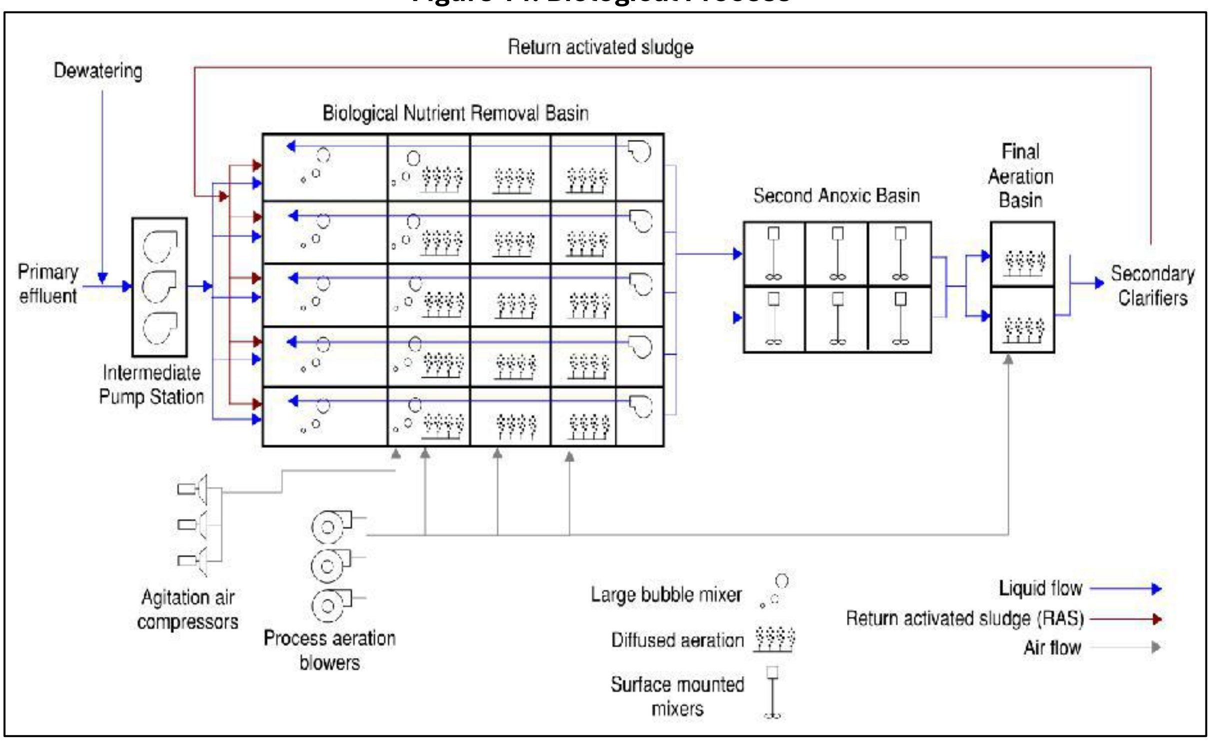
Biological Process

LOTT's biological nutrient removal system operates a modified four-stage Bardenpho process to optimize total inorganic nitrogen removal from the incoming wastewater. Effluent from the primary sedimentation tanks flows through a series of anoxic (low dissolved oxygen) and aeration (higher dissolved oxygen concentration) basins. Renovations to the process were completed in 2023.

Primary effluent, RAS, and an internal recycle stream are fed into an anoxic zone (stage 1) where nitrogen is removed from the wastewater (denitrification). The anoxic basins are mixed through large bubble displacement. Denitrified mixed liquor passes to a large, aerated zone (stage 2), where BOD is removed, and where ammonia is converted to nitrate (nitrification). The nitrified mixed liquor is split – with one portion being pumped back to the anoxic zone for denitrification, and another portion flowing by gravity to a second anoxic basin.

The second anoxic and final aeration basins (stage 3 and 4) provide the final biological denitrification and nitrification steps prior to settling and disinfection. Stages 3 and 4 consist of two trains, each with four cells. The first three cells of each train serve as the second anoxic zone, and the fourth cell as the final aeration zone. In the anoxic cells, additional nitrate removal is achieved. In the final aeration cells the mixed liquor is aerated to further polish the mixed liquor prior to flowing to the secondary clarifiers.

Figure 14. Biological Process



Capacity Analysis

The secondary process tanks comprise 12.95 million gallons of anoxic and aerobic basin volume. While this process volume is sufficient to provide for BOD and TIN removal through build out, performance becomes increasingly tied to the mixed liquor suspended solids (MLSS) concentrations. The MLSS concentration is proportional to the BOD loading, which is projected to increase by approximately 200% by build out and is also influenced by the operational sludge retention time (SRT), which is based on nitrification requirements.

The capacity of the aeration basins is linked to the secondary clarifiers via the relationship between MLSS concentration and solids loading. Aeration capacity is based on blowers. The plant currently has three blowers, each with a capacity of 6,600 standard cubic feet per minute (scfm). There is space to add a fourth blower, as needed. Capacity projections for the system are summarized in Table 9.

Table 9. Biological Process System Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity Basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
Aeration basins	Capacity is driven by secondary clarifier solids loading							
Aeration blowers	Peak day air flow	scfm	Firm	16,400	6,082	8,134	46%	62%

Completed and Planned Projects

The Biological Process Improvements project, completed in 2023, reconfigured the biological treatment process and reduced the energy required to accomplish biological nutrient removal. The improvements included replacing oversized blowers and minimizing recycle pumping to reduce power consumption. The project also provided the opportunity to pilot test an alternative carbon source to methanol used for the secondary process.

Table 10. Completed and Planned Projects: Biological Process

On-line	Name	Cost/Estimate	Status	Description
2011	Aeration Blower Upgrade	$344,264	Complete	Added Neuros high-speed turbo blower
2023	Biological Process Improvements	$35,902,102	Complete	Upgrades aeration control, instrumentation, and process tank reconfiguration
2026	Supplemental Carbon System Upgrade	$1,090,000	Planning	Replaces storage tank, feed pump, and controls for carbon addition

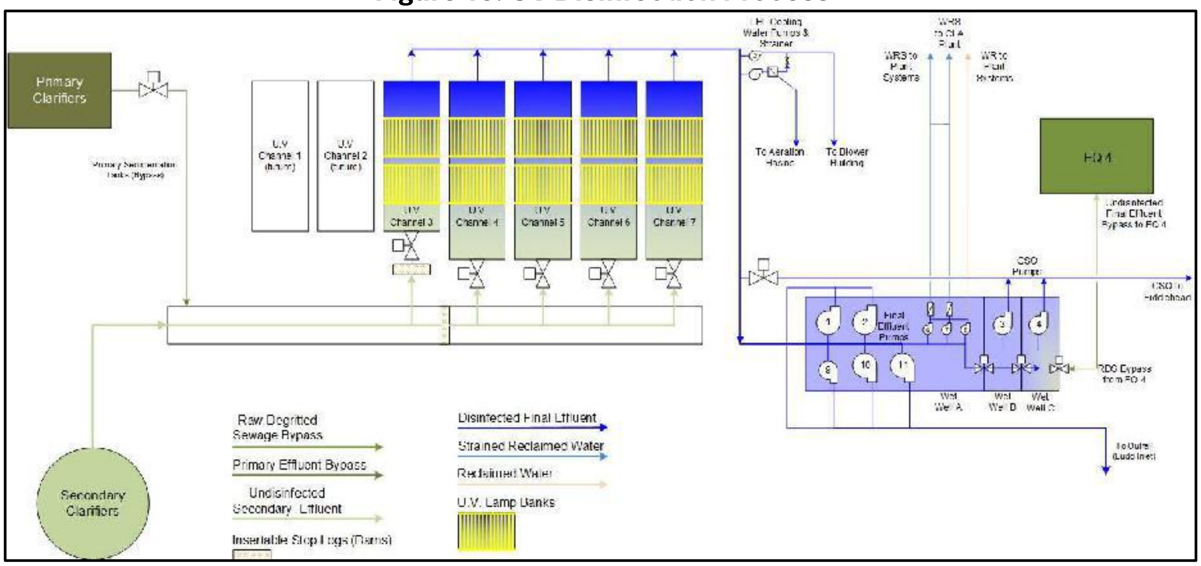
Ultraviolet Disinfection and Effluent Pumping

Ultraviolet Disinfection

The ultraviolet (UV) disinfection system is the final liquid stream processing step prior to discharge to Budd Inlet. The purpose of the system is to disinfect the effluent from the secondary clarifiers to satisfy NPDES permit requirements for fecal coliform counts in the final effluent.

A UV disinfection system exposes bacteria in the effluent to UV light by flowing past UV bulbs. The UV disinfection system consists of five channels equipped with 45-degree angled UV bulbs arranged in modules across the width of a channel. The spacing of the lamps in the channels provides sufficient UV radiation to ensure destruction of pathogenic microorganisms as effluent flows through the channel. The performance of the UV disinfection system is contingent on the successful performance of the secondary clarifiers, since high suspended solids will block the UV radiation and reduce the amount available for disinfection.

Figure 15. UV Disinfection Process



Effluent Pumping

The LOTT treatment plant has two 48-inch outfalls, the North Outfall and the Fiddlehead Outfall. Treated effluent is typically discharged to Budd Inlet out of the North Outfall that extends 953 feet off the shoreline near the north end of Washington Street. The final 250 feet of the outfall contains a diffuser section approximately 19 feet below the mean lower low water (MLLW) level.

The effluent pump station for the North Outfall includes five pumps, four rated at 18 mgd and one rated at 12 mgd. The North Outfall is used for all plant flows up to 55 mgd at high tide and approximately 75 mgd at low tide. Most of the North Outfall was upgraded from 30-inch to 48-inch diameter in 1997. A portion of the pipeline, which crosses through a state-regulated Cascade Pole dangerous waste site, was not upgraded at that time. The remaining 1,200 feet of 30-inch diameter pipe creates a flow bottleneck. A project to replace this section of pipe with a new 48-inch pipe is currently in design and will increase the North Outfall discharge firm capacity to approximately 72 mgd at mean high high water MHHW level. Construction is anticipated to be completed in 2026.

Peak flows in excess of the North Outfall capacity can be discharged through the Fiddlehead Outfall, utilizing two pumps rated at 15 mgd each. In the event that the Fiddlehead Outfall is utilized, LOTT must notify the Department of Ecology that flow was diverted to this pipe.

Capacity Analysis

UV Disinfection

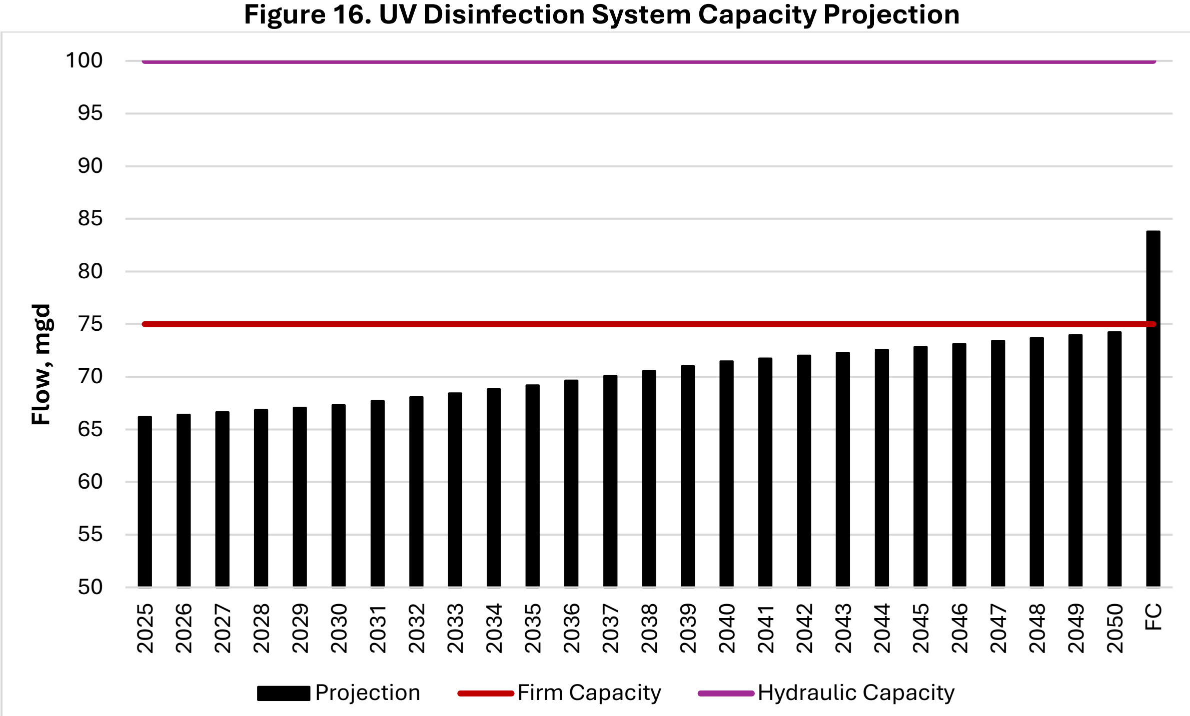
The UV disinfection system was replaced in 2020 and includes UV lights installed at a 45-degree angle with deeper channels, thus increasing each channel's overall capacity. The system layout has four duty channels with one redundant channel. Each channel contains two banks of UV lamps. Each bank contains eighteen lamps for a total of 180 lamps in the system treating a flow of 75 MGD at the design minimum UVT of 63%. The design criteria was based on peak hourly flow and is included in Table 11. Each channel has a hydraulic capacity is 25 mgd.

Table 11. Trojan UV Signa™ Design Criteria

Parameter	Capacity
Peak Design Flow	75 mgd
Average Daily Flow	23.3 mgd
UV Transmission	63% minimum
Total Suspended Solids (TSS)	30 mg/l (30 Day Average, grab sample)
Minimum Dose	24 mJ/cm^2
Discharge Limit	200 Fecal Coliforms, 30 Day Geometric Mean

The UV system is not projected to reach its firm capacity until 2050. The system has capacity to expand in the future either by installing more or improved bulbs or adding another channel. Figure 16 shows the firm and total capacities for the projected 10-year peak hour flow.

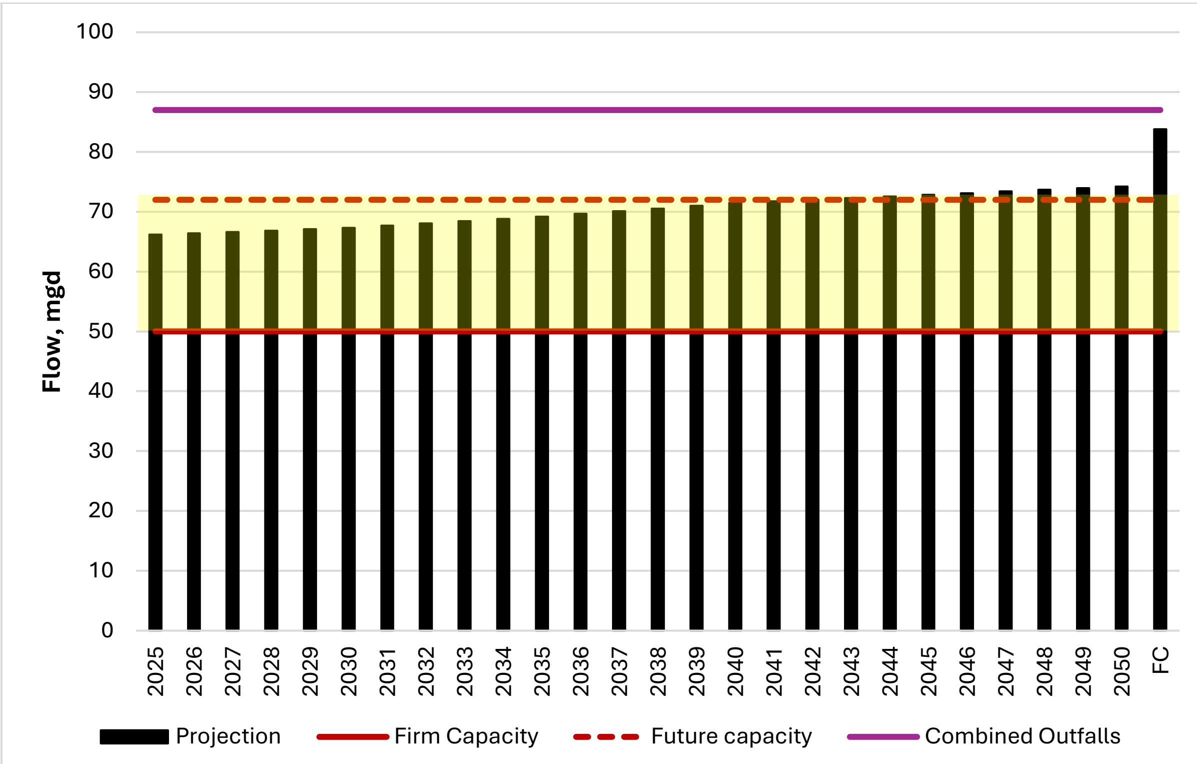
Figure 16. UV Disinfection System Capacity Projection



Effluent Pumping

There are four 300 hp pumps discharging to the North Outfall, each with a nameplate capacity of 16.7 mgd at high tide. However, experience has suggested that the real-world combined firm pumping capacity ranges between 50 mgd and 72 mgd depending on tidal level. At high tide, pressure limitations in the outfall pipeline limit the flow. This range is indicated in yellow in Figure 17. Two additional 15 mgd pumps can direct flow to the Fiddlehead Outfall under emergency circumstances, bringing the combined outfall capacity to 87 mgd shown in purple. LOTT prefers to minimize use of the Fiddlehead Outfall as much as possible. The pumping capacities shown in Figure 17 are for the projected 10-year peak hour flow at high tide.

Figure 17. North Outfall Capacity Projection



Currently, the North Outfall does not have capacity to discharge peak hour flows under high tide conditions. However, such conditions are rare, and the plant's influent flow equalization basins typically reduce peak hourly flow through the plant. Therefore, the plant has very rarely needed to discharge flow to the Fiddlehead Outfall. With the biological process improvements project, the first anoxic tanks are now available for flow equalization. In addition, off-line biological nutrient removal basins can also be used to store flow.

UV Disinfection System and Outfalls Capacity Summary

Table 12 provides a summary of the capacity analysis and assumptions for the UV disinfection system and the North Outfall.

Table 12. UV Disinfection System and Outfalls Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity Basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
UV Disinfection	Peak hour flow	mgd	Firm	75	62.2	77.0	88%	99%
North Outfall pumps	Peak hour flow	mgd	Firm	50	62.2	77.0	132%[1]	148%[1]
Fiddlehead Outfall pumps	Peak hour flow	mgd	Firm	30	N/A	N/A	N/A	N/A

1. Capacity rating is based on flow capacity at maximum tide conditions

Completed and Planned Projects

A list of planned projects is included in Table 13 below. The North Outfall Upgrade, planned for 2026, will address the current pressure limitations in the North Outfall pipeline, increasing the effluent pumping firm capacity, at MHHW to 72 mgd.

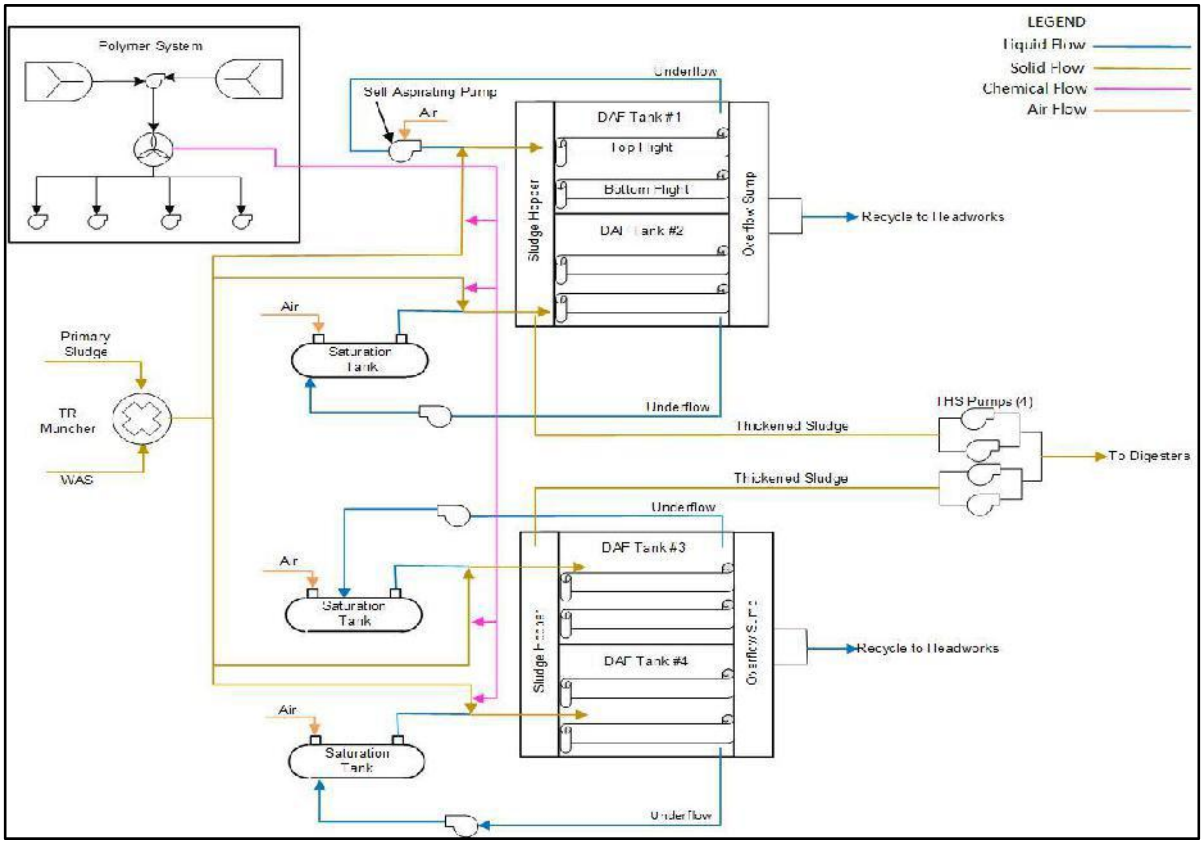
Table 13. Completed and Planned Projects: UV Disinfection and Effluent Pumping

On-line	Name	Cost/Estimate	Status	Description
2013	Effluent Drive and Motor Control Centers Replacement	$1,692,754	Complete	Replaced effluent pump variable frequency drives and motor control centers
2020	Ultraviolet Disinfection Upgrades	$8,407,815	Complete	Upgrades 20-year-old TrojanUV3000™ system to new Trojan UV Signa™
2026	North Pipeline Expansion	$9,192,000	Design	Remove existing bottleneck from outfall pipe run

Sludge Thickening

The sludge thickening process removes excess water from the combined primary and waste activated sludge (WAS) flows prior to anaerobic digestion. The BITP sludge thickening system consists of four rectangular dissolved air flotation thickener (DAFT) tanks. Polymer is used to enhance sludge thickening and performance of the DAFTs.

Figure 18. Dissolved Air Flotation Thickeners Process



Air bubbles attach to the sludge and polymer particles, floating them to the surface. Skimmers collect the thickened sludge and push it into hoppers for transfer to the anaerobic digesters. Sludge that settles to the bottom of the DAFT tanks is drained back to headworks once each day. Overflow from the DAFTs drains back to headworks for re-processing with the plant influent flow. In 2024, a project was completed that retrofitted all four DAFT tanks with self-aspirating pumps, which are more energy efficient and easier to operate and maintain.

Capacity Analysis

Common hoppers are shared between DAFT tanks 1 and 2 and tanks 3 and 4. The thickened sludge then combines in a common manifold and is carried to the digesters. The DAFT system was rated to a capacity of 29.7 pounds per square foot per day (lbs/ft^2/d) in the 2006 Budd Inlet Treatment Plant Master Plan. However, the system has been operated at much higher loadings since that time. Historically, the system has been operated up to 60 lbs/ft^2/d, although recently the system has struggled to perform under such loadings. A more conservative capacity estimate of 45 lbs/ft^2/d has been used to assess capacity needs for the sludge thickening system. Figure 19 depicts the firm capacity of the DAFT system.

Figure 19. Sludge Thickening Capacity Projection

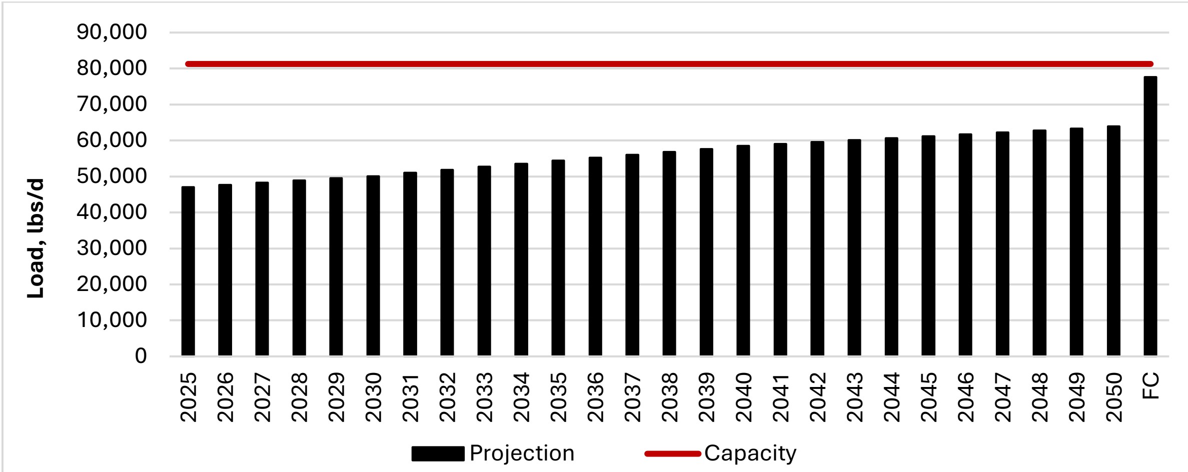


Table 14 provides a summary of the capacity analysis and assumptions for the sludge thickening system. The capacity assumptions will be updated as additional performance data is gathered after the Sludge Thickening Improvements project completed in 2024.

Table 14. Sludge Thickening System Firm Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
DAF Thickening	Peak day solids load	lbs/d/ft^2	Firm	45	26.1	35.4	58%	79%
Sludge pumping	Peak day solids load	gpm	Firm	180	61	82	34%	46%

Completed and Planned Projects

The Sludge Thickening Improvements project completed in 2024 upgrade the DAFT system to include replacing the existing pressurization systems with self-aspirating pumps and replacing the bottom and top collectors all tanks to include new drives and motors. A pilot of a dual-stage positive displacement thickened sludge pump is currently underway.

Table 15. Completed and Planned Projects: Sludge Thickening

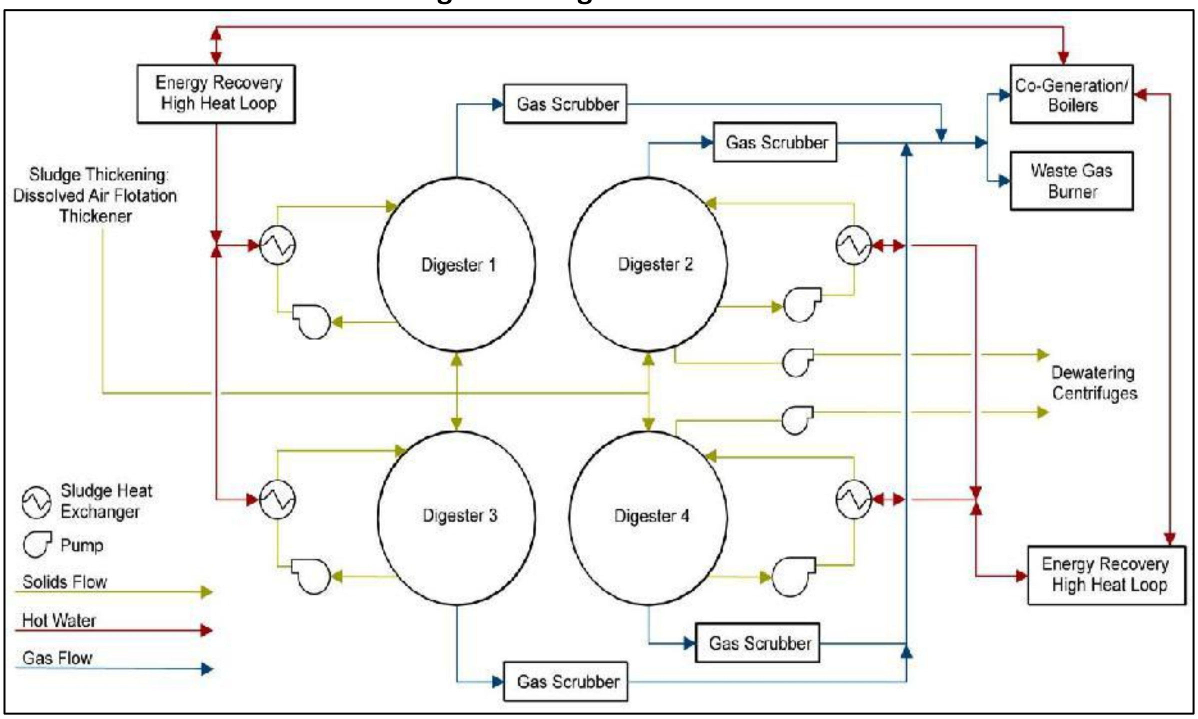
On-line	Name	Cost/ Estimate	Status	Description
2011	Thickening System Equipment Replacement	$372,196	Complete	New sprocket, chains, collectors, and beaches for the top collectors
2012	DAFT Cover Replacement	$223,516	Complete	Replaced tank covers
2014	DAFT Polymer System Upgrade	$918,128	Complete	New polymer mixer, transfer pump, metering pumps and associated controls and electrical
2024	Sludge Thickening System Improvements	$5,977,832	Complete	Updated the DAFT system with new collectors, and hopper cross collectors, aspirating pumps, and process piping
2025	Thickened Sludge Pumping Improvements	$60,000	Piloting	Replace existing single stage progressive cavity pumps with dual stage pumps to increase capacity

Digesters (Sludge Stabilization)

The anaerobic digesters biologically stabilize thickened sludge from the DAFTs by converting portions of the sludge to carbon dioxide, methane, and water. Following anaerobic digestion, the residual material (biosolids) is suitable for land application.

Anaerobic sludge digestion facilities include four 70-feet diameter, 30-feet deep concrete tanks with floating covers. Normal practice is to operate three digesters at a time, two being used for primary digestion, a third used for secondary digestion/solids holding, and the fourth digester being held in reserve.

Figure 20. Digesters Process



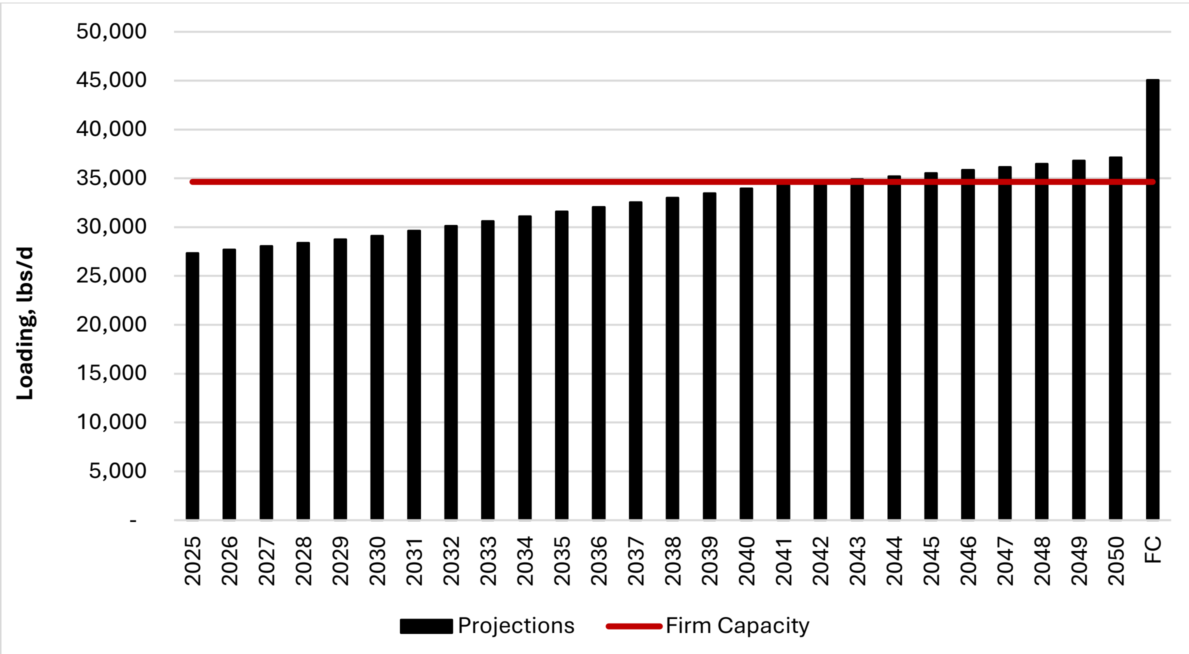
The anaerobic digester equipment building contains all process mechanical equipment needed to operate the digestion process. Thickened sludge is fed to the bottom of the digesters through the circulating sludge system in the center of the tank. Circulating sludge is withdrawn from each digester and pumped to sludge heat exchangers before being returned to the digesters to assist in keeping them completely mixed. The heat exchangers are used to maintain the temperature in the digester at 95° F, which is a permit requirement in order to meet Class B biosolids standards.

Methane gas from the digesters is the principal fuel for the high temperature heat loop system. Digested sludge is withdrawn from the bottom of the secondary digester and pumped to the solids dewatering centrifuges. The digesters are equipped with floating gasholder-type covers, which are supported by digester gas pressure. Each digester contains two separate gas-piping systems. The gas utilization system withdraws gas for use as fuel for the high temperature heat loop system. The second system uses digester gas to continuously mix the contents of the digester. A dedicated gas compressor recirculates digester gas through each digester.

Capacity Analysis

Digester capacity is typically evaluated in terms of the hydraulic retention time (HRT) and the volatile solids loading rate. The Environmental Protection Agency (EPA) Biosolids rule requires a minimum detention time of 15 days. Historically, the plant has aimed to maintain an HRT of at least 25 days in order to allow stable operation. Of the two capacity criteria, volatile solids loading is more limiting. Most mesophilic digesters can operate at volatile solids loadings rate of 0.150 to 0.200 lbs/ft^3/d. The existing digesters employ gas mixing, which can be inefficient, reducing loading capacities. Figure 21 plots projected peak 14-day volatile solids loadings for 2 primary digesters at a loadings rate of 0.150 lbs/ft^3/d.

Figure 21. Digester System Volatile Solids Loading Capacity Projection



After Digester System Improvements Phase II project, which will upgrade the mixing, the loading rate can increase to 0.200 lbs/ ft^3/d. Although the plant has four digesters, one unit is reserved for secondary digestion or solids holding, while another unit is reserved as a standby unit. This effectively limits primary digestion to two units. The ongoing digester upgrades are expected to provide sufficient capacity for most of the planning horizon. If additional capacity is required, the digesters may be converted to thermophilic operation in the future.

Table 16 below summarizes the digester loading projections and capacity.

Table 16. Digester System Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity Basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
Anaerobic digestion	Peak 14-day volatile solids loading	lbs/ft^3/d	2 digesters	0.15	0.118	0.161	79%	107%
Anaerobic digestion	Minimum 14-day hydraulic retention time	days	2 digesters	15	26.4	19.4	57%	77%

Completed and Planned Projects

A digester upgrade project is currently underway. A potential thermophilic upgrade project is included in the long-range CIP. A list of projects is included in Table 17.

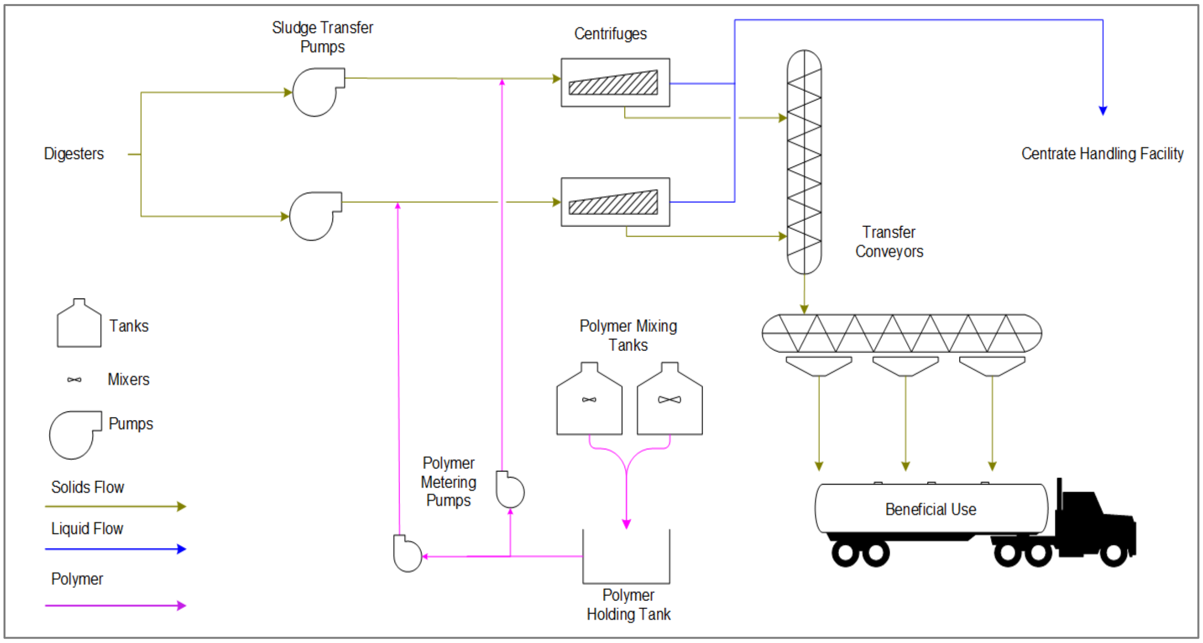
Table 17. Completed and Planned Projects: Sludge Digestion

On-line	Name	Cost/Estimate	Status	Description
2016	Digester Concrete Support Repair	$192,084	Complete	Repair degraded concrete supports
2018	Digester Building Drain Replacement	$286,580	Complete	Replace failing drain lines in the digester building
2023	Digester System Improvements Phase I	$ 3,232,622	Complete	HVAC, air quality monitoring, and micro-aeration
2028	Digester System Improvements Phase II	$47,200,000	Design	Replace floating covers with fixed, new mixing, general asset replacement, and new waste gas burner
2045	Digestion Capacity Expansion	$4,428,593	Future	Thermophilic upgrades

Sludge Dewatering

The solids dewatering process removes excess moisture from anaerobically digested sludge (2-3% solids) to create biosolids (20-24% solids), thereby reducing land application hauling costs. Solids dewatering equipment consists of two centrifuges, dewatered sludge conveyance equipment, and loading facilities for sludge hauling trucks. All solids dewatering equipment is contained in the solids handling building.

Figure 22. Sludge Dewatering Process Diagram



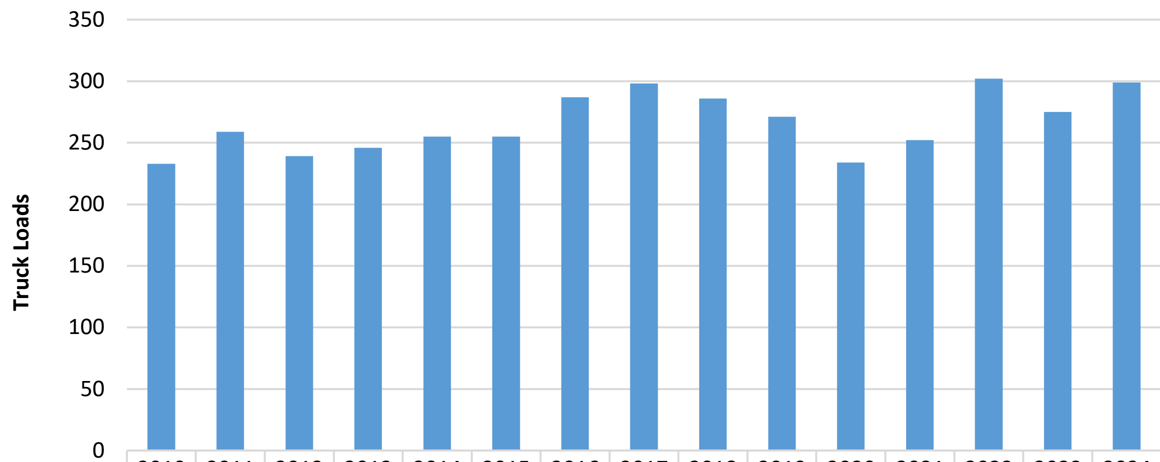
The 1979 facility was completely overhauled in 2018 to include two new Andritz D6LX centrifuges, each with a maximum capacity of 3,500 dry pounds per hour. It is assumed that the units will have a minimum 20-year life, at which time a new project will be initiated to upgrade the system. Firm capacity assumes one unit to remain as a standby to provide full redundancy.

The established level of service requires a truckload to be dewatered in no longer than 12 hours per day, 7 days per week (including centrifuge flushing). For optimum performance, the manufacturer's recommendation is to operate the centrifuges in an approximate range of 60-80% of the design capacity. The system will allow both centrifuges to run simultaneously if needed.

Polymer is added to improve dewatering performance. Dewatered biosolids are discharged from the centrifuges into a screw auger conveyor and transferred to the biosolids hauling trucks for land application. Effluent from the centrifuges (centrate) is drained to a centrate handling facility. Centrate is then metered into the secondary treatment process to control the ammonia loading.

Truck and trailer combination sets are alternatively used to transport biosolids to contracted land application sites in Eastern Washington. The trucks and trailers are all equipped with heavy-duty tarping systems and watertight tailgates to reduce odors and eliminate spillage. Depending on dewatering efficiency, 230 to 300 truckloads of biosolids are delivered for land application every year. The number of loads over the past thirteen years is shown in Figure 23.

Figure 23. Historical Biosolids Truckloads



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Loads	233	259	239	246	255	255	287	298	286	271	234	252	302	275	299

Capacity Analysis

Each unit has a rated capacity of 3,500 lbs/hr. Operationally, the system works best when flow is kept under 160 gpm. At an average feed of 3% solids, the 160 gpm hydraulic rating is more restrictive.

System capacity is based on hours of operation. At 84 hours per week (14 hours per day, 6 days per week), capacity would be 806,400 gallons per week, which averages out to 115,200 gpd. The firm capacity, a single unit in service, is show on Figure 24 for the peak 14-day loadings projection.

Figure 24. Dewatering System Capacity Projection

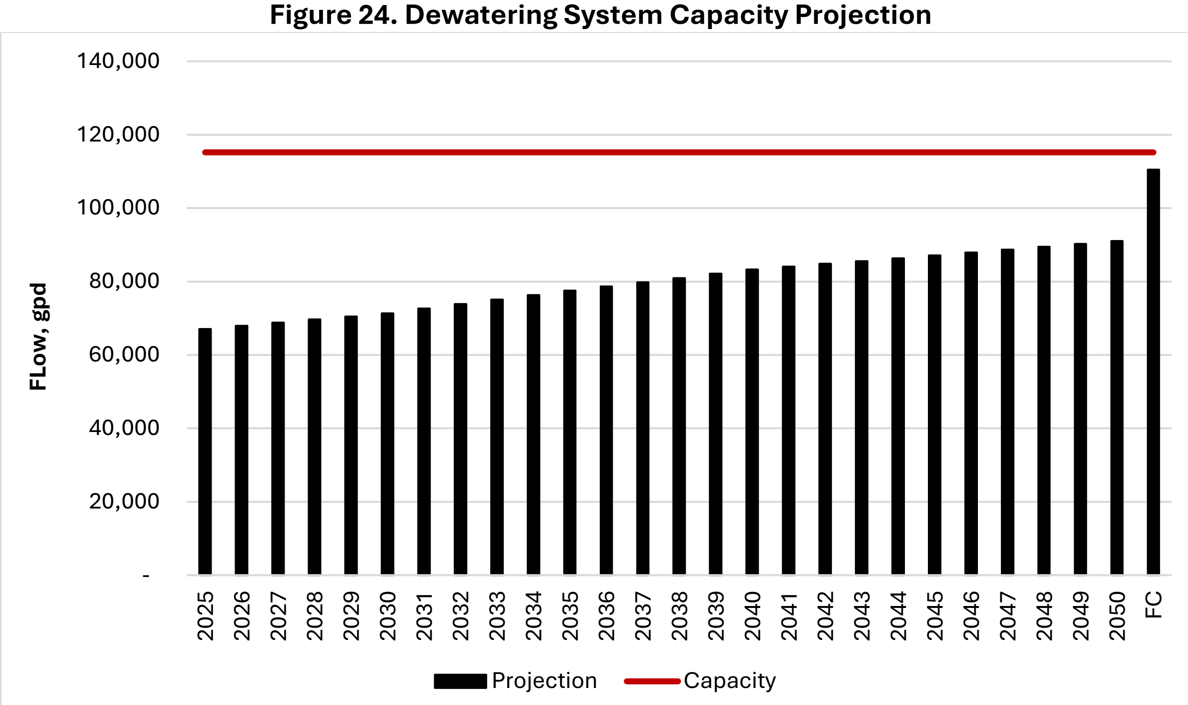


Table 18 below provides a summary of the capacity analysis and assumptions for the sludge dewatering system.

Table 18. Sludge Dewatering System Capacity Summary

					Condition		Utilization	
Unit Process	**Capacity basis**	**Units**	**Redundancy Basis**	**Capacity**	**Current**	**2050**	**Current**	**2050**
Dewatering	Peak 14-day solids loading	gpm	Firm	160	93	126	58%	79%

Completed and Planned Projects

Having just completed an overhaul of this system, no future projects are currently planned.

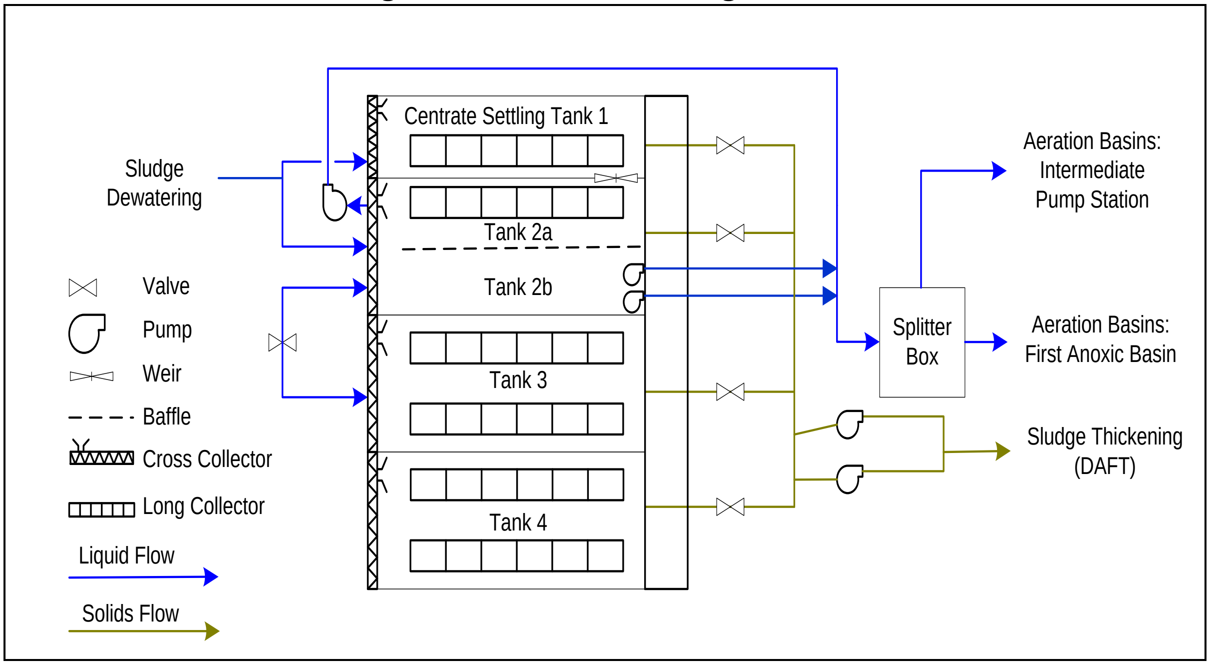
Table 19. Completed and Planned Projects: Sludge Dewatering

On-line	Name	Cost/Estimate	Status	Description
2018	Sludge Dewatering System Upgrade	$12,972,813	Complete	Replace existing centrifuges and polymer addition system

Centrate Management

The centrate handling process removes easily settleable material from the centrate and provides storage for equalizing the ammonia load sent to the biological treatment process. This process includes flow measurement, ammonia concentration monitoring, seven rectangular sedimentation tanks modified to provide settling and storage of centrate, two centrate discharge pumps, and two centrate sludge pumps as illustrated in Figure 25.

Figure 25. Centrate Handling Process



Centrate from the solids dewatering process enters the centrate handling facility through a 12-inch HDPE line. Centrate can be sent to either Centrate Tank 1 or 2a, though during normal operation, flow is directed to Tank 1, where any remaining solids are allowed to settle. Longitudinal collectors move the settled sludge to the sludge hoppers where it is pumped to the dissolved air flotation thickeners via two positive displacement, progressing cavity pumps.

Clarified centrate overflows from tank 1 to tank 2a via a weir at the north end and then flows south through tank 2a and back north through tank 2b. Centrate is metered into the secondary treatment process via two self-priming centrifugal pumps.

Capacity Analysis

Capacity related to the centrate handling facility is dependent on a variety of factors to include solids dewatering (centrifuging) duration and performance, centrate dilution, and the amount and concentration of centrate that can be sent secondary treatment process due to performance issues or compliance periods (i.e. permit discharge limitations).

There are seven tanks, each with a volume of 100,000 gallons, totaling 700,000 gallons of storage capacity. The plant produces an average of 50,000 gallons per day of centrate, which is diluted up to a ratio of 3:1 to minimize struvite formation. Up to 270,000 gallons of diluted centrate may be sent to this system on a peak day. During normal operation, only tanks 1, 2a, and 2b are used.

Completed and Planned Projects

A project to rehabilitate the building was completed in early 2025 which included replacement of the roof and odor control systems, as well as seismic retrofits and electrical improvements. The project also re-established the ability to route raw degritted sludge (RDS) from headworks through tanks 3 and 4, allowing the facility to provide additional primary sedimentation treatment during peak wet weather events.

In addition, with the completion of the Biological Process Improvements project, the first anoxic tanks will no longer be needed for the biological process. In the near-term, the first anoxic basins will provide for wet weather flow equalization. Potential future uses of the basins identified through the master planning work include centrate treatment, which could be added in the decommissioned centrate storage basins, and one train of the former first anoxic basin. The estimated cost is $3.2 million and could be implemented in stages. This treatment would provide for bioaugmentation using the centrate treatment basins to incubate a highly efficient nitrifying population, which would seed the main biological treatment process and improve efficiency. The project is anticipated to result in more stable and resilient operation, and the improved efficiency may reduce solids loading to the secondary clarifiers, thereby extending the capacity of the secondary process.

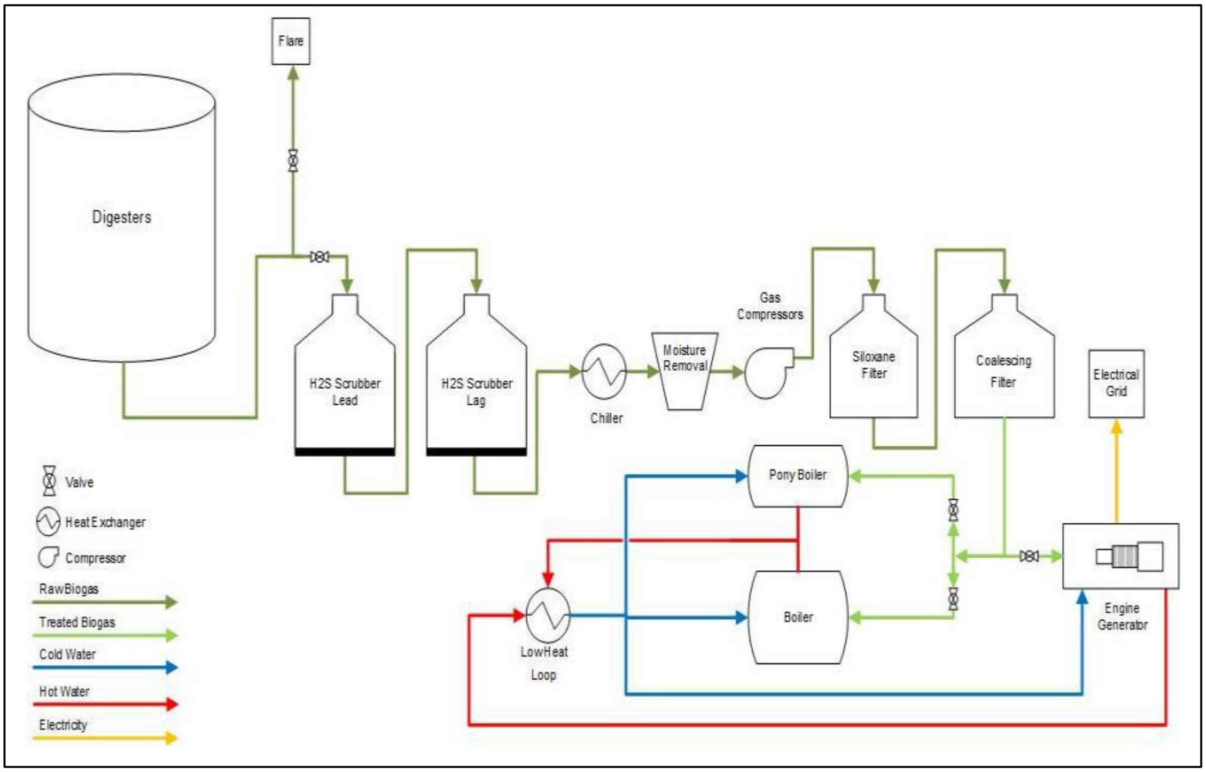
Table 20. Completed and Planned Projects: Centrate Management

On-line	Name	Cost/Estimate	Status	Description
2009	Centrate Metering Pump	$30,000	Complete	Replace centrate metering pump
2017	Centrate Handling Improvements	$942,106	Complete	Upgrades the centrate pumping system to include adding two new pumps, instrumentation, and baffles
2025	Centrate Building Rehabilitation	$9,514,857	Complete	Replace roof structure, odor control system, electrical upgrades, and add covers to the tanks
2033	Centrate Handling and Treatment	$3,200,000	Future	Install new centrate treatment system

Energy Recovery

The digestion process produces methane gas. LOTT utilizes this gas in a co-generation engine generator which produces both electricity and heat. Additionally, two boilers are available to combust the methane gas to produce heat which is used to maintain the low heat loop. The system is illustrated in Figure 26.

Figure 26. Energy Recovery Process



Capacity Analysis

Raw digester gas contains hydrogen sulfide and must be conditioned before it can be utilized by the engine generator or boilers. The gas conditioning system consists of two hydrogen sulfide (H_2S) scrubber tanks which use a media to strip off the H_2S. The gas then passes through a chiller to drop out the moisture. The gas is then reheated and sent through the siloxane scrubber. The scrubbed gas is then utilized in the engine generator or boilers to create electricity and heat. Any gas that cannot be beneficially used is combusted in the waste gas burner (flare).

Completed and Planned Projects

The original cogeneration project was completed in 2011 through a Puget Sound Energy (PSE) grant. A long block overhaul of the Jenbacher engine generator was completed in 2018. A project is underway to evaluate beneficial biogas utilization options for when the Jenbacher reaches the end of its useful life. Additionally, as part of the digester system upgrade project, a new waste gas burner will be installed to increase the reliability and capacity of that system.

Table 21. Completed and Planned Projects: Energy Recovery

On-line	Name	Cost/Estimate	Status	Description
2011	LEED Co-Generation	$3,002,636	Complete	Installed gas conditioning system and GE Jenbacher Engine Generator
2015	Boiler Upgrade Project	$2,205,675	Complete	Replaced 1980 boiler with two new boilers (one large and one small)
2018	Engine Generator Replacement	$401,299	Complete	Completed a long-block replacement on the engine generator and replaced chiller
2027	Biogas Utilization Upgrades	$14,600,000	Planning	Select and implement preferred biogas utilization strategy anticipating engine generator end of life

Ongoing and Planned Projects Overview

As described in the previous sections, a number of projects are either in planning or are currently underway to address anticipated capacity limitations. The following highlights recent and upcoming large-scale projects. For more information regarding future planned projects, refer to the 2025-2026 Budget and Capital Improvements Plan and the 2050 Master Plan.

- Hydraulic limitations at the influent pump station will be addressed through an expansion project. The project is planned for 2029 and will reduce the 2050 risk of bypass to the Fiddlehead Outfall to less than once in ten years.

- The Centrate Handling Building Rehabilitation project reestablished the ability for the facility to accept flow from Headworks, relieving primary sedimentation basin hydraulic capacity constraints during wet weather high flow events.

- The Digester System Improvements Phase 2 project, currently under construction, will renovate the existing digesters with fixed covers, new mixers, and a new waste gas burner. These improvements are expected to eliminate existing volatile solids loading limitations and extend capacity another 20 years. Upgrades for thermophilic operation are currently planned for 2045, which would further expand capacity.

- The North Pipeline Expansion project, currently in design with construction planned for 2026, will remove an existing 36-inch bottleneck in the pipeline and allow discharge of the full capacity of the influent pump station. This will bring the effluent pumping capacity up to 75 mgd at high-high tide.

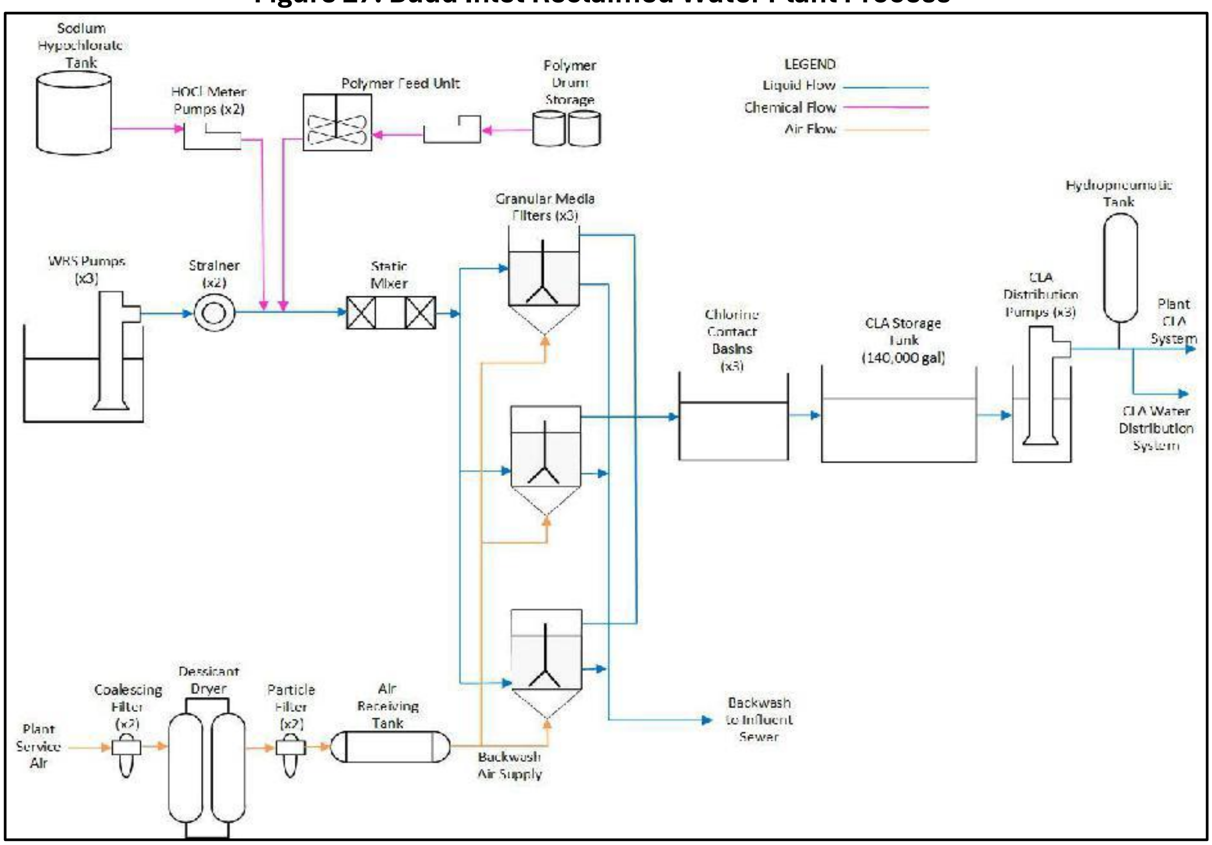
Reclaimed Water Production Capacity

Reclaimed water production capacity is an essential component of LOTT's overall treatment program. In response to community questions about residual chemicals from pharmaceuticals and personal care products, LOTT completed the multi-year Reclaimed Water Infiltration Study in 2022. The purpose of the study was to evaluate risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day and determine what can be done to reduce those risks. Study findings indicate that the practice of using Class A reclaimed water for groundwater recharge is safe and responsible. That information and the associated cost/benefit analysis regarding future options for higher levels of treatment helped to inform the master planning effort, which was completed in early 2023.

Budd Inlet Reclaimed Water Plant

The Budd Inlet Reclaimed Water Plant (BIRWP), commissioned in 2004, produces Class A reclaimed water using sand media and sodium hypochlorite to filter and disinfect secondary effluent. The facility is capable of treating up to a maximum of 1.5 mgd in the form of three bays of sand filters (0.5 mgd each). Some water is used for internal processes at the Budd Inlet Treatment Plant and the Capitol Lake Pump Station. The City of Olympia also has various customers in the downtown and Port Peninsula area that irrigate using reclaimed water. With the completion of the Tumwater Reclaimed Water Storage Tank in 2015, the City of Tumwater also uses reclaimed water to irrigate the Tumwater Valley Municipal Golf Course. Approximately 163 million gallons of reclaimed water were produced and put to beneficial use in 2024.

Figure 27. Budd Inlet Reclaimed Water Plant Process



Completed and Planned Projects

In 2015, HDR Engineering was contracted to update the 2010 Budd Inlet Reclaimed Water Plant Reclaimed Water Demand and Supply Analysis report. The update concluded that LOTT is currently able to meet the instantaneous demands of its existing customers. The report also identified potential future users of reclaimed water, which could include the Washington State Capitol Campus.

The Master Plan Update estimated future demand for up to 3 mgd of reclaimed water along the Deschutes River corridor. While earlier plans involved expansion of the BIRWP, the Master Plan included a new tertiary filtration facility to be constructed as part of an effluent quality enhancement approach. The tertiary filter would allow for upstream second-stage nitrogen removal and would also reduce effluent BOD discharge. The planned filtration system would produce 7.5 to 15 mgd of product at a Class A reclaimed water standard and would replace the BIRWP. The BIRWP facility would be converted to a tertiary disinfection facility.

Table 22. Completed and Planned Project Summary

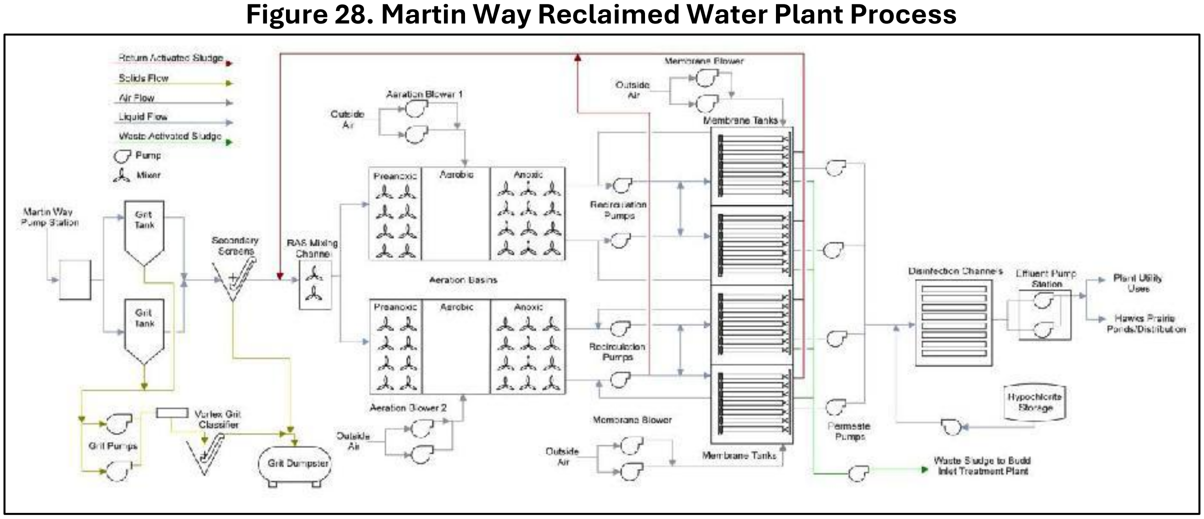
On-line	Name	Cost/Estimate	Status	Description
2015	BIRWP Improvements	$425,990	Complete	Upgrades to the existing facility

Martin Way Reclaimed Water Plant

The Martin Way Reclaimed Water Plant (MWRWP) is a membrane bioreactor (MBR), treating raw wastewater to Class A reclaimed water. The Martin Way Pump Station performs preliminary screening of the raw wastewater, which is pumped to the plant for treatment. The plant has a current treatment capacity of approximately 1.5 mgd, due to diurnal wastewater flow fluctuations and overall flow limitations in the portion of the collection system feeding the satellite facility. Reclaimed water produced at the plant is pumped to LOTT's Hawks Prairie Ponds and Recharge Basins for groundwater infiltration. Reclaimed water is also utilized at the Woodland Creek Groundwater Recharge Facility, a water rights mitigation project developed by the cities of Lacey and Olympia.

In 2024, the MWRWP produced 372 million gallons of reclaimed water, of which 215 million gallons was diverted to the Hawks Prairie Ponds, 180 million gallons to the Woodland Creek Groundwater Recharge Facility, and the remainder was used for internal processes at the Martin Way treatment plant and pump station.

Figure 28. Martin Way Reclaimed Water Plant Process

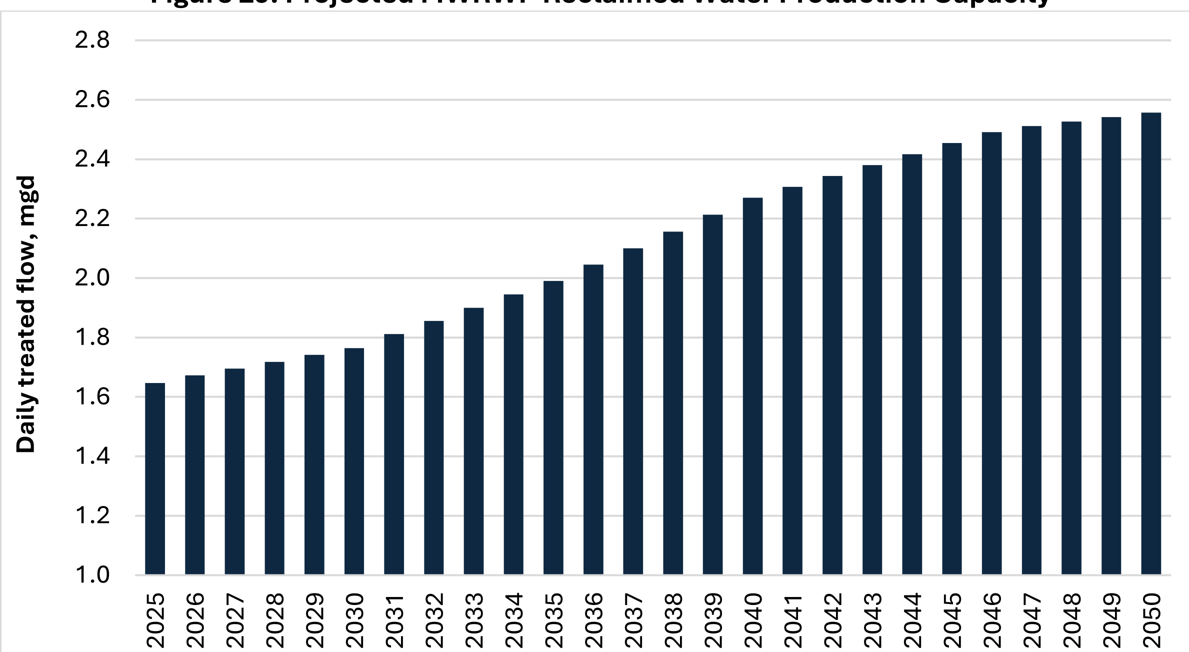


The MWRWP was designed to be expandable up to 5 mgd of treatment capacity with additional construction at the site. Process tanks for the third mgd of treatment capacity were included as part of the original construction project. LOTT also secured additional property from the City of Lacey through a perpetual easement to provide space to expand to 8 mgd if needed.

Two recent studies have resulted in a change in approach with respect to MWRWP expansion. Treatment capacity at the MWRWP has always been limited by diurnal flow variability. The system can only accept a small amount of variability, which means that the overnight minimum flow is the main driver of capacity. The two studies looked at the costs of implementing flow equalization, as well as the benefits with respect to discharge capacity, collection system expansion, and other impacts to the BITP. These studies, even taking into account the benefits at the most optimistic level of probability, found that adding equalization was not cost effective considering the high capital costs.

As a result, dictated by the existing limitations associated with flow variability and turndown, the current plan is to expand the MWRWP as flows become available. This plan allows for a third mgd of membrane capacity to be constructed by 2037, at which point the average daily output of the MWRWP can increase to 2 mgd. Average output would be projected to be 2.6 mgd by 2050. This plan does not require expansion of the MWRWP beyond the 3rd mgd increment, the structure of which has already been constructed. This will require no expansion of the distribution pumping or conveyance pipeline, and no site expansion beyond the existing facility. Figure 29 plots the planned 24-hour average reclaimed water production capacity of the MWRWP, assuming the third mgd of treatment comes online in 2037.

Figure 29. Projected MWRWP Reclaimed Water Production Capacity



Completed and Planned Projects

Consistent and reliable operation of the facility is increasingly important now that the Woodland Creek Groundwater Recharge Facility is on-line. Recently completed improvements at the Martin Way Reclaimed Water Plant include an additional blower and a redundant drum screen. Replacement of the membranes was completed in 2023. Additional anticipated improvements include replacement of aging process valves and equipment as well as the

DeviceNet control system to improve process reliability and control, currently scheduled for 2027.

Expansion to the third mgd of treatment capacity is currently scheduled for 2037. Whether this expansion includes flow equalization has yet to be determined, and this decision may impact the timing of the project. Master planning included partner jurisdiction projections for future reclaimed water needs. These projections indicate that expansion to 3 mgd is likely sufficient to meet currently identified needs.

Table 23. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2006	2 mgd Plant	$25,798,818	Complete	Original plant construction
2010	Huber Drum Screen	$720,000	Complete	Added secondary fine screens
2014	MWRWP Membrane Upgrade	$2,674297	Complete	Upgrades to the existing facility
2018	Waste Activated Sludge (WAS) Pump upgrades	$462,372	Complete	Replaced two WAS pumps and associated controls
2023	MWRWP Blower and Screen Upgrade	$946,910	Complete	Added blower and redundant drum screen
2023	MWRWP Membrane Filter Replacement	$915,955	Planning	Replace the membrane filters at the end of their service life
2027	MWRWP Improvements	$8,142,397	Planning	Replace process valves, DeviceNet and other aging equipment
2037	MWRWP 3rd mgd Equipment	$8,150,000	Future	Add equipment to bring facility capacity to 3 mgd.

Discharge Capacity

All of the flow generated within the LOTT system must ultimately be discharged or beneficially used. At the BITP, final effluent is discharged to Budd Inlet. Reclaimed water is reused at LOTT facilities and distributed to LOTT partner jurisdictions for beneficial reuse by a variety of users. Reclaimed water is also used to replenish groundwater at LOTT's Hawks Prairie Ponds and Recharge Basins and Lacey/Olympia's Woodland Creek Groundwater Recharge Facility.

Budd Inlet Outfall Permit Limitations

LOTT's National Pollutant Discharge Elimination System (NPDES) Permit includes discharge limitations to Budd Inlet for both concentration as well as loadings (pounds per day). Primary loading limitations include biological oxygen demand (BOD), total suspended solids (TSS), and total inorganic nitrogen (TIN). The existing permit was issued on February 16, 2018, with an expiration date of March 31, 2023. Table 24 lists the loadings-based permit limitations.

Table 24. Budd Inlet Treatment Plant NPDES Discharge Limits (lbs/d)

	Winter (November-March)		Shoulder (April, May, and October)		Summer (June-September)	
Parameter	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
BOD (lbs/day)	5,640	8,460	900	1,350	671	1,006
TSS (lbs/day)	5,265	7,898	5,265	7,898	5,265	7,898
TIN	-	-	3 mg/L, 338 lbs/day		3 mg/L, 288 lbs/day	
Ammonia (as N)	26 mg/L	36 mg/L				

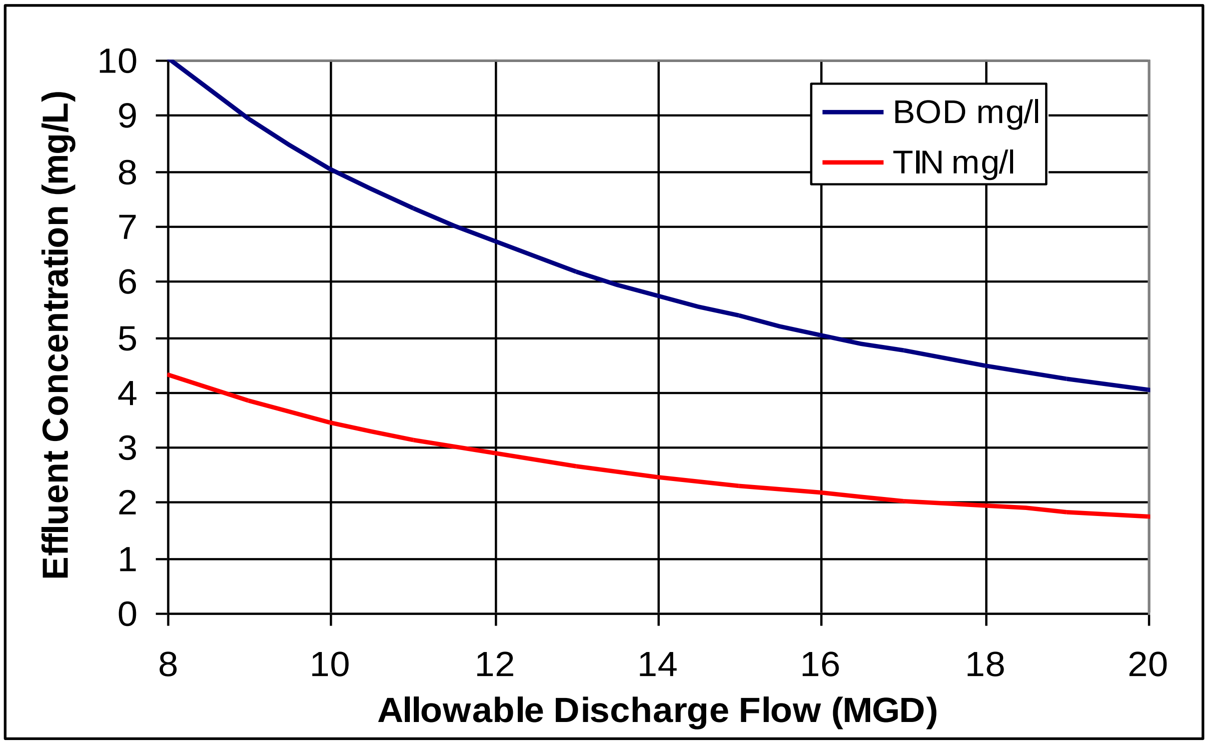
In 2022, Ecology completed the Budd Inlet Dissolved Oxygen Total Maximum Daily Load: Water Quality Improvement Report and Implementation Plan, which established new waste load allocation for discharges to Budd Inlet. The new proposed monthly average waste load allocations are included in Table 25 and include total nitrogen (TN), dissolved inorganic nitrogen (DIN), total organic carbon (TOC), biological oxygen demand (BOD), and dissolved organic carbon (DOC).

Table 25. Proposed Budd Inlet Waste Load Allocations

Month	TN (lbs/d)	DIN (lbs/d)	TOC (lbs/d)	BOD (lbs/d)	DOC (lbs/d)
January	2,529	1,984	6,054	5,639	6,054
February	1,920	1,446	6,054	5,639	6,054
March	1,049	661	6,054	5,639	6,054
April	683	337	1,285	899	1,285
May	683	337	1,285	899	1,285
June	628	289	1,056	670	1,056
July	628	289	1,056	670	1,056
August	584	249	853	470	853
September	584	249	853	470	853
October	683	337	1,285	899	1,285
November	2,405	1,874	6,054	5,639	6,054
December	2,652	2,094	6,054	5,639	6,054

The proposed limits result in a reduction of allowable discharge to Budd Inlet of 30% for BOD and 14% for TIN. By treating wastewater to lower effluent concentrations of BOD and TIN, greater discharge capacity can be achieved. The two primary discharge limitations versus flow for the two seasonal conditions, summer and shoulder, are plotted in Figures 30 and 31.

Figure 30. Effluent Concentration versus Discharge Flow, Summer Condition

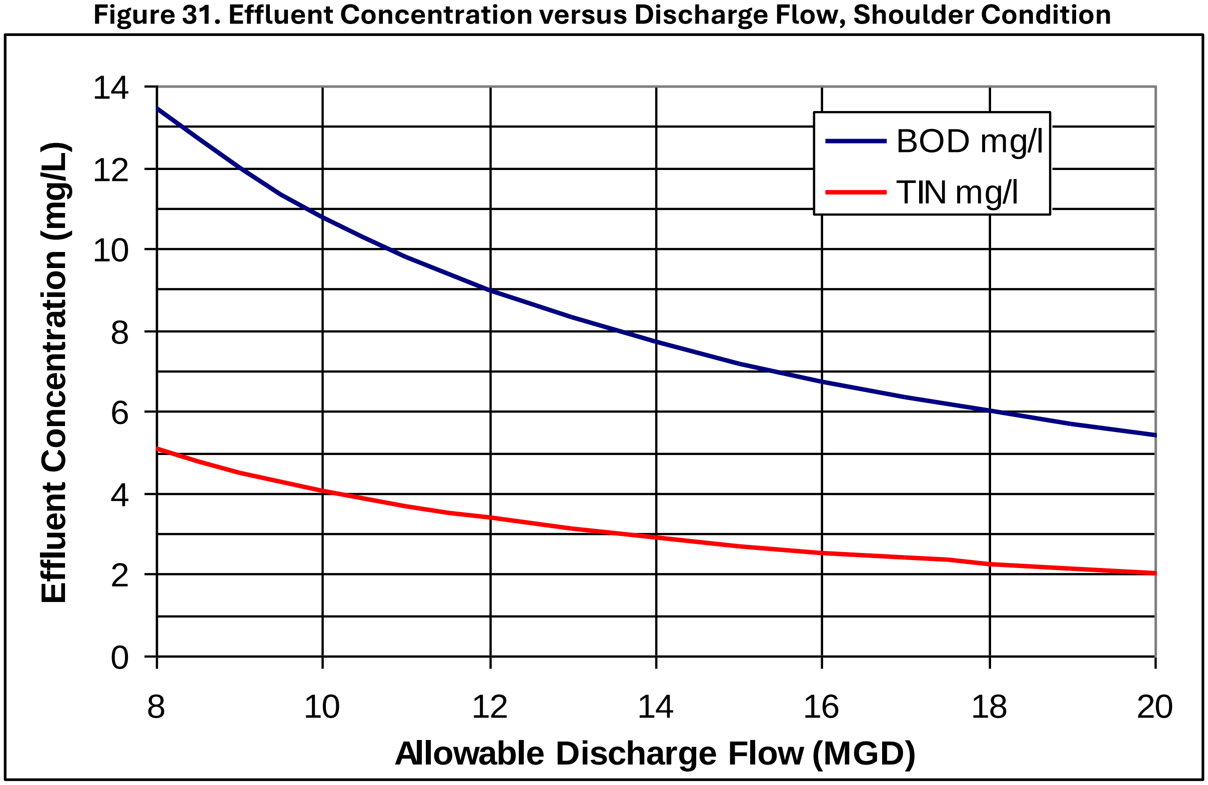


The allowable discharge is:

mgd = 671 lbs/d BOD ÷ x mg/L BOD ÷ 8.34 (based on BOD)

mgd = 288 lbs/d TIN ÷ x mg/L TIN÷ 8.34 (based on TIN)

Figure 31. Effluent Concentration versus Discharge Flow, Shoulder Condition



The allowable discharge is:

mgd = 900 lbs/d BOD ÷ x mg/L BOD ÷ 8.34 (based on BOD)

mgd = 338 lbs/d TIN ÷ x mg/L TIN÷ 8.34 (based on TIN)

Budd Inlet Treatment Plant Biological Process Improvements

The biological process improvements project reconfigured and optimized the secondary biological treatment system. Previously, the biological nutrient removal process required recirculation of treated water between two process areas in the plant. The project reconfigured the process resulting in reduced recycle-pumping rates, increased process control by adding additional instrumentation, and freeing up valuable space on the plant site for potential future treatment processes. After three years of operation, initial results indicate that performance and efficiency have improved. However additional information is needed to gain a better understanding of the long-term resiliency and consistency of the treatment process.

The current NPDES permit is based on loadings (pounds per day) of biological oxygen demand (BOD) and nutrients in the form of total inorganic nitrogen (TIN). By increasing the efficiency of the treatment process (lowering the effluent loadings concentration), LOTT could potentially regain discharge capacity to Budd Inlet.

Table 26 summarizes the plant's current performance relative to its existing NPDES permit.

Table 26. Budd Inlet Treatment Plant Final Effluent Levels (mg/L)

Parameter/Season	NPDES Permit Limits	Average 2024	Maximum Month 2024
TIN (mg/L)			
Summer	3	2.11	2.21
Shoulder	3	1.95	2.23
Critical (Aug/Sept)	3	2.02	2.04
BOD (mg/L)			
Summer	7	3.91	5.94
Shoulder	8	2.83	2.92
Critical (Aug/Sept)	7	3.01	3.28
Winter	30	4.67	5.84
TSS (mg/L)			
Winter	30	7.01	12.32

In addition to the NPDES permit limitations, LOTT reserves 1.5 mgd of treatment capacity as an added measure of safety in measuring operational capacity. This serves two purposes: 1) allows for additional operational flexibility during peak flow events, minimizing the likelihood of a permit violation; and 2) protects the system from unanticipated rapid population growth and/or delays in the construction of new treatment capacity.

Figures 32 through 35 show the plant's BOD and TIN performance in terms of both concentration and loading for 2024. The plant has met BOD and TIN regulations throughout this period. While LOTT strives to perform at discharge levels well below those required by permit, it is important to note that:

- Operational conditions and performance vary considerably due to factors outside of LOTT's control, such as influent temperature, storm flows, or illicit discharges affecting the treatment process. Therefore, the existing buffer between permit limits and performance levels is necessary to ensure continued permit compliance.

- LOTT is responsible for the management of wastewater from our partner jurisdictions, and they in turn are responsible for accommodating growth. By enhancing the performance of the Budd Inlet Treatment Plant, LOTT gains capacity in the system that will be necessary to responsibly manage community growth in the future.

Figure 32. Monthly Final Effluent BOD Compared to Permit

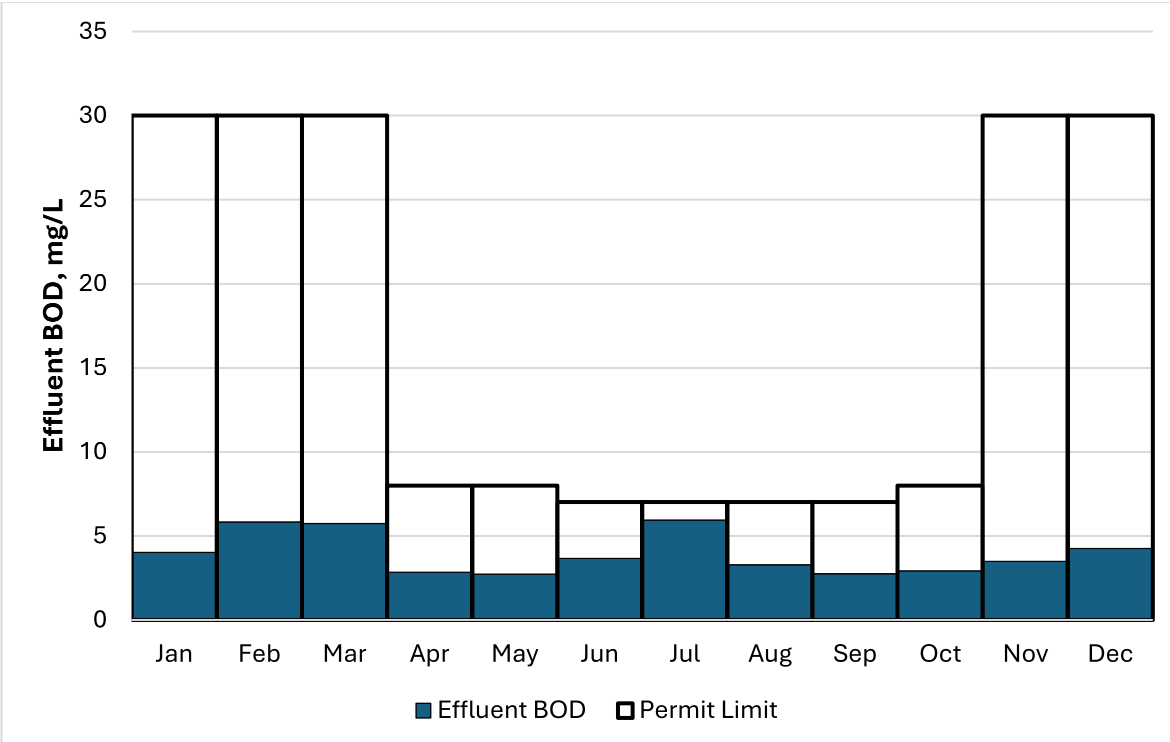


Figure 33. Monthly Final Effluent TIN Compared to Permit

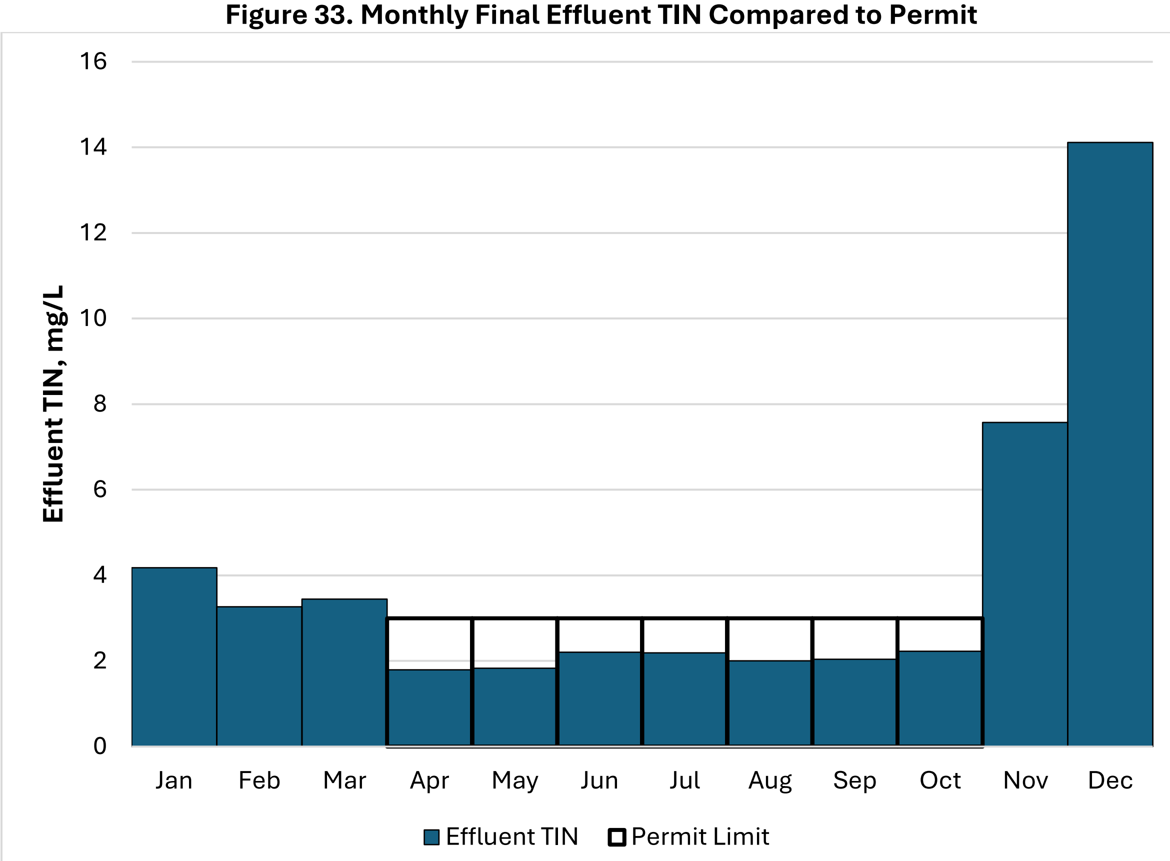


Figure 34. Monthly Final Effluent BOD Load Compared to Permit

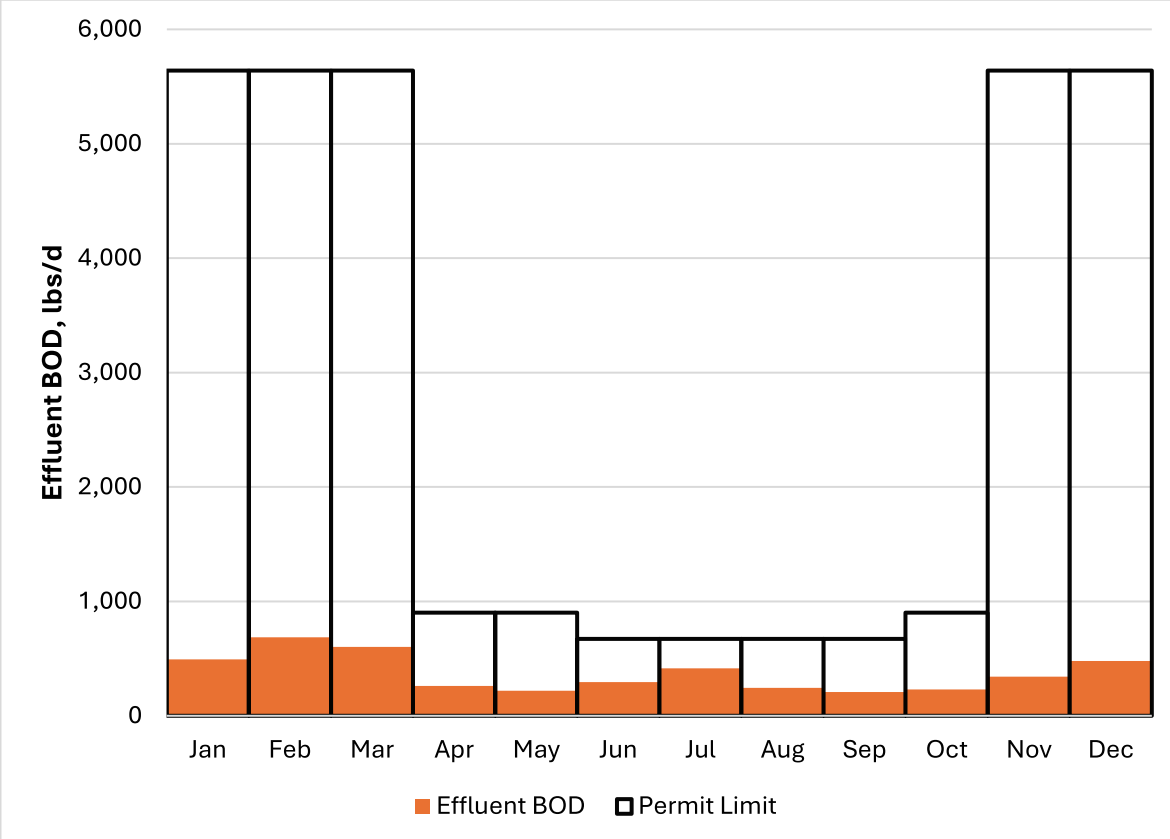
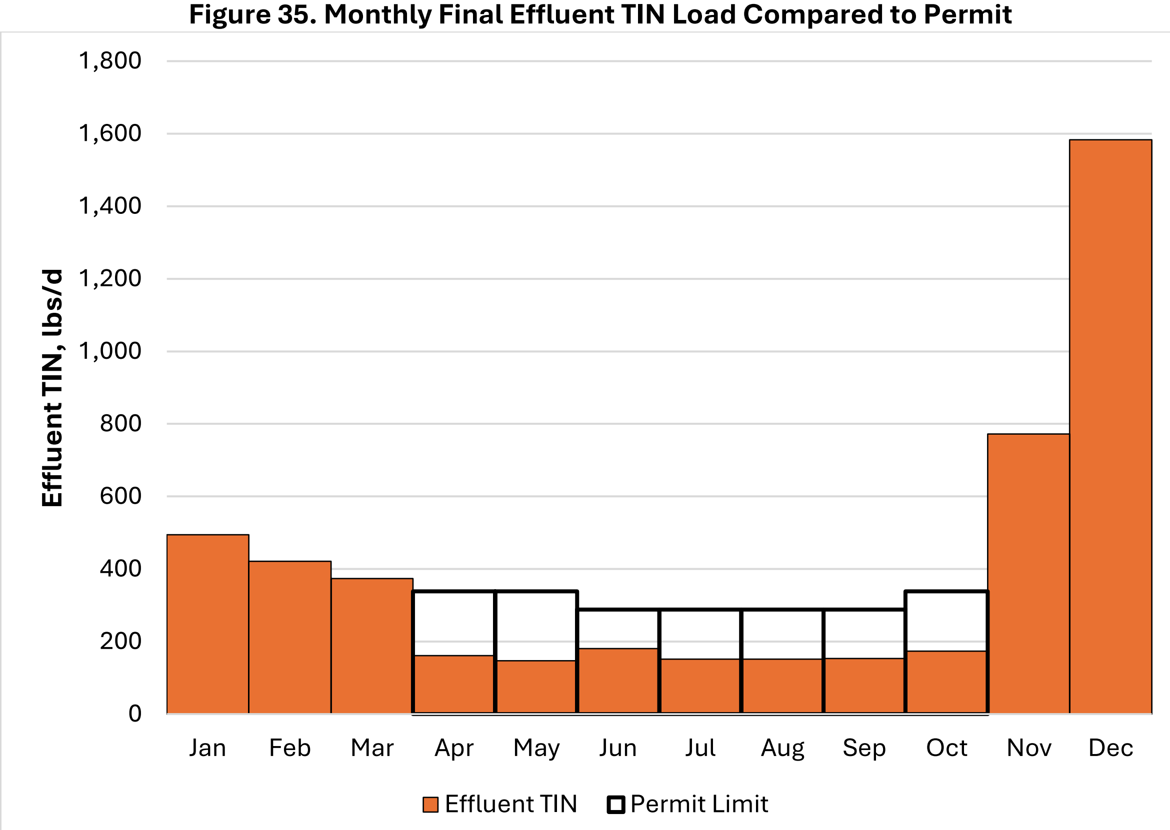


Figure 35. Monthly Final Effluent TIN Load Compared to Permit



Budd Inlet Treatment Plant Site Planning

LOTT recently completed a long-term master planning effort which was conducted in several phases. The first phase evaluated the Budd Inlet Treatment Plant footprint and updated the site plan, locating various treatment processes to meet future capacity needs. The site plan, presented in Figure 36, identifies the location of various facility needs through 2050.

The second phase of master planning considered LOTT's overall capacity management strategy, re-evaluating the reclaimed water production, distribution, and disposition program and other options for managing capacity long-term. This planning considered that system capacity requirements have decreased, and that community use and demand for reclaimed water has increased since LOTT's original Wastewater Resource Management Plan (1999) and Budd Inlet Treatment Plant Master Plan (2006) were completed. In addition, new treatment technologies offer the opportunity to further improve treatment performance at the Budd Inlet Treatment Plant and increase hydraulic discharge capacity.

Figure 36. Budd Inlet Treatment Plant Site Plan

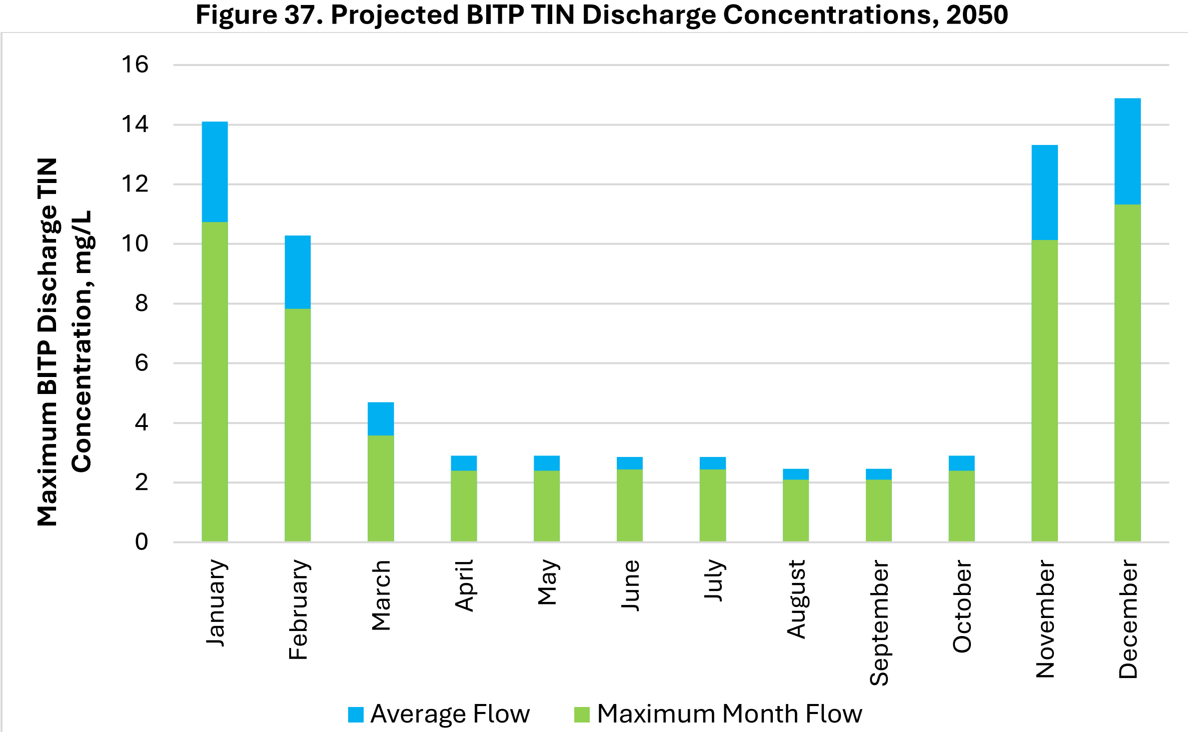
Budd Inlet Discharge Capacity Analysis

The 2022 Capacity Management portion of the Master Plan Update summarized LOTT's approach to discharge capacity. The approach is focused on generating increasingly high quality effluent to meet mass limitations on discharge to Budd Inlet, coupled with water reuse and recycling efforts to match demands. In summary, the plan envisions the following:

- The MWRWP will expand on pace with flow availability, generating an average of 2.6 mgd of reclaimed water by 2050.
- The BITP will add tertiary treatment. This will include second-stage nitrogen removal, filtration, and disinfection, generating a product with a TIN of 1 mg/L and a BOD of 3 mg/L, which is also compatible with Class A reclaimed water standards.
- The BIRWP will be replaced by the tertiary treatment system described above, but existing pumping and distributions systems will be used to discharge an estimated 3 mgd of reclaimed water for beneficial end uses along the Deschutes River corridor.

Figures 37 and 38 depict the maximum BITP discharge concentrations for TIN and BOD in 2050, using the proposed mass limits summarized in Table 25. During the summer, discharge TIN would need to be 2.5 mg/L on average, and 2.1 mg/L under a maximum month flow condition. These are similar to current levels of performance, as the average summer TIN in 2024 was 2.1 mg/L.

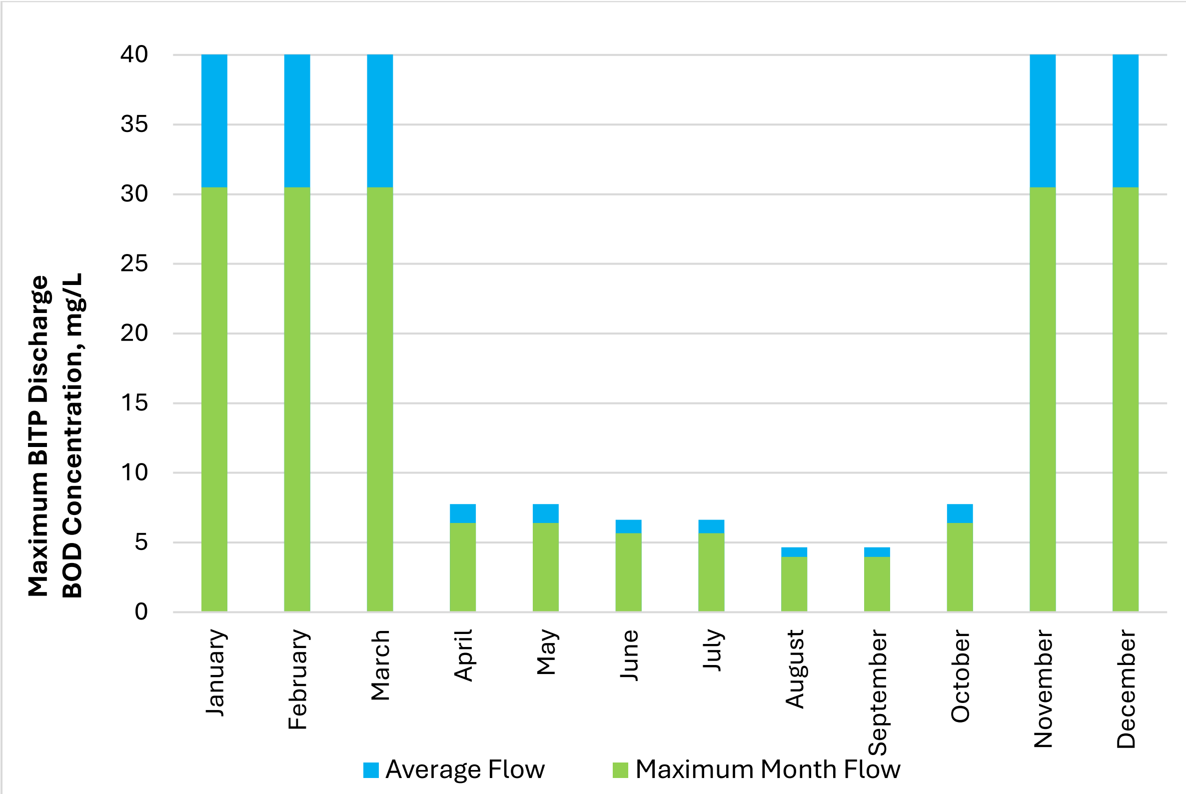
Figure 37. Projected BITP TIN Discharge Concentrations, 2050



Assumes 2.6 mgd treatment at MWRWP and 3 mgd of reuse along the Deschutes River corridor, with 1.5 mgd of reserve capacity at the BITP.

The summer BOD concentration would need to average 4.6 mg/L, or 4.0 mg/L under a maximum month flow condition. These are also similar to current levels of performance, as the 2024 average summer BOD discharge was 3.9 mg/L.

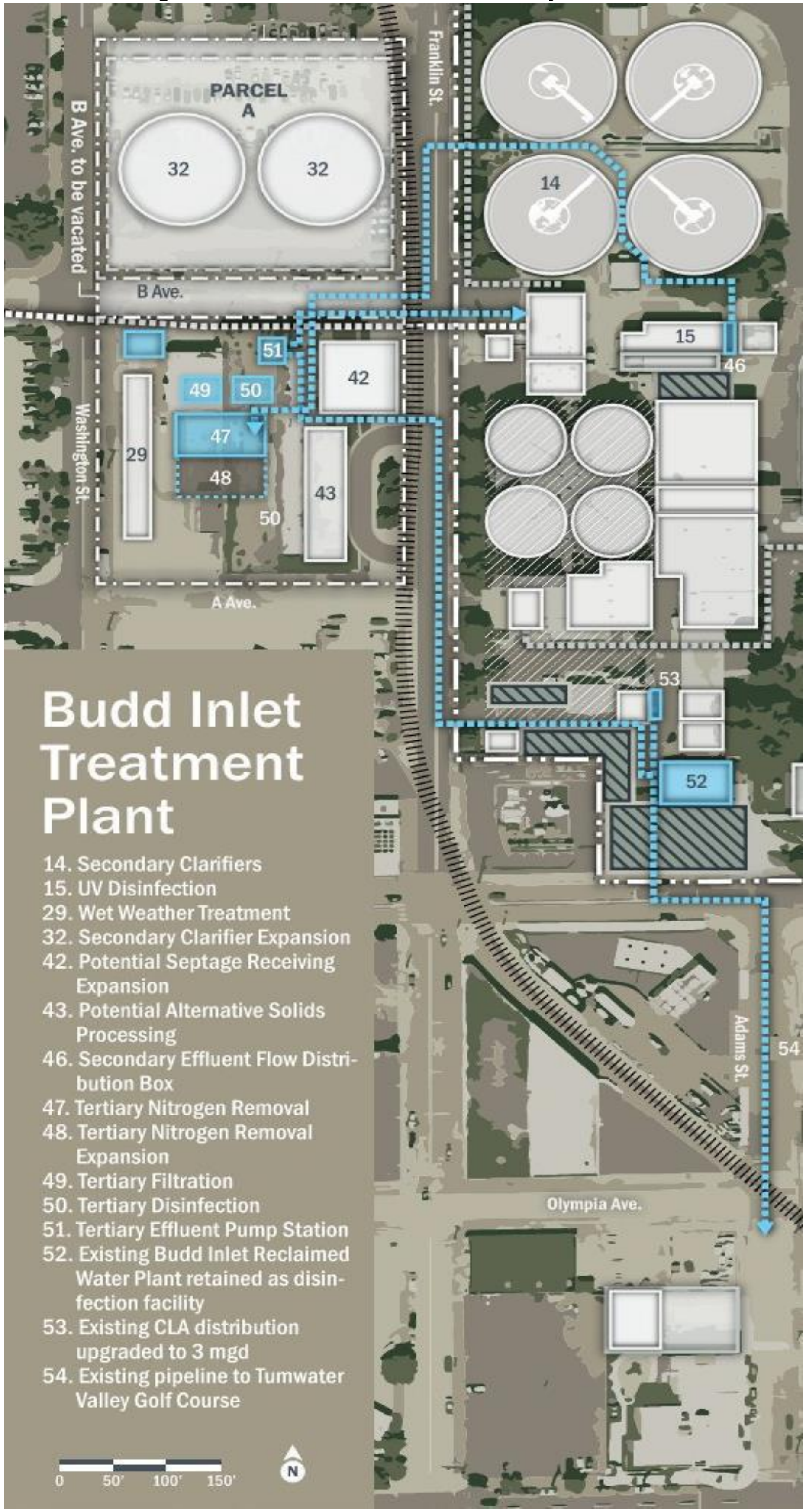
Figure 38. Projected BITP BOD Discharge Concentrations, 2050



Assumes 2.6 mgd treatment at MWRWP and 3 mgd of reuse along the Deschutes River corridor, with 1.5 mgd of reserve capacity at the BITP.

The tertiary treatment system will be implemented on an as-needed basis. The system is designed to be modular. While space has been reserved for up to 15 mgd of treatment (adequate to treat over 90 percent of the summer flow in 2050), the system could be implemented in smaller increments. Also, elements of the system can be implemented at different paces. For example, a tertiary filtration system to generate reclaimed water and reduce effluent BOD concentrations could be implemented independently of the tertiary nitrogen removal element. Figure 39 shows how the tertiary facilities would fit onto the BITP site.

Figure 39. BITP Site Plan with Tertiary Facilities



Alternative Discharge Planning

Reclaimed water approaches to alternative discharge considered in this analysis include the following:

- Non-potable reuse (NPR), which includes consumption of reclaimed water by end users for irrigation or industrial uses.

- Environmental uses, which include streamflow or surface water augmentation and wetland enhancement.

- Indirect potable reuse (IPR), which includes groundwater recharge through soil percolation and direct injection to groundwater.
  Direct potable reuse (DPR), which involves discharge to a potable water distribution system.

Reclaimed water currently generated at the BIRWP and MWRWP is primarily used for irrigation, process water at LOTT facilities, and groundwater recharge. In its capital program, LOTT includes tentative projects to generate up to 17.6 mgd of reclaimed water.

Reclaimed Water Treatment

Existing treatment facilities include the BIRWP and the MWRWP. These sites generate Class A reclaimed water, suitable for NPR, environmental uses, and groundwater recharge.

The BIRWP has a current treatment capacity of 1.5 mgd, which is sufficient to meet the demand of existing reclaimed water customers. Construction of the Tumwater Reclaimed Water Tank has allowed LOTT to meet instantaneous demands and allows for more reliable delivery to existing LOTT users. Community demand for reclaimed water in the area may drive expansion of the BIRWP. Potential users may include the Washington State Capitol Campus. In 2016, Gray and Osborne Consulting Engineers completed the Capitol Campus Reclaimed Water Assessment. The estimated cost was $2,427,000 to construct the necessary infrastructure to provide service to the campus.

The MWRWP treats raw sewage generated in Lacey. Reclaimed water from this facility is primarily used for groundwater recharge at LOTT’s Hawks Prairie Ponds and Recharge Basins, and by the cities of Lacey and Olympia for water rights mitigation through their Woodland Creek Groundwater Recharge Facility. The plant is currently treating approximately 1.6 mgd of flow, and future expansion will increase production to 2.6 mgd by 2050.

A future tertiary filtration facility at the BITP would replace the BIRWP and could provide up to 15 mgd of production capacity.

Table 27 summarizes previous assumptions about expansion of existing reclaimed water production facilities in the LOTT system.

Table 27. Reclaimed Water Production Sites

Facility	Product	Existing Capacity (mgd)	Potential Capacity in 2050 (mgd)	Next Steps
Budd Inlet Reclaimed Water Plant	Class A	1.5	0.0	To be replaced by tertiary treatment facility
Martin Way Reclaimed Water Plant	Class A	1.6	2.6	Add 3rd mgd of membrane capacity (2038)
Budd Inlet Treatment Plant Tertiary Treatment	Class A	0.0	15.0	To be constructed on an as-needed basis
Total		3.1	17.6	

Alternative Discharge Location

To ensure the capacity for adequate discharge, LOTT's original long-range plan assumed that LOTT would develop its own groundwater recharge locations. LOTT has purchased a number of properties as potential future infiltration sites. However, site suitability has been re-evaluated since the original estimates at time of purchase.

Overall discharge capacity is lower than previously estimated, and the cost of conveyance continues to escalate. Master planning confirmed that expansion of infiltration at the existing Hawks Prairie site is a more cost-effective option than developing new infiltration facilities and associated conveyance lines. Master planning also identified new opportunities to manage future discharge capacity through enhanced treatment at the BITP, greatly reducing the need to invest in new infiltration facilities. Future alternative discharge will be driven primarily by demand.

Planned Projects

Potential projects for providing discharge capacity are summarized in Table 28. These projects would be implemented on an as-needed basis.

Table 28. Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
TBD	Tertiary filtration, disinfection, and pumping, Phase 1	$24,300,000	Future	Produce up to 7.5 mgd of filtered effluent at Class A reclaimed water standard
TBD	Tertiary filtration, disinfection, and pumping, Phase 2	$6,100,000	Future	Expand facility from 7.5 to 15 mgd
TBD	Tertiary nitrogen removal, phase 1	$10,800,000	Future	Treat up to 7.5 mgd of BITP effluent to reduce TIN to 1.0 mg/L
TBD	Tertiary nitrogen removal, phase 2	$7,300,000	Future	Expand facility from 7.5 to 15 mgd

Conveyance System Analysis

LOTT has instituted a program to inspect all of its collection system maintenance holes and pipes on a regular schedule. This program keeps track of the condition of collection system assets and prioritizes projects to repair or replace pipes and maintenance holes.

Conveyance system capacity is periodically assessed through dynamic sewer modeling. The following section summarizes the capacity analysis of the collection and conveyance systems conducted in 2022/2023. The projects listed at the end of this section involve capacity expansion and are separate from the repair and replacement projects developed as part of the LOTT's ongoing sewer inspection program.

Modeling Description

The LOTT sewer model includes all of the Olympia and Lacey pipes greater than 8-inch diameter, a number of key pipes of 8-inch diameter and smaller, and the Tumwater siphon pipeline running from Hixon Street into the LOTT Southern Connection. The model was designed to simulate a 10-year peak hour storm event and was run at 5-year time increments from 2025 through 2050, with an additional run with full connection of all septic tanks within the cities and UGAs. A summary of the model output as it relates to LOTT-owned pipe follows. Note that the model was run assuming flow diversion to the Martin Way Reclaimed Water Plant for all scenarios. The quantity of flow diversion starts with the current average diversion of 1.4 mgd, increasing to 1.9 mgd by 2050, and 2.0 mgd at full connection. This assumes no further increments of capacity are added at the MWRWP, and no flow equalization is added at the MWRWP.

Sewer Capacity Definition

The capacity of the collection system may be assessed in several ways. In this report, capacity is assessed using three measures:

1. Depth to flood. The most obvious measure of capacity is whether a pipeline is projected to flood. A conservative capacity trigger would be a water elevation which comes within 5 feet of maintenance hole rim elevation at peak flows. Other communities have set capacity triggers anywhere from 1.5 to 7.0 feet of rim. The capacity trigger depends upon many factors, including the consequence of flooding (pipelines near sensitive areas may require a more conservative trigger), as well as the likelihood of secondary flooding (at what water elevation do nearby laterals begin to backflow).

2. Pipe filling or surcharge ratio. Pipe filling is defined as the energy grade level divided by the pipe diameter. A full pipe will have a pipe filling ratio of 1.0, meaning it is 100% surcharged. A pipe filling ratio of 2.0 means that the pipe is full, and there are x-inches of pressure in the pipe, where x is the pipe diameter. An 8-inch pipe with a pipe filling ratio of 3.0 will flood laterals 16 inches above the crown of the pipe. Pipe filling is a useful way to gauge the capacity of the sewer system, as surcharged pipes will act as bottlenecks, and will often result in a backwater effect upstream of the restriction. However, a pipe with a ratio of 2.0 or higher may be innocuous. For example, very deep pipes may carry a substantial surcharge, with little risk of flooding laterals due to the main's burial depth.

3. Pipe flow capacity. The capacity of a gravity sewer may be estimated by its diameter and slope. The model compares the projected flow in each pipe segment to its theoretical capacity and reports the ratio. Pipes which are flowing at or above capacity act as bottlenecks, and cause flow to back up into upstream pipes.

The summaries in this section express capacity in terms of pipe filling, with additional discussion of capacity and depth-to-flood.

Existing Condition

Figure 40 presents a schematic of the existing system, as modeled. Pipes are colored by size, with pump stations shown as triangles. The model includes 22 pump stations, including the LOTT stations and a number of Olympia and Lacey stations. The model is mostly comprised of partner pipes, with the LOTT collection system forming the backbone.

Figure 40. Map of modeled sewer system

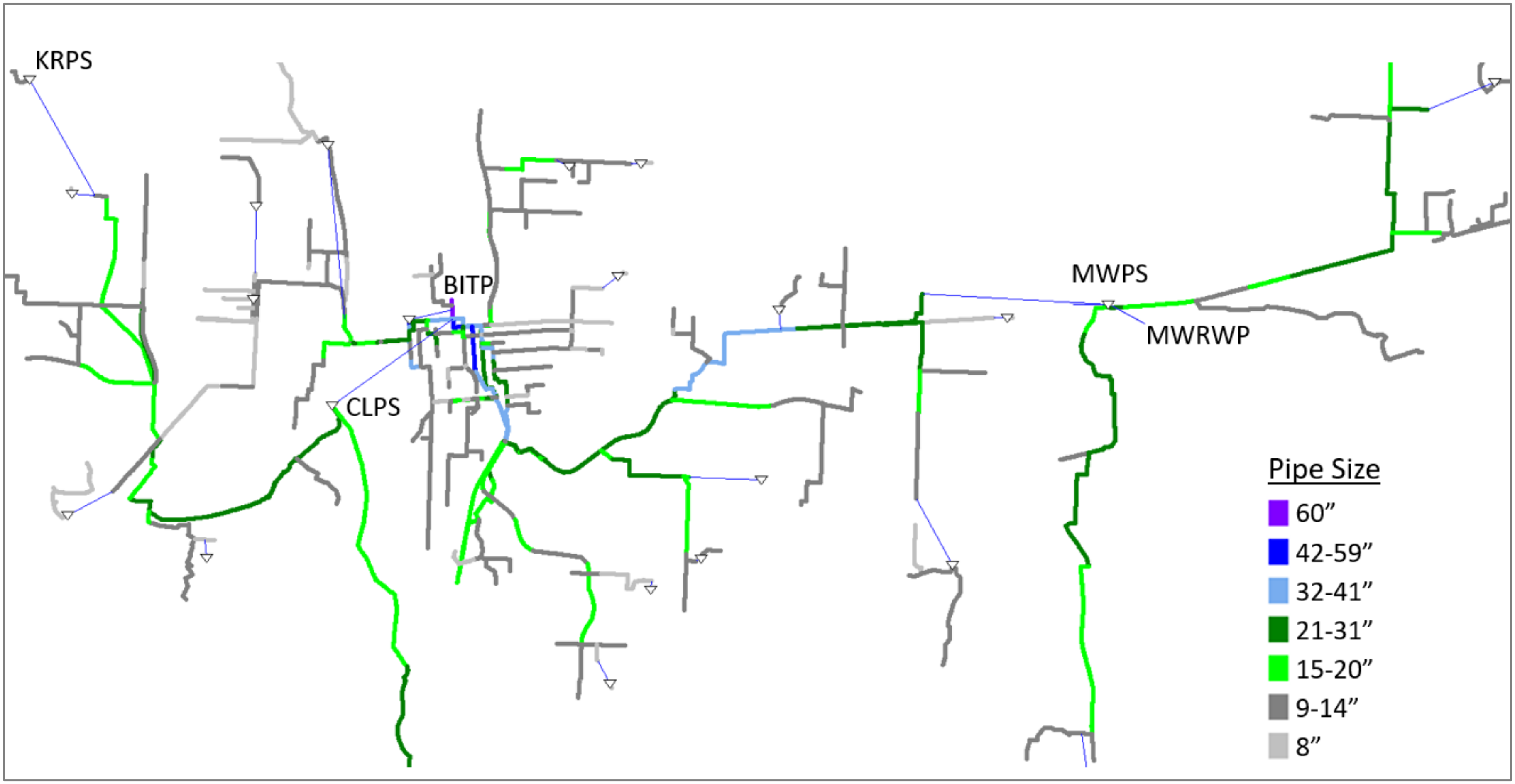
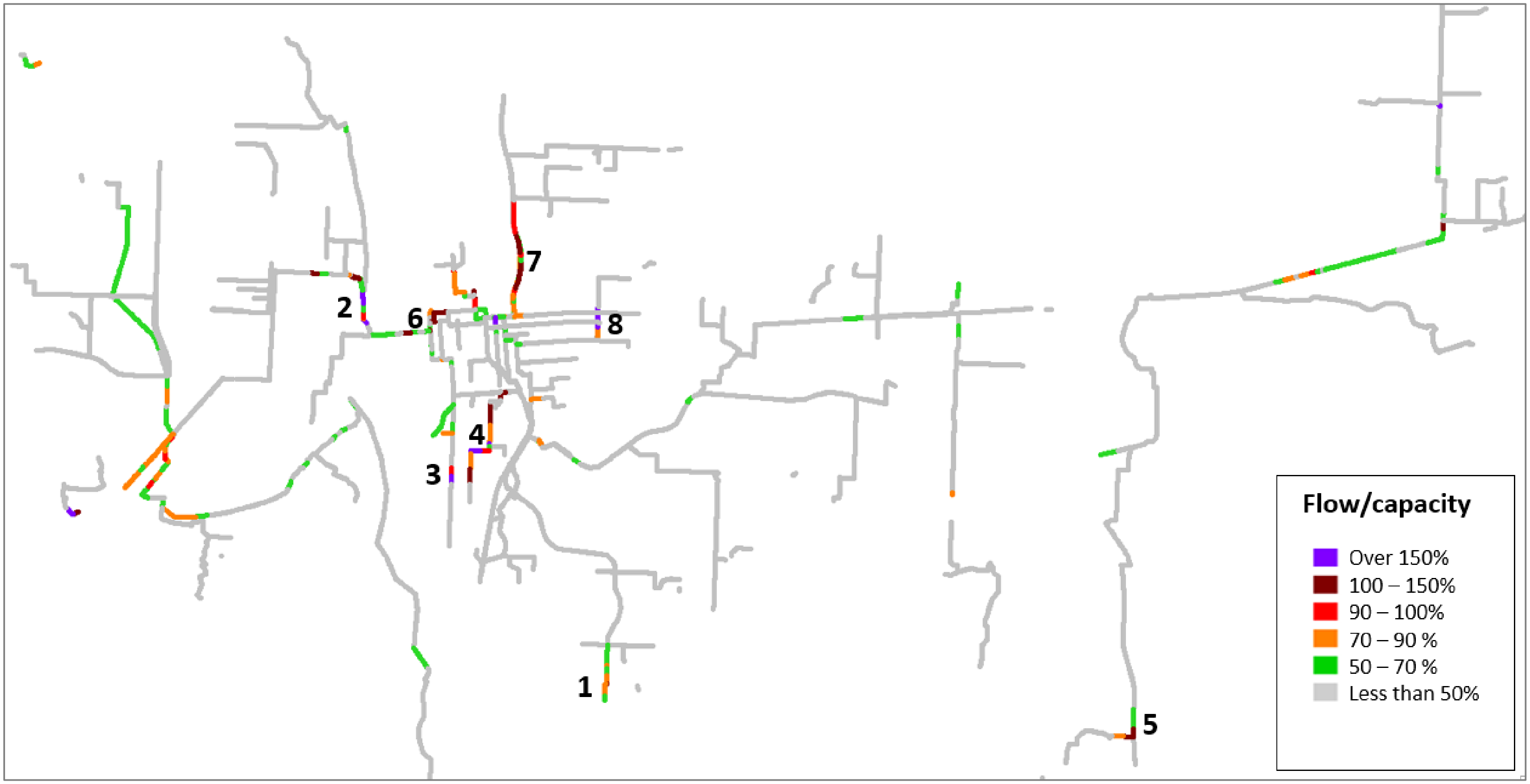


Figure 41 presents the current peak hour flow condition for the existing system. The figure shows the peak hour flow divided by the theoretical capacity of each segment. The purpose of this figure is to summarize existing capacity limitations in the system. These limitations are currently restricting flow to downstream pipes, making it difficult to assess the capacity of downstream segments.

Figure 41. 2023 Peak Hour Scenario Existing System (As-Is) – Flow Capacity



The as-is model simulates the current situation as we know it in regard to flows and pipe sizes that are represented in the geodatabase. Major issues identified within the existing system include the following:

1. Bottlenecks in the 10” pipes at the southern end of the Henderson pipeline
2. Restrictions in several pipe sections along West Bay Drive
3. Restrictions in the 10” pipes along Capitol Way
4. Restrictions in the 10” pipes along Franklin and Jefferson Streets
5. Restrictions near the lift station outlet in south Lacey near Mullen Road
6. Restrictions in both pipelines coming across the 4th Avenue Bridge
7. Restrictions in both pipelines along East Bay Drive
8. Bottlenecks in the 12” pipe along Central Street

These issues are projected to cause flooding, or near-flooding conditions at several maintenance holes. Flooding is projected at the 4th Avenue Bridge, West Bay Drive, as well as along Franklin Street. Near-flooding conditions are projected along East Bay Drive and Central Street. To date, flooding has been observed at only some of these locations. This may be related to sealed maintenance holes, misallocation of I&I to certain locations, or the conservative nature of the sewer model.

Most of the major existing issues affect Olympia pipes. Olympia is aware of these limitations, and each jurisdiction is developing strategies to meet these capacity related issues.

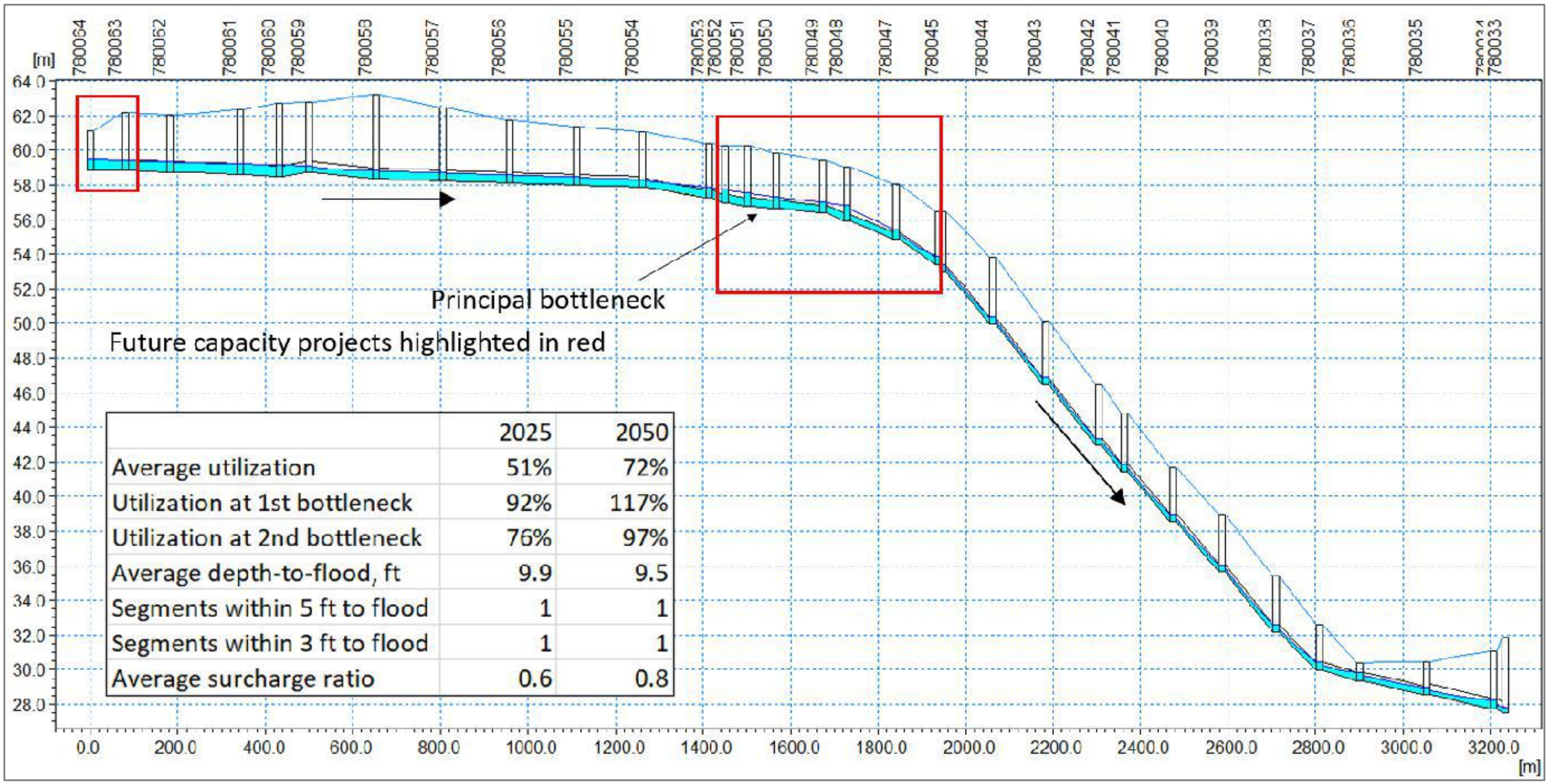
For the following scenarios, the bottlenecks causing surcharging in south and downtown Olympia and along West Bay Drive were removed to allow effective modeling of downstream pipes.

LOTT System Analysis

Martin Way Interceptor (East)

This interceptor consists of a relatively flat section of 24-inch pipe flowing into progressively steep portions of 18- and 15-inch pipe. The 15-inch pipe, particularly in a pair of less-steep upstream sections, acts as a flow bottleneck. Figure 42 presents the pipe profile, along with water depth at the 2050 peak hour condition, and other analytical information.

Figure 42. Martin Way Interceptor (East) 2050 Peak Hour Flow Profile



	2025	2050
Average utilization	51%	72%
Utilization at 1st bottleneck	92%	117%
Utilization at 2nd bottleneck	76%	97%
Average depth-to-flood, ft	9.9	9.5
Segments within 5 ft to flood	1	1
Segments within 3 ft to flood	1	1
Average surcharge ratio	0.6	0.8

The pipe is deep for most of its length, and only a single maintenance hole near the outlet poses a risk of flooding. The depth-to-flooding at maintenance hole 780036 is within 2 ft by 2050.

The pipe projects to be fully surcharged for most of its length, although the amount of surcharging is low, and there appears to be little risk of flooding. The maximum amount of surcharging, taking place near the middle of the pipeline, is just under 1-foot of depth. That surcharge level is still 8 ft below ground level.

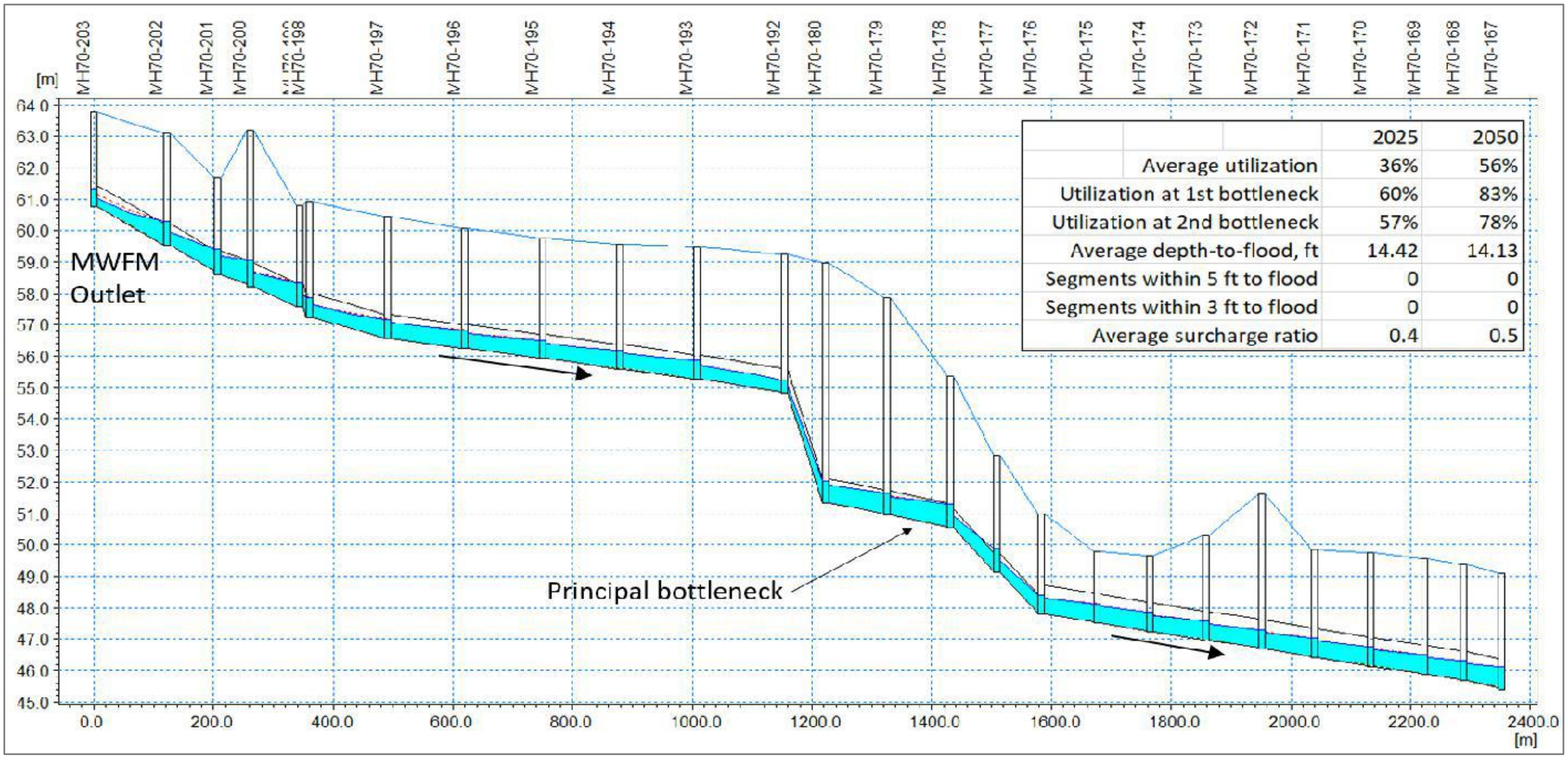
Overall, there does not appear to be any reason to increase capacity by 2050. The full connection scenario projects much more severe surcharging, with higher likelihood of lateral and/or basement flooding, as the surcharge level approaches within 5 feet of ground level for much of its length. A bottleneck replacement project would target 7 segments of pipe, mostly in the middle of the pipeline. This project will not be needed until after 2050.

This interceptor discharges into the MWPS. Peak flows reported at the MWPS have increased in recent years, which raises concern over whether those increases translate to increases at the MW Interceptor East segment. If so, the Interceptor may have significantly less capacity than modeled.

Martin Way Interceptor (West)

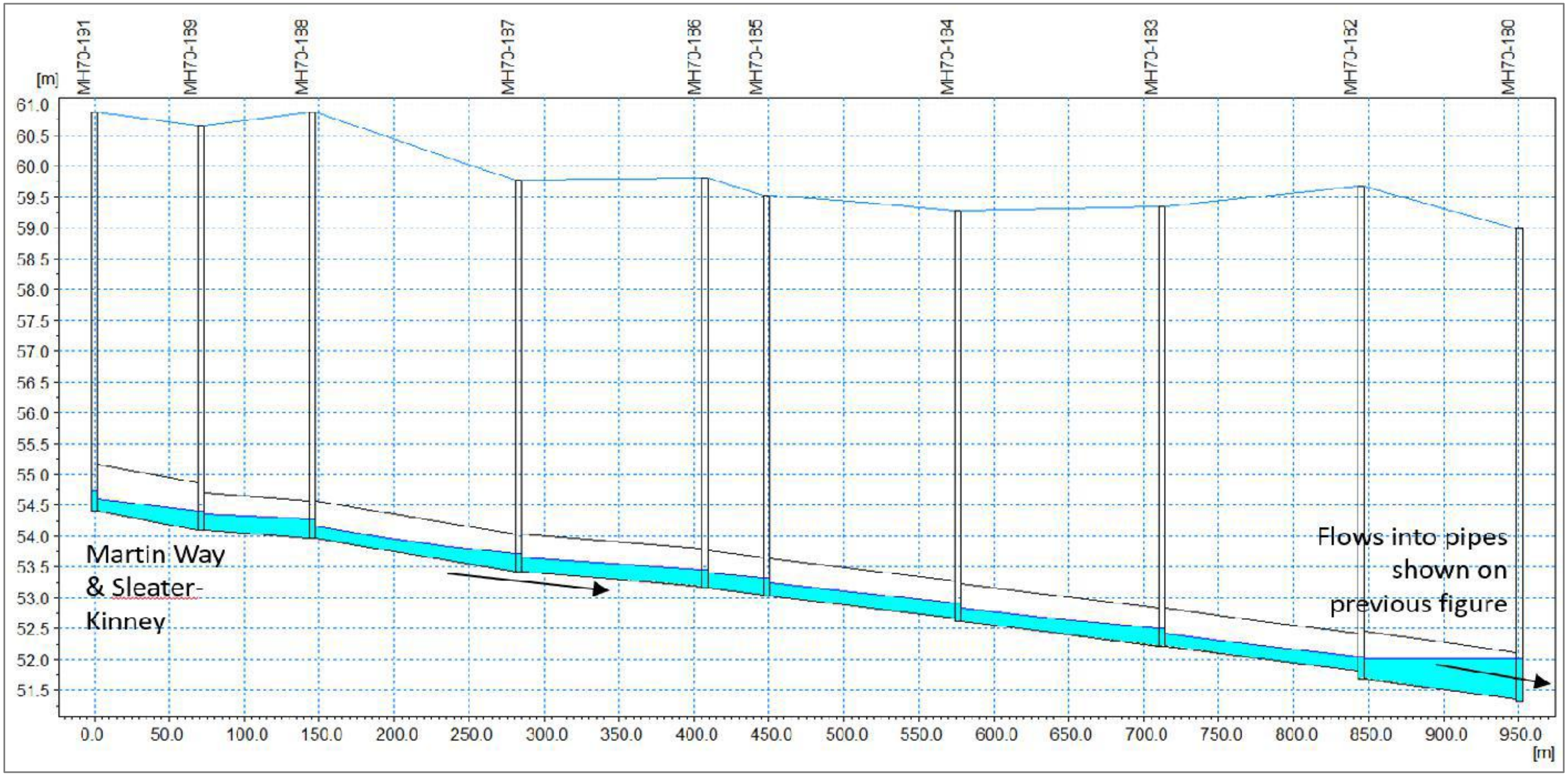
The Martin Way Interceptor (West) accepts flows from the MWPS Force Main, as well as from the Lacey interceptor running north along Sleater-Kinney Road. Flow splits between a northern and southern branch for the upstream portion of this pipeline—the north branch taking flow from the MWPS Force Main, and the southern branch taking flow from Lacey. Figures 43 and 44 present the profile of the interceptor in the 2050 peak hour flow condition.

Figure 43. Martin Way Interceptor (West), Including North Branch, 2050 Peak Hour Condition



	2025	2050
Average utilization	36%	56%
Utilization at 1st bottleneck	60%	83%
Utilization at 2nd bottleneck	57%	78%
Average depth-to-flood, ft	14.42	14.13
Segments within 5 ft to flood	0	0
Segments within 3 ft to flood	0	0
Average surcharge ratio	0.4	0.5

Figure 44. Martin Way Interceptor (West), South Branch, 2050 Peak Hour Condition



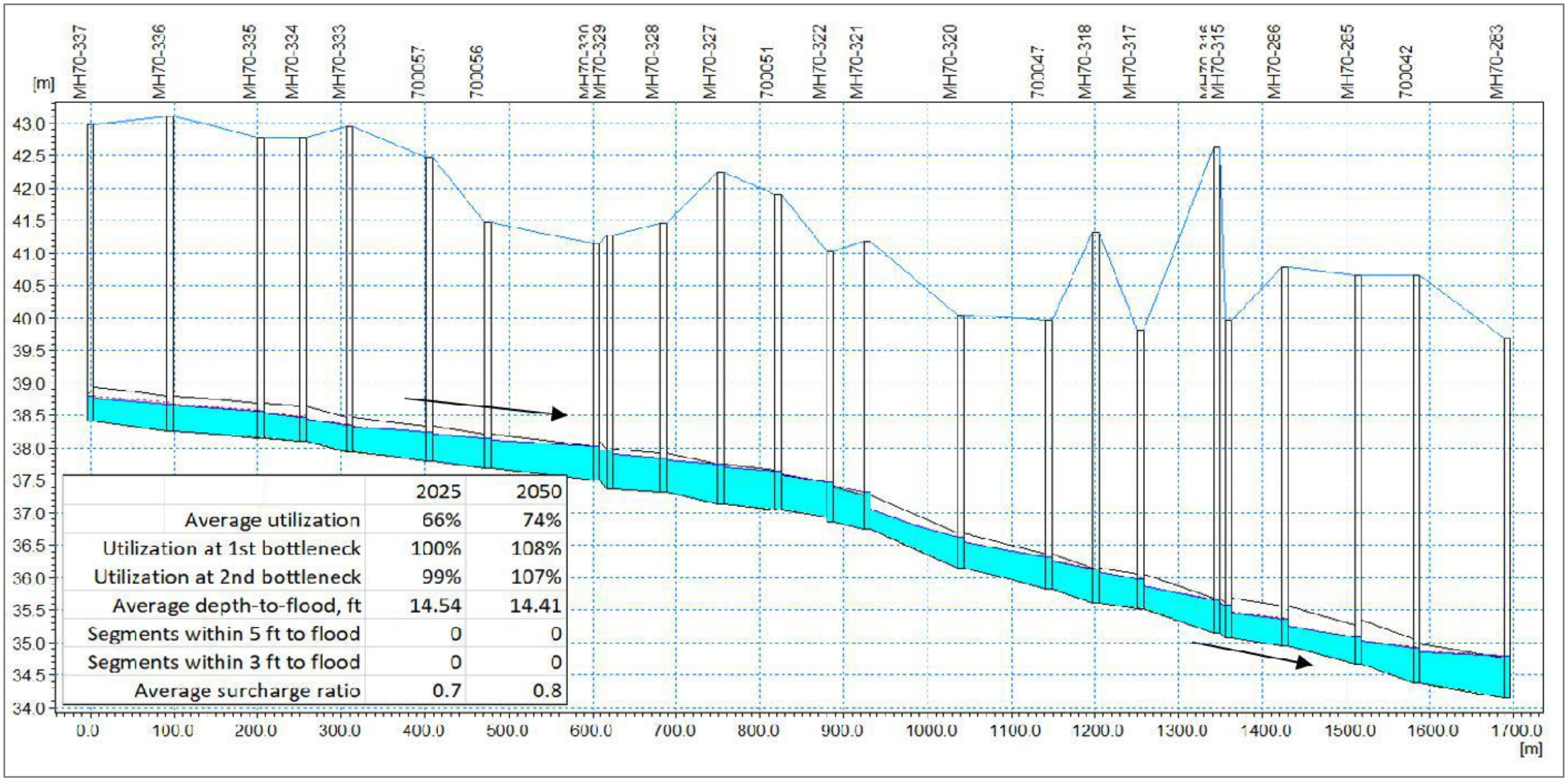
This pipeline poses a low risk of flooding, with no segments or maintenance holes projected to fill within 5 feet of the ground elevation. No significant surcharging is projected to occur before 2050.

With full connection, a capacity restriction in the middle of the pipeline leads to some minor surcharging. No capacity-related projects are envisioned at this time.

Cooper Point Interceptor

The Cooper Point Interceptor is a deep pipeline, averaging over 10 feet of burial depth. Figure 45 presents its 2050 peak hour flow profile. The pipeline appears to be well-sized for 2050 flows, with only minor surcharging, and an average depth-to-flood of over 14 ft. There are no significant choke-points or shallow maintenance holes. No capacity work is projected for this pipeline.

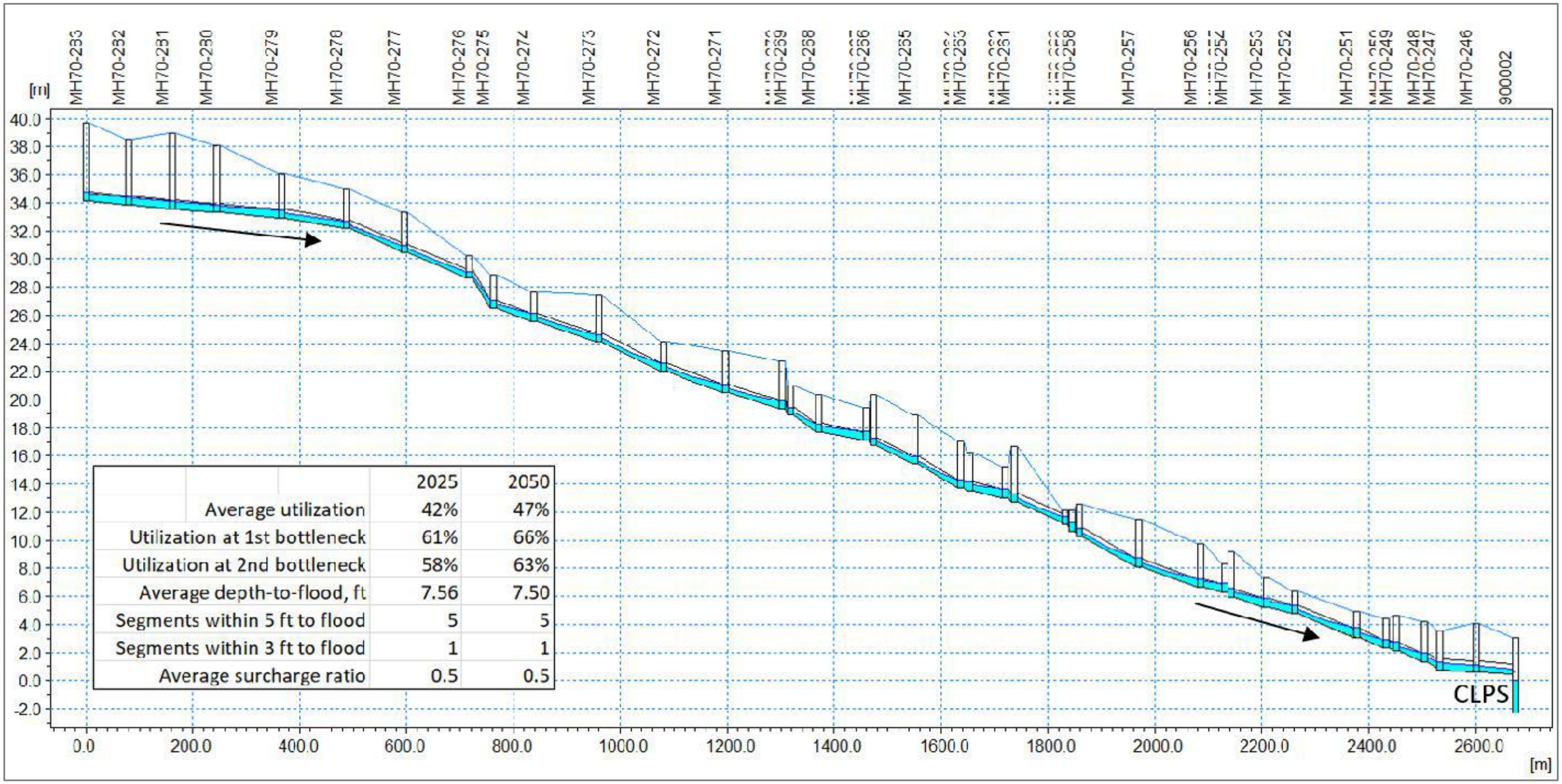
Figure 45. Cooper Point Interceptor, 2050 Peak Hour Condition



Percival Creek Interceptor

The Percival Creek Interceptor is a long and comparatively steep pipeline, with areas under minimal cover. The 2050 peak hour profile is plotted on Figure 46. No capacity issues are observed in this pipeline. While the pipeline is shallow, it has ample capacity for projected flows. No capacity-related projects are planned for this pipeline.

Figure 46. Percival Creek Interceptor, 2050 Peak Hour Condition

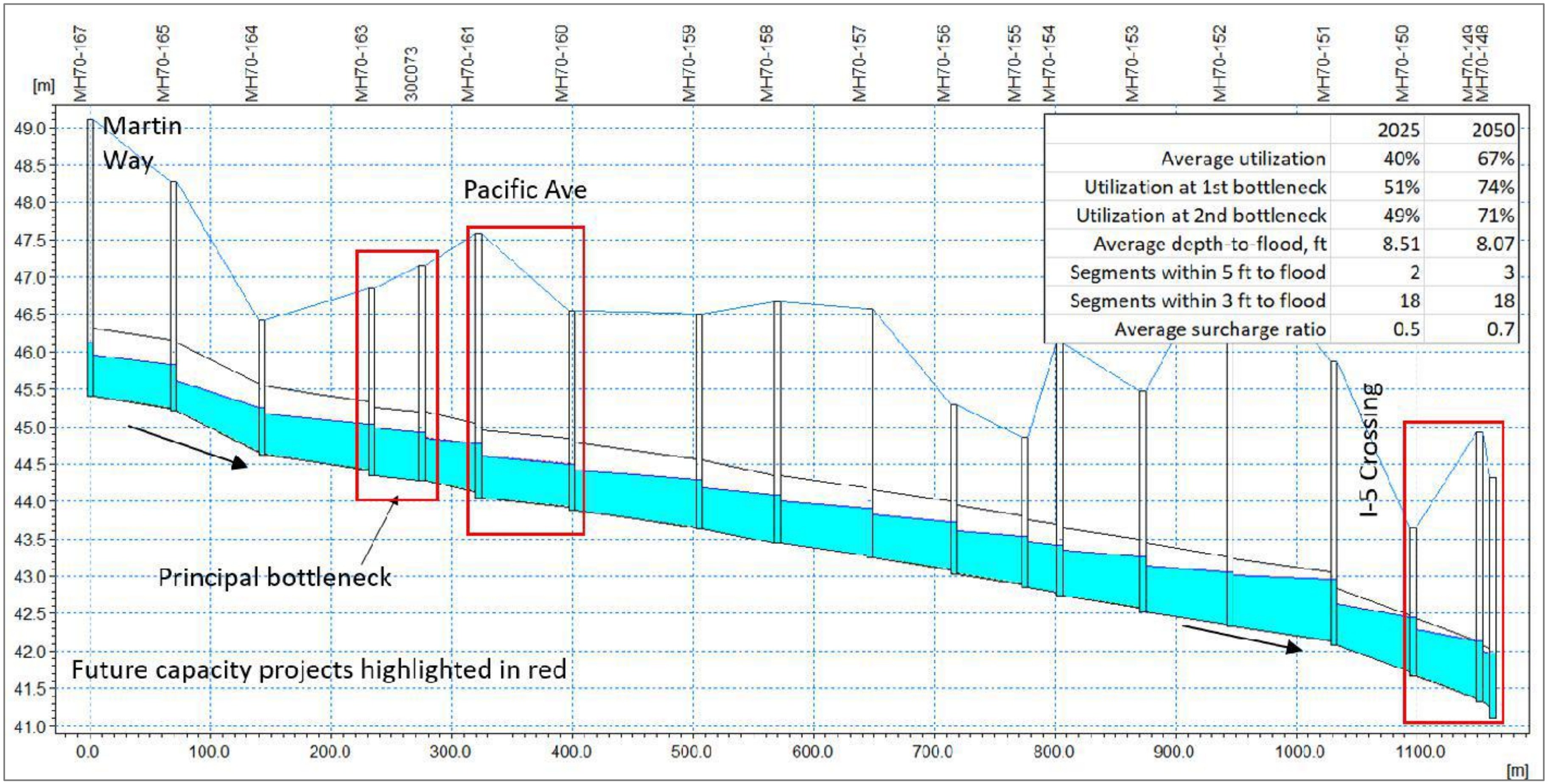


	2025	2050
Average utilization	42%	47%
Utilization at 1st bottleneck	61%	66%
Utilization at 2nd bottleneck	58%	63%
Average depth-to-flood, ft	7.56	7.50
Segments within 5 ft to flood	5	5
Segments within 3 ft to flood	1	1
Average surcharge ratio	0.5	0.5

Indian Creek Interceptor

The Indian Creek Interceptor consists of three segments. The upstream segment of mostly 36-inch pipe runs from Martin Way down to I-5. The middle segment, more steeply sloped, is mostly 30-inch pipe running along the Karen Fraser Woodland Trail. The final segment splits into two parallel pipes, travel through Watershed Park and cross back under I-5. Profiles of each segment at the 2050 peak hour flow condition are presented in Figures 47 to 49.

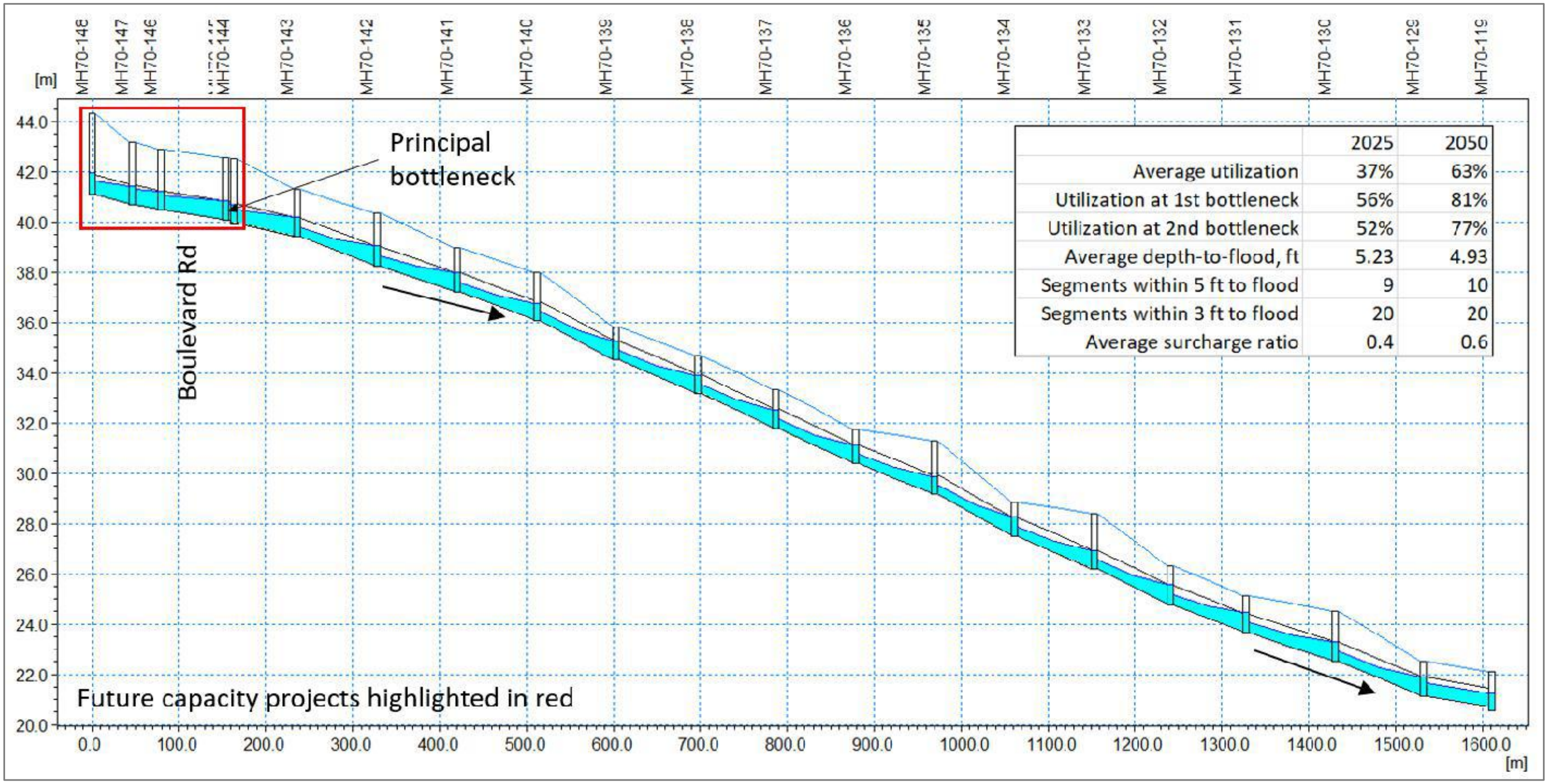
Figure 47. Indian Creek Interceptor, Upper, 2050 Peak Hour Condition



	2025	2050
Average utilization	40%	67%
Utilization at 1st bottleneck	51%	74%
Utilization at 2nd bottleneck	49%	71%
Average depth-to-flood, ft	8.51	8.07
Segments within 5 ft to flood	2	3
Segments within 3 ft to flood	18	18
Average surcharge ratio	0.5	0.7

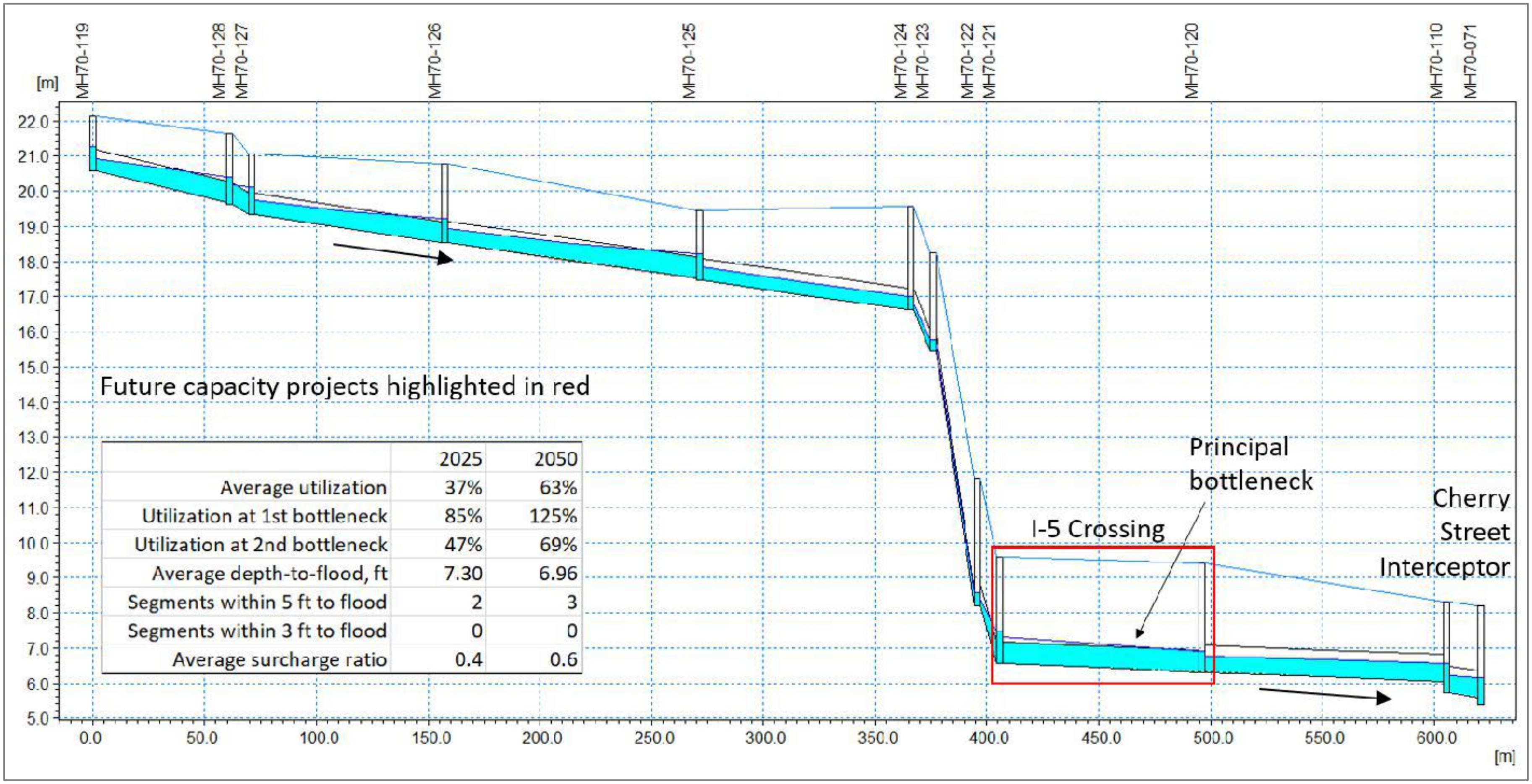
In the upper portion of the pipeline, a pair of bottlenecks limit flow to approximately 16-18 mgd. While this provides sufficient capacity for 2050, these restrictions are projected to result in surcharging and near-flood conditions for the full connection scenario. The shallow maintenance hole MH70-164 is projected to come within 6-inches of flooding at full connection. A trio of bottleneck removal projects are planned for post-2050.

Figure 48. Indian Creek Interceptor, Middle, 2050 Peak Hour Condition



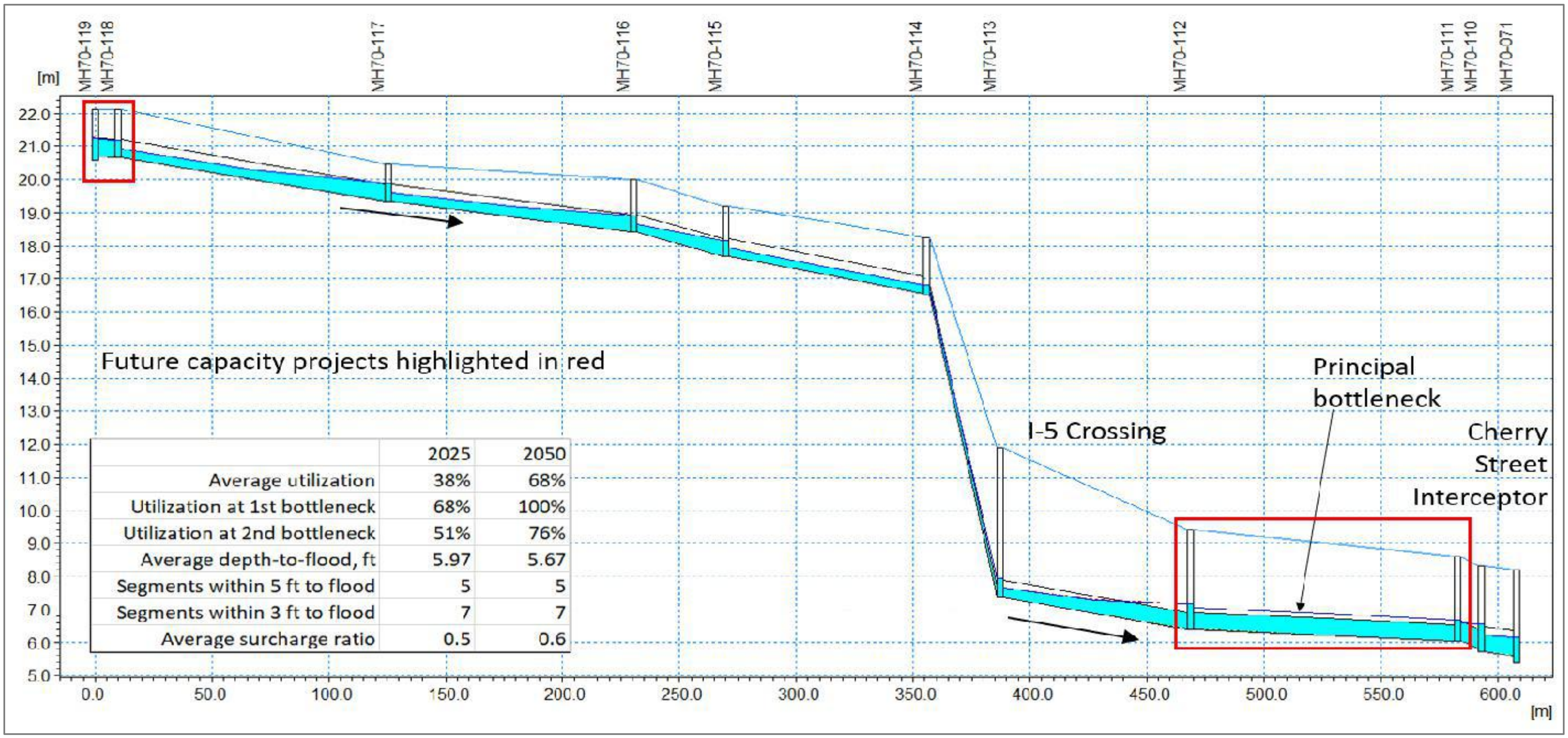
The middle section of the pipe is relatively steep, with most segments offering 25-35 mgd of flow capacity. Bottlenecks at the upstream end limit flow to 18-19 mgd, and a capacity project at that location would be required, after 2050, to accommodate full connection.

Figure 49. Indian Creek Interceptor, Lower (North Branch), 2050 Peak Hour Condition



The interceptor splits into two parallel pipelines which cross I-5 before recombining at the Cherry Street Interceptor on Henderson Blvd. The northern branch has a flow restriction in the segment passing under I-5, which limits flow capacity to 7 mgd. This results in some moderate surcharging by 2050, and more major surcharging at full connection. This segment of pipe would need to be expanded to accommodate the full connection scenario. The other segment has a pair of flow restrictions. The first restriction is right after the split and MH70-119, with a small, flat segment of pipe limiting capacity to 7 mgd. The larger restriction is just downstream of the I-5 crossing, under the City of Olympia Maintenance Yard, where a relatively flat segment of pipe restricts flow to 5.6 mgd. These restrictions are not projected to be a problem before 2050 but would need to be corrected to accommodate full connection.

Figure 50. Indian Creek Interceptor, Lower (South Branch), 2050 Peak Hour Condition



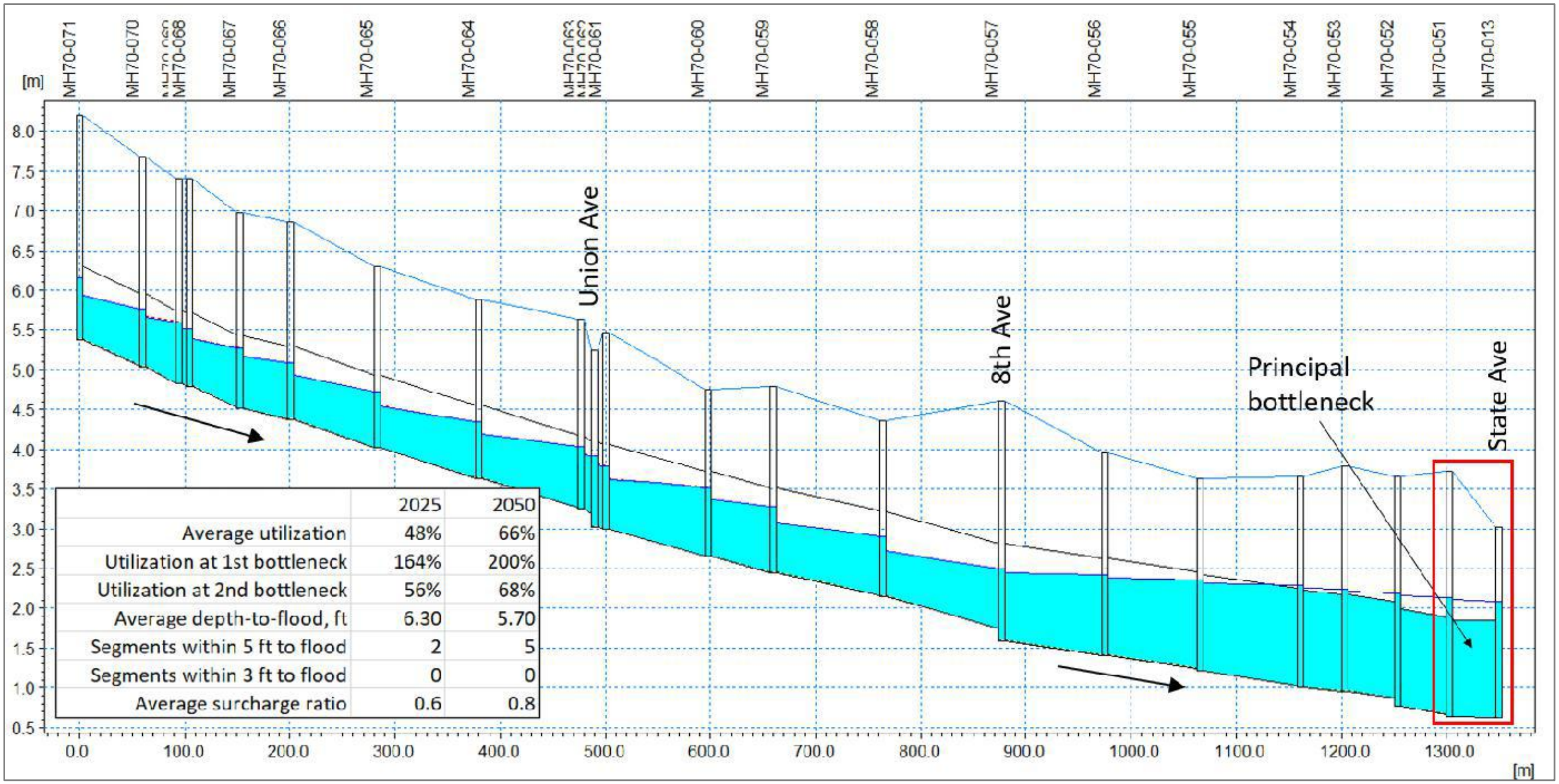
	2025	2050
Average utilization	38%	68%
Utilization at 1st bottleneck	68%	100%
Utilization at 2nd bottleneck	51%	76%
Average depth-to-flood, ft	5.97	5.67
Segments within 5 ft to flood	5	5
Segments within 3 ft to flood	7	7
Average surcharge ratio	0.5	0.6

Cherry Street Interceptor

The Cherry Street Interceptor takes most of the flow from the Indian Creek Interceptor and the Henderson Road Interceptor and picks up combined flows from the City of Olympia at Union Avenue. Figure 51 presents the 2050 peak hour profile. The interceptor has a capacity of 25-35 mgd for most of its run,

with a major restriction at its outlet. That pipe limits flow capacity to 10.3 mgd and is already causing backups.

Figure 51. Cherry Street Interceptor, 2050 Peak Hour Condition

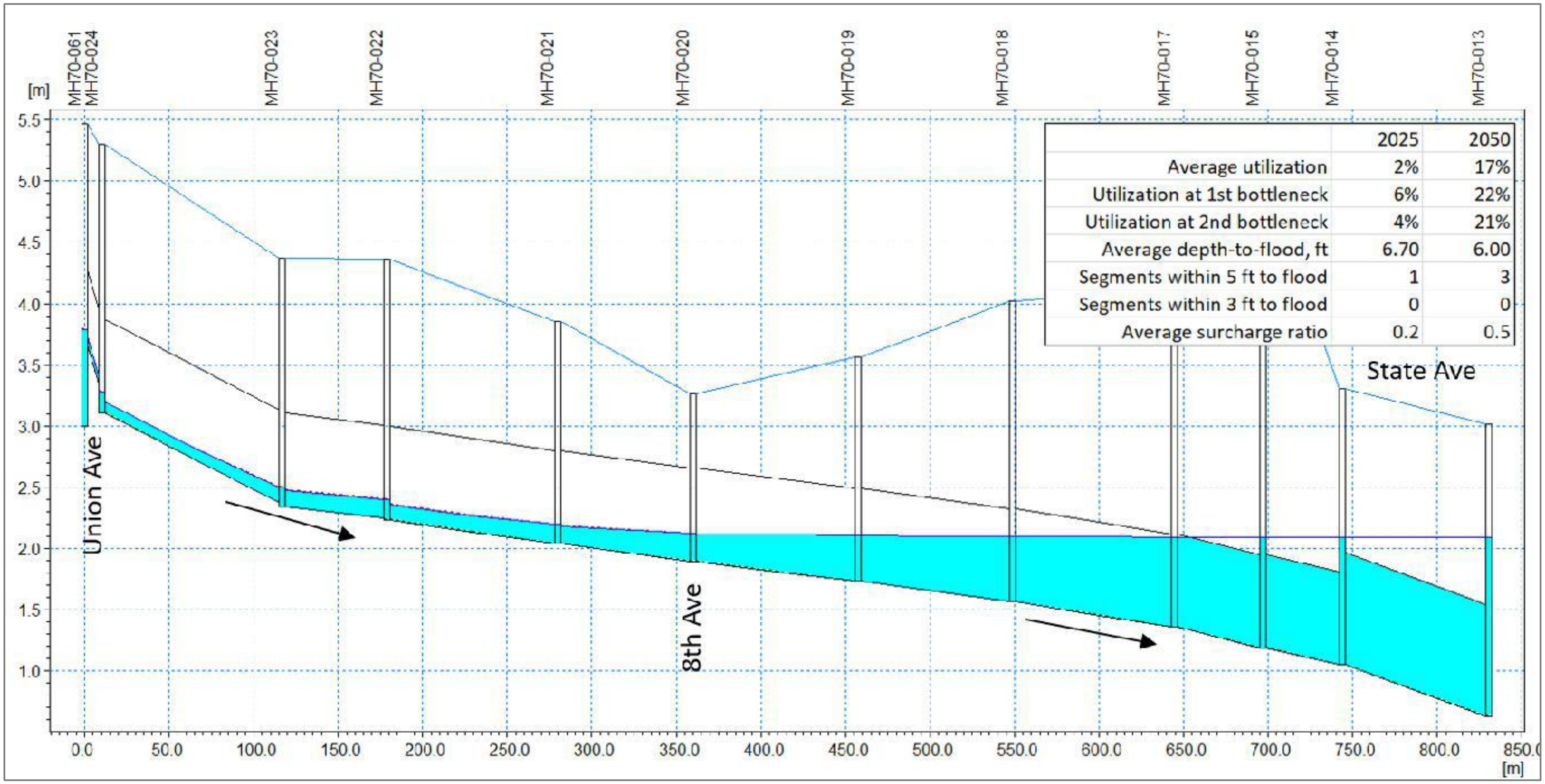


	2025	2050
Average utilization	48%	66%
Utilization at 1st bottleneck	164%	200%
Utilization at 2nd bottleneck	56%	68%
Average depth-to-flood, ft	6.30	5.70
Segments within 5 ft to flood	2	5
Segments within 3 ft to flood	0	0
Average surcharge ratio	0.6	0.8

Chestnut Street Interceptor

The Chestnut Street Interceptor takes overflows from the Cherry Street Interceptor at Union Avenue. Figure 52 presents the 2050 peak hour profile. The Chestnut Street Interceptor is under-utilized. Overflows at Union Street are rare, and most of the flow in this pipe is backwater caused by restrictions along State Avenue and Adams Street. There are no significant restrictions in the Chestnut Street Interceptor itself. Maintenance hole MH70-020, at 8th Avenue, is subject to flooding due to its relatively low elevation. This maintenance hole is projected to be within 3.8 ft of flooding by 2050, and within 2 ft of flooding under the full connection scenario.

Figure 52. Chestnut Street Interceptor, 2050 Peak Hour Condition

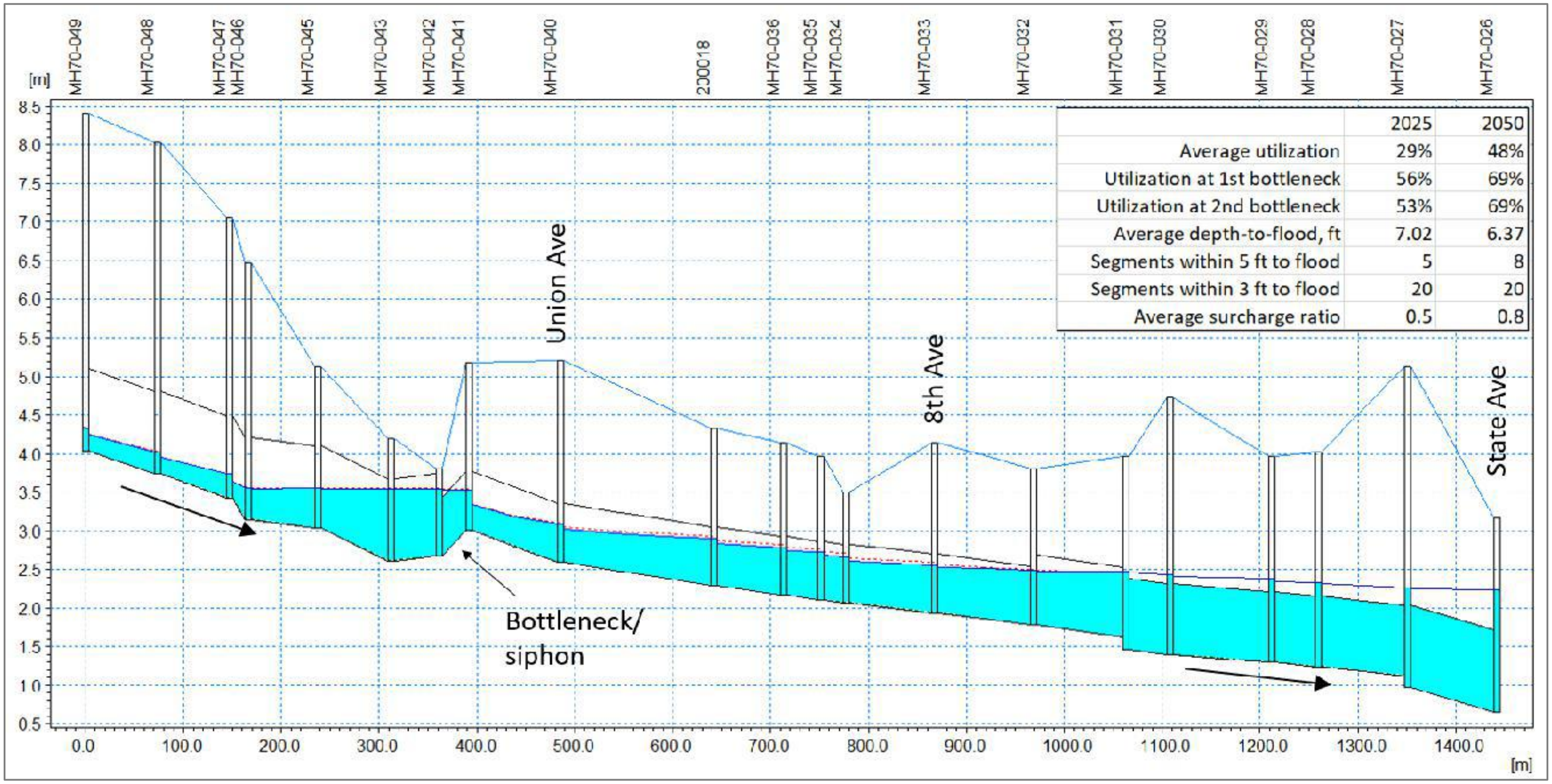


	2025	2050
Average utilization	2%	17%
Utilization at 1st bottleneck	6%	22%
Utilization at 2nd bottleneck	4%	21%
Average depth-to-flood, ft	6.70	6.00
Segments within 5 ft to flood	1	3
Segments within 3 ft to flood	0	0
Average surcharge ratio	0.2	0.5

Plum Street Interceptor

The Plum Street Interceptor takes flows from Tumwater and Olympia north of North Avenue. There is an overflow at its start, which allows a portion of flow from the Indian Creek Interceptor and Henderson Road to enter this pipeline. Figure 53 presents the 2050 peak hour profile. For most of its run, the Plum Street Interceptor has at least 10 mgd of capacity, which is sufficient both for 2050 projections, as well as for the full connection scenario. The pipeline is projected to fill up at its downstream end, due to restrictions in the State Avenue and Adams Street pipes. There is a section of upwards-sloping pipe from maintenance hole MH70-043 to MH70-041which creates a small siphon at high flows. Maintenance hole MH70-042 is at low elevation and will flood if not sealed.

Figure 53. Plum Street Interceptor, 2050 Peak Hour Condition

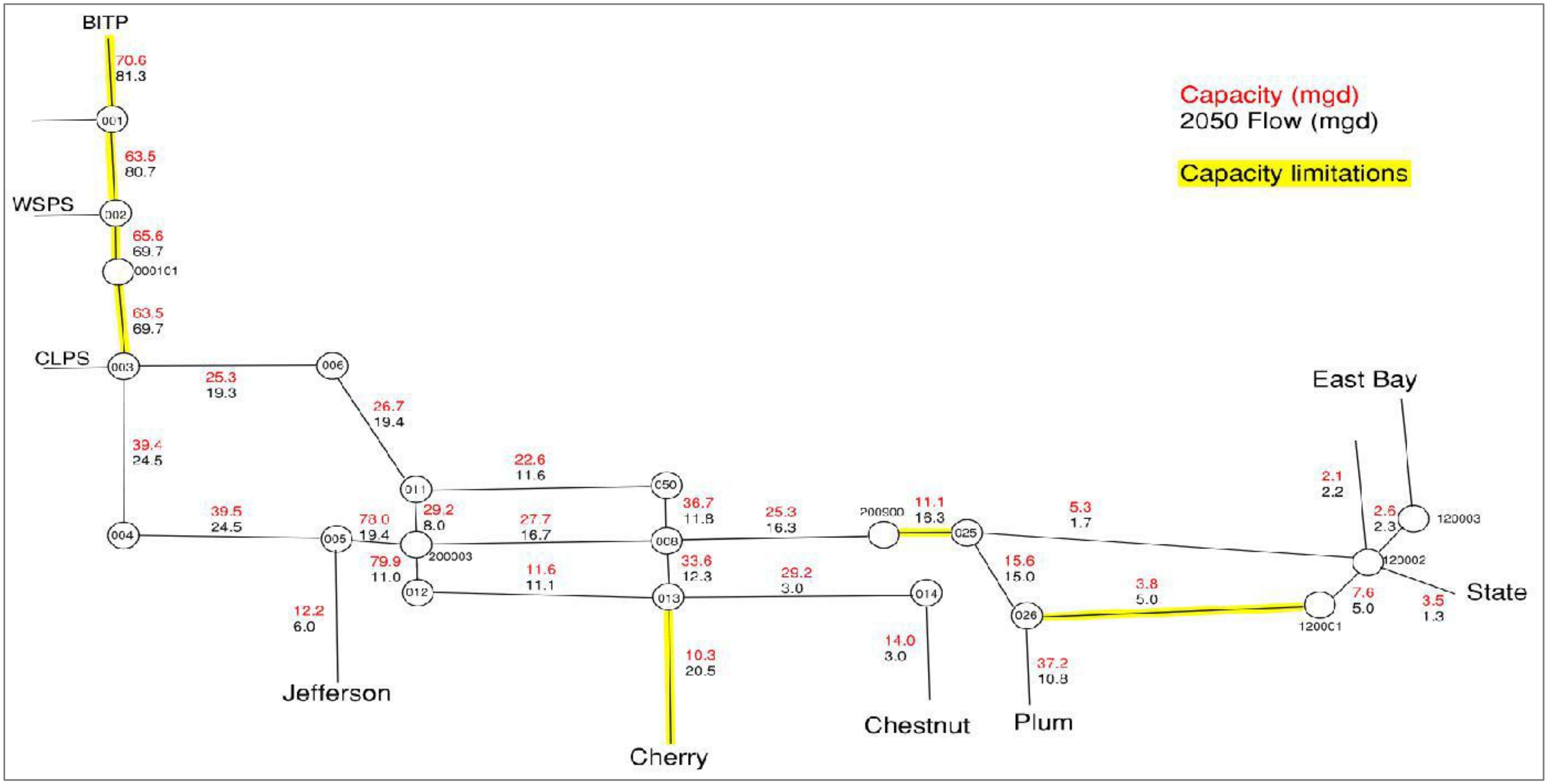


	2025	2050
Average utilization	29%	48%
Utilization at 1st bottleneck	56%	69%
Utilization at 2nd bottleneck	53%	69%
Average depth-to-flood, ft	7.02	6.37
Segments within 5 ft to flood	5	8
Segments within 3 ft to flood	20	20
Average surcharge ratio	0.5	0.8

State and Adams Street Interceptors

The State Street Interceptor receives flow from the Cherry, Chestnut, and Plum Street Interceptors. It also conveys flow from the two Olympia East Bay Interceptors, and State Avenue to the west. This interceptor turns north on Adams Street and conveys flow to the BITP. The Adams Street Interceptor also receives pressurized flow from the Capitol Lake Pump Station and the Water Street Pump Station. These interceptors are shown schematically in Figure 54. The figure shows the capacity of each pipeline, along with the 2050 peak hour flow.

Figure 54. Projected 2050 Peak Hour Flow (black) and Capacity (red), State Avenue and Adams Street Interceptors



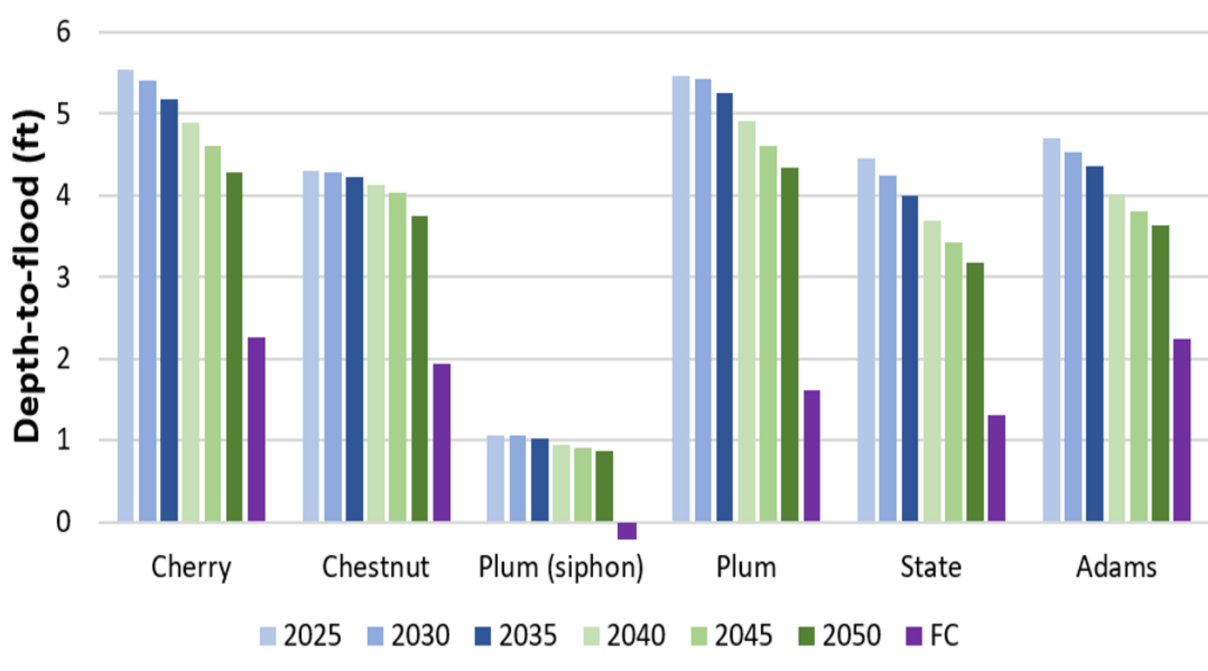
Major capacity restrictions are noted in seven pipes, highlighted in yellow on Figure 54:

- Cherry Street Interceptor maintenance hole MH70-051 to MH70-013 (as shown above in Figure 51)
- State Street Interceptor maintenance hole 120001 to MH70-026
- State Street Interceptor maintenance hole MH70-025 to 200900
- Adams Street Interceptor from maintenance hole MH70-003 to the BITP (4 pipes)

These restrictions are causing backwater effects into each of the three large LOTT interceptors (Cherry, Chestnut, and Plum). By 2050, this results in depth-to-flood of approximately three feet in several locations. That represents a loss of about 2-3 feet of freeboard in most cases. While it is possible that the increased surcharging may lead to lateral and/or basement flooding, it is not projected to cause ground-level overflows.

For the full connection scenario, the depth-to-flood decreases to 1-2 feet in most places, with flooding projected at the siphon in the Plum Street Interceptor as described in Figure 53. A depth-to-flood of 1-2 feet is very likely to cause lateral flooding, and many of the pipes will experience several feet of surcharge pressure. Figure 55 shows the minimum depth-to-flood for each of the major downtown interceptors from 2025 to 2050, and at full connection.

Figure 55. Minimum Depth-to-flood for Downtown Olympia Interceptors



FC = full connection of all septic tanks within cities and urban growth areas

There are two ways to alleviate flooding in these interceptors:

1. The first option is simply to relieve the bottlenecks identified above. Upsizing the seven pipes identified in Figure 54 will alleviate most of the issues noted above (flooding would still be observed at the Plum Street siphon at MH70-042, if the maintenance hole is not properly sealed).

2. The second option would be to install a pump station in the region of the State Avenue and Adams Street pipes. The pump station would selectively remove flow from the surcharged interceptors. Targeted bottleneck removal at Cherry Street and the two State Street Interceptors would likely still be necessary.

This does not appear to be necessary before 2050, although a detailed assessment of lateral impacts would need to be conducted to properly assess the implications.

Sewer System Modeling Summary

Key findings from the updated sewer modeling include the following:

- A number of pipes in Olympia and Lacey are either capacity-limited or projected to become capacity-limited in the near future. These pipes are currently acting as bottlenecks, and restricting flow to downstream pipes under peak flow conditions. These include:
    - Both of the large diameter pipes along the 4th Avenue Bridge
    - Piping along Madison Ave and West Bay Road
    - Piping along Central Street in downtown Olympia
    - Both pipelines along East Bay Road, but particularly the one originating on San Francisco Ave.
    - Piping along Franklin and Jefferson Streets
    - Piping along Central Street

- The LOTT interceptors appear to have sufficient capacity for flows projected through 2050. This is a change from previous modeling work, which projected several capacity needs in the 2030s and 2040s. This change is the result of conservation, which is reducing the per capita wastewater generation rate, and slower population growth projections.

- The most significant capacity restrictions are in the large diameter interceptors in downtown Olympia along State Avenue and Adams Street. Although no flooding is projected through 2050, it is unclear how increased surcharge levels will impact nearby laterals.

- Segments of the Indian Creek Interceptor may require expansion after 2050, as septic tanks are converted to sewer.

- The Martin Way Interceptor (East) will need to be monitored in upcoming years, to determine how much of the peak flow increased noted at MWPS is attributable to this interceptor. This may push capacity limitations in the interceptor ahead of 2050.

Pressure Mains

The capacity of LOTT pressurized force mains is summarized in Table 29. In most cases, capacity is based on a maximum pipe velocity of 7 ft/sec. The capacity of each force main was recently determined through hydraulic modeling.

Table 29. LOTT Force Main Capacity

Force Main	Size (in)	Capacity (mgd)	Current	2030	2040	2050
Martin Way Force Main[1]	18	9.2	75%	80%	100%	115%
Capitol Lake Force Main (south only)	24	14.5	76%	80%	92%	99%
Capitol Lake Force Main (south and north)	20+24	23.8	46%	49%	56%	60%
Southern Connection	22	14.5	36%	37%	43%	47%
Kaiser Road Force Main	10	2.1	49%	52%	52%	53%

1. Including satellite flow diversion increments to the Martin Way Reclaimed Water Plant: existing (1.4 mgd), 2050 (1.9 mgd)

- The Martin Way Force Main would currently be at 95% capacity with no flow to MWRWP. With flow to MWRWP as planned, the force main will not reach 85% of capacity until 2033.

- The Capitol Lake Pump Station discharges into two force mains, a 24-inch pipeline that runs south of the lake, and a 20-inch pipeline that runs north of the lake. Using just the southern pipeline, the system would reach 85% capacity by 2035. With both force mains in use, the system is not projected to reach 85% capacity within the planning period.

- The Southern Connection is a double-barreled force main, which runs from Tumwater to the Capitol Lake Pump Station. The smaller 20-inch pipeline has been converted to a pipeline to convey reclaimed water from the Budd Inlet Treatment Plant to Tumwater. With only the 22-inch pipeline used for wastewater conveyance, the system is not projected to become limited within the planning period.

- The Kaiser Road Force Main is not projected to become limited at any point in the planning period.

Pump Stations

LOTT owns and operates three primary pump stations. Table 30 lists the current capacity of the LOTT pump stations in million gallons a day and the percentage of that capacity that will be reached in future years based on updated flow projections. The capacity listed is firm capacity, the capacity of the pump station with one of the largest units out of service.

Table 30. LOTT Pump Station Firm Capacity

Pump Station	Pumps	Total Capacity (mgd)	Current Flow (mgd)	2030	2040	2050	Full Connection
Martin Way Pump Station	4	9	95%	101%	127%	146%	198%
Capitol Lake Pump Station	5	24	46%	49%	55%	60%	76%
Kaiser Road Pump Station	3	2	52%	52%	52%	53%	59%

Martin Way Pump Station

The Martin Way Pump Station (MWPS) was originally constructed in the early 1990's and then upgraded in 2005, adding screening and additional pumping to provide source water for the Martin Way Reclaimed Water Plant. The pump station has 3 pumps, each rated at 4 mgd, for conveying flows to the BITP. There is also a pump rated at 2 mgd which pumps to the MWRWP. The firm pumping capacity to the BITP is 7.2 mgd, and the firm pumping capacity to the MWRWP is 1.8 mgd, for a total pumping capacity of 9.0 mgd.

The pump station is reaching the end of its service life. A project to replace the pump station is currently in the planning stages with construction anticipated for 2028. The design firm capacity for the new pump station will be 16 mgd to BITP, and 3 mgd to the MWRWP.

Table 31. Completed and Planned Projects: MWPS

On-line	Name	Cost/Estimate	Status	Description
2009	MWPS Reclaimed Water Utilization Project	$394,409	Complete	Booster skid for using reclaimed water for screen washing
2014	MWPS Odor Scrubber Media Replacement	$121,744	Complete	Replaced odor scrubber media
2014	MWPS ATS and Main Breaker Replacement	$60,000	Complete	Replaced automatic transfer switch and main breaker
2014	MWPS Fuel Storage Tank	$13,000	Complete	Installed backup generator day tank
2028	MWPS Improvements	$35,400,000	Planning	Project to replace pump station and increase pumping capacity

Capitol Lake Pump Station

The Capitol Lake Pump Station (CLPS) is located along Deschutes Parkway, across from Marathon Park and conveys flow generated in Tumwater and portions of west Olympia. There are two separate wet wells and a total of 5 pumps, each with a pumping capacity of 6 mgd. Total pumping capacity of the pump station is 30 mgd and a firm capacity (one of the largest units out of service, of 26 mgd. The highest recorded flow over the last 5 years was 11.8. Based on updated flow projections, the pump station has sufficient capacity to meet build-out.

Table 32. Completed and Planned Projects

On-line	Name	Cost/Estimate	Status	Description
2010	Odor Control Improvements	$587,060	Complete	Replaced odor control system
2019	Power Improvements	$211,000	Complete	Reconfigure emergency power configuration to increase redundancy
2026	CLPS Wet Well Coatings	$2,322,547	Design	Replaces wet well coatings and influent isolation valves

Kaiser Road Pump Station

The Kaiser Road Pump Station (KRPS) is located northwest Olympia on Kaiser Road. The primary contributor to the pump station if the Evergreen State College. The pump station was replaced in 2010. It includes 3 pumps; each rated at 1 mgd resulting in a firm capacity of 2 mgd and a total capacity of 3 mgd. The highest flow over the last 5 years was 0.72 mgd.

Table 33. Completed and Planned Projects

On-line	Name	Cost/Estimate	Status	Description
2010	KRPS Improvements	$2,936,947	Complete	Replaced pump station

Required Conveyance Capacity Improvements Projects

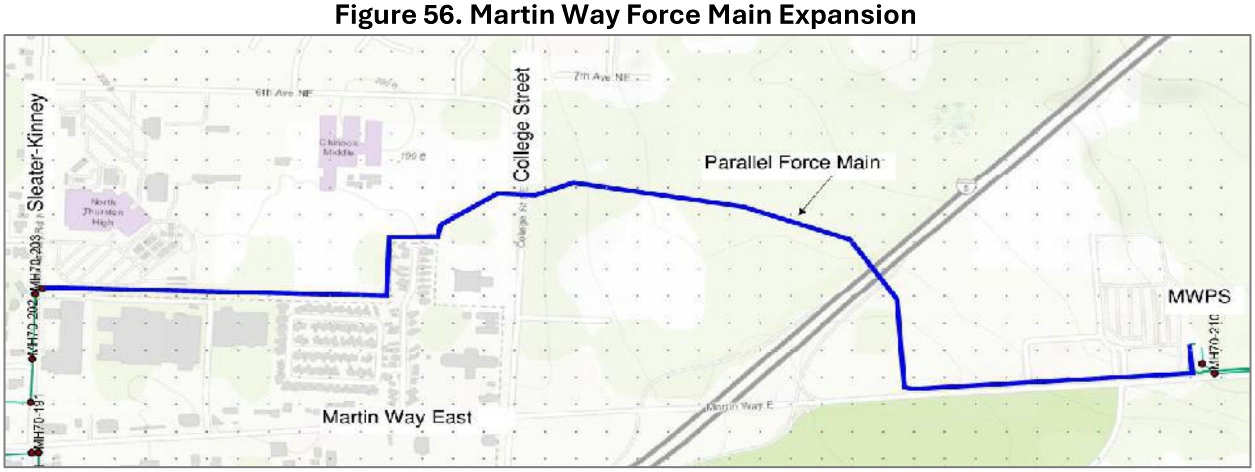
Martin Way Pump Station

The Martin Way Pump Station currently sees peak flows around 8 mgd. This represents 93% of the station capacity, which includes 7.2 mgd of pumping to BITP and 1.8 mgd of pumping to the MWRWP. A pump station expansion would most likely involve swapping out the existing pumps and installing larger units. The pump station expansion depends on flow peaking in the influent sewers. The MWPS wet well has very limited storage capacity, so spikes in influent flow rate can quickly lead to flooding conditions. Influent peaking is related to precipitation, as well as to the influence of numerous upstream pump stations. Peak influent flows have increased over the past few years. A detailed assessment of 10 years of data in 2020 determined that the peak influent flow was approximately 6.3 mgd. Since that time, there have been verified peaks of 7.9 mgd, 6.2 mgd (twice), and an anomalous peak of 8.3 mgd. Planning for a pump station expansion is underway and will include flow monitoring of the two influent pipelines, an assessment of peaking related to upstream City of Lacey pump stations, and an evaluation of electrical and mechanical improvement alternatives.

Martin Way Force Main

Recent peak flow increases at the MWPS have pushed capacity limitations at this force main up to the mid-2030s. The force main is 7,700 feet along its current alignment, which includes one crossing of Interstate 5. A capacity increase would involve construction of a parallel force main (Figure 56). This expansion may happen concurrently with the MWPS expansion, in 2035.

Figure 56. Martin Way Force Main Expansion



Martin Way Interceptor (East)

While a portion of the Martin Way Interceptor (East) will be surcharged by 2050, the risk of flooding will remain low until after 2050. LOTT plans to install a parallel pipeline, running from Marvin Road to the Martin Way Pump Station (10,000 feet), in response to further development in western Lacey. The parallel pipeline will not become necessary until after 2050 timeframe, unless development and/or septic conversion in Lacey accelerates beyond the current projection. This pipeline is susceptible to the same peaking issues discussed above for the MWPS, so flows in this pipeline should be periodically tracked with active flow monitoring.

Table 34 summarizes the sewer pipe capacity projects discussed in this section.

Table 34. Planned Conveyance Capacity Projects

On-line	Name	Cost/Estimate	Status	Description
2028	Martin Way Pump Station	$35,400,000	Planning	Relieves projected capacity limitations
2035	Martin Way Force Main Expansion	$3,800,000	Future	Adds parallel force main to meet projected capacity limitations, though affected by pace at which the Martin Way Reclaimed Water Plant is expanded
post-2050	Martin Way Interceptor (East)	$11,600,000	Future	Increases capacity from Marvin to Carpenter

Reclaimed Water Conveyance Lines

Table 35 summarizes existing reclaimed water distribution pipes, and their related capacities and The system includes a one million gallon Reclaimed Water Storage Tank to manage reclaimed water supply to the Tumwater Valley Golf Course and other end users in Olympia and Tumwater.

Table 35. Reclaimed Water Distribution Pipe Capacities

Reclaimed Water Main	Size (in)	Capacity (mgd)	Length (ft)
Martin Way Reclaimed Water Plant to Hawks Prairie Ponds	14	4	16,600
Budd Inlet Reclaimed Water Plant to Marathon Park	12	3.5	7,160
Marathon Park to Southern Connection A	20	10	230
Marathon Park to Southern Connection B	18	8	180
Marathon Park to Southern Connection C	20	10	8,900
Southern Connection to Deschutes Valley	18	8	1,110
Deschutes Valley to Tumwater Golf Course	20	10	5,110
Mullen Road	12	3	7,250

The force main from the MWPS to the MWRWP has the capacity to convey 4 mgd of flow. With MWRWP planned for up to 3 mgd of treatment, and with the new MWPS being designed to pump 3 mgd, this force main has sufficient capacity and does not require expansion.

The BIRWP pump station is currently limited to only 2 mgd of pumping. The pipeline from the BIRWP to the Reclaimed Water Storage Tank can handle up to 3 mgd of flow. The pumps at the BITP will need to be expanded to allow pumping of 3 mgd along the Deschutes River corridor if additional flow is needed. There are currently no planned reclaimed water conveyance capacity project at this time.

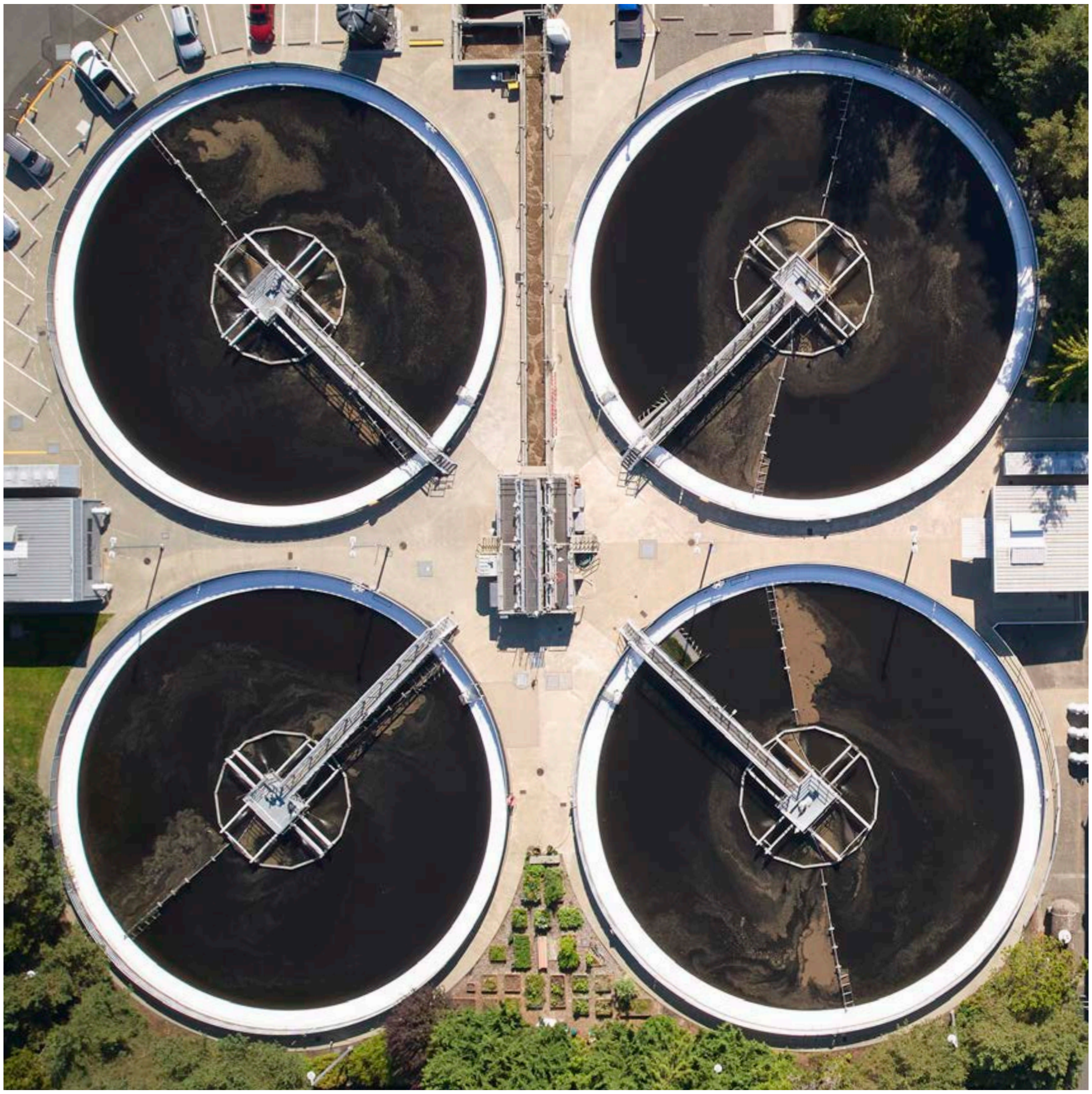
Operational Capacity Analysis Summary

The projects identified in the 2025-2026 Capital Improvements Plan tie together process limitations at the Budd Inlet Treatment Plant, and capacity limitations related to treatment, discharge/use, and conveyance throughout the LOTT system. The list is based upon a number of key assumptions, many of which will have to be re-evaluated on an annual basis. In particular, the discharge capacity analysis will have to be reassessed once performance levels associated with completion of the Biological Process Improvements project are established, and the target effluent TIN and BOD concentrations are finalized.

LOTT maintains 1.5 mgd of reserve discharge capacity to Budd Inlet in order to manage peak flows and potential delays in the construction of new capacity. LOTT will continue to evaluate and monitor the system requirements and adjust capital improvement projects accordingly to ensure operational capacities are met.

The capacity assessment outlined in this document, along with the 2025-2026 CIP, provides a review of capacity needs and how they can be met in the future. LOTT has also recently completed several major initiatives relevant to evaluation of overall system capacity, including the Reclaimed Water Infiltration Study, 2050 Master Plan, BITP hydraulic modeling, and completion of the Biological Process Improvements project. All these efforts offer insights and opportunities to manage capacity needs into the future. This new information will be incorporated into future iterations of the annual capacity assessment report.

LOTT CLEAN WATER ALLIANCE



BUDGET AND CAPITAL IMPROVEMENTS PLAN

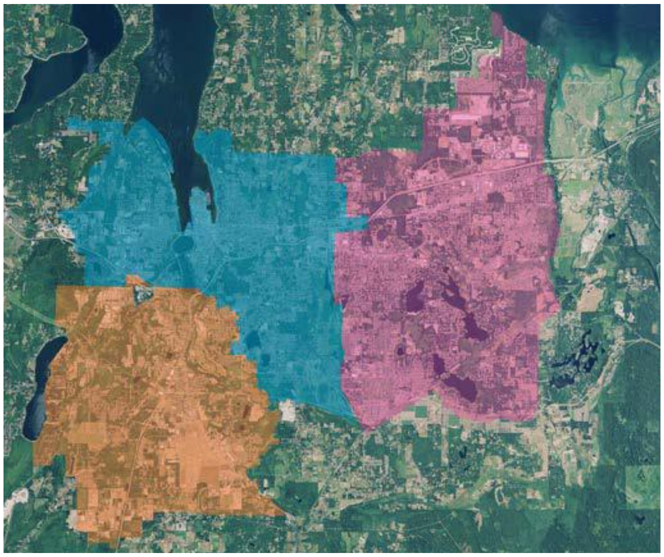
2025-2026

Table of Contents

Executive Summary

The LOTT Clean Water Alliance provides wastewater treatment and reclaimed water production services for the urban areas of Lacey, Olympia, and Tumwater in north Thurston County. LOTT's complex system of treatment and conveyance facilities represents one of our communities' largest regional investments, worth an estimated $1 billion.

To sustain the communities' investment in the existing system and accommodate future service needs, LOTT operates under a continual cycle of planning, designing, and completing numerous capital projects.



LOTT provides wastewater treatment and reclaimed water production services for the urban areas of Lacey, Olympia, and Tumwater in north Thurston County.

Many of these projects are large-scale, span multiple years, and require substantial investment. At the same time, LOTT must operate its treatment facilities 24 hours a day, 7 days a week, 365 days a year, to ensure that wastewater is properly treated and cleaned before it is released into the environment. To support all this, LOTT must carefully manage financial resources, planning ahead with a long-term view that provides flexibility to adjust to changing conditions, while minimizing impacts to ratepayers. LOTT uses a six-year financial planning period, and 2025-2026 represents the first biennium of the current planning cycle.

This document outlines LOTT's two budgets for the 2025-2026 biennium – a Capital Budget and an Operating Budget. The Capital Budget includes costs to replace, upgrade, or rehabilitate existing facilities and to build new system capacity. These projects are described in the Capital Improvements Plan, also included in this document. The Operating Budget contains all the costs necessary to operate LOTT's facilities and provide related services. The following table shows a combined summary of both operating and capital revenues and expenses for 2025-2026.

Overall Budget Summary 2025-2026

REVENUE	2025-2026 Budget	2023-2024 Budget	Annual % Change
Wastewater Service Charge	$80,508,448	$72,555,094	5.5%
Capacity Development Charge	$16,003,817	$16,010,795	0.0%
Miscellaneous Revenue	$8,633,119	$1,850,169	183.5%
Net Revenue from Rates and Charges	**$105,145,384**	**$90,416,058**	**8.1%**
Debt Funding	$10,000,000	$10,000,000	0.0%
Use/(Saving) of Cash on Hand	$15,484,027	$21,260,611	(13.6%)
Total Resources	**$130,629,411**	**$121,676,669**	**3.7%**
EXPENSES	**2025-2026 Budget**	**2023-2024 Budget**	**Annual % Change**
Net Operating Expense	$38,435,562	$32,423,273	9.3%
Debt Service	$16,308,150	$15,845,499	1.5%
Capital Expense	$75,885,699	$73,407,897	1.7%
Total Expenses	**$130,629,411**	**$121,676,669**	**3.7%**

Capital Budget

Capital costs are based on LOTT's Capital Improvements Plan (CIP), which is reviewed and updated each biennium. The projects identified in the CIP are necessary to ensure LOTT sustains the existing wastewater treatment system and provides needed new system capacity. The CIP includes a detailed six-year plan through 2030 and a summary long-range plan for 2031 through 2037 and beyond. The Capital Budget includes costs for projects on the short-term CIP that LOTT expects to spend within the calendar years 2025 and 2026. It is up about 1.7% per year over the 2023-2024 Capital Budget due to inflation and several large-scale projects needed to upgrade portions of the Budd Inlet Treatment Plant.

Operating Budget

The Operating Budget includes three categories of expense – personnel, direct operating expense, and general expense. Overall operating expenses for 2025-2026 have increased approximately 9.3% per year over the previous Operating Budget due largely to the increasing costs for personnel, electricity, and insurance.

Revenue

LOTT has two primary sources of revenue – a monthly rate for LOTT sewer service and a one-time connection fee. The monthly rate is called the Wastewater Service Charge (WSC). Revenue from the WSC is used to pay for costs of sustaining and operating the existing wastewater treatment system. The connection fee is referred to as the Capacity Development Charge (CDC). Revenue from the CDC pays for costs associated with building new system capacity to serve new customers.

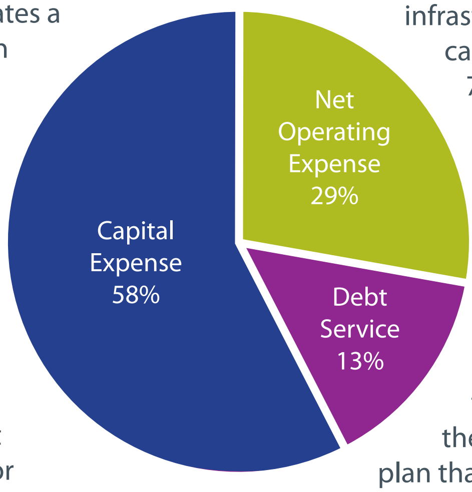
- Wastewater Service Charge – The monthly rate will be $47.52 in 2025 and $48.95 in 2026, which reflects a 3% inflationary adjustment for each year. Growth in WSC revenue is estimated to be approximately 5.5% per year.
- Capacity Development Charge – The fee for new connections will be $7,434.99 in 2025 and $7,806.74 in 2026. About 1,050 new connections are anticipated for each year. This rate reflects a 3% annual inflationary adjustment and a 2% adjustment each year for a pilot affordable housing support program.

The projects identified in the CIP are necessary to ensure LOTT sustains the existing wastewater treatment system and provides needed new system capacity.

Financial Planning

Overview

The LOTT Clean Water Alliance operates a complex system of facilities worth an estimated $1 billion. The system includes the Budd Inlet Treatment Plant, Budd Inlet Reclaimed Water Plant, Martin Way Reclaimed Water Plant, Hawks Prairie Reclaimed Water Ponds and Recharge Basins, a reclaimed water storage tank, three major pump stations, 22 miles of sewer interceptor lines, and 11 miles of reclaimed water pipelines. Portions of the Budd Inlet Treatment Plant are over 50 years old, and major upgrades to the plant have been ongoing for the past several years.



To sustain the Budd Inlet Treatment Plant and other facilities, LOTT operates under a continual cycle of planning, designing, and completing numerous capital projects. Many of these projects are large-scale, span multiple years, and require substantial investment. LOTT revenue needs are driven primarily by the cost of this capital construction. Of the three cost centers shown in the chart, two – debt service and capital expense – exist to fund the total cost of capital construction. For 2025-2026, LOTT's combined infrastructure investment (debt service plus capital costs) represents approximately 71% of total expense, with operating costs representing approximately 29%.

With large-scale capital project commitments, the Board of Directors must consider budget decisions based on long-term financial planning. LOTT uses a customized finance planning tool to track anticipated expenses into the future, develop a capital finance plan that provides sufficient funds for capital projects, and balance the source of funds between rate income and borrowed dollars. Continual efforts are made to identify and implement cost-saving measures and minimize LOTT's debt, reducing costs to ratepayers from interest and other expenses associated with borrowing money. The results of this approach have been excellent. LOTT's service charge remains below the average for the region.

The Projected Budget Summary table on the following page shows anticipated expenses for each biennium in the current six-year planning period.

With large-scale capital project commitments, the Board of Directors must consider budget decisions based on long-term financial planning.

Projected Budget Summary 2025-2030

REVENUE	2025-2026 Budget	2027-2028 Budget	2029-2030 Budget
Wastewater Service Charge	$80,508,448	$87,997,206	$96,175,156
Capacity Development Charge	$16,003,817	$17,139,266	$18,183,039
Miscellaneous Revenue	$8,633,119	$1,572,023	$1,281,450
Net Revenue from Rates and Charges	**$105,145,384**	**$106,708,494**	**$115,639,645**
Debt Funding	$10,000,000	$10,000,000	$15,000,000
Use/(Saving) of Cash on Hand	$15,484,027	$4,968,174	($1,579,172)
Total Resources	**$130,629,411**	**$121,676,669**	**$129,060,473**
EXPENSES	**2025-2026 Budget**	**2027-2028 Budget**	**2029-2030 Budget**
Net Operating Expense	$38,435,562	$43,464,708	$48,674,578
Debt Service	$16,308,150	$13,900,379	$13,679,975
Capital Expense	$75,885,699	$85,624,361	$66,705,920
Total Expenses	**$130,629,411**	**$121,676,669**	**$129,060,473**

LOTT's primary sources of revenue are the monthly Wastewater Service Charge and the Capacity Development Charge for new connections.

Revenue, Rates, and Fee Summary

LOTT's primary sources of revenue are the monthly Wastewater Service Charge, and the Capacity Development Charge for new connections. LOTT also receives miscellaneous revenues from other sources.

Wastewater Service Charge

The Wastewater Service Charge (WSC) is used to pay most of the cost for repairs or upgrades to the existing wastewater treatment system, loan payments for system-related capital costs, and operating costs. The WSC is assessed based on the number of equivalent residential units of each connection. The LOTT charge is included on the customers' utility bills, which are sent out by LOTT's partner cities. Each city also assesses a separate charge on utility bills for costs associated with maintaining their city-owned sewer collection systems.

Because approximately 71% of LOTT's expenses are related to the capital budget, a 3% inflationary adjustment aligned with construction industry data is planned for the WSC and the CDC rates each year 2025-2030. The annual adjustment was first established by the LOTT Board of Directors in 2012 as part of a comprehensive capital finance plan to ensure the utility keeps pace with escalating construction costs over time and is able to adequately fund LOTT's Capital Improvements Plan. This steady approach to rate adjustments was designed by the Board to keep rate adjustments modest and predictable and to avoid the need for dramatic, unforeseen rate increases.

The 3% annual adjustment was reviewed by the Board during both the 2025-2030 strategic planning process and the 2025-2026 budgeting process and found to be necessary. Large-scale capital improvements projects must be completed within the next few years to replace critical, aging infrastructure and ensure LOTT's continued ability to meet its mission. The adjustments allow LOTT to complete these projects despite inflation and rising construction costs. Inflation is currently higher than the 3% adjustment; however, LOTT's finance plan and steady approach to rate adjustments has allowed LOTT to weather the impact without the need to deviate from the planned adjustment. The Board will further evaluate the effects of inflation when setting rates for the next biennium.

For 2025, the monthly rate will be $47.52, increasing by $1.38 from the 2024 rate. For 2026, the monthly rate will be $48.95.

Capacity Development Charge

The Capacity Development Charge (CDC), also described as a connection fee or hook-up fee, is used to build projects that add new capacity to treatment plants, larger sewer lines, and related projects that increase LOTT's ability to serve new customers. The CDC is assessed based on equivalent residential units.

The fee for new connections in 2025 will be $7,434.99, and in 2026, will be $7,806.74. For each year, this reflects the 3% inflationary adjustment and a 2% adjustment to account for costs associated with a pilot affordable housing support program.

Miscellaneous Revenue

LOTT also receives revenues from other sources, such as interest on cash deposits. During the 2025-2026 biennium, LOTT anticipates selling properties that have been identified as no longer required for utility purposes. At least three properties are planned for sale, which are projected to generate approximately $6 million. This one-time revenue is anticipated to be needed for future property purchases to support long-term management strategies identified in the 2050 LOTT System Plan.

Revenue Projections and Analysis

Both the WSC and the CDC are measured in terms of equivalent residential units (ERUs). In general, an ERU is one single family residence for residential customers, or 900 cubic feet of wastewater for non-residential customers. Throughout the past several budget cycles, ERUs have seen stable growth. For the 2025-2026 biennium, growth in ERUs is estimated at 1.5% per year. When combined with the planned adjustments to rates, revenue from the WSC is projected to increase approximately 5.5% per year.

For the CDC, growth in the number of new ERUs has historically averaged approximately 1,000 per year, but was less than expected in the prior biennium. The estimate for new ERUs in the 2025-2026 biennium is 1,050 each year, which is anticipated to result in overall CDC revenue similar to the prior biennium.

Wastewater Rate Comparisons

The LOTT Clean Water Alliance is frequently asked about monthly service rates. Some residents have the impression that rates are high, but in fact, LOTT wastewater rates are below the regional average. In addition, LOTT provides the highest level of wastewater treatment in the Puget Sound region, offering good value to the community for the investment. Concerns are sometimes raised, however, for several reasons:

- Some new residents have moved here from areas of the country with less stringent treatment requirements and lower utility costs.
- Bills for wastewater services are sent for a two-month time period, making the overall bill appear higher.
- Drinking water service fees, which are by contrast lower, appear on the same bill, making wastewater fees seem disproportionately higher.

Wastewater treatment is, in general, an expensive business. LOTT treats an average of 12 million gallons of wastewater each day. The water must be treated to high standards to meet state permit requirements and be safely released into the environment. This requires a complex system of infrastructure – pipelines, pump stations, treatment plants, and related equipment – that must be up and running 24 hours a day, 7 days a week.

By contrast, local drinking water services are considerably less expensive. This is due to the fact that our region enjoys a stable supply of high quality groundwater to meet drinking water needs. This water generally requires only minimal treatment. Rates for drinking water and for wastewater services can seem disproportionate, but are mainly due to the vast differences in the amount and complexity of treatment involved in each.

Part of the cost of wastewater treatment comes from our communities' location along Puget Sound. The U.S. Environmental Protection Agency (EPA) requires states to comply with the federal Clean Water Act by identifying water bodies that do not meet water quality standards and developing action plans to bring those waters into compliance. Puget Sound, and more specifically Budd Inlet, are water quality impaired. The Washington State Department of Ecology has placed stringent requirements on LOTT to reduce the amount of nitrogen and biochemical oxygen demand discharged into Budd Inlet. LOTT was the first plant along Puget Sound required to treat wastewater to advanced secondary standards to remove nitrogen from the water. This high level of treatment adds technological complexity and cost to the operation of LOTT's main treatment facility.

LOTT is a recognized leader in wastewater treatment in the state. The Budd Inlet Treatment Plant remains one of the only treatment plants employing biological nutrient removal on Puget Sound. This advanced nitrogen removal technology is likely to be required of most major plants along Puget Sound in the future, potentially resulting in major rate increases for those communities. LOTT also operates an advanced membrane biological reactor system at the Martin Way Reclaimed Water Plant, which was one of the first membrane plants in the state producing Class A Reclaimed Water. This same technology is now being developed by several communities in our region to meet ever more stringent treatment requirements, and may require significant increases to their rates.

LOTT conducts an informal survey every two years to see how its residential rates compare with other communities. Some utilities, like LOTT, use a flat rate structure and others use a volume-based structure. To even out the different structures, all of the surveyed rates were compared assuming a conservation value of 700 cubic feet (or 5,236 gallons) per month for an equivalent residential unit. The current survey, conducted in 2024, shows that our monthly charges are lower than the average. Given LOTT's lower than average rates, and the advanced treatment already provided, LOTT ratepayers are receiving a high value for the investments they are making. LOTT strives to ensure its service charges are reasonable and affordable, and the rate survey indicates it is meeting that objective when compared to other utilities in the region.

Wastewater Rate Comparisons

	2024 Rate	2023 Rate	Percent Change	Flat or Volume	2024 Rank	2023 Rank
City of Shelton	$135.89	$130.02	4.5%	V	1	1
City of Seattle	$128.10	$123.41	3.8%	V	2	4
City of Tenino	$125.66	$125.66	0.0%	F	3	3
Thurston County*	$120.31	$119.71	0.5%	F	4	5
City of Bonney Lake	$113.53	$129.01	-12.0%	V	5	2
City of Bellevue	$110.90	$103.70	6.9%	V	6	6
City of Chehalis (in city limits)	$98.50	$98.50	0.0%	V	7	7
City of Centralia (in city limits)	$91.85	$89.08	3.1%	V	8	9
City of Yelm	$89.27	$89.27	0.0%	F	9	8
City of Renton	$88.78	$84.80	4.7%	F	10	11
City of Everett	$87.53	$87.53	0.0%	F	11	10
Average	**$87.38**	**$85.12**	**2.7%**			
City of Auburn	$85.15	$80.05	6.4%	F	12	14
City of Sumner	$84.46	$80.83	4.5%	V	13	13
City of Snoqualmie	$83.76	$82.16	1.9%	F	14	12
City of Puyallup	$77.62	$73.38	5.8%	V	15	17
City of Bremerton (in city limits)	$77.57	$74.96	3.5%	V	16	16
City of Lacey	**$76.39**	**$72.43**	**5.5%**	**F**	**17**	**18**
City of Longview (in city limits)	$75.28	$75.28	0.0%	V	18	15
City of Tacoma	$74.85	$69.64	7.5%	V	19	20
City of Olympia	**$72.95**	**$70.59**	**3.3%**	**F**	**20**	**19**
City of Aberdeen	$72.00	$66.00	9.1%	F	21	23
City of Kelso	$70.42	$68.37	3.0%	F	22	21
City of Tumwater	**$69.48**	**$66.64**	**4.3%**	**F**	**23**	**22**
City of Orting	$69.41	$64.87	7.0%	F	24	24
City of Mount Vernon	$63.03	$60.23	4.6%	V	25	25
Pierce County Sewer	$61.57	$59.06	4.2%	F	26	26
Lakehaven Sewer District	$60.60	$52.24	16.0%	V	27	29
City of Bellingham (in city limits)	$56.43	$53.54	5.4%	F	28	27
City of Edmonds	$53.06	$53.06	0.0%	F	29	28
City of Vancouver	$48.44	$45.71	6.0%	V	30	30

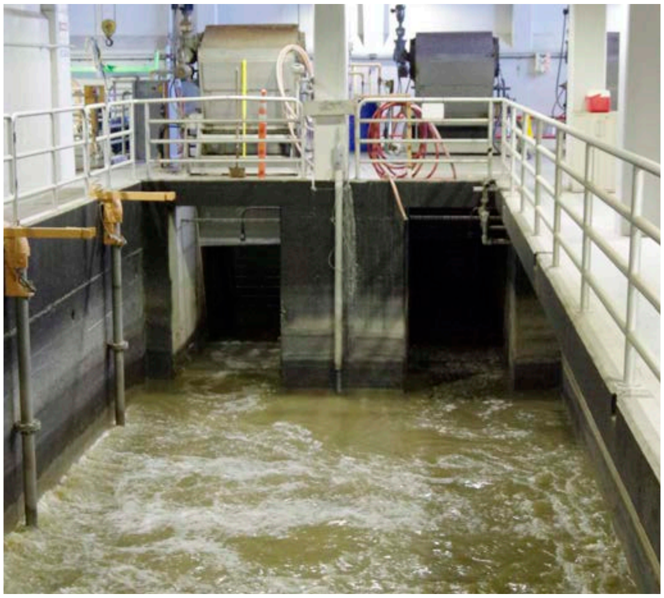
* Thurston County utilities are combined into a single line in the table. Actual 2023 and 2024 amounts are: Tamoshan: $147.36, $152.10; Boston Harbor: $119.10, $117.67; Olympic View: $114.14, $114.14; Grand Mound: $100.62, $94.91.

Cost Allocation

Operating costs are paid out of Wastewater Service Charge (WSC) revenue; capital projects and debt service are paid from both WSC and Capacity Development Charge (CDC) revenues. The allocation between these funds depends on the type of project involved, as specified by the Interlocal Cooperation Act Agreement for Wastewater Management.

The primary purpose of the CDC is to pay for new capacity in the system and to ensure that growth pays for growth. This was one of the guiding principles in the development of the interlocal agreement. The LOTT Board determined that the costs assigned to the CDC should reflect the full spectrum of construction, interest on debt, costs for staff, and related ancillary costs to support new capacity development. Because LOTT strategically develops new capacity as it is needed, the utility invests significant staff time and other resources in ongoing activities, such as planning, engineering, land acquisition, permit acquisition, public involvement, and other project-related activities.

It is important to recognize that the CDC is adjusted over the life of the Capital Improvements Plan (CIP) and is not used for short-term revenue adjustments. When conditions require short-term revenue adjustments for capital projects, the WSC must be raised to meet costs as required by the interlocal agreement. Over time, the two funding sources are reviewed to ensure that system costs and new capacity costs are applied to the appropriate projects.



LOTT strategically develops new capacity as it is needed.

The estimated costs and revenues are balanced over the life of the CIP, and the Board of Directors reviews these costs each biennium to determine if adjustments are needed.

LOTT has completed a comprehensive review of its approach to cost allocation, originally referred to as a cost of service study. This work involved separate analyses completed over several years, including evaluation of:

- The basic unit of measurement (the equivalent residential unit or ERU) used for billing
- Cost centers and cost allocations employed in LOTT's accounting practices
- Benefits and challenges of volume-based billing
- Wastewater service rates in the context of long-term system growth and operating expenses
- Capacity development charge rates in the context of the long-term system growth and capital expenses

Results of these analyses indicated that LOTT's current approach is valid. The ERU basis of billing remains the industry standard; the current approach of flat-rate residential billing and volume-based commercial billing is still appropriate; WSC and CDC rates fit well with projected growth and anticipated long-term expenses, and LOTT's approach to cost allocation remains appropriate. The 2050 LOTT System Plan anticipates a future in which capital improvements to expand reclaimed water production will be driven by partner jurisdiction demand for the resource, rather than strictly capacity-driven. Adjustments in cost allocations may be needed to accommodate this "new" type of project, but for now, the existing categories and allocations work well.

Emergency Reserves

One of LOTT's Board-directed goals is to maintain six months of operating expenses and additional reserves for emergency capital expenditure. These amounts are separate from, and in addition to, reserves required by debt covenants. For 2025 and 2026 emergency reserves will include:

- $3 million for emergency capital expenditures
- $12.8 million (approximately) in emergency operating reserves

LOTT actively manages projects and programs to identify efficiencies and cost-savings, minimize expenses, and limit the need to increase rates.

Cost Efficiency

LOTT operates under a set of guiding principles that includes practicing effective utility management in a responsible, responsive, cost-effective, and resilient manner. Toward that goal, LOTT actively manages projects and programs to identify efficiencies and cost-savings, minimize expenses, and limit the need to increase rates. Cost control takes vigilance and effort, and is an integral aspect of how LOTT does business. LOTT cannot prevent the rising cost of supplies and labor, but makes every effort to minimize capital and operational costs through a variety of efforts, including:

- Asset Management – The Asset Management Program inventories LOTT's equipment, processes, and systems to proactively identify and schedule needed repairs and replacements. This program protects LOTT's assets and extends their useful life.
- Debt Management – LOTT strives to obtain low-cost debt financing when appropriate to help keep rates as stable as possible. The interest rate on existing debt is less than 2% for all outstanding issues.
- Business Case Evaluation – Value engineering by a team of technical staff ensures that each project is designed and built efficiently and effectively. Projects are scheduled over time, and rearranged on the CIP, so as not to exceed available financial and staffing resources.
- Energy Reduction Efforts – LOTT completes a comprehensive greenhouse gas emissions (GHG) inventory each year to track energy reduction progress over time. This work is shared with the Thurston Climate Mitigation Collaborative to track progress toward community-wide GHG reduction goals. The Biological Process Improvements project, completed in 2023, resulted in significant energy savings at the Budd Inlet Treatment Plant, and a solar array is being installed as part of the Centrate Building Rehabilitation to further energy gains. A climate action assessment is also underway to identify potential future energy and GHG reduction efforts.
- Human Resource Management – LOTT strives to make the most of staffing levels, realigning workloads and resources to create efficiencies. Investment in a proactive knowledge management program is helping create training tools and succession plans to effectively prepare future employees with the specialized technical knowledge needed in this industry.

Capital Improvements Planning

LOTT operates under a National Pollution Discharge Elimination System (NPDES) permit that is issued by the Washington State Department of Ecology for the U.S. Environmental Protection Agency (EPA). LOTT must meet all permit requirements, as well as expectations of federal and state agencies regarding responsible utility management. The EPA has developed the Capacity, Management, Operation, and Maintenance Program that requires wastewater utilities to demonstrate they have a comprehensive, long-term plan for maintaining existing utility infrastructure and meeting future system needs. LOTT meets that expectation through development of an organizational Strategic Plan every six years, and through continual review and adjustment of the Capital Improvements Plan (CIP). The CIP, prepared each biennium, is submitted to the Department of Ecology, along with a three-part Capacity Report, as part of permit requirements.

Continuous planning is key to this process and allows LOTT to sustain existing infrastructure and build new infrastructure to meet projected future capacity needs. One of the first steps in planning capital improvements is gathering information about the condition of existing infrastructure, repair and replacement needs, current system capacity, and needs for additional capacity in the future. Data gathered includes:

- Asset management data, such as system condition, criticality, useful life, and replacement cost
- Population forecasts from the Thurston Regional Planning Council
- Recently added sewer pipelines
- Anticipated septic tank conversions to the sewer system
- Flow monitoring results
- Planned development

The asset management data is used to identify and prioritize projects necessary to sustain existing treatment, conveyance, and discharge equipment and facilities. Portions of LOTT's main treatment facility, the Budd Inlet Treatment Plant, are over 50 years old. The plant involves a complex maze of piping and thousands of assets that must be maintained properly to keep the plant running. Asset management is a proactive approach to sustaining the plant and LOTT's other infrastructure, allowing the utility to keep ahead of needed maintenance and avoid unexpected, and potentially catastrophic, system failures.

Capacity-related data is modeled in a geographic information system (GIS) to develop population growth forecasts and predict associated wastewater flows and loadings spatially throughout the system. This information is used to develop a three-part Capacity Report, which helps identify and prioritize capital projects for inclusion in the CIP. Based on this report, LOTT identifies needs within the system and develops projects to meet those needs.

All this information funnels into the CIP, which lists projects anticipated over the short- and long-term.

Capacity Report

LOTT's Capacity Report is updated every two years, and is available on LOTT's website at www.lottcleanwater.org. The report contains three sections:

Flows and Loadings Report analyzes residential and employment population projections within the urban growth area, and estimates the impact on wastewater flows and loadings in the LOTT wastewater system.

Inflow & Infiltration and Flow Monitoring Report uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface stormwater (inflow) and subsurface groundwater (infiltration) entering the sewer system, and prioritizes sewer line rehabilitation projects.

Capacity Assessment Report analyzes system components to determine when limitations will occur and provides a timeline for new and upgraded system components.

Capital Project Categories

LOTT's Capital Improvements Plan is built around four major project categories. Understanding these categories, and the types of projects within them, provides a general understanding as to how they are funded. Each individual project is assessed regarding the proportion of existing system/new capacity benefits, and is funded through a combination of WSC/CDC funds that reflects that proportion.

System Upgrades

System Upgrade projects include improvements to existing facilities. Upgrades are necessary to replace outdated equipment, improve efficiency, and in some cases, to meet higher water quality standards. One of the public values guiding LOTT's operations is to maximize use of existing facilities before building new ones. These projects are funded primarily from monthly rates.

New Capacity

New Capacity projects are those that provide new facilities to serve added wastewater flows. LOTT is continuously planning for new system capacity, to be built "just in time" to ensure that future demands are met. This approach allows LOTT to adapt to changing conditions and take advantage of the most up-to-date treatment technologies. LOTT considers three types of capacity when describing its overall operational capacity – treatment capacity, discharge and use capacity, and conveyance capacity. New capacity projects are funded primarily from new connection fees.

Asset Management (Repair, Rehabilitation, and Replacement)

When systems or equipment reach the point where repairs are no longer cost-effective, they can be rehabilitated (overhauled) to a usable condition or they can be replaced. These projects are funded primarily from monthly rates.

Support Services and Projects

Support Services and Projects provide planning information and services that support projects in all categories. They include the ongoing flow monitoring and flow reduction programs, property acquisition, and special studies and projects that support LOTT's long-range Capital Improvements Plan. Engineering and staff costs allied with the Capital Improvements Plan are also included in this category. These projects are funded primarily from monthly rates.

CIP Overview and Organization

The Capital Improvements Plan (CIP) represents all major capital projects in the foreseeable future. It is revised each biennium based on updated capacity reports, asset management evaluations, and other changing conditions.

The CIP is divided into two sections – short-term and long-term. Each section is summarized in a table.

- 2025-2030 CIP – This six-year CIP groups projects by category. It includes a Capital Budget column showing anticipated spending for 2025 and 2026 for each project. Following the table, a project summary page is provided for each project in the short-term plan.
- 2031-2037 and beyond – The longer-range table divides projects by operational systems, based on asset management life-cycle investments needed to meet the expected build-out condition of the entire Lacey-Olympia-Tumwater service area.

Capital Budget and Short-Term CIP Summary

	2025-2026 Budget	2025-2030 CIP
System Upgrades	$37,386,379	$111,513,353
New Capacity	$12,891,491	$39,262,528
Asset Management	$4,389,880	$14,832,782
Support Services and Projects	$21,217,949	$62,607,316
Total	**$75,885,699**	**$228,215,980**

Capital Budget and Capital Improvements Plan

2025-2026 Capital Budget

Summary Page		Year Start	Year Complete	2025-2026 Expenditure	2025-2030 CIP
	System Upgrade Projects			**$37,386,379**	**$111,513,353**
	Budd Inlet Treatment Plant				
16	Supplemental Carbon System Upgrade	2024	2026	$754,706	$754,706
17	Alkalinity Adjustment Facility	2025	2026	$616,036	$616,036
18	Centrate Building Rehabilitation	2023	2025	$2,071,799	$2,071,799
19	Digester System Improvements Phase 2	2023	2028	$25,844,657	$44,503,910
20	Biogas Utilization Upgrades	2023	2030	$231,405	$17,394,739
21	Odor Control Upgrades	2028	2030	$0	$2,314,573
	Conveyance				
22	Martin Way Pump Station Improvements	2024	2028	$4,276,692	$29,355,524
23	Force Main Air Valve Replacement	2023	2026	$1,758,457	$1,758,457
24	Capitol Lake Pump Station Wet Well Coatings	2023	2025	$1,063,732	$1,063,732
25	Collection System Management Program	2008	2030	$418,180	$1,793,682
	Martin Way Reclaimed Water Plant				
26	Reclaimed Water Plant Upgrades	2025	2030	$350,714	$9,886,193
	New Capacity Projects			**$12,891,491**	**$39,262,528**
27	Reclaimed Water Capacity Development	2025	2027	$916,663	$1,077,048
28	Influent Pumping and Emergency Power Improvements	2024	2030	$1,020,090	$27,124,001
29	North Pipeline Upgrades	2023	2026	$9,308,152	$9,308,152
30	Thickened Sludge Pumping Capacity Expansion	2023	2025	$907,070	$907,070
31	Primary Sludge Pumping Capacity Expansion	2023	2027	$739,515	$846,257
	Asset Management Projects			**$4,389,880**	**$14,832,783**
32	General Equipment Repair and Replacement	2009	2050	$2,691,616	$8,576,590
33	Instrumentation and Controls Replacement	2012	2050	$494,612	$1,576,036
34	Substation and Switchgear A/B Replacement	2023	2026	$823,425	$823,425
35	Final Effluent Pumping Improvements	2029	2033	$0	$2,778,816
36	Facility Roof Repair and Replacement	2016	2050	$380,227	$1,077,915

2025-2026 Capital Budget *(continued)*

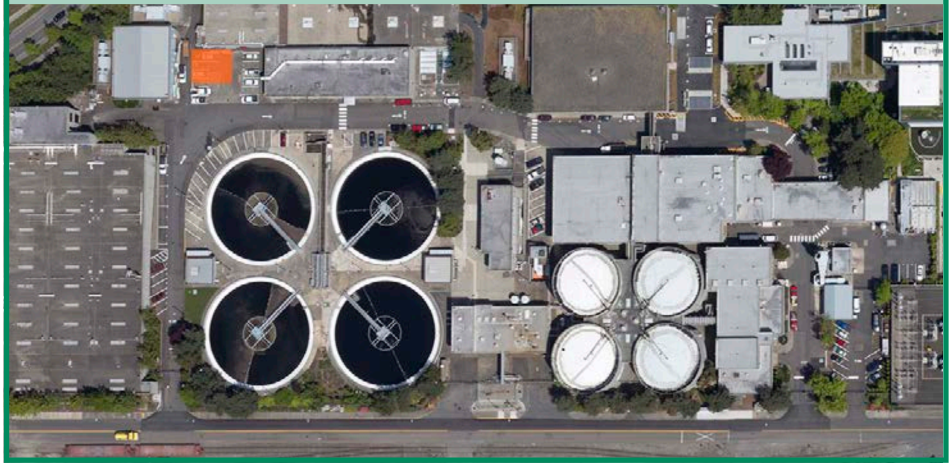
Summary Page		Year Start	Year Complete	2025-2026 Expenditure	2025-2030 CIP
	Support Services and Projects			**$21,217,949**	**$62,607,316**
37	Annual Miscellaneous Professional Services	2006	Ongoing	$455,463	$1,480,918
38	Engineering Project Support	2006	Ongoing	$5,373,241	$16,939,142
39	Facilities Project Support	2006	Ongoing	$3,346,299	$10,549,206
40	Administrative Project Support	2006	Ongoing	$4,508,518	$14,213,104
41	Flow Monitoring Program	2006	Ongoing	$334,416	$1,065,587
42	WET Center Exhibit Updates	2011	Ongoing	$500,000	$500,000
43	Information Technology Upgrades	2014	Ongoing	$1,484,057	$2,644,120
44	Climate Action and Sustainability Program	2014	Ongoing	$445,355	$1,419,084
45	Future Technologies Pilot Program	2022	Ongoing	$263,900	$840,893
46	Miscellaneous Small Projects	2006	Ongoing	$835,700	$1,928,998
47	Property Acquisition	2001	Ongoing	$2,000,000	$5,000,000
48	Occupied Space and Facilities Improvements	2019	Ongoing	$406,000	$1,293,682
49	Water Stewardship Programs	2025	2030	$130,000	$390,000
50	Deschutes Estuary Restoration Agreement	2027	Ongoing	$0	$817,581
51	Water Quality and Habitat Improvement	2006	2030	$175,000	$525,000
52	Septic Conversion Incentive Program	2017	2030	$360,000	$1,200,000
53	Affordable Housing Support Program	2023	2030	$500,000	$1,500,000
54	Sea Level Rise Response	2017	Ongoing	$100,000	$300,000
	Total			**$75,885,699**	**$228,215,980**

LOTT funds ongoing efforts to identify and support water quality and habitat improvement projects.

Supplemental Carbon System Upgrade

Project Type	System Upgrade
Location	Budd Inlet Treatment Plant
Description	The biological nutrient removal process needs supplemental carbon at times to operate efficiently. The existing system, which uses methanol, is being demolished as part of the Digester System Improvements Phase 2 project. This project involves the evaluation and installation of a new system utilizing a safer and more environmentally friendly replacement carbon source.
Background	In 2022, LOTT successfully pilot tested a carbon product as an alternative to the use of methanol. Methanol requires special care and handling because it is highly flammable. Using an alternative source eliminates the need to install a costly fire suppression system, improves safety for staff and the public, and lowers LOTT's carbon footprint.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2024	2026	$754,706	$754,706



Alkalinity Adjustment Facility

Project Type	System Upgrade
Location	Budd Inlet Treatment Plant
Description	To operate efficiently, the biological nutrient removal process requires a consistent pH. The project adds a storage and feed system to allow the dosing of magnesium hydroxide, a pH buffer, to minimize pH fluctuation.
Background	In 2022 and 2023, LOTT piloted several products for alkalinity adjustment, including calcium carbonate and magnesium hydroxide. The magnesium hydroxide option proved effective, and the resulting alkalinity control enhanced nitrification capacity and improved energy efficiency by reducing aeration demand.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2025	2026	$616,036	$616,036

Centrate Building Rehabilitation

Project Type	System Upgrade
Location	Budd Inlet Treatment Plant
Description	This phase of the centrate management system upgrade includes replacement of the roof, refurbishment of the interior steel beams and columns, seismic retrofits, odor control system replacement, and electrical upgrades.
Background	Centrate is the liquid removed during the solids dewatering process. With the addition of new primary sedimentation basins in 2017, use of the original basins was converted to storage and management of centrate, which is high in ammonia. This is the second phase of work to repurpose the basins for additional equalization storage and better management of centrate loading to the secondary treatment process.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2025	$2,071,799	$2,071,799

Digester System Improvements Phase 2

Project Type	System Upgrade
Location	Budd Inlet Treatment Plant
Description	The project includes refurbishment of aging components associated with the sludge digestion system. Improvements include replacement of the digesters' floating covers with fixed covers, upgrades to the sludge mixing system, replacement and relocation of the emergency waste gas burner, and replacement of aging mechanical equipment.
Background	The digesters were constructed in 1982 and much of the associated equipment is reaching the end of its useful life. There are four digesters, with three in-service and one off-line at any one time. This project will follow a rotational schedule to complete upgrades to one digester at a time.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2028	$25,844,657	$44,503,910

Biogas Utilization Upgrades

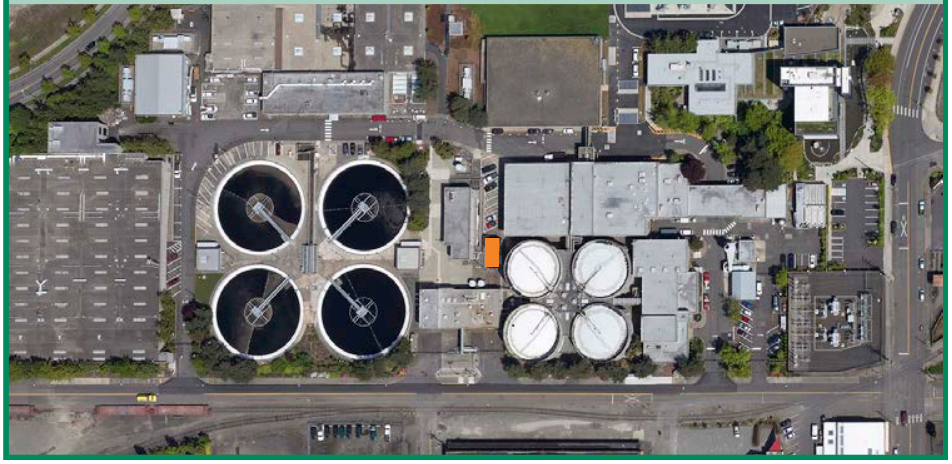
Project Type	System Upgrade
Location	Budd Inlet Treatment Plant
Description	This project will further evaluate biogas utilization options identified through a business case evaluation completed in 2024. Upgrade options could include replacement of the existing engine generator or installation of an alternative system to optimize the use of biogas as a resource. The evaluation will incorporate operational data following the digester system improvements, which are anticipated to increase gas production.
Background	The Jenbacher engine generator was originally installed in 2009 as part of a Puget Sound Energy grant. The engine was overhauled in 2018 and again in 2024, and has a normal service life of seven years before it must be overhauled again or replaced.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2030	$231,405	$17,394,739

Odor Control Upgrades

Project Type	System Upgrade
Location	Budd Inlet Treatment Plant
Description	This project includes improvements to the headworks, solids, and maintenance building air handling systems. It also includes modifications to consolidate foul air flows to the south odor scrubber, eliminating the need to replace the north odor scrubber.
Background	The north scrubber equipment was originally installed in the early 1980s to treat foul air from the equalization basins. Plant upgrades since then have reduced the volume of fowl air to the north scrubber, allowing for consolidation of air handling to the south scrubber. The south scrubber was installed in 2003 and is in good condition.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2028	2030	$0	$2,314,573



Martin Way Pump Station Improvements

Project Type	System Upgrade – Conveyance
Location	Martin Way Pump Station
Description	The project expands the Martin Way Pump Station, replacing aging infrastructure and increasing its pumping capacity to accommodate projected growth in the service area.
Background	The Martin Way Pump Station conveys flows from Lacey to the Budd Inlet Treatment Plant. It also sends raw wastewater to the Martin Way Reclaimed Water Plant. The pump station was originally constructed in 1991 and upgraded in 2004. Much of the equipment is undersized and reaching the end of its useful life.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2024	2028	$4,276,692	$29,355,524

Force Main Air Valve Replacement

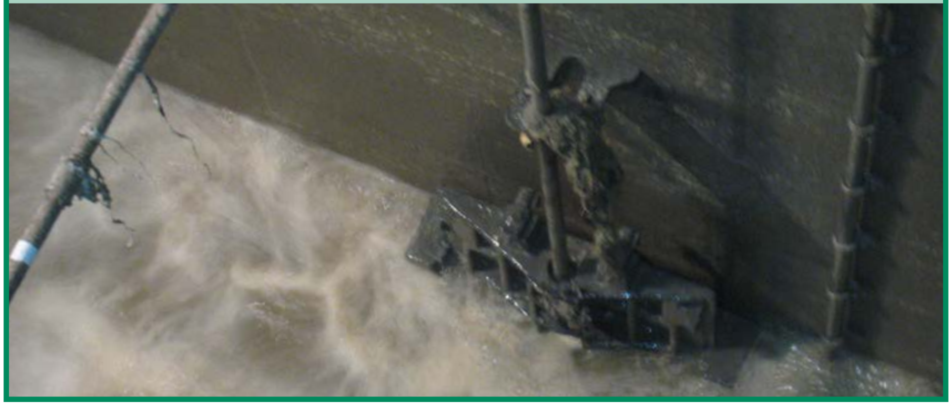
Project Type	System Upgrade – Conveyance
Location	Collection System
Description	The project replaces approximately 50 force main valves that are in poor condition and includes repairs and modification to some of the vaults to prevent flooding.
Background	Air inlet release and vacuum release valves are necessary to protect pressurized pipe systems. Through a comprehensive force main condition assessment, LOTT identified the valve replacements and improvements needed to wastewater force main pipelines and reclaimed water pipelines.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2026	$1,758,457	$1,758,457

Capitol Lake Pump Station Wet Well Coatings

Project Type	System Upgrade – Conveyance
Location	Capitol Lake Pump Station
Description	Coatings of wet wells protect the concrete from degradation caused by the presence of hydrogen sulfide. This project involves replacing the coatings in the Capitol Lake Pump Station wet wells, which have begun to fail, creating the risk of wet well deterioration and pump blockages.
Background	Wet well coatings were installed at the Capitol Lake Pump Station in 1999, however, moisture from groundwater intrusion prevented proper adhesion. New wet well coatings will increase the lifespan of the concrete, as well as ladders and other metal components within the wet wells.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2025	$1,063,732	$1,063,732



Collection System Management Program

Project Type	System Upgrade – Conveyance
Location	Systemwide
Description	This includes the ongoing monitoring and rehabilitation of sewer lines and maintenance holes within the LOTT collection system. It ensures federal compliance with capacity management, operations, and maintenance standards and is an integral part of LOTT's Asset Management Program. Annual activities include closed circuit televised inspection and condition assessment, which is used to identify needed repairs and replacements.
Background	LOTT currently owns and maintains approximately 22 miles of gravity sewer lines, 8 miles of force mains, and 325 maintenance holes. The collection system management program provides an efficient and systematic approach to inspection, maintenance, repair, and replacement of LOTT's collection system assets.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2008	2030	$418,180	$1,793,682

Martin Way Reclaimed Water Plant Upgrades

Project Type	System Upgrade
Location	Martin Way Reclaimed Water Plant
Description	This project involves a number of improvements to the treatment plant to replace aging infrastructure and improve operational reliability. Improvements include valve replacement, improvements to automation, and upgrades to the electrical and control systems.
Background	Since the Martin Way Reclaimed Water Plant first came on-line in 2006, reclaimed water demand in the system has increased significantly, making continuous operation increasingly important. These upgrades, including replacement of an obsolete control system, will enhance operations and reliability.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2025	2030	$350,714	$9,886,193

Reclaimed Water Capacity Development

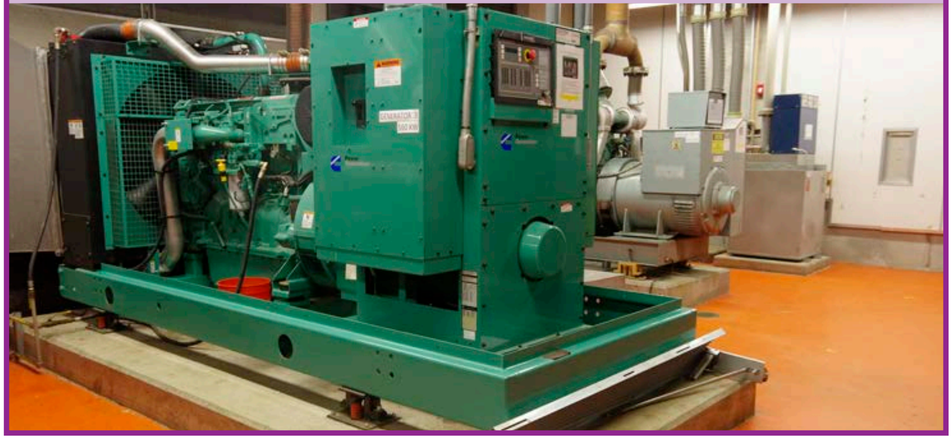
Project Type	New Capacity
Location	Systemwide
Description	This effort includes planning associated with expansion of LOTT's reclaimed water system. This could include evaluations of treatment technologies, conveyance routes, reuse opportunities, and site assessments for potential groundwater recharge sites. One such project is a possible demonstration pilot to treat water to Class A+ potable water quality, in collaboration with the partner jurisdictions and Washington State Departments of Health and Ecology.
Background	The 2050 LOTT System Plan looks to new opportunities to address future system capacity needs, including employing enhanced treatment technologies at the Budd Inlet Treatment Plant. However, expansion of reclaimed water production, reuse, and recharge may also be pursued in the future with LOTT's partner jurisdictions' increasing interests in reuse and recharge as the primary driver.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2025	2027	$916,663	$1,077,048

Influent Pumping and Emergency Power Improvements

Project Type	New Capacity
Location	Budd Inlet Treatment Plant
Description	The influent pump station consists of four pumps, each capable of pumping 18 million gallons per day. This project replaces the pumps to increase pumping capacity, reliability, and redundancy. The project also involves replacement of old emergency standby generators located in the same area. This work provides opportunity to expand back-up power to additional treatment processes and improve redundancy.
Background	The influent pump station must lift and pump all the flow entering the Budd Inlet Treatment Plant to convey it to the primary sedimentation basins. Replacement of the influent pumps, originally installed in 1992, will improve pumping capacity to better manage high flow events associated with more frequent and intense storm events. The existing standby generators were installed in 1982 and 2004 and are in need of replacement.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2024	2030	$1,020,090	$27,124,001

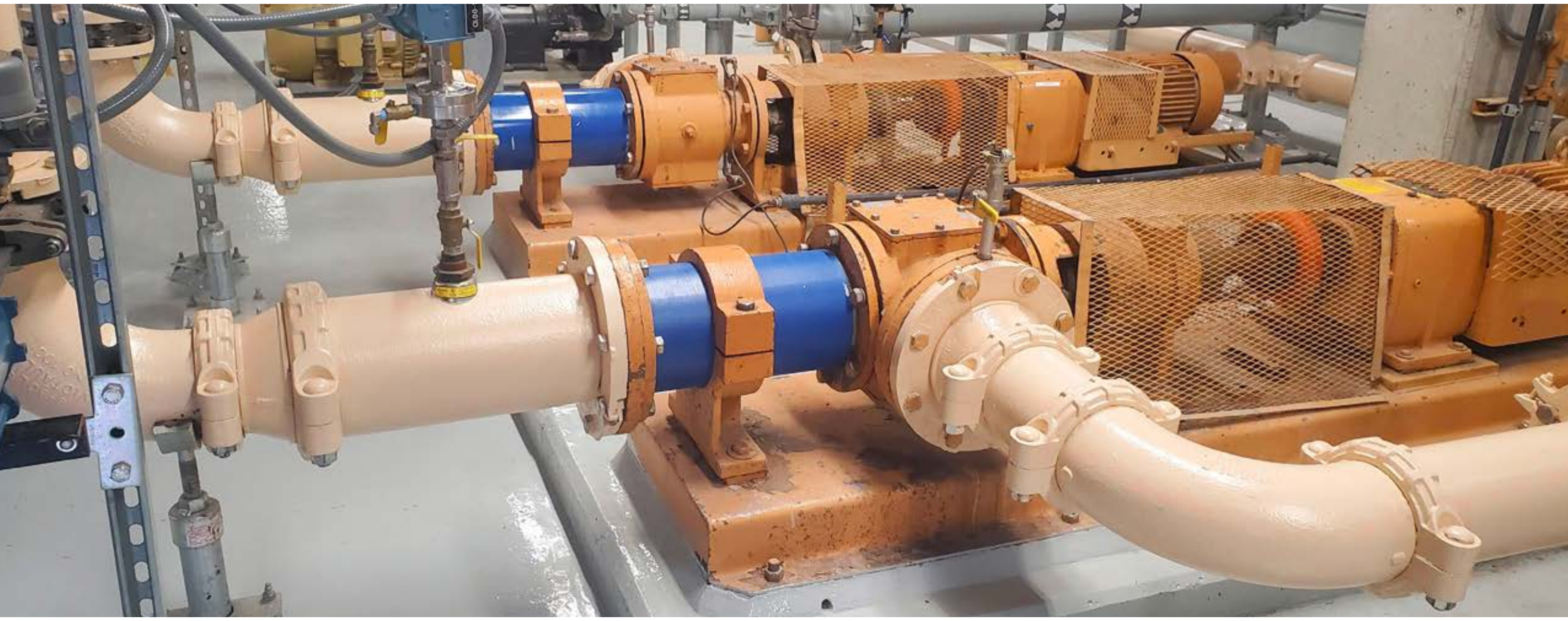


North Pipeline Upgrades

Project Type	New Capacity
Location	Budd Inlet Treatment Plant
Description	This project upgrades a 1,250-foot section of north outfall pipeline from 30-inch to 48-inch diameter pipe to increase hydraulic pumping capacity. The pipeline runs north from the treatment plant, through the Port of Olympia log yard and Cascade Pole site, to the northernmost point of the Port peninsula.
Background	The original 30-inch diameter north outfall pipeline was constructed in 1952. In 1992 the outfall was replaced with a 48-inch pipeline, with the exception of a lined section running through the contaminated soils of the Cascade Pole site. That section is a hydraulic bottleneck, limiting outfall capacity. This project will resolve the bottleneck and improve LOTT's ability to manage high flow events.

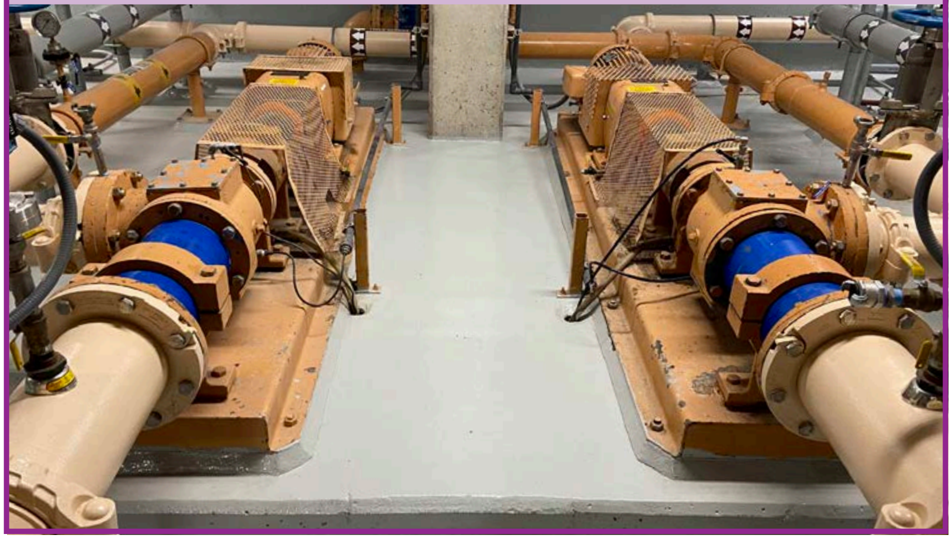
Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2026	$9,308,152	$9,308,152

Thickened Sludge Pumping Capacity Expansion



Project Type	New Capacity
Location	Budd Inlet Treatment Plant
Description	This project represents the third phase of sludge thickening system improvements. It involves replacing aging sludge pumps to increase pumping capacity and energy efficiency.
Background	Thickened sludge pumps move sludge from the dissolved air flotation thickener tanks into the digesters. These pumps were installed in the 1980s and have reached the end of their useful life.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2025	$907,070	$907,070



Primary Sludge Pumping Capacity Expansion

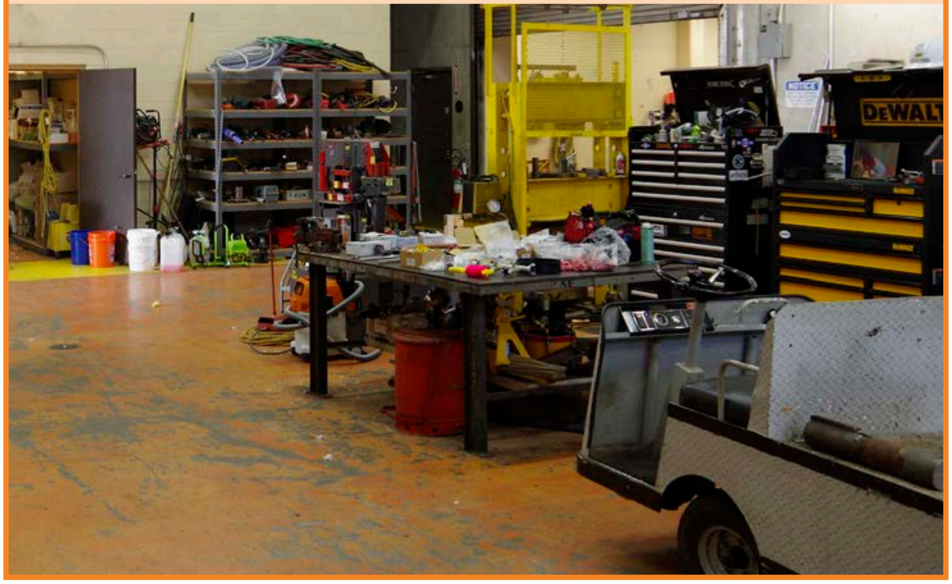
Project Type	New Capacity
Location	Budd Inlet Treatment Plant
Description	This project increases the primary sludge pumping capacity. It involves upsizing discharge piping and pumps to increase pumping capacity and energy efficiency.
Background	The primary sludge pumps move settled solids in the primary sedimentation basins to the dissolved air flotation thickener tanks where the sludge is thickened prior to being sent to the digesters.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2027	$739,515	$846,257

General Equipment Repair and Replacement

Project Type	Asset Management
Location	Systemwide
Description	This provides funding for miscellaneous small repair and replacement projects.
Background	In 1987, LOTT established the LOTT Equipment Replacement Fund (LERF) to set aside funds for equipment replacement. These funds pay for small projects identified through LOTT's Asset Management Program.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2009	2050	$2,691,616	$8,576,590



Instrumentation and Controls Replacement

Project Type	Asset Management
Location	Systemwide
Description	This line item provides funding for instrumentation and controls replacements and upgrades.
Background	The control system receives input from a number of controls and instruments, many of which are reaching the end of their useful lives and need to be replaced.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2012	2050	$494,612	$1,576,036

Substation and Switchgear A/B Replacement

Project Type	Asset Management
Location	Budd Inlet Treatment Plant
Description	This project replaces substation and switchgear A/B. This equipment provides critical utility power to headworks, influent pumping, and the Budd Inlet Reclaimed Water Plant. Temporary power will be required to maintain service during construction, supplied through a combination of portable and plant generators.
Background	The substation and switchgear A/B was installed in 1980 and is reaching the end of its useful life. Replacement equipment with a lead time of nearly two years was ordered in 2023 in anticipation of this project.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2026	$823,425	$823,425

Final Effluent Pumping Improvements

Project Type	Asset Management
Location	Budd Inlet Treatment Plant
Description	This project involves upgrades to aging infrastructure associated with the final effluent pump station. It includes pumps, drives, motors, valves, and other mechanical equipment.
Background	The final effluent pumps were installed in 1993 and much of the associated equipment will be nearing the end of its useful life.

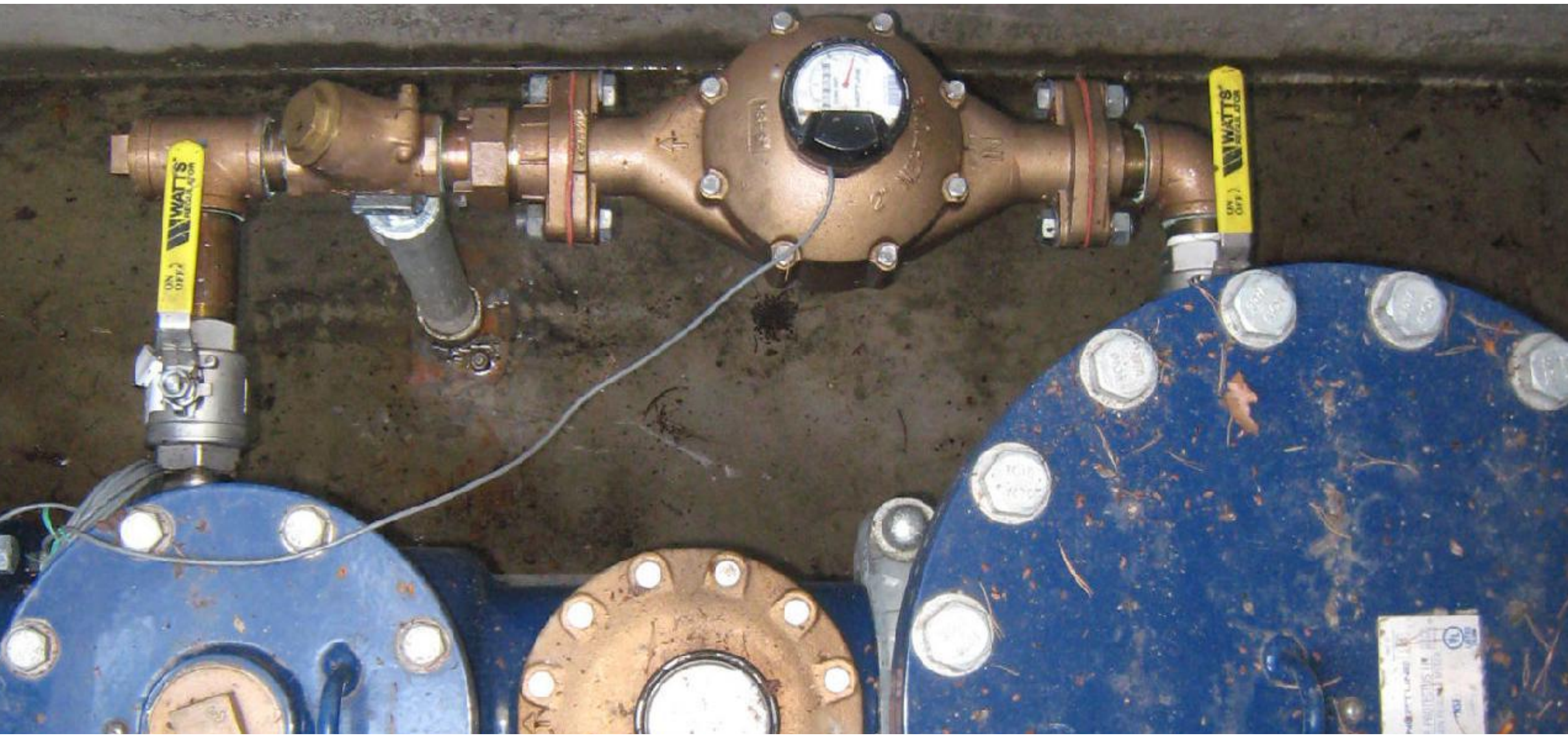
Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2029	2033	$0	$2,778,816

Facility Roof Repair and Replacement

Project Type	Asset Management
Location	Systemwide
Description	This involves repair and replacement of facility roofs at the Budd Inlet Treatment Plant and offsite facilities, including replacement of the headworks building roof planned for 2026.
Background	As part of LOTT's Asset Management Program, a maintenance and monitoring program was established to maximize the life of all existing roofs and plan for their eventual replacement. A number of roofing systems at the plant and pump stations are reaching the end of their useful lives and need to be replaced in the coming years.

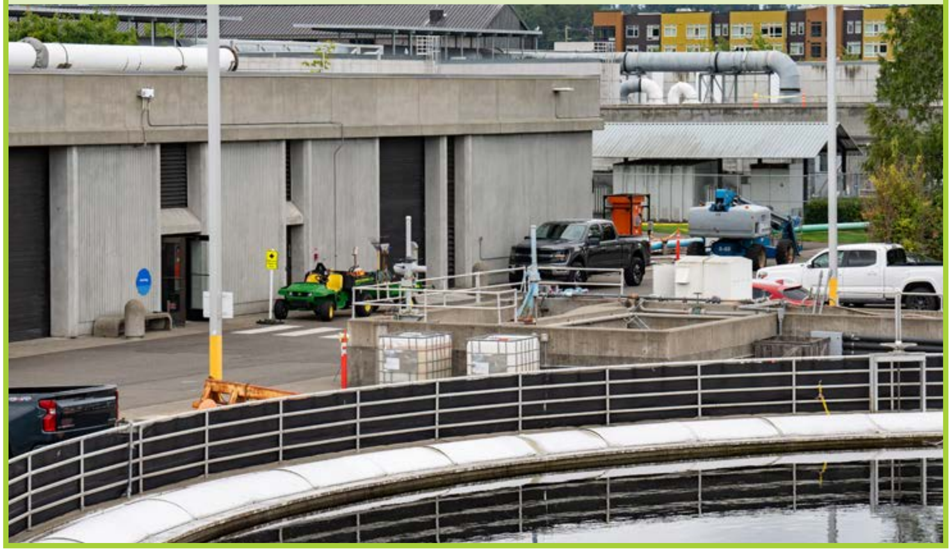
Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2016	2050	$380,227	$1,077,915

Annual Miscellaneous Professional Services

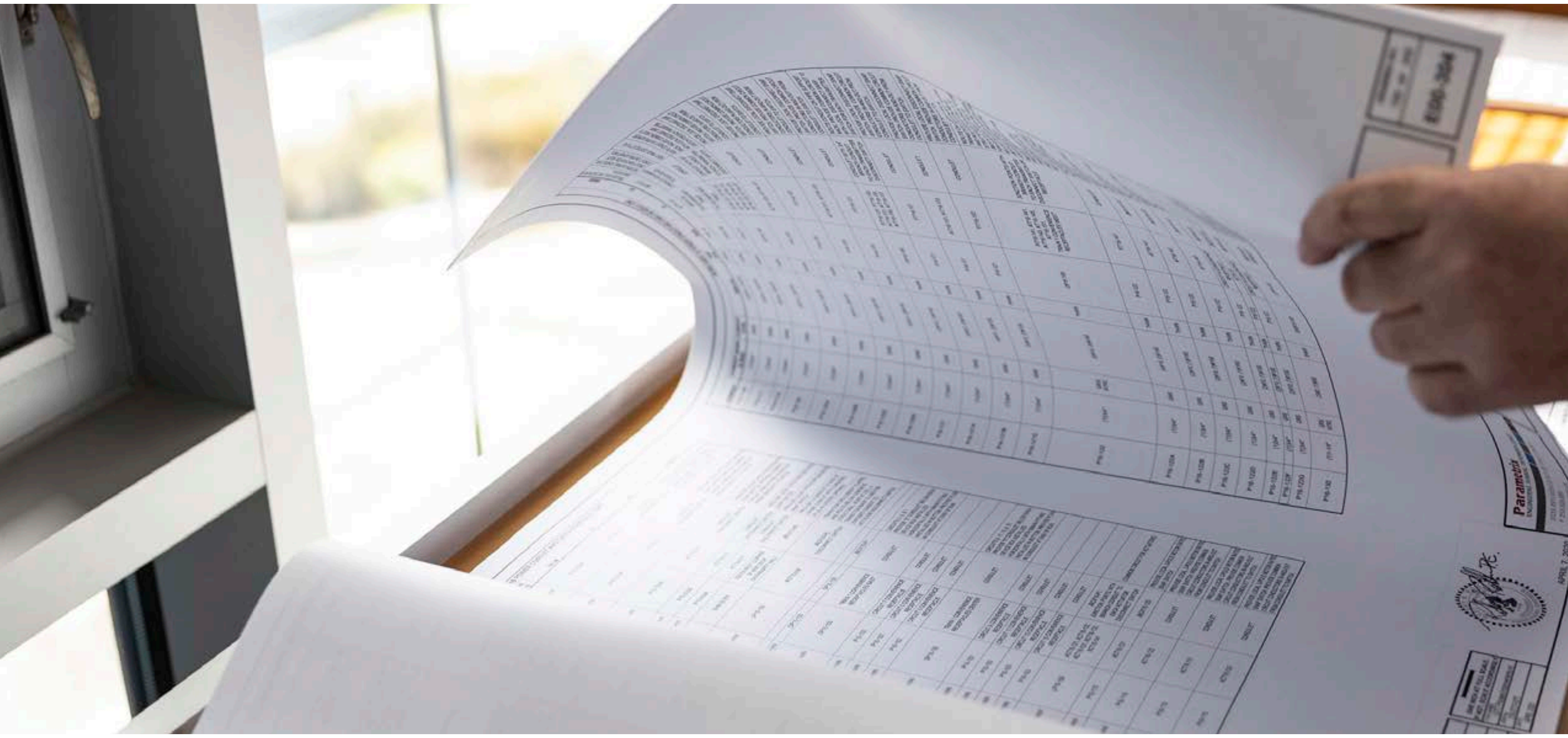


Project Type	Support Services and Projects
Location	Systemwide
Description	This provides funding for various engineering and professional consulting services associated with unexpected small projects identified during the biennium, including projects associated with emergency situations.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	Ongoing	$455,463	$1,480,918



Engineering Project Support



Project Type	Support Services and Projects
Location	Systemwide
Description	Engineering staff provide support for current and future projects. Services include facility planning, permitting, engineering design, construction management, and documentation.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	Ongoing	$5,373,241	$16,939,142

Facilities Project Support

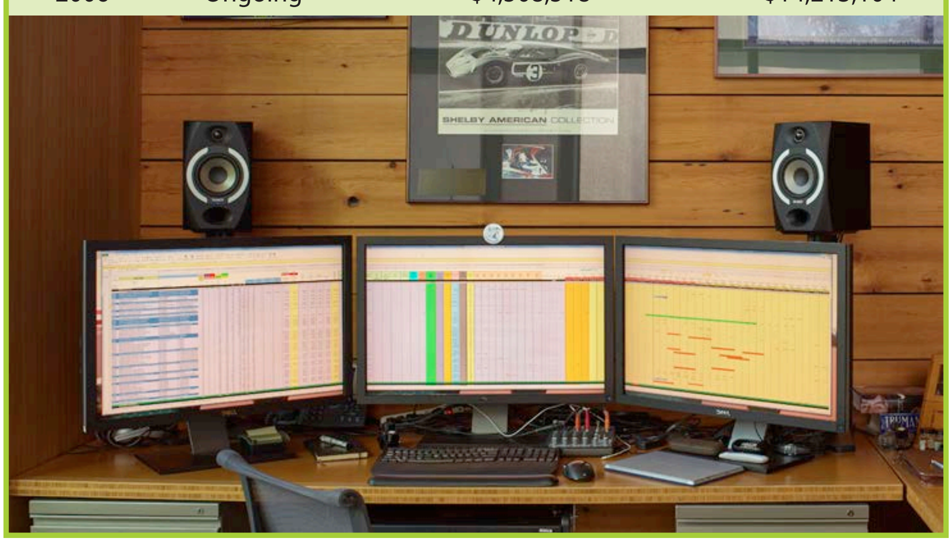
Project Type	Support Services and Projects
Location	Systemwide
Description	Staff from the Operations, Maintenance, Control Systems, and Environmental Compliance departments provide support for capital projects. Services include participation on project teams, design review, construction support, equipment and process commissioning, and integration into LOTT's asset management system.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	Ongoing	$3,346,299	$10,549,206

Administrative Project Support

Project Type	Support Services and Projects
Location	Systemwide
Description	Staff from the Finance & Administration, Environmental Planning & Communications, and Human Resources & Risk Management Divisions provide a variety of support for capital projects. Services include environmental evaluations, public notification, participation on project teams, staff recruitment, risk and claims management, contracting and bid support, accounting, financing. This line item also includes a portion of LOTT's general expenses related to capital projects.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	Ongoing	$4,508,518	$14,213,104



Flow Monitoring Program

Project Type	Support Services and Projects
Location	Systemwide
Description	This provides funding for the collection and analysis of flow monitoring data to support the development of the biennial three-part Capacity Report (Flows and Loadings, Inflow & Infiltration and Flow Monitoring, and Capacity Assessment). Annual costs include the monthly data collection fees, and annual calibration, relocation, and maintenance of flow meters.
Background	As part of LOTT's National Pollutant Discharge Elimination System (NPDES) permit, LOTT is required to monitor its sewer collection basins so that each is assessed within a seven-year period. This comprehensive monitoring program began in 1994 following completion of an initial Infiltration Inflow Analysis.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	Ongoing	$334,416	$1,065,587

WET Center Exhibit Updates

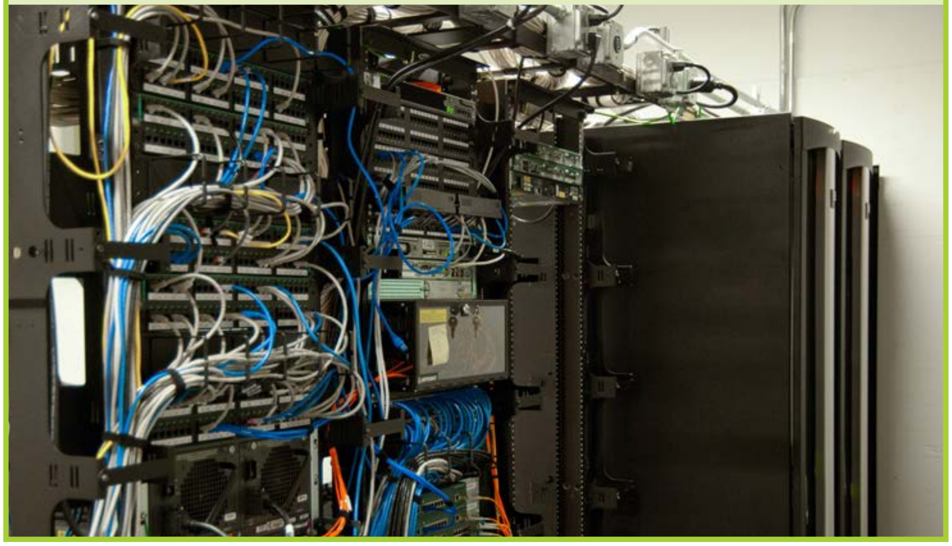
Project Type	Support Services and Projects
Location	Regional Services Center
Description	The WET Science Center serves as the heart of LOTT's education and outreach program. Exhibits and other features of the WET Science Center are updated occasionally to ensure they reflect relevant, up-to-date information and hold community interest.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2011	Ongoing	$500,000	$500,000

Information Technology Upgrades

Project Type	Support Services and Projects
Location	Systemwide
Description	This funds information system upgrades to include network servers, routers, switches, desktop computers, security, fire protection, and video surveillance systems. It also supports the continued development of LOTT's electronic operation and maintenance (O&M) manual system, which is a permit requirement.
Background	As technology continues to advance, LOTT must keep pace and continue to upgrade and maintain its information technology infrastructure.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2014	Ongoing	$1,484,057	$2,644,120



Climate Action and Sustainability Program

Project Type	Support Services and Projects
Location	Systemwide
Description	This line item provides funding for energy conservation and emissions reduction efforts. A climate action assessment completed in 2024 identified promising project areas to be explored for possible implementation in the 2025-2030 time period. LOTT's Green Team, which consists of staff from multiple work groups, will evaluate and prioritize projects for implementation.
Background	Wastewater treatment is energy-intensive and LOTT is one of the largest consumers of electricity in Thurston County. LOTT's emissions inventory indicates that 90% of LOTT's carbon footprint is due to electricity usage. The inventory is completed annually to track progress in reducing energy use, generating renewable energy, and lowering LOTT's overall carbon footprint. The Board of Directors supports efforts to move LOTT toward carbon neutrality over time.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2014	Ongoing	$445,355	$1,419,084

Future Technologies Pilot Program

Project Type	Support Services and Projects
Location	Systemwide
Description	This line item provides funding for projects to pilot test alternative and new technologies identified by the staff-led Pilot Team. The intent of pilot projects is to identify opportunities that may improve processes or create efficiencies. The program supports core tenants of LOTT's culture of excellence, including innovation, problem-solving, and forward-thinking.

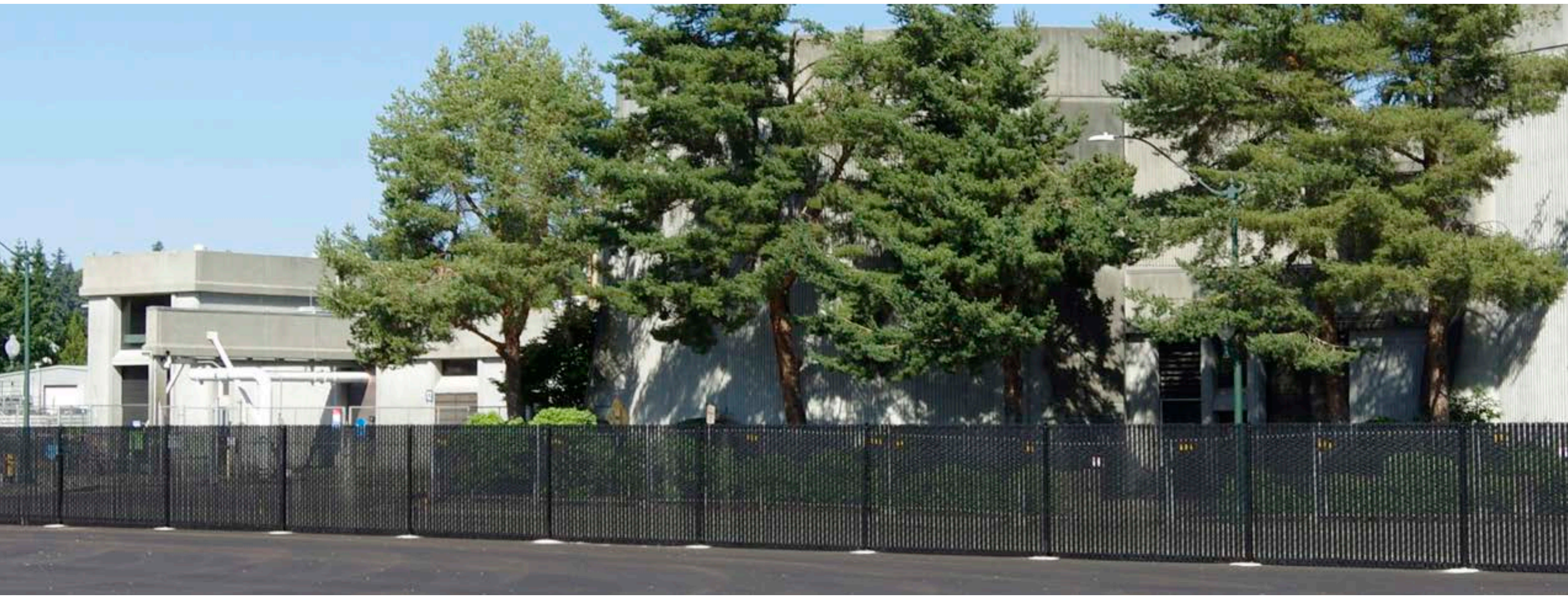
Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2022	Ongoing	$263,900	$840,893

Miscellaneous Small Projects

Project Type	Support Services and Projects
Location	Systemwide
Description	This line item provides funding for unidentified small projects that arise during the biennium. Small-scale projects that fall into this category include collection and conveyance system improvements, small construction projects, and engineering analysis and design.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	Ongoing	$835,700	$1,928,998

Property Acquisition



Project Type	Support Services and Projects
Location	Systemwide
Description	This line item provides funding for purchase of property adjacent to the Budd Inlet Treatment Plant and elsewhere to meet future infrastructure and system needs.
Background	As capacity needs and regulatory requirements change over time, additional properties may be needed to expand existing facilities and to build new treatment, conveyance, and discharge facilities.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2001	Ongoing	$2,000,000	$5,000,000

Occupied Space and Facilities Improvements

Project Type	Support Services and Projects
Location	Systemwide
Description	This provides funding for the continued maintenance, refurbishment, and expansion of LOTT-owned occupied spaces such as offices and workrooms. It also includes funding for security improvements for LOTT facilities.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2019	Ongoing	$406,000	$1,293,682

Water Stewardship Programs

Project Type	Support Services and Projects
Location	Regional
Description	This line item funds collaborative efforts to encourage water conservation, source control, and water quality protection. LOTT provides source control and conservation outreach materials and behavior change tools like water saving kits and grease scrapers for distribution by the partner jurisdictions. This item also includes the Public Health Emergency Support Program, under which LOTT offers small grants to partner jurisdictions to improve management of human waste associated with the unhoused population.
Background	These efforts are intended to reduce inputs of fats, oils, greases, wipes, and other pollutants into the sewer system and into receiving waters. Public health support projects like rental of portable toilets at encampments help reduce risks to public health and the environment by keeping human waste and associated bacteria and nutrients out of local surface waters.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2025	2030	$130,000	$390,000

Deschutes Estuary Restoration Agreement

Project Type	Support Services and Projects
Location	Regional
Description	This line item includes funding to meet LOTT's contribution outlined under the funding and governance framework for restoration of the Deschutes Estuary. The framework centers on the State of Washington funding initial estuary restoration, with several state agencies and local entities, including LOTT, contributing to costs associated with long-term maintenance of the restored estuary.
Background	The Budd Inlet Dissolved Oxygen Total Maximum Daily Load (TMDL) analysis by the Washington State Department of Ecology found Capitol Lake is the cause of 62% of the oxygen depletion in Budd Inlet, indicating that estuary restoration is necessary to significantly improve water quality. Even though LOTT's current discharge to Budd Inlet only represents 3% of the oxygen depletion, Ecology has indicated that if the estuary is not restored, they would likely be required to further restrict LOTT's discharge, greatly increasing treatment costs. By participating in jointly-funded long-term maintenance of a restored estuary, LOTT reduces the likelihood of further discharge regulation and delays the need to construct future advanced treatment processes. A detailed business case evaluation showed that participation in maintenance of the estuary is the most cost-effective option for LOTT ratepayers.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2027	Ongoing	$0	$817,581

Water Quality and Habitat Improvement

Project Type	Support Services and Projects
Location	Regional
Description	LOTT funds ongoing efforts to identify and support water quality and habitat improvement projects. Some of these projects result from collaborative efforts with the Squaxin Island Tribe and other local organizations.
Background	Projects that protect or enhance the water quality or habitat of local surface waters or groundwater have benefit in terms of improving these vital shared resources. They also help protect the receiving waters where LOTT discharges water treated at the Budd Inlet Treatment Plant or infiltrates reclaimed water to groundwater.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2006	2030	$175,000	$525,000

Septic Conversion Incentive Program

Project Type	Support Services and Projects
Location	Regional
Description	This program incentivizes conversion from urban septic systems to sewer service through rebates for a portion of LOTT's connection fees.
Background	Connecting properties served by onsite septic systems to the public sewer system helps protect LOTT's receiving waters by ensuring a higher level of treatment than can be provided by septic systems.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2017	2030	$360,000	$1,200,000

Affordable Housing Support Program

Project Type	Support Services and Projects
Location	Regional
Description	This pilot program is designed to encourage development of affordable housing within LOTT's service area through the partial rebate of LOTT's connection fee.
Background	An increased supply of affordable housing is a regional goal shared by the LOTT justifications. This pilot program was extended through 2030 to reduce costs and lower barriers to the development of low income housing in alignment with the Regional Housing Council's efforts to foster development of more low income housing units.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2023	2030	$500,000	$1,500,000

Sea Level Rise Response

Project Type	Support Services and Projects
Location	Regional
Description	This line item provides funding for continued sea level rise response efforts, including administrative costs and joint projects of the Sea Level Rise Response Collaborative. Near-term joint projects include data gathering efforts such as monitoring of subsidence and development of a funding strategy for longer-term response measures.
Background	LOTT, the City of Olympia, and the Port of Olympia completed a joint planning effort in 2019 to create the Olympia Sea Level Rise Response Plan. The plan provides a comprehensive list of short-term, mid-term, and long-term strategies for minimizing and preventing flooding to downtown Olympia and protecting LOTT's Budd Inlet Treatment Plant from rising sea levels.

Start	Complete	2025-2026 Expenditure	2025-2030 CIP
2017	Ongoing	$100,000	$300,000

Long-Range Planning

The long-range Capital Improvements Plan (CIP) represents major capital projects projected to occur within the 2031-2037 timeframe and those that are anticipated beyond that period. This table is based on LOTT's current understanding of system needs well into the future. However, the plan is refined each biennium based on new information, including updated capacity reports, asset management evaluations, and other data. Revisions also occur due to changing conditions that result from internal planning efforts, regional planning such as the Sea Level Rise Response Collaborative work plans, and regulatory developments such as the state-level Puget Sound Nutrient General Permit. This long-range CIP has been revised based on the 2050 LOTT System Plan completed in 2023, and will continue to be adjusted based on the most current information.

Long-Range Capital Improvements Plan

System Life-Cycle Investments	2031-2037	Beyond 2037	Project Cost
Headworks			
Headworks Solids Handling Improvements		✓	$19,700,000
Wet Weather Flow Capacity Expansion		✓	$27,500,000
Primary Sedimentation			
Chemically Enhanced Primary Treatment	✓		$3,638,000
Primary Sedimentation Basins Refurbishment	✓		$4,980,000
Secondary Treatment			
Intermediate Pump Station Improvements	✓		$9,000,000
Tertiary Treatment Facility Phase 1	✓		$27,958,000
Tertiary Treatment Facility Phase 2		✓	$10,586,000
Biological Treatment Process Refurbishment		✓	$27,010,000
Secondary Clarifiers			
Secondary Clarifier Refurbishment	✓		$6,930,000
Secondary Clarifier Expansion		✓	$15,000,000
UV Disinfection			
UV Disinfection System Refurbishment		✓	$7,914,000
Budd Inlet Reclaimed Water Plant			
Budd Inlet Reclaimed Water Plant Expansion	✓		$3,900,000
Sludge Thickening			
Sludge Thickening System Upgrade		✓	$9,700,000
Sludge Digestion			
Digestion Refurbishment and Expansion		✓	$20,000,000

Long-Range Capital Improvements Plan *(continued)*

System Life-Cycle Investments	2031-2037	Beyond 2037	Project Cost
Sludge Dewatering and Disposal			
Struvite Precipitation	✓		$7,376,000
Centrate Treatment	✓		$3,224,000
Sludge Dewatering and Disposal Refurbishment		✓	$5,762,000
Odor Control			
South Odor Scrubber Upgrade	✓		$1,770,000
Electrical and Controls			
Substation and Switchgear E/F Replacement	✓		$2,877,000
Substation and Switchgear C/D Replacement	✓		$2,929,000
BITP Control System Upgrades		✓	$500,000
Collection			
Percival Creek/Mottman Road Interceptor		✓	$6,525,000
Martin Way Parallel Force Main	✓		$7,998,000
Henderson/Indian Creek Improvements		✓	$4,532,000
East Corridor Upgrade (Marvin to Carpenter)		✓	$11,607,000
Tumwater Hillside Interceptor Rehabilitation	✓		$1,170,000
Indian Creek Interceptor Improvements		✓	$15,378,000
Pump Stations			
Kaiser Road Pump Station Improvements	✓		$600,000
Capitol Lake Pump Station Refurbishment	✓		$5,000,000
Martin Way Pump Station Refurbishment		✓	$3,985,000
Martin Way Reclaimed Water Plant			
Membrane Replacement	✓		$2,372,000
Martin Way Reclaimed Water Plant 3rd mgd	✓		$30,731,000
Martin Way Reclaimed Water Plant 4th and 5th mgd		✓	$46,721,000
Hawks Prairie Ponds			
Martin Way to Hawks Prairie Pipeline Expansion		✓	$15,207,000
Reclaimed Water Capacity Expansion (Based on second phase of master planning effort)			
Treatment/Production Facilities Expansion			TBD
Conveyance System			TBD
Infiltration/Recharge/Augmentation Projects			TBD

Operating Budget

2025-2026 Operating Budget

The Operating Budget for 2025-2026 was the subject of multiple work sessions with the Board of Directors during 2024. It includes three categories of expense – personnel, direct operating expense, and general expense. Budgeted amounts for each category are shown in the table. The overall 2025-2026 Operating Budget has increased approximately 9.3% per year over the previous budget.

Operating Expense Summary 2025-2026

	2025-2026 Budget	2023-2024 Budget	Annual % Change	Biennial $ Change
Personnel	$23,000,973	$20,441,036	6.3%	$2,559,938
Direct Operating Expense	$13,012,033	$9,919,674	15.6%	$3,092,359
General Expense	$2,422,556	$2,062,563	8.7%	$359,992
Total Operations Expense	**$38,435,562**	**$32,423,273**	**9.3%**	**$6,012,289**

Personnel

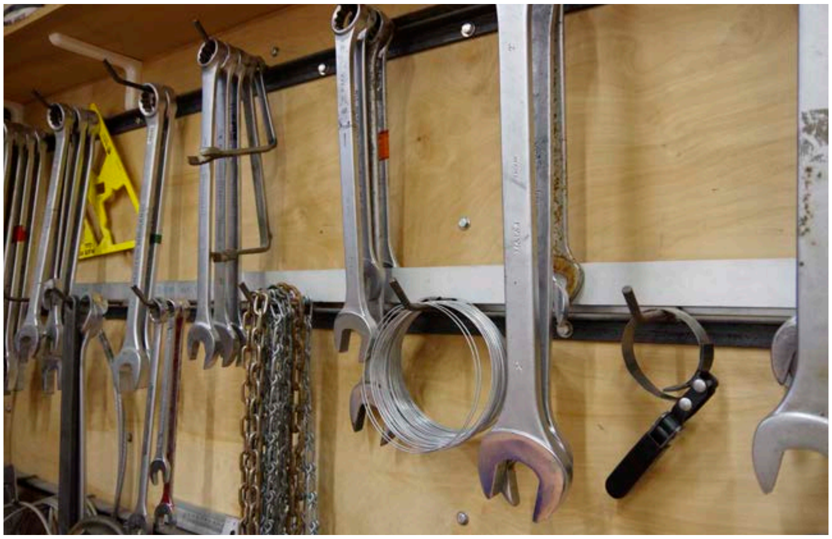
This category includes all staffing and related benefit costs. LOTT's staffing level for 2025-2026 includes a total of 91.75 full-time equivalent (FTE) positions. Three new positions and conversion of one temporary position to permanent status are included in the total. Other factors that contribute to the personnel budget increase are higher healthcare costs and scheduled cost of living adjustments.

General Expense

General Expense, the smallest of the three categories, includes all other necessary expenses that are not directly related to operations. This includes items such as training, professional services, and other overhead costs. Total expenses in this category have increased 8.7% per year in comparison to the 2023-2024 budget due to moving to a managed service model for Information Technology.

Direct Operating Expense

This accounts for all the non-personnel costs associated with the wastewater treatment process and production of reclaimed water. It includes items such as operating supplies, utilities, chemicals, and tools. This category increased by 15.6% per year, largely due to an increase in property insurance and electricity costs.



The Direct Operating Expense category accounts for non-personnel costs, including operating supplies, utilities, chemicals, and tools.

Our Commitment

The LOTT Clean Water Alliance is committed to meeting our communities' needs for wastewater treatment and reclaimed water production services, and doing so in a fiscally responsible, sound, and equitable manner. Protecting our communities' investment in LOTT's regional infrastructure and meeting future needs for new treatment capacity requires effective operations, continuous planning, and completion of large-scale capital projects. While the cost of these needs is substantial, LOTT has managed to minimize impacts to ratepayers, while keeping the utility financially sound.

LOTT is committed to meeting our communities' needs in a fiscally responsible, sound, and equitable manner.

LOTT Clean Water Alliance

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