Appendix F

LOTT Report

LOTT Clean Water Alliance

Flows and Loadings Report 2010

Analyzes Population Projections

2010 Flows and Loadings Report

October 2010

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PREFACE

The Flows and Loadings Report is one of three related documents that are part of the annual 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 annually, and are used to help identify capital projects for inclusion in the annual Capital Improvements Plan.

Flows and Loadings Report
This 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 & Infiltration and Flow Monitoring Report
The 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 to prioritize sewer line rehabilitation projects.

Capacity Assessment Report
Using flows, loadings, inflow, and infiltration data, the Capacity Assessment Report analyzes system components (i.e. treatment, discharge/use, and conveyance) to determine when limitations will occur and provides a timeline for new system components and upgrades.

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

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Executive Summary

In accordance with the Highly Managed Plan, LOTT is continuously planning to ensure it maintains adequate operational capacity to meet the community needs. The primary goal of the annual 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 2010 Capacity Assessment Report and the 2011 Capital Improvements Plan.

Data elements incorporated into this analysis include the following: 1) current population forecasts provided by the Thurston Regional Planning Council; 2) additional flow monitoring data collected as part of LOTT's inflow and infiltration evaluation program; 3) pump run time data collected by the City of Olympia at each of its sewer pump stations; 4) timelines for sewering of non-sewered areas provided by each of the jurisdictions (Lacey, Olympia, and Tumwater); and 5) sewer line maps.

This report also includes a drinking water evaluation using calendar year 2009 drinking water consumption data obtained from the jurisdictions. This analysis was used to recalibrate wastewater generation rate profiles for each of the jurisdictions.

The updated flow projections through 2030 are similar to those developed for the 2008 and 2009 Flows and Loadings Reports. Employment estimates from 2030 to 2053 are lower than previous estimates due to a change in the projection methodology. The Thurston Regional Planning Council does not provide employment projects past 2030. In previous reports, employment growth was tied to population growth proportionally on a basin-by-basin level. This resulted in an overestimation of employment population of the 2030 to 2053 time period. In order to reduce the dependence of the projection on individual basins, the analysis was revised to consider the service area as a whole. For the 2010 report, the employment population projection at build-out (2053) was 67,000 less than the 2009 report.

1. Introduction

1.1 Purpose

Accurate projections of future wastewater flows and loadings are essential in planning for new treatment capacity. In accordance with the Wastewater Resource Management Plan, also known as the Highly Managed Plan, LOTT is continuously monitoring and planning to assure adequate new wastewater treatment capacity "just in time." The primary goal of the annual 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 43-year planning cycle (2010-2053) and will be used to evaluate the existing LOTT Capital Improvements Plan and develop recommendations for the timing of capacity related projects.

1.2 Data Elements

Data used for the development of this report included flow data, sewered and non-sewered population projections, existing sewer lines, planned developments, estimated timelines for sewering of non-sewered areas within the overall Urban Growth Area (UGA), and 2009 drinking water consumption. Flow data was collected at the Budd Inlet Treatment Plant and at various flow monitoring locations throughout the collection system. Population projections were obtained from the Thurston Regional Planning Council (TRPC) in the form of projected residential and employment populations per parcel. Residential projections include the following years: 2010, 2015, 2020, 2025, and 2030. Employment projections were available for the years 2003 and 2030. The estimated sewering timelines, drinking water consumption, and existing collection system piping were obtained from each of the jurisdictions (Lacey, Olympia, and Tumwater).

1.3 Modeling Software

To develop flow and loading projections, the data listed above were entered into the Capacity Assurance Planning Environment (CAPE) application, a tool developed by Brown & Caldwell. CAPE is an integrated set of software tools designed to process geographical and tabular data and provide flow, loading, and population projections.

1.4 Changes From Previous Reports

The CAPE model was updated in 2010 with the following information: 1) 2009 drinking water consumption analysis; 2) updated wastewater generation rates; and 3) updated flow monitoring data.

After 2030, the method for projecting employment has changed. Because the Thurston Regional Planning Council (TRPC) does not provide employment estimates for 2053, the rate of increase from 2030 to 2053 has been tied to the rate of population increase. In the past, this analysis has been performed at the basin level. That is, for each specific basin, the rate of population increase from 2030 to 2053 was applied to the employment. When employment from all basins was summed, this led to a disproportionate increase in employment.

In the 2009 Flows and Loadings Report, the service area employment increased by 82% from 2030 to 2053, while the residential population increased by 37%. By conducting the analysis at the basin level, the analysis became subject to skew caused by the ratio of population to employment in each basin. For example, basin 44 is a small area located in downtown Olympia along Plum Street. By 2030, the residential population in this basin is projected to be 354. The 2030 employment in this basin is projected to be 1,831 (the basin houses a number of large office buildings). TRPC projects the residential population in this basin to increase to 1,996 by 2053, with the addition of some high density residential developments. That equates to an increase of 464%. When this is applied to the employment, it leads to an employment projection of 12,770, which is unrealistic given the size of the basin.

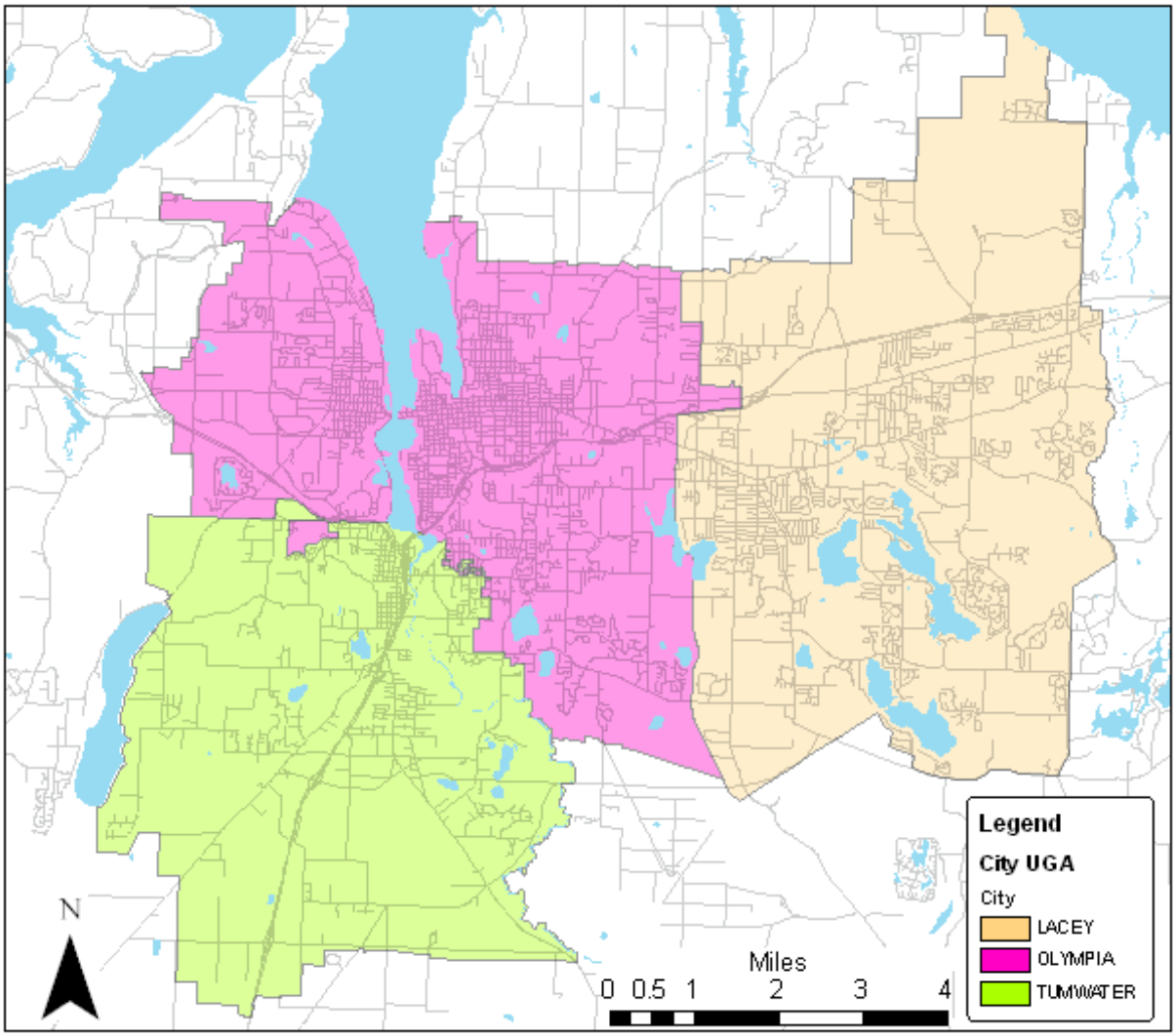
In order to reduce the dependence of the projection on individual basins, the analysis was revised to consider the service area as a whole. In this year's report, the total employment projects to increase by the same rate as population (37%). The increase was fractioned out to individual basins based upon the 2030 employment.

2. Study Area

2.1 Service Area

The LOTT Service area includes the UGAs for Lacey, Olympia, and Tumwater. The combined UGA encompasses approximately 53,000 acres with a current residential population of 160,227 and an employment population of 111,042.

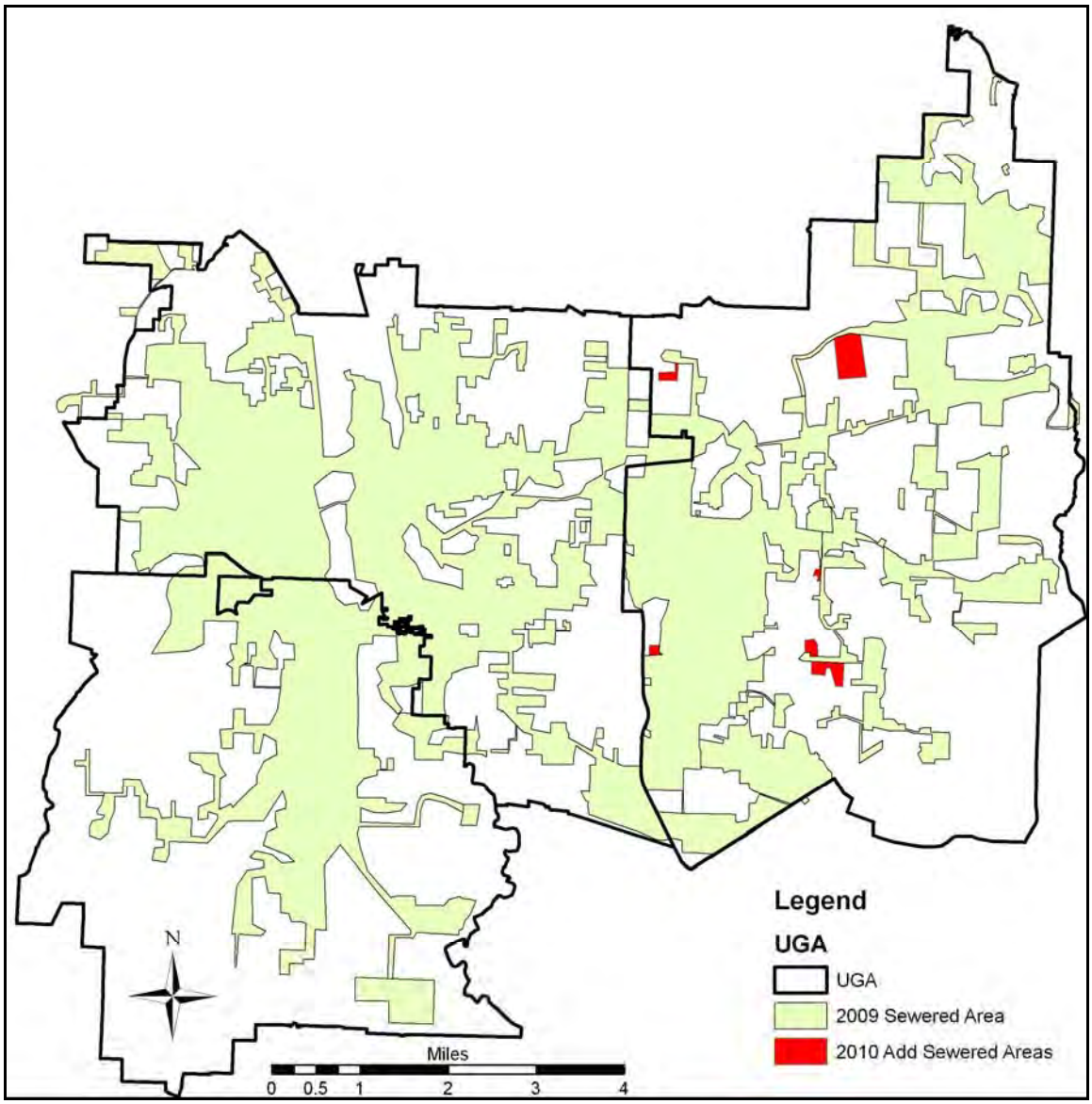
Figure 1. LOTT Service Area by Jurisdiction



2.2 Current Sewered Area

Within the LOTT service area, approximately 21,341 acres are sewered, serving a residential population of 93,911 and an employment population of 87,044. An additional 180 acres (red) were added to the sewered area since the 2009 Flows and Loadings Report.

Figure 2. Current Sewered Area

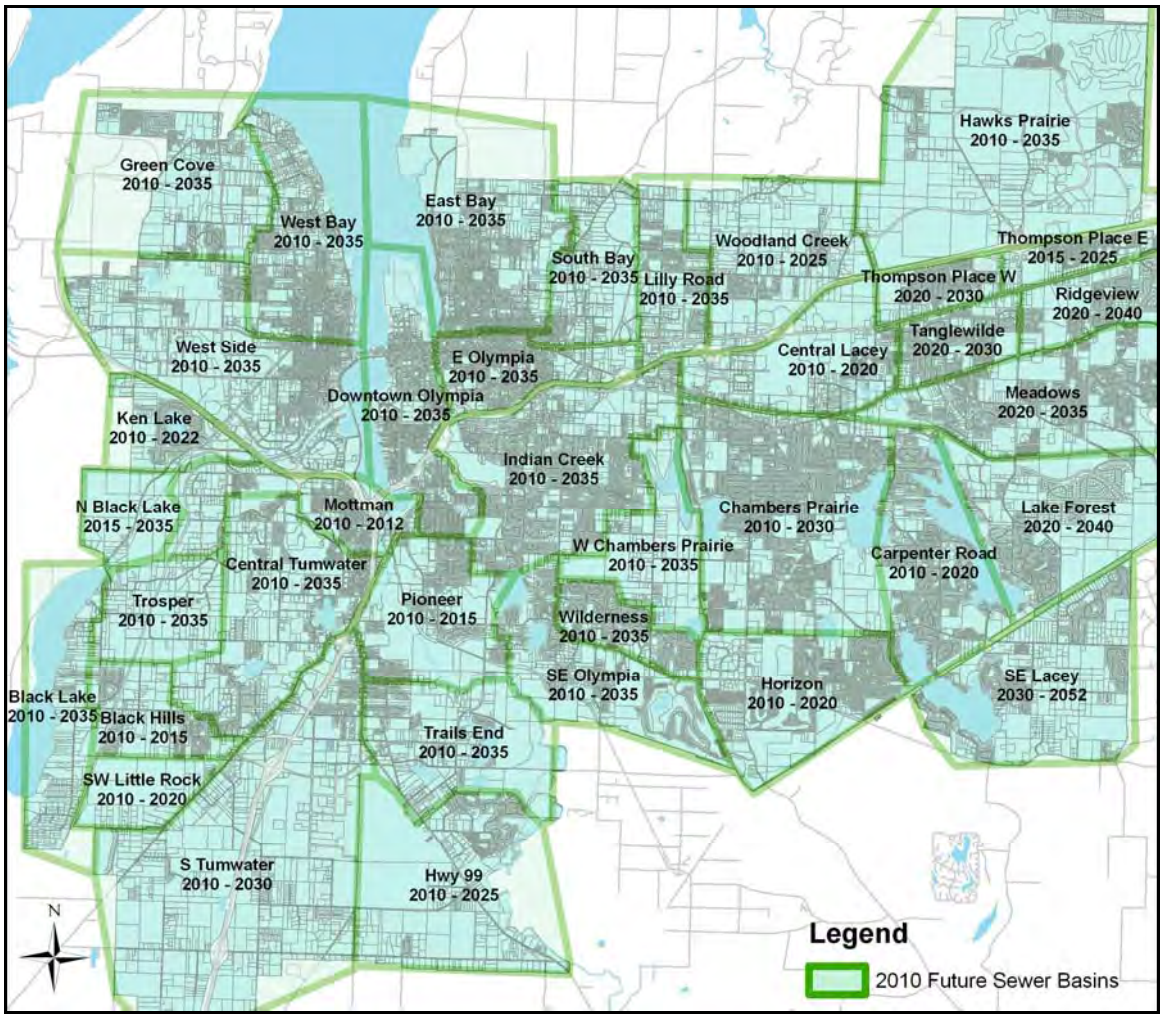


2.3 Future Sewered Area

In order to properly project future flows and loadings, future sewered areas must be accounted for. For each sewer basin shown in Figure 3, the jurisdictions were asked to associate a start and end date for connecting to the sewer system, to include conversions from septic systems. The start date is an estimate of when the non-sewered areas would begin connecting to the sewer system. The end date is an

estimate of when the entire basin would be sewered. This information was entered into the forecasting model, which allocated the new sewered population evenly over that time period. Figure 3 illustrates the future sewered areas and their associated timeline.

Figure 3. 2010 Future Sewer Basins



2.4 Planned Developments

While TRPC population and employment data are updated annually, LOTT has typically canvassed the partner jurisdictions to incorporate any new or planned developments, which might not have made it into the TRPC projection. Though the TRPC projections in this report include the majority of the planned developments, which LOTT has been tracking, there were a few cases where the development information received from the cities were significantly different from the TRPC projection. The largest of these developments are summarized in Table 1. Each of these developments was included in the LOTT flows and loadings projection.

Table 1. Planned Developments and TRPC Population Projections Comparison

Development	Planned*		2006 TRPC Projections					
			Residential					Emp
	Res	Emp	2010	2015	2020	2025	2030	2030
Horizon Point (00-217)	3,323		1,271	1,685	2,062	2,162	2,280	416
Gateway	6,750	3,000	481	1,134	1,701	2,205	2,572	886
Village at Union Mills	850		21	96	164	239	280	56
Sagewood	1,617		0	0	0	0	0	71
Doelman	2,160		2	2	1	1	0	35
Briggs Village	2,179	223	6	22	31	34	36	912
Triway Mixed Use		588	0	0	0	0	0	20
Tilley Road Industrial Park		274	2	2	2	2	2	126
Big Rock Medical Plaza		500	0	0	0	0	0	258
Wal Mart		103	0	0	0	0	0	242
New Market Industiral Park		998	0	0	0	0	0	300
Commerce Industiral Park		340	0	0	0	0	0	0
Benaroya Industiral Park		431	3	3	3	3	2	137
Accountability and Resitution Center	320	117	0	0	0	0	0	2
Chamber Lake	861		94	138	176	211	252	17

* 2008 data collected from the jurisdictions

Based on the additional developments identified in Table 1, Table 2 displays the additional values that were added to the various parameters.

Table 2. Developments Analysis Impact on TRPC-based Projections

Year	Res	Emp	Base Flow (mgd)	ERU*	BOD lbs/d	TSS lbs/d
2010	752	904	77,703	428	205	205
2015	3,297	1,808	273,080	1,592	661	661
2020	5,966	2,712	475,346	2,808	1,134	1,134
2025	9,105	3,616	708,025	4,211	1,672	1,672
2030	12,642	4,521	965,593	5,722	2,267	2,267

*Equivalent Residential Unit

3. Population and Employment Forecast

3.1 Projections

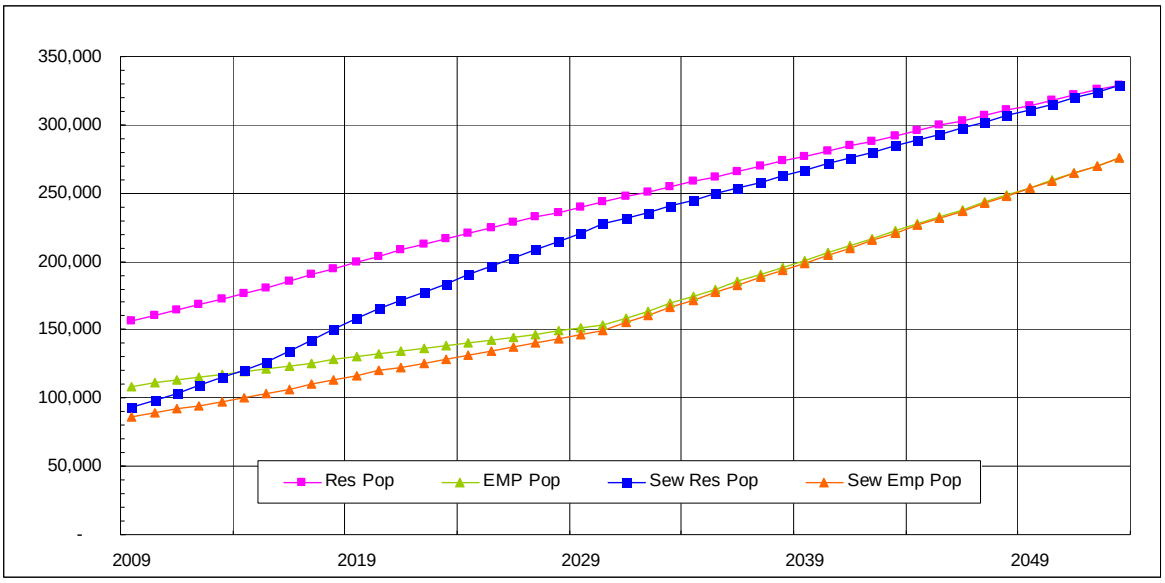
The population forecasts for the LOTT service area were developed using a geographical information system (GIS) file obtained from TRPC. The file was updated in 2009 and included polygons of all parcels within the service area with an associated population for each of the projection years to include: 2010, 2015, 2020, 2025, and 2030.

Table 3 displays the results of the population analysis performed by the CAPE model to include the developments data collected from the jurisdictions. 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. Figure 4 displays the projected population and employment forecasts for the planning period (2010-2053).

Table 3. Population and Employment Projections

Year	Residential Population	Employee Population	Sewered Residential Population	Sewered Employee Population
2010	160,227	111,042	93,911	87,044
2011	164,342	113,151	98,515	89,737
2012	168,442	115,257	103,309	92,498
2013	172,552	117,361	108,273	95,263
2014	176,659	119,476	113,418	98,101
2015	180,762	121,579	118,743	100,993
2016	185,412	123,681	124,191	103,797
2017	190,072	125,795	129,849	106,667
2018	194,708	127,900	135,699	109,590
2019	199,369	130,004	141,759	112,574
2020	204,023	132,113	148,033	115,620
2021	208,168	134,232	154,730	118,678
2022	212,282	136,332	161,623	121,786
2023	216,400	138,431	168,662	124,918
2024	220,534	140,542	175,917	128,116
2025	224,677	142,655	183,400	131,388
2026	228,471	144,756	190,034	134,542
2027	232,257	146,859	196,804	137,749
2028	236,057	148,974	203,721	141,016
2029	239,861	151,086	210,823	144,333
2030	243,648	153,188	218,054	147,691
2031	247,364	155,581	224,754	150,323
2032	251,097	157,974	231,598	152,954
2033	254,801	160,366	238,556	155,586
2034	258,547	162,759	245,675	158,218
2035	262,241	165,152	252,861	160,850
2036	265,959	167,545	257,275	163,481
2037	269,682	169,938	261,728	166,113
2038	273,392	172,330	266,174	168,745
2039	277,127	174,723	270,683	171,377
2040	280,840	177,116	275,203	174,009
2041	284,554	179,509	279,236	176,640
2042	288,264	181,901	283,278	179,272
2043	292,001	184,294	287,362	181,904
2044	295,709	186,687	291,440	184,536
2045	299,423	189,080	295,538	187,168
2046	303,143	191,472	299,663	189,799
2047	306,852	193,865	303,794	192,431
2048	310,581	196,258	307,961	195,063
2049	314,304	198,651	312,151	197,695
2050	318,016	201,044	316,333	200,327
2051	321,737	203,436	320,553	202,958
2052	325,454	205,829	324,783	205,590
2053	329,184	208,222	328,506	208,222

Figure 4. Population and Employment Projections (2010-2053)



3.2 Equivalent Residential Units (ERUs)

For billing and capital project planning, 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. LOTT has historically defined an ERU as 900 cubic feet of wastewater volume per month (224 gallons per day). Each single-family home counts as one ERU. For multi-family housing (apartments) each living unit is counted as 7/10 of an ERU. Commercial and industrial dischargers are billed according to water consumption and mathematically converted to ERUs. Changes in wastewater generation rates have decreased the actual residential unit production, but the value of 900 cubic feet per month continues to be used for billing purposes as an agreed-upon standard of reference. In order to project ERUs into the future, the following conversion table has been developed. Residents per ERU have been assigned to match US Census data for household size for the three jurisdictions (2000 Census).

Table 4. Jurisdiction ERU Summary 2010

Jurisdiction	Residents/ERU	Employees/ERU
Lacey	2.51	5.10
Olympia	2.26	8.67
Tumwater	2.26	5.75
Weighted Average	2.35	6.94

Based on billing data provided by the jurisdictions, Table 5 lists the total ERUs connected to the LOTT system over the last thirteen years.

Table 5. ERUs Served 13-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	44,920
2005	14,335	24,064	7,569	45,969
2006	15,326	24,575	7,808	47,709
2007	17,513	24,341	8,350	50,203
2008	18,497	24,522	8,937	51,956
2009	19,092	24,333	8,622	52,047

Figure 5 displays the total ERUs connected to the LOTT system over the last thirteen years. Residential and employment population projections were converted to ERUs based on the ratios shown in Table 4. Figure 6 displays the projected number of ERUs for each jurisdiction. Table 6 lists the projected number of ERUs for each jurisdiction based on the CAPE model including proposed developments. The model projections for ERUs for each jurisdiction are shown in Figure 6.

Figure 5. ERUs Served 13-Year Comparison

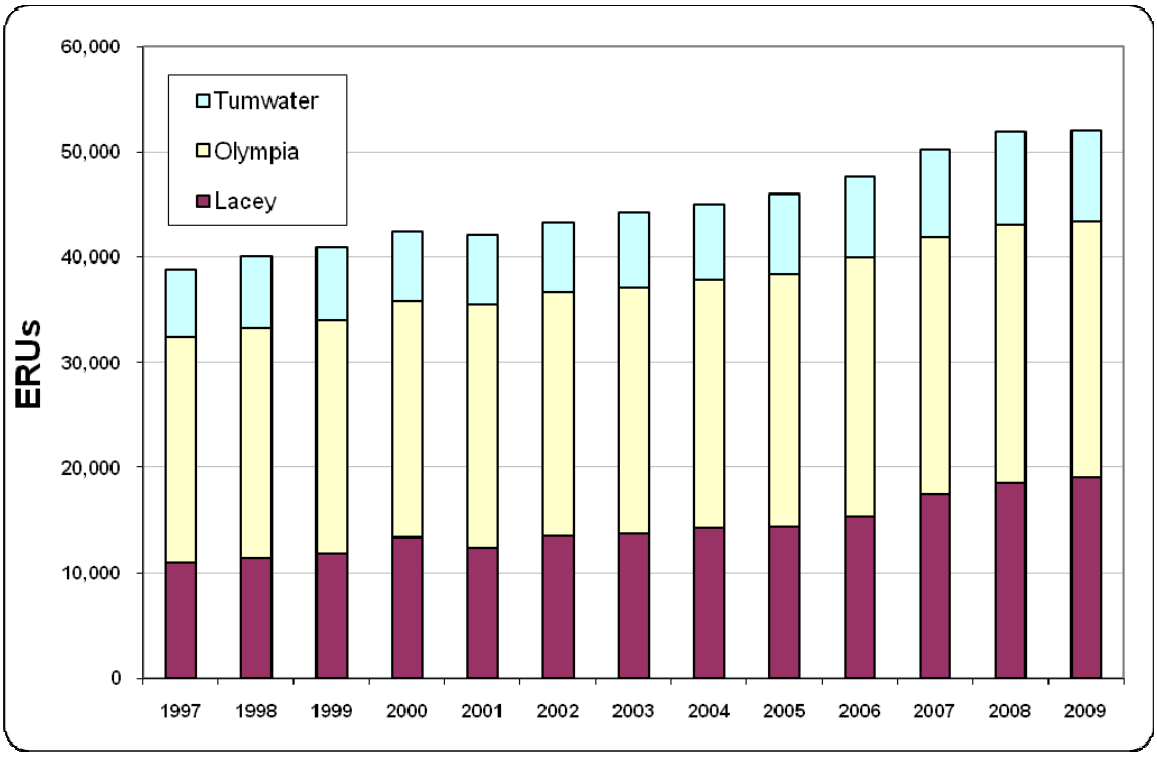
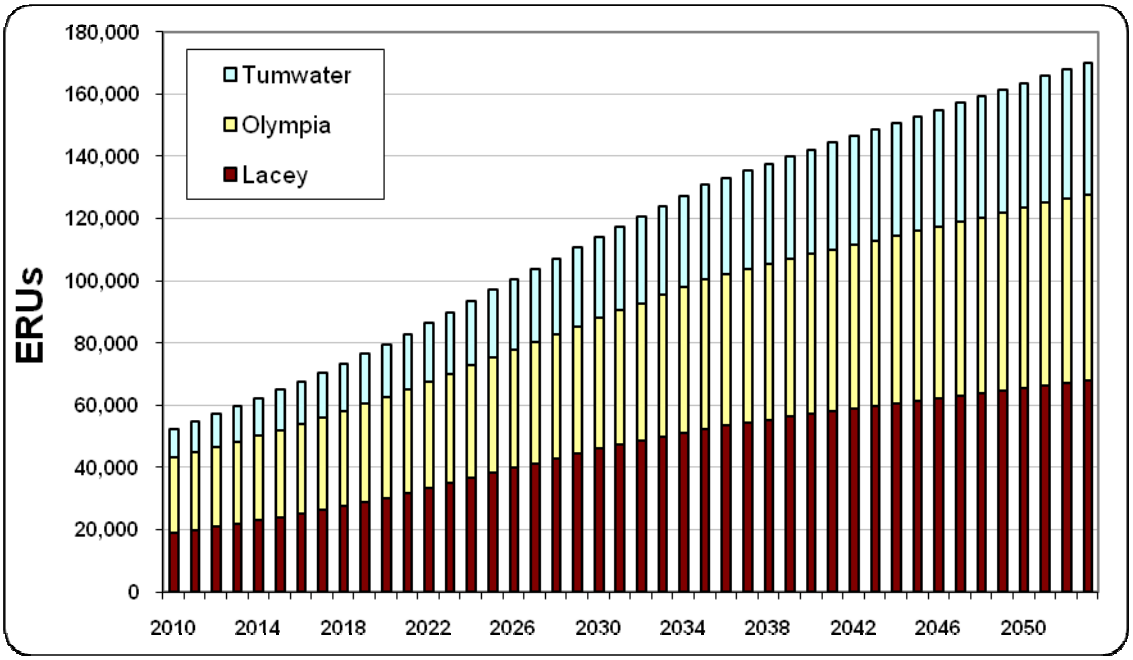


Table 6. ERUs Served – Model Projections

Year	Olympia	Tumwater	Lacey	Other*	Total
2010	24,264	9,071	18,997	116	52,447
2011	24,953	9,789	19,962	122	54,826
2012	25,676	10,532	20,960	128	57,297
2013	26,424	11,288	21,994	135	59,841
2014	27,206	12,068	23,058	142	62,474
2015	28,015	12,871	24,156	149	65,191
2016	28,842	13,623	25,323	158	67,945
2017	29,695	14,413	26,524	166	70,799
2018	30,574	15,240	27,755	176	73,744
2019	31,485	16,105	29,015	185	76,790
2020	32,421	17,010	30,312	195	79,937
2021	33,317	17,875	31,849	206	83,247
2022	34,236	18,769	33,427	217	86,648
2023	35,151	19,692	35,045	228	90,116
2024	36,088	20,649	36,709	240	93,685
2025	37,056	21,636	38,421	252	97,364
2026	37,978	22,504	39,907	263	100,652
2027	38,923	23,385	41,423	274	104,005
2028	39,886	24,287	42,973	285	107,431
2029	40,878	25,208	44,561	297	110,943
2030	41,887	26,145	46,176	309	114,517
2031	43,081	26,969	47,390	318	117,759
2032	44,291	27,807	48,636	327	121,061
2033	45,518	28,656	49,902	337	124,412
2034	46,759	29,518	51,206	346	127,830
2035	48,007	30,388	52,525	356	131,275
2036	48,671	31,041	53,466	358	133,536
2037	49,333	31,695	54,423	361	135,812
2038	49,993	32,348	55,381	363	138,085
2039	50,655	33,000	56,362	365	140,383
2040	51,314	33,653	57,351	368	142,686
2041	51,974	34,306	58,144	370	144,794
2042	52,635	34,958	58,942	372	146,906
2043	53,298	35,611	59,752	374	149,035
2044	53,957	36,263	60,565	376	151,161
2045	54,616	36,916	61,385	378	153,295
2046	55,277	37,569	62,215	380	155,440
2047	55,939	38,220	63,046	382	157,587
2048	56,600	38,872	63,893	384	159,749
2049	57,262	39,525	64,747	386	161,920
2050	57,920	40,178	65,600	389	164,088
2051	58,583	40,832	66,465	391	166,271
2052	59,242	41,483	67,340	393	168,457
2053	59,904	42,138	68,006	394	170,442

*Areas in the County not accounted for by the jurisdictions

Figure 6. ERUs Served – Model Projections



3.3 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 7 lists the number of CDCs collected over the last thirteen years. Table 8 lists the projected new connections over the planning period.

Table 7. New Connections 13-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	587	155	295	1,748
2008	688	201	288	1,177
2009	510	247	118	875

Table 8. New Connection Projections Through the Year 2053

Year	Lacey	Olympia	Tumwater	Other	Total
2011	965	689	718	6	2,379
2012	998	724	743	6	2,471
2013	1,034	748	755	7	2,544
2014	1,065	781	780	7	2,633
2015	1,097	810	803	7	2,718
2016	1,167	826	752	8	2,753
2017	1,201	853	791	9	2,854
2018	1,231	879	826	9	2,945
2019	1,260	910	866	10	3,046
2020	1,297	936	904	10	3,148
2021	1,537	896	866	11	3,310
2022	1,578	918	893	11	3,401
2023	1,618	915	924	11	3,468
2024	1,664	937	957	12	3,569
2025	1,712	967	987	12	3,678
2026	1,486	923	868	11	3,288
2027	1,516	945	881	11	3,354
2028	1,550	963	902	11	3,425
2029	1,588	992	921	12	3,512
2030	1,615	1,009	937	12	3,574
2031	1,214	1,195	824	9	3,242
2032	1,245	1,210	838	9	3,302
2033	1,266	1,227	849	9	3,351
2034	1,304	1,241	863	10	3,418
2035	1,319	1,248	869	10	3,446
2036	941	664	653	2	2,260
2037	957	662	654	2	2,276
2038	958	660	653	2	2,273
2039	981	663	652	2	2,298
2040	989	658	653	2	2,303
2041	793	660	654	2	2,108
2042	798	661	651	2	2,112
2043	810	663	653	2	2,129
2044	813	659	652	2	2,126
2045	820	659	653	2	2,134
2046	830	661	653	2	2,145
2047	831	662	652	2	2,148
2048	847	661	652	2	2,161
2049	854	663	653	2	2,171
2050	854	658	654	2	2,168
2051	865	662	654	2	2,183
2052	875	660	650	2	2,187
2053	666	662	656	2	1,985

4. Flows and Loadings

4.1 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 September 1, 2005, and became effective on October 1, 2005. The compliance is based primarily on loadings (Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), and Total Inorganic Nitrogen (TIN)), rather than flow. The final effluent limitations took effect November 1, 2006 and lasted through September 30, 2010. LOTT submitted the permit renewal application to Ecology in September 2010. Table 9 lists the loadings-based permit limitations.

Table 9. NPDES Permit Limitations

	Winter (November-March)		**Shoulder** (April, May, 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				

4.2 Drinking Water Analysis

For the 2010 report, drinking water consumption data for 2009 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, wintertime (December, January, February, and March) drinking water consumption was used for sewered customers only. The total consumption was divided by the total number of days to determine the gallons per day per parcel. The wastewater generation rates were then updated using the population and employment data provided by TRPC.

The drinking water basins were created by consolidating sewer basins with similar consumption characteristics into larger basins. Figure 7 illustrates the drinking water basins included in this analysis. These basins were then imported into the CAPE model with their updated wastewater generation rates. The wastewater generation rates by drinking water basin are shown in Table 10. The large geographic differences in drinking water consumption (and therefore, wastewater generation) between basins may be attributed to a number of contributing factors. These include the type of residential units predominating 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.

Figure 7. 2010 Drinking Water Basins

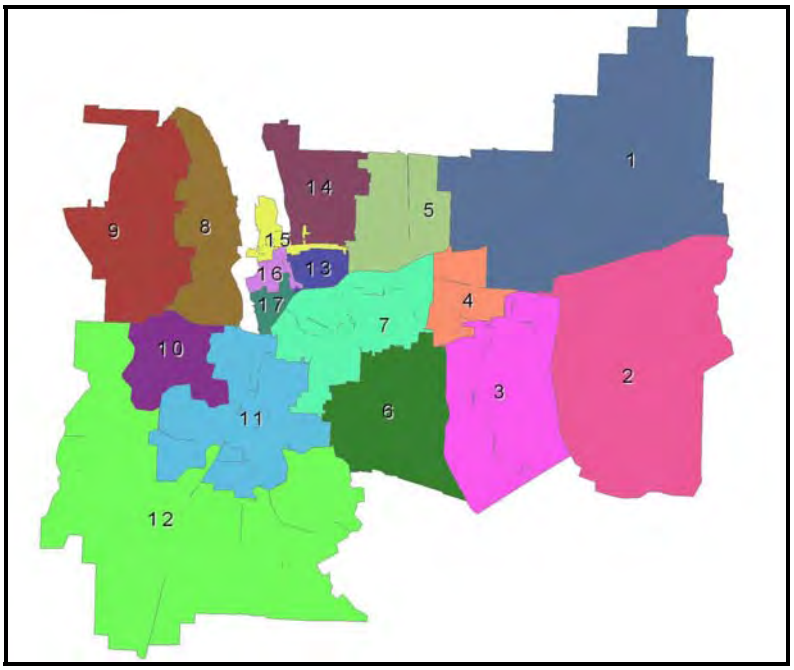


Table 10. Wastewater Generation Rates by Drinking Water Basin

	Population		Drinking Water Consumption			Adjusted WW Generation Rate		
Basin	Sewered Res	Sewered Emp	Total gpd	Res gpd	Emp gpd	Res gpcd[1]	Emp gped[2]	Base Flow gpd
1	8,006	7,346	781,111	505,792	275,319	63.2	37.5	781,695
2	5,285	729	383,712	364,793	18,919	69.0	25.9	383,288
3	19,358	3,622	1,349,432	1,285,784	63,647	66.4	17.6	1,349,262
4	5,554	8,368	504,345	372,280	132,064	67.0	15.8	504,305
5	3,528	7,616	386,198	262,197	124,000	74.3	16.3	386,303
6	3,164	408	205,122	196,026	9,096	62.0	22.3	204,848
7	8,374	2,916	577,254	529,941	47,313	63.3	16.2	577,584
8	10,206	6,758	863,260	726,578	136,682	71.2	20.2	864,037
9	6,508	8,201	776,521	515,080	261,441	79.1	31.9	775,383
10	2,415	3,511	181,232	144,160	37,073	59.7	10.6	182,292
11	9,694	9,826	805,682	686,021	119,661	70.8	12.2	805,086
12	1,357	3,424	177,418	122,682	54,736	90.4	16.0	177,124
13	1,836	3,068	139,843	106,904	32,939	58.2	10.7	139,701
14	4,559	752	319,747	310,138	9,609	68.0	12.8	319,647
15	1,175	7,362	188,352	58,179	130,174	49.5	17.7	189,031
16	653	10,030	121,576	40,330	81,245	61.8	8.1	121,317
17	1,312	2,020	157,011	97,731	59,279	74.5	29.3	156,936
Total	92,984	85,958	7,917,816	6,324,616	1,593,200	68.0[3]	29.3[3]	7,917,839[4]

[1] Gallons per capita per day
[2] Gallons per employee per day
[3] Averages
[4] Flow does not match observed base flow exactly, due to differences in parcel allocation and basin boundaries, exclusion of 400,000 gpd of Olympia artesian flow, and 144,000 gpd from The Evergreen State College.

4.3 Base 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 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 to no influence from inflow and infiltration. The BSFs, measured in million gallons per day (mgd), from 2001 to 2010 are provided in Table 11 and exclude flows from the Tumwater Brewery.

Table 11. Base Sanitary Flow in LOTT Service Area

Year	Base Sanitary Flow (mgd)[1]
2001*	7.19
2002*	7.17
2003*	7.37
2004	8.01
2005	8.32
2006	8.27
2007	8.26
2008	8.58
2009	8.47
2010	8.34

* Corrected raw degritted sludge (RDS) measurements

Base sanitary flow is measured at the influent of the Budd Inlet Treatment Plant. The Martin Way Reclaimed Water Plant was put on-line in August 2006, which diverts flow from the Budd Inlet Treatment Plant. The diverted flow to the Hawks Prairie Ponds/ Recharge Basins was added to monitored flows at the Budd Inlet Treatment Plant to determine total system flows.

The current NPDES permit requires that the LOTT 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 ten flow monitors, five of which are rotated on an annual basis. In the summer of 2009, LOTT rotated the five flow meters to new locations within the system. 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 12. A more detailed analysis is included in the 2010 Inflow & Infiltration and Flow Monitoring Report (October, 2010).

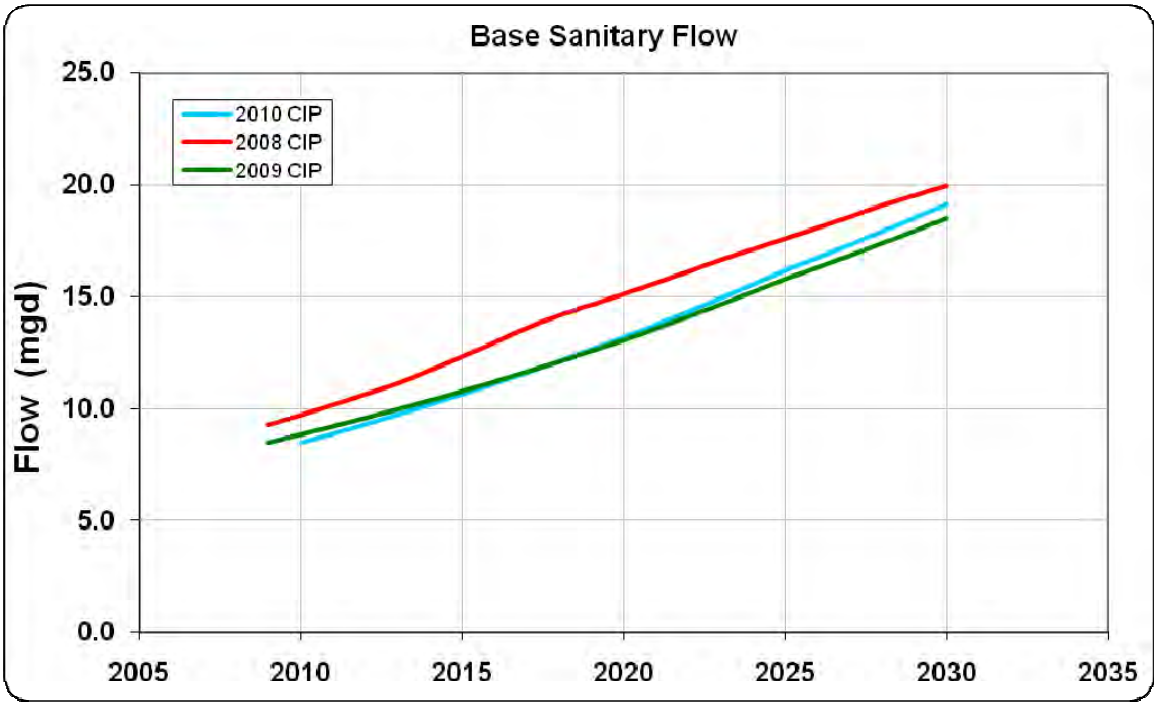
Table 12. Base Sanitary Flow by Jurisdiction (mgd)

Location	2006	2007	2008	2009	2010
Lacey	2.63	2.63	2.94	3.09	3.14
Olympia	4.31	4.32	4.02	3.42	3.56
Tumwater	1.73	1.21	1.14	1.41	1.19
Point Sources (TESC*, etc.)	0.05	0.10	0.48	0.54	0.45
Total	8.27	8.26	8.58	8.47	8.34

*The Evergreen State College

Previous BSF projections developed for the 2008 and 2009 Capital Improvements Plans, along with the current projections, are included in Figure 8. The current projections are similar to last year's projections.

Figure 8. Base Sanitary Flow Projections



4.4 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 from each of the jurisdictions, enabling a more precise estimation of the wastewater generation rate profiles (Table 10). These profiles have been organized into city-specific profiles for comparison with previous estimates. Table 13 summarizes the historical rate profiles, along with the corresponding values developed in this report. These values are extrapolated from the values in Table 10 though were not used in the model. They are are presented for the sake of comparison to previous years' profiles.

Table 13. Previous Wastewater Generation Rate
Gallons Per Capita Per Day (gpcd)

Source	Lacey	Olympia	Tumwater	UGA	Employment
1995-2002 CIP	66	85	73	66	40
2003 CIP	64	81	69	64	39
Budd Inlet Master Plan (2004)	64	75	69	71	35
2005 CIP	68	62	65	68	35
2006 Flows and Loadings	71	64	61	71	34
2007 Flows and Loadings	69	67	74	86	22
2008 Flows and Loadings	62	66	81	73	26
2009 Flows and Loadings	66	67	73	65	20
2010 Flows and Loadings	66	69	69	65	25

4.5 Flow Projections

Flow projections are calculated by the CAPE model by entering the calculated wastewater generation rate for each jurisdiction's projected residential and employment population. The model assumes that these generation rates are constant throughout the simulation period (2010-2053). Each year these wastewater generation rates will be recalibrated based on ongoing flow monitoring and population estimates. Figure 9 displays the projected base flow, annual average, compliance period (winter, summer, shoulder), and peak flows through the year 2053.

4.6 Inflow and Infiltration Projections

The impact of inflow and infiltration on projected flows was also modeled using the CAPE tool. CAPE combines a history of flows recorded at the Budd Inlet Treatment Plant with a history of precipitation to determine a numerical relationship between precipitation intensity, timing, and wastewater flow. Precipitation data collected by the National Weather Service at the Olympia Airport from 1954 to 2003, and from the LOTT Alliance's own rain gauges from 2003 to the present were used to calibrate the inflow and infiltration scenarios. This relationship was applied to the following risk-based I&I 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, October); and 7) winter (November-March) time period flows. Flow projections are displayed in Figure 9 and listed in Table 14.

Figure 9. Flow Projections (2010-2053)

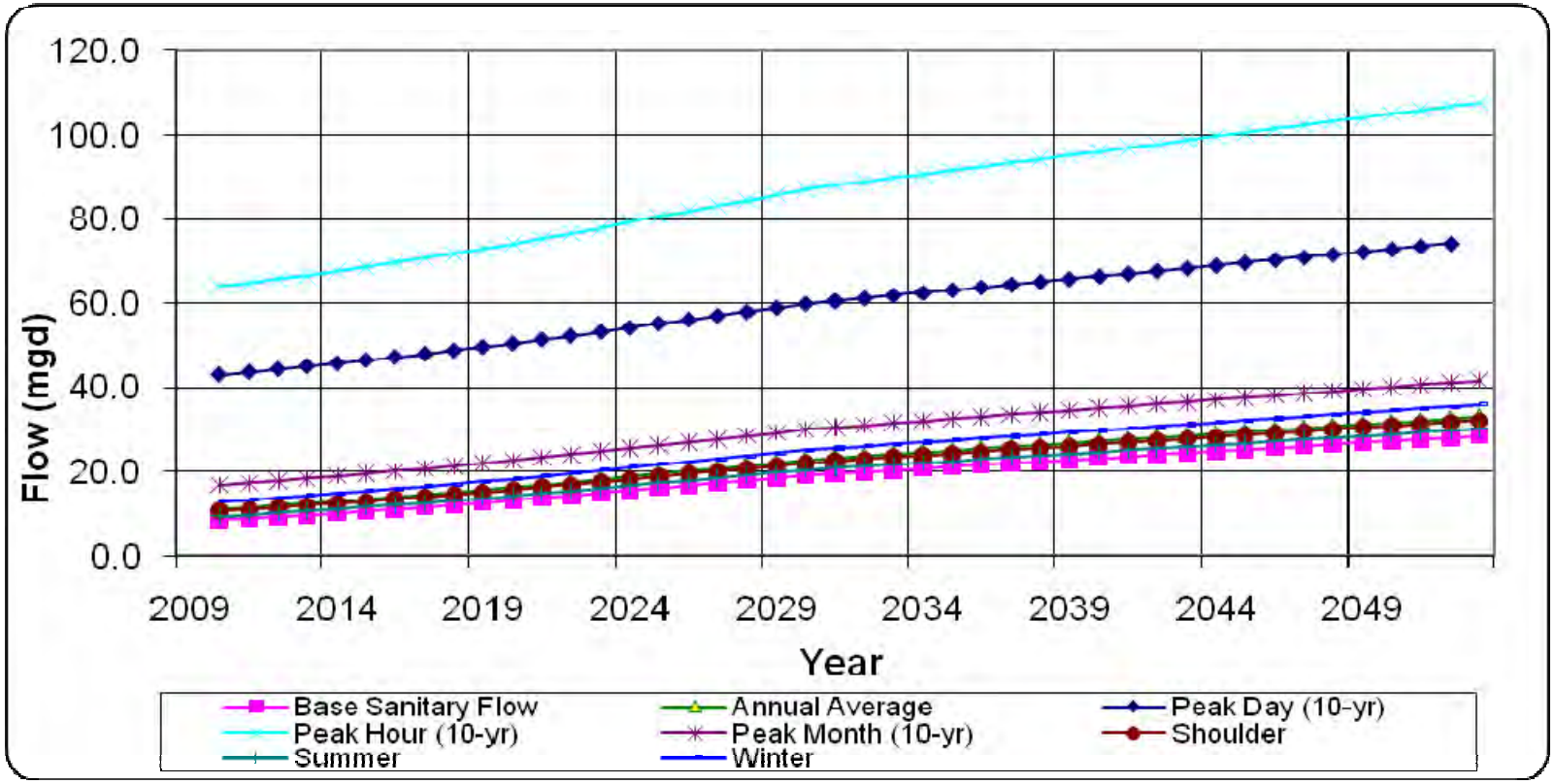


Table 14. Flow Projections (mgd)

Year	Base Sanitary Flow	Annual Average	Peak Day (10-year)	Peak Hour (10-year)	Peak Month (10-year)	Shoulder[1]	Summer[2]	Winter[3]
2011	8.9	11.6	43.6	64.8	17.4	11.1	9.8	13.4
2012	9.3	12.1	44.3	65.7	17.9	11.6	10.3	13.9
2013	9.7	12.5	45.0	66.7	18.4	12.0	10.7	14.3
2014	10.2	13.0	45.7	67.6	19.0	12.5	11.2	14.9
2015	10.6	13.5	46.4	68.6	19.5	13.0	11.7	15.4
2016	11.1	14.0	47.2	69.6	20.1	13.5	12.2	15.9
2017	11.6	14.6	48.0	70.7	20.7	14.0	12.7	16.5
2018	12.1	15.1	48.8	71.8	21.3	14.6	13.2	17.1
2019	12.6	15.7	49.6	72.9	22.0	15.1	13.7	17.7
2020	13.2	16.3	50.4	74.1	22.6	15.7	14.3	18.3
2021	13.7	16.9	51.3	75.3	23.4	16.3	14.9	18.9
2022	14.3	17.5	52.3	76.6	24.1	17.0	15.5	19.6
2023	14.9	18.2	53.2	77.9	24.8	17.6	16.1	20.3
2024	15.5	18.8	54.2	79.2	25.6	18.3	16.7	21.0
2025	16.2	19.5	55.2	80.6	26.4	18.9	17.4	21.7
2026	16.7	20.1	56.1	81.9	27.1	19.5	18.0	22.4
2027	17.3	20.8	57.0	83.1	27.8	20.2	18.6	23.0
2028	17.9	21.4	58.0	84.4	28.5	20.8	19.2	23.7
2029	18.5	22.1	58.9	85.7	29.2	21.5	19.8	24.4
2030	19.1	22.8	59.9	87.1	30.0	22.1	20.4	25.1
2031	19.5	23.2	60.6	88.0	30.5	22.6	20.9	25.6
2032	19.9	23.6	61.2	88.9	31.0	23.0	21.3	26.1
2033	20.3	24.1	61.9	89.8	31.5	23.4	21.7	26.5
2034	20.8	24.5	62.5	90.7	32.0	23.9	22.1	27.0
2035	21.2	25.0	63.2	91.6	32.5	24.3	22.6	27.5
2036	21.6	25.4	63.8	92.5	33.0	24.7	23.0	27.9
2037	22.0	25.9	64.5	93.4	33.6	25.2	23.4	28.4
2038	22.4	26.3	65.1	94.3	34.1	25.6	23.8	28.9
2039	22.8	26.8	65.8	95.2	34.6	26.1	24.3	29.4
2040	23.2	27.2	66.4	96.0	35.1	26.5	24.7	29.8
2041	23.6	27.7	67.1	96.9	35.6	26.9	25.1	30.3
2042	24.0	28.1	67.7	97.8	36.1	27.4	25.5	30.8
2043	24.4	28.5	68.4	98.7	36.6	27.8	25.9	31.2
2044	24.8	29.0	69.0	99.6	37.1	28.3	26.4	31.7
2045	25.3	29.4	69.7	100.5	37.6	28.7	26.8	32.2
2046	25.7	29.9	70.3	101.4	38.1	29.1	27.2	32.6
2047	26.1	30.3	71.0	102.3	38.6	29.6	27.6	33.1
2048	26.5	30.8	71.7	103.2	39.1	30.0	28.1	33.6
2049	26.9	31.2	72.3	104.1	39.6	30.5	28.5	34.0
2050	27.3	31.7	73.0	105.0	40.1	30.9	28.9	34.5
2051	27.7	32.1	73.6	105.9	40.6	31.3	29.3	35.0
2052	28.1	32.6	74.3	106.8	41.1	31.8	29.8	35.5
2053	28.5	33.0	74.9	107.7	41.7	32.2	30.2	35.9

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

4.7 Loading Projections

Loading projections are updated each year based upon observed BOD and TSS loadings at the Budd Inlet Treatment Plant. In 2009, the average BOD and TSS loads at the treatment plant were 22,251 lbs/d and 21,894 lbs/d, respectively. In order to generate system loadings, BOD and TSS removed at the Martin Way Reclaimed Water Plant must be taken into account. The Martin Way Plant removed approximately 581 lbs/d of TSS and 1,339 lbs/d of BOD. Projected BOD and TSS loadings for this report are based on a correlation of loadings from 2003-2009, with the 2007 through 2009 values corrected to account for reclaimed water plant removals. 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 15.

Table 15. Wastewater Load Generation Rate Profiles (lbs per capita/employee day)

Residential		Employment	
BOD	TSS	BOD	TSS
0.135	0.129	0.135	0.129

Figure 10 displays the historical influent loading characteristics at the Budd Inlet Treatment Plant to include monthly averages for TSS and BOD.

Figure 10. Historical Budd Inlet Treatment Plant Primary Influent Loads (Monthly Average)

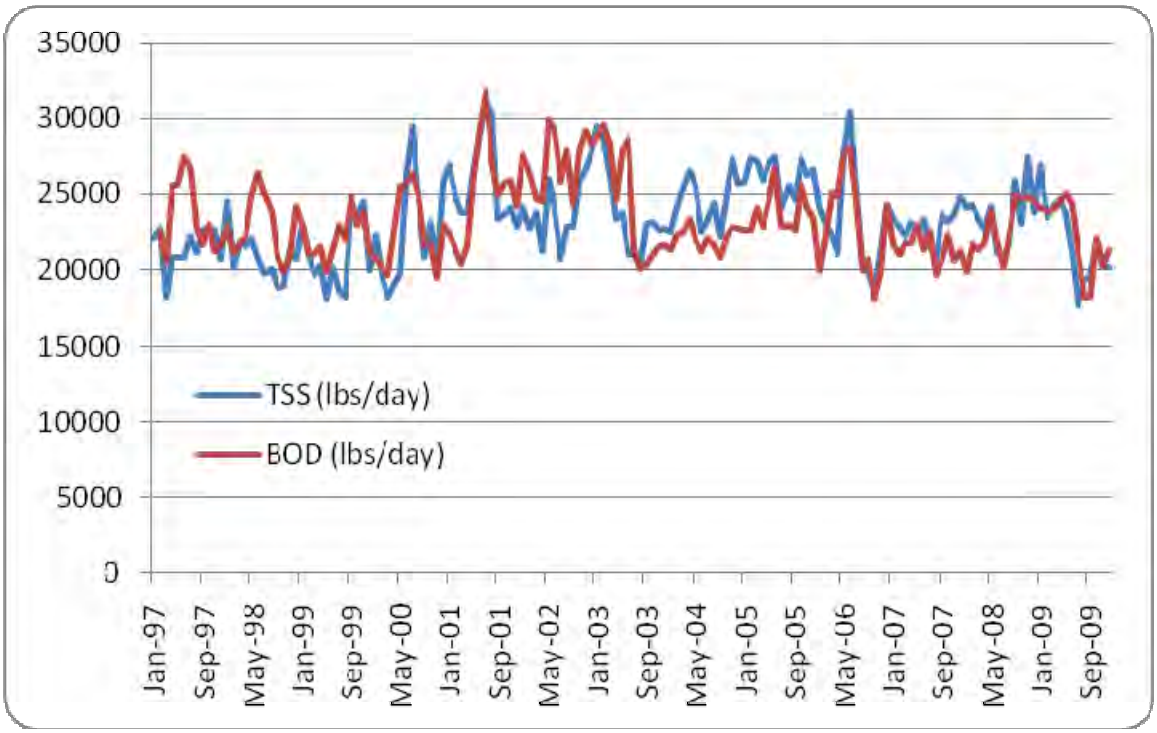


Figure 11 displays the projected total flows and loadings to the Budd Inlet Treatment Plant based on the planned timeline for adding additional satellite reclaimed water production capacity through 2053.

Figure 11. Projected Primary Influent Annual Averages for TSS, BOD and Flow

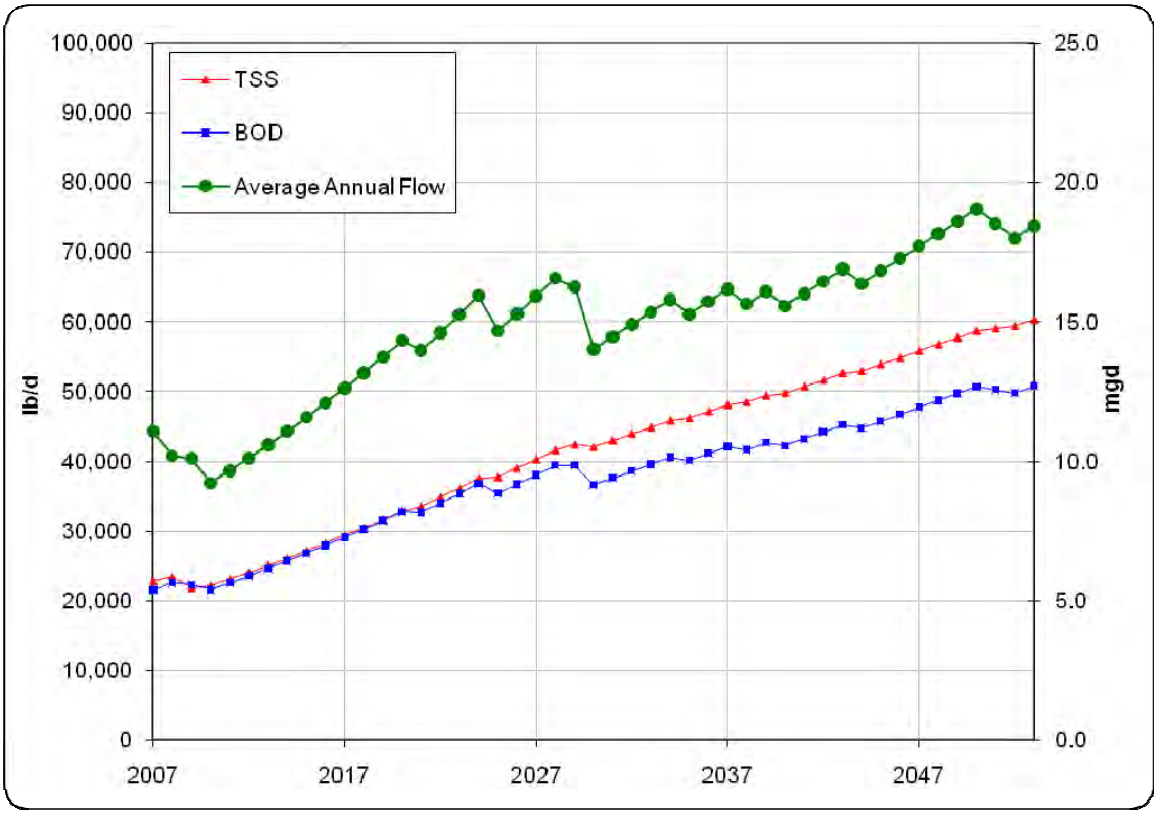


Table 16 lists the CAPE model projection results for flows and loadings to the Budd Inlet Treatment Plant throughout the planning period to include reclaimed water satellite flow diversions. The results assume 9 mgd of satellite treatment by 2030.

Table 16. Projected Primary Influent Flows and Loadings

Year	Satellite Flow	Average Annual Flow (mgd)	BOD (lbs/day)	TSS (lbs/day)
2011	2	9.7	22,571	23,136
2012	2	10.1	23,587	24,108
2013	2	10.6	24,631	25,105
2014	2	11.1	25,707	26,132
2015	2	11.6	26,817	27,194
2016	2	12.1	27,932	28,260
2017	2	12.6	29,086	29,362
2018	2	13.2	30,274	30,497
2019	2	13.7	31,498	31,666
2020	2	14.3	32,758	32,871
2021	3	14.0	32,643	33,545
2022	3	14.6	33,999	34,841
2023	3	15.3	35,380	36,162
2024	3	15.9	36,801	37,518
2025	5	14.7	35,407	37,754
2026	5	15.3	36,732	39,022
2027	5	15.9	38,086	40,314
2028	5	16.6	39,467	41,633
2029	6	16.3	39,456	42,409
2030	9	14.0	36,633	42,064
2031	9	14.5	37,623	43,010
2032	9	14.9	38,613	43,956
2033	9	15.4	39,603	44,902
2034	9	15.8	40,594	45,849
2035	10	15.3	40,157	46,217
2036	10	15.7	41,148	47,163
2037	10	16.2	42,139	48,110
2038	11	15.6	41,699	48,474
2039	11	16.1	42,689	49,421
2040	12	15.6	42,246	49,782
2041	12	16.0	43,237	50,728
2042	12	16.5	44,227	51,675
2043	12	16.9	45,219	52,622
2044	13	16.4	44,772	52,980
2045	13	16.8	45,763	53,927
2046	13	17.3	46,754	54,874
2047	13	17.7	47,746	55,822
2048	13	18.2	48,738	56,770
2049	13	18.6	49,730	57,718
2050	13	19.1	50,723	58,666
2051	14	18.5	50,271	59,020
2052	15	18.0	49,819	59,371
2053	15	18.4	50,811	60,319