CITY OF POULSBO

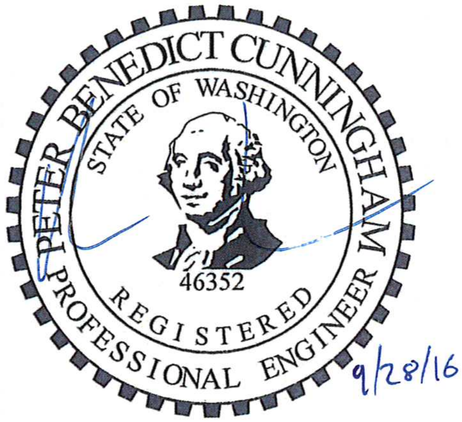
COMPREHENSIVE SANITARY SEWER PLAN UPDATE

September 2016

ACKNOWLEDGEMENTS

The technical material and data contained in this Plan was prepared by Peter Cunningham, P.E. and Chris Kelsey, PE of BHC Consultants, LLC.

Christopher W. Kelsey, P.E.
Project Manager



Peter Benedict Cunningham, P.E.
Project Engineer

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Executive Summary

ES.1 Introduction

The City of Poulsbo's sanitary sewer system can be generally divided based on age and type of construction. The downtown and older parts of the City were largely constructed during the 1940s using clay and concrete tile pipe. The wastewater collected was treated by the City owned treatment plant until 1978, when the treatment plant was shut down and the conveyance to the County treatment plant was completed. Over the last 20 years the City has implemented numerous projects to replace the outdated clay and concrete pipes with polyvinyl chloride (PVC) and high density polyethylene (HDPE) materials as well as upgrade service connections to houses and businesses with a focus on reducing infiltration and inflow (I/I) into the sanitary sewer. Since 1998, the ongoing infiltration and inflow (I/I) program has helped to reduce peak flows and extend the capacity of the system. BHC Consultants, LLC (BHC) was authorized by the City of Poulsbo in June 2015 to prepare this Comprehensive Sewer Plan (CSP) Update. The sewer plan has been prepared in accordance with Washington Administrative Code (WAC) 173-240, which provides guidelines for the preparation of General Sewer Plans. This plan will be adopted by the City under the provisions of the RCW 35.67. This document updates the City of Poulsbo CSP of February 2008.

A requirement for any city to upgrade or expand its sewage facilities is the preparation and adoption of a comprehensive plan under RCW 35.67. An additional driving force is the land use planning process mandated under the Growth Management Act (GMA). Poulsbo adopted their Comprehensive Land Use Plan in 2009 and is preparing an update that will be adopted in 2016. One of the key elements of this land use plan, as required by GMA, is a Capital Facilities Plan (CFP). This CFP is a twenty year plan for capital improvements that support Poulsbo's current and future population and economy. The CFP must address sanitary sewer service for the planning period.

ES.2 Service Area, Population, and Flow Projections

City of Poulsbo population projections are based on projections provided by the Kitsap Countywide Planning Policies, and are found in Appendix D. Table ES-1 summarizes the population forecast for the planning period as established by the Kitsap Countywide Planning Policies, starting with the most recent Census data from 2010. Table ES-2 summarizes the projected flow per basin, as well as the total system flows. Basin population distributions were developed by the City.

Table ES-1 Poulsbo City and UGA Population Forecast*

Population Distribution	2010	Population Growth	2036
City Limits	9,222	1,330	10,552
UGA	478	3,778	4,256
Total	**9,700**	**5,108**	**14,808**

**For the purposes of facility planning, Poulsbo does not make a distinction between City limits and its UGA. Therefore the total population forecast of 14,808 is used for the purposes of this document.*

Table ES-2 Projected Flow per Basin

Basin	2015 Population	2036 Growth	2036 Population	2015 Peak Hour Flow (mgd)	2015 Peak Hour Flow (gpm)	2036 Peak Hour Flow (mgd)	2036 Peak Hour Flow (gpm)	Percentage of Growth	Percentage of Basin Developed
Viking Avenue Basin[1]	2,171	900	3,071	0.545	379	0.722	501	19%	71%
Finn Hill Basin	534	1,450	1,984	0.134	93	0.418	290	30%	27%
Central Poulsbo Basin	1,819	0	1,819	0.457	317	0.457	317	0%	100%
Village Basin[2]	1,007	300	1,307	0.471	327	0.720	500	6%	77%
6th Avenue Basin	700	40	740	0.176	122	0.184	128	1%	95%
9th Avenue Basin	162	40	202	0.041	28	0.049	34	1%	80%
Noll Road Basin	201	1,300	1,501	0.051	35	0.305	212	27%	13%
East Poulsbo Basin	3,355	828	4,183	0.843	585	1.005	698	17%	80%
Total	**9,950**	**4,858**	**14,808**	**2.717**	**1,886**	**3.859**	**2,680**	**100%**	**67%**

Notes:

1) Flow projections for the Liberty Pump Station, located in the Viking Avenue Basin, were prepared as part of the design for the rehabilitation of the Liberty Pump Station and are included in Appendix L.
2) Flow projections for the Village Basin were prepared as part of the design for the rehabilitation of the Village Pump Station and are included in Appendix L. These use a different methodology than the other basins and result in higher calculated flows.

ES.3 Sewer System Description

The City of Poulsbo sewer collection system was initially constructed during the 1930s and 1940s. In 1942, a primary wastewater treatment plant was constructed near the City's business district. The City-owned treatment plant discharged to Liberty Bay until the late 1970s, at which time the Central Interceptor was constructed along SR 305 to transport flows to facilities owned by Kitsap County. The County facilities transport wastewater from Lemolo to the Central Kitsap Wastewater Treatment Plant (CKWWTP) in Brownsville. The flow crosses Liberty Bay via two 12-inch gravity siphons and is routed south to the CKWWTP.

The collection system contains a variety of pipe materials including concrete, PVC, and ductile iron. Over time, sewers in the oldest part of the City have been replaced, which has reduced I/I. Nine pump stations transport flow throughout the collection system and eventually to the Central Interceptor. Generally speaking, most of West and North Poulsbo is transmitted to the Central Interceptor through the Bond Road Pump Station. Sewer drainage basins that are lower than the interceptor, on the eastern shores of Liberty Bay, discharge fairly directly to the interceptor. Uphill basins east of SR 305 generally flow by gravity to the interceptor.

The existing system transports flow to the Kitsap County Metering Station at Johnson Road and Peterson Way. From that point, flow is directed to the CKWWTP through County conveyance facilities.

ES.4 Sewer System Evaluation

Evaluation of the existing system consisted of a review of previous work and documents, a conveyance system capacity assessment, and review of the City pump stations with maintenance staff. From previous analyses, certain areas of the sewer system still clearly had adequate capacity for year 2036 projected flows, and hence were not studied in detail with this CSP update.

The Central Interceptor is known to have capacity limitations. The existing peak hour flow through the Central interceptor is approximately 2.67 mgd, and it has a capacity of approximately 2.35 mgd within its minimally sloped section. Projects recommended to address this deficiency include the near-term construction of an off line storage facility to divert peak flows and prevent system surcharge, coupled with the long-term consideration of extending the Bond Road Pump Station force main past the minimally sloped section.

The Village Basin is known to have I/I issues. The City recently smoke tested the basin to determine the most effective ways to reduce I/I in the basin. The Village Pump Station is currently under design and will be replaced in 2016. Upstream and downstream gravity capacity improvements may be necessary, depending on the effectiveness of I/I rehabilitation within the basin.

The City currently owns and operates nine sanitary sewage pump stations. Over the last several years, the City has, or is in the process of, investing in capital improvements at several of these facilities. As part of this CSP update, BHC conducted site visits and interviews with maintenance staff at each pump station, assessing structural and equipment condition as well as recent repair and maintenance records. Recommendations for additional improvements have been derived from this field work and are summarized in Section 4.4. Four of the nine pump stations have been recently upgraded, or are in the process of being upgraded.

ES.5 Downstream Conveyance and Treatment System

The CKWWTP has an existing maximum month treatment capacity of 6 mgd, which is adequate to accommodate City flows. The CKWWTP has a treatment capacity of 6.0 mgd, and the City will participate on a pro-rata basis of 15.83% for capital improvements needed at the CKWWTP. The CKWWTP will be able to accommodate Poulsbo wastewater flows over the planning horizon of this document. The City will need to negotiate an increase of their current/y allocated 0.95 mgd maximum month capacity at the facility during this planning period to avoid peaking charges that may begin to occur more regularly as flows from Poulsbo increase.

For this CSP update, BHC performed conformational modeling of the siphon using MikeUrban, to identify the capacity of the siphon with the recent facility modifications. This model indicated a capacity in the siphon of 3.54 mgd without surcharging the gravity pipe at Johnson Road, which is insufficient to convey the projected peak hour flows 2036 flows of 3.86 mgd. Construction of additional siphon capacity is included within this document's recommended capital improvements.

ES.6 Operations and Maintenance Program

The Public Works Department (PWD) is managed by the Public Works Superintendent. Design, CIP implementation and sewer comprehensive plans and updates are managed by the engineering department. In addition to the sewer utility, the PWD also manages water, stormwater, and solid waste utilities as well as maintains the parks, streets, and public buildings. Public Works staff generally split their time between various duties, although a few operations and maintenance staff are fully dedicated to the sewer utility. Currently the PWD has 1.5 full time equivalent (FTE) field staff designated for sewer system O&M. The department seeks to add 1 FTE to meet department needs which include ongoing I/I monitoring and system maintenance. When additional manpower is required, PWD employees from other utility departments are required to complete the maintenance and operation work.

ES.7 Capital Improvement Plan

System upgrades are anticipated to accommodate growth and address aging facilities. The cost of each project has been scheduled over a six-year period to reflect priorities and to balance annual capital costs. City sewer projects identified in the 6-year Capital Improvement Plan (CIP) are listed in Table ES-3. County projects which are funded either wholly or in part by the City are listed in Table ES-4.

Table ES-3 City Sewer Capital Improvement Projects

CIP #	Project Name	2017 Project Costs	2018 Project Costs	2019 Project Costs	2020 Project Costs	2021 Project Costs	2022 Project Costs	Total 6-year Project Costs	2023-2037 Project Costs	2022-2036 Project Year
1	Annual Inflow Reduction Program[3]	90,000	180,000	180,000	180,000	180,000	180,000	990,000	180,000	Annual
2	Poulsbo Village Pump Station Upgrades[1]	500,000						500,000		
3	Harrison Force Main Replacement[1]	283,671						283,671		
4	SR-305 Force Main Extension[2]				200,000	2,610,000		2,810,000		
5	Liberty Bay Pump Station Improvements[1]	360,000						360,000		
6	Purchase and Demolition of Lemolo House[1]	350,000						350,000		
7	Public Works Facility[1,5]		120,000	120,000	120,000	120,000	120,000	600,000	120,000	Annual through 2030
8	Noll Road Sewer Improvements[1]		20,000	210,000				230,000		
9	Applewood Pump Station Replacement[2]		100,000					100,000		
10	Annual Pump Station Rehabilitation/Replacement[2,3]	50,000	50,000	50,000	50,000	50,000	50,000	300,000	50,000	Annual
11	Storage Facility[1]	500,000						500,000		
12	Old Town					100,000	100,000	200,000	100,000	Annual
13	Water Meter Replacement	175,000	250,000					425,000		
	Total City Sewer Capital Projects	**2,308,671**	**720,000**	**560,000**	**550,000**	**3,060,000**	**450,000**	**7,648,671**	**3,755,000**	

Notes:
1) Project costs generated by City Engineering Department.
2) Project costs generated by BHC Consultants, see Appendix I.
3) Annual/bi-annual allocation for continuing City sewer utility programs.
4) Project costs developed by Kitsap County; allocations included are based on City-obligated contractual percentages
5) Costs are for annual bond payments.
6) All CIP projects are in 2015 dollars.

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Table ES-4 County Sewer Capital Improvement Projects (Projected Poulsbo Cost-Share by Current Agreement)

CIP #	Project Name	2017 Project Costs	2018 Project Costs	2019 Project Costs	2020 Project Costs	2021 Project Costs	2022 Project Costs	Total 6-year Project Costs	2023-2037 Project Costs	2022-2036 Project Year	Poulsbo's percentage of project
1	Capital Facilities Charge for CK Plant[4]	133,000	133,000					266,000			15.83%
2	Kitsap County Pump Station #16 & 67 Replacement[4]		5,000,000					5,000,000			93.60%
3	Lemolo Capacity/Condition Improvements[1]	350,000			1,140,000	3,600,000		5,090,000			100.00%
4	CKTP Primaries and Aeration Tanks 5 & 6[4]					523,182		523,182	4,011,005	2024 (estimated)	15.83%
5	CKTP UltraViolet Disinfection Upgrade[4]		316,600					316,600			15.83%
6	CKTP Screw Press[4]			158,300				158,300			15.83%
7	CKTP Campus Buildings[4]						221,620	221,620	1,646,320	2022 (estimated)	15.83%
8	Lemolo Siphon Phase 2[4]	200,000	300,000					500,000	8,000,000		100.00%
9	Johnson Road Metering Station	450,000						450,000			
10	Sewer Plant Upgrade	5,000,000						5,000,000			
	Total County Sewer Capital Projects	6,133,000	5,749,000	158,300	1,140,000	4,123,182	221,620	17,525,102	13,657,325		

Notes:
1) Project costs generated by City Engineering Department.
2) Project costs generated by BHC Consultants, see Appendix I.
3) Annual/bi-annual allocation for continuing City sewer utility programs.
4) Project costs developed by Kitsap County; allocations included are based on City obligated contractual percentages.
5) Costs are for annual bond payments.
6) All CIP projects are in 2015 dollars.

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ES.8 Financial Plan

The financial plan assesses the City's ability to execute the capital improvement plan recommended in Chapter 7 of this CSP while maintaining sewer user rates at reasonable levels. It evaluates the historical financial condition of the City's utility and estimates the financial impact of executing the capital improvement plan, given projected capital funding needs and potential funding sources. This financial plan is intended to satisfy the requirements outlined in WAC 173.240.050 and RCW 36.70A.070.

The findings of the financial forecast indicate that the City can execute and finance the capital improvement plan while maintaining reasonable and affordable sewer rates. The projected 2% rate increases in 2018 and 2020 will be sufficient to support the City's CIP. The projected 6-year revenue requirements are listed in Table ES-5.

Table ES-5 6-Year Revenue Requirement Forecast

	2016	2017	2018	2019	2020	2021	2022
Sewer GFC							
City Portion	$4,010	$4,010	$4,010	$4,010	$4,010	$4,010	$4,010
County Portion	4,420	4,420	4,420	4,420	4,420	4,420	4,420
Total	$8,430	$8,430	$8,430	$8,430	$8,430	$8,430	$8,430
Annual Rate Adjustment (Above CPI)	0.00%	0.00%	2.00%	0.00%	2.00%	0.00%	0.00%
Monthly Residential Bill @ 7 ccf	$67.40	$68.75	$71.50	$72.93	$75.84	$77.36	$78.91
Change From Prior Year		$1.35	$2.75	$1.43	$2.91	$1.52	$1.55

The City plans to reevaluate their financial model every 3 years to determine the need to update the sewer rate structure for changes in utility costs, structure, and customer demands (relative between classes). The City could also consider further sewer rate structure enhancements at that time.

It is important to remember that the analysis performed in this CSP assumes growth rates based on recent experience of the City. If the future growth rates change, the proposed annual rate increases may need to be updated and revised.

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Chapter 1 Introduction

1.1 Background and Authorization

The City of Poulsbo owns, operates, and maintains a wastewater collection and conveyance system that serves approximately 2.5 square miles within the City of Poulsbo and the associated Urban Growth Area (UGA), as shown on Figure 2-1. The sewer system consists primarily of gravity collection lines, which feed two interceptor sewers that convey wastewater from the west and north sides of Liberty Bay to the Kitsap County conveyance system at Lemolo. The County conveyance facilities transport the wastewater south under Liberty Bay to the Central Kitsap Wastewater Treatment Plant (CKWWTP) located in Brownsville. The effluent is treated at the CKWWTP, which is owned and operated by Kitsap County Department of Public Works (KCDPW).

The City of Poulsbo's sanitary sewer system can be generally divided based on age and type of construction. The downtown and older parts of the City were largely constructed during the 1940s using clay and concrete tile pipe. This wastewater was treated by the City owned treatment plant until 1978 when the treatment plant was shut down and the conveyance to the County treatment plant was completed. Over the last 20 years the City has implemented numerous projects to replace the outdated clay and concrete pipes with polyvinyl chloride (PVC) and high density polyethylene (HDPE) materials as well as upgrade service connections to houses and businesses with a focus on reducing infiltration and inflow (I/I) into the sanitary sewer. Since 1998 the ongoing I/I program has helped to reduce peak flows and extend the capacity of the system. BHC Consultants, LLC (BHC) was authorized by the City of Poulsbo in June 2015 to prepare this Comprehensive Sewer Plan (CSP) Update. The sewer plan has been prepared in accordance with Washington Administrative Code (WAC) 173-240, which provides guidelines for the preparation of General Sewer Plans. This plan will be adopted by the City under the provisions of the RCW 35.67. This document updates the City of Poulsbo CSP of February 2008.

1.2 Purpose and Scope

The purpose of the CSP is to evaluate the City sewer system and determine if the sewer utility is adequately serving the current and future needs of the community, as well as meeting applicable regulatory requirements. Specific goals of this CSP update include:

- Evaluate existing wastewater collection and treatment requirements and project future wastewater system demands.
- Analyze the existing wastewater system to determine if it meets minimum requirements mandated by the Department of Ecology (DOE).
- Identify wastewater system improvements necessary to resolve existing system deficiencies and accommodate future needs of the system for 20 years into the future.
- Prepare a Capital Improvement Plan (CIP) and implementation schedule of improvements that meet the goals of the City's community service needs.
- Meet Growth Management Act (GMA) goals and the 2016 City wide Comprehensive Plan.
- Prepare a Financial Plan which addresses operational and capital costs and assesses sewer rates and connection fees.

Since the City is unique in that the treatment plant is located 6 miles south across from Liberty Bay, there are two additional goals related specifically to the siphon and conveyance route:

- Evaluate the feasibility of a new Westside overland conveyance route to CKWWTP.
- Evaluate the downstream capacity and any longevity issues with the existing siphon at Lemolo running under Liberty Bay.

1.3 Need for the Plan

A requirement for any city to upgrade or expand its sewage facilities is the preparation and adoption of a comprehensive plan under RCW 35.67. An additional driving force is the land use planning process mandated under the Growth Management Act (GMA). Poulsbo adopted their Comprehensive Land Use Plan in 2009 and is preparing an update that will be adopted in 2016. One of the key elements of this land use plan, as required by GMA, is a Capital Facilities Plan (CFP). This CFP is a twenty year plan for capital improvements that support Poulsbo's current and future population and economy. The CFP must address sanitary sewer service for the planning period.

In 2008 the City of Poulsbo developed the CSP which was adopted and approved by DOE. This CSP is an update to the 2008 CSP. The following documents have been reviewed in the preparation of this document:

- Central Kitsap County Wastewater Facilities Plan by Brown and Caldwell, May 1994
- Criteria for Sewage Works Design by the Department of Ecology, August 2008, Publication #98-37 WQ.
- 2015 KC Lift Station 16 and 67 Upgrades Plan
- 2015 KC Sewer Treatment Plant Improvements Plan
- Poulsbo Subarea Plan Draft by Kitsap County Department of Community Development, 2001
- 2016 Kitsap County Comprehensive Plan
- City of Poulsbo Water System Plan by Gray & Osborne, Inc. dated January, 2014
- Contract for Sanitary Sewer Service dated October 8, 2012 (Kitsap County)
- 2008 City of Poulsbo Comprehensive Sanitary Sewer Plan by Parametrix dated September 2008

1.4 City Officials

A list of City officials involved in the sewage projects is included in Table 1-1.

Table 1-1 City Officials Involved with Sewage Projects

Name	Title	Email	Phone Number
Andrzej Kasiniak, P.E.	Director of Engineering	akasiniak@cityofpoulsbo.com	360.779.4078
Diane K. Lenius, P.E.	City Engineer	dlenius@cityofpoulsbo.com	360.779.4078
Dean Zavack, P.E.	Senior Utilities Engineer	dzavack@cityofpoulsbo.com	360.779.4078
Mike Lund	Public Works Superintendent	mlund@cityofpoulsbo.com	360.779.4078
Keith Svarthumle	Asst. Public Works Superintendent	ksvarthumle@cityofpoulsbo.com	360.779.4078

Chapter 2 Service Area, Population, and Flow Projections

This chapter presents the planning data and flow projections needed to assess existing and future system needs including service area, population and conveyance capacity.

The City of Poulsbo Comprehensive Plan was adopted in 2009 and an updated Comprehensive Plan will be completed and adopted in 2016. The Comprehensive Plan is developed to meet the requirements of the Washington State GMA. The GMA requires, among other things, consistency between land use and utility plans and their implementation. This chapter demonstrates the compatibility of the Comprehensive Sewer System Plan with other plans, identifies the designated land uses within the existing and future service area, and identifies population projections within the Poulsbo planning area.

2.1 Service Area Description

2.1.1 Sewer System Service Area

The City of Poulsbo is located adjacent to Liberty Bay, which is a portion of Puget Sound in central Kitsap County. Figure 2-1 shows the City limits and the UGA approved by Kitsap County and Poulsbo. The City is not undergoing a UGA boundary change, and the UGA has not changed since the Poulsbo Subarea Plan was adopted in 2001. The Poulsbo sanitary sewer utility serves essentially the entire City and currently there are few extensions outside the City limits. The service area is limited to the UGA, although there are 27 existing connections outside the UGA allowed for public health reasons, (see Appendix A). The City and County, through the comprehensive planning process completed by Kitsap County in 2001, have designated the Poulsbo UGA as shown in Figure 2-1.

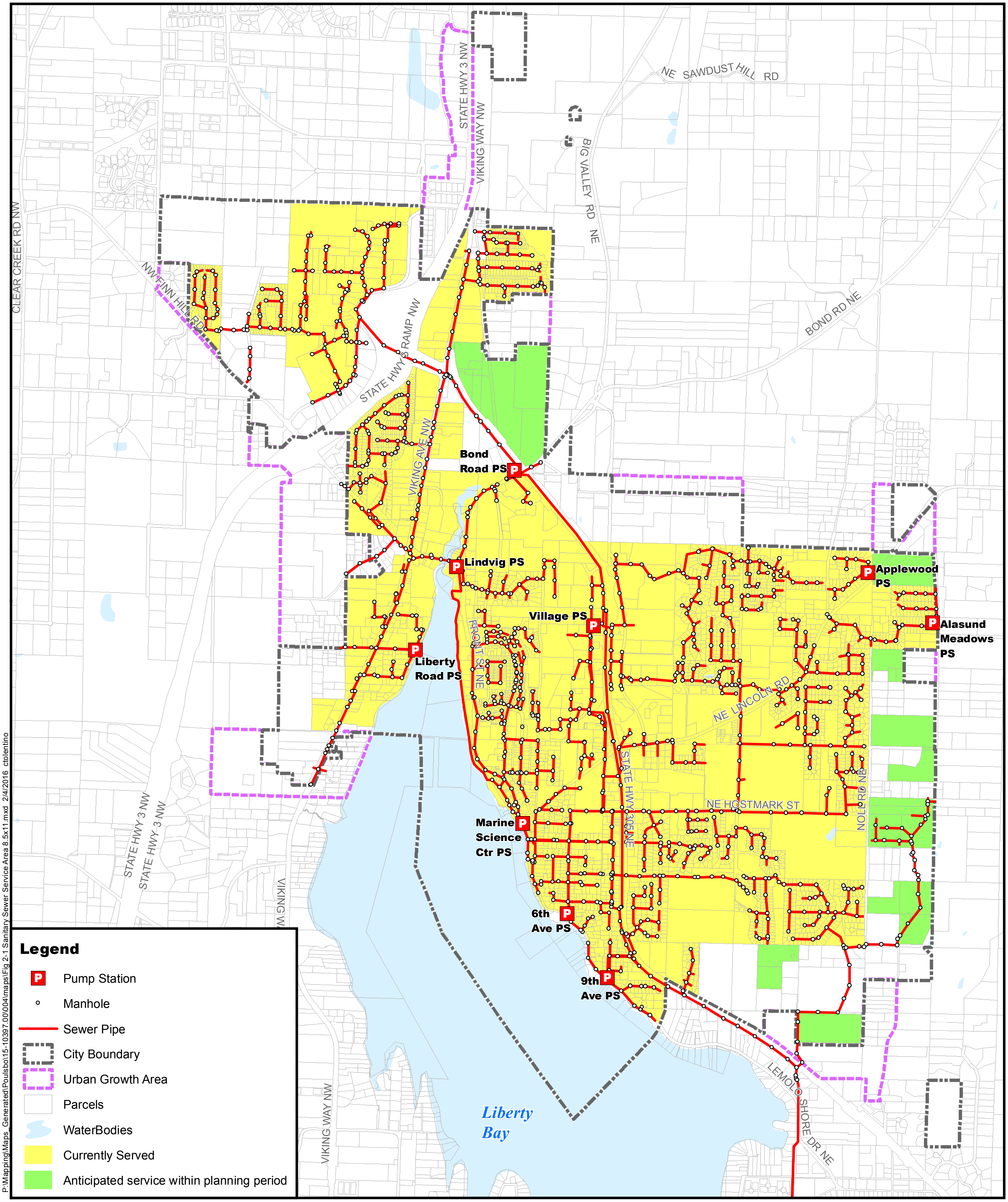
Most of the land area within the City limits and UGA is designated for residential use. Approximately 73 percent of the land area within the City limits and approximately 93 percent of the land area within the UGA is designated for residential use. Commercial use accounts for approximately 18 percent of the land area within the City limits and less than 2 percent of the land area within the UGA. The remaining land area is designated for business park, light industrial, open space, parks, conservation (environmentally sensitive areas), and public schools uses. The City completed an industrial discharge evaluation in November 2015 and found no significant industrial or manufacturing uses in the Poulsbo area. Zoning and land use is shown in Figure 2-2.

2.1.2 Climate

The average annual precipitation for Poulsbo is about 37 inches and the average annual temperature is approximately 60°F. The climate is heavily influenced by Poulsbo's proximity to the Pacific Ocean. Maritime air has a moderating influence on landward temperature in both winter and summer. The prevailing wind is from the south or southwest in fall and winter, gradually shifting to west or northwest in late spring and summer. There is a well-defined dry season in summer and a rainy season in winter characterized by prolonged periods of moderate rainfall and cloudiness.

2.1.3 Topography, Geology, and Critical Environmental Areas

The topography of Poulsbo is typical of Kitsap County, with numerous hills and valleys, streams, and Puget Sound waterfront (Figure 2-3). Elevations in Poulsbo range from sea level to 440 feet, with moderate to steep slopes prevalent. Two ridges run along each side of Liberty Bay and gradually rise in elevation to the north, accentuating the general topographical trend within Poulsbo. The entire city limits lie within the Liberty Bay Watershed.



This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County.

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CITY OF POULSBO VIKING CITY

Existing Sanitary Sewer Service Area

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
2-1

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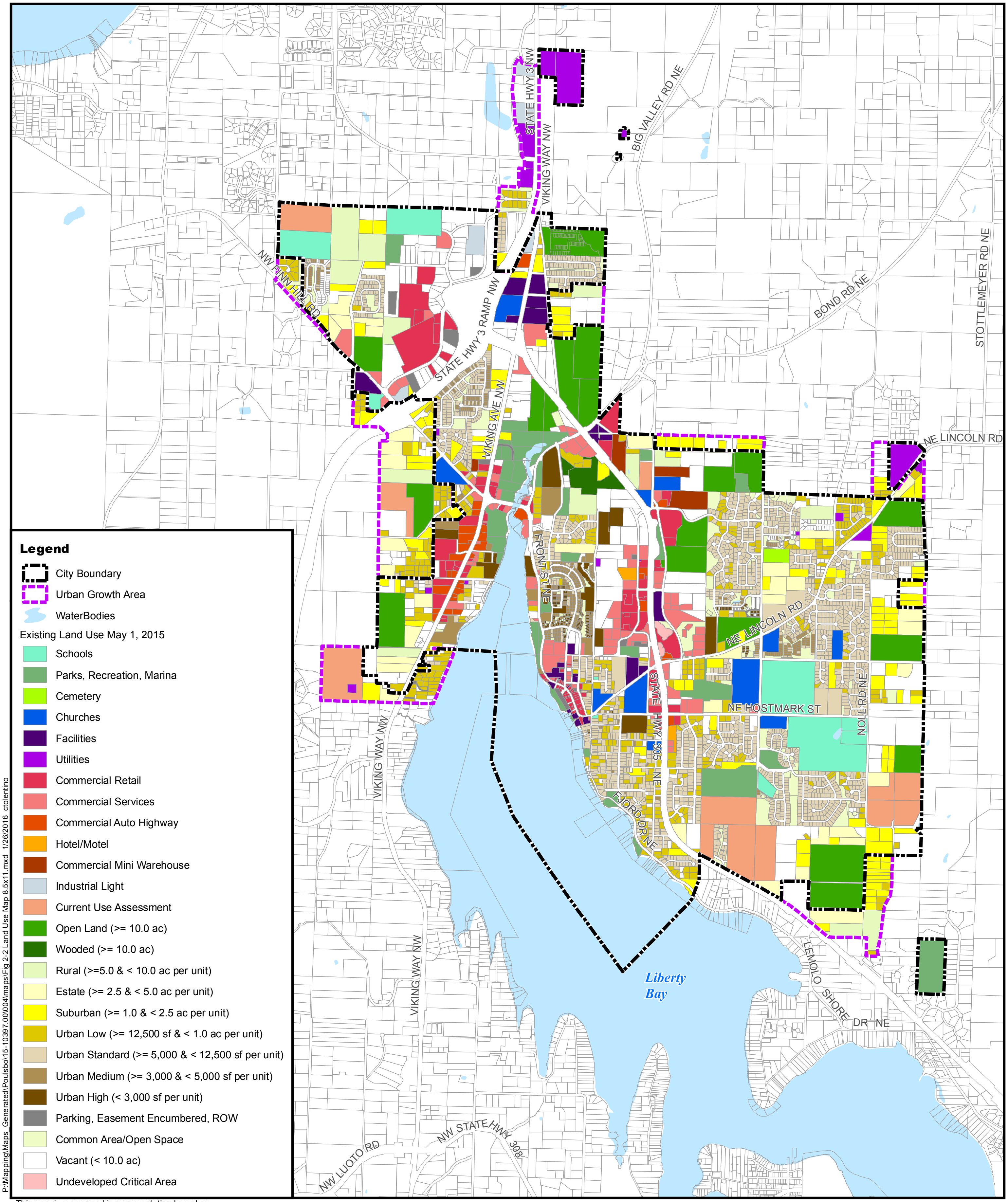

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County 2015. Land Use: City of Poulsbo - May 2015

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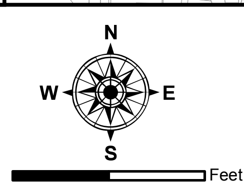

CITY OF POULSBO
VIKING CITY

Existing Land Use Map

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
2-2

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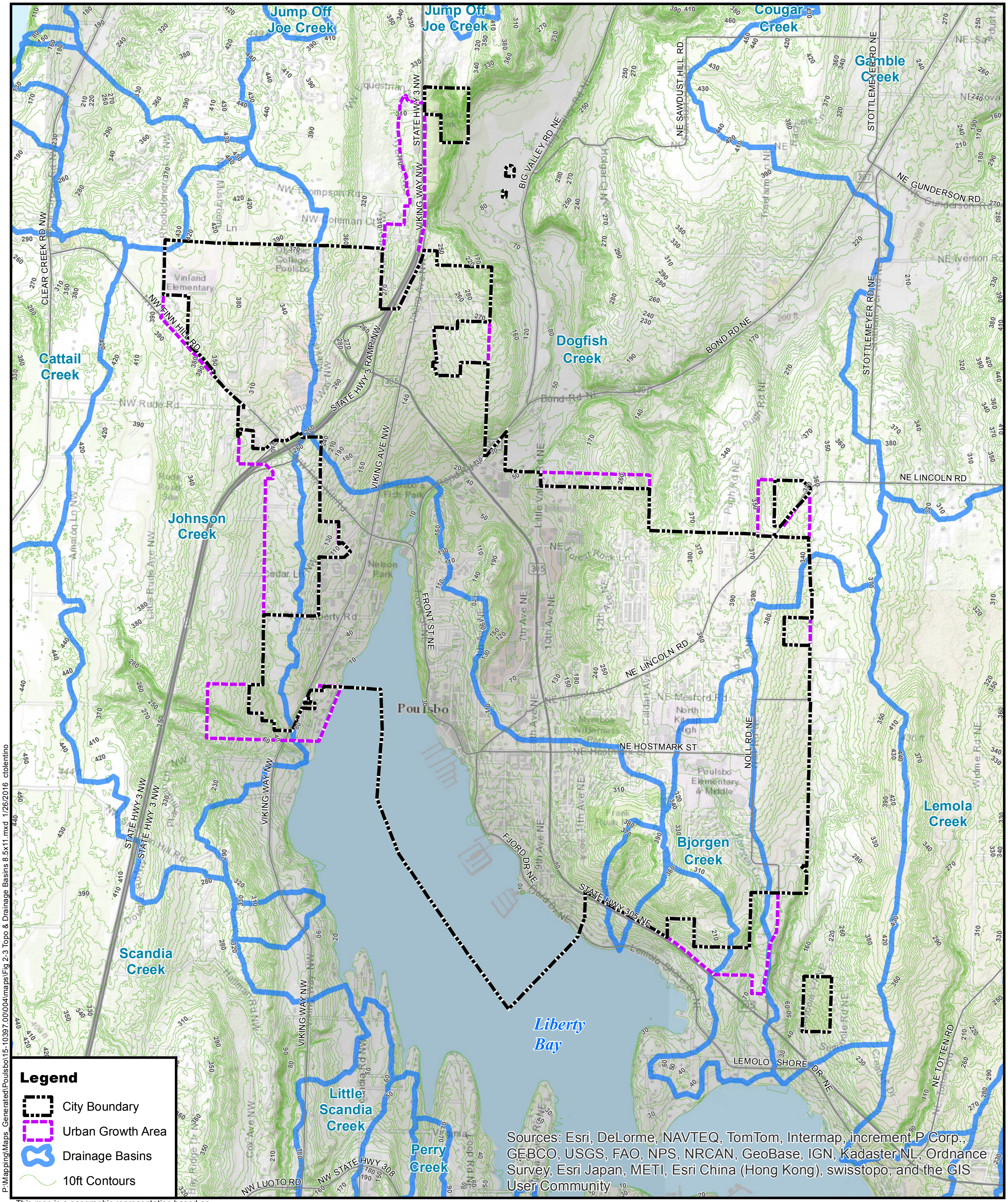

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County.
Drainage Basins: wria15 watersheds - Dept of Ecology, March 2006

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Topography & Drainage Basins

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
2-3

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Surface soils in the Poulsbo area consist of Poulsbo series gravely sands, and Vashon Till (hardpan) with a depth ranging from 20 to 40 inches. The majority of soil within the UGA is composed of the Poulsbo-Ragnar unit, which is composed of a gravelly sandy loam. The soil profile is nearly level to moderately steep, moderately deep, and moderately well drained on broad uplands.

Geologically critical areas are places highly susceptible to erosion, landslides, earthquakes, or other geologic events. In Poulsbo, the most hazardous of these areas is typically found along the marine shoreline and stream ravines. In many cases, these areas may be extremely desirable for development because of their scenic views or water and beach access, but their development may endanger people, property, and surface water resources.

Environmental critical areas within the study area include the Liberty Bay marine shoreline; Dogfish Creek, which drains into Liberty Bay at the northern end of the bay; the wetlands along the South Fork of Dogfish Creek, which follows SR 305 from Bond Road south, steep slopes adjacent to Liberty Bay, and Bjorgen Creek and associated wetlands.

The GMA requires that critical areas be designated and protected. Critical areas include aquifer recharge areas, wetlands, geological hazards, and steep slopes. The Critical Area map developed by Planning Department, designates these areas, see Appendix B.

2.1.4 Frequently Flooded Areas

Areas designated as 100-year flood zones are located along the western and eastern sides of Liberty Bay and along Dogfish Creek, as shown on Figure 2-4. A 100-year storm event has a one percent chance of occurring each year, although this type of storm may occur more frequently. The areas portrayed in Figure 2-4 were identified by the Federal Emergency Management Agency (FEMA) from aerial photos and topographic maps. Portions of the designated 100-year floodplain associated with Dogfish Creek lie within the service area.

2.1.5 Water Utility

The City of Poulsbo owns and operates the water utility as well as the sewer utility. Figure 2-5 shows the water system. Poulsbo has an intertie at Finn Hill Road to the Kitsap Public Utility District (KPUD) System. Some areas, both in the City and within the UGA, are served by KPUD. The City has an agreement with KPUD to provide water and fire flow in areas outside the City's water service area, also shown on Figure 2-5. The City does provide sewer utility within these areas. The City has seven deep wells, and all are chlorinated and fluoridated. Table 2-1 summarizes the average production in gallons per day (gpd) for each of the six wells. The Pugh Well provides emergency flow when necessary.

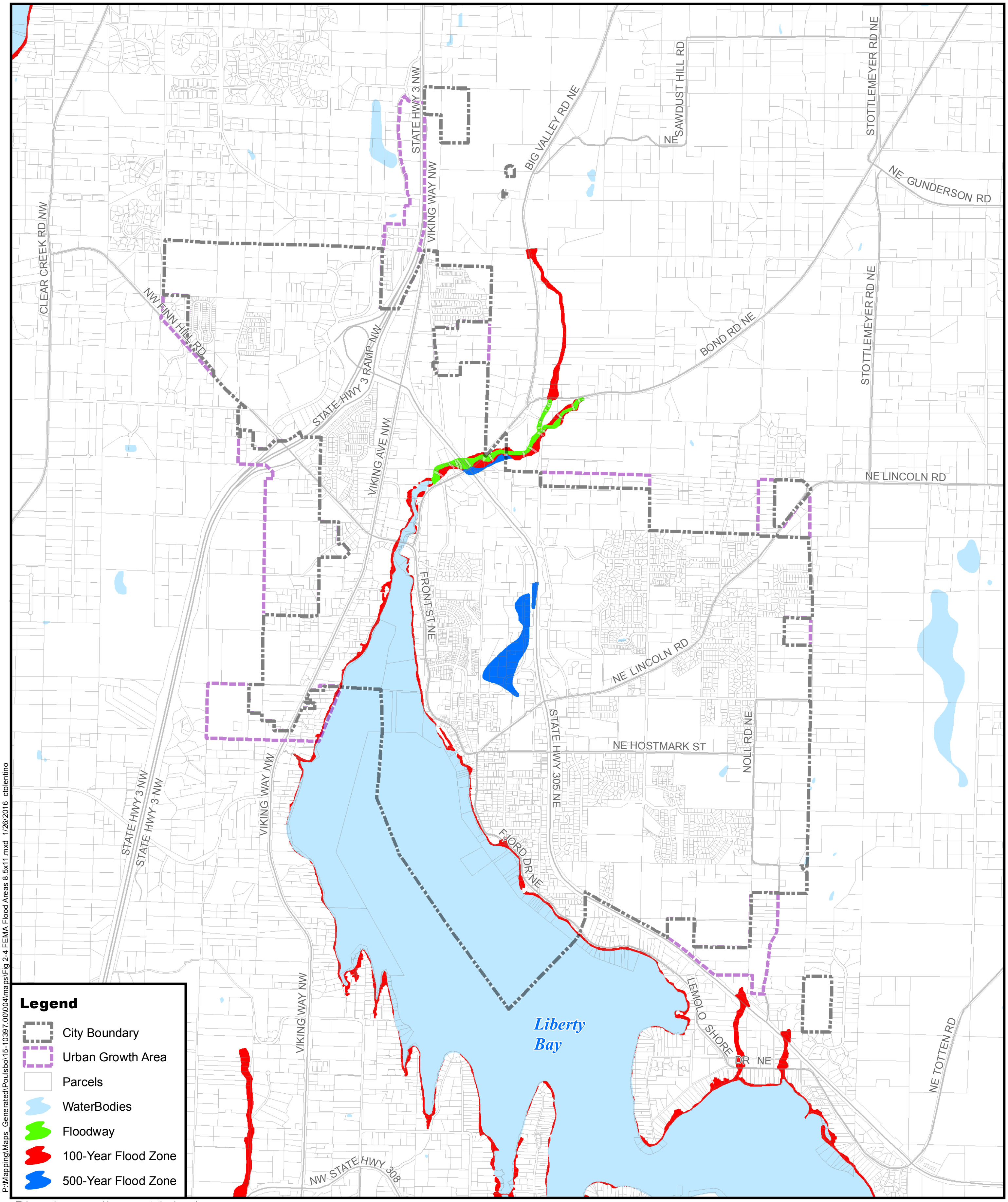
Table 2-1 Poulsbo Water Supply Wells

Well	Average Production (gpd) for 2015
Big Valley Well No. 1	178,200[1]
Big Valley Well No. 2	394,900
Pugh Well	30,500[2]
Lincoln Well #1	277,700
Lincoln Well #2	456,700[1]
Westside Well	119,800
#7 Bus Barn	144,000

Notes:
1) In use June and July Only
2) In use Feb, April, and June Only

Source: City of Poulsbo Water Production (1/1/15 to 8/31/15)

The City's water system provides service to approximately 9,388 people located in an area totaling 2,970 acres. These customers are served by five wells possessing a cumulative production capacity of 3.4 million gallons per day (mgd), nine reservoirs (total storage capacity of 4.1 million gallons), and six pressure zones. Approximately two-thirds of total water consumption is use by residential customers. The amount of water the City uses in gpd per equivalent residential unit (gpd/ERU) has dropped significantly in the last eight years. In the 2007 Water Plan, the City used on average 195 gpd/ERU and currently uses 159 gpd/ERU. This decrease in water has been a combination of increased efficiency, education, and reducing distribution system leakage. Consequently, the long term projected consumption of the City is not anticipated to exceed their water rights.



P:\Mapping\Maps_Generated\Poulsbo\15-10397.00\004\maps\Fig 2-4 FEMA Flood Areas 8.5x11.mxd 1/26/2016 ctolentino

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County. Flood Areas: FEMA 2007

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CITY OF POULSBO VIKING CITY

FEMA Flood Areas

Comprehensive Sewer Plan
City of Poulsbo
February 2016

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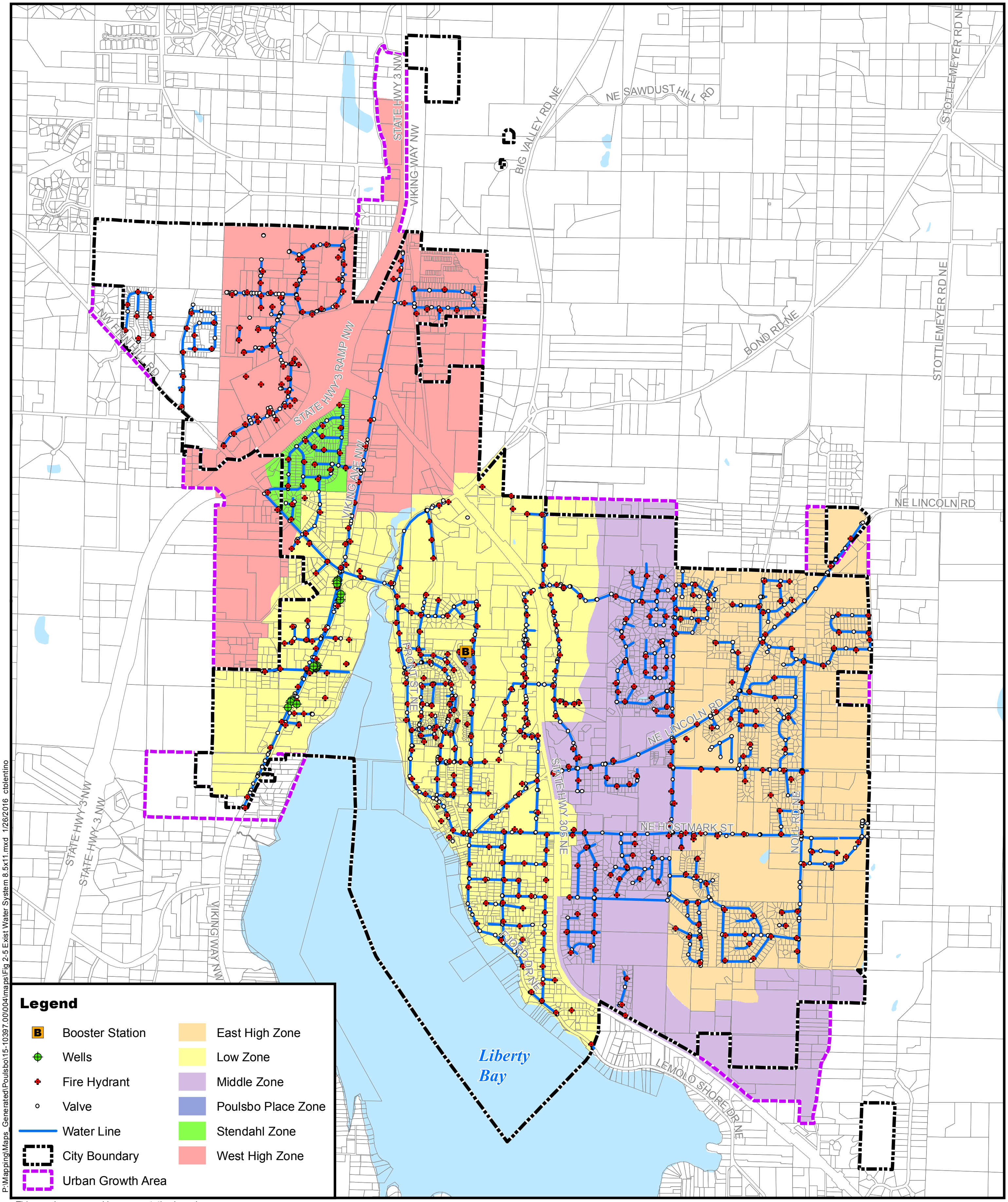

P:\Mapping\Maps_Generated\Poulsbo\15-10397.00\004\maps\Fig 2-5 Exist Water System 8.5x11.mxd 1/26/2016 ctolentino

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County. Flood Areas: FEMA 2007

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CITY OF POULSBO VIKING CITY

Existing Water System

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
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2.2 Sanitary Sewer System Organization

2.2.1 Sanitary Sewer System Ownership and Management

The City provides service to approximately 3,432 customers within a service area of about 3.9 square miles. The City contracts with Kitsap County to treat the wastewater. The Poulsbo collection system transports the wastewater to a Kitsap County metering structure from which the County accepts responsibility for transport across Liberty Bay to the CKWWTP at Brownsville under a new Agreement signed in October 8, 2012, see Appendix C.

The system functions under the direction of the Engineering and Public Works Departments. The Superintendent of Public Works supervises daily operations of the Public Works Division. Tasks performed by the operations and maintenance staff include general and TV inspection, testing, installation, cleaning and repair of system facilities, routine operation and preventive maintenance, record keeping, data collection, administrative tasks, and corrective or breakdown maintenance required in response to emergencies.

2.2.2 Wastewater Treatment History

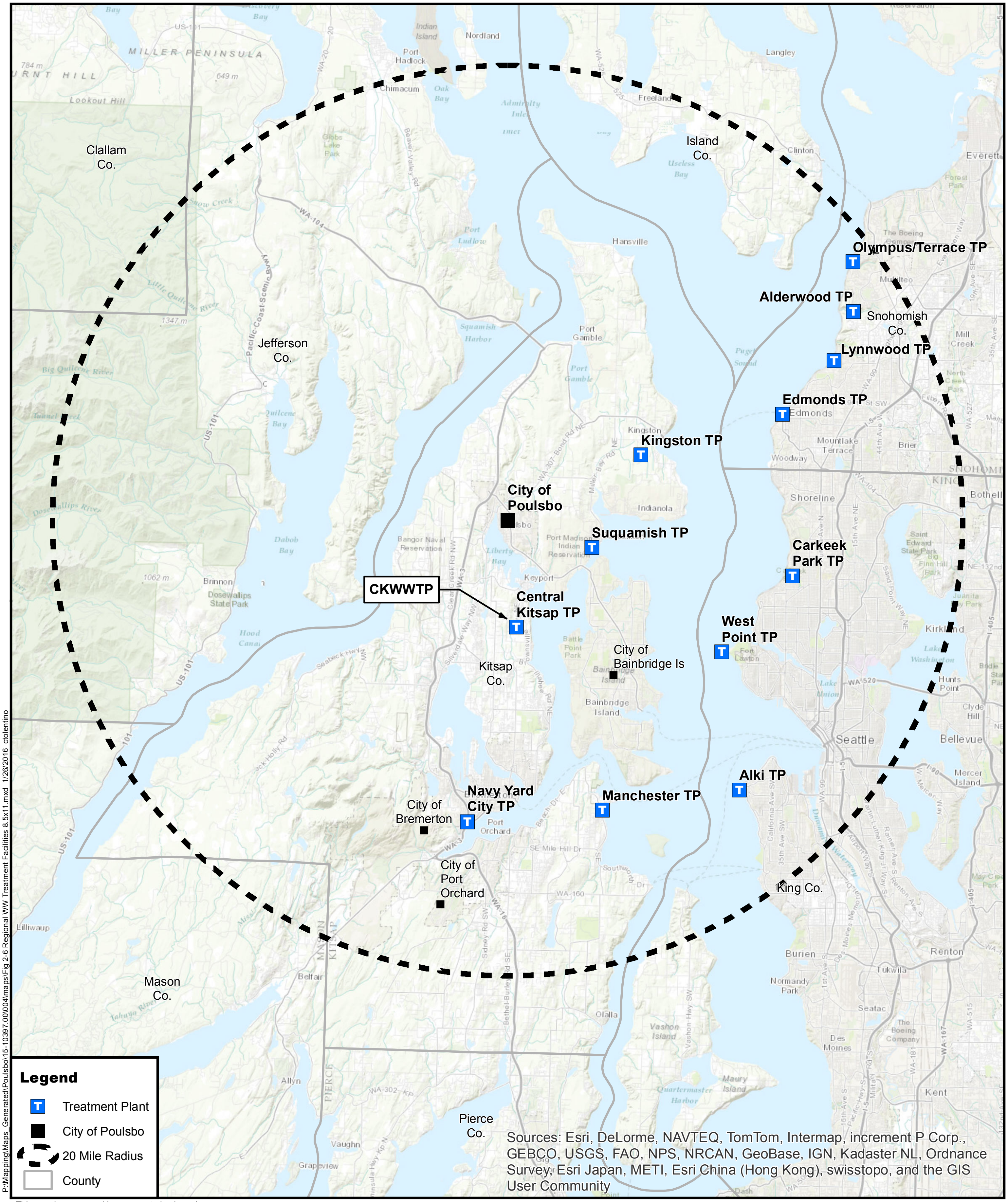
Poulsbo's sewer collection system was initially constructed during the 1930s and 1940s. In 1942, a primary wastewater treatment plant was constructed near the City's business district. The City-owned treatment plant discharged effluent to Liberty Bay until the late 1970s. The City then entered into a contract with Kitsap County for the treatment of Poulsbo's wastewater. In 1978, the Central Interceptor was constructed parallel with SR 305, connecting the City of Poulsbo to the metering facility at Johnson Road. The County transports wastewater from the Central Interceptor at the metering station to Lemolo Shore via a 14-inch force main, then across Liberty Bay via two 12-inch gravity siphons and Kitsap County Pump Stations Nos. 16 and 24 to the CKWWTP in Brownsville. Kitsap County is in the process of eliminating Pump Station 16, adding new gravity sewer conveyance pipes directly to the Pump Station 67 wetwell, and transferring flows to Pump Station 67, which will be online in Dec. 2016.

Approximately 26 single-family residences are connected to the County system between Johnson Road and Pump Station 16 in Keyport, shown in Appendix A. The community of Keyport and the US Navy Undersea Warfare Station connects to the County system between Pump Station 16 and Pump Station 67, with flows being transmitted by Pump Station 67 in the future.

Kitsap County operates four Wastewater Treatment Plants in the area (Kingston, Suquamish, Central Kitsap, and Manchester). Figure 2-6 shows the regional wastewater treatment facilities. Figure 2-7 shows the principle collector sewers and force mains in Poulsbo and the route of wastewater flow from the City to the CKWWTP. City wastewater is transmitted under Liberty Bay at Lemolo. Currently the sewer treatment plant operates at an average influent flow of 5.5 mgd with a treatment capacity of 7 mgd. The CKWWTP is currently being upgraded, with the new 2015 facility upgrades expanding the treatment capacity to 6.0 mgd when completed.

2.2.3 Kitsap County Wastewater Treatment and Disposal Agreement

The City discharges wastewater to Kitsap County for treatment and discharge. Under the terms of the Agreement, the average flow from the City is not to exceed 0.95 mgd averaged over 3 months. The City is charged a fixed fee for operations and maintenance costs based upon the proportionate ratio of reserved capacity. The Agreement also provides for the City to participate in the cost of CKWWTP improvements, as well as sharing the costs for County conveyance improvements. The Agreement, is included in Appendix C.



P:\Mapping\Maps_Generated\Poulsbo\15-10397.00\004\maps\Fig 2-6 Regional WW Treatment Facilities 8.5x11.mxd 1/26/2016 ctolentino

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County.
Flood Areas: FEMA 2007

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Regional Wastewater Treatment Facilities

Comprehensive Sewer Plan
City of Poulsbo
February 2016

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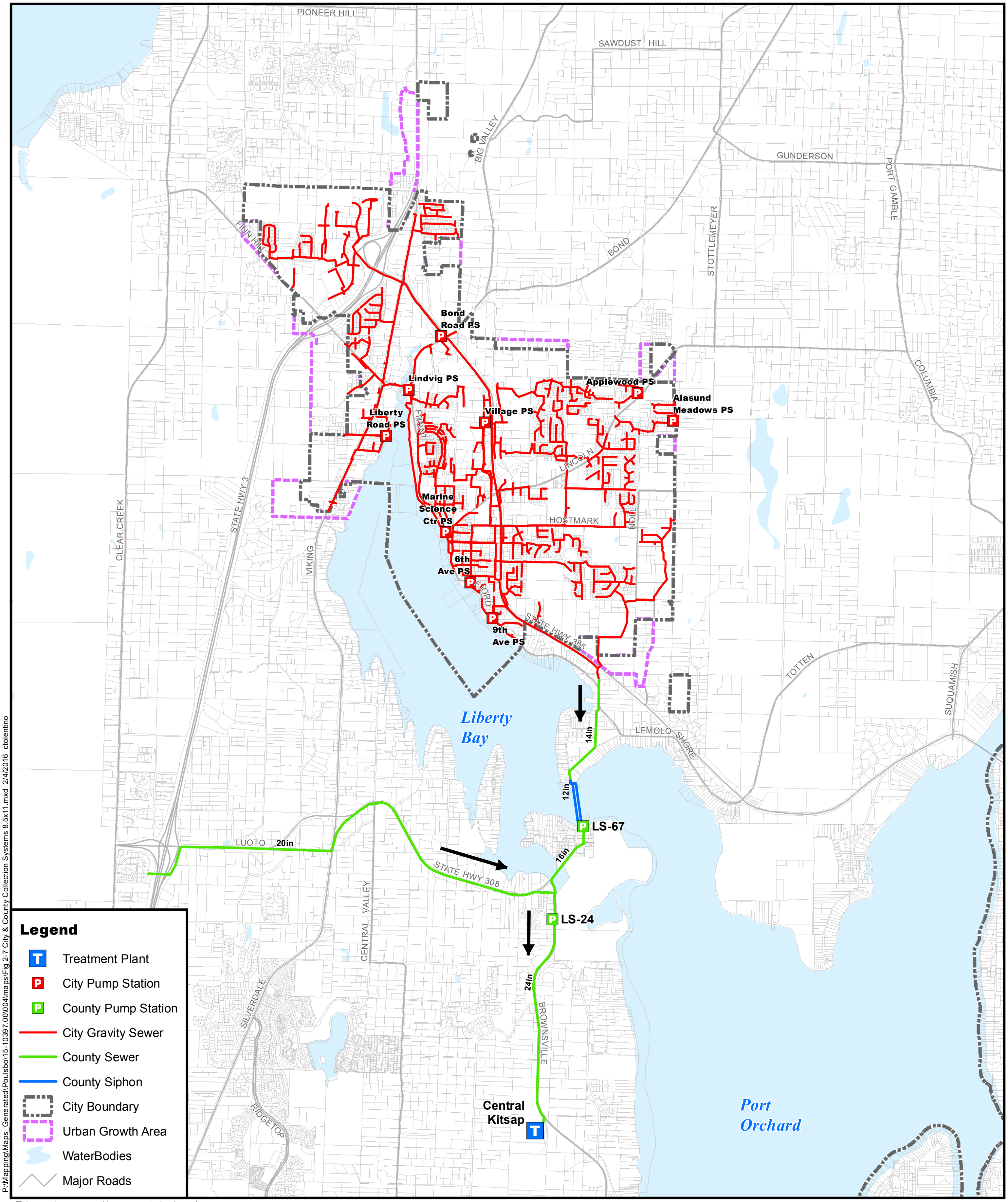

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County. Flood Areas: FEMA 2007

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City & County Collection Systems

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
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2.3 Population

2.3.1 Historical Population

The City's population growth rate over the last twenty years is presented in Table 2-2. Over the last twenty years, approximately 4,037 new residents have become part of the City. Population growth during this period averaged 2.6 percent annually. The 12.2% increase in population between 2008 and 2009 was the result of a revised estimate of the population, and not growth.

Table 2-2 City of Poulsbo Historical Population 1995 to 2015

Year	City Population	Annual Growth Rate
1995	5,913	7.6%
1996	6,188	4.6%
1997	6,301	1.8%
1998	6,637	5.3%
1999	6,663	0.3%
2000	6,813	2.2%
2001	6,988	2.5%
2002	7,081	1.3%
2003	7,129	0.6%
2004	7,357	3.1%
2005	7,657	4.0%
2006	7,722	0.8%
2007	7,823	1.3%
2008	8,110	3.6%
2009	9,106	12.2%
2010	9,222	1.0%
2011	9,245	0.2%
2012	9,360	1.2%
2013	9,585	2.4%
2014	9,775	1.98%
2015	9,950	1.79%

2.3.2 Household Trends

The 2010 Census reported 3,883 total households. The average household size in Poulsbo was 2.3 persons per household in 2015. The average household size in all of Kitsap County was 2.51 persons per household in 2009 - 2013. The City Planning Department attributes the smaller average household size in Poulsbo reflects the retirement base of the Poulsbo community. It is estimated that approximately 100 residences are on septic systems and not connected to the City's sewer system.

2.3.3 Future Population

City of Poulsbo population projections are based on projections provided by the Kitsap Countywide Planning Policies, and are found in Appendix D. Table 2-3 summarizes the population forecast for the planning period as established by the Kitsap Countywide Planning Policies.

Table 2-3 Poulsbo City and UGA Population Forecast*

Population Distribution	2010	Population Growth	2036
City Limits	9,222	1,330	10,552
UGA	478	3,778	4,256
Total	**9,700**	**5,108**	**14,808**

**For the purposes of facility planning, Poulsbo does not make a distinction between City limits and its UGA. Therefore the total population forecast of 14,808 is used for the purposes of this document.*

The population forecast allocated to the City and UGA is 14,808 by 2036. Sewer system flow increases associated with this growth are described in the following section and depicted in Table 2-8.

2.4 Wastewater Flows

Wastewater flow analysis is an important tool in the evaluation and planning of the sewer system. Table 2-4 defines typical wastewater flow parameters used in this section. The rate of wastewater flow varies throughout the day, the month, and the year.

Table 2-4 Typical Wastewater Flow Parameters

Parameter	Definition
Average Annual Flow (AAF)	The average flow computed from yearlong flow records.
Average Dry Weather Flow (ADWF)	Average flow occurring in dry-weather seasons.
Average Wet Weather Flow (AWWF)	Average flow occurring in wet-weather seasons.
Average Design Flow (ADF)	Peak month flow rate.
Peak Hour Flow (PHF)	The peak 60 minute flow rate occurring during wet weather. This is the design flow to determine capacity in the conveyance system.
Peaking Factor (PF)	Peak Hour Flow / Average Annual Flow
Infiltration	When groundwater enters the system through cracks in the pipe, joints or defects in the manhole walls.
Inflow	When surface runoff enters the system during storm events from storm drains, roof drains, curtain drains, and other stormwater connections.
I/I	Stormwater Inflow + groundwater infiltration into the sanitary sewer

Table 2-4 Typical Wastewater Flow Parameters	
Parameter	**Definition**
Steady Flow	Water entering the system through constant sources of discharge including leaking faucets, leaking toilets, or cooling water. This parameter is used by the City but is not used for the flow projections in this Plan.

2.4.1 Historical Wastewater Flows

A summary of average monthly flows for 1995 through 2015 is shown below in Table 2-5 and in Figure 2-8.

Monthly sewer flows average approximately 0.76 mgd during the 1995 through 1999 period. In 2000, the City constructed the 6th Street I&I reduction project. Between 2000 and 2006, average monthly flows dropped to 0.65 mgd. This drop in average monthly flows equates to an approximate 15 percent reduction. During the 2000 to 2006 period, the City population increased by 909 residents. The reduction in flow during a period of growth attests to the effectiveness of the completed I/I reduction projects and reductions in inflow and infiltration during the wet season. Current City sewer flows (2014 – 2015) average approximately 0.61 mgd mostly due to a steady decrease in sewer flows per capita from completed I/I reduction projects since 1995 and an overall reduction in water usage, see Figure 2-8. Monthly billed sewer totals from 1995 to 2015 are listed in Table 2-5.

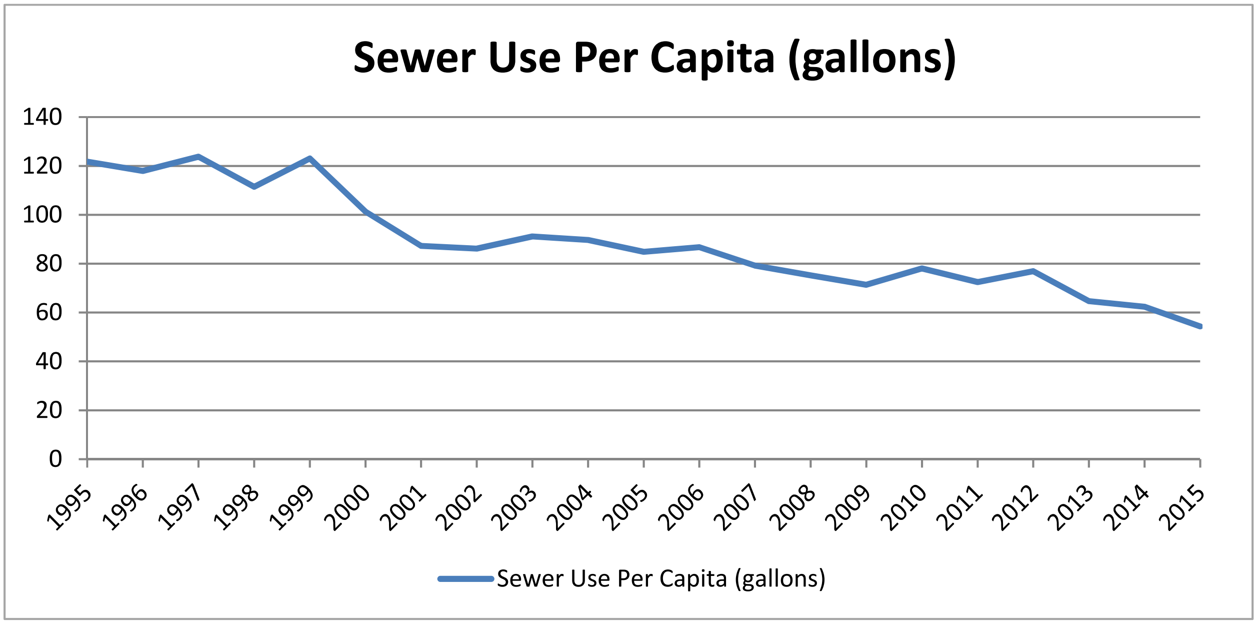

Figure 2-8 City of Poulsbo Sewer Use per Capita

Table 2-5 Monthly and Average Yearly Sewer Flows

Year	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1995	0.94	0.96	1.00	0.73	0.65	0.53	0.59	0.57	0.57	0.60	0.68	0.86	0.72
1996	0.90	1.03	0.66	0.80	0.78	0.59	0.62	0.63	0.45	0.72	0.66	0.93	0.73
1997	1.19	0.67	0.99	0.85	0.72	0.62	0.70	0.57	0.57	0.77	0.82	0.84	0.78
1998	1.15	0.94	0.80	0.72	0.64	0.65	0.62	0.59	0.59	0.65	0.78	0.77	0.74
1999	1.04	1.40	0.93	0.69	0.72	0.63	0.67	0.58	0.69	0.64	0.90	0.90	0.82
2000	0.90	0.83	0.98	0.75	0.63	0.63	0.59	0.55	0.52	0.61	0.60	0.68	0.69
2001	0.64	0.63	0.62	0.52	0.55	0.58	0.49	0.53	0.54	0.51	0.73	0.93	0.61
2002	0.77	0.73	0.69	0.60	0.56	0.58	0.53	0.56	0.50	0.54	0.58	0.68	0.61
2003	0.84	0.58	0.74	0.71	0.61	0.55	0.52	0.55	0.52	0.63	0.73	0.78	0.65
2004	0.88	0.75	0.70	0.66	0.58	0.59	0.59	0.57	0.59	0.59	0.61	0.78	0.66
2005	0.68	0.64	0.64	0.76	0.65	0.65	0.58	0.55	0.53	0.53	0.65	0.91	0.65
2006	1.10	0.74	0.80	0.68	0.63	0.66	0.55	0.51	0.52	0.52	0.79	0.97	0.67
2007	0.74	0.63	0.70	0.56	0.57	0.56	0.56	0.51	0.52	0.57	0.59	0.94	0.62
2008	0.84	0.64	0.63	0.66	0.61	0.56	0.55	0.56	0.52	0.54	0.65	0.57	0.61
2009	0.64	0.66	0.62	0.66	0.64	0.57	0.57	0.54	0.55	0.55	0.64	0.86	0.65
2010	0.97	0.86	0.86	0.61	0.65	0.67	0.59	0.55	0.57	0.59	0.67	1.07	0.72
2011	0.71	0.71	1.14	0.77	0.63	0.60	0.58	0.53	0.57	0.48	0.70	0.62	0.67
2012	0.70	0.69	0.88	0.65	0.63	0.89	0.60	0.52	0.54	0.58	0.94	0.98	0.72
2013	0.78	0.64	0.64	0.65	0.55	0.58	0.52	0.46	0.57	0.52	0.54	0.93	0.62
2014	0.57	0.84	0.83	0.76	0.53	0.49	0.50	0.48	0.45	0.49	0.63	0.81	0.61
2015	0.62	0.70	0.61	0.51	0.48	0.43	0.41	0.43	0.46	0.46	0.51	0.87	0.54

2.4.2 Infiltration and Inflow (I/I) Analysis

The 1992 CSP identified significant I&I in the older sections of the City. The City spent the next twenty years repairing and replacing many of the original sanitary sewers in the downtown corridor and older parts of the City. The 2008 CSP identified a significant reduction of infiltration, steady flow, and inflow into the Poulsbo wastewater collection system compared to the 1992 study. Between 1996 and 2008, approximately 30,000 lineal feet of gravity sewer main in Jensen Way, Front Street, Caldart Avenue, and streets in the 6th Avenue Basin area were repaired or replaced by both open trench and pipe bursting methods. A major concern for the City is the continued I/I from other areas within the City. Inflow during storm events before 1999 had often exceeded the capacity of the Kitsap County conveyance system, causing the Central Interceptor to surcharge, lifting off manhole covers, and causing the 6th Avenue pump station to run continuously for days.

The City of Poulsbo has an on-going Infiltration and Inflow (I/I) Reduction Program. This program includes continuous monitoring of sewer pump station flow run times, I/I reduction, capital projects, and videotaping and inspection of the gravity sanitary sewer main as needed.

The following recent I/I sewer projects have already been completed by the City:

1. 6th Avenue I & I Improvement Project (2002)
2. 5th Ave. & Viewmont Sewer Project (2008)
3. Central Poulsbo I & I Improvements Project (2008)
4. Approximately 750 Rainstopper™ Sewer Lids installed (2008 – 2015)
5. Sealed Four Sewer Manholes in vicinity of previous overflows and added vent lids per Ecology request to increase conveyance capacity (October, 2013)
6. Installed water level sensor and early warning system in Central Interceptor (April, 2013). Equipment updated in 2015 to include real time flow rate monitoring and level warning controls.

When individual City lift stations are compared to one another based on sewer flow per capita per day, the City lift station basins from the areas of completed I/I work show the lowest sewer flows per capita, see Sanitary Sewer I/I Preliminary Investigation Report (Appendix E).

The United States Environmental Protection Agency (USEPA) requires analysis of I/I if the domestic wastewater flow plus infiltration exceeds 120 gallons per capita per day (gpcd) during periods of high groundwater level (7-14 day average) or 275 gpcd during a storm event as a prerequisite to treatment plant expansion projects. Averages that exceed these amounts are considered “excessive” by the I&I Analysis and Projection Certification, Ecology Publication No. 97-03.

Based on the result of the projects mentioned above, the inflow and infiltration for the City do not exceed the EPA guidelines for excessive inflow or excessive infiltration. However, the City is aware of areas of high I/I, and has been working on addressing them. The 6th Avenue and Marine Science Center sanitary sewer basins, which have recent I/I repair and replacement, show the lowest values of I/I per capita in the City. The Poulsbo Village Sewer Basin, which has the highest values of I/I in the City, will be smoke tested, and repair and rehabilitation projects are expected to be completed soon. The City will pursue projects that will lead to an overall I/I reduction and a reduction of sewer flows.

2014 & 2015 Sewer Flow Records

Year 2014 and 2015 sewer flow records show a dry weather (August 2014 and 2015) average flow of 0.455 mgd, and an average wet weather (November 2014 through April, 2015) average daily flow of 0.674 mgd.

Average sewer flows during periods of heavy rainfall and during seasonal high water were calculated to compare with EPA criteria as shown in Tables 2-6 and 2-7. Based on this data, the City does not exceed EPA criteria for excessive inflow or infiltration. Inflow during periods of heavy rain was calculated at 132 gallons per capita per day (gpcd), compared to EPA “excessive inflow” criteria of 275 gpcd. Infiltration during the seasonal high water table period of December through March was calculated at 83 gpcd, compared to EPA “excessive infiltration” criteria of 120 gpcd.

Table 2-6 Average Daily Flow Per Capita During Heavy Rainfall Conditions, 2014 - 2015

Date	24 Hr Rainfall (in)	Total Daily Measured Flow (MGD)	Population	Gal/Capita/Day
3/5/2014	1.22	1.396	9,775	143
3/6/2014	1.37	1.580	9,775	162
12/10/2014	1.17	1.474	9,775	151
12/11/2014	0.78	1.233	9,775	126
2/5/2015	1.32	1.244	9,950	125
2/6/2015	0.94	1.072	9,950	108
3/15/2015	1.80	1.097	9,950	110
Averages	**1.23**	**1.299**	**9,850**	**132**
EPA Threshold for "excessive" inflow				*275*

Table 2-7 Average Daily Flow Per Capita During High Infiltration (Seasonal High Water Table) Conditions, 2014 - 2015

Date [1]	24 Hr Rainfall (in)	Total Daily Flow (MGD)	Population	Gal/Capita/Day
3/8/2014	0	1.091	9,775	112
3/12/2014	0.01	0.873	9,775	89
12/23/2014	0.01	0.840	9,775	86
1/20/2015	0	0.714	9,950	72
1/27/2015	0.01	0.688	9,950	69
3/17/2015	0.01	0.727	9,950	73
Average	**0.00**	**0.822**	**9,863**	**83**
EPA Threshold for "excessive" infiltration				*120*

Pump Records Analysis

An I/I analysis was recently performed by the City to evaluate stormwater inflow and infiltration in the City's lift station basins, and to assess apparent effectiveness of the 6th Avenue basin I/I project completed in 2001. Of the nine sewer basins evaluated (6th Avenue, 9th Avenue, Liberty Bay, Lindvig, Marine Science Center, Alasund, Applewood, Poulsbo Village, and Bond), the basin with the highest sewer flows per capita was the Viking Village Basin. The City will prioritize I/I investigation and repairs in the Poulsbo Village Basin and continue to investigate other sources of I/I into the sewer.

On the basis of total inflow, the Poulsbo Village pump station basin most likely has contributed the greatest volume of stormwater, followed by the Bond basin and the Lindvig pump station basin. The pump station I/I flow analysis is provided in the June 2015 *Sanitary Sewer Inflow and Infiltration Preliminary Investigation Report* in Appendix E.

Effect of 6th Avenue Basin I&I Reduction Project

A contract for pipe bursting and side sewer replacement in the 6th Avenue Basin was completed in early 2001. The work included replacement of the majority of collection sewers and a portion of side services to individual residences. Prior to the project, major rainfalls caused the 6th Avenue pump station to run continuously for several days. During these events, the Central Interceptor would surcharge, causing back pressure on the force main and reducing the pumping rate.

Analysis of pump records indicate that the completed I/I project reduced pump run time by over 35 percent. The limited number of data points does not provide sufficient information for a strong conclusion. However, it does indicate that the project is likely to have reduced sewer flow in the basin by approximately 35 percent.

I/I Conclusions

Flow analysis and the I/I evaluation shows that there continues to be a significant I/I problem in some lift station basins, especially in the older portions of the City. Further evaluation is necessary to determine specific sources of inflow and infiltration. I/I reduction efforts including investigation, pipe rehabilitation and implementation of ongoing inflow reduction program measures are therefore included in the CIP.

2.5 Projected Wastewater Flows

Projected sewer flows for existing and future population were calculated using different per capita rates and peaking factors. Total future sewer flows were calculated by adding existing sewer flows to the calculated sewer flows from future population growth.

Future wastewater flows were estimated using an estimated peaking factor (PF) of 2.8 and sewer flows of 70 gallons per day per person (gpcd) for new population and PF of 4.05 with sewer flows of 62 gpcd for existing population. The higher future per capita flow rates were used in order to be conservative, while the lower peaking factor is assuming modern construction materials and techniques which will result in lower I/I.

Existing and future sewer flows for the Village Basin were calculated separately for the design of the Village Pump Station and are included in Appendix L.

2.5.1 Existing Sewer Flows

Existing sewer flows were calculated to be an average annual flow rate of 62 gallons per capita per day (gpcd) based on metered flow and existing population estimates for 2014 and 2015. A peak hour factor of 4.05 was also established from the metered flow records.

2.5.2 Future Sewer Flows

Total future sewer flows were calculated by adding existing sewer flows to the calculated sewer flows from future population growth.

Average annual sewer flows for future population are conservatively estimated at 70 gpcd. A peaking factor of 2.8 was derived from the DOE Criteria for Sewage Works Design (Orange Book), based on sewered population. This lower peaking factor is based on using modern materials and standards, which will have lower I/I, and a larger population, which will spread peak flows out over time and reduce the diurnal variation of flows.

Peak hour flow projections are shown in Table 2-8 and graphically in Figure 2-9, and do not reflect I/I reductions from the annual inflow reduction program. The flow projections should therefore be considered conservative estimates of potential future conditions. Flow projections per basin are shown in Table 2-9 and include higher flow projections for the Village Basin based on design calculations for the Village Pump Station, which results in a higher total flow rate.

Table 2-8 Peak Hour Flow Projections

Year	City Population	Average Annual Flow (mgd)	Peak Hour Flow (mgd)
2015	9,950	0.62	2.72
2016	10,181	0.63	2.77
2017	10,412	0.65	2.83
2018	10,643	0.67	2.88
2019	10,874	0.68	2.94
2020	11,105	0.70	2.99
2021	11,336	0.71	3.05
2022	11,567	0.73	3.10
2023	11,798	0.75	3.15
2024	12,029	0.76	3.21
2025	12,260	0.78	3.26
2026	12,491	0.79	3.32
2027	12,722	0.81	3.37
2028	12,953	0.83	3.43
2029	13,185	0.84	3.48
2030	13,416	0.86	3.53
2031	13,647	0.88	3.59
2032	13,878	0.89	3.64
2033	14,109	0.91	3.70
2034	14,340	0.92	3.75
2035	14,571	0.94	3.80
2036	14,808	0.96	3.86

Table 2-9 Projected Flow per Basin

Basin	2015 Population	2036 Growth	2036 Population	2015 Peak Hour Flow (mgd)	2015 Peak Hour Flow (gpm)	2036 Peak Hour Flow (mgd)	2036 Peak Hour Flow (gpm)	Percentage of Growth	Percentage of Basin Developed
Viking Avenue Basin[1]	2,171	900	3,071	0.545	379	0.722	501	19%	71%
Finn Hill Basin	534	1,450	1,984	0.134	93	0.418	290	30%	27%
Central Poulsbo Basin	1,819	0	1,819	0.457	317	0.457	317	0%	100%
Village Basin[2]	1,007	300	1,307	0.471	327	0.720	500	6%	77%
6th Avenue Basin	700	40	740	0.176	122	0.184	128	1%	95%
9th Avenue Basin	162	40	202	0.041	28	0.049	34	1%	80%
Noll Road Basin	201	1,300	1,501	0.051	35	0.305	212	27%	13%
East Poulsbo Basin	3,355	828	4,183	0.843	585	1.005	698	17%	80%
Total	9,950	4,858	14,808	2.717	1,886	3.859	2,680	100%	67%

Notes:

1) Flow projections for the Liberty Pump Station, located in the Viking Avenue Basin, were prepared as part of the design for the rehabilitation of the Liberty Pump Station and are included in Appendix L.
2) Flow projections for the Village Basin were prepared as part of the design for the rehabilitation of the Village Pump Station and are included in Appendix L. These use a different methodology than the other basins and result in higher calculated flows.

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Chapter 3 Sewer System Description

The City's sewer system consists of a combination of gravity collection lines, pump stations, and force mains. No wastewater treatment is performed by Poulsbo; rather, the City contracts with Kitsap County for treatment at the CKWWTP in Brownsville.

The original portions of the sewer system were constructed in the 1930s and 1940s. The post-war system contains a variety of pipe materials including concrete and vitrified clay. Many of the older concrete and vitrified clay pipes have been replaced over the last 20 years with the projects in the downtown corridor. The majority of the system constructed since the 1960s consists of 8-, 10-, 12-, and 15-inch ductile iron, and 18-inch PVC pipe. The majority of the existing sewers are 8-inch diameter. Recent pipe replacement projects have used high-density polyethylene (HDPE) or C-900 PVC pipe. New development projects typically use 8-inch diameter PVC SDR 35 sewer pipe unless a larger size is required to convey the build out sewer flows.

The system is considered a separated sewer system, meaning that it is designed to carry only sanitary wastewater. Storm and surface water are accommodated in other systems. The oldest sanitary sewers typically experience a high rate of infiltration and inflow (I/I), which is groundwater that leaks into the pipes (infiltration), and rainwater that flows directly into the sewer (inflow). The City has an ongoing I/I program and has installed rain stopper manhole lids, upgraded pipes and service laterals, and purchased data logging equipment to monitor sewer flows at the lift stations. The City is committed to replacing and/or sealing brick sewer manholes.

In 1942, a primary wastewater treatment plant was constructed near the City Business District and operated until 1978. In 1978, an interceptor was constructed along SR-305 connecting the City system to the Kitsap County conveyance system south of Poulsbo at Lemolo, where the wastewater is discharged to facilities owned by Kitsap County. The interceptor constructed in 1978 is referred to as the Central Interceptor. The County transports the wastewater to the CKWWTP near Brownsville via a series of pumping stations, force mains and gravity interceptors.

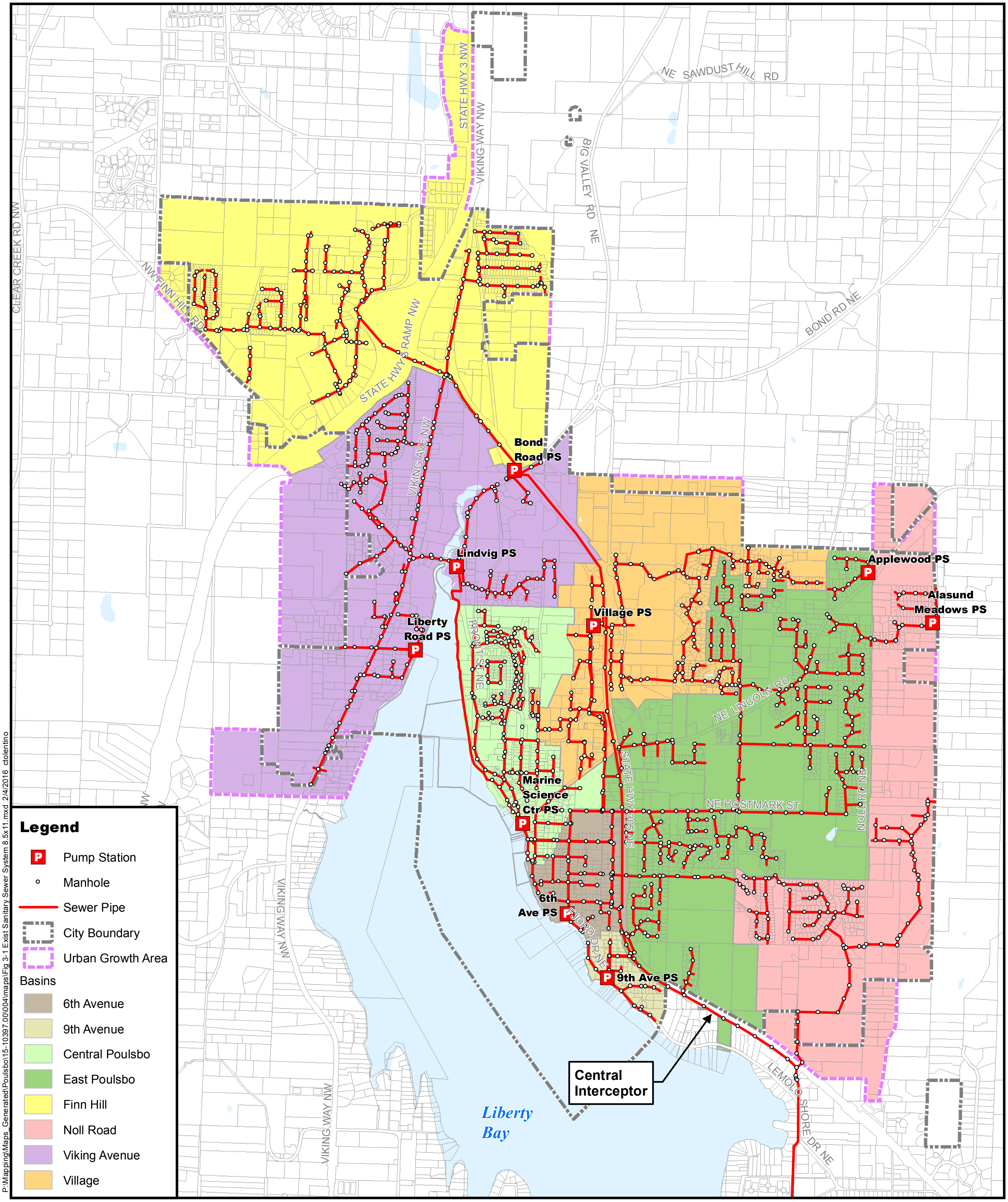
Several infrastructure upgrades have been made recently, or are in process, to the City's main trunk network, pumping facilities and Central Interceptor:

- A new force main was installed in 2006 to carry wastewater from the Olhava development to the Central Interceptor gravity main connection located at NE Tollefson Street.
- In 2007 a new lift station was constructed at the Bond Road/SR-305 intersection.
- In 2008 a new force main was installed from the Lindvig PS to the Bond Road PS and the existing 10-inch diameter 4,600 feet long force main along the beach was taken out of service.
- In 2015 the City upgraded the 6th Avenue and 9th Avenue pump stations as well as installed a new force main to the Central Interceptor.
- The Village and Liberty pump stations will be upgraded in 2016.

- In 2015 and 2016 the City has a plan to upgrade telemetry system in order to better monitor pump station flows, high level alarms, and run time. New high flow alarms, flow monitoring, and real time water surface level monitoring were installed in the Central Interceptor in 2015.
- The City continues surveying GIS mapping to help better maintain the sewer lines and to use as an asset management tool.

3.1 Collection and Conveyance System

The sewer system consists of approximately 42 miles of collection system main, nine wastewater pump stations, and a gravity interceptor connecting the City’s system with Kitsap County’s conveyance system. Table 3-1 summarizes collection and conveyance piping. Figure 3-1 illustrates the Poulsbo sewer collection system.



P:\Mapping\Maps_Generated\Poulsbo\15-10397.00\004\maps\Fig 3-1 Exist Sanitary Sewer System 8.5x11.mxd 2/4/2016 ctolentino

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County.

N W E S

0 1,250 2,500 Feet

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CITY OF POULSBO VIKING CITY

Existing Sanitary Sewer System

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
3-1

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Table 3-1 Sizes and Lengths of Gravity and Pressurized Pipe

Diameter of Pipe	Length of Pipe (Feet)	
	Gravity Sewer	Force Main
4-inch	-	6,200
6-inch	18,500	2,900
8-inch	160,000	3,700
10-inch	12,900	4,600[1]
12-inch	3,700	2,200
15-inch	1,700	0
18-inch	7,000	0
Total	203,800	19,600

Notes:
[1] 4,600' Unused FM on beach from Lindvig PS to MSC PS

The City's collection system is divided into eight drainage basins as shown on Figure 3-1. Basin boundaries are determined primarily by the topography. Six of the basins flow to a pump station at the low point in the basin. The Poulsbo East Basin, however, flows by gravity to the Central Interceptor. Figure 3-2 represents the sewer collection system schematically.

The following sections provide a general description of each basin. Information on sewer system condition and recommended improvements, basin maps and proposed upgrades, is provided in Chapter 4.

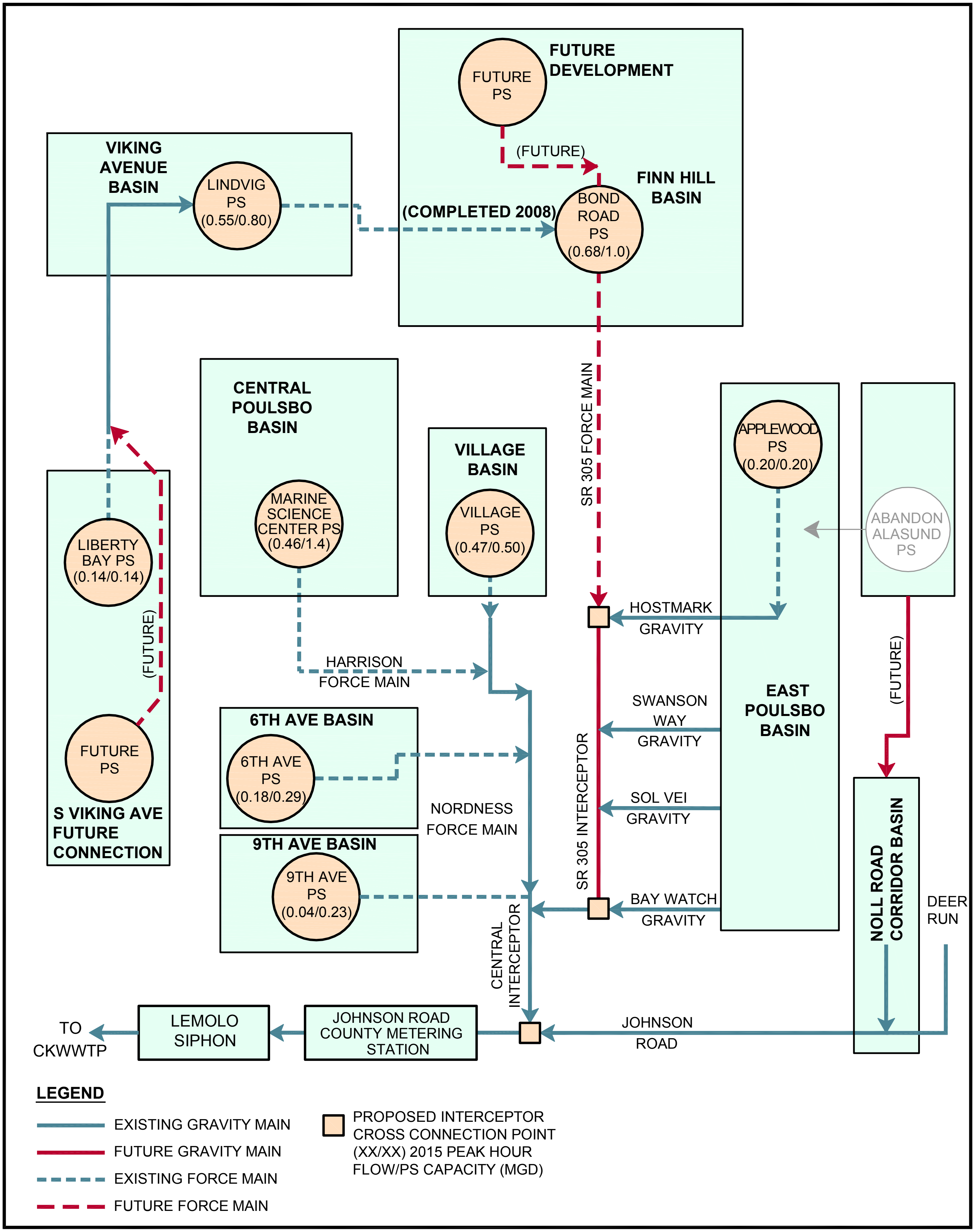
3.1.1 Viking Avenue Basin

This basin serves Poulsbo west of Liberty Bay from the south City limits to the commercial properties west of Viking Avenue. It is bounded by the SR-3 and SR-305 interchange to the north. The south Viking corridor fronts commercial properties and some high density residential properties along the water front. The wastewater from the properties on the west shore of Liberty Bay is pumped from the lower shore areas to South Viking Avenue by the Liberty Bay Pump Station. The area south of Finn Hill road is served by the trunk line on Viking Avenue, gravity flowing into the Lindvig Pump Station. The area north of Finn Hill is also served by the trunk line in Viking flowing south to the Lindvig Pump Station; this area includes Stendahl Ridge, some commercial, and large undeveloped medium and high density residential parcels. The Lindvig Pump Station conveys wastewater east on Lindvig and then north on Bond to the Bond Road Pump Station via an 8-inch force main constructed in 2008. The old Lindvig 10 inch diameter force main pumped wastewater along the beach to the Marine Science Center Pump Station but is not currently in use due to the new 8-inch diameter force main. This basin has growth potential in the form of some undeveloped residential properties along North Viking Avenue, South Viking Avenue, and redevelopment of the commercial property along South Viking Avenue.

3.1.2 Finn Hill Basin

This large basin includes commercial, residential, and light industrial developments. Vinland Pointe installed an 8-inch PVC sewer main which ties into the sewer on Urdahl road and through the Liberty Hill neighborhood. The sewer then flows into the system installed with the Olhava development which includes a mix of developed and vacant commercial properties. From Olhava the gravity main follows SR-305 south; at the intersection of SR-305 and Viking Ave NW a main connects from the north picking sewer up from the industrial developments along Viking as well as the residential communities of Summerset and Vetter Homestead. The gravity main eventually ties into the Bond Road Pump Station.

The Rose Master Plan, a planned community located just north of the intersection of Bond and SR-305, will utilize the constructed sewer extended across the intersection to Bernt Road. A low point within the southwest corner of this basin, at the intersection of Finn Hill road and Olhava Way, is not currently served by sewer and will likely need a small pump station. Growth is expected within the Finn Hill Basin primarily from the vacant commercial lots in Olhava, large undeveloped parcels in the north, and the Rose development. At this time, the sewer conveyance infrastructure within the basin can handle the increased flows for future development. The Bond Road Pump Station will require pump impeller modifications to increase the flow capacity for future development. Additional capacity upgrades will be required downstream along SR-305 in the Central Interceptor for the increased peak flows.



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CITY OF POULSBO VIKING CITY

Sewer System Schematic

City of Poulsbo
February 2016

Figure
3-2

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3.1.3 Central Poulsbo and Marine Science Center Basin

The Marine Science Center (MSC) pump station provides service to the central area of Poulsbo, including the downtown business area, the Port of Poulsbo, Waterfront Park, and the Poulsbo Place neighborhood. The MSC pump station is located off Front Street, immediately adjacent to the Marine Science Center. It pumps through a 12-inch force main south along the beach and then runs east along Harrison Street where it connects to the gravity system at the intersection of Harrison Street and 9th Avenue. System rehabilitation and I&I reduction through pipe bursting of the sewer trunk lines and replacement of side sewers was completed in 2008 which led to a large reduction of I&I flows in this basin. This basin is almost entirely built out and any new developments would be in-fill with a minimal increase of sewer flows.

3.1.4 Village Basin

This drainage basin, also referred to as the Poulsbo Village basin, collects commercial wastewater from the shopping and business centers along 7th Avenue NE and 10th Avenue NE south to NE Lincoln Road. The Village Basin includes residential and apartments along NE Iversen Street as far west as 4th Avenue NE, the Public Library and the City Public Works Facility. It also collects wastewater from a portion of Forest Rock Hills located on the hillside to the east of SR-305 via a deep gravity sewer line under SR-305 that connects to the Village pump station wet well at an elevation of 26-feet below ground surface. Wastewater is pumped from the Village pump station via a 6-inch force main south along 7th Avenue into the gravity sanitary sewer manhole between Lincoln Road and Hostmark Street that gravity flows south to the Central Interceptor. 30% growth is expected in the Village Basin from 2006 to 2036 as much of the Village basin area consists of wetlands and steep hillsides but it also contains large tracts of undeveloped commercial property. This basin experiences high levels of I/I following storm events and the City is currently undergoing smoke testing to find I/I entry points to the sanitary sewer.

3.1.5 6th Avenue Basin

Prior to 2001, this older established area south of Hostmark Street had been an area of significant infiltration. Most of the older mains and side sewers in this basin were replaced in 2000-2001 with a pipe bursting project, including some trunk lines off of 6th Avenue. The basin has a main trunk on 6th Avenue and side sewers from the residential areas on both sides of the street. The trunk line gravity flows to the 6th Avenue Pump Station. In 2015 the pump station and wet wells were upgraded and the force main realigned so that the wastewater is pumped up Matson Street via a 4-inch force main, connecting to the gravity sewer manhole on 9th Avenue and Tollefson Street. From there, wastewater is conveyed into the Central Interceptor located on SR-305. Very little growth is expected within this basin and any that occurs will be in-fill as the basin is almost entirely built out.

3.1.6 9th Avenue Basin

This older established area south and east of the 6th Avenue Basin contains many of the older sewer mains and side sewers in the City and is primarily residential. A new pump station rebuild in 2015 handles the wastewater from 9th Avenue as well as flows from Fjord Drive to the southern City limit. The pump station, located at the intersection of 9th Avenue and Fjord Drive, pumps wastewater via a 4-inch force main along 9th Avenue to Nordness Street, then southeast to a gravity sewer manhole located along the 18-inch trunk line on SR-305. From there, it then gravity flows to the Central Interceptor located on SR-305. Very little growth is expected within this basin and it will be primarily in-fill.

3.1.7 Poulsbo East Basin

This is a very large basin east of SR-305, extending to Noll Road and north of Lincoln to City limits. It already contains quite a few neighborhoods, the elementary, middle and high schools, commercial developments along SR-305, and has potential for even more growth. There is a single small pump station, the Applewood Lift Station, serving the Applewood development but the rest of the basin drains by gravity to the Central Interceptor at five different locations. Main trunk lines run down both Hostmark Street and Lincoln Road providing service to large areas. This basin is expected to grow as there are large undeveloped properties but the trunk lines have sufficient capacity and the single small pump station has capacity to serve the neighborhood.

3.1.8 Noll Road Basin

The area east of Noll Road extending to the City limits can be served by a new trunk line. This new main will be driven by growth within the basin and will be built as properties develop. Currently only Deer Run and Meredith Heights developments are using the Noll Road gravity main sewer line. One small developed residential area, Alasund Meadows on Noll, installed a lift station with their development but the plan is to abandon the lift station at the time when gravity sewer is available. The lift station currently pumps wastewater into the East Basin. In 2015 Mountain Aire Development extended the sewer approximately 4,500 feet completing 30% of the total sewer extension required to serve the basin. The remainder of the sewer main will be installed by the developers as their projects are approved and built. The gravity main drains to the Johnson Road Metering Station (JRMS). The Noll Road Corridor has potential for future growth and the existing sewer infrastructure is sized to handle the future residential growth.

3.2 Pump Stations

The City of Poulsbo currently operates and maintains nine pump stations located throughout the existing service area. They vary in size from approximately 0.1 to 1.4 mgd and are summarized in Table 3-2. The most current pump test data on file at the City is also shown in Table 3-2.

Table 3-2 Existing Pump Stations in 2015

Location	Design Flow (mgd)	Pump Data	Standby Power	Flow Metering
Liberty Bay PS 2015 numbers used; PS is currently scheduled for replacement in 2016	0.14	2 Pumps 7.5 HP 100 gpm @ 56 head (each)	Portable Generator Connection	No
Lindvig PS Rebuilt in 1999	0.8	2 pumps 60 HP Pump 1: 515 gpm Pump 2: 500 gpm	On-site Generator	Yes
Marine Science Center PS Pumps replaced in 2000	1.4	3 pumps Pump 1: 50 HP, 705 gpm Pump 2: 50 HP,725 gpm Pump 3: 30 HP, 383 gpm	On-site Generator	No
Bond Road PS Constructed in 2007 Capacity can be increased to 2.0 mgd by replacing pump impellors	1.0	2 Pumps 150 HP 700 gpm	On-Site Generator	Yes
Village PS 2015 numbers used; PS is currently scheduled for replacement in 2016	0.5	2 Pumps 20 HP 350 gpm @ 92' Head (each)	On-site Generator	No
Applewood PS	0.2	2 Pumps 10 HP 135 gpm @ 60' Head (each)	On-site Generator (located at Water Well)	No
Alasund Meadows PS	0.18	2 Pumps 15 HP 125 gpm @ 90' Head (each)	On-site Generator	No
9th Avenue PS Constructed in 2015	0.23	2 Pumps 15 HP 160 gpm @ 89' Head (each)	Portable Generator	Yes
6th Avenue PS Constructed in 2015	0.29	2 Pumps 25 HP 200 gpm @ 109' Head (each)	On-site Generator	Yes

The City's policy is to identify and implement the ultimate design of a collection and conveyance system and to eliminate proliferation of interim facilities and pump stations. In the future, all pump stations shall be designed according to Ecology and City standards and shall include flow meters, telemetry, generators, trash pump connections, and if necessary odor control.

3.3 Central Interceptor

The Central Interceptor located along the south side of SR-305 consists of a 12-inch force main connection from the Bond Road pump station to Harrison Street, a new 18-inch gravity main to Tollefson Street, and an older 18-inch gravity main along SR-305 to the Kitsap County manhole at Johnson Way. The Central Interceptor accepts gravity flow from the East Poulsbo Basin and pumped flow from the pump stations as shown in Table 3-3.

Table 3-3 Pump Station Discharge Location

Pump Station	Inflow Location
Village PS	South of Lincoln Street at 8th Avenue NE
Marine Science Center PS	At Harrison Street and 9th Avenue NE
Sixth Avenue PS	9th and NE Tollefson Street
Ninth Avenue PS	SR-305 and Nordness Place NE
Bond Road PS	NE Tollefson Street and NE Harrison Street at SR-305
Liberty Bay PS	Viking Ave NW and NW Liberty Bay Road
Lindvig PS	Pumps to Bond Road LS
Alasund PS	NE Kevos Pond Drive
Applewood PS	Pugh Road NE and NE Lincoln Road

The City of Poulsbo's Central Interceptor connects to the Kitsap County conveyance system at the intersection of SR-305 and Johnson Road, the location of Kitsap County's metering station. County conveyance facilities to the CKWWTP are summarized in Section 3.4. At this point, the Central Interceptor connects to a 24-inch gravity main, then to a 14inch force main. The force main continues south to the two 12-inch siphons at Lemolo, where it crosses under Liberty Bay to Keyport. Work is being done at Keyport which will be completed in 2016. Once completed, the siphon will discharge to a 30-inch gravity sewer draining south to Pump Station 67, where it is pumped southwest through a 16-inch force main to Pump Station 24. From Pump Station 24, it discharges through a 24-inch force main to the CKWWTP.

3.4 County Conveyance System

The City of Poulsbo's Central Interceptor connects to the Kitsap County conveyance system at the intersection of SR 305 and Johnson Road, the location of Kitsap County's metering station. At the Johnson Road metering station, the Central Interceptor connects to a 24-inch gravity main, then into a 14-inch force main. The force main continues south to two 12-inch siphons at Lemolo, where it crosses under Liberty Bay to Keyport. Work is being done at Keyport which will be completed in 2016. Once completed, the siphon will discharge to a 30-inch gravity sewer draining south to Pump Station 67. Flow will be transmitted from there southwest through a 16-inch force main to Pump Station 24. From Pump Station 24, it discharges through a 24-inch force main to the CKWWTP.

3.5 Wastewater Treatment

The City of Poulsbo has a contract with Kitsap County to allow for the treatment of the City's sewage at the CKWWTP. Details of the Agreement and Amendments No. 1 and No. 2 are discussed in Section 2.2.3 of this Plan. The full Agreement is included as Appendix C.

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Chapter 4 Sewer System Evaluation

4.1 System Evaluation

Evaluation of the existing system consisted of a review of previous work and documents, a conveyance system capacity assessment, and review of the City pump stations with maintenance staff.

4.2 Previous Conveyance System Capacity Assessment

4.2.1 1998 Hydraulic Model

The purpose of the 1998 hydraulic model was to identify capacity problems within the system. The Poulsbo sanitary sewer system was evaluated in 1998 using the HydraGraphics Software Package, Version 4.85 (HYDRA). The HYDRA model generates the sanitary flow using input diurnal curves, which represent the daily flow pattern of the service area. These diurnal curves are combined with the daily flow for a residence or other land use to create a sanitary hydrograph. This method creates realistic flow patterns within the system by having the ability to input the diurnal curves for individual service areas to reflect the service area characteristics, the system geometry, and the changing contributions the area encounters in the future. The model additionally accounts for time delays (detention) associated with moving the flows through the system. It then combines these hydrographs using the time delays to create the outfall hydrograph for the system. The output identifies peak hourly flow rates and percent capacity for the piping network.

The model was based on the 1991 HYDRA model prepared by R. W. Beck. The data from the previous model was transferred into the updated version of HYDRA. This information was supplemented with additional piping data provided by the City of Poulsbo Engineering Department and updated population data from the Planning Department.

From the 1998 analysis, it was determined that the majority of the sewer mains within the system are adequately sized for existing flows from tributary areas. The principle capacity problems identified by the 1998 analysis were the capacity of the Central Interceptor, as well as the Marine Science Center and Lindvig Pump Stations, to accommodate the peak hour flow (PHF). The deficiencies are listed in Table 4-1, along with action the City has taken since 1998.

Table 4-1 1998 System Capacity Deficiencies and City Action

Location	Problem	Action
Central Interceptor	7,160 lineal feet of sewer main potential to surcharge during peak hour flow.	Parallel interceptor has been constructed in SR-305. I&I has been reduced.
Marine Science Center Pump Station	Peak hour flow exceeds maximum pump station discharge rate.	Pumps upgraded in 2000 and 2007.
Lindvig Pump Station	Excessive pump cycling. Pumps undersized and wet well under sized.	Pump station rebuilt in 1999.
Inflow and Infiltration	Excessive I&I in basins tributary to the Marine Science Center, 9th Avenue, and 6th Avenue pump stations.	Extensive pipe bursting and replacement has been completed. Second I&I project has been designed.

4.2.2 2007 Capacity Evaluation

A supplemental capacity evaluation was performed as part of the 2008 CSP by Parametrix. The assumptions made in the 2007 capacity evaluation assumed an average annual flow rate of 75.6 gallons per capita per day (gpcd). Build out population was based on all vacant land being fully built out as allowed by existing zoning. A peaking factor of 4.0 was used to determine peak hour flow rates.

Current per capita flow rates are approximately 62 gpcd, and the peaking factor for the City as a whole is 4.05. A higher peaking factor may still be appropriate in pipe runs with smaller tributary areas. In comparing the system flows generated by these current rates and factors with those developed as part of the 2007 capacity analysis, the 2007 analysis is still assumed to be reasonable. As growth continues, it may need to be revised.

The purpose of the 2007 capacity assessment was to evaluate selected conveyance pipes that had been identified by the City as having potential capacity concerns due to recent or future growth or observed field surcharging conditions. Conveyance pipes in the following areas were evaluated:

- Finn Hill and Olhava area, particularly the sewer mains in the Olhava shopping district that are proposed to convey sewage from the Finn Hill housing areas located west of Olhava to the Bond Road pump station
- Sewer trunk line from Olhava to the Bond Road pump station
- Viking Avenue, both north and south of SR-305
- Caldart Avenue from a location approximately 200 feet north of Lincoln Street to Hostmark Avenue, and then down Hostmark to SR-305
- 8th and 9th Avenue mains between the Village pump station and the point where the main feeds into the new main recently installed in SR-305 at Harrison Avenue
- Noll Road, including an evaluation of providing a new sewer to serve the eastern boundary of the service area and an evaluation of the sewer main between Deer Run and the JRMS.

Appendix F provides additional detail on the capacity analysis including location of sewer mains. Based on the analysis, it is likely that pipe segments in several areas of the City are potentially deficient before 2018. A single pipe segment along Caldart Avenue NE in the Central Poulsbo basin marginally exceeds full build out flows, but may not be a concern with the current per capita flow rates. Capacity in the Viking basin is adequate with the exception of the Liberty Bay pump station, which will be expanded and is currently under design.

Conveyance pipes in the Finn Hill basin that have long-term capacity concerns are primarily due to future development so it may be appropriate for the future residential development outside of Olhava to fund conveyance capacity increases in this basin.

Based on the results of the capacity assessment, the following projects were added to the 2008-2014 CIP included in the 2008 CSP:

- Finn Hill basin near Wal-Mart, Pipe Run 18. Increase 246-ft of 8-in diameter pipe to 10 or 12-in diameter. This is a developer driven project and will be included in the 20-year CIP.
- Finn Hill basin on Bond Road, Pipe Run 94. Increase 70-ft of 8-in diameter pipe to 10 or 12-in diameter. This is a developer driven project and will be included in the 20-year CIP.
- Viking basin. Liberty Bay pump station. Increase capacity from 100 gpm to 180 gpm. This project is currently under design in 2016.

4.3 2015 Capacity Evaluation

Based on an assessment of recent growth patterns, previous capacity evaluations, and recently observed system capacity concerns, three new collection system facility evaluations were conducted as part of this CSP update.

4.3.1 Central Interceptor Evaluation

The Central Interceptor was evaluated using a spreadsheet model with asbuilts from Washington State Department of Transportation (WSDOT). The City surveyed the rims and inverts of the manholes to confirm the elevations, although several inverts were not able to be measured because the manhole lids were jammed or locked. The flattest slope in the system is estimated to be 0.12 percent along an 18-inch run of pipe based on asbuilts from WSDOT, which correlates to a flowing full capacity of 2.35 mgd.

The Central Interceptor collects flow from most of the City’s collection system. The Alasund pump station is expected to be abandoned and replaced with a gravity sewer within the next 6 years, at which point all basins except Noll Road will discharge to the Central Interceptor. The existing peak hour flow rate is approximately 2.67 mgd, which exceeds the flowing full capacity of 2.35 mgd. The projected 2036 peak hour flow is 3.55 mgd.

The Central Interceptor is known to surcharge and has experienced flooding. As a result, the City has sealed the manholes prone to flooding. The main alternatives to increase capacity are to extend the Bond Road force main to bypass the Central Interceptor, or to construct a parallel gravity sewer to add additional capacity. The force main extension would reduce the 2036 peak hour flow through the flatter, more capacity limited section of the Central Interceptor to 2.41 mgd, which is slightly higher than the 2.35 mgd capacity, but with further I/I reductions, particularly in the Village Basin, will likely be reduced. As an alternative, a new parallel 18-inch gravity sewer could be installed, which would double the capacity to 4.70 mgd. Spreadsheet capacity calculation information and opinions of probable cost for each improvement alternative are included within Appendices F and K.

An additional analysis of surcharging in the pipe was performed and is included as Appendix J.

WSDOT is considering widening SR-305 and may require the City to relocate the interceptor, but this also represents an opportunity to construct new sewer facilities. The City's preferred alternative to alleviate capacity deficiencies, extending the Bond Road force main, is included within the Chapter 7 CIP.

4.3.2 Village Basin Evaluation

The Village Basin drains to the Village Pump Station via 8-inch gravity sewers. Asbuilt elevation data for the gravity sewers were not available, so the capacity was reviewed assuming pipes were installed at minimum slopes based on DOE Criteria for Sewer Works Design ("orange book") recommendations.

The basin is known to have I/I issues. City staff has indicated that there is a rapid increase in flows after rainfall, indicating that inflow is a problem. The City will perform smoke testing in 2016 to determine where the inflow is coming from and how to resolve it.

Peak hour flow projections were developed by the City, and are estimated to be 327 gpm under existing conditions and 500 gpm in 2036. These calculations are included in Appendix L. Although the City calculated a more conservative 2036 peak hour flow of 648 gpm, due to stormwater issues in the basin they do not anticipate the basin to be fully built out, and therefore a more realistic flow of 500 gpm is used for planning purposes.

The 8-inch sewers draining to the Village Pump Station have a minimum assumed capacity of 343 gpm. This exceeds the current peak hour flow, but is less than the 500 gpm 2036 peak hour flow. The pipe carrying the full basin flow to the wet well is approximately 100 feet, and it is likely that the pipes further upstream have sufficient capacity. Additionally, once the smoke testing is completed and I/I reduction projects completed, it is possible that the peak hour flows will be reduced to less than the capacity of the pipe. Therefore, it is recommended that no pipe upsizing be completed now but that City staff monitor the sewers upstream of the pump station for capacity issues.

The Village Pump Station pumps south through a 6-inch force main that discharges into a 10-inch gravity sewer at 8th Avenue NE just south of NE Lincoln Road. A 6-inch force main at 8 ft/s has a capacity of approximately 700 gpm, which is greater than the 2036 peak hour flow of 500 gpm. The downstream gravity system has sufficient capacity through at least 2036.

The Village pump station is currently under design for rehabilitation. It will have a capacity of 500 gpm to support new development within the basin.

4.4 Pump Station Field Evaluation

The City of Poulsbo currently owns and operates nine sanitary sewage pump stations. Over the last several years, the City has, or is in the process of, invested in capital improvements at several of these facilities. As part of this CSP update, BHC conducted site visits and interviews with maintenance staff at each pump station, assessing structural and equipment condition as well as recent repair and maintenance records. Recommendations for additional improvements have been derived from this field work. The results of the site observations are summarized in Table 4-2 and the following sub-sections. Photographs are included as Appendix G.

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Table 4-2 Existing Pump Station Recommendations

Pump Station	Pump Station under Design in 2016	Pump Station under Construction	Install Fall Protection/Maint. Access System	Wet Well Mechanical/Structural Hardware Replacement	Wet Well Coating/Patching Needed	Submersible Pump Removal – Install Lifting Chains	Mechanical/Electrical O&M Manual Updates	Air/Vac Assembly Maintenance	Control Hardware Training	Regular Valve Exercising	Consider City Standards	Other Recommended Improvements
Liberty Bay	x											Larger diameter wet well
Lindvig			X	X	X		TBD	TBD	X	X		Inspect/service generator, structural/electrical building inspection due to building movement, grind concrete lip tripping hazard around wet well, more frequent flow measurement, electrical building ventilation inspection
Marine Science Center				X		N/A	TBD	TBD	X	X		Inspect/replace pump check and gate valves, install dry well sump pump, discuss parking stall access obstructions, control modifications to optimize pump run times, secondary containment for diesel fuel barrel
Village	x		X			N/A	TBD	TBD	X	X		Inspect/service generator and pumps, secondary containment for diesel fuel barrel, inspect/replace pump check and gate valves, add safety screen at dry pit, use temporary submersible pump wet well cleaning
6th Avenue		x	X	N/A	N/A	X	X	TBD	X	X	X	Provide ventilation for electrical building
9th Avenue		x	X	N/A	N/A	X	X	TBD	X	X	X	
Alasund Meadows			X	X		X	TBD	TBD	X	X		Control modifications to eliminate station failure potential in backup power mode and reduce ragging issues, relocate junction boxes outside wet well, valve vault lacks drainage
Applewood			X	X	X	X	X	TBD	X	X	X	Major rehabilitation or station replacement recommended
Bond Road			X			N/A	X	X	X	X		Control modifications to eliminate station failure during brownout, service/replace Pump No. 1 suction isolation valve, add flex couplings to reduce strain on PVC air release/vacuum valve piping, replace seal water pumps, develop trash pump standard operating procedure, install motor spreader bar for easier removal

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4.4.1 General Recommendations

City of Poulsbo operational staff are knowledgeable and diligent in performing operations and maintenance duties associated with the collection system. The following general recommendations for all pump stations are made recognizing the labor and equipment resource limitations of that staff, as well as the deficiencies inherent to the aging infrastructure at some of the pump stations:

- Identify locations of all air/vacuum valves on pump station force mains and confirm they are operating properly. Perform manufacturer's recommended service/inspection of valve (i.e. remove and inspect float mechanism and seat, back flush with clean water, etc.).
- Request operation and maintenance (O&M) manuals for existing electrical and mechanical equipment from local vendor/representatives and/or equipment manufacturer. O&M manuals are missing, lacking information, and/or difficult to follow for several of the pump stations.
- Request services of the applicable equipment vendor or representative to conduct training sessions at pump stations with Human Machine Interface (HMI) devices for all O&M staff that may be required to review and/or change settings and alarms for the operating equipment.
- Install lifting chains for deeper submersible pumps, attach chain to pump, and affix to a hook near the wet well hatch. All materials (chain/cable/hook, etc.) shall be constructed of type 316 stainless steel. Lifting chain options (i.e. chain or cable/chain and "grip eye") shall be reviewed and selected with O&M staff at each station and should consider station depth and accessibility.
- Inspect and replace all hooks, supports, carabineers, concrete anchors, strain relief grips, and other appurtenances in wet well with type 316 stainless steel materials as appropriate.
- Install a fall protection system at each pump station wet well that requires regular inspection. Fall protection system should consist of a hinged safety grating or retractable safety net. Fall protection safety into the wet well can be maintained during routine inspection and maintenance activities for O&M personnel when the wet well hatch is open.
- Develop and implement a valve exercise program to regularly inspect and exercise isolation and check valves (including buried valves) to confirm acceptable operation. Identify, prioritize, and replace/rehabilitate valves as necessary.
- Develop City standard lift station criteria such as equipment preferences and manufacturers, coatings, material grades, fall protection, ladder accessibility, etc. to ensure future pump stations are constructed with similar minimum requirements.

4.4.2 Liberty Bay Pump Station

Description

The Liberty Bay pump station serves a portion of the Viking Avenue Basin. It collects wastewater from the south Viking Avenue area and pumps it to the Lindvig pump station. This small 0.14 mgd pump station currently has two 7.5 hp pumps mounted at grade above a 48-inch diameter wet well.

General Comments

The south end of the basin is expected to experience significant development (low and high density residential). Expansion of the pump station will be required to increase capacity from its current limit of 100 gpm, to 180 gpm (0.26 mgd).

Recommendations

There is visible infiltration at the influent sewers which worsens during high tides. There are problems with the pump priming system. There is a crack in the suction piping in the wet well. The Liberty Bay Pump Station is scheduled for replacement to resolve these issues and increase capacity. Design is ongoing. The new station is intended to include submersible pumps in an 8-foot diameter wet well.

4.4.3 Lindvig Pump Station

Description

This pump station serves much of Poulsbo west of Liberty Bay, including the commercial district along Viking Avenue and the Olhava housing along Viking Ave. It accepts wastewater from the Liberty Bay pump station. This pump station discharges to the Bond Road pump station. This 0.8 mgd pump station was reconstructed in 1999 and has two 60 HP submersible pumps, with space for a third pump, in a 9-foot diameter wet well.

General Comments

The 1999 rebuild provided excess pumping capacity, room for expansion, flow metering, variable speed pumping, and emergency power generation.

A new force main was constructed in 2007 along Bond Road to the new Bond Road pump station. The force main avoids the unstable hillside and pipeline along the beach and reduces flow to the Marine Science Center pump station. The force main is 8 inches in diameter and approximately 2,400 feet long.

Recommendations

The recommended improvements to the pump station are:

- Inspect and replace support accessories in wet well with type 316 stainless steel materials as appropriate, see general recommendations Section 4.4.1.
- Request services of manufacturer's representative to inspect and service generator. O&M staff has observed coolant issues and generator shutting down on over temperature.
- The uncoated pump discharge and drain pipe in the wet well is corroding and will continue to corrode. The rate of corrosion should be monitored and the corroded pipe replaced with epoxy coated pipe and type 316 stainless steel bolts and nuts in the future.
- Install wet well fall protection system, see general recommendations Section 4.4.1.
- Train O&M staff on HMI devices, see general recommendations Section 4.4.1.
- Patch inside walls of wet well where there is visible infiltration.
- The electrical building has multiple cracks in the concrete walls and floor, the structure has shifted likely as a result of a past nearby water main break. Electrical panels and conduit appear to be strained in some locations due to the building movement. The structure and electrical equipment should be inspected by a structural and electrical engineer and recommendations considered and implemented as appropriate.

- Concrete lips between the wet well and adjacent concrete/asphalt can create a trip hazard when the wet well hatch is open, these should be trimmed/grinded flush to eliminate potential trip hazards.
- Consider recording flows at regular intervals since the pump station is equipped with a flow meter.
- Inspect and replace ventilation system components as necessary (i.e. louver/exhaust fan) in electrical building to maintain acceptable temperatures for electrical equipment. O&M staff says the doors are left cracked open to prevent the cabinet over temperature light from coming on when ambient temperature exceeds approximately 80 degrees. MCC panel doors should be closed. Clean filter on MCC panel door to increase air flow.

4.4.4 Marine Science Center Pump Station

Description

This 1.4-mgd pump station serves the Central Poulsbo Basin. The station has three pumps (two 50 hp and one 30 hp) located in a below-grade dry well adjacent to an 8 foot diameter wet well. This station pumps wastewater via a 12-inch force main to the Central Interceptor.

General Comments

The station is in fair condition. In 2000, the pumps were replaced and in 2007 check valves were replaced. Since the Lindvig pump station was redirected to the Bond Road pump station, no increase in pumping capacity is required.

The recommended improvements to the pump station are:

- Add flow metering to the central alarm location
- Relocate and improve the receiving manhole at the end of the force main
- Replace pump discharge gate valves (3 total, City has valves).
- Install sump pump in pump station dry pit (City has sump pump).
- Inspect and rehabilitate pump discharge check valves, as necessary (3 total).
- Train O&M staff on HMI device (see general recommendations Section 4.4.1).
- Parking/access at pump station is difficult for O&M staff. Consider reviewing agreement with the Marine Science Center and discussing a permanent parking stall for O&M staff.
- Flows to the station have decreased as a result of no longer receiving flows from Lindvig pump station. Review operational strategy to optimize pump alternation, cycling, and run time based on size and age of existing pumps and more recent flow conditions.
- Manhole rungs in wet well are heavily corroded and appear to be unsafe for use. O&M staff should be cautioned. Entry shall follow confined space requirements and appropriate fall protection equipment and harnesses should be used.
- Provide secondary spill containment for diesel barrel.

4.4.5 Village Pump Station

Description

This pump station serves the businesses along 7th Avenue and the residential developments along the hillside east of SR-305. This 0.5 mgd pump station has two 20 hp dry pit pumps serving an extremely deep (38 feet) wet well. This station pumps wastewater via a 6-inch force main to the Central Interceptor at SR-305 near Lincoln Road.

General Comments

The pump station is extremely deep because it collects the flow from the gravity sewer on Forrest Rock Drive, which goes underneath SR-305.

Recommendations

Pump station upgrades are currently in design phase. The recommended improvements to the pump station are:

- Provide secondary spill containment for diesel barrel.
- Request services of manufacturer's representative to inspect and service generator. O&M staff have observed leaks in the water pump.
- Request services of manufacturer's representative to inspect and service pumps, and/or pump station design engineer for current design phase. O&M staff says pump no. 2 sounds like it loses prime and dry runs and then pump no. 1 will turn on, however, wet well level and pump submergence is the same for both pumps.
- Replace pump discharge gate valves and rehabilitate or replace pump discharge check valves. O&M staff indicate gate valves will not shut and pump no. 1 check valve leaks.
- Add safety screen at pump station dry pit hatch to provide fall protection when reading pump run time.
- City trash pump is limited to approximately 25 feet of suction lift; the wet well is approximately 30 feet in depth. During routine wet well cleaning, recommend using a portable submersible solids handling pump to fully draw down the wet well for full cleaning and inspection.

4.4.6 6th Avenue Pump Station

Description

This pump station serves the residential area south of the Central Business district. This 0.29-mgd pump station has two 25 hp self-priming pumps located above grade in a small building located in a playground. Wastewater is pumped via a 6-inch force main to the Central Interceptor.

General Comments

Provide ventilation for electrical building.

Recommendations

This pump station was replaced in 2015.

4.4.7 9th Avenue Pump Station

Description

This pump station serves a residential area at the south end of Poulsbo. This small 0.23-mgd pump station has two 15 hp pumps located below grade in a "can" pump station. Wastewater is pumped to the Central Interceptor.

General Comments

This pump station was replaced in 2015.

Recommendations

This pump station was replaced in 2015.

4.4.8 Applewood Pump Station

Description

This small 0.2 mgd pump station serves a small housing development in the Poulsbo East Basin. Two small pumps located above a small wet well pump wastewater via a 4-inch force main to a manhole that connects to a gravity main in Caldart Avenue, which ultimately leads to the Central Interceptor in SR-305.

General Comments

This station serves very few homes and runs for only a couple of hours a day. Emergency power is provided from a generator at a nearby water system facility.

Recommendations

The recommended improvements to the pump station are:

- Pump station should be fully replaced/rehabilitated. All mechanical, structural, electrical, and instrumentation including but not limited to submersible pumps, guide rail system, level measurement, electrical equipment and shed structure, discharge piping and valves, and valve vault should be replaced. Provided alternative siting for the pump station is not feasible or desired, the existing wet well could be rehabilitated and reused. The top slab with integral access hatches should be replaced with a new concrete top slab with integral, large aluminum access hatch. All interior surfaces of the wet well should be coated with an appropriate epoxy or polyurethane coating system to protect the concrete from the corrosive environment and extend the life of the structure. The valve vault should be replaced with a larger, more accessible concrete vault to house the new pump isolation and check valves, and flow meter if desired.
- Relocate telemetry antenna to prevent regular trimming of trees if feasible.
- Electrical engineer should determine if automatic transfer to generator power is feasible for the replaced/rehabilitated pump station to eliminate current operations that require manual transfer of power at the nearby water tank site by O&M staff.
- Secure pump station site with fencing if vandalism is a concern.

4.4.9 Alasund Meadows Pump Station

Description

This small 0.18-mgd pump station serves several housing areas located east of Noll Road. Two 15 HP pumps delivers wastewater via a 4-inch force main to a gravity main in Noll Road that flows east to the Poulsbo East Basin.

General Comments

This pump station uses a power converter to transform locally available power to 230 volts, making the system somewhat unreliable. However, this pump station will be abandoned once the new Noll Road gravity main is installed.

Recommendations

There are no recommendations, other than to construct the new Noll Road gravity trunk main, for this pump station. The pump station will be abandoned upon completion of the gravity main. However, if the Noll Road gravity main is not installed, then a new 230 volt power service should be installed in order to eliminate the power converter.

4.4.10 Bond Road Pump Station

Description

This pump station serves the Finn Hill Basin, which includes Olhava and the Olympic College annex, as well as the Liberty Bay and Lindvig pump stations.

General Comments

This pump station rehabilitation was recently completed and is in excellent condition.

Recommendations

The recommended improvements to the pump station are:

- O&M staff note that during a brownout (partial utility service power loss), the pump station will not operate because it is not receiving utility power and the generator still thinks there is power, so it will not turn on. O&M staff have to manually turn off the utility service so the generator will turn on to power the station. This issue should be reviewed by an electrical engineer and electrician to troubleshoot and correct the issue such that power can be automatically transferred to the generator during a brownout.
- Service and/or replace isolation valve on pump no. 1 suction piping. O&M staff says it will not fully close.
- Add restrained flexible rubber couplings in PVC piping to alleviate vibration and strain on the piping. O&M staff said the PVC pipe cracked and flooded the station in the past, likely from pump vibration as it is directly connected to the discharge of the pump.
- Replace damaged seal water pumps to utilize the air gap tank per the original design.
- Request O&M manuals for motor lubrication, see general recommendations Section 4.4.1.
- Train O&M staff on Human Machine Interface (HMI) devices, see general recommendations Section 4.4.1.
- Develop a standard operating procedure for set up and operation of the permanent standby trash pump. Set up with all O&M staff present that may be required to install and operate. Take pictures to document correct installation for future reference. Document time to setup and discuss methods for reducing setup time. O&M staff indicate the trash pump is turned on and run dry on a monthly basis. The standard operating procedure shall include a full set up and wet run operation at regular intervals (i.e. yearly).
- Purchase a spreader bar to more easily attach to and remove the pump motor.
- Review as-built drawings and O&M manuals with a pump station engineer to educate O&M staff of the standard functions and maintenance requirements of the existing pump station components.
- Locate and service air/vacuum valves on pump station force main, see general recommendations Section 4.4.1.
- Install fall protection system at pump station wet well, see general recommendations Section 4.4.1.

4.5 Basin by Basin Summary

The following summary sheets (Tables 4-3 through 4-9) and map figures (Figures 4-1 through 4-7) summarize the improvements recommended to the existing system and present future methods for providing service to areas currently undeveloped and unsewered.

The term "Proposed" is used to refer to capital improvement projects that are in design and intended to be completed within two to four years. The term "Future" is used for sewer system extensions that are presented here only as a concept of how developers may service an area currently undeveloped and unsewered. No "Future" projects are considered as capital improvements.

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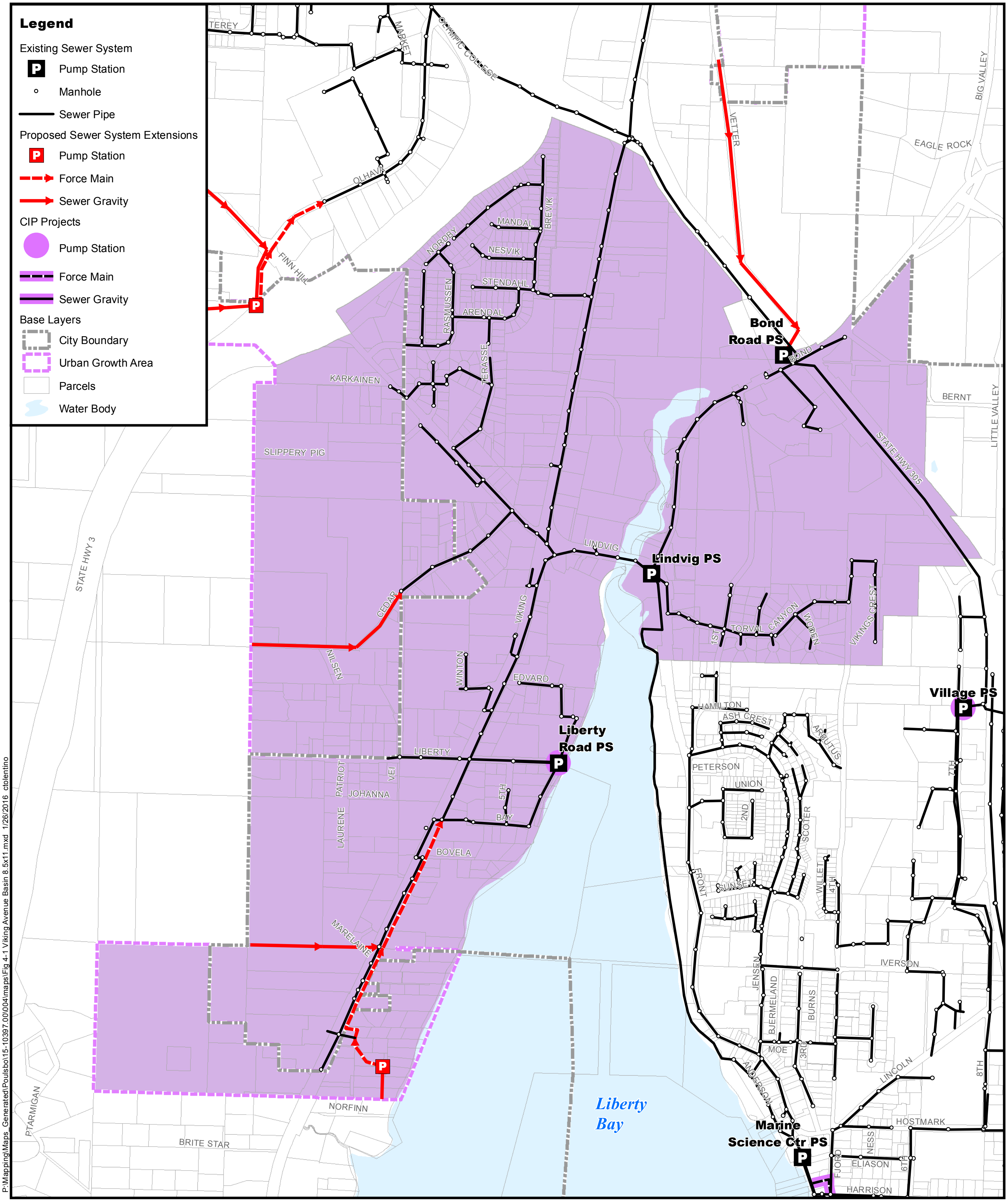

P:\Mapping\Maps_Generated\Poulsbo\15-10397.00\004\maps\Fig 4-1 Viking Avenue Basin 8.5x11.mxd 1/26/2016 ctolentino

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CITY OF POULSBO VIKING CITY

Viking Avenue Basin

Comprehensive Sewer Plan
City of Poulsbo
August 2016

Figure
4-1

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Table 4-3 Viking Avenue Basin – Descriptive Information

Size:	708 acres
Percent Developed:	71 Percent
Zoning:	• Low Density Residential (55 Percent) • Medium Density Residential (5 Percent) • High Density Residential (15 Percent) • Commercial (15 Percent) • Parks (10 Percent)
This basin serves all of Poulsbo west of Liberty Bay, including the commercial district along Viking Avenue. It also serves the portion of Olhava and Finn Hill Road located south of SR-3. Most of the wastewater flows by gravity to the Lindvig Pump Station. A small pump station (Liberty Road Pump Station) collects wastewater adjacent to the bay and lifts it up to the gravity main in Viking Avenue. The Finn Hill basin wastewater now flows through this basin directly down SR-305 to the Bond Road pump station.	

Facilities	Comments and Recommended Improvements
1. **Lindvig Pump Station:** This 1.4-mgd variable speed submersible pump station was reconstructed in 1999. It has two submersible pumps in a 9-foot-diameter wet well. Space for a future third pump exists.	1. Minor rehabilitation such as replacement of corroded components, fall protection system, fixing cracks, and replacing ventilation system.
2. **Force Main:** Wastewater is pumped from the Lindvig Pump Station to the Bond Road Pump Station via an 8-inch force main.	2. No new work needed.
3. **Liberty Road Pump Station:** This small 0.2-mgd pump station has two 7.5-hp Smith and Loveless vertical nonclog pumps mounted at grade above a 48-inch-diameter wet well.	3. Pump station replacement is currently in design phase.
4. **Collection System:** Wastewater is pumped to Viking Way then flows by gravity to the Lindvig PS.	4. I/I investigation with smoke test and TV inspection of the collection system. I/I improvements as necessary.
5. **Future Extension:** The undeveloped areas of this basin can generally be served with gravity sewer extensions and one small pump station.	5. A new small pump station at Anderson Lane will be required to lift sewage up to the gravity line in Viking Avenue.

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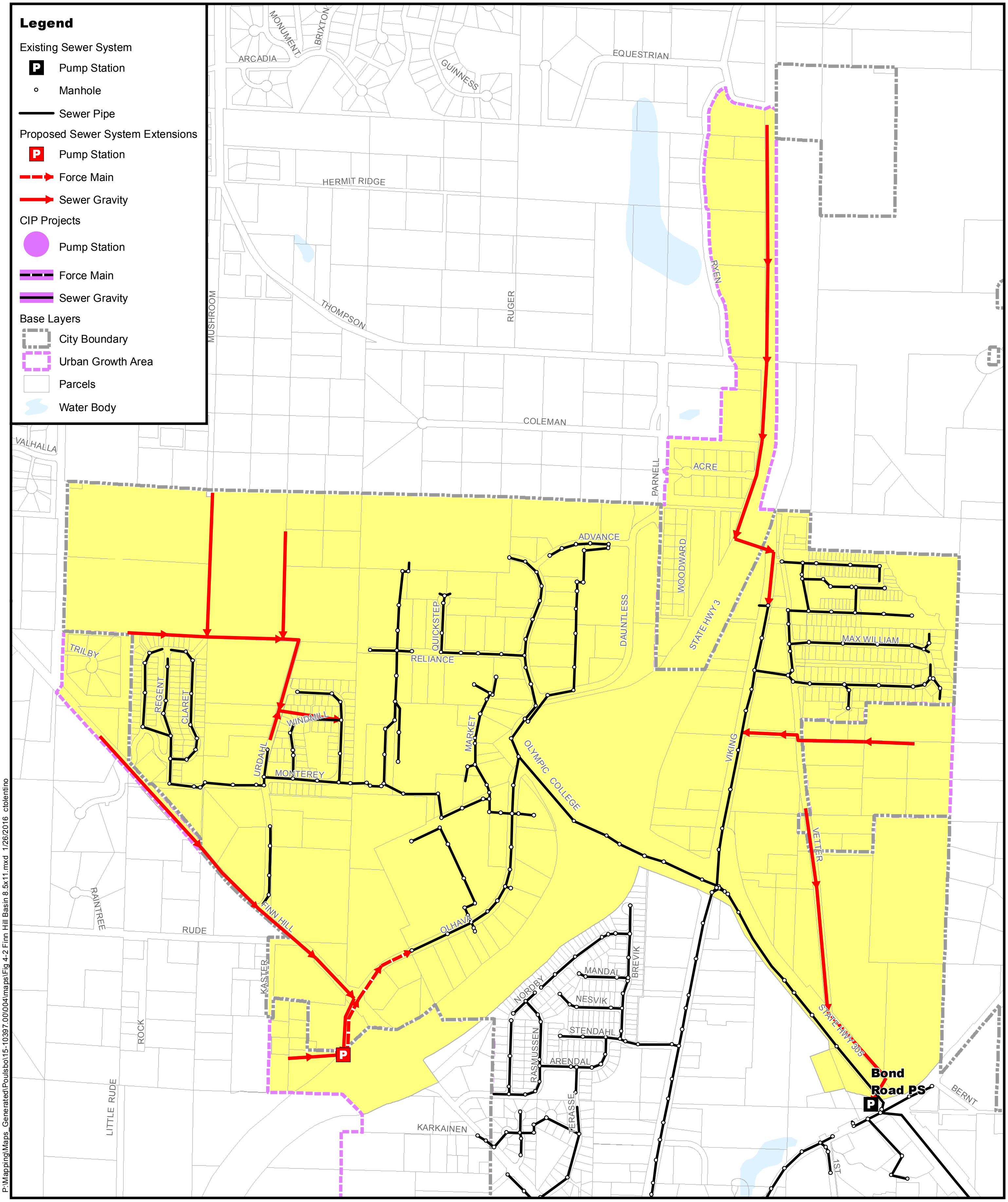

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Finn Hill Basin

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure **4-2**

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Table 4-4 Finn Hill Basin – Descriptive Information

Size: **Percent Developed:**	766 acres 27 Percent
Zoning:	• Low Density Residential (45 Percent) • Medium Density Residential (15 Percent) • Commercial (25 Percent) • Light Industrial (15 Percent)

A large portion of this basin is occupied by the Olhava project. Land west of Olhava, on either side of Finn Hill Road, can be served either by this basin or by the Lindvig Basin. To prevent overloading the distribution system to the Lindvig Basin, flow will generally be directed through this basin to the new Bond Road Pump Station. The Bond Road Pump Station directs flow to the Central Interceptor via a new force main in SR-305.

Facilities	Comments and Recommended Improvements
1. **Bond Road Pump Station:** This pump station was constructed in 2007.	1. Minor rehabilitation.
2. **Force Main:** A new 12-inch HDPE force main was constructed in SR-305 from Bond Road Pump Station to Hostmark Street.	2. No improvements or upgrades planned.
3. **SR-305 Interceptor:** Tollefson Street to Kitsap County metering station accepts flow from Bond Road Pump Station and most of the East Poulsbo Basin.	3. Install Bond Road force main extension to increase capacity.
4. **Existing Gravity Sewers:** Existing gravity sewers near Wal Mart and the Bond Road Pump Station have inadequate capacity to support full build out in the basin.	4. Increase capacity in identified segments. Funding to be provided by Developers.
5. **Future Gravity Sewers:** The entire basin will be served by gravity sewers to the new Bond Road Pump Station.	5. Gravity sewers will be provided by Developers.
6. **Future Pump Station:** Construct a new pump station at the low end of Finn Hill and a new force main from this pump station to the gravity sewer in A Street in front of Wal-Mart.	6. Pump station will be provided by Developers.

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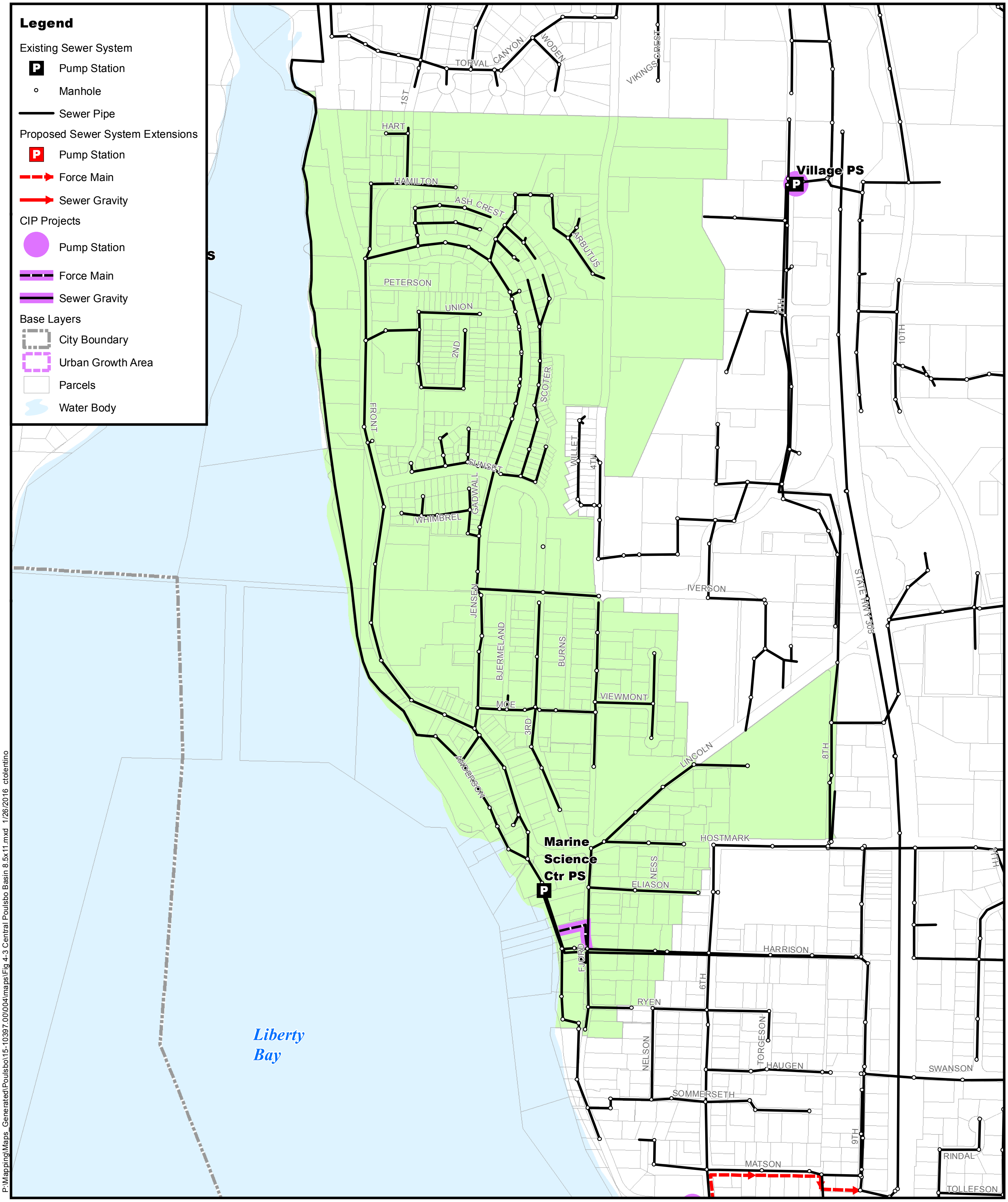

P:\Mapping\Maps_Generated\Poulsbo\15-10397.000\004\maps\Fig 4-3 Central Poulsbo Basin 8.5x11.mxd 1/26/2016 ctolentino

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Central Poulsbo Basin

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure **4-3**

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Table 4-5 Central Poulsbo Basin – Descriptive Information

Size:	238 acres
Percent Developed:	100 Percent
Zoning:	• Low Density Residential (25 Percent) • Medium Density Residential (5 Percent) • High Density Residential (35 Percent) • Commercial (15 Percent) • Parks (20 Percent)

The Marine Science Center Pump Station provides service to the central area of Poulsbo, including the downtown business area. The Marine Science Center Pump Station is located just off Front Street, immediately adjacent to the Marine Science Center. This station pumps the flows from the drainage basin to the Central Interceptor through a 12-inch force main.

Facilities	Comments and Recommended Improvements
1. **Marine Science Pump Station:** This pump station has three vertical nonclog pumps in a below-grade dry well adjacent to an 8-foot-diameter wet well. An on-site generator is located in the enclosure above the pumps. In 2000, the City replaced the pumps with larger 50-hp pumps and one 30-hp pump. Limitations to the wiring prevent installing three 50-hp pumps.	1. Minor rehabilitation and operation changes.
2. **Pump Station Discharge Main:** The 12-inch discharge force main runs along the beach and then up Harrison Street to the Interceptor.	2. Reroute the force main along Fjord Dr to Harrison Street to minimize breaks and discharge along the beach.
3. **Gravity Collection Sewers:** The sewers in this basin are the oldest in the system. Many of the lines had failed and have been replaced using pipe bursting techniques or total sewer replacement. Some additional sewer replacements are still required.	4. Most collection sewers and side sewers have been replaced. Lincoln Avenue is perhaps the notable exception which remains to be replaced. Previous reports set the I&I rate at over 12,000 gpm. The I&I has been almost eliminated.

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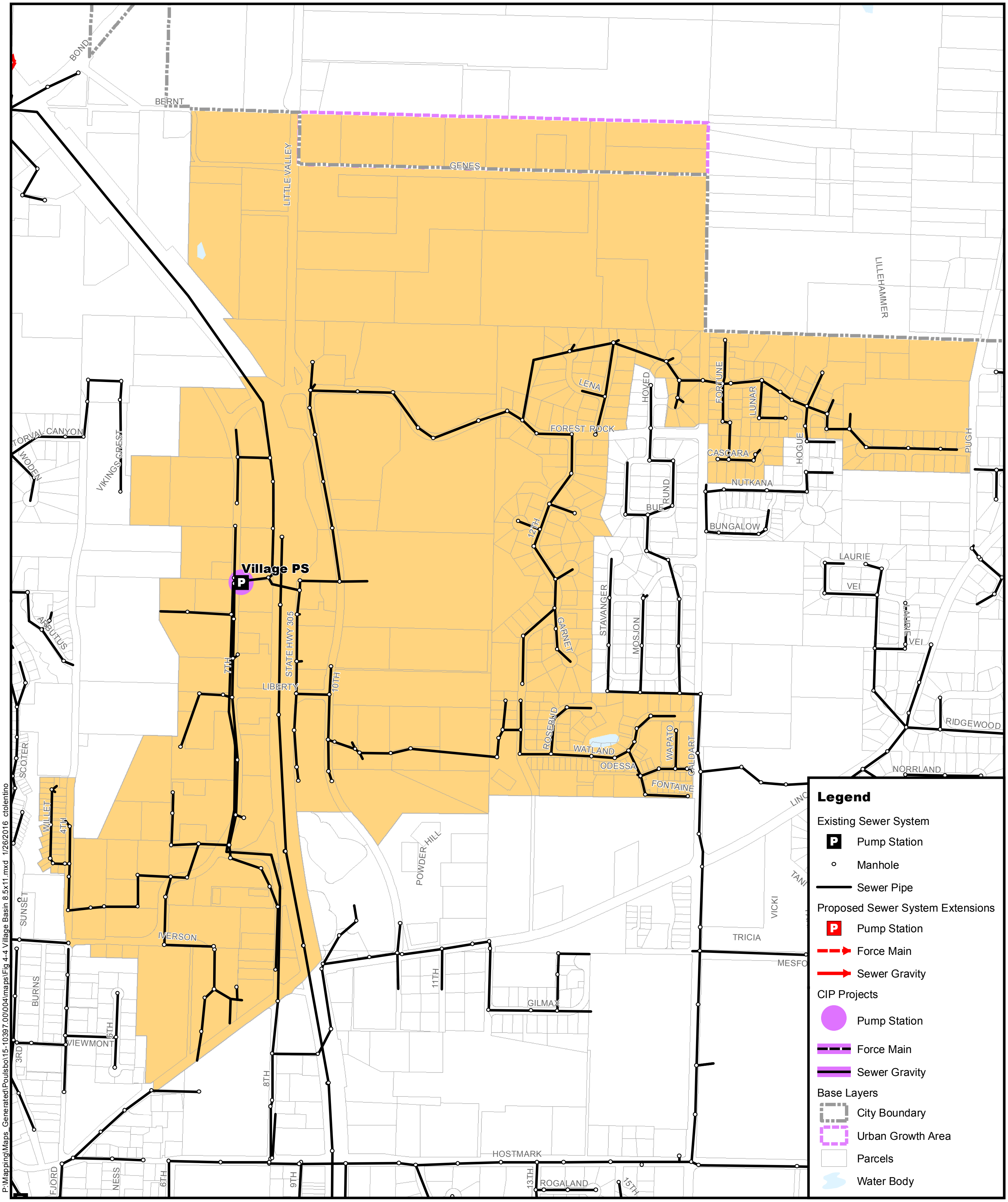

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VIKING CITY

Village Basin
Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
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Table 4-6 Village Basin – Descriptive Information

Size:	389 acres
Percent Developed:	61 Percent
Zoning:	• High Density Residential (8 Percent) • Low Density Residential (40 Percent) • Commercial (45 Percent) • Light Industrial (3 Percent)
This drainage basin, sometimes referred to as the Little Valley Basin, collects commercial wastewater from the shopping and business centers along Seventh Avenue and SR-305. It also collects wastewater from the residential neighborhoods located on the hillside to the east of SR-305. Wastewater is pumped from the Village Pump Station via a 6-inch force main south along Seventh Avenue into the Central Interceptor between Lincoln Road and Hostmark Street.	
Facilities	**Comments and Recommended Improvements**
1. **Village Pump Station:** This 0.5-mgd pump station contains two 20-hp vertical dry pit pumps below grade. The wet well is extremely deep. The electrical panel has been located above grade. There is an on-site generator.	1. Pump station rehabilitation/replacement is currently in the design phase.
2. **Force Main:** 6-inch force main going south on Seventh Avenue to the beginning of the Central Interceptor.	2. No recommendations.
3. **Gravity Collection Sewers:** Most sewers in this basin are well-constructed PVC pipes. Infiltration is within normal guidelines. Any development in this basin will be infill.	3. Smoke test and TV inspect basin for I&I identification.
4. Future pump station relocation could eliminate extreme depth.	4. Pump station relocation will depend on the future extension of 7th Avenue and budgetary limitations.

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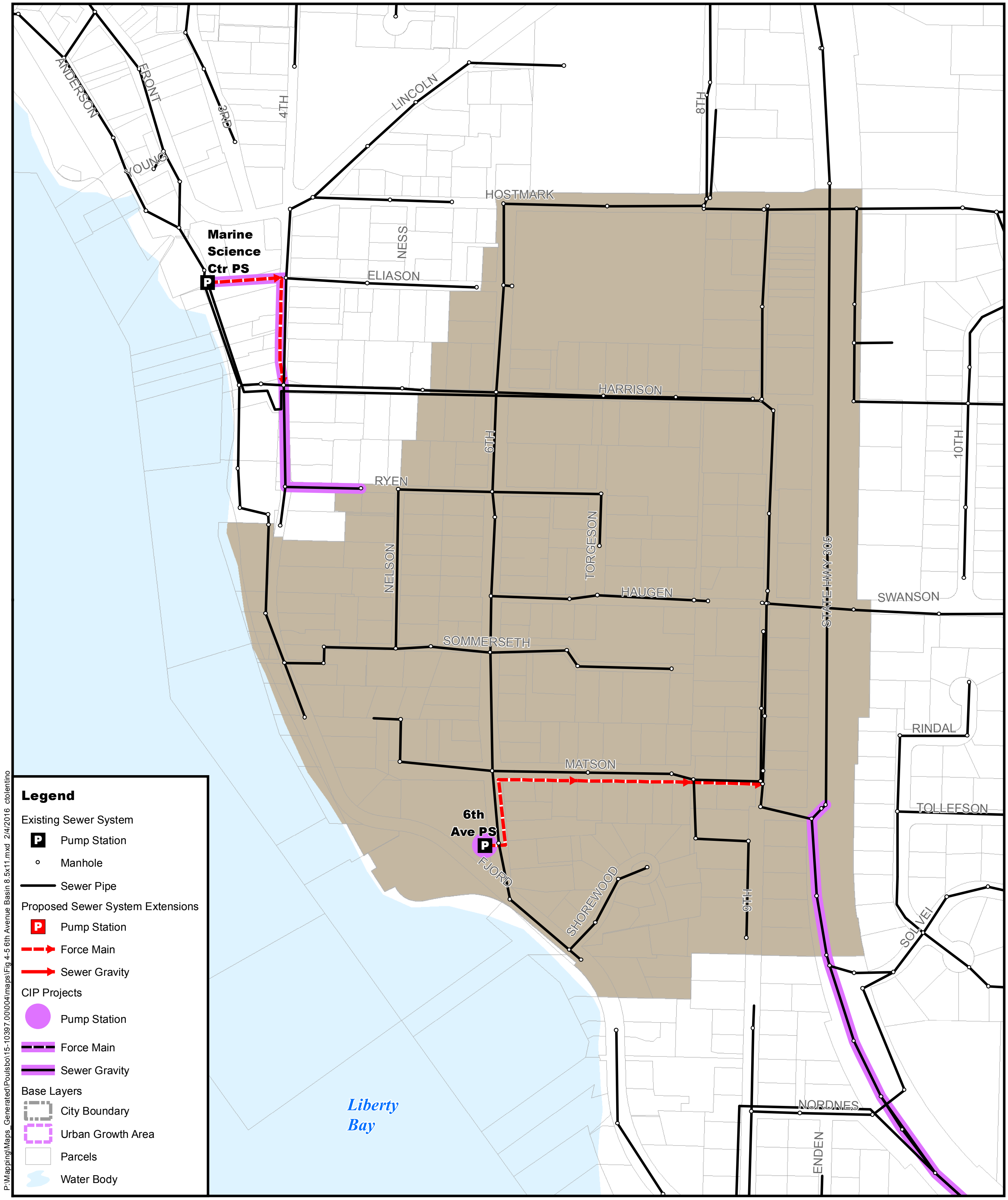

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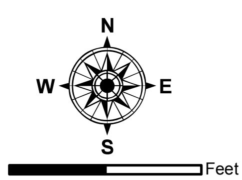

6th Avenue Basin

Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
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Table 4-7 Sixth Avenue – Descriptive Information	
Size: 88 acres **Percent Developed:** 95 Percent **Zoning:** • Low Density Residential (85 Percent) • High Density Residential (10 Percent) • Commercial (5 Percent)	
The Sixth Avenue pump station collects and conveys wastewater from Sixth Avenue south of Hostmark Street via a 6-inch force main along Matson Street to the Central Interceptor located on SR-305. Almost all of the mains and side sewers in the Sixth Avenue Basin were replaced by pipe bursting in 2000.	
Facilities	**Comments and Recommended Improvements**
1. **Sixth Avenue Pump Station:** Pump station has two 15-hp self-priming pumps mounted in an aboveground building adjacent to the wet well. There is a connection for a portable generator. Rated capacity is 200 gpm. There is a 4-foot by 6-foot cast-in-place concrete wet well that has access from outside the building.	1. Pump station replacement is currently under construction.
3. **Sixth Avenue Force Main:** Force main along Matson Street discharges to the Central Interceptor in SR-305.	3. No additional work.
4. **Sixth Avenue Gravity Collection Sewers:** Original pipes failed and have been replaced using pipe bursting methods on main and side sewers.	4. No additional work.

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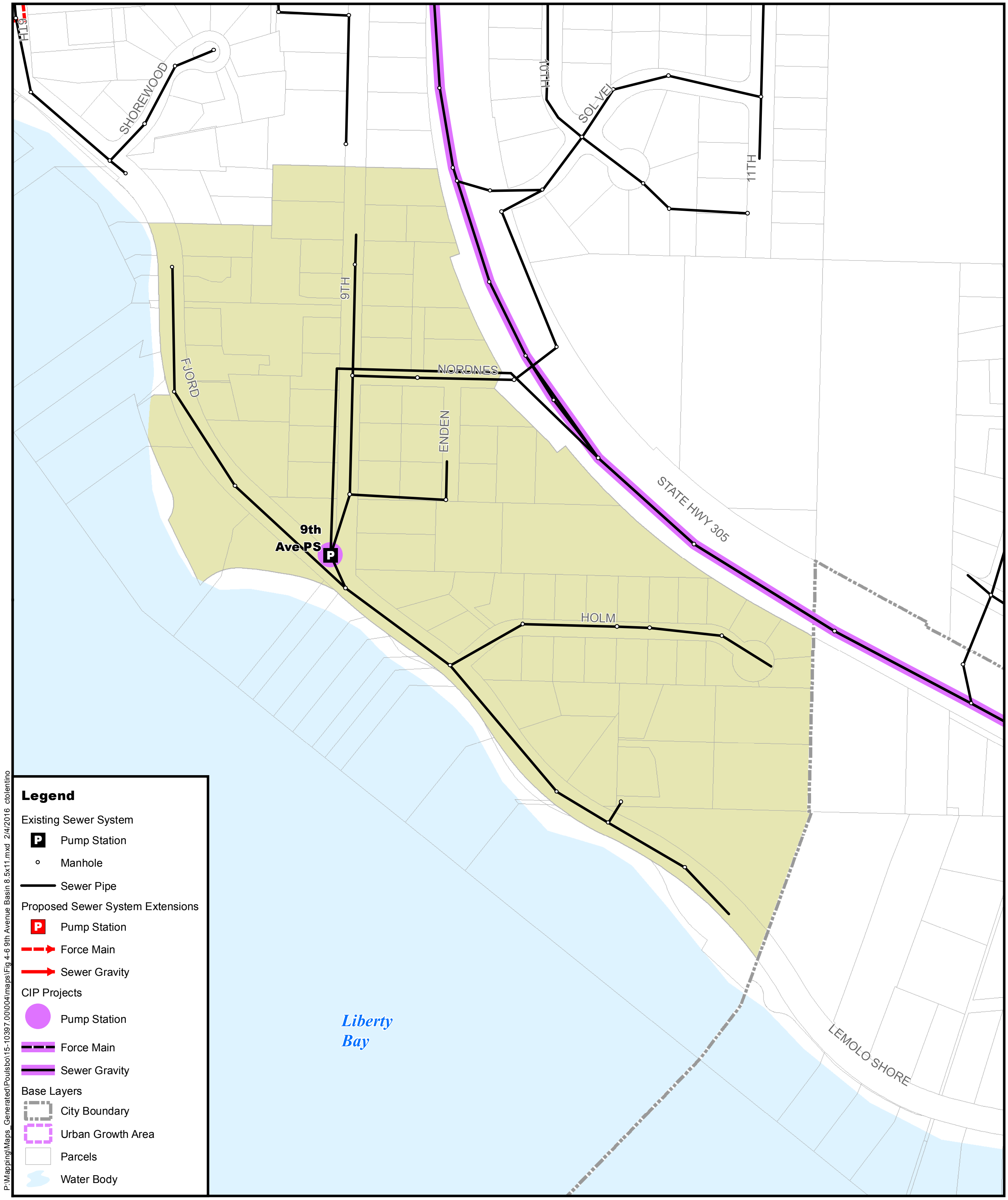

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CITY OF POULSBO VIKING CITY

9th Avenue Basin
Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure
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Table 4-8 Ninth Avenue– Descriptive Information	
Size: 59 acres **Percent Developed:** 80 Percent **Zoning:** • Low Density Residential (100 Percent)	
Ninth Avenue pump station collects and conveys wastewater from Ninth Avenues south of Hostmark Street via a 6-inch force main along Ninth Avenue and Nordness Street to the Central Interceptor located on SR-305.	
Facilities	**Comments and Recommended Improvements**
1. **Ninth Avenue Pump Station:** Vertical “can” pump station with two 15-hp submersible pumps. Replaced in 2015. Check valves and control panel directly above 4-foot-diameter wet well. Pump capacity is 160 gpm. Connection for portable generator.	
2. **Ninth Avenue Force Main:** Force main discharges to Central Interceptor in SR-305.	2. No additional work.
3. **Ninth Avenue Gravity Sewers:** Normal infiltration.	3. Smoke test and TV inspect sewers to determine the amount of I&I. Replace sewers and side services.

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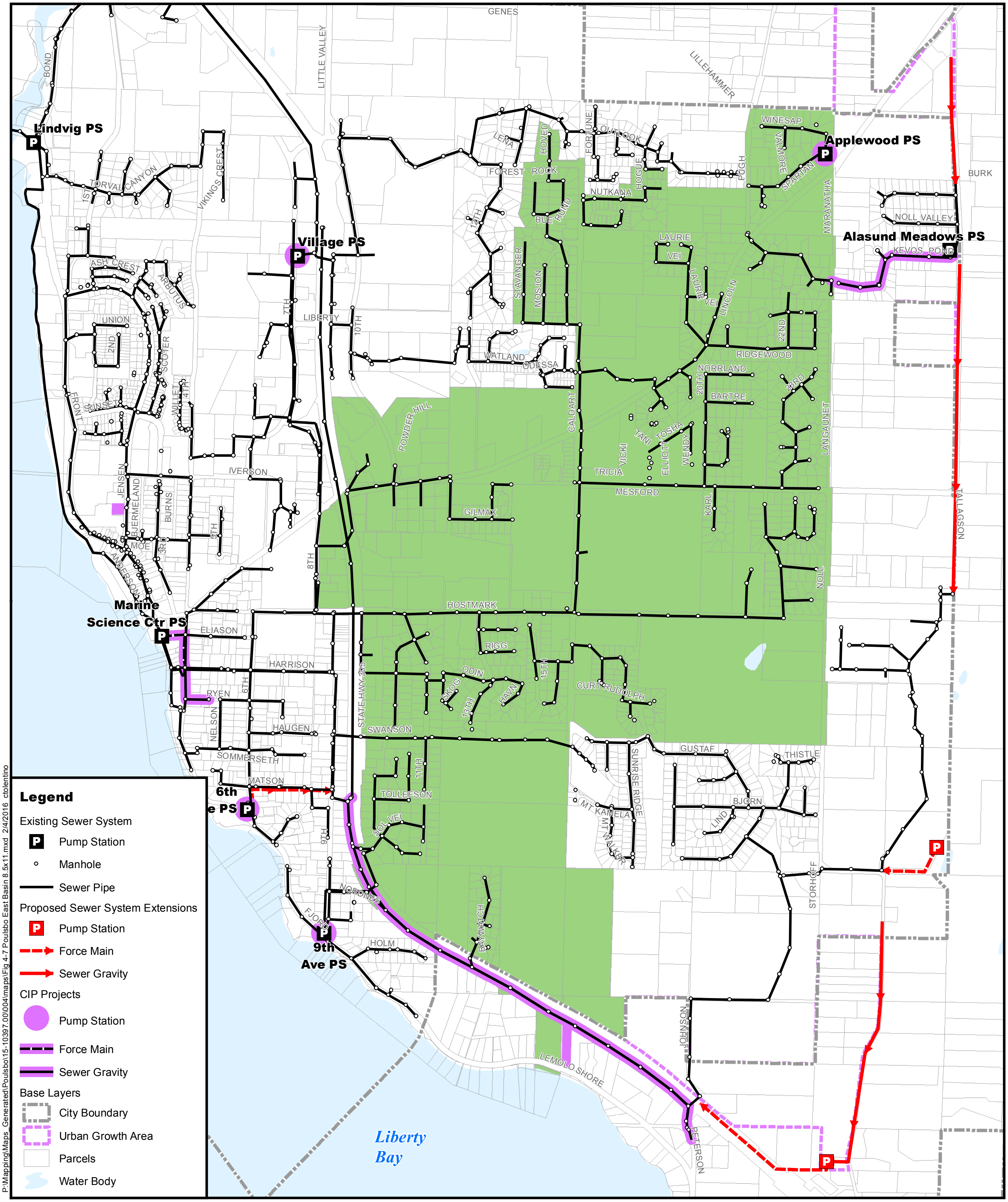

P:\Mapping\Maps_Generated\Poulsbo\15-10397.001\004\maps\Fig 4-7 Poulsbo East Basin 8.5x11.mxd 2/4/2016 ctolentino

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CITY OF POULSBO VIKING CITY

Poulsbo East Basin
Comprehensive Sewer Plan
City of Poulsbo
February 2016

Figure **4-7**

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Table 4-9 Poulsbo East Basin – Descriptive Information

Size: 773 acres
Percent Developed: 80 Percent
Zoning:
- Low Density Residential (80 Percent)
- High Density Residential (5 Percent)
- Parks (5 Percent)
- Commercial (10 Percent)

This large drainage basin has the potential for significant growth. The basin is located on the hill to the east of SR-305. The entire area drains by gravity to the Central Interceptor at five locations. The only exception is the Applewood area.

Facilities	Comments and Recommended Improvements
1. **Applewood Pump Station:** This small 0.2 8-mgd pump station serves a small housing development. It has two pumps with a total design capacity of 135 gpm. A water utility generator is used for emergency power. A small three-sided enclosure protects the electrical panels.	1. Pump station should be fully replaced/rehabilitated.
2. **Alasund Meadows Pump Station:** This small pump station will be abandoned after the Noll Road gravity main is installed.	2. Electrical system is deficient. Existing power feed requires a converter. Run new PSE service to pump station and perform other rehabilitation. Do not accomplish if Noll Road gravity main is imminent. Abandon after Noll Road gravity main is installed.
3. **Force Main:** 4-inch force main from Applewood PS to the Lincoln Road gravity sewer.	3. None
4. **Sewers enter the Central Interceptor at:** • Lincoln Avenue • Hostmark Avenue • Haugen Avenue • Sol Vei Way • Johnson Way	4. Establish program of I&I investigation with smoke testing and TV inspection.
5. **Caldart/Hostmark Mains:** Flows from the Applewood Pump Station discharge to the Caldart Avenue gravity main, which was replaced in 2001 with a 12-inch HDPE gravity main. This new 12-inch main flows into the 8-inch PVC line running down Hostmark to the Central Interceptor line in SR-305.	5. Replacement of the Caldart Avenue sewer in 2001 has eliminated maintenance problems in that line.

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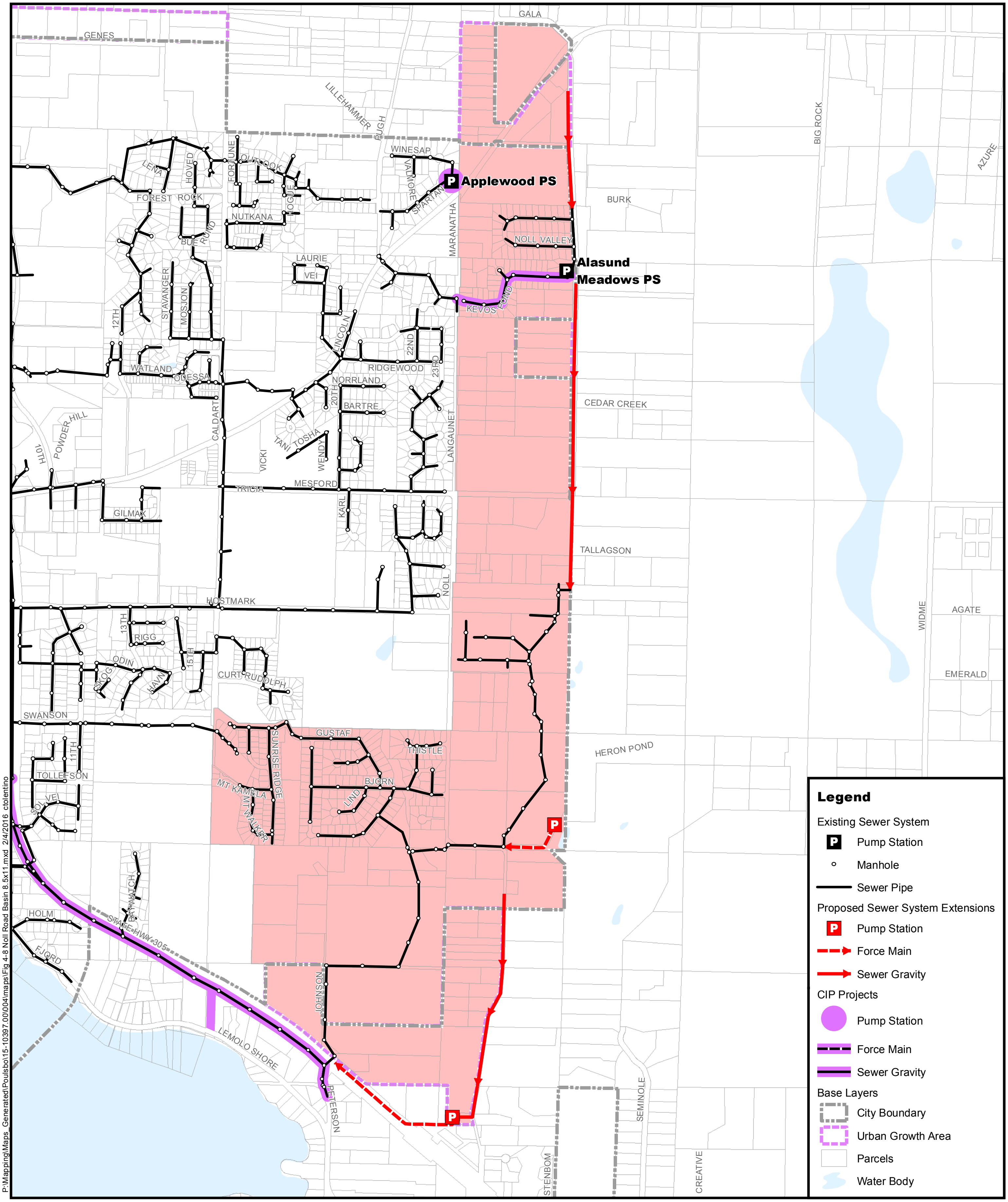

P:\Mapping\Maps_Generated\Poulsbo\15-10397.000\004\maps\Fig 4-8 Noll Road Basin 8.5x11.mxd 2/4/2016 ctolentino

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Noll Road Basin

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City of Poulsbo
February 2016

Figure

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Table 4-10 Noll Road Basin – Descriptive Information	
Size: 427 acres **Percent Developed:** 13 Percent **Zoning:** • Low Density Residential (100 Percent)	
Most of this drainage basin is undeveloped. This basin has the potential for significant growth, although some property will probably remain as small farms for some time. A future gravity main on Noll Road, which is situated in a natural swale, will carry wastewater south to a tie into the existing gravity system serving the Deer Park Development. From here, the wastewater flows to the Johnson Road Metering Station.	
Facilities	**Comments and Recommended Improvements**
1. **Noll Road Gravity Main:** None currently exists	1. Construct new gravity main along east edge of basin that ties into the Deer Park Collection system. This will serve the northern three fourths of the basin. Construct new gravity main in Noll Road leading to SR-305 to serve southern quarter of the basin. These gravity sewers will be provided by Developers.
2. **Pump Station and Force Main:** None currently exists	2. Construct new pump station at Noll Road and SR-350 intersection. Provide new force main to Johnson Road chlorination manhole. This pump station and force main will be provided by Developers.
3. **Alasund Meadows Pump Station**	3. Abandon and remove pump station after gravity main is installed.

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Chapter 5 Downstream Conveyance and Treatment System

The objective of the downstream conveyance and treatment evaluation is to ensure that adequate capacity is available within the Kitsap County conveyance and treatment system to meet the growth needs of the City.

5.1 Description of Downstream Conveyance and Treatment System

The City's sewer system currently discharges to the County's system at the metering manhole located at Johnson Road in Lemolo. At this point, the City's Central Interceptor connects to a 14-inch gravity/force main which continues south to the two, 12-inch diameter siphons at Lemolo that cross under Liberty Bay to Keyport.

Upgrades to County Pump Stations 16 and 67 on the other side of the bay are currently under construction, and include replacing the existing valve vault at the upstream end of the two siphons with direct bury valves, and sealing two manholes upstream to allow for higher head to accommodate higher flows through the siphon. On the downstream end, the siphon will be extended to a new 30-inch gravity sewer which will discharge to Pump Station 67, which is being rebuilt with a higher firm capacity. Pump Station 16 is being abandoned and is being replaced with a gravity sewer line to the Pump Station 67 wet well. The City has a contract with Kitsap County for treatment of up to 0.95 mgd average daily flow of wastewater at the CKWWTP. Based on the 2012 contract, included as Appendix C, the County bills the City using a 3-tier system for sharing in the cost of capital improvements whereby County system connection charges were collected by the City and passed through to the County. The agreement stipulates that the City contributes capital for its proportional share of these North Central Conveyance improvements, and pays their fair share of the required plant improvements on a system-wide basis.

Fixed costs consist of operation and maintenance of the CKWWTP, Pump Stations 67 and 24 that convey Poulsbo wastewater to the CKWWTP, and the Johnson Road chlorination and meter station. Variable costs are calculated based on amount of wastewater. Currently, this is 100% of facilities from the City system through the Lemolo siphon, 93.6% for PS 67, 45.6% to PS 24, and 15.83% of treatment costs.

5.2 Downstream Treatment Capacity

The CKWWTP has an existing maximum month treatment capacity of 6 mgd, which is adequate to accommodate City flows. The City will participate on a pro-rata basis of 15.83% for capital improvements needed at the CKWWTP. The CKWWTP will be able to accommodate Poulsbo wastewater flows over the planning horizon of this document.

5.3 Downstream Conveyance Capacity

The Lemolo siphon was evaluated as part of the Pump Station 16 and 67 Upgrades Lemolo Inverted Siphon Hydraulic Analysis memorandum prepared for Kitsap County dated July 24, 2013 by BHC Consultants (Lemolo Memorandum), and included as Appendix H. This memorandum recommended several upgrades to the Lemolo siphon and Pump Stations 16 and 67 that are under construction now and are expected to be completed in 2016.

As described in Section 5.1, upgrades to the siphon (direct bury valves, sealed manholes, new access ports for cleaning, and downstream conveyance and Pump Station 67 upgrades) will allow for higher head to accommodate higher flows through the siphon. For this CSP update, BHC performed conformational modeling of the siphon using MikeUrban, a dynamic sewer model, to identify the capacity of the siphon with the recent facility modifications. This model indicated a capacity in the siphon of 3.54 mgd without surcharging the gravity pipe at Johnson Road, which is insufficient to convey the projected peak hour flows 2036 flows of 3.86 mgd. The hydraulic profile from the model and previous Lemolo analyses are included in Appendix H.

5.3.1 Future Potential Capacity Upgrades to Existing Conveyance System

There are two projects that have potential to increase the capacity of the County's conveyance system, subject to additional engineering analysis and concurrence by Ecology. These improvements appear in County planning documents and are described in the following sections. The City will plan to continue discussions with the County concerning the necessity of these upgrades, for which Poulsbo's payment share is 100%, but these projects have been included within the CIP to occur between years 2021 and 2036.

Pipe Replacement at Johnson Road

The conveyance pipe from Johnson Road and State Route 305 leaves the JRMS in an 18-inch diameter reinforced concrete pipe (RCP). One hundred and seventy-five feet away the conveyance turns into a 14-inch diameter ductile iron pipe force main. This pipe connects into the two 12-inch diameter siphons under Liberty Bay. This 18-inch diameter pipe should be upsized to match the capacity of the upstream 305 interceptor improvements.

Improvements resulting from this action are based on preliminary analysis. A more comprehensive hydraulic and preliminary engineering analysis would need to be conducted of the siphon and conveyance system to evaluate and confirm the effects of this alteration.

Pipe Replacement Upstream of Lemolo Siphon

The Lemolo Memorandum included analysis of an alternative with the 14-inch pipe upstream of the Lemolo siphon upsized to 18-inches. The model showed that with a flow of 4.74 mgd no surcharging would occur. These upgrades are estimated to be needed in the next 20 year planning horizon, and it indicates that additional flows will be able to be accommodated without installing an additional siphon. An additional siphon for redundancy may still be desired, subject to the existing condition of the 14-inch gravity/force main.

5.3.2 West Side Conveyance Alternative

Constructing a new or supplemental conveyance system around the west side of Liberty Bay has been previously identified as a potential alternative to the continued use of the Lemolo siphon (Final Supplemental Environmental Impact Statement to the Final Environmental Impact Statement for the Central Kitsap County Wastewater Facilities Plan, 2000). These alternatives would eliminate or supplement the two Lemolo siphons by reversing the wastewater flow from Poulsbo to flow around the north end of Liberty Bay and then south along the west side of Liberty Bay to the CKWWTP located near Brownsville.

A Parametrix October 2007 Technical Memorandum included by appendix with the 2008 CSP first estimated the facilities and cost associated with this concept. As part of this CSP update, BHC has reviewed and refined this concept based on a general assessment of the pumping and conveyance facilities that would be needed given suggested routing and associated ground elevations. The total estimated project cost to reroute all wastewater along the west side of Liberty Bay is estimated to be approximate $36 million, excluding added refined costs that would be required for County facility conveyance to CKWWTP associated with a potential new connection point. In addition to the undefined modifications/improvements that would be required to the regional conveyance system, reconfiguration of substantial portions of the City's existing collection and conveyance system would be required. Refer to Appendix F for details on the west side conveyance alternative and costs.

Flow projections show that the current siphon system will have capacity until at least 2036, assuming a growth rate consistent with current City of Poulsbo Comprehensive Plan, and improvements upstream of the siphon can expand the capacity further. Since capacity is available through the 20-year planning horizon associated with this plan, the west side conveyance alternative concept remains a cost prohibitive alternative and is not included as part of facility planning. However, long range planning and future updates to the CSP should continue to consider the west side option if capacity or cost of the siphon system becomes unfavorable.

5.4 Planning for Long Term Conveyance Capacity

Based on the planned improvements described above, there will be sufficient capacity within the existing system to convey projected flows through the 20-year planning period. The City will coordinate with Kitsap County on potential long term alternatives to ensure that adequate downstream conveyance capacity for peak hour flows remains available. This will include continued refinement of the flow monitoring system and implementation of additional I/I projects. The schedule and cost for these projects, including engineering analyses of downstream conveyance components, are identified in the CIP presented in Chapter 7.

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Chapter 5 Downstream Conveyance and Treatment System

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Chapter 6 Operation and Maintenance Program

This chapter provides a description and evaluation of the City's operation and maintenance program and its ability to adequately manage and maintain sewer facilities.

6.1 General Organization

The Public Works Department (PWD) is managed by the Public Works Superintendent. Design, CIP implementation and sewer comprehensive plans and updates are managed by the engineering department. In addition to the sewer utility, the PWD also manages water, stormwater, and solid waste utilities as well as maintains the parks, streets, and public buildings. Public Works staff generally split their time between various duties, although a few operations and maintenance staff are fully dedicated to the sewer utility. Currently the PWD has 1.5 full time equivalent (FTE) field staff designated for sewer system O&M. The department seeks to add 1 FTE to meet department needs which include ongoing I/I monitoring and system maintenance. When additional manpower is required, PWD employees from other utility departments are required to complete the maintenance and operation work.

6.2 System Operation and Control

The City has a Supervisory Control and Data Acquisition (SCADA) system with a master terminal unit (MTU) control located at the Public Works maintenance facility. The MTU polls all system Remote Telemetry Units (RTU's) by radio telemetry. The system uses a maximum transmission unit graphical interface on a series of screens that allow the operator to view a variety of parameters at all lift station facilities. The system includes an error handling alarm system with automated dialer.

The lift station telemetry provides only informational input data. It does not allow the operator to remotely control or operate any lift station equipment. Additionally, the system does not provide any flow indication at any of the pump station sites. Remote flow metering would provide the ability to quickly identify and respond to sewer pipe breaks, and the City is working on an automated monitoring system.

6.3 Monitoring Procedures

The City maintains a Lift Station Monitoring System (LSMS) that provides a tool for the daily evaluation of the sanitary sewer lift station system for leaks, line breaks, pump failures, or other abnormalities. The LSMS is a manual data entry spreadsheet operating in Microsoft Excel. The pump run time for each pump is monitored and recorded daily in a Lift Station Log by a Public Works maintenance worker.

The LSMS is updated daily by the Utility Engineer using the recorded data in the Lift Station Logs. The LSMS spreadsheet consists of 19 tabs for data entry. There are two tabs for each of the nine pump stations, and one tab for recording the daily rainfall. The tabs are all interactive and worksheets are updated daily by the Utility Engineer. The LSMS plots a monthly graph for each lift station for the pump run time plotted along with the normal pump run time operational & alarm limits and daily precipitation amounts during that interval of pump run time. High pump time flow trends, pump problems, and data entry errors become very apparent when shown in graphical form. With the LSMS, I/I can be monitored between lift station basins for the wet season during and after large storms.

As data is being entered, the spreadsheet checks it against an historical range trend. If the data falls out of the trend, an alarm in the spreadsheet is triggered and the operator must either re-enter the data or add an explanation for why it is out of the historical range.

Trends are updated routinely, generally every 45 days. Evaluation of the spreadsheet graphs and other data are also accomplished routinely.

Although the system requires manual inputting of data, and manual evaluation, it does provide a means for identifying system failures, or, in the case of repairs such as I/I projects, system improvements.

6.3.1 Central Interceptor Monitoring

In 2015 sewer surface elevation and flow metering was installed in Manhole #311 of the Central Interceptor to monitor the trunk line's surface level and flow in real time to safeguard against sewer surface surcharging. In case of excessive surcharge or flow, alarms will notify the Utility Foreman, Services Foreman, and the Utility Engineer.

6.4 Emergency Procedures

The City completed an Emergency Operations Plan (EOP) in March 2008. The EOP identifies the authorities and responsibilities of the City during an emergency. This is not specifically tailored to the emergency response of the sewer system, but does provide a framework for organizing and executing a successful response to an emergency.

6.4.1 Pump Station Emergency Procedures

The City has developed an emergency procedures manual for each of the pump stations, included in Appendix I. The first section of the manual is a brief description of potential failures and what immediate action to take to correct the problem, such as a power failure stuck floats, or pump failures.

Each manual provides a call list for notifying key personnel in the County and State, as well as local emergency coordinators.

The manuals also provide technical information for each pump station. Types of pumps, depths of wet wells, high and low float levels for pump start and stops, and other useful data are summarized in the manual. Copies of forms that can be used to notify agencies of spills are also included.

6.4.2 Sewer Spill or Overflow Emergency Procedures

The City has developed Sewer Spill or Overflow Response Procedures, which includes a list of contact information for city employees, the Kitsap Public Health Department, the Department of Ecology, and State Department of Health. The Sewer Spill Emergency Response Policy/Procedure is included in Appendix I.

6.4.3 Central Interceptor Surcharge Procedure

In case of excessive surcharge or flow in the Central Interceptor, high water surface alarms will notify the Public Works Utility Foreman, Services Foreman, and the Sr. Utility Engineer. The Central Interceptor Surcharge Response is included in Appendix I.

6.4.4 Customer Complaint Response

The City responds to all customer utility complaints. Administrative staff generally receives initial customer contact where the complaint is taken. The Public Works Utilities Foreman is notified of all complaints and decides how to resolve the situation. If a complaint cannot be resolved by phone, staff will visit the customer and take appropriate action. Complaints that require an amendment of current City policies are reviewed by the City Engineer. All city policy modifications are to be approved by the City Engineer under supervision from the City Mayor.

6.5 Preventative Maintenance Program

Maintenance of the system is generally on an as-needed basis. Future upgrades of lift stations are included within the utility CIP before sewer capacity within the basin is reached. Facility components are repaired or replaced as they are damaged, worn out, or expended. The City performs regular inspections of system components to remove accumulated debris and sediment, and minimize potential spills, leaks, and complaints. The City video inspects sewers and side sewers to take corrective action. All new sewer main in developments is video inspected and reviewed by inspectors prior to acceptance by the City.

The desire to add an additional FTE in utility field staff is partially attributable to the desire to perform additional collection system preventative maintenance. The proposed duties of the added staff member might include some of the observations and general recommendations made in Section 4.4 Pump Station Field Evaluation, such as acquiring equipment manufacturers' data for a more complete O&M manual and implementing and performing regular valve exercising and cleaning programs,

6.6 I/I Assessment

The City has periodically performed smoke tests and TV assessment to evaluate potential I/I problems. The City has performed a recent I&I evaluation to locate lift station basins which show high I/I, see Appendix J. The results from the analysis will be used to plan future projects to reduce I/I. It is recommended that the City increase their routine I/I assessment and monitoring procedures as part of the on-going O&M program. This would include on-going systematic evaluation to identify and correct potential in-flow sources, and areas of significant infiltration. Refer to Section 7.3.1 for additional information on the annual inflow reduction program.

6.7 Design Standards

Section 3 of the City of Poulsbo Construction Standards provides details and standards for residential and commercial connection to the sewer system. The Construction Standards also include standard details and figures and is available on the City's website.

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Chapter 7 Capital Improvement Plan

This chapter presents the Capital Improvement Plan (CIP) for the six-year period 2017 to 2022, including future improvements and estimated costs for each project. Previous chapters evaluated future sewage flow projections and various aspects of the existing collection and conveyance system, and identified where improvements to the existing facilities and expansions of the system are necessary to provide adequate service to existing and future users. For long-term planning purposes, less critical capital improvements that are anticipated over the duration of the 20-year planning horizon (2023 to 2037) are also identified and incorporated within the CIP.

Projects are categorized as system upgrades, or system rehabilitation and maintenance. System upgrade projects are generally associated with expanding the system to meet the future sewage flows resulting from population and commercial expansion. Rehabilitation and maintenance projects are generally associated with repairing existing older components of the system, such as projects to reduce infiltration in downtown Poulsbo and to replace components in pump stations.

7.1 Recently Completed Projects

The City continues to maintain and upgrade their sewer facilities with capital projects. The following projects have recently been completed:

- The Bond Road force main included a new 12-inch force main between Bond Road and Harrison Street and a new 18-inch gravity main from Harrison Street to Tollefson Street. Both pipelines are located in SR-305 and were installed in conjunction with the SR-305 highway widening project. This new force main carries wastewater from the Olhava development, and caries all wastewater from Finn Hill and Viking Avenue areas.
- The Bond Road pump station delivers wastewater through the Central Interceptor main.
- The Central Poulsbo I/I Reduction project has reduced I/I in the sewer system.
- The 6th Avenue Pump Station force main resulted in the 6th Avenue and 9th Avenue pump stations no longer sharing a common force main.
- The Marine Science Center Pump Station has been repaired.
- The I/I Effectiveness and Downstream Capacity Engineering Study has been completed.
- The Sixth Avenue pump station upgrade was completed in 2015.
- The Ninth Avenue pump station upgrade was completed in 2015.

7.2 System Repair and Upgrades

Tables 7-1 and 7-2 summarize projects that provide repairs to pump stations, replace deteriorated piping systems, and install new infrastructure to allow for continued expansion of the service areas, and includes planning level opinions of probable project costs in 2015 dollars, and the schedule for construction. Table 7-1 summarizes City projects, and Table 7-2 summarizes County projects that Poulsbo will pay a portion of. The CIP schedule was developed with priority given to those projects needed to prevent or reduce risk of spill or leak, projects needed to repair existing facilities, and projects needed to serve future development. Consideration was also given for balancing the yearly project expenditures. These projects are described in more detail in Appendix I and in the paragraphs following Tables 7-1 and 7-2. City projects are shown on Figure 7-1.

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Table 7-1 City Sewer Capital Improvement Projects

CIP #	Project Name	2017 Project Costs	2018 Project Costs	2019 Project Costs	2020 Project Costs	2021 Project Costs	2022 Project Costs	Total 6-year Project Costs	2023-2037 Project Costs	2022-2036 Project Year
1	Annual Inflow Reduction Program[3]	90,000	180,000	180,000	180,000	180,000	180,000	990,000	180,000	Annual
2	Poulsbo Village Pump Station Upgrades[1]	500,000						500,000		
3	Harrison Force Main Replacement[1]	283,671						283,671		
4	SR-305 Force Main Extension[2]				200,000	2,610,000		2,810,000		
5	Liberty Bay Pump Station Improvements[1]	360,000						360,000		
6	Purchase and Demolition of Lemolo House[1]	350,000						350,000		
7	Public Works Facility[1,5]		120,000	120,000	120,000	120,000	120,000	600,000	120,000	Annual through 2030
8	Noll Road Sewer Improvements[1]		20,000	210,000				230,000		
9	Applewood Pump Station Replacement[2]		100,000					100,000		
10	Annual Pump Station Rehabilitation/Replacement[2,3]	50,000	50,000	50,000	50,000	50,000	50,000	300,000	50,000	Annual
11	Storage Facility[1]	500,000						500,000		
12	Old Town					100,000	100,000	200,000	100,000	Annual
13	Water Meter Replacement	175,000	250,000					425,000		
	Total City Sewer Capital Projects	**2,308,671**	**720,000**	**560,000**	**550,000**	**3,060,000**	**450,000**	**7,648,671**	**3,755,000**	

Notes:
1) Project costs generated by City Engineering Department.
2) Project costs generated by BHC Consultants, see Appendix I.
3) Annual/bi-annual allocation for continuing City sewer utility programs.
4) Project costs developed by Kitsap County; allocations included are based on City-obligated contractual percentages
5) Costs are for annual bond payments.
6) All CIP projects are in 2015 dollars.

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Table 7-2 County Sewer Capital Improvement Projects (Projected Poulsbo Cost-Share by Current Agreement)

CIP #	Project Name	2017 Project Costs	2018 Project Costs	2019 Project Costs	2020 Project Costs	2021 Project Costs	2022 Project Costs	Total 6-year Project Costs	2023-2037 Project Costs	2022-2036 Project Year	Poulsbo's percentage of project
1	Capital Facilities Charge for CK Plant(4)	133,000	133,000					266,000			15.83%
2	Kitsap County Pump Station #16 & 67 Replacement(4)		5,000,000					5,000,000			93.60%
3	Lemolo Capacity/Condition Improvements(1)	350,000			1,140,000	3,600,000		5,090,000			100.00%
4	CKTP Primaries and Aeration Tanks 5 & 6(4)					523,182		523,182	4,011,005	2024 (estimated)	15.83%
5	CKTP UltraViolet Disinfection Upgrade(4)		316,600					316,600			15.83%
6	CKTP Screw Press(4)			158,300				158,300			15.83%
7	CKTP Campus Buildings(4)						221,620	221,620	1,646,320	2022 (estimated)	15.83%
8	Lemolo Siphon Phase 2(4)	200,000	300,000					500,000	8,000,000		100.00%
9	Johnson Road Metering Station	450,000						450,000			
10	Sewer Plant Upgrade	5,000,000						5,000,000			
	Total County Sewer Capital Projects	6,133,000	5,749,000	158,300	1,140,000	4,123,182	221,620	17,525,102	13,657,325		

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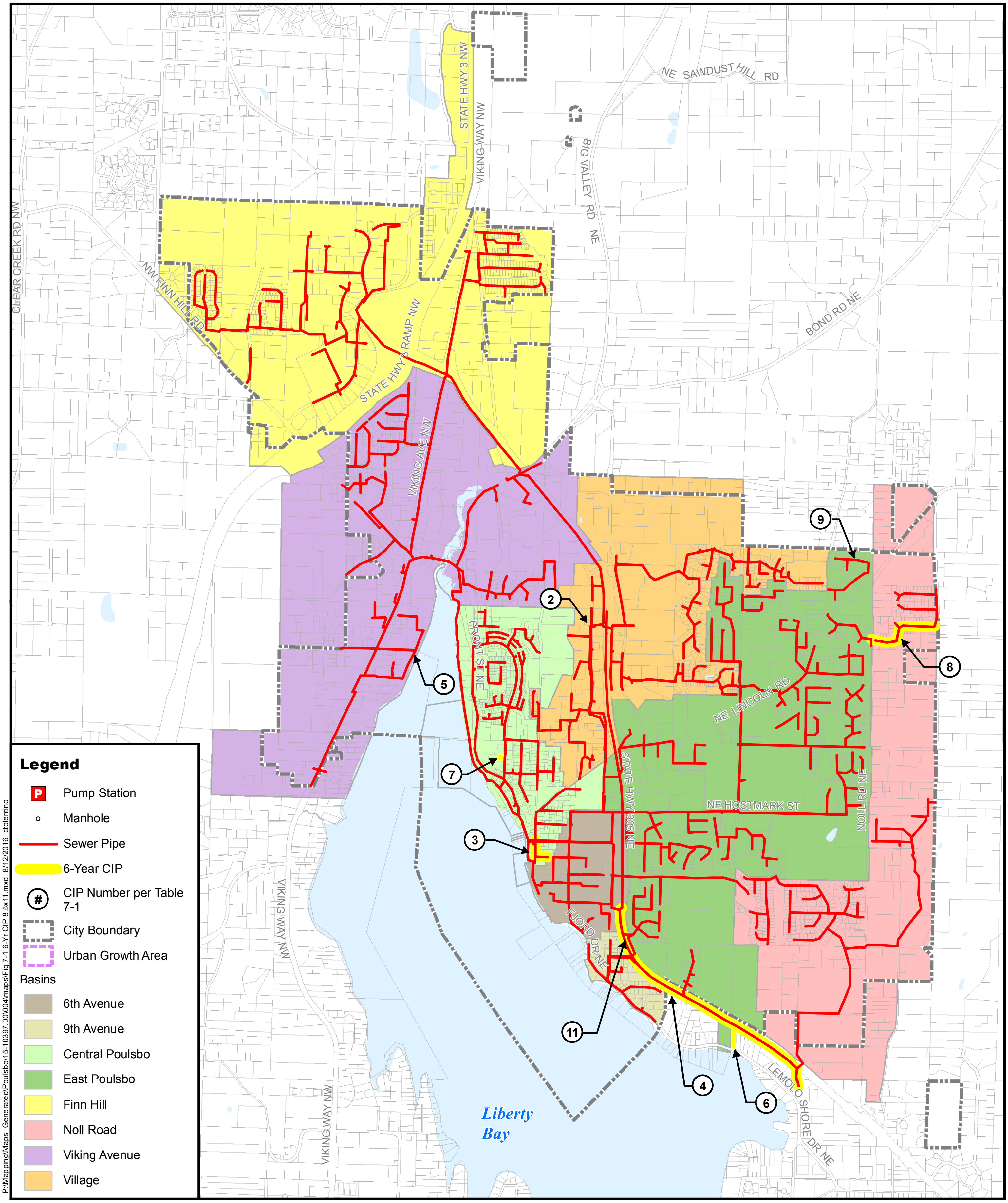

P:\MappingMaps_Generated\Poulsbo\15-10397.00\004\maps\Fig 7-1 6-Yr CIP 8.5x11.mxd 8/12/2016 ctolentino

This map is a geographic representation based on available information. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map. Source: Kitsap County.

BHC CONSULTANTS

N W E S

0 1,250 2,500 Feet

CITY OF POULSBO VIKING CITY

6-Year CIP

Comprehensive Sewer Plan
City of Poulsbo
August 2016

Figure **7-1**

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7.3 City Sewer Capital Improvement Projects

7.3.1 Annual Inflow Reduction Program

Flow monitoring data presented in Chapter 2 indicates the City's system has significant I/I. Additionally, downstream conveyance capacity is limited and treatment costs above the City's Agreement threshold with the County become escalated. Therefore, I/I reduction will continue to be a high priority for the sewer utility CIP.

Flow monitoring data shows that the existing sewer system experiences high levels of inflow during storm events. This inflow may be associated with leaking manholes, storm drain connections or roof drain connections. The City will continue an annual inflow reduction program consisting of identifying and repairing inflow sources.

The Village Basin is known to have high I/I rates, and is currently being smoke tested as part of this program. Flow rates at the Village Pump Station increase rapidly after a rain event, indicating that inflow is the primary problem. After smoke testing is completed, the City will determine a solution to disconnecting any connections and rehabilitating pipes and manholes as necessary to reduce I/I. If this program is executed and sources of inflow are addressed, the capacity of the collection system within the basin should be sufficient to accommodate full buildout.

The annual I/I control program will include the following elements:

- Installation of inflow prevention devices (such as manhole inserts) in public right-of-way
- Development of an I/I monitoring program to identify areas of high I/I
- Smoke tests of suspected high I/I areas to identify specific inflow sources
- Development of public education activities and City policies that will encourage private property owners to disconnect roof drains and other sources of direct inflow to the sanitary sewer system

This is a system rehabilitation and maintenance project.

7.3.2 Poulsbo Village Pump Station Upgrades

This project is under design now and construction will be completed in 2017. The firm capacity hasn't yet been finalized, but it will allow for upgrades to approximately 700-750 gpm by replacing impellors or pumps. It will also include replacement of electrical panels, controls, and site piping. This is a system upgrade and a system rehabilitation and maintenance project.

7.3.3 Harrison Force Main Replacement

This project replaces the 12-inch force main from the Marine Science Center pump station that runs along the beach. The existing main is subject to damage or failure which would result in release of sewage to Liberty Bay. The force main will be rerouted along Fjord Drive and then tie into the existing Central Interceptor main in SR-305 at Harrison Street. This is a system rehabilitation and maintenance project. This project will be combined with sewer main repairs along Fjord Drive.

7.3.4 SR-305 Force Main Extension

This project would install approximately 5,170 lf of 12-inch force main from the existing Bond Road Pump Station force main to the Johnson Road chlorination manhole. This would reduce flows in the capacity limited portion of the Central Interceptor and associated surcharging and flooding. The project would include air/release vacuum valves as necessary, as well as roadway restoration.

WSDOT is considering widening SR-305 through Poulsbo, which could present an opportunity for this project to be constructed concurrently.

This is a system upgrade project.

7.3.5 Liberty Bay Pump Station Improvements

This project is under design now and construction will be completed in 2016. The proposed upgrade, modifications or additions to the pump station are planned generally as follows:

- Remove above grade wet well mounted pump station including enclosure, control system, power service and appurtenances
- Evaluate and repair wet well infiltration sources
- Add constant speed duplex submersible solids-handling pumps on guide rail system
- Add precast concrete top slab with access doors and interior fall protection hinges and grating
- Repair or replace existing concrete pad immediately around wet well
- Add valve/meter vault with check valves, plug valves, electromagnetic flow meter and sump pump
- Add above grade reduced pressure backflow assembly, in insulated enclosure
- Add above grade electrical power cabinet, control and telemetry systems
- All work will be located within City right-of-way

This is a system upgrade and a system rehabilitation and maintenance project.

7.3.6 Purchase and Demolition of Lemolo House

Kitsap County currently owns the property at 17152 Lemolo Shore Drive NE (parcel number 252601-2-045-2009). The County was considering using the property to construct a pump station, but has opted not to. The City will purchase the property, which could be used as a staging/construction area to install a third siphon barrel across Liberty Bay.

This is a system upgrade project.

7.3.7 Public Works Facility

The City will be constructing a new Public Works Facility which will be shared with all City utilities. The total project cost is estimated at $7,000,000. The sewer utility will fund 30% of the total project cost with bonds estimated at $120,000 per year starting in 2017. This is a system rehabilitation and maintenance project.

7.3.8 Noll Road Sewer Improvements

This project will abandon the Alasund Pump Station with a gravity sewer once the gravity sewer in Noll Road is extended north. This is a system rehabilitation and maintenance project.

7.3.9 Applewood Pump Station Rehabilitation

This project will include rehabilitation per the recommended improvements discussed in Section 4.4.8. This is a system rehabilitation and maintenance project.

7.3.10 Annual Pump Station Rehabilitation/Replacement

The City has budgeted $50,000 for ongoing pump station rehabilitation/replacement. Capital improvement items that this annual allocation might be used for, as discussed in Section 4.4, include the following:

- Request services of the applicable equipment vendor or representative to conduct training sessions at pump stations with Human Machine Interface (HMI) devices for all O&M staff that may be required to review and/or change settings and alarms for the operating equipment.
- Install lifting chains for deeper submersible pumps, attach chain to pump, and affix to a hook near the wet well hatch. All materials (chain/cable/hook, etc.) shall be constructed of 316 stainless steel. Lifting chain options (i.e. chain or cable/chain and “grip eye”) shall be reviewed and selected with O&M staff at each station and shall consider station depth and accessibility.
- Inspect and replace all hooks, supports, carabineers, concrete anchors, strain relief grips, and other appurtenances in wet well with 316 stainless steel materials as appropriate.
- Install a fall protection system at each pump station wet well that requires regular inspection. Fall protection system shall consist of a hinged safety grating or retractable safety net. Fall protection safety into the wet well can be maintained during routine inspection and maintenance activities for O&M personnel when the wet well hatch is open.
- Develop and implement a valve exercise program to regularly inspect and exercise isolation and check valves (including buried valves) to confirm acceptable operation. Identify, prioritize, and replace/rehabilitate valves as necessary.

This is a system rehabilitation and maintenance project.

7.3.11 Storage Facility

This project would include construction of a storage facility adjacent to the SR-305 Interceptor to reduce surcharging during high flow events, and to help limit flow surcharges due to pumps turning on and off. The facility would be approximately 80,000 gallons and located near Sol Vei and SR-305.

7.3.12 Old Town

Replacements and upgrades to sewer connections in the Old Town area will be completed in conjunction with the Old Town water main replacements.

7.3.13 Water Meter Replacement

This program replaces the aging water meters within the City’s water system. There are many residential and commercial meters that are past their service life. Most are up to twenty years old. Worn out meters read inaccurately and therefore undermeasure water/sewer use. The result is lost or unaccounted for water which also results inaccurate sewer billing.

7.4 County Sewer Capital Improvement Projects

The City pays for a portion of County capital projects that serve the City. The percentage paid is as follows:

Table 7-3 City Portion of County Project Costs

Project Type	City Portion of Costs
Johnson Road Chlorination Station to Pump Station 67	100 percent
Pump Station 67	93.60 percent
Force Main to Pump Station 24	45.60 percent
Fixed Treatment Plant Costs	15.83 percent

7.4.1 Capital Facilities Charge for CK Plant

Capital Facilities Charges are included within the City's current Agreement with the County for conveyance and treatment, and are designated for ongoing treatment and maintenance at the CKWWTP.

7.4.2 Kitsap County Pump Station #16 & 67 Replacement

This project in Keyport is to change the hydraulics on the Poulsbo side of the piping system in order to eliminate PS16 and reroute all the Poulsbo flow to PS 67. Upgrades to PS 67 are needed to handle the increase in flow. This is a joint project with the Stormwater Division.

7.4.3 Lemolo Capacity/Condition Improvements

This project replaces the existing gravity/forcemain from the Johnson Road Metering Station (JRMS) to the shoreline where siphon barrels under Liberty Bay start. The project will upsize pipe for capacity and replace outdated material.

7.4.4 CKTP Primaries and Aeration Tanks 5 & 6

This project will address primary treatment effectiveness, nitrification capacity, hydraulic capacity, updating outdated equipment.

7.4.5 CKTP UltraViolet Disinfection Upgrade

This project will replace the outdated and inefficient UV Disinfection System.

7.4.6 CKTP Screw Press

This project will provide redundancy in solids dewatering system.

7.4.7 CKTP Campus Buildings

Replace and upgrade admin building, laboratory, storage/maintenance building to improve energy efficiency and capacity.

7.4.8 Lemolo Siphon Phase 2

City will evaluate visibility, cost and timing of adding/replacing of the Lemolo siphons. A Visibility Study will be prepared in 2017 for approximately $200,000. Preliminary Design/Permitting will occur in 2018 for approximately $300,000. Contract Documents and construction will in future years.

7.4.9 Johnson Road Metering Station

The existing metering station cannot record flows above 2.5 MGD. It will be replaced with a new metering station that can record flows of up to 4 MGD.

7.4.10 Sewer Plant Upgrade

In 2015/16 Kitsap County is upgrading the Sanitary Sewer Treatment Plant in Brownsville. The estimated cost for upgrades is over $30,000,000. The City share is 0.95 Million Gallons Per Day(MGD)/6.0 MGD or 15.8%. To fund this project the City will issue 20 year bonds in the amount of $5,000,000. The estimated payments of the bond is $368,000 per year beginning in 2017.

7.5 System Expansion Projects

System expansion projects provide for new facilities in the service area in order to support new housing and commercial development within the City as well as the UGA. These upgrades generally consist of new gravity collection mains that carry wastewater to one of the nine existing pump stations. In a few cases, at low elevations in the service area, a pump station will be required to lift the wastewater to a gravity main. Attempts to minimize new pump stations have been made in order to reduce future operation and maintenance costs and to be consistent with City policy. The following sections describe specific projects to expand the service area, and are assumed will be funded by developers.

7.5.1 Finn Hill Basin Collection System

This project consists of constructing a new collection system to serve the Finn Hill and Urdahl Road areas located north of SR-3. Wastewater from these properties will all flow via the Olhava gravity system to the Bond Road pump station. A gravity main will be installed in Finn Hill Road and a portion of Urdahl Road that will drain to a new pump station at Finn Hill near SR-3. This pump station will lift the wastewater to the gravity system in Olhava Way NW, which will carry it to the Bond Road pump station. Portions of the north end of Urdahl can flow either by gravity to the Olhava sewer system, or to the new pump station at the lower end of Finn Hill Road.

Based on the capacity assessment, the following upgrades to the existing sewer system in the Finn Hill basin will be needed as development occurs.

- Olhava basin near Wal-Mart, Pipe Run 18. Increase 246-ft of 8-in diameter pipe to 10 or 12-in diameter.
- Olhava basin on Bond Road, Pipe Run 94. Increase 70-ft of 8-in diameter pipe to 10 or 12-in diameter.
- Additional projects to increase capacity of the other segments in the Olhava basin that exceed capacity for 100 percent of full build out may be added to the CIP at a later date after development assumptions and as-built conditions are confirmed. These pipe segments appear to have adequate capacity in the near term to allow completion of a more detailed hydraulic model and back water analysis that would verify capacity conditions.

7.5.2 Noll Road (North) Collection System

This project will serve new residential development in the Noll Road corridor and consists of a new gravity main in or near Noll Road between Lincoln Avenue and Bjorn Street. The new pipe will connect to the 10-inch main carrying wastewater from the Deer Run development. Since the 10-inch Deer Run gravity main is on a very flat slope, the new development flows will result in existing capacity being exceeded. Therefore, the existing 10-inch main will either be increased to a 15-inch diameter main using pipe bursting methods, or a new 10-inch diameter main paralleling the existing main will be installed.

A new pump station and force main would be constructed to serve a small portion of this basin that is not able to connect to the main by gravity flow.

The new gravity sewer would allow the construction of CIP #9 so that the existing Alasund Meadows pump station and force main could be phased out.

This project will allow the development of new housing along Noll Road. Funding will be by LID, or with repayment by developers under latecomer agreements.

7.5.3 Noll Road (South) Collection System

Property along Noll Road south of Bjorn Street is at a low elevation and therefore cannot drain into the existing collection main. To serve this area, a new 10-inch main will be placed in or near Noll Road from Bjorn Street to SR-305. A pump station will be constructed at SR-305 and the wastewater pumped through a new force main in SR-305 to the chlorination manhole located at Johnson Road.

This project will allow wastewater collection from existing and future homes along Noll Road. No major developments are currently proposed, nor is it likely that any large development will be proposed that could fund the entire project. Funding may therefore need to be a combination of developer latecomer fees and City funding, if available.

7.5.4 South Viking Way Collection System

This project consists of constructing a new collection system to serve residential and commercial areas at the south end of Viking Way. A pump station at the lower end of Anderson Lane will be required to convey wastewater to the existing gravity main in Viking Way. Flow from both the east and west sides of Viking Way could discharge to this pump station.

This project will allow wastewater to be collected from a new development west of Viking Way. Existing homes located east of Viking Way, currently on septic systems, could connect to the system if the pump station is located in Anderson Lane.

7.5.5 Central Viking Way Collection System

This project consists of constructing a new collection system to serve the area west of Viking Way that can flow either to the Liberty Road pump station or to the gravity main on Viking that flows to the Lindvig pump station. No pump stations or force mains will be required.

Chapter 8 Sewer System Financial Plan

8.1 Introduction

This chapter assesses the City's ability to execute the capital improvement plan recommended in Chapter 7 of this CSP while maintaining sewer user rates at reasonable levels. It evaluates the historical financial condition of the City's utility and estimates the financial impact of executing the capital improvement plan, given projected capital funding needs and potential funding sources. This financial plan is intended to satisfy the requirements outlined in WAC 173.240.050 and RCW 36.70A.070.

8.2 Historical Financial Condition

Table 8-1 summarizes the historical financial performance of the City's sewer utility per its 2010 – 2015 Financial Statements:

Table 8-1 Statement of Revenues, Expenses, & Changes In Net Assets

Historical Financial Summary	2010	2011	2012	2013	2014	2015
Operating Revenues:						
Charges For Services	$ 2,493,605	$ 2,520,664	$ 2,766,701	$ 3,000,258	$ 3,170,156	$ 3,242,314
Other Operating Revenues	33,103	37,479	36,303	40,565	38,336	45,509
Total Operating Revenues	$ 2,526,707	$ 2,558,143	$ 2,803,004	$ 3,040,822	$ 3,208,493	$ 3,287,822
Operating Expenses:						
Administrative & General	$ 428,218	$ 478,448	$ 514,198	$ 322,888	$ 341,959	$ 387,026
Contracted Processing & Operations	571,747	561,568	565,259	749,338	778,109	867,854
Maintenance	12,572	20,480	9,841	-	-	-
Operating	264,991	299,824	314,953	497,525	447,934	596,660
Depreciation	464,184	583,737	590,697	584,484	607,438	633,625
Bad Debt Expense	-	-	-	-	60	-
Total Operating Expenses	$ 1,741,712	$ 1,944,057	$ 1,994,947	$ 2,154,235	$ 2,175,499	$ 2,485,167
Operating Income (Loss)	$ 784,995	$ 614,085	$ 808,056	$ 886,587	$ 1,032,994	$ 802,656
Non-Operating Revenues (Expenses):						
Interest & Other Earnings	$ 31,018	$ 24,973	$ 21,278	$ 11,345	$ 21,796	$ 15,448
Interest Expense	(79,567)	(88,941)	(80,808)	(60,334)	(47,296)	(33,208)
Amortization of Debt Issue Costs	(15,261)	(15,259)	(15,024)	(24,107)	(13,208)	(13,208)
Gain (Loss) On Disposition of Capital Assets	-	-	-	-	-	-
Other Non-Operating Revenues (Expenses)	-	-	-	-	-	-
Total Non-Operating Revenues (Expenses)	$ (63,809)	$ (79,227)	$ (74,555)	$ (73,096)	$ (38,708)	$ (30,968)
Income (Loss) Before Contributions	$ 721,186	$ 534,859	$ 733,501	$ 813,491	$ 994,286	$ 771,688
Total Capital Contributions	$ 126,035	$ 157,750	$ 678,809	$ 957,329	$ 274,955	$ 1,670,719
Change In Net Assets	$ 847,221	$ 692,609	$ 1,412,310	$ 1,770,820	$ 1,269,241	$ 2,442,407
Total Net Assets (Beginning of Year)	20,487,115	21,334,335	20,803,371	22,246,672	24,017,797	25,287,037
Prior Year Adjustment	-	(1,223,572)	-		-	-
Change in Acctg Principle Pension Oblig. (GASB 68)	-	-	-	-	-	(204,683)
Total Net Assets (End of Year)	$ 21,334,337	$ 20,803,371	$ 22,215,681	$ 24,017,492	$ 25,287,037	$ 27,524,761

The City's sewer rate revenue has increased by about 30.0% from 2010 – 2015, primarily due to the sewer rate increases that the City implemented during that period. Growth in the City's sewer customer base has also contributed to observed revenue growth over time.

Operating expenses have generally increased every year except 2014, when expenses remained consistent with 2013 levels. Excluding depreciation, operating expenses increased by 1.8% in 2010, 6.5% in 2011, 3.2% in 2012, and 11.8% in 2013 before decreasing by 0.1% in 2014; operating expenses increased by 18.1% in 2015. These changes represent an average annual increase of about 7.7% from 2010 – 2015; including depreciation expense decreases the average annual rate of increase to 7.4%. Table 8-1 shows positive net operating income ranging from a low of roughly $614,000 in 2011 to a high of $1,033,000 in 2014. It is worth noting that the City changed how it categorizes certain expenses for reporting purposes beginning in 2013 – as a result, it is more difficult to meaningfully characterize changes to specific expense categories over time.

The City continues to realize a positive change to net assets, with part of that change being attributable to capital contributions. Capital contributions include both customer connection charges (cash payments) and the value of developer-donated facilities (in-kind contributions). The majority of the positive change to net assets, however, can be attributed to the growth in revenues outpacing the growth in expenses over the last six years. The City has set rates to accommodate future capital improvements and operating costs in anticipation of joint projects with the County to upgrade its regional wastewater treatment plant.

Table 8-2 summarizes the sewer utility's balance sheets from 2010 – 2015:

Table 8-2 Statement of Net Assets – Sewer Fund

Historical Financial Summary	2010	2011	2012	2013	2014	2015
Assets						
Current Assets:						
Cash & Cash Equivalents	$ 178,021	$ 46,593	$ 453,590	$ 1,031,017	$ 647,011	$ 173,670
Investments	4,027,285	4,892,731	5,635,907	6,283,197	7,732,161	7,616,701
Accounts Receivable	232,426	231,164	264,176	260,293	280,476	289,150
Due From Other Governments	-	-	-	-	-	-
Inventories	6,230	6,212	6,400	6,396	6,732	6,989
Prepaid					500	500
Total Current Assets	$ 4,443,962	$ 5,176,700	$ 6,360,073	$ 7,580,903	$ 8,666,880	$ 8,087,011
Noncurrent Assets:						
Restricted Cash, Cash Equivalents, & Investments:						
Custodial Trust Funds	$ -	$ -	$ -	$ -	$ -	$ -
Revenue Bond Covenant Investment	383,768	383,768	345,462	244,452	244,452	244,452
Total Restricted Assets	$ 383,768	$ 383,768	$ 345,462	$ 244,452	$ 244,452	$ 244,452
Capital Assets:						
Land	$ 277,676	$ 277,676	$ 277,676	$ 234,396	$ 234,396	$ 414,874
Buildings & Structures	253,933	253,933	253,933	283,606	283,606	283,606
Intangibles	104,032	104,032	80,697	114,209	114,209	114,209
Other Improvements	23,058,569	23,865,576	24,261,089	25,099,115	25,367,994	26,353,361
Machinery & Equipment	785,691	792,541	792,541	825,482	810,281	793,141
Construction In Progress	928,262	308,928	284,567	243,684	342,717	2,241,141
Less: Accumulated Depreciation	(5,073,071)	(6,880,380)	(7,447,741)	(8,104,630)	(8,696,866)	(9,303,482)
Total Capital Assets (Net of Depreciation)	$ 20,335,092	$ 18,722,306	$ 18,502,762	$ 18,695,862	$ 18,456,337	$ 20,896,850
Total Noncurrent Assets	$ 20,718,861	$ 19,106,075	$ 18,848,225	$ 18,940,315	$ 18,700,789	$ 21,141,302
Total Assets	**$ 25,162,823**	**$ 24,282,775**	**$ 25,208,298**	**$ 26,521,216**	**$ 27,367,669**	**$ 29,228,312**
Deferred Charges	$ 14,532	$ 12,716	$ 10,899	$ 52,830	$ 39,623	$ 51,643

Table 8-2 (Continued): Statement of Net Assets – Sewer Fund

Historical Financial Summary	2010	2011	2012	2013	2014	2015
Liabilities						
Current Liabilities:						
Accounts Payable	$ 81,143	$ 77,856	$ 181,504	$ 96,980	$ 109,947	$ 370,925
Accrued Interest Payable	44,946	44,018	48,118	45,374	41,863	37,034
Revenue Bonds Payable (Net of deferred amt refunded)	295,015	295,672	309,712	334,620	345,540	356,460
Unearned Revenue	-	-	-	96	99	163
Custodial	32,477	24,816	-	55,718	13,026	112,710
Deferred Revenue	-	-	-	-	-	-
Compensated Absences	1,850	3,218	3,125	3,196	3,603	4,138
Notes Payable	-	50,000	50,000	125,000	125,000	125,000
Due to Other Governmental Units	37,687	37,687	-	37,687	37,687	-
Total Current Liabilities	$ 493,117	$ 533,267	$ 592,459	$ 698,672	$ 676,765	$ 1,006,429
Noncurrent Liabilities:						
Revenue Bonds Payable (Net of deferred amt refunded)	$ 1,950,193	$ 1,664,002	$ 1,354,290	$ 1,072,500	$ 726,960	$ 370,500
Compensated Absences	16,648	28,958	28,122	28,766	32,426	37,238
Notes Payable	1,232,317	1,152,830	915,581	718,931	684,103	115,527
Due to Other Governmental Units	150,747	113,061	113,061	37,687	-	-
Pension Obligation	-	-	-	-	-	195,375
Total Noncurrent Liabilities	$ 3,349,904	$ 2,958,852	$ 2,411,054	$ 1,857,883	$ 1,443,488	$ 718,639
Total Liabilities	**$ 3,843,021**	**$ 3,492,119**	**$ 3,003,513**	**$ 2,556,555**	**$ 2,120,254**	**$ 1,725,068**
Net Assets						
Invested In Capital Assets, Net of Related Debt	$ 16,683,667	$ 15,421,769	$ 15,771,016	$ 16,369,438	$ 16,537,047	$ 19,955,778
Restricted For Debt Service	338,823	383,768	345,462	244,452	244,452	244,452
Unrestricted	4,311,846	4,997,834	6,099,205	7,403,601	8,505,539	7,324,532
Total Net Assets	**$ 21,334,335**	**$ 20,803,371**	**$ 22,215,683**	**$ 24,017,492**	**$ 25,287,037**	**$ 27,524,761**

Table 8-2 suggests that the City has been maintaining a relatively high current ratio (ratio of current assets to current liabilities), with a minimum ratio of just above 8:1 in 2015. As a general benchmark, a ratio of 2:1 or higher is considered to be very good in terms of healthy liquidity and means the City can more than cover its debt and operating expenses. The current ratio realized has ranged from 9:1 to 13:1 with the City's investments constituting the majority of its current assets.

The City's cash reserves dropped from $178,000 at the end of 2010 to $47,000 in 2011, rebounding to reach $1,031,000 by 2013 – however, the amount of cash reserves declined over 2014 and 2015. The net value of the City's sewer assets has generally increased annually, except 2011. From 2010 – 2015, the sewer utility's annual operating revenue increased by $761,000 while its annual operating expenses increased by only $574,000; the utility's net asset value increased by $6.2 million.

Overall, the City's sewer utility has realized positive net income and annual increases in net asset value in recent years, exhibiting relatively stable financial performance.

8.3 Current Financial Structure

The City operates its sewer utility under a set of financial policies that target management of a financially viable and fiscally responsible enterprise fund. The policy framework used in the financial forecast is discussed in further detail below.

8.3.1 Utility Reserves

The sewer utility's resources are separable into three primary funds:

- **Sewer Utility Fund (Fund 403):** This is the utility's pool of unrestricted resources. Inflows include rate revenue and other service charges (excluding general facilities charges, which are restricted for capital purposes); outflows include operating and maintenance (O&M) expenses and other utility revenue needs not covered by other sources. The financial plan assumes that the City maintains a minimum "working capital" balance of 60 days (16.4%) of projected operating expenses in this fund.

- **Sewer Capital Reserve (Fund 423):** This reserve represents the hub of the sewer utility's capital activity. Inflows include general facilities charges (GFCs), capital grants, and other money set aside for capital purposes; the City spends these funds on capital improvement projects. Assuming that the City has the option of issuing debt or deferring capital expenditures as needed, the financial plan does not assume an explicit minimum balance for this fund (though expenditures are limited to available resources).

- **Sewer Debt Service Fund (Fund 433):** This reserve maintains restricted debt-related funds (such as the bond reserve and annual payment accruals) as required by the City's bond and loan agreements.

Table 8-3 summarizes the sewer utility's fund balances as of the end of 2015:

Table 8-3 2015 Ending Balances – City of Poulsbo Sewer Utility

Sewer Utility Fund:	$ 400,000
Sewer Capital Reserve:	6,411,777
Debt Service Reserve:	950,490
Total:	$7,762,267

In addition to the reserves shown in Table 8-3, the City had $2 million in GFC revenue "banked" with Kitsap County at the end of 2015. New sewer connections in the City's service area pay a GFC to buy into the City's local conveyance system and regional treatment facilities. The treatment portion of the GFC is a "pass-through" charge that the City remits to Kitsap County; these "pass-through" revenues accrue in an account held by Kitsap County, and are applied toward the City's share of the cost of regional treatment-related capital projects.

8.3.2 System Reinvestment

The sewer utility's infrastructure represents a significant long-term liability, as the utility's assets lose value over time and must eventually be replaced. The cost of these future replacements will likely exceed the original construction or acquisition cost due to inflation and differing construction conditions. Funding system reinvestment through rates provides cash resources for future capital projects, generating a cash flow surplus above current operating and debt service costs. The annual funding level is often set based on the depreciation expense of fixed assets as a quantified measure of the loss in value and future liability. Though system reinvestment often leads to higher near-term rates, it intends to facilitate lower longer term rates by building a stable funding source for infrastructure replacement needs.

8.3.3 Debt Management

The City has established the following debt management policies:

- The term of long-term debt issued will not exceed the estimated useful life of the projects financed. Current operations will not be financed with long-term debt.
- The City shall strive to maintain its good credit rating in the interest of preserving access to favorable borrowing terms.
- The City shall not issue debt unless it is confident that a specifically identified revenue source is available to ensure repayment.

8.4 Capital Needs and Funding Strategy

Section 8.1 indicates that the primary purpose of this chapter is to assess the impacts of the CIP on the City's ratepayers, confirming that the City can execute the CIP and maintain reasonable sewer rates. The CIP can impact rates directly depending on the City's capital funding strategy – for example, the City may set rates to generate cash funding for the CIP or issue additional debt to fund projects. Determining these impacts is a two-step process, involving the identification of capital investment needs and the development of a funding strategy.

8.4.1 Capital Investment Needs

Tables 7-1 and 7-2 of this CSP outline a plan of capital improvements that are needed between 2016 and 2022 for both City projects and the City's share of County projects related to regional wastewater treatment. Table 8-4 summarizes the total capital cost projections:

Table 8-4 2016 – 2022 CIP (Inflated Dollars)

2016 - 2022 CIP	2016	2017	2018	2019	2020	2021	2022
City Projects							
Annual Inflow Reduction Program	$155,137	$90,000	$180,000	$180,000	$180,000	$180,000	$180,000
Poulsbo Village Pump Station Upgrades	$284,580	$500,000					
Harrison Force Main Replacement		$283,671					
SR-305 Force Main Extension					$200,000	$2,610,000	
Purchase and Demolition of Lemolo House		$350,000					
Liberty Bay Pump Station Improvements	$283,797	$360,000					
Old Town Sewer Upgrades						$100,000	$100,000
Water Meter Replacement	$40,011	$175,000	$250,000				
Noll Road Sewer Improvements			$20,000	$210,000			
Applewood Pump Station Replacement			$100,000				
Annual Pump Station Rehabilitation/Replacement		$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Storage Facility at Sol Vei & SR 305		$500,000					
Equipment Purchases (Non-CIP)		$80,000	$80,000	$80,000	$80,000	$80,000	$80,000
City Share of County Projects							
Capital Facilities Charge for CK Plant	$133,000	$133,000	$133,000				
Kitsap County Pump Station #16 & 67 Replacement			$5,000,000				
Lemolo Capacity/Condition improvements		$350,000			$1,140,000	$3,600,000	
CKTP Primaries and Aeration Tanks 5 & 6						$523,182	
CKTP Ultraviolet Disinfection Upgrade			$316,000				
CKTP Screw Press				$158,300			
CKTP Campus Buildings							$221,620
Lemolo Siphon Phase 2		$200,000	$300,000				
Kitsap County Johnson Road Metering Station		$450,000					
Kitsap County Sewer Plant Upgrade		$5,000,000					
Total	**$896,525**	**$8,521,671**	**$6,429,000**	**$678,300**	**$1,650,000**	**$7,143,182**	**$631,620**

Table 8-4 shows a total 2016 – 2022 CIP of $26.0 million.

8.4.2 Capital Funding Strategy

The financial forecast assumes the following conceptual capital funding hierarchy:

1. Any available grants or developer contributions would be used first, as they come from third-party sources and generally contribute toward specific projects. The City would rationally use this funding to pay for projects before tapping its own resources. This analysis does not assume the availability of any grant or developer funding.

2. Available cash reserves (above the assumed minimum balances) are then applied.

3. Anticipated low-cost loans (PWTF) would then be used, if any are available. This analysis does not assume the availability of any low-cost loans.

4. Revenue bonds, as relatively high-cost debt with additional coverage requirements, are the last resort for any costs in excess of other available resources.

Table 8-5 shows the proposed capital funding strategy for both the City's local conveyance projects and its share of the County's regional treatment projects.

Table 8-5 2016 – 2022 Capital Funding Strategy

Capital Funding Strategy	2016	2017	2018	2019	2020	2021	2022	Total
Total Capital Cost	**$896,525**	**$8,521,671**	**$6,429,000**	**$678,300**	**$1,650,000**	**$7,143,182**	**$631,620**	**$25,950,298**
Capital Funding:								
Cash Reserves	$896,525	$3,521,671	$6,429,000	$678,300	$310,000	$933,182	$631,620	$13,400,298
Revenue Bonds		5,000,000			1,340,000	6,210,000		12,550,000
Total	**$896,525**	**$8,521,671**	**$6,429,000**	**$678,300**	**$1,650,000**	**$7,143,182**	**$631,620**	**$25,950,298**

Table 8-5 indicates that the sewer utility intends to cash-fund about $13.4 million (51.6%) of the 2016 – 2022 CIP. This relies on the assumption that the sewer utility funds system reinvestment based on depreciation expense, as noted in Section 8.3.2. This analysis projects that the utility will generate $6.2 million in cash funding during the 2016 – 2022 planning period.

The remainder of the cash contribution shown in Table 8-5 is expected to come from a combination of existing cash balances, GFC revenue collections, interest earnings, and miscellaneous revenue. Table 8-5 shows a gap of $12.6 million between the total projected capital expenditures and the cash resources described above.

8.4.3 Available Financing Options

Potential sources of external capital project financing include:

A. Grants and Low-Cost Loans

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However, these assistance programs have been mostly eliminated, substantially reduced in scope and amount, or replaced by loan programs. Remaining miscellaneous grant programs are generally lightly funded and heavily subscribed. Nonetheless, the benefit of low-interest loans makes the effort of applying worthwhile. Grants and low-cost loans for Washington State utilities are available from the Department of Commerce including several assistance programs that the City may be eligible for.

- **Public Works Trust Fund (PWTF)** – Cities, counties, special purpose districts, public utility districts, and quasi-municipal governments are eligible to receive loans from the PWTF. Eligible projects include repair, replacement, and construction of infrastructure for domestic water, sanitary sewer, stormwater, solid waste, road, and bridge projects that improve public health and safety, respond to environmental issues, promote economic development, or upgrade system performance. Currently the Public Works Board has suspended the non-Construction Programs and significantly reduced funding to the construction loan program. The Public Works Board website notes that the next funding cycle is to be determined by funding levels in early 2016-17.

  In addition to lack of PWTF funding over the last few years, the Board must implement policies and procedures designed to maximize local government use of federal funds to finance local infrastructure including, but not limited to, drinking water state revolving funds (DWSRF) operated by the state departments of health and ecology. Projects that are eligible for drinking water state revolving funds are not eligible for Public Works Board construction loans. Under this requirement, there are three ways in which a project can be considered eligible for a DWSRF loan:

  a.) Projects that have applied to the state revolving funds and are awaiting a funding decision

  b.) Projects that have been rejected for funding solely due to not meeting readiness requirements

  c.) Projects that have not applied, but would likely be eligible if the project applied and met the project readiness requirements

  When the program is funded and available, PWTF loans are available at interest rates ranging from 1.28% to 2.55% depending on the repayment term, with reduced interest rates available for all projects located in “distressed” communities. The standard loan offer is 2.55% interest repaid over a term of 5 – 20 years. All loan terms are subject to negotiation and Board approval. Currently no local match is required and the maximum loan amount is $7 million per jurisdiction per biennium.

  Information regarding the application process as well as rates and terms are posted on the PWTF website in early spring. The next application cycle is planned for the spring of 2016.

  Further detail is available at http://www.pwb.wa.gov.

- **State Water Pollution Control Revolving Fund (WAC 173-98):** Managed by the Department of Ecology (Ecology), this program provides loan assistance to utilities for high-priority water quality projects consistent with the Clean Water Act. It is funded through federal capitalization grants, state matching funds, and principal and interest repayments. The program funds projects with a quantifiable water quality benefit, such as transitioning customers from septic to sewer.

- **Community Economic Revitalization Board (RCW 43.160):** A federal program administered by the State Department of Community Trade and Economic Development, this program provides grants and loans for infrastructure improvements including utility projects. It prioritizes projects that create or retain jobs for low and moderate-income residents – because it is need-based and intended to be “last-resort” relative to other funding sources, the City may not qualify for assistance under this program.

- **Infrastructure Assistance Coordinating Council:** The Infrastructure Assistance Coordinating Council (Council) is comprised of state and local agencies whose function is to provide funding for infrastructure repair and development. Its purpose is to assist local governments in coordinating funding efforts for infrastructure improvements, and can be a valuable resource to provide awareness of any new funding opportunities.

- **Hazard Mitigation Grant Program (HMGP):** The purpose of the HMGP program is to help communities implement hazard mitigation measures following a Presidential major disaster declaration. This state-administered program is authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 404 of Public Law 93-288, as amended. HMGP funds mitigation planning initiatives and mitigation projects designed to reduce or eliminate the effects and costs of future disaster damage. Eligible applicants include state and local government and special districts.

  Applicants must be jurisdictions that are participating and in good standing in the National Flood Insurance Program, and in compliance with State Growth Management Act requirements, or located in a community that is.

  The grants are available to eligible applicants on a competitive basis on the following cost share: 75 % federal and 25 % non-federal (applicant and state may split this share, based on legislative approval). The amount available for the HMGP is based on a %age of FEMA expenditures on disaster assistance, which may limit the size of projects and grant awards. All mitigation project proposals will be evaluated against federal and state program criteria and they must be must be cost-effective.

B. Bond Financing

Two types of municipal bonds are considered for financing the City's capital costs:

- **General Obligation Bonds:** General obligation (G.O.) bonds are bonds secured by the full faith and credit of the issuing agency, committing all available tax and revenue resources to debt repayment. With this high level of commitment, G.O. bonds have relatively low interest rates and few financial restrictions. However, the authority to issue G.O. bonds is restricted in terms of the amount and use of the funds, as defined by Washington constitution and statute. Specifically, the amount of debt that can be issued is linked to assessed valuation.

  RCW 39.36.020 states:

  "(ii) Counties, cities, and towns are limited to an indebtedness amount not exceeding one and one-half % of the value of the taxable property in such counties, cities, or towns without the assent of three-fifths of the voters therein voting at an election held for that purpose.

  (b) In cases requiring such assent counties, cities, towns, and public hospital districts are limited to a total indebtedness of two and one-half % of the value of the taxable property therein."

  While bonding capacity can limit availability of G.O. bonds for utility purposes, these can sometimes play a valuable role in project financing. A rate savings may be realized through two avenues: the lower interest rate and related bond costs, and the extension of repayment obligation to all tax-paying properties (not just developed properties) through the authorization of an ad valorem property tax levy.

- **Revenue Bonds:** Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility and the debt obligation does not extend to the City's other revenue sources. With this limited commitment, revenue bonds typically bear higher interest rates than G.O. bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (added bond debt service coverage). The City agrees to satisfy these requirements by ordinance as a condition of bond sale.

  Revenue bonds can be issued in Washington without a public vote. There is no bonding limit, except perhaps the practical limit of the utility's ability to generate sufficient revenue to repay the debt and provide coverage. In some cases, poor credit might inhibit a utility's ability to issue bonds.

8.5 Financial Forecast

The near-term projections that drive the financial forecast are discussed in further detail below:

8.5.1 Revenues

Given that most of the sewer utility's operating revenues are linked to customer growth in some way, the rate of customer growth is a key assumption of the financial forecast. The City's GFC revenue projections suggest annual growth ranging from 2.1% to 2.7% through 2019, dropping to 1.3% by 2022.

The projected revenues for 2016 are generally based on the projections in the City's 2016 Budget, with a couple of exceptions:

- ***Rate Revenue:*** 2016 rate revenue projections are based on more recent projections from the City, with adjustments to reflect projected customer growth and inflation (as provided for in Section 13.70.520 of the Poulsbo Municipal Code). To forecast future rate revenues, this analysis assumes an annual CPI inflation rate of 2.0%.

- ***Investment Interest:*** Interest earnings are computed on the sewer utility's projected cash balances assuming an annual earnings rate of 0.25% in 2016, growing to 0.50% in 2017 and 2018, 0.75% in 2019 and 2020 and reaching 1.0% by 2021.

8.5.2 Expenses

Operating expense projections for 2016 are generally based on the City's 2015 Budget. In virtually all cases, operating expense projections reflect annual adjustments for inflation. The inflation rates used in the financial forecast include:

- ***General Cost Inflation:*** Assumed to be 2.0% throughout the study period, this rate applies to most expenses. This assumption is consistent with the ten-year average Historical Consumer Price Index for All Urban Consumers (CPI-U).

- ***Labor Cost Inflation:*** Based on feedback received from City staff regarding annual cost-of-living adjustments, step increases, and rising healthcare costs, the financial forecast assumes that salary and benefit costs increase at a rate of 4.0% per year. This rate is also applied to professional service costs, which are presumably based on billing rates that are linked to the salary and benefit costs of the professionals hired by the City.

- ***Taxes:*** Taxes are computed based on the sewer utility's projected revenues assuming a city tax rate of 6% (down from 12% in 2015), a business and occupation (B&O) tax rate of 1.50%, and an effective sewer excise tax rate of 3.327%.

Capital expense projections can be separated into three different categories:

- ***Capital Projects:*** Chapter 7 of this CSP outlines a capital improvement plan, with Tables 7-1 and 7-2 being the primary source of information for capital project expenditure in the financial forecast.

- ***Debt Service:*** The City's sewer utility currently has one revenue bond outstanding as well as the sewer utility's share of debt service for the new City Hall. Table 8-6 summarizes the sewer utility's existing debt service repayment schedules:

Table 8-6 Summary of Existing Sewer Utility Debt Service

	2016	2017	2018	2019	2020	2021	2022
2005 Refunding Bond (Sewer Share: 78%)							
Principal	$ 356,460	$ 370,500	$ -	$ -	$ -	$ -	$ -
Interest	25,080	12,782	-	-	-	-	-
Total	$ 381,540	$ 383,282	$ -	$ -	$ -	$ -	$ -
Sewer Share of PW Complex & City Hall Debt							
Principal	$ -	$ 52,245	$ 54,596	$ 57,053	$ 59,620	$ 62,303	$ 65,107
Interest	-	73,755	71,404	68,947	66,380	63,697	60,893
Total	$ -	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000
Total Existing Debt Service							
Principal	$ 356,460	$ 422,745	$ 54,596	$ 57,053	$ 59,620	$ 62,303	$ 65,107
Interest	25,080	86,537	71,404	68,947	66,380	63,697	60,893
Total	$ 381,540	$ 509,282	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000

- ***Depreciation:*** Though depreciation is not a cash expense *per se*, the City has a policy to make annual transfers from the Utility Fund to the Capital Reserve equal to the annual depreciation amount. Depreciation on existing assets is estimated at $710,000 per year, based on the City's 2016 Budget – incremental depreciation from CIP projects is added to this total to forecast depreciation and the consequent funding required from rates. The financial forecast uses the following useful life assumptions to estimate depreciation on the CIP projects:

  – Mains: 50 Years

  – Pump Stations: 30 Years

  – Flow Metering Station: 20 Years

  – Portable Trash Pumps & Engineering Study: 10 Years

  – Rate Study & Comprehensive Plan Update: 5 Years

8.5.3 Revenue Sufficiency

With revenues and expenses defined and projected, the next step is to define how much revenue is adequate to meet the sewer utility's financial needs and satisfy the City's policy objectives. The financial forecast defines revenue sufficiency via a series of tests:

A. Cash Flow Sufficiency Test

This test requires that the sewer utility generate sufficient funds to meet its cash obligations. The cash flow obligations relating to rates include:

- Operating, maintenance and administrative expenses
- Debt service payments
- Rate-funded capital expenditures
- Depreciation funding (system reinvestment)
- Additions to operating reserves

Offsetting these obligations are various sources of revenue, including:

- Interest earnings on operating and bond reserves
- Miscellaneous operating and non-operating revenues
- Use of surplus operating or bond reserves

To satisfy this test, sewer rate revenue must be sufficient to cover all cash needs not covered by other sources. Some resources, such as bond proceeds or GFC revenues, are not typically considered available for meeting these needs but are used for capital project funding.

B. Coverage Sufficiency Test

When the City issues revenue bonds, it agrees to certain terms and conditions related to the repayment of those bonds. One of those terms is referred to as bond coverage – simply put, the City agrees to collect enough in revenues to meet all operating expenses and not only pay debt service but actually collect an additional multiple of that debt service. A bond coverage ratio of 1.25 is most common, meaning that the City would collect expenses plus 1.25 times debt service as a minimum legal level of revenues.

The financial forecast assumes a two-tiered coverage requirement, requiring that sewer rates and other eligible revenues be sufficient to satisfy both of the following tests:

- ***Coverage Test (Without GFCs):*** The City’s bond covenants require that it set rates and charges so that revenues are sufficient to cover operation and maintenance expenses plus 1.25 times annual revenue bond debt service. Given the unpredictable nature of customer growth, it is prudent to limit reliance on GFC revenue to help meet coverage requirements. Consequently, this coverage test requires that net revenues (excluding GFCs) be equal to a minimum of 1.25 times annual revenue bond debt service.

- ***Coverage Test (With GFCs):*** This coverage test allows the inclusion of projected GFCs in the definition of “net revenue,” but requires that net revenues be equal to a minimum of 1.50 times total annual debt service (including both bond and loan payments).

Besides being a legal requirement, the coverage ratio actually realized is an important statistic used to rate a utility’s financial integrity and ability to meet its debt obligations. Revenue generated to comply with coverage requirements may be used for capital purposes, and may reduce the amount of revenue needed to meet cash needs in subsequent years – it can also be used to meet capital requirements (and may thus reduce future borrowing), but generally cannot be held over to reduce coverage needs in subsequent years.

C. Sewer Rate Revenue Requirement

Though the cash flow and coverage sufficiency tests each provide a different perspective on how much revenue is appropriate, it is relatively common for multiple benchmarks to overlap. For example, producing a coverage ratio of 1.25 times annual debt service may generate positive cash flow and concurrently satisfy both sufficiency tests; alternatively, the cash requirements for capital investment may assure positive earnings and adequate coverage. This multi-faceted approach reduces the utility's financial risk and increases financial stability – any near-term increases which result will help facilitate lower and more stable long-term rates. Table 8-7 shows the 2016 – 2022 revenue requirement forecast.

Table 8-7 2016 – 2022 Revenue Requirement Forecast

Cash Flow Sufficiency Test	2016	2017	2018	2019	2020	2021	2022
Revenues							
Sewer Rate Revenue	$ 3,200,000	$ 3,349,019	$ 3,487,267	$ 3,629,674	$ 3,762,337	$ 3,888,627	$ 4,018,450
Other Operating Revenues	34,000	34,903	35,646	36,389	36,991	37,493	37,995
Operating Reserve Interest Earnings	1,000	5,944	7,931	15,495	19,255	30,303	29,847
Use of Debt Service Fund For Debt Service	381,540	383,282	-	-	-	-	-
Total	**$ 3,616,540**	**$ 3,773,149**	**$ 3,530,844**	**$ 3,681,558**	**$ 3,818,583**	**$ 3,956,423**	**$ 4,086,292**
Expenses							
Operating Expenses	$ 1,736,256	$ 1,789,455	$ 1,840,387	$ 1,894,083	$ 1,947,035	$ 2,000,947	$ 2,057,238
Debt Service	381,540	876,188	492,906	492,906	601,365	1,104,002	1,104,002
System Reinvestment Funding	710,000	710,000	781,000	859,100	945,010	1,039,511	1,143,462
Total	**$ 2,827,796**	**$ 3,375,644**	**$ 3,114,292**	**$ 3,246,089**	**$ 3,493,410**	**$ 4,144,460**	**$ 4,304,703**
Cash Flow Surplus (Deficit)	**$ 788,744**	**$ 397,505**	**$ 416,551**	**$ 435,469**	**$ 325,173**	**$ (188,037)**	**$ (218,411)**

Coverage Sufficiency Test	2016	2017	2018	2019	2020	2021	2022
Revenues							
Sewer Rate Revenue	$ 3,200,000	$ 3,349,019	$ 3,487,267	$ 3,629,674	$ 3,762,337	$ 3,888,627	$ 4,018,450
Other Revenues	34,000	34,903	35,646	36,389	36,991	37,493	37,995
Interest Earnings (All Reserves)	19,406	41,857	32,592	28,087	36,072	63,584	73,234
GFCs	370,000	450,000	370,000	370,000	300,000	250,000	250,000
Total	**$ 3,623,406**	**$ 3,875,779**	**$ 3,925,505**	**$ 4,064,150**	**$ 4,135,400**	**$ 4,239,704**	**$ 4,379,679**
Operating Expenses	**$ 1,736,256**	**$ 1,789,455**	**$ 1,840,387**	**$ 1,894,083**	**$ 1,947,035**	**$ 2,000,947**	**$ 2,057,238**
Coverage Without GFCs:							
Revenue Bond Debt Service	$ 381,540	$ 876,188	$ 492,906	$ 492,906	$ 601,365	$ 1,104,002	$ 1,104,002
Coverage Ratio Required	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Coverage Ratio Realized	3.98	1.87	3.48	3.65	3.14	1.80	1.88
Coverage With GFCs:							
Total Debt Service (Bonds & Loans)	$ 381,540	$ 876,188	$ 492,906	$ 492,906	$ 601,365	$ 1,104,002	$ 1,104,002
Coverage Ratio Required	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Coverage Ratio Realized	4.95	2.38	4.23	4.40	3.64	2.03	2.10
Coverage Surplus (Deficit)	**$ 1,314,840**	**$ 772,042**	**$ 1,345,759**	**$ 1,430,708**	**$ 1,286,317**	**$ 582,754**	**$ 666,437**

Sewer Rate Adjustments	2016	2017	2018	2019	2020	2021	2022
Annual Rate Adjustment Implemented (1)	**0.00%**	**0.00%**	**2.00%**	**0.00%**	**2.00%**	**0.00%**	**0.00%**
Post-Adjustment Summary:							
Sewer Rate Revenue	$ 3,200,000	$ 3,349,019	$ 3,557,012	$ 3,702,268	$ 3,914,336	$ 4,045,728	$ 4,180,795
Net Cash Flow	$ 788,744	$ 397,505	$ 479,791	$ 501,292	$ 462,994	$ (45,590)	$ (71,208)
Coverage Ratio Realized (Without GFCs)	3.98	1.87	3.61	3.79	3.37	1.93	2.01
Coverage Ratio Realized (With GFCs)	4.95	2.38	4.36	4.54	3.87	2.16	2.24

(1) *Rate adjustments are above CPI, assumed to be 2.0% per year. The actual increases (including inflation) are:*

	2017	2018	2019	2020	2021	2022
Annual Rate Adjustment	*2.00%*	*4.00%*	*2.00%*	*4.00%*	*2.00%*	*2.00%*

Table 8-7 indicates a rate strategy of 2.0% increases above CPI (assumed to be 2.0% per year) in 2018 and 2020 to preserve the sewer utility's financial integrity. Though it shows negative cash flow in 2021 and 2022, the sewer utility is projected to end 2022 with a combined reserve balance of $6.6 million (excluding restricted bond reserves). The rate strategy shown in Table

8-7 contemplates generating cash funding for Phase 2 of the Lemolo Siphon project, an $8.5-million project that is expected to occur sometime after 2022.

8.6 Sewer Rate Structure Evaluation

The City's current single-family sewer rate structure consists of a monthly fixed charge that includes 4 ccf of water usage and a volume charge that applies to each hundred cubic feet (ccf) above 4 ccf per month. Recognizing that June – October usage generally includes irrigation water that does not enter the sewer system, the City bills single-family residences for actual water consumption from November – May billings and winter-average water consumption from June – October. The City's current commercial and multi-family rate structure consists of a monthly fixed charge based on meter size as well as a volume charge per hundred cubic feet (ccf) that applies to water usage over a 4-ccf allowance.

Table 8-8 shows the forecast of sewer rates for customers inside City limits from 2016 – 2022, assuming uniform "across-the-board" increases to the existing (2016) sewer rate structure:

Table 8-8 2016 – 2022 Sewer Rate Forecast

Sewer Rates Inside City	2016	2017	2018	2019	2020	2021	2022
Single-Family Residential:							
Monthly Fixed Charge	$ 48.35	$ 49.32	$ 51.29	$ 52.32	$ 54.41	$ 55.50	$ 56.61
Commodity Charge (Applies to Usage Over 4 ccf)	$ 6.35	$ 6.48	$ 6.74	$ 6.87	$ 7.15	$ 7.29	$ 7.43
Low-Income Senior:							
Monthly Fixed Charge	$ 22.66	$ 23.11	$ 24.04	$ 24.52	$ 25.50	$ 26.01	$ 26.53
Commodity Charge (Applies to Usage Over 4 ccf)	$ 6.28	$ 6.41	$ 6.66	$ 6.80	$ 7.07	$ 7.21	$ 7.35
Commercial & Multi-Family:							
Monthly Fixed Charge:							
3/4" Meter	$ 51.19	$ 52.21	$ 54.30	$ 55.39	$ 57.60	$ 58.76	$ 59.93
1" Meter	$ 77.82	$ 79.38	$ 82.55	$ 84.20	$ 87.57	$ 89.32	$ 91.11
1-1/2" Meter	$ 121.46	$ 123.89	$ 128.84	$ 131.42	$ 136.68	$ 139.41	$ 142.20
2" Meter	$ 175.53	$ 179.04	$ 186.20	$ 189.93	$ 197.52	$ 201.47	$ 205.50
3" Meter	$ 333.99	$ 340.67	$ 354.30	$ 361.38	$ 375.84	$ 383.35	$ 391.02
4" Meter	$ 495.40	$ 505.31	$ 525.52	$ 536.03	$ 557.47	$ 568.62	$ 579.99
6" Meter	$ 940.03	$ 958.83	$ 997.18	$ 1,017.13	$ 1,057.81	$ 1,078.97	$ 1,100.55
8" Meter	$ 1,472.52	$ 1,501.97	$ 1,562.05	$ 1,593.29	$ 1,657.02	$ 1,690.16	$ 1,723.97
Commodity Charge (Applies to Usage Over 4 ccf)	$ 7.04	$ 7.18	$ 7.47	$ 7.62	$ 7.92	$ 8.08	$ 8.24

It is worth noting that the forecasted rates shown in Table 8-8 may differ based on how the Consumer Price Index changes over time. The financial forecast assumes a CPI inflation rate of 2.0% per year, which is consistent with trends that have occurred over the past ten years.

Sewer Rate Affordability

As noted in Section 8.1, a key objective of this financial chapter is to evaluate the City's ability to execute the capital improvement plan outlined in this CSP while maintaining reasonable sewer rates. While the term "reasonable" is relatively subjective in its definition, agencies that offer low-cost loans to utilities often use an "affordability index" based on median household income to define a threshold beyond which utility rates impose financial hardship on ratepayers. The benchmark most often used in this evaluation is 2.0% of the median household income in the relevant demographic area. The 2014 American Community Survey indicates a median income of $57,296 for households in the City of Poulsbo – assuming 2.0% annual cost-of-living adjustments, the equivalent 2016 median income level would be about $59,611. Table 8-9 shows the affordability evaluation of the projected 2016 – 2022 residential sewer rates:

Table 8-9 Affordability Evaluation of 2016 – 2022 Sewer Rates

Year	Median Household Income (1)	Projected Bill @ 7 ccf	% of Median Household Income
2014	$57,296		
2015	$58,442		
2016	$59,611	$67.40	1.4%
2017	$60,803	$68.75	1.4%
2018	$62,019	$71.50	1.4%
2019	$63,259	$72.93	1.4%
2020	$64,525	$75.84	1.4%
2021	$65,815	$77.36	1.4%
2022	$67,131	$78.91	1.4%

(1) Assumes escalation at 2% per year

Table 8-9 shows that the projected residential sewer bills are expected to remain around 1.4% of median household income over the planning period, remaining within the range defined as "affordable."

8.7 Conclusion

The findings of the financial forecast indicate that the City can execute and finance the capital improvement plan while maintaining reasonable and affordable sewer rates. Table 8-10 shows a comparison of the City's average monthly residential sewer bills with some other jurisdictions of comparable location and / or size.

Table 8-10 Monthly Residential Sewer Bill Comparison

Jurisdiction	Monthly Fixed Charge	Volume Charge per ccf	Volume Allowance	Average Bill @ 7 ccf
Shelton	$44.50	$8.91	-	$106.87
Snohomish	$69.99	$5.90	2 ccf	$99.49
Chehalis	$53.49	$6.43	-	$98.50
Bainbridge Island	$42.69	$7.28	-	$93.65
Hoquiam	$78.60			$78.60
Port Townsend	$30.00	$41.85	4,000 gallons	$71.85
Poulsbo (Proposed 2017 Rates)	***$49.32***	***$6.48***	***4 ccf***	***$68.75***
Brier (AWWD)	$68.61			$68.61
Kitsap County - Central Kitsap	$67.98			$67.98
Kitsap County - Kingston	$67.98			$67.98
Kitsap County - Suquamish	$67.98			$67.98
Poulsbo (Current 2016 Rates)	**$48.35**	**$6.35**	**4 ccf**	**$67.40**
Bremerton	$34.24	$4.59	-	$66.37
Gig Harbor	$33.57	$4.13	-	$62.48
Fife	$60.91			$60.91
Fircrest	$57.00			$57.00
Port Orchard	$55.50			$55.50
Steilacoom	$49.96			$49.96
Liberty Lake W&S District	$45.37			$45.37
Burlington	$30.56	$4.36	5 ccf	$39.28
Selah	$38.20			$38.20

As shown in Table 8-10, the projected 2017 increase would bring the City's average monthly residential sewer bill to $68.75 in the recommended scenario – this appears to be within reasonable bounds, given what customers in neighboring communities are experiencing. Table

8-10 does not account for differences in utility fiscal management policies and practices (for example, cities with lower rates may not be funding depreciation-based system reinvestment at the same level as the City if at all), nor does it account for any near-term rate adjustments that these jurisdictions may be planning.

It would be prudent for the City to engage in a more comprehensive cost-of-service rate study within the next several years to update the sewer rate structure for changes in utility costs, structure, and customer demands (relative between classes). The City could also consider further sewer rate structure enhancements at that time.

It is important to remember that the analysis performed in this chapter relies on a variety of assumptions regarding growth, cost escalation, and operational conditions (among others). To verify that the rate strategy shown in Table 8-7 remains adequate to fund the needs of the City of Poulsbo's sewer utility, the City plans to revisit the financial forecast and GFCs on a three-year cycle. The City will also review the financial strategy in anticipation of events that may potentially have a material fiscal impact, such as the completion of the Lemolo evaluation.

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Chapter 9 References

Brown and Caldwell, 1994. Central Kitsap County Wastewater Facility Plan. Prepared for Kitsap County Public Works.

CH2M Hill, 2001. Existing Lemolo Pipeline and Pump Station 16 Analysis. Technical memorandum prepared for Kitsap County. July 19.

City of Poulsbo and Kitsap County, 2001. Poulsbo Sub-Area Plan. olume I. December 17.

Gray and Osborne, Inc., 2007. City of Poulsbo Draft Water System Plan. G&O #06657. January.

Kitsap County, 2000. Final Supplemental Environmental Impact Statement for the Central Kitsap County Facilities Plan.

Kitsap County, 2006. Final 10-Year Comprehensive Plan Update. December.

Parametrix, 1998. City of Poulsbo Draft Comprehensive Sewer Plan Update. May.

Parametrix, 2002. City of Poulsbo Draft Comprehensive Sewer Plan Update – 2002 Update. April.

Parametrix, 2008. City of Poulsbo Draft Comprehensive Sewer Plan Update – 2008 Update. September.

R.W. Beck, 1992. City of Poulsbo Comprehensive Sanitary Sewer Plan. August.

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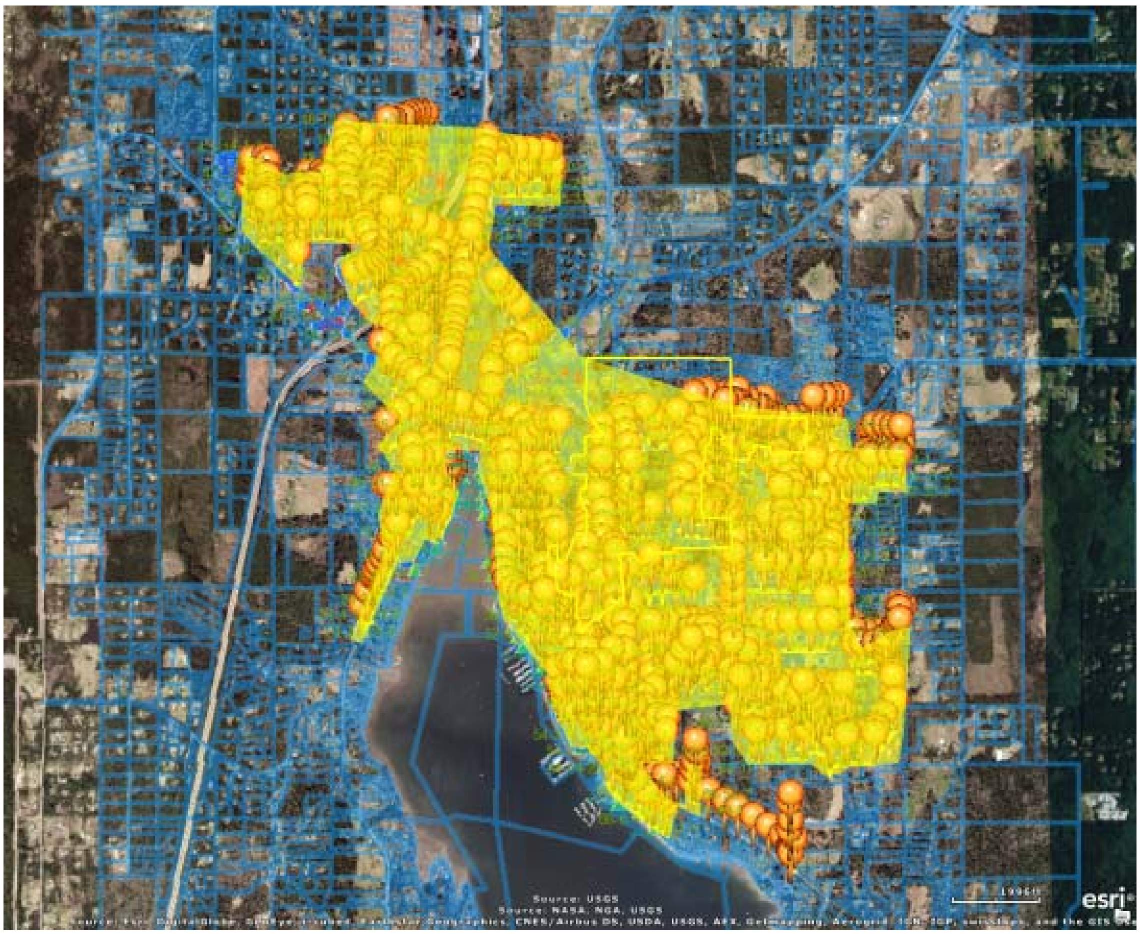
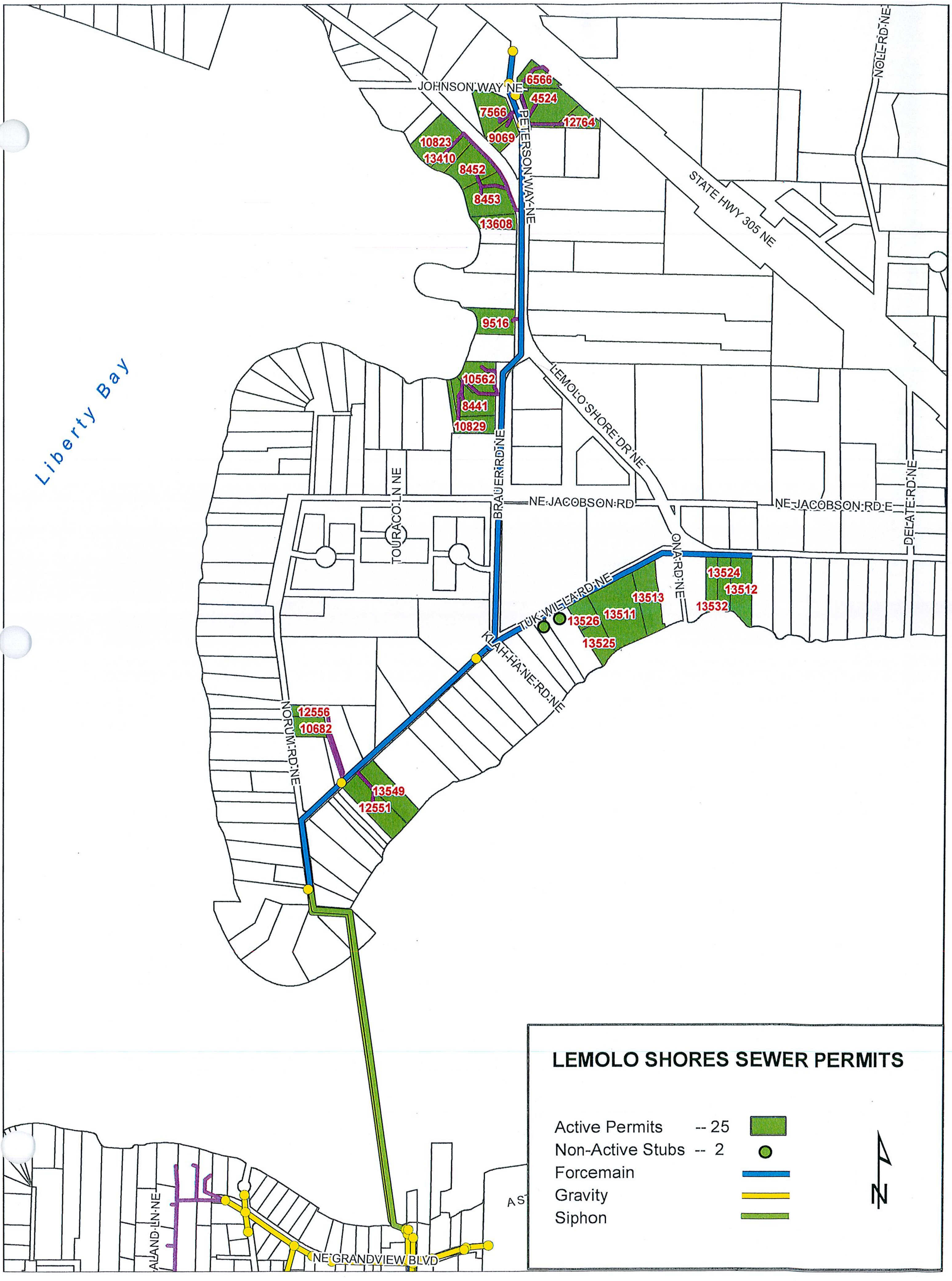
Appendix A

Connections Outside UGA

2015 City of Poulsbo Sewer Service Area




LEMOLO SHORES SEWER PERMITS
Active Permits -- 25
Non-Active Stubs -- 2
Forcemain
Gravity
Siphon
N
Liberty Bay
JOHNSON WAY NE
PETERSON WAY NE
STATE HWY 305 NE
NOLL RD NE
LEMOLO SHORE DR NE
BRAUER RD NE
TOURACO LN NE
NE JACOBSON RD
NE JACOBSON RD E
DELATE RD NE
ONA RD NE
TUKWILA RD NE
KLAH-HA-NE RD NE
NORUM RD NE
ALAND LN NE
NE GRANDVIEW BLVD
6566
4524
7566
12764
9069
10823
13410
8452
8453
13608
9516
10562
8441
10829
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12556
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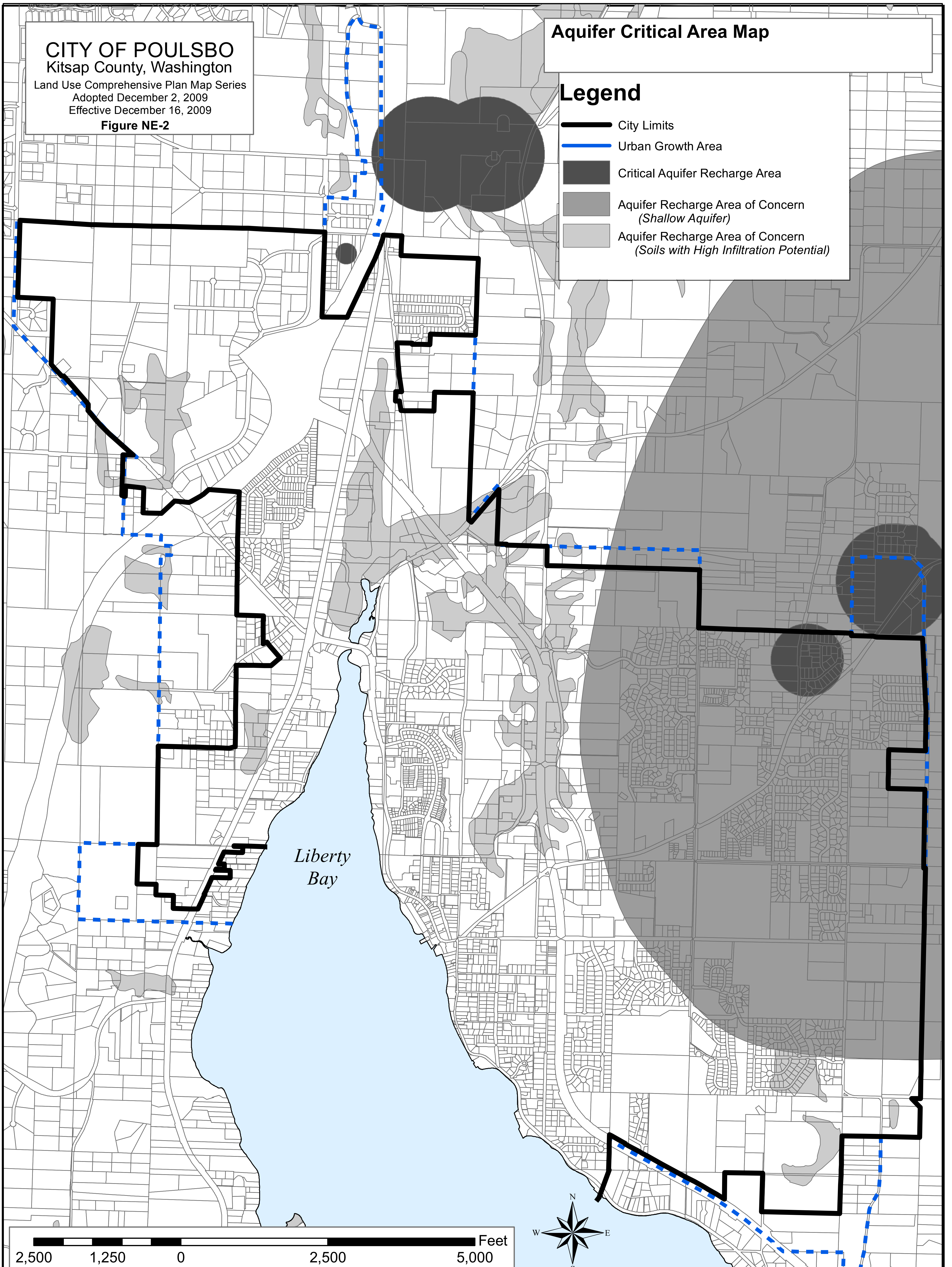
Appendix B

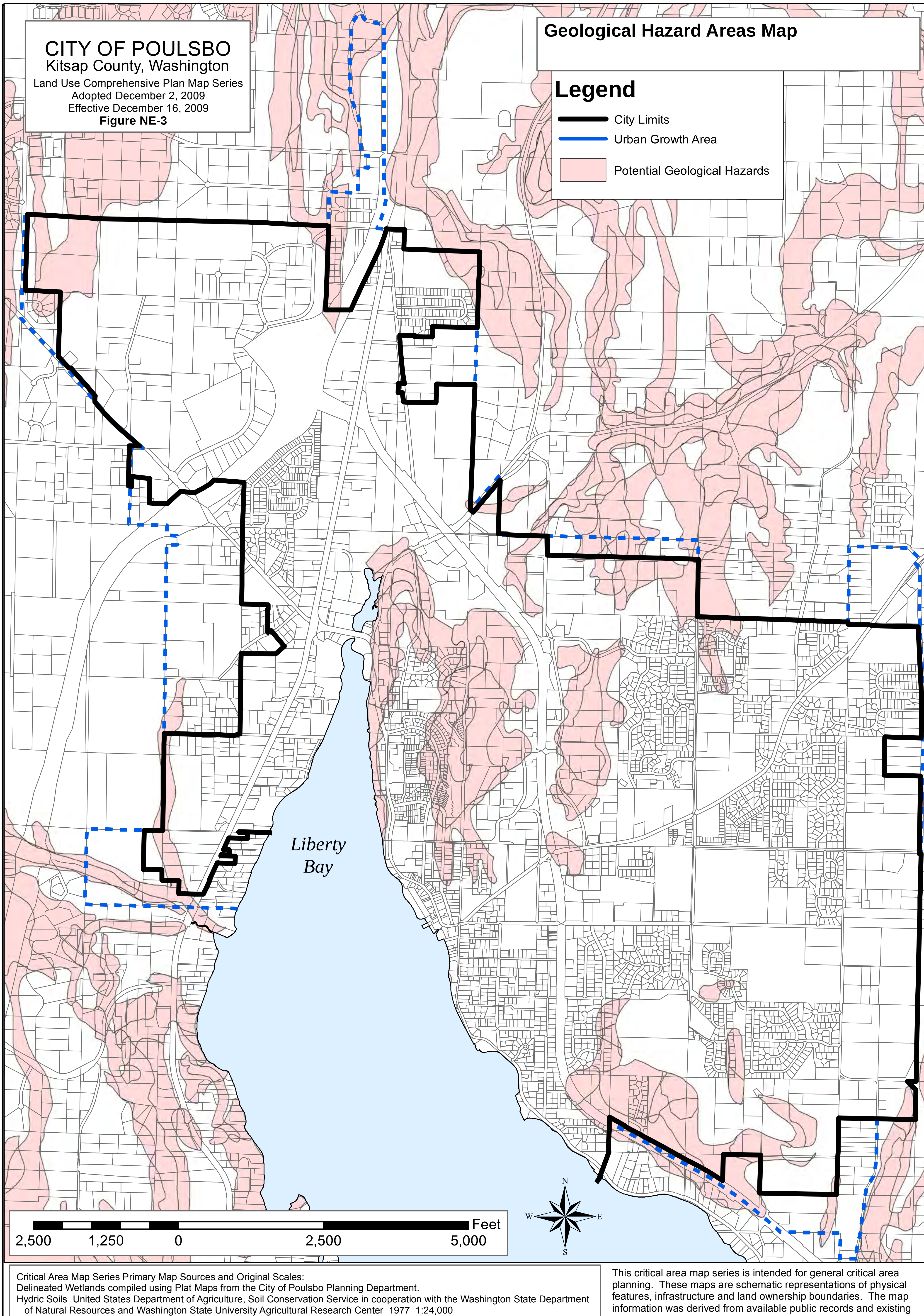
Critical Areas



Critical Area Map Series Primary Map Sources and Original Scales:
Delineated Wetlands compiled using Plat Maps from the City of Poulsbo Planning Department.
Hydric Soils United States Department of Agriculture, Soil Conservation Service in cooperation with the Washington State Department of Natural Resources and Washington State University Agricultural Research Center 1977 1:24,000
W.S.D.N.R. Hydrography, Washington State Department of Fish and Wildlife 1:24,000
Deeter, J. 1979, Quaternary Stratigraphy of Kitsap County Appendix III, p 149-159 and Plate 9
Shallow Aquifer and Wellhead, Kitsap Public Utility District
Kitsap County Assessor's Tax Maps 1:12,000 (Kitsap County IT, GIS Division)
* Note: Saltwater wetlands are not represented on this map, however, they are of concern within the Shoreline Management Act.

This critical area map series is intended for general critical area planning. These maps are schematic representations of physical features, infrastructure and land ownership boundaries. The map information was derived from available public records and existing sources, not from surveys. Studies may be necessary with project review to verify information.

City of Poulsbo Planning Department GIS
Printed on July 11, 2012



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W.S.D.N.R. Hydrography, Washington State Department of Fish and Wildlife 1:24,000
Deeter, J. 1979, Quaternary Stratigraphy of Kitsap County Appendix III, p 149-159 and Plate 9
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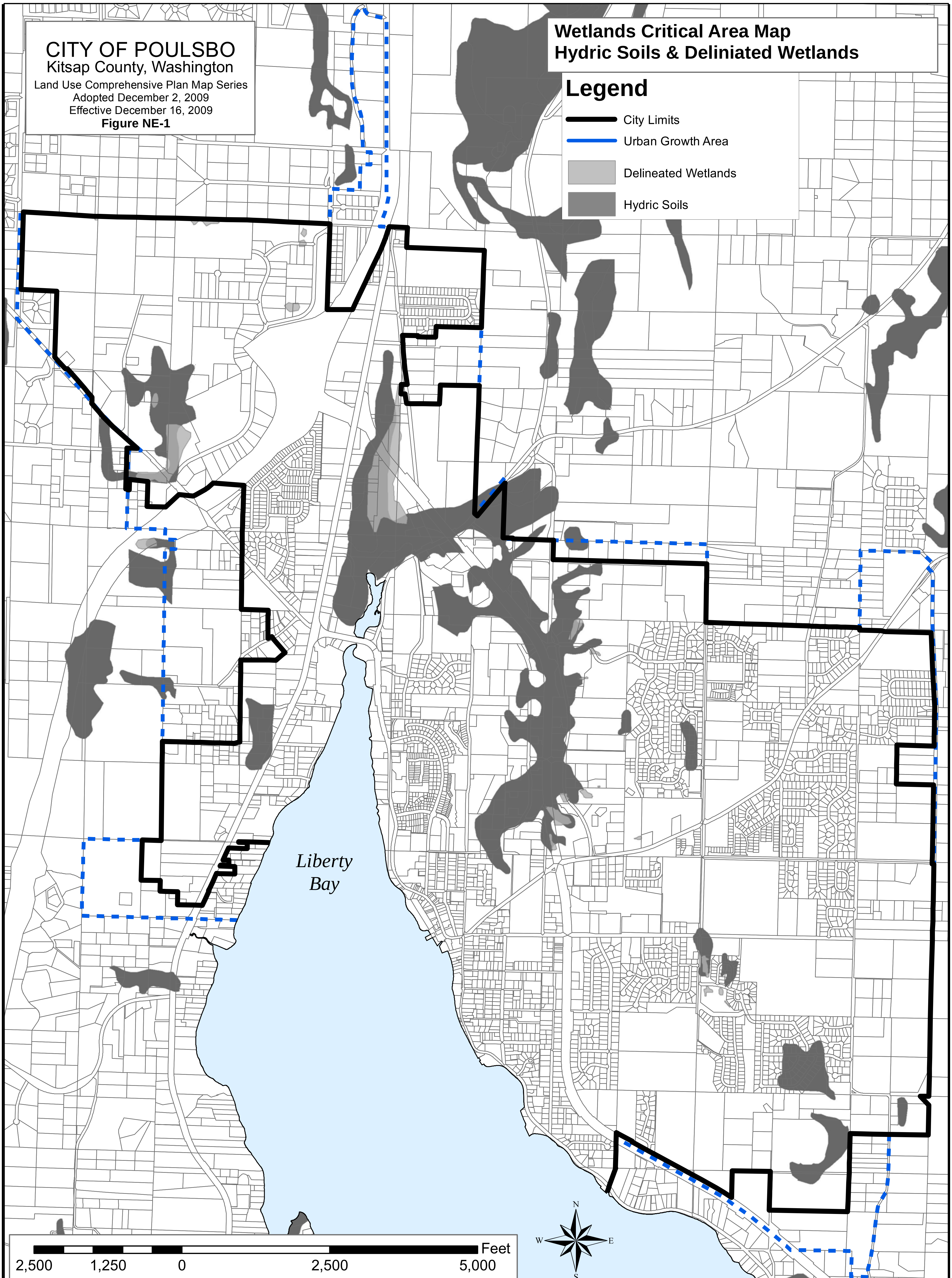

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City of Poulsbo Planning Department GIS
Printed on July 11, 2012

Appendix C

Interlocal Agreements

POULSBO AGREEMENT DISTRIBUTION SCHEDULE

SUBJECT: **ILA – Kitsap County - Sanitary Sewer Service**

CONFORM AS TO DATES & SIGNATURES

(X) Approved by the City Council: 09/05/2012
(X) Completion: 12/31/2032
(X) Recorded: Posted to City Website in lieu of recording

DISTRIBUTE CONFORMED COPIES AS FOLLOWS:

(_) City Attorney
(1) Clerk's Department: Original
(X) Posted to Library Drive
(X) Posted to Web Site
(_) Finance:
(_) Fire District #18
(_) Mayor
(_) Municipal Court
(_) MRSC
(_) Parks/Recreation
(_) Planning/Building
(_) Police
(_) Public Works/Engineering:

Jill A. Boltz
City Clerk

October 18, 2012
Date

Contract for Sanitary Sewer Service

This agreement is entered into between Kitsap County (hereinafter referred to as "the County") and the City of Poulsbo (hereinafter referred to as "the City"), for the purposes hereinafter stated.

Whereas, RCW 36.94.190 and Chapter 39.34 RCW authorize cities and counties to contract with one another for the establishment, maintenance, and operation of sewerage systems, and

Whereas, the County has constructed and currently operates sanitary sewer facilities capable of receiving, carrying, treating, and disposing of sewage produced by the City, and

Whereas, the County and the City have contracted since 1979 for County treatment, and disposal of the City's sanitary sewage under that certain agreement entitled "Contract for Sanitary Sewage Service" and the City's sanitary sewer currently connects to the County's facilities in the vicinity of Johnson Road and SR-305, and

Whereas, the present contract terminated September 30, 2000, and the parties desire to continue to contract for the provision of sanitary sewer service to the City by the County, and

NOW, THEREFORE, in consideration of the mutual covenants contained herein, it is hereby agreed as follows:

Section 1. Sewerage Facilities.

A. The County shall plan, construct, reconstruct, operate, and maintain a sanitary sewage system, which shall include treatment facilities, sewer lines and interceptors, pump stations, outfalls, and other necessary appurtenances. This sanitary facility shall be known as the Kitsap County Central Kitsap Wastewater Facility (hereinafter referred to as the "wastewater facility"). The wastewater facility shall be capable of receiving, carrying, treating, and disposing of the sanitary sewage produced by the City in the quantities and of the qualities specified in Section 4 of this document, and shall be constructed and maintained to allow connection by the City at the delivery point specified in Section 3.

B. The County shall plan, construct, operate and maintain the wastewater facility in a manner that will constitute no unnecessary hazard to the public health, safety, or welfare and in conformance with all applicable federal, state and local laws, rules and regulations as now or hereafter amended.

Section 2. The City's Collection Facilities.

A. The City shall construct, operate, and maintain a sanitary sewer collection system to the point of delivery specified in Section 3. Such system shall be capable of collecting and delivering the sanitary sewage generated within the City to the said point of delivery.

B. The City shall plan construct, operate and maintain its sanitary sewer system in such a manner that will constitute no unnecessary hazard to the public health, safety or welfare and in compliance with all applicable federal, state and local laws, rules and regulations as now or hereafter amended.

C. The County shall not make any connection to Poulsbo's sanitary sewage collection system in order to provide sewage service to areas outside the city limits of the City without the prior written consent of Poulsbo.

Section 3. Delivery and Receipt of Sewage.

A. The City shall deliver to the County and the County shall receive from the City the sanitary sewage produced by the City. The delivery and receipt shall occur at the metering manhole at a mutually agreed upon point in the immediate vicinity of the intersection of Johnson Road and SR 305.

B. The City shall notify the County of changes in its Capital Improvement Plan that will result in substantial increases in the quantity of sewage delivered to the County in order that the County may anticipate and plan for this increase.

Section 4. Quantity of Sanitary Sewage.

A. The County shall make available to the City the capacity to receive, convey, treat and dispose of sanitary sewage from the City's sewer customers in accordance with the Central Kitsap Wastewater Treatment Facilities Plan dated March 2011 and the City of Poulsbo Comprehensive Sanitary Sewer Plan dated September 2008. Said plans are to be reviewed on a periodic schedule, and updates are to be included in this agreement.

B. In accordance with the terms of prior contracts for sanitary sewer service, the City has made capital contributions to reserve capacity in the Central Kitsap Treatment. As a result of those contributions, the County shall reserve and make available to the City the capacity to receive, carry, treat, and dispose of sanitary sewage in the amount of 0.95 million gallons per day (MGD). Average daily flow shall be computed by dividing the total flow for each month by the number of days in that corresponding month. The flow referred to in this section is that measured at the metering manhole near Johnson Road and SR 305.

Section 5. Ownership of Facilities.

Notwithstanding any payment or capital contribution made by the City, the wastewater facility and all parts thereof constructed, operated, and maintained by the County shall be and remain the property of the County. Notwithstanding any payment or capital contribution made by the County, all sewer service facilities constructed, operated, and maintained by the City shall be and remain the property of the City.

Section 6. Ownership of Reclaimed Water.

The Facilities Plan for the wastewater facility anticipates future capital improvements to produce re-claimed water for potential uses such as re-sale, groundwater recharge, and wetlands enhancement. Any revenues from re-sale, water rights created, or mitigation credits recognized by the County that result from the production and distribution of re-claimed water from the wastewater facility will be shared with the City in the same percentage as the City wastewater flows are of the total flows to the facility.

Section 7. Maintenance, Operation, and Repair Charges.

A. Generally.

1. Maintenance, Operation, and Repair Charges Generally:

   Both parties recognize generally that the County will incur operation and maintenance and repair costs in connection with the treatment plant and that portion of the Wastewater facility that is used to transport raw sewage generated by Poulsbo to the treatment plant. The City agrees to pay the proportionate share of these costs allocable to the City based upon the City's flow through the system. The allocable proportion shall be made up of two components: (1) a fixed maintenance and operation component; and (2) a variable maintenance and operation component.

2. Capital Contributions and Bonds:

   Both the City and the County anticipate that each may issue bonds in order to make capital contributions for those portions of the Wastewater Facility that each will utilize. Debt service, coverage requirements, principal payments and related fees for bonds issued by the City shall be the sole responsibility of the City. Similarly, debt service, coverage requirements, principal payments and related fees for bonds issued by the County shall be the sole responsibility of the County. No amount for debt service, coverage requirements, principal payments, and/or related fees for County bonds shall be included within or as part of the maintenance and operation costs to be borne by the City, unless specifically agreed upon in writing by both parties as an amendment to this agreement.

B. Fixed Maintenance and Operation Component

1. Treatment Plant Costs:

Fixed maintenance and operation costs shall include all costs of maintaining and operating the wastewater facility, except for those costs included within the variable maintenance and operation component. The fixed maintenance and operation component of treatment plant costs payable by the City is based upon the ratio, which the treatment capacity of the treatment plant reserved for the City (0.95 MGD average daily flow (ADF)) bears to the treatment capacity of the entire wastewater facility (6.0 MGD ADF). Thus the fixed maintenance, operation and replacement component for treatment plant costs payable by the City equals 15.83 percent (0.95 MGD/6.0 MGD). This ratio will be adjusted as changes are made is future years to either the treatment plant capacity reserved for the City or by the rated treatment capacity of the entire plant.

2. Fixed Costs for Transporting Sewage:

The City's proportionate share of the fixed operation, maintenance and replacement costs of that portion of the wastewater facility used to transport raw sewage generated by the City to the treatment plant shall be based upon the ratio which the total daily flow of sewage generated by the City and carried through said facilities bears to the total flow of all sewage carried through said facilities. These ratios will be recalculated each year. Facilities used by the City for transporting sewage, which will be used for determining costs are:

a. The Johnson Road chlorination station, meter, valve vault and pressure line to Pump Station #16.
   - Current City funding responsibility is 100% for this portion of the system due to the small number of existing connections to the line between Johnson Road and Pump Station #16. Should this number increase above 5% of the total flow in the line, the City's percentage will be adjusted.

b. Pump Station #16 and pressure line to Pump Station #24.
   - Current City funding responsibility for Pump Station # 16 is 93.6% and pressure line to Pump Station #24 is 79.5%.

c. Pump Station #24 and pressure line to the treatment plant.
   - Current City funding responsibility for Pump Station #24 and pressure line to the treatment plant is 45.6%.

The fixed and variable costs shall be computed as provided in Section 7,

(E) and (F).

C. Variable Maintenance and Operation Component.

Variable maintenance, operation and replacement costs at the treatment plant consist of the following:

- Sludge and grit processing and disposal
- Chlorination
- Dechlorination
- Utilities for the treatment plant

The variable maintenance and operation component payable by the City is based upon the amount of sewage actually delivered by the City. The City shall pay the proportion of the variable maintenance and operation costs of the treatment plant which is determined by dividing the entire amount of sewage received, treated and disposed of at the treatment plant into the amount of sewage delivered by the City, and then multiplying that figure with the variable maintenance and operation costs for the treatment plant.

D. Billings.

The County shall bill the City for the City's share of maintenance and operation on a monthly basis. The City shall pay such bills within thirty (30) days of receipt thereof and any portion of any bill not so paid shall bear interest at the rate of eight percent (8%) per annum until paid, provided, however, that in the event the City disputes in good faith any portion of any bill, interest shall no be applicable to that portion of the bill, if any, which is ultimately found not to be properly chargeable to the City.

E. Rate Adjustment.

On or before August 5, 2012, and each August 5 thereafter during the term of this Agreement, the County shall estimate the anticipated fixed and variable maintenance and operation costs for the year commencing on the following October 1. The County will consider previous and anticipated maintenance and operation costs, anticipated inflation, and other relevant facts and information. On or before August 5, 2012, and each August 5 thereafter, the County shall submit the rate estimates to the City for review and comment. Thereafter the County shall evaluate the City's comments, if the same are received by September 5, and may, in its discretion, implement such comments into the rate estimates. The rate estimates shall become effective October 1, 2012, and each October 1 thereafter for the term of this Agreement.

F. Overage and Underage.

The intent of this subsection is to require an annual accounting so that amounts paid by the City, which were based upon estimated or declared rates, may be adjusted so that the City pays no more or less than actual costs for maintenance and operation as such costs are subsequently determined. Should the rate or rate estimate declared in this section prove insufficient or in excess of actual costs for maintenance and operation, then, in the case of an insufficiency, the City shall pay a supplementary bill in the appropriate amount, or, in the case of an excess, the County shall allow the City a credit in the appropriate amount. The foregoing adjustment shall occur on or before December 31, 2012, and, thereafter, on or before December 31 of each year during the term of this Agreement. This subsection applies only to the usage of facilities within the agreed to flow limits identified in Section 4 of this document.

G. Measurement of Service.

The quantity of sewage collected by the City and received by the County shall be measured by metering equipment located at the point of delivery and receipt specified in Section 3. The metering equipment shall be of standard design and manufacture and shall be furnished, installed, maintained and read by the County. Initial calibration of the meter shall be performed by manufacturer's representative and the County shall no less than weekly inspect the meter and shall test the metering device no less than annually. The City shall have access to the meter-recording device to obtain data for the maintenance and operation of its sewage collection system and the County operation of its sewage collection system and the County shall furnish the City with a copy of the weekly flow chart, if requested. In the event that any meter fails to correctly measure the quantity of sewage delivered, the quantity of sewage delivered shall be estimated by the County, and the City shall be so advised. An adjustment shall be made if the meter read registers more than plus or minus two percent (2%) of actual volume. If necessary, the County shall make an adjustment in previous billings to reflect the greater or lesser amount of sewage delivered.

Section 8. Capital Improvement Contributions

This section establishes the procedure for the City to share the cost of wastewater facility and conveyance Capital Improvement projects to be constructed by the County.

The City's participation in the capital program will involve 3 techniques:

- Two tiered – System Development Charges
- Prior Capital Costs
- Capital Recovery Charges

A. System Development Charges

New customers in the City will be charged a two tiered system development charge (SDC). The SDC will include the City's portion plus a charge equal to the County's Central Kitsap Treatment Plant Newcomer Assessment. The County portion will be passed through to Kitsap County on a monthly basis. The total SDC charges received by the County for each month will be shown on monthly billing statements it sends to the City as described in section 7.D.

The city may apply the accumulated charges towards its share of capacity projects or treatment upgrades as described in section 8.C.2, or toward additional reserved treatment plant capacity for the City as described in section 16.

B. Prior Capital Costs

Prior Capital Costs incurred by the County for capital projects that serve the City are reconciled with the System Development Charges received from the City as of February 10, 2012 in Exhibit A.

C. Capital Recovery Charges

1. Existing Capital Recovery Charges:

The City has been paying off prior capital charges related to plant upgrades in 1998 on an annual basis. The remaining annual payments are shown in exhibit B. These payments shall be split into twelve monthly payments and added to the monthly billing statement described in section 7.D commencing on January 1, 2013.

2. Future Capital Recovery Charges:

The City agrees to reimburse the County for its proportionate share of all costs associated with the refurbishment, replacement, upgrade, or new facilities that serve the City. These capital costs shall include property acquisition, design, construction, and construction management. The proportionate share shall be the ratio of design flow dedicated to the City as it relates to the total design flow for the capital project. The City shall pay the County its proportionate share starting in the calendar year following completion of the capital project.

The City may pay its proportionate share as a lump sum or as annual payments. Annual payments may be in the form of shared payment of sewer revenue bonds sold by the County. In such a case the City shall pay a proportionate share of the bond principal plus interest payments and set up fees to the County. Any annual payment plan will require an amendment to this agreement as specified in section 21.

D. Management of Capital Improvement Projects

For the portion of the Wastewater facility that is primarily used to transport raw sewage generated by Poulsbo to the treatment plant (Johnson Road chlorination station, meter, valve vault, pressure line to Pump Station #16, and Pump Station #16, or reconstructed line from Pump Station #16 to Pump Station #67). The County will consult closely with the City on project planning, design, and construction. City elected officials and staff will be invited in County Commissioners' briefings regarding Capital Facilities Plan development prior to final approval by the Commissioner.

Section 9. Repeal of Sewage Agreement.

The City and the County hereby repeal, terminate and declare null and void that certain Agreement entitled "Contract for Sanitary Sewer Service" executed by both parties on November 6, 1995, and amended on June 17, 1996 and February 9, 1998.

Section 10. Term of Agreement.

This Agreement shall be in full force and effect upon execution by both parties, and shall terminate on December 31, 2032. The agreement may be extended upon mutual agreement of both parties.

Section 11. Termination of the Agreement

If either party wishes to terminate the agreement prior to the date specified in section 10, either party may terminate this contract upon five year's written notice to the other

Section 12. Management of Wastewater Facility.

The County shall use reasonable and efficient business judgment in the management, operation, maintenance, and control of the wastewater facility to the end that the City's costs for maintenance and operation will not be unnecessarily increased. Furthermore, the County shall comply with all applicable federal, state and local laws, rules and regulations in the management, operation, maintenance and control of the wastewater facility.

Section 13. Books and Records.

The County shall maintain detailed and sufficient books and records pertaining to the planning, construction, maintenance and operation of the wastewater facility. Furthermore, the County shall develop and maintain detailed and sufficient books and records pertaining to the rates and rate adjustments mention in section 7.E. Each party shall have full and complete access to the books and records of the other at any and all reasonable times.

Section 14. Delivery and Legal Sewage

The City agrees to deliver only legal and lawful sewage to the County as determined by applicable federal, state and local laws, rules and regulations as now or hereafter amended, including but not limited to, Kitsap County Code 13.12, as now existing or as hereinafter amended or superseded. The County shall take all reasonable measures to insure that no person, firm corporation, governmental entity or other entity discharges or delivers into the Wastewater Facility any unlawful or illegal sewage as such is defined by the preceding sentence.

Section 15. Upgrading Facilities.

Subsequent to the effective date of this contact, should any federal or state law, rule or regulation increase acceptable water quality standards, mandate more costly methods of effluent or sludge treatment, restrict acceptable types or amounts of effluent discharge or sludge disposal, or otherwise make sewage or sludge carriage, treatment or discharge more costly, the parties shall make all reasonable efforts to agree upon a means of upgrading the wastewater facility to meet such new standards, methods or needs; provided, that if either party determines that it is unwilling or unable to participate in or bear the additional costs or expenses which would permit its proportionate share to be upgraded, either party may terminate this contract upon five year's written notice to the other.

Section 16. Increasing Capacity.

Subsequent to the effective date of this contract, should the City desire to increase the capacity reserved to it beyond that mentioned in Section 4, the County shall cooperate with the City in all reasonable ways to make increased capacity available. Such efforts shall include, but are not limited to, the temporary use of capacity legally available to the County, the City reimbursing the County for additional permanent capacity assigned to the City if available at the plant, the use of the County rights of way and property for additional sewerage facilities, concurrence of the County and grant applications by the City and letting construction contracts for additional sewerage facilities. The parties understand that such efforts by the County will not necessarily be free of charge by the County and the City shall agree upon any additional charge for such efforts prior to such efforts being made.

Section 17. Grant Assistance.

The County shall, at the City's request, assist the City in all reasonable ways to obtain grants and other funds from state or federal agencies or departments in order that the City may obtain financial assistance to make improvements to the sewage system presently owned and operated by the City, and in order that the City may obtain financial assistance to defray, in whole or in part, cost incurred as a result of this Agreement and/or costs incurred to construct or maintain any collection facilities deemed necessary by the City to comply with the terms of this Agreement.

Section 18. Indemnity.

The County shall protect, defend, save harmless and indemnify the City and its officers, agents and employees from and against all claims, suits and actions for all damage, sickness, death or injury arising from the negligent and/or malicious acts or errors or omissions and any willful, wanton, malicious acts or intentional tortuous conduct on the part of the County or its agents and/or employees arising from or in any way related to the operation and/or performance of this agreement. The County further agrees to fully indemnify the City from and against any and all costs including attorney's fees of defending any such claim or demand. Additionally, the County specifically waives its immunity under Title 51 of the Revised Code of Washington, the Industrial Insurance Act, for injuries to its employees and agrees that the obligation to indemnify the City extends to any claim, demand, or action brought by or on behalf of any employee of the County, and includes any judgment, award, and cost thereof including attorney's fees incurred. This paragraph shall not apply to damages and claims resulting from the sole negligence of the City.

The City shall protect, defend, save harmless and indemnify the County and its officers, agents, and employees from and against all claims, suits and actions for all damage, sickness, death or injury arising from the negligent and /or malicious acts or errors or omissions and any willful, wanton, malicious or intentional tortuous conduct on the part of the City or its agents and/or employees arising from or in any way related to the operation and/or performance of this agreement. The City further agrees to fully indemnify the County from and against any and all costs including attorney's fees of defending any such claim or demand. Additionally, the City specifically waives its immunity under Title 51 of the Revised Code of Washington, the Industrial Insurance Act, for injuries to its employees and agrees that the obligation to indemnify the County extends to any claim, demand, or action brought by or on behalf of any employee of the City, and includes any judgment, award, and cost thereof including attorney's fees incurred. This paragraph shall not apply to damages and claims resulting from the sole negligence of the County.

Section 19. Notices.

All communications, notices, bills and other correspondence regarding this contract shall be addressed as follows:

The City:	City of Poulsbo 200 NE Moe St. Poulsbo, WA 98370
The County:	Kitsap County Public Works Department 614 Division Street MS 26 Port Orchard, WA 98366

Section 20. Entire Agreement.

This Agreement constitutes the entire understanding between the parties and no other agreement, oral or otherwise, shall be deemed to exist with respect to the subject matter herein.

Section 21. Modifications.

Either party may request modifications to this contract. Proposed changes, which are mutually agreed upon, shall be incorporated by written amendment to this contract.

Section 22. Assignments and Subcontract.

The County shall not assign or subcontract, to any person or entity, any of the services contemplated by this contract without the City's written consent.

Section 23. Applicable Law - Venue.

This contract shall be governed and construed in accordance with the laws of the State of Washington and, in the event of a dispute, the venue of any action brought hereunder shall be in Kitsap County, Washington.

DATED this 5TH day of SEPTEMBER, 2012.

CITY OF POUSLBO:

REBECCA ERICKSON, MAYOR

ATTEST/AUTHENTICATED:

CITY CLERK, JILL BOLTZ

APPROVED AS TO FORM:
OFFICE OF THE CITY ATTORNEY

BY:

KC-146-12

DATED this 8th day of October, 2012.

BOARD OF COUNTY COMMISSIONERS

KITSAP COUNTY, WASHINGTON

ROBERT GELDER, Chair

NOT PRESENT

JOSH BROWN, Commissioner

CHARLOTTE GARRIDO, Commissioner

ATTEST:

Dana Daniels, Clerk of the Board

Exhibit A: Reconciliation of City Sewer Development Charges Paid by City to County and Prior Capital Charges Owed by City to County

City Sewer Development Charges Received by County as of 6/30/12			$3,009,035.00
City 1999 Bond Payments (see Exhibit B)		2005	$135,464.43
Payments necessary to bring City current		2006	$134,926.21
		2007	$135,009.32
		2008	$134,884.26
		2009	$135,376.97
		2010	$134,867.25
		2011	$133,306.41
		2012	$132,659.36
City Share of Replaced Headworks (06/30/12)			
	$16,645,410	8.6%	$1,424,607.2

8.6% for Headworks based on 0.95 MGD capacity for City vs. 11.1 MGD Design basis for Headworks

Poulsbo Sewer Development Charge Balance as of 6/30/12	$507,933.62

BOND ISSUE		PRINCIPAL	INTEREST	DEBT TOTAL	POULSBO SHARE @ 15.83%	ANNUAL POULSBO SHARE
4141 SEW REV 99	6/1/2005	-	197,872.50	197,872.50	31,323.22	2005
4141 SEW REV 99	12/1/2005	460,000.00	197,872.50	657,872.50	104,141.22	135,464.43
4141 SEW REV 99	6/1/2006	-	188,672.50	188,672.50	29,866.86	2006
4141 SEW REV 99	12/1/2006	475,000.00	188,672.50	663,672.50	105,059.36	134,926.21
4141 SEW REV 99	6/1/2007	-	178,935.00	178,935.00	28,325.41	2007
4141 SEW REV 99	12/1/2007	495,000.00	178,935.00	673,935.00	106,683.91	135,009.32
4141 SEW REV 99	6/1/2008	-	168,540.00	168,540.00	26,679.88	2008
4141 SEW REV 99	12/1/2008	515,000.00	168,540.00	683,540.00	108,204.38	134,884.26
4141 SEW REV 99	6/1/2009	-	157,596.25	157,596.25	24,947.49	2009
4141 SEW REV 99	12/1/2009	540,000.00	157,596.25	697,596.25	110,429.49	135,376.97
4141 SEW REV 99	6/1/2010	-	145,986.25	145,986.25	23,109.62	2010
4141 SEW REV 99	12/1/2010	560,000.00	145,986.25	705,986.25	111,757.62	134,867.25
4141 SEW REV 99	6/1/2011	-	133,666.25	133,666.25		
4141 SEW REV 99	12/1/2011	585,000.00	133,666.25	718,666.25		
4141 SEW REV 99	6/1/2012	-	120,503.75	120,503.75		
4141 SEW REV 99	12/1/2012	610,000.00	120,503.75	730,503.75		
4141 SEW REV 99	6/1/2013	-	106,473.75	106,473.75		
4141 SEW REV 99	12/1/2013	640,000.00	106,473.75	746,473.75		
4141 SEW REV 99	6/1/2014	-	91,433.75	91,433.75		
4141 SEW REV 99	12/1/2014	670,000.00	91,433.75	761,433.75		
4141 SEW REV 99	6/1/2015		75,521.25	75,521.25		
4141 SEW REV 99	12/1/2015	705,000.00	75,521.25	780,521.25		
4141 SEW REV 99	6/1/2016	-	58,425.00	58,425.00		
4141 SEW REV 99	12/1/2016	735,000.00	58,425.00	793,425.00		
4141 SEW REV 99	6/1/2017	-	40,417.50	40,417.50		
4141 SEW REV 99	12/1/2017	775,000.00	40,417.50	815,417.50		
4141 SEW REV 99	6/1/2018	-	20,655.00	20,655.00		
4141 SEW REV 99	12/1/2018	810,000.00	20,655.00	830,655.00		

1999 Sewer Revenue Bonds Refunded as 2010 Series A in 2010

2010 SERIES A	6/1/2011		85,700.00	85,700.00	13,566.31	2011
2010 SERIES A	12/1/2011	660,000.00	96,412.50	756,412.50	119,740.10	133,306.41
2010 SERIES A	6/1/2012		86,512.50	86,512.50	13,694.93	2012
2010 SERIES A	12/1/2012	665,000.00	86,512.50	751,512.50	118,964.43	132,659.36
2010 SERIES A	6/1/2013		76,537.50	76,537.50	12,115.89	2013
2010 SERIES A	12/1/2013	685,000.00	76,537.50	761,537.50	120,551.39	132,667.27
2010 SERIES A	6/1/2014		66,262.50	66,262.50	10,489.35	2014
2010 SERIES A	12/1/2014	705,000.00	66,262.50	771,262.50	122,090.85	132,580.21
2010 SERIES A	6/1/2015		55,687.50	55,687.50	8,815.33	2015
2010 SERIES A	12/1/2015	730,000.00	55,687.50	785,687.50	124,374.33	133,189.66
2010 SERIES A	6/1/2016		44,737.50	44,737.50	7,081.95	2016
2010 SERIES A	12/1/2016	745,000.00	44,737.50	789,737.50	125,015.45	132,097.39
2010 SERIES A	6/1/2017		31,700.00	31,700.00	5,018.11	2017
2010 SERIES A	12/1/2017	780,000.00	31,700.00	811,700.00	128,492.11	133,510.22
2010 SERIES A	6/1/2018		16,100.00	16,100.00	2,548.63	2018
2010 SERIES A	12/1/2018	805,000.00	16,100.00	821,100.00	129,980.13	132,528.76

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Exhibit B: 1999 Shared Bond Repayment Schedule

City will begin payments on January 1, 2013 for totals listed for 2013 through 2018 per contract sections 8b, 8c1 and Exhibit A

JR

Appendix D

Kitsap Countywide Planning Policies

Adopted Kitsap Countywide Planning Policies
November 19, 2007

Attached are the Kitsap Countywide Planning Policies as adopted by the Kitsap County Board of Commissioners by ordinance on November 19, 2007 (Ordinance 403-2007). The Countywide Planning Policies as revised are currently in effect in Kitsap County.

The Kitsap Countywide Planning Policies are the framework for growth management in Kitsap County. Under the Growth Management Act, the Puget Sound Region is defined as King, Kitsap, Snohomish and Pierce Counties. The Puget Sound Regional Council is responsible for developing the four-county regional transportation and land use vision. The Kitsap Countywide Planning Policies tailor the Puget Sound Regional Council's regional growth management guidelines to Kitsap County and are the policy framework for the County's and the Cities' comprehensive plans. The Kitsap Countywide Planning Policies address 15 separate elements, ranging from urban growth areas to affordable housing.

The Countywide Planning Policies are required by the Growth Management Act and may be appealed (only) by Cities and the Governor of Washington. The original Kitsap Countywide Planning Policies (adopted by Kitsap County in 1992) and subsequent revisions (August 2001, December 2003, November 2004, November 2007) were developed through a multi-jurisdictional collaboration sponsored by the Kitsap regional Coordinating Council among: Kitsap County, the Cities of Bremerton, Bainbridge Island, Port Orchard & Poulsbo, the Suquamish & Port Gamble S'Klallam Tribes, the Navy, the Port of Bremerton, and Kitsap Transit.

Kitsap County is lead agency for its environmental review.

CONTENTS

INTRODUCTION

The Growth Management Act (GMA) is founded on the principle that it is in the best interest of the citizens of the State to foster coordination and cooperation among units of local and state government. Cities and counties must engage in a collaborative planning process under the requirements of the Act. Specifically, the Act states that, *"THE LEGISLATURE FINDS THAT UNCOORDINATED AND UNPLANNED GROWTH ... POSE A THREAT TO THE ENVIRONMENT, SUSTAINABLE ECONOMIC DEVELOPMENT, AND THE HEALTH, SAFETY, AND HIGH QUALITY OF LIFE ENJOYED BY RESIDENTS OF THE STATE. IT IS IN THE PUBLIC INTEREST THAT CITIZENS, COMMUNITIES, LOCAL GOVERNMENTS, AND THE PRIVATE SECTOR COOPERATE AND COORDINATE WITH ONE ANOTHER IN COMPREHENSIVE LAND USE PLANNING."*

The Growth Management Act (*RCW 36.70A.210*) states that *"A COUNTYWIDE PLANNING POLICY IS A WRITTEN POLICY STATEMENT OR STATEMENTS USED SOLELY FOR ESTABLISHING A COUNTYWIDE FRAMEWORK FROM WHICH COUNTY AND CITY COMPREHENSIVE PLANS ARE DEVELOPED AND ADOPTED ... (TO) ENSURE THAT CITY AND COUNTY COMPREHENSIVE PLANS ARE CONSISTENT..."* as required in *RCW 36.70A.100. "NOTHING IN THIS DOCUMENT SHALL BE CONSTRUED TO ALTER THE LAND USE POWERS OF CITIES."*. The Act requires that the countywide policy be collaboratively developed among Cities and the County. Further, *"FEDERAL AGENCIES AND INDIAN TRIBES MAY PARTICIPATE IN AND COOPERATE WITH THE COUNTYWIDE PLANNING POLICY ADOPTION PROCESS."* These policies may also be used for other purposes requiring collaboration and cooperation in addition to the development and adoption of comprehensive plans.

The 1992 Kitsap Countywide Planning Policies and subsequent revisions in 2001 and 2003 were developed by a committee of planners representing Kitsap County, the City of Bremerton, the City of Port Orchard, the City of Poulsbo, the City of Bainbridge Island, the Port Gamble S'Klallam Tribe, the Suquamish Tribe, the Navy, and Kitsap Transit. At each point, the Kitsap Regional Coordinating Council conducted a public hearing and prepared a recommendation for adoption by the Kitsap County Board of Commissioners and ratification by Cities and Tribes. The process of review and discussion through the Kitsap Regional Coordinating Council forum is intended to foster consensus whenever possible. County and City Comprehensive Plans must be consistent with the adopted Countywide Planning Policies.

Policies for Update and Ratification (UR):

1. The Kitsap Countywide Planning Policies should be dynamic and regularly monitored for applicability and effectiveness.

   a. The adopted Countywide Planning Policies should be reviewed through the Kitsap Regional Coordinating Council process at least every five years. Proposed revisions shall be reviewed for impacts according to the State Environmental Protection Act (SEPA) and shall be consistent with the State Growth Management Act (GMA).

   b. The County or a City may propose a policy amendment to the Countywide Planning Policies.

2. Proposed amendments should be considered on a regular basis and voting is subject to the Kitsap Regional Coordinating Council by-laws.

   a. Kitsap County shall take action to consider and adopt amendments or revisions to the Countywide Planning Policies following recommendation from the Kitsap Regional Coordinating Council.

b. The Kitsap Regional Coordinating Council will strive for ratification by all Cities and Tribes during the 90 days following the Board of County Commissioners' adoption of its subject ordinance. The adopted CPP will become effective upon ratification by three or more cities in Kitsap County.

c. A City or Tribal Council that does not ratify the revised Countywide Planning Policies within 90 days of the Board of County Commissioners' adoption of its subject ordinance shall provide a written statement of its objections to the Kitsap Regional Coordinating Council, in order to facilitate further review. (See Appendix A for process flow chart).

d. Once the ratified revisions to the Countywide Planning Policies take effect, a City or the Governor's office may appeal the revisions to the Growth Management Hearings Board within a further 60 day period.

Element A. Countywide Growth Pattern

The vision for the future of Kitsap County, as articulated in the Kitsap County Comprehensive Plan (1998), "seeks to maintain and enhance the quality of life that makes our County a special place to live and work...... envision a future in which our natural systems are protected; the water quality in our lakes, streams and Puget Sound is enhanced; the village character of some of our smaller towns is preserved; the historical nature of our communities is respected in order to preserve our heritage for future generations; a diversified economic base that supports good jobs, contributes to healthy downtowns in our cities and affordable housing choices; and the rural appearance of our county is perpetuated.

This vision of the future – which is shared by citizens and elected officials – includes the following elements:

a. Livable urban communities and neighborhoods, centers for employment, civic activities, housing:

- Attractive, well designed and livable urban communities, supported by efficient and high quality services and facilities, and providing a range of housing choices.
- Healthy cities that are the region's centers for employment, affordable housing choices, and civic and cultural activities.

b. Vital diversified economy: A vital diversified economy that provides living wage jobs for residents, supported by adequate land for a range of employment uses and that encourages accomplishment of local economic development goals.

c. Efficient multi-modal transportation system: Creation of an efficient multi-modal transportation system – including roads and highways, ferries, airports, and opportunities for non-motorized travel – that provides efficient access and mobility for county residents and supports our land use pattern.

d. Natural systems protection:

- Protection and enhancement of the natural environment, including wetlands, streams, wildlife habitat, water quality and natural resource activities.
- Creation of a system of open space, parks and greenbelts that provide opportunities for recreation and that give structure and separation to urban areas.

e. Rural character outside of Urban Growth Areas: Maintenance of the traditional character, appearance, functions and lifestyles of Kitsap County's rural communities and areas

f. Responsive Government: An efficient and responsive government that works with citizens, governmental entities and Tribes to meet collective needs fairly; and that supports education, environmental protection and human services.

A key strategy to accomplish this vision is the intention to encourage future urban growth in areas within incorporated cities and in unincorporated areas that are already characterized by urban growth with existing and planned services and facilities. These actions will work to strengthen our natural environment and rural character, and are geared to reduce taxpayer costs by focusing the expenditure of public funds, encouraging concentrated development where appropriate, and increasing our choices for housing and jobs."

From the Kitsap County Comprehensive Plan, 1998

Balancing historical patterns of growth with a preferred vision of the future and legal requirements is an on-going challenge. Tradeoffs must be made to balance the costs with the gains; flexibility is necessary to adapt to changing conditions. These policies are intended to reflect the long-term goals of the people living, working and doing business here.

Policies for Countywide Growth Pattern (CW):

1. Roles of Cities and Urban Growth Areas/Urban Communities

a. The primary role of Kitsap's urban communities is to encourage growth, through new development, re-development and in-fill. (See Appendix B for current and projected population distribution.)

b. Each of Kitsap's urban communities should foster its unique vision as a high quality place to live and work.

c. In Kitsap, urban communities are closely linked to water and natural amenities and provide open space links to the natural environment.

2. Roles of Kitsap County:

a. Keep regional vision in mind when making local decisions.

b. Promote stewardship of unincorporated urban areas and promote transition to cities when financially viable.

c. Maintain/enhance natural systems and rural character.

d. Include a variety of low density rural communities, densities, and uses.

3. To achieve these goals, the Kitsap Regional Coordinating Council member jurisdictions should:

a. Make decisions together when needed.

b. Coordinate and cooperate on land use, policy and capital planning.

c. Establish and keep updated a Buildable Land Analysis Program.

d. Develop a program for the Transfer of Development Rights to preserve lands with important public benefits.

e. Maintain/preserve distinct urban identities with green breaks or other natural features.

f. Promote tiering and/or phasing of infrastructure development within Urban Growth Areas.

g. Develop and implement land use policies, regulations and incentives to promote the efficient use of urban areas.

Element B. Urban Growth Areas

The basic premise for designating Urban Growth Areas is to encourage the location of urban density residential, commercial and industrial developments in areas where services can be most economically provided. The benefits of directing growth to designated urban areas include:

* Higher density residential development within walking distance of jobs, transit, schools and parks.
* Limiting urban expansion into rural and forested areas.
* Promotion of in-fill or redevelopment of existing urban areas.
* Preservation of open space, critical areas and lands designated for resource protection.
* Accommodation of employment growth in a concentrated pattern.
* More economical provision and maintenance of streets, sewer/ water lines and other public facilities.
* Promotion of attractive residential neighborhoods and commercial districts which provide a sense of community.
* A harmonious relationship with regional planning as articulated by Vision 2020 and Destination 2030 adopted by the Puget Sound Regional Council as the growth and transportation strategy for central Puget Sound.

Policies for Urban Growth Areas (UGA):

1. **Land Utilization & Monitoring Programs**:

   Consistent with RCW 36.70A.115, the County and Cities shall ensure that, taken collectively, adoption of and amendments to their comprehensive plans and/or development regulations provide sufficient capacity of land suitable for development within their jurisdictions to accommodate their housing and employment growth (derived from population distribution), as adopted in the applicable Countywide Planning Policies and consistent with the 20-year population forecast from the WA Office of Financial Management.

   a. The County and the Cities shall maintain a Land Capacity Analysis Program using consistent, agreed-upon methodology to estimate the land supply available to accommodate future residential, commercial, and industrial growth.

   b. The County and the Cities shall participate in an agreed-upon Buildable Lands Analysis Program to monitor and evaluate the effectiveness of their respective Comprehensive Plans.

Background: The Growth Management Act was amended in 1997 requiring Kitsap County and Cities to monitor countywide development activities in five-year intervals in order to test their Comprehensive Plans' growth and land absorption assumptions. Two different analyses are used: (1) The Land Capacity Analysis, first conducted by Kitsap County in 2002, estimates the existing land supply based on a set of defined assumptions, *e.g.* market factor, speed of land absorption, critical areas exclusions, etc. It uses a consistent, agreed-upon methodology, with allowance for documented variations for individual jurisdiction's conditions. (2) The Buildable Land Analysis (as required by the State GMA) uses recorded permit activity to track and monitor residential, commercial, and industrial growth. It will be updated throughout Kitsap County in 2007. It is an adaptive management tool for comparing development assumptions, targets, and objectives with actual development. If inconsistencies are found, the County and Cities must then implement reasonable measures, other than adjusting Urban Growth Areas, that will be taken in order to comply with the GMA. The following countywide planning policies relate to this regional program to monitor the buildable land supply for future growth as forecasted by the State and distributed through the Kitsap Regional Coordinating Council process.

c. The County and Cities shall establish procedures for resolving disputes in collection and analysis of Land Capacity data. In the event a resolution cannot be achieved, the Kitsap Regional Coordinating Council shall be a forum to review and if possible facilitate any disputes between parties.

2. **Each jurisdiction is responsible for implementing appropriate reasonable measures within its jurisdictional boundaries. If the Buildable Lands Analysis shows that a jurisdiction's Comprehensive Plan growth goals are not being met, that jurisdiction shall consider implementing additional reasonable measures in order to use its designated urban land more efficiently.**

3. **Process and criteria for establishing, expanding, and adjusting Urban Growth Areas in Kitsap County:**

   a. Urban Growth Areas are areas "within which urban growth shall be encouraged and outside of which growth can occur only if it is not urban in nature" (RCW 36.70A.110(1)) except under specific circumstances, as fully contained communities and master planned resorts as authorized by the Growth Management Act.

   b. Unincorporated Urban Growth Areas should be associated with an existing or future city.

   c. All Urban Growth Areas shall be reflected in County and respective City comprehensive plans.

   d. Sufficient area must be included in the Urban Growth Areas to accommodate the adopted 20-year population distribution as adopted by the Kitsap Regional Coordinating Council and consistent with WA Office of Financial Management projections.

   e. A jurisdiction may define growth tiers within its Urban Growth Area (RCW 36.70A.110.3) to focus public and/or private investment where growth is desired. Utility development and/or expansion may be phased to support efficient and cost-effective growth and to prioritize investments.

   f. The County, City, or interested citizens may initiate an amendment to an existing Urban Growth Area through the comprehensive plan amendment process as authorized by the Growth Management Act.

   g. Any jurisdiction seeking to expand its Urban Growth Area shall achieve densities and urban growth patterns consistent with the Growth Management Act and the City's adopted Comprehensive Plan and any inter-local agreement between the City and the County.

   h. If an adopted or proposed, 20-year projected population distribution requires the expansion of its Urban Growth Area, the respective jurisdiction shall conduct planning and analysis, addressing the following conditions:

      i. Update and confirm the capacity analysis for land within the existing Urban Growth Area for residential, commercial, and/or industrial lands, which takes into account all development approved within the overall UGA since the last UGA expansion. This shall be based upon updated Buildable Land and Land Capacity Analyses that follow the guidelines of RCW 36.70A.215. or other analysis determined appropriate for the particular UGA involved. To maximize consistency across jurisdictions, each jurisdiction shall use consistent methodology in calculating capacity.

ii. Review the planning and zoning regulations and any incentive programs in place to determine expected densities and urban growth patterns in the existing UGA consistent with the Growth Management Act and the jurisdiction's adopted Comprehensive Plan.

iii. Determine whether the adoption and implementation of suitable reasonable measures should be considered, if the Buildable Land Analysis shows that its Comprehensive Plan growth goals are not being met.

iv. Data collection and analysis for the Land Capacity Analysis should be done cooperatively. The County will be responsible for data describing growth and capacity in the unincorporated portion of the Urban Growth Area, and the City for the incorporated portion.

i. Expansion of Urban Growth Areas shall direct growth first to areas already characterized by urban growth that have adequate existing public facility and service capabilities to serve development; second to areas already characterized by urban growth that will be served adequately by a combination of both existing public facilities and services and any additional needed public facilities and services that are provided; and third to areas that are adjacent to incorporated cities or established Urban Growth Areas once the available land meeting the first or second priority has been designated. Areas which have existing public facilities or where public facilities can be reasonably extended and are not currently at urban densities should be considered first within this category.

j. A jurisdiction, as part of its Comprehensive Plan amendment or Subarea Plan process, that proposes an expansion of the UGA shall prepare or update a comparison of potential areas for expansion, including.

i. Planning and zoning regulations currently in place.

ii. An evaluation of how a full range of urban-level infrastructure and services would be provided within potential expansion areas, including appropriate capital facility analysis.

Fire	Storm Water	Solid Waste
Police	Potable Water	Park & Recreation Facilities
Transportation	Sewer	Schools

Utilities: Power and Telecommunications, including Broadband
Emergency Medical Services

All service providers including special districts and adjacent jurisdictions should be included in the evaluation. Best available infrastructure technology may be used provided that it has been approved by the jurisdiction as part of a broader review of available technology.

iii. Although specific standards and criteria are not implied, other factors shall be addressed in evaluating areas for Urban Growth Area expansion, including but not limited to: environmental constraints; economic development; preservation of cultural, historical, and designated resource lands.

k. The City and County shall conduct early and continuous public involvement when establishing, expanding, or adjusting Urban Growth Areas, and shall do so jointly when appropriate. Residents of unincorporated areas should be consulted and actively involved in the process affecting them.

4. Coordinated Growth Management in Urban Growth Areas:

a. Adopted City and County comprehensive plans shall reflect the intent that all land within unincorporated Urban Growth Areas will either annex to a city or incorporate within the 20-year planning horizon.

b. To maximize the efficient use of urban lands, subdivisions in Urban Growth Areas shall be consistent with the associated jurisdiction's Comprehensive Plan and underlying zoning densities.

c. As described in the Growth Management Act, cities are the primary provider of municipal services and facilities in their Urban Growth Areas, responsible for demonstrating within their Comprehensive Plans the capacity to provide all urban services within their associated Urban Growth Area(s). This may be accomplished through a collaborative process with Kitsap County and/or other service providers.

d. The County and Cities shall establish procedures to facilitate the smooth transfer of governance for associated Urban Growth Area(s) through the adoption of Urban Growth Area Management Agreements (UGAMAs), as per Appendix C: Urban Growth area Management Agreements.

e. For Urban Growth Areas not associated with a specific city:

   i. The County should plan with local communities to address land uses, infrastructure needs, level of service standards as identified in these policies, and other issues as needed. The results should be reflected in the County Comprehensive Plan.

   ii. The County should continue to provide a level of urban facilities and services generally equivalent to those of cities on an interim basis for those Urban Growth Areas that will be associated with a specific city or that will eventually incorporate, and on an on-going basis as appropriate.

4. **Distribution of 20 year population increments, as forecasted by the WA Office of Financial Management:**

    a. The Kitsap Regional Coordinating Council shall coordinate the process for distributing the forecasted population for the period 2005 – 2025 and every five years thereafter, consistent with the requirements of the Growth Management Act. Kitsap County shall adopt any revision to the population distribution as part of its next Comprehensive Plan amendment process and the Cities shall base their Comprehensive Plan amendments upon that distribution. The distribution process should consider countywide demographic analysis, the Land Capacity Analysis, and the OFM projections and it shall promote a countywide development pattern targeting over three quarters (76%) of new population growth to the designated Urban Growth Areas. The County and the Cities recognize that the success of this development pattern requires not only the rigorous support of Kitsap County in the rural areas, but also Cities' Comprehensive Plans being designed to attract substantial new population growth.

       Population distribution will be reviewed through the Kitsap Regional Coordinating Council process every five years. The review will include an analysis of the Cities' and County's progress in achieving target distributions. If the 76% UGA target mentioned above for new population growth and the overall population targets are met or exceeded, the target for new population will revert to five sixths (83%), as per the revised County-wide Planning Policies adopted by Kitsap County Ordinance #258-01 on August 20, 2001. Otherwise, the target may be reaffirmed or explicitly modified.

    b. Each jurisdiction with a designated Urban Growth Area shall develop an estimate and/or range of the additional population that it could accommodate and service during the 20 year planning horizon, consistent with its vision for future community character. The estimate shall consider the need for increasing population density within the Urban Growth Areas to promote efficient service delivery, avoid sprawl, and preserve community character.

    c. The population estimates and/or ranges shall be provided to the Kitsap Regional Coordinating Council, with a statement of need concerning adjusted Urban Growth Area boundaries.

    d. The Kitsap Regional Coordinating Council shall compile the jurisdictions' population estimates, including the estimate of additional population capacity for areas outside the Urban Growth Areas, and determine whether adjustments to the overall distribution are required in order to fit within the OFM projected range.

    e. The Kitsap Regional Coordinating Council, after conducting a public hearing, shall recommend the estimate and/or ranges of 20 year population distribution to Kitsap County for adoption as an amendment to the Countywide Planning Policies.

    f. Kitsap County should give substantial weight to the Kitsap Regional Coordinating Council's recommendation in adopting the 20-year population distribution.

    g. Following adoption of the estimates and/or ranges, each jurisdiction should update its comprehensive plan, so as to arrive at a final population target consistent with the estimate and/or within the original range.

h. After each jurisdiction has completed its comprehensive plan update, the final adopted target should be compiled and reviewed through the Kitsap Regional Coordinating Council process and the revised population distribution incorporated into the Countywide Planning Policies. A final distribution to Urban Growth Areas versus non-Urban Growth Areas within the range specified above should then be calculated.

5. Fully Contained Communities and Master Planned Resorts

A Master Plan review process and decision criteria for fully contained communities and master planned resorts should be incorporated in the County's comprehensive plan, must reflect the standards and requirements in the GMA, and in addition must address the following:

a. Necessary public facilities, including but not limited to parks, schools, and public safety facilities should be provided within or along with the development, consistent with adopted capital facility and level of service standards;

b. Impacts to public infrastructure, nearby communities, adjacent rural areas, environmental resources, and designated resource lands should first be avoided, second minimized, and third mitigated;

c. Provisions for review of such developments through the Kitsap Regional Coordinating Council process, in addition to other procedural requirements.

> Under the Growth Management Act (RCW 350), fully contained communities (FCCs) may be considered, provided that a portion of the twenty-year population forecast is reserved for and subsequently distributed to the FCC. The GMA requires that FCCs provide for a mix of uses that would provide jobs, housing, and public facilities and services to support a long-term residential population.
>
> The GMA (RCW 360) also allows the consideration of proposed master planned resorts (MPR's) outside of Urban Growth Areas for shorter-term residential uses. Master planned resorts are described as self-contained, fully integrated planned developments in areas with significant natural amenities.

Element C: Centers of Growth

Centers are intended to be compact and centralized working, shopping and/or activity areas linked to other Centers by transit. Centers and their boundaries are intended to be locally determined by the County and the Cities where a community-wide focal point can be provided, significant population and/or employment growth can be located, and the increased use of transit, walking and bicycling can be supported. Designated Centers are intended to define the pattern of future residential and commercial/industrial growth in Kitsap County. (See Appendix F for listing of Kitsap Designated Centers.)

Policies for Centers of Growth (C):

> The Puget Sound Regional Council has defined several types of Regional Centers within Urban Growth Areas in the four-county planning region, with planning guidelines (*Vision 2020*, Appendix 1).

1. **In decisions relating to population growth and resource allocation supporting growth, Centers have a high priority.**
2. **In Kitsap County, the following Regional Centers are applicable:**
   a. Regional Centers of Growth:
      i. Metropolitan Center: Bremerton including the Bremerton Naval complex. "Metropolitan Centers function as anchors within the region for a high density mix of business, residential, public, cultural and recreational uses, and day and night activity. They are characterized by their historic role as the central business districts of the major cities within the central Puget Sound region, providing services for and easily accessible to a population well beyond their city limits. Metro Centers may also serve national or international roles." (*Vision 2020*)
      ii. Urban Center: Silverdale Urban Core. In Kitsap County, Urban Centers are areas with the comprehensive planning to support a wide range of commercial, housing, and cultural choices. All areas of the Urban Center are serviced by transit throughout the day and much of the area is within walking or bicycling distance. Significant at in-fill opportunities exist with the highest residential, commercial, and employment densities expected.
   b. Regional Manufacturing/Industrial Centers: South Kitsap Industrial Area. "Regional Manufacturing/Industrial Centers are major, existing regional employment areas of intensive, concentrated manufacturing and industrial land uses which cannot be easily mixed at higher densities with other uses. To preserve land at these centers for manufacturing, industry and related uses, large retail uses or non-related offices are discouraged. Provision of adequate public facilities and services, including good access to the region's transportation system, is very important to the success of manufacturing/industrial centers." (*Vision 2020*)
3. **The following are other types of centers within Kitsap County:**
   a. Town or City Centers are usually the existing downtown core of a city or Urban Growth Area. There is an abundant mix of shopping, service, employment, and cultural opportunities. Multifamily housing may be intermixed and single family housing may be

within walking or bicycling distance. Infill should include mixed use and higher densities surrounding the Town Center.

b. Mixed Use Centers are a generic category that can be described in terms of neighborhoods or districts within a city or Urban Growth Area. The designation represents a commitment to planning for Center development, with a planned mix of housing, commercial, and employment opportunities. Most shopping and commercial uses are within a short walking or bicycling distance of housing. There is a higher proportion of multi-family housing at relatively high densities. Navy facilities could be considered for this designation.

c. Activity and Employment Centers are areas of concentrated employment and are a magnet for significant numbers of people usually during daytime hours because of business and/or manufacturing activities. They may be located outside of Urban Growth Areas, consistent with the Growth Management Act. Industrial and business parks and Navy employment centers are in this category. Within Urban Growth Areas, the opportunity to include a proportional residential element should be determined on a case-by-case basis, considering the unique geography and economics of the area.

d. Transportation Hubs are locations of regional inter-modal connection that may be located outside of Urban Growth Areas. Examples are ferry terminals, the Bremerton National Airport, or certain transit stations.

4. For purposes of distributing countywide federal transportation funding, a process and criteria for designating local centers should be developed and coordinated through the Kitsap Regional Coordinating Council. (See Appendix G) The following should be included:

Current or programmed transportation resources
(including roads, ferries, transit, airports, bicycle, pedestrian)
Balance of employment opportunities with residential
Proximity and connectivity among jobs, housing, retail services
Types and density of residential uses
Inclusion of affordable housing
Provision of community gathering space, parks, and cultural opportunities

Element D: Rural Land Uses and Development Patterns

Rural areas of Kitsap County are characterized as having a variety of parcel sizes, with a diversity of land use activities. These areas also contain significant amounts of complex natural systems. It is a high priority to preserve and enhance the rural character of these areas. Counties are responsible for designating and regulating rural areas through the comprehensive planning process. However, rural preservation is a regional issue and it is important to coordinate these planning objectives with the Cities.

Policies for Rural Land Uses and Development Patterns (R):

1. **Preserving rural character and enhancing the natural environment.**

   a. Preserve the character of identified rural areas by protecting and enhancing the natural environment, open space and recreational opportunities, and scenic and historic areas; supporting small-scale farming and forestry uses; and permitting low-density residential living and cluster development maintained by rural levels of service. Support Rural Communities as locations for a mix of housing types, rural levels of service, cultural activities, and employment that serves the needs of rural areas.

   b. This policy is not intended to preclude the future designation of Urban Growth Areas.

2. **Preserving rural land use and development patterns:**

   a. **Rural Communities** are already-existing residential and commercial areas of more intensive rural development designated in the Kitsap County Comprehensive Plan under RCW 36.70A.070.5. In-fill is expected. Rural Communities should be serviced by transportation providers and other services consistent with the Levels of Service adopted by Kitsap County for roads and by Kitsap Transit for transit upon their designation as an area of more intensive rural development.

   b. **Transportation Hubs** may be located within existing areas of more intensive development. Walking, bicycling, and transit are the major forms of travel. Transportation Hubs are locations of regional intermodal connection. Examples are ferry terminals and transit stations with convenience services.

   c. The County shall develop criteria consistent with the Growth Management Act for designating future industrial and commercial development outside of Urban Growth Areas that protect rural character while encouraging vehicle trip reduction. The criteria should allow for industrial resource-based land use and recreation and for convenience commercial that is scaled to serve the daily needs of rural residents.

3. **Establishing and maintaining rural levels of service:**

   a. Rural level-of-service standards shall address sewage disposal, water, transportation and other appropriate services. The standards shall be developed based upon levels of service typically delivered in rural areas consistent with RCW 36.70A.030 (16).

   b. For purpose of trip reduction, develop a range of alternative modes of transportation consistent with rural levels of service to connect Rural Communities with urban Centers.

c. When sewers need to be extended to solve isolated health, environmental, and sanitation problems, they shall be designed for limited access so as not to increase the development potential of the surrounding rural area.

4. Conserving small-scale natural resource use in rural areas:

a. Rural land use designations in the County's Comprehensive Plan should support rural uses such as farming, forestry, mining, recreation, and other rural activities, and permit a variety of low-density residential uses which preserve rural character, and can be sustained by rural service levels.

b. The County's Comprehensive Plan policies shall promote clustering residential development and other techniques to protect and enhance significant open spaces, natural resources, and critical areas for more efficient use of the land. Clustering should not increase residential housing units in the overall area designated as rural, consistent with designated rural densities. Development clusters shall be designed, scaled and sited in a manner consistent with rural character and the provision of rural levels of service.

c. The County's Comprehensive Plan policies shall support Rural Communities as locations of employment, a mix of housing types, and cultural activities for rural areas that primarily function as locations for service needs such as grocery stores, shopping, and community services, and small-scale cottage industries for the surrounding rural area.

Element E. Countywide Strategies for Open Space Preservation, Resource Preservation, and Critical Areas

Open space is defined as land area consisting of natural systems, resource lands and critical areas that include building limitations for future development. These critical areas include wetlands, wildlife conservation areas, steep slopes, frequently flooded areas and areas with a critical recharging affect. These open space lands also include aesthetic functions such as view sheds of the water or ridgelines. Many of these natural systems are inter-connected and cross multi-jurisdictional boundaries within the County. The strategy is to conserve these areas and connect them to create a regional open space network to protect critical areas, conserve natural resources, and preserve lands and resources of countywide and local significance

Policies for Open Space Preservation, Resource Protection, and Critical Areas (PPCA):

1. **Creating a regional network of open space:**

    a. The County and the Cities shall implement the Kitsap County Open Space Plan and the Kitsap County Consolidated Greenway Plan which identify a countywide green space strategy that incorporates planning efforts of the County, Cities, state agencies, non-profit interest groups and land trusts in the County.

    b. The County and the Cities shall preserve and enhance, through inter-jurisdictional planning, significant networks and linkages of open space, regional parks and public/private recreation areas, wildlife habitats, critical areas resource lands, water bodies and trails.

    c. The County and the Cities shall frame and separate urban areas by creating and preserving a permanent network of urban and rural open space, including parks, recreation areas, critical areas and resource lands.

2. **Conserving and enhancing the County's natural resources, critical areas and environmental amenities while planning for and accommodating sustainable growth:**

    a. The County's and the Cities' Comprehensive Plans shall each address regional air and water quality protection.

    b. The County and the Cities shall protect critical areas (wetlands, aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, steep slopes, and geologically hazardous areas) and other environmental amenities such as view corridors, canopy cover, and ridgelines.

    c. The County and the Cities shall establish and implement Best Management Practices to protect the long-term integrity of the natural environment, adjacent land use, and the productivity of resource lands.

    d. The County and the Cities shall establish procedures to preserve significant historic, visual and cultural resources including views, landmarks, archaeological sites, and areas of special locational character.

    e. The County and the Cities shall encourage the use of environmentally sensitive development practices to minimize the impacts of growth on the County's natural resource systems.

f. The County and the Cities shall work together to identify, protect, and restore networks of natural habitat areas and functions that cross-jurisdictional boundaries.

g. The County and Cities shall protect and enhance ecosystems that support Washington State's Priority Habitat and Species as identified by the Washington Department of Fish and Wildlife.

f. All jurisdictions shall maintain or enhance water quality through control of runoff and use of best management practices to protect aquatic resources.

3. **Listed species recovery under the Endangered Species Act (ESA):**

a. The County and the Cities shall preserve, protect, and where possible, restore the functions of natural habitat to support ESA-listed species, through the adoption of comprehensive plan policies, critical area ordinances, shoreline master programs and other development regulations that seek to protect, maintain or restore aquatic ecosystems associated habitats and aquifer through the use of management zones, development regulations, incentives for voluntary efforts of private landowners and developers, land use classifications or designations, habitat acquisition programs or habitat restoration projects.

b. The County and the Cities shall provide incentive-based non-regulatory protection efforts such as acquisition of priority habitats through fee-simple and conservation easements from willing sellers.

c. The County and the Cities shall jointly establish and implement monitoring and evaluation program to determine the effectiveness of restoration, enhancement, and recovery strategies for salmon including ESA-listed species. Each jurisdiction shall apply an adaptive management strategy to determine how well the objectives of listed species recovery and critical habitat preservation/restoration are being achieved.

4. **Coordination of watershed and land use planning:**

a. The County and the Cities shall participate in a planning program that determines changes in stream hydrology and water quality under different land use scenarios at full build-out of designated land use classifications.

b. The County and the Cities shall coordinate land use planning using watersheds or natural drainage basins to implement strategies for restoration of aquatic habitat and to reduce impacts to other natural systems.

c. Kitsap County shall coordinate and maintain a regional database of best available science for the purpose of modifying Critical Areas Ordinances, if funding is available.

d. Upon adoption of a state classification system, the Cities and the County shall establish a single system for stream typing.

Element F. Contiguous and Orderly Development

Upon designation of Urban Growth Areas, the County and Cities will need to develop consistent implementation measures to ensure that development occurs in an orderly and contiguous manner. The intent of the following countywide planning policies is to minimize differences in urban development regulations and standards between the County and the Cities and to facilitate the economical provision of urban services to development.

Policies for Contiguous and Orderly Development (COD):

1. **Encouragement of cooperative inter-jurisdictional planning by federal, tribal, state, local, and special purpose government:**

   a. Inter-jurisdictional discussion, information exchange, and coordination of proposals shall be initiated as early and expeditiously as possible by the responsible agencies.

   b. Initial inventories and analyses of utilities and public services information are critical to the planning process and shall be made available as early and expeditiously as possible by the responsible agencies.

   c. The Kitsap Regional Coordinating Council may establish or designate on-going technical committee(s) comprised of representatives from utilities and service providers to investigate long-range regional needs for various facilities and services, including but not limited to those for transportation, sewer and storm drainage, availability and delivery of potable water, solid waste, broadband, parks and recreation, and open space.

   d. The Countywide Planning Policies will further the implementation of Vision 2020 and Destination 2030 as adopted by the Puget Sound Regional Council.

2. **Inter-regional coordination of land use and transportation planning:**

   a. The County and the Cities shall participate in the Puget Sound Regional Council and the Peninsula Regional Transportation Planning Organization.

   b. Locally-generated data shall be provided to the Puget Sound Regional Council and the Peninsula Regional Transportation Planning Organization for use in their coordination of population forecasts, land use, and transportation.

   c. The planning proposals of these regional organizations shall be monitored and adjustments recommended to insure that they accurately reflect local needs and plans.

3. **Fiscal equity:**

   a. It is recognized that fiscal disparities exist as a result of growth and changes in municipal boundaries. The Kitsap Regional Coordinating Council shall monitor the Revenue Sharing Inter-local Agreement among the County and Cities (shown as Appendix D) and seek additional ways to address fiscal disparities as they relate to promoting coordinated development and the implementation of the Growth Management Act.

   b. The County and the Cities shall work together to insure that all fees associated with development approval are based upon the real cost of service and act to encourage development within designated Urban Growth Areas.

   c. The Kitsap Regional Coordinating Council shall facilitate on-going regional discussion on revenue equity issues.

Element G. Siting Public Capital Facilities of a Countywide or Statewide Nature

The Growth Management Act requires local governments to inventory existing capital facilities owned by public entities, to identify locations and to determine capacities to meet future demand for growth without decreasing levels of service. The Washington State Office of Financial Management is responsible for identifying and maintaining a list of essential state public facilities that are required or likely to be built within the next six years as required by the Growth Management Act. Counties and cities are also required to coordinate the siting of countywide and statewide capital facilities to mitigate potential adverse impacts from the location and development of these facilities.

<u>Policies for Siting Public Capital Facilities (CF):</u>

1. **Identification of needed capital facilities:**

   a. The County and the Cities shall each inventory their existing capital facilities and identify needed facility expansion and construction and provide that data to the Kitsap Regional Coordinating Council.

   b. The Kitsap Regional Coordinating Council shall develop and maintain a list of public capital facilities needed to serve Kitsap County as a whole, based upon the County and Cities' Comprehensive Plans, the Countywide Coordinated Water System Plan, and other appropriate system plans. These include, but are not limited to, solid and hazardous waste handling facilities and disposal sites, water and wastewater treatment facilities, regional water supply intertie facilities, regional education institutions, airports, local correctional facilities, in-patient facilities including hospitals and regional park and recreation facilities, and government buildings that serve Kitsap County as a whole, including those essential public facilities as defined in RCW 36.70A.200.

2. **Establishing a process and review criteria for the siting of facilities that are of a countywide or statewide nature:**

   a. When essential public facility as defined in RCW 36.70A.200 is proposed in Kitsap County, the Kitsap Regional Coordinating Council shall appoint a Facility Analysis and Site Evaluation Advisory Committee composed of citizen members selected by the member jurisdictions to represent a broad range of interest groups to evaluate proposed public facility siting. At a minimum this evaluation shall consider:

      i. The impacts created by existing facilities:

      ii. The potential for reshaping the economy, the environment and community character;

      iii. The development of specific siting criteria for the proposed project, giving priority consideration to siting within Designated Centers;

      iv. The identification, analysis and ranking of potential project sites;

      v. Measures to first minimize and second mitigate potential physical impacts including, but not limited to, those relating to land use, transportation, utilities, noise, odor and public safety;

      vi. Measures to first minimize and second mitigate potential fiscal impacts.

b. Certain public capital facilities such as schools and libraries that generate substantial travel demand should be located first in Designated Centers or, if not feasible to do so, along or near major transportation corridors and public transportation routes.

c. Some public capital facilities, such as those for waste handling, may be more appropriately located outside of Urban Growth Areas due to exceptional bulk or potentially dangerous or objectionable characteristics. Public facilities located beyond Urban Growth Areas should be self-contained or be served by urban governmental services in a manner that will not promote sprawl. Utility and service considerations must be incorporated into site planning and development.

d. Uses shall adhere to local health district or state agency rules regarding commercial and industrial use of on-site sewage systems.

e. The multiple use of corridors for major utilities, trails and transportation rights-of-way is encouraged.

f. County and City comprehensive plans and development regulations shall not preclude the siting of essential public facilities.

g. Public facilities shall not be located in designated resource lands, critical areas, or other areas where the siting of such facilities would be incompatible.

3. Air transportation facilities in Kitsap County:

a. The Counties and the Cities shall recognize the importance of airports as essential public facilities and the preservation of access to the air transportation system.

b. The County and the Cities shall ensure the safety of the community and airport users through compatible land use planning adjacent to airports and coordination of the airport with ground access. Examples would include not encouraging or supporting higher residential densities, schools, or hospitals near airports or airport approach corridors.

c. The County and the Cities shall plan for heliports throughout Kitsap County for emergency use.

Element H. Transportation

The Growth Management Act requires that transportation planning be coordinated among local and state jurisdictions. The Growth Management Act further requires that transportation planning be coordinated with the land use elements of local comprehensive plans. Coordination of land use and transportation plans will allow Kitsap County and the Kitsap Cities to meet three inter-related transportation goals:

- Serve Designated Centers to reduce sprawl, conserve land and make more efficient use of infrastructure,
- Preserve the natural environment, including water and air quality,
- Provide a balanced system for the efficient, safe movement of people, goods and services among Designated Centers within Kitsap County and the larger Puget Sound region.

The intent of the following policies is to define appropriate methods and strategies to achieve these goals through inter-regional and intra-regional coordination among transportation and land use planning agencies.

For the purpose of this Policy, the following transportation facilities are of countywide significance:

a. state and federal highways;
b. major arterials;
c. public transit facilities and services;
d. non-motorized facilities connecting designated centers;
e. marine transportation facilities (ferries, shipping);
f. airports and heliports (passenger and/or freight);
g. rail facilities (passenger and/or freight)

The following facilities and system components should be included in the multi-modal network:

a. roads, including major highways, arterials and collectors;
b public transit, including bus, rail, and park & ride lots;
c. non-motorized facilities;
d. vehicle and public or private passenger only ferries;
e. airports;
f. parking facilities that support the multi-modal network;
g. facilities related to transportation demand management;
h. intelligent transportation systems (ITS).

<u>**Policies for Transportation (T):**</u>

1. Strategies to optimize and manage the use of transportation facilities and services:

a. The County and the Cities shall each emphasize the maintenance and preservation of their existing transportation network.

b. Through the regular update of the Transportation Element of their Comprehensive Plan, the County and the Cities should each identify and prioritize operational and safety deficiencies.

c. The County and the Cities should utilize Transportation System Management strategies such as parking restrictions, traffic signal coordination, transit queue jumps (traffic signal modification equipment that allows busses to move ahead of other vehicles), ramp metering, striping non-motorized transportation facilities, and real time sensor adjustments for traffic signals.

d. The County and the Cities should develop and implement access management regulations that provide standards for driveway spacing and delineation and encourage the joint use of access points where practical.

e. The County and the Cities shall actively seek opportunities to share facilities, expertise, and transportation resources, such as multiple use park & ride/parking lots or shared traffic signal maintenance responsibility.

2. **Reducing the rate of growth in auto traffic, including the number of vehicle trips, the number of miles traveled, and the length of vehicle trips taken, for both commute and non-commute trips:**

> Since 1980, the total number of vehicle miles traveled in the Puget Sound Region has grown twice as fast as employment and four times as fast as population. While it has been fueled by a number of factors, trying to meet this escalating demand for vehicle travel would require financial resources far beyond existing funding sources, with substantial negative environmental impacts. The shift of travel trips from single occupant (SOV) to high occupant vehicles (HOV) and from vehicles to non-motorized modes will benefit air quality and the level of traffic congestion.

a. The County and the Cities shall provide both infra-structure and policy incentives to increase the use of non-SOV modes of travel.

i. The range of infrastructure incentives to encourage the use of non-SOV modes of travel could include the following:

- Provide public transit, including preferential treatments for transit, such as queue by-pass lanes (dedicated bus lanes that allow for transit queue jumps), traffic signal modifications, and safe, transit stops.

- Provide integrated transfer points to facilitate seamless trips between transit and other modes of travel, particularly at ferry terminals, including park & ride lots, bike storage facilities, carpool/vanpool and transit advantages to ease ingress/egress, with proximity to actual connection points, and innovative transit-oriented development.

- Provide non-recreational bicycle and pedestrian facilities, including safe neighborhood walking and biking routes to school.

- During the development of all state, county, and city highway capacity improvement projects, consider the market for non-SOV travel, and the addition of High Occupancy Vehicle (HOV) lanes, park & ride lots, appropriate infrastructure for both bicycling and walking.

ii. The range of policy incentives to encourage the use of non-SOV modes of travel could include the following:

- Increased emphasis on the Commute Trip Reduction Program already in place (including ridesharing incentives), with Kitsap Transit designated as the lead agency, including program promotion and monitoring.

- Managed parking demand at ferry terminals, employment, and retail centers to discourage SOV use through privileged parking for HOV users, fee structure and parking space allocations.

- Encouraging telecommuting and home-based businesses as a viable work alternative.

- Encouraging the shift of work and non-work trips to off-peak travel hours.

- Congestion pricing.

- Auto-restricted zones.

- Promotion of driver awareness through educational efforts.

d. The County and the Cities shall develop standards that address appropriate bicycle and pedestrian facilities for development of new streets and reconstruction of existing streets in Designated Centers and Rural Communities.

e. In Designated Centers, the jurisdictions should complete missing vehicular and non-motorized links between key arterials to accommodate pedestrian and bicycle facilities, without compromising safety standards.

f. The County and the Cities should develop coordinated bicycle and pedestrian systems or plans, which should be consistent across jurisdictional boundaries with particular consideration to providing safe routes for children to walk and to bike to school.

g. In cases of substantial residential or commercial development, Kitsap Transit shall review and comment on development proposals to facilitate convenient use and operation of appropriate transit services.

3. Environmental impacts of transportation policies:

a. Transportation improvements shall be located and constructed so as to discourage/minimize adverse impacts on water quality and other environmental features.

b. The County, the Cities, and Kitsap Transit shall consider programming capital improvements and transportation facilities that alleviate and mitigate impacts of land use on air quality and energy consumption, such as: high-occupancy vehicle lanes; public transit; vanpool/ carpool facilities; electric and other low emission vehicles including buses; bicycle and pedestrian facilities that are designed for functional transportation.

c. The County and the Cities shall ensure environmental protection, water quality, and conformance with ESA requirements through best management practices throughout the life of the transportation facilities, including:

i. Facility design, and in particular collection and treatment of storm water and surface run-off.

   ii. Avoiding construction during the rainy season.

   iii. Regular and routine maintenance of systems.

   d. The County, the Cities, and Kitsap Transit should support Puget Sound Clean Air Agency public education about anti-pollution measures.

4. **Recognizing that the County and the Cities each encompass a range of development and density patterns, each jurisdiction shall designate its Centers consistent with the criteria set forth in Element C of the Countywide Planning Policies. The following policies relate to planning guidelines to support transit and pedestrian travel appropriate to each type of urban and rural development or re-development:**

   a. The County and the Cities shall each prepare development strategies for their Designated Centers that encourage focused mixed use development and mixed type housing to achieve densities and development patterns that support multi-modal transportation.

   b. In Urban Growth Areas, comprehensive plans should promote pedestrian- and transit-oriented development that includes access to alternative transportation and, in the interest of safety and convenience, includes features, such as lighting, pedestrian buffers, sidewalks, and access enhancements for physically challenged individuals.

   c. Rural Communities outside Urban Growth Areas shall accommodate appropriate pedestrian/bicycle connections and transit service and facilities consistent with rural levels of service in order to minimize vehicle trips.

5. **Transportation linkages between designated local and regional Centers:**

   a. Regional corridors shall be designated for automobile, freight, transit, HOV facilities, rail, marine, bicycle, and pedestrian travel between centers as part of the countywide transportation plan.

   b. The transportation system linking Designated Centers within the county shall be transit-oriented and pedestrian and bicycle friendly.

6. **Freight transportation:**

   a. Preferred routes for the movement of freight shall be identified as part of the countywide transportation plan.

   b. The County and the Cities shall work to ensure that compatible land uses are applied along designated freight corridors; including, but not limited to, corridors for air, rail, road and marine traffic.

   c. The County and the Cities shall use appropriate roadway standards for designated freight corridors.

7. **Transportation relationships with the Puget Sound Regional Council and the Peninsula Regional Transportation Planning Organization:**

   a. The Countywide Planning Policies shall further the implementation of Vision 2020 and Destination 2030 as adopted by the Puget Sound Regional Council.

b. The County and the Cities shall actively participate in the Puget Sound Regional Council and the Peninsula Regional Transportation Planning Organization (RTPO) to assure that transportation planning in the two regions is consistent and accurately reflects local needs related to identified regional system components.

c. The Kitsap Regional Coordinating Council shall serve as the point of coordination to assure Puget Sound Regional Council and Peninsula RTPO planning programs are consistent and mutually beneficial to jurisdictions within Kitsap County.

d. The Transportation Improvement Program (TIP) for Kitsap County shall continue to be a part of the regional TIP adopted by the Puget Sound Regional Council. Local review, comment and recommendations shall be coordinated through the Kitsap Regional Coordinating Council.

8. Identification of needed transportation related facilities and services within Kitsap County:

a. The Puget Sound Regional Council and the Peninsula RTPO shall identify regional system components and related improvements within Kitsap County with the concurrence of the Kitsap Regional Coordinating Council.

b. A countywide transportation plan developed by the Kitsap Regional Coordinating Council shall be prepared pursuant to the Growth Management Act to identify countywide transportation facility and service needs. A technical committee including transit and local, regional, and state transportation providers shall be used in this process.

9. Coordination of intra-county transportation planning efforts:

a. The Puget Sound Regional Council reviews Cities' and the County's Comprehensive plans for consistency of land use and transportation elements.

b. The County and the Cities shall address compatibility between land use and transportation facilities by:

i. Not using new road improvements to justify land use intensification.

ii. Managing access on new transportation facilities outside Urban Growth Areas.

iii. Allowing phased development of improvements including acquiring right of way.

iv. Using comprehensive plans and development regulations to ensure that development does not create demands exceeding the capacity of the transportation system, such as: density limits in areas outside of Urban Growth Areas; concurrency management and adequate public facility regulation; integrated multi-modal and non-motorized networks.

c. The County and the Cities shall work together in a coordinated, iterative process to periodically reassess whether regional land use and transportation goals can realistically be met. If transportation adequacy and concurrency cannot be met, the following actions should be considered:

i. Adjust land use and/or level of service (LOS) standards.

ii. Make full use of all feasible local option transportation revenues authorized but not yet implemented.

iii. Work with Washington State Department of Transportation (including Washington State Ferries), Kitsap Transit, and the private sector to seek additional State transportation revenues, state and federal grants for infrastructure improvements, and local options to make system improvements necessary to accommodate projected population growth.

d. Adjacent jurisdictions in Kitsap County shall develop consistent street classification system and street standards.

e. Kitsap Regional Coordinating Council may establish a process for evaluating development impacts including those that may affect neighboring jurisdictions within the county.

f. The Kitsap Regional Coordinating Council shall function to ensure that transportation planning, system management and improvements at local, regional, and state levels are coordinated, complementary, and consistent with adopted comprehensive land use plans.

10. Coordinated and consistent level of service (LOS) standards:

a. The County and the Cities should develop comparable level of service standards among the County, Cities and the State of Washington for identified regional system components.

b. The County and the Cities shall adopt roadway LOS standards. Urban growth management agreements shall designate level of service standards.

c. The County and the Cities shall adopt transit LOS in the form of "Service Standards" adopted by the Kitsap Transit Board of Commissioners. The standards shall consider both frequency of service and bus capacity.

d. Consistent with State law, the County and Cities shall recognize the Level of Service Standards for Highways of Statewide Significance, including principal arterial ferry routes, that have been adopted by the Washington State Transportation Commission, in their respective Comprehensive Plans.

e. For State highways and facilities of regional significance, including the Southworth ferry route, the County and the Cities shall include the Level of Service Standards adopted for these routes by the Puget Sound Regional Council and the Peninsula RTPO in their respective Comprehensive Plans.

f. On highways and streets which are subject to concurrency requirements, the County and the Cities shall each identify capacity deficiencies and either address them in terms of identified funding, adjust the LOS standard on a temporary basis, or place a temporary moratorium on development.

g. On highways and streets which are subject to concurrency requirements, new development should not cause LOS to degrade to a level lower than the adopted standard, consistent with State law.

Element I. Affordable Housing

The Growth Management Act requires cities and counties to encourage the availability of housing that is affordable for all income levels at a variety of housing densities. Local jurisdictions are also encouraged to preserve existing housing resources in their communities.

The following definitions relate to the Countywide Planning Policies:

Below Market Rate Housing shall mean housing intended for low-to-middle income households. These income levels are further defined as follows (WAC 365.195):

- **Extremely low-income** shall mean those households that have incomes that are at or below 30% of the countywide median.
- **Very low-income** shall mean those households that have incomes that are within the range of 31 - 50% of the countywide median.
- **Low-income** shall mean those households that have incomes that are within the range of 51 - 80% of the countywide median.
- **Moderate-income** shall mean those households that have incomes that are within the range 81-95% of the countywide median.
- Middle-income shall mean those households that have incomes that are within the range of 96-120% of the countywide median.

Market Rate Housing shall mean housing intended for households with incomes that are greater than 120% of the countywide median.

Policies for Affordable Housing(AH):

1. **Coordinated process among County, Cities, and housing agencies for determining and fulfilling housing needs, and the equitable distribution of below market rate housing in Kitsap County:**

   a. The County and the Cities should inventory the existing housing stock consistent with the Growth Management Act following each decennial census review, and correlate with current population and economic conditions, past trends, and ten year population and employment forecasts, to determine short and long range housing needs, including rental and home ownership. Navy personnel housing policy should also be considered.

   b. Recognizing the percentage share of the existing and forecasted countywide population and the distribution of existing below market rate housing, the County and the Cities should develop strategies to equitably disperse projected countywide below market rate housing needs throughout Kitsap County in the Urban Growth Areas and, where they are specifically found to be appropriate in consideration of existing development patterns and densities, in designated Rural Communities.

   c. Local housing inventories, projections, and equitable distribution strategies should be compiled, updated, and monitored under the coordination of the Kitsap Regional Coordinating Council to identify countywide conditions and projected needs.

d. The County and the Cities should each identify specific policies and implementation strategies in their Comprehensive Plans and should enact implementing regulations to provide a mix of housing types and costs to achieve identified goals for both market rate and below market rate housing.

2. **Recognizing that the market place makes adequate provision for those in the upper economic brackets, each jurisdiction should consider some combination of appropriately zoned land, regulatory incentives, financial subsidies, and innovative planning techniques to make adequate provisions for the needs of middle and lower income persons. (WAC 365.195-070.6)**

3. **Provision of below market rate housing:**

   a. Local comprehensive plan policies and development regulations shall encourage and not exclude below market rate housing.

   b. Below market rate housing strategies should include:

      i. preservation, rehabilitation and redevelopment of existing neighborhoods as appropriate, including programs to rehabilitate substandard housing;

      ii. provision for a range of housing types such as multi-family, single family, accessory dwelling units, cooperative housing, and manufactured housing on individual lots and in manufactured housing parks;

      iii. housing design and siting compatible with surrounding neighborhoods;

      iv. mechanisms to help people purchase their own housing, such as low interest loan programs, "self-help" housing, and consumer education.

   c. Each jurisdiction shall promote the development of below market rate housing in a dispersed pattern so as not to concentrate or geographically isolate low-income housing in a specific area or community.

   d. Below market rate housing should be located throughout Kitsap County in a manner to provide easy access to transportation, employment, and other services. Designated Centers should include below market rate housing. Rural self- help housing programs should be encouraged either in or outside of designated Rural Communities.

   e. Housing policies and programs shall address the provision of diverse housing opportunities to accommodate the homeless, the elderly, physically or mentally challenged, and other segments of the population that have special needs.

   f. Innovative regulatory strategies shall be developed and implemented to provide incentives for the development of below market rate housing within Designated Centers. Jurisdictions shall develop strategies which provide a wide range of opportunities for promoting the production of below market rate housing through means such as: reducing housing cost by subsidizing utility hook-up fees and rates, impact fees, and permit processing fees; density incentives; smaller lot sizes; zero lot line designs; inclusionary zoning techniques, such as requiring below-market rate housing in new residential developments; transfers of development rights and/or a priority permit review and approval process.

g. Policies and regulations shall encourage the production of below market rate housing. The County and the Cities shall incorporate a regular review of public health and safety regulations pertaining to housing implementation strategies to assure that protection of the public health and safety remains the primary purpose for housing standards.

h. The County and the Cities shall participate with housing authorities established to facilitate the production of below market rate housing. The County and the Cities shall also recognize and support other public and private not-for-profit housing agencies. Supporting housing agencies is encouraged through public land donations, guarantees, suitable design standards, tax incentives, fee waivers, providing access to funding sources and support for funding applications, or other provisions as appropriate.

Element J. Countywide Economic Development

Growth Management Act requires that general economic development policies be identified in the Countywide Planning Policies. Consistent with the goals of the Act, economic development planning must be coordinated with local comprehensive plans. The intent of the following policies is to encourage coordinated economic growth among all jurisdictions in Kitsap County and to add predictability and certainty to the private investment decision.

Policies for Countywide Economic Development (ED):

1. **A general strategy for enhancing economic development and employment:**

   a. The County and the Cities recognize that a healthy economy that provides opportunities for diverse segments of the community is important to the quality of life in the county. Economic development should be balanced with environmental concerns and protect the quality of life.

   b. The County and the Cities recognize that the economy in Kitsap County is very dependent on the U.S. Navy and diversification is necessary. The County and the Cities shall collaborate with ports, tribes, and other special districts to encourage economic growth and diversification that is consistent with comprehensive plans and policies for land use, transportation, public transit, regional water supply, capital facilities, urban governmental services and environmental quality.

   c. Local governments are encouraged to utilize the Economic Development Council as a resource to provide advice on economic development needs, the potential for retaining and expanding existing industries, including the U.S. Dept. of Defense, and attracting new industries, especially those that would improve wage and salary levels, increase the variety of job opportunities, and utilize the resident labor force.

   d. The County and the Cities recognize that widespread access to broadband capability will enhance economic development in Kitsap County. Local governments are encouraged to collaborate with the Economic Development Council to promote the expansion of telecommunications in Kitsap County and to coordinate telecommunications policy with regional and federal agencies, including public utility districts, Bonneville Power Administration, regional transportation planning organizations, and neighboring counties.

   e. Efforts of educational institutions to improve and expand vocational and post-secondary education programs should be supported to assure a highly skilled, technically trained resident work force.

2. **The role of government agencies in assuring coordinated, consistent efforts to promote economic vitality and equity throughout Kitsap County:**

   a. The County and the Cities shall promote Urban Growth Areas and existing industrial sites as centers for employment.

   b. The County and the Cities shall encourage the full utilization/development of designated industrial and commercial areas. The County and the Cities shall promote revitalization within existing developed industrial and commercial areas to take advantage of the significant investments in existing buildings and infrastructure.

c. The County and the Cities shall cooperate with tribes, ports, other special districts, and all economic development interests to identify the capital facility needs of designated industrial and commercial sites and investments to support economic development.

d. The County and the Cities shall collaborate with tribes, ports, and other special districts to identify innovative development methods such as public and private partnerships and community development assistance financing to increase economic vitality.

e. The County and the Cities shall collaborate with the EDC and the Ports to establish a common method to monitor the supply of designated commercial and industrial sites and to ensure adequate land supply for the expansion of existing enterprises and the establishment of new economic enterprises. The monitoring method shall indicate environmental constraints, infrastructure availability and capacity, and shall use the Kitsap County Geographic Information System and Land Capacity Analysis as a regional database for this information.

f. The County and the Cities shall establish common infrastructure policy and standards, including telecommunications infrastructure.

3. The Kitsap Regional Coordinating Council shall coordinate the development of land supply monitoring methods, common infrastructure policy and standards, and other strategies among the County, the Cities, Tribes, Ports, and other special districts to encourage economic development in Kitsap County:

a. The County and the Cities shall each establish and monitor a development review process that is timely, predictable, efficient, fair, and consistent.

b. Where more than one jurisdiction is involved in planning and permitting a business development, the jurisdictions shall work collaboratively to provide consistent development regulations and permitting.

c. The County and the Cities shall encourage small business enterprises and cottage industries, and allow appropriate and traditional home occupations as permitted by local regulations.

Element K. An Analysis of the Fiscal Impact

In order to preserve and maintain the community's quality of life and level of government services, jurisdictions are expected to fully evaluate their financial capacity to provide the full range of urban services (as described in Element B – 3[j]) within designated Urban Growth Areas.

Policies for Analysis of Fiscal Impact (FI):

1. The Countywide Planning Policies recognize three opportunities for jurisdictions to consider and plan for urban-level infrastructure and services:

    a. During each jurisdiction's comprehensive plan amendments, through the Capital Facilities Plan, including sub-area plans, Urban Growth Area boundary changes, incorporations, partial dis-incorporations, proposed new fully contained communities and master planned resorts.

    b. At the point where a jurisdiction is comparing and analyzing geographic areas for possible expansion of its Urban Growth Area (as described in Element B – 3[j]).

    c. As part of the development of the Urban Growth Area Management Agreement (see Element B-4 [d] and Appendix C).

    These analyses and plans should identify infrastructure and service costs as well as the anticipated revenues to support them.

2. Special districts should be included in planning for the provision of urban level services in Urban Growth Areas and should include future population growth in their plans.

3. **The Kitsap Regional Coordinating Council shall facilitate on-going regional discussion of infrastructure and service delivery strategies (see Element F-1 [c]) and revenue equity issues (see Element F-3 [c]).**

Element L. Coordination with Tribal Governments

The Suquamish Tribe, the Port Gamble S'Klallam Tribe, and other federally recognized Indian tribes have reservations and/or trust resources within Kitsap County, Washington. These tribes are parties to treaties with the United States Government through which certain rights and privileges both on and off reservation were articulated and remain in effect. These tribes have authorities, responsibilities, interests and treaty rights within their respective reservation boundaries and Usual and Accustomed Areas. Since future growth and land use decisions in Kitsap County affect all governmental entities, governmental agencies must be well informed and continuously involved in regional and local planning.

Policies for Coordination with Tribal Governments (CT):

1. Meaningful and substantial opportunities for early and continuous tribal government participation shall be incorporated into regional and local planning activities.

2. Local jurisdictions should work with the tribes to develop agreements that provide for discussion on comprehensive planning issues among governments and ensure that the tribes are consulted on issues within their interest. The parties will jointly determine the appropriate contents of the agreements and a schedule for completing them.

3. Tribal governments, federal agencies, and county and local governments are encouraged to coordinate plans among and between governments and agencies to address substantive areas of mutual interest especially where geographical areas overlay and promote complementary and cooperative efforts.

4. City and County governments are encouraged to include Tribal governments in joint comprehensive planning and development activities for areas within the Tribes' Usual and Accustomed areas. Activities include but are not limited to the establishment and revision of urban growth boundaries, distribution of forecasted population; regional transportation, capital facility, housing and utility plans; and policies that may affect natural and/or cultural resources.

5. All County, City, and Tribal government agencies shall be included in the normal public notice and comment procedures of other agencies and kept informed of matters of interest to them.

6. The County, the Cities, and Tribal governmental agencies are encouraged to keep one another informed about matters of local and regional interest by mutually agreeable means and schedule.

Element M. Coordination with Federal Government including Navy

The federal government has unique authorities, responsibilities, interests affecting land use and other activities. Since the impacts of future growth and development in Kitsap County affect all governmental entities, governmental agencies must be well informed and continuously involved in regional and local planning.

<u>Policies for Coordination with Federal Government (CF):</u>

1. Meaningful and substantial opportunities for early and continuous federal government participation shall be incorporated into regional and local planning activities.

2. It is recognized that constitutional and statutory provisions may constrain federal government agencies from entering into local agreements and processes. However, when possible, the County, the Cities, and federal governments should establish intergovernmental cooperative agreements promoting coordination and involvement in activities that are of mutual interest.

3. Federal agencies and county and local governments are encouraged to coordinate plans among and between governments and agencies to make plans as consistent and compatible as possible for properties over which they have authority or activities they authorize and the adjacent areas affected.

4. Federal government agencies are encouraged to participate in City, County, and joint comprehensive planning and development activities that may affect them, including the establishment and revision of urban growth areas encompassing, adjacent to or within federally-owned lands; distribution of forecasted population; regional transportation, capital facility, housing and utility plans; and policies that may affect natural and/or cultural resources of interest.

5. The following policies relate to promoting coordination among the Cities, County, and the federal government including the Navy:

    a. All jurisdictions should promote planning that considers the impact of new growth to avoid the potential for encroachment on military readiness activities as described below when developing zoning ordinances or designating land uses affecting military facilities. Each jurisdiction and the Navy should coordinate to identify the types of development and areas of interest to the Navy, method of notice, and opportunities for comment.

    b. "Military readiness activities" mean all of the following:
        i. Training, support, and operations that prepare the men and women of the military and Naval ships and submarines for combat.
        ii. Operation, maintenance, and security of any military installation.
        iii. Testing of military equipment, vehicles, weapons, and sensors for proper operation or suitability for combat use.

    c. "Impacts" include but are not limited to:
        i. Aircraft, boat, and rail traffic.
        ii. Incompatible adjacent land uses.

d. Through the Kitsap Regional Coordinating Council, jurisdictions should monitor issues that arise in implementing these policies, and should identify areas for improved coordination.

6. All County, City, and federal governmental agencies shall be included in the normal public notice and comment procedures of other agencies and kept informed of matters of interest to them.

7. The County, the Cities, and federal governmental agencies are encouraged to keep one another informed of matters of local and regional interest by mutually agreeable means and schedule.

Element N. Roles and Responsibilities

The County, Cities, Tribal governments, and special districts are all involved in planning activities related to their statutory authority and responsibility. In addition to the responsibilities defined in previous countywide planning policies, this section further clarifies the planning roles and responsibilities of the Kitsap Regional Coordinating Council and member agencies.

Policies for Roles and Responsibilities (RR):

1. **The KITSAP REGIONAL COORDINATING COUNCIL was established by interlocal agreement (see Appendix E) to assure coordination, consensus, consistency, and compliance in the implementation of the Growth Management Act and comprehensive planning by County, city and tribal governments within Kitsap County. The Kitsap Regional Coordinating Council also provides a voice for all jurisdictions and opportunity for citizens and stakeholders to provide input to planning policies to be applied countywide. The interlocal agreement adopted by the County, the Cities and the Tribal governments declared that the Kitsap Regional Coordinating Council is necessary to maintain a regular intergovernmental communication network for all local and tribal governments within the county, facilitate compliance with the coordination and consistency requirements of the Growth Management Act, provide an effective vehicle to resolve conflict among and/or between jurisdictions with respect to urban growth boundaries or comprehensive plan consistency, and to build consensus on planning solutions for countywide growth management issues. The Kitsap Regional Coordinating Council shall:**

    a. Submit agreed-upon recommendations on behalf of member jurisdictions to multi-county regional agencies and State government on proposed changes to multi-county regional plans, State plans, and laws.

    b. Provide a forum, as necessary, for achieving coordination in the development of local plans and resolving planning and plan implementation issues that are common among jurisdictions.

    c. Promote coordination and consistency among local plans and between local plans and the Countywide Planning Policies and the Growth Management Act to the extent necessary to achieve regional policies and objectives. Through the Kitsap Regional Coordinating Council forum, jurisdictions should establish a process to monitor and review individual comprehensive plans and associated implementation mechanisms to determine consistency with the Countywide Planning Policies.

    d. Serve as a forum for resolving disputes locally. The process shall not preclude appeals to the Central Puget Sound Growth Planning Hearings Board if the local process has been exhausted without resolution of the dispute.

    e. Promote coordination of educational programs and the dissemination of planning-related information of regional interest.

    f. Coordinate the review, revision and monitoring of the Countywide Planning Policies.

    g. Apply for grants and administer contracts relative to regional tasks and plans.

h. Conduct the region-wide growth management planning consistent with these policies.

i. Initiate and coordinate the development of other regional planning policies and implementation mechanisms that may improve the effectiveness of the comprehensive planning process.

j. Define and implement procedures that assure opportunities for early and continuous public involvement in policy discussions facilitated by the Kitsap Regional Coordinating Council.

2. KITSAP COUNTY is the regional government within the county boundaries providing various services within unincorporated and incorporated areas as required and specified by law and by legal agreements. Kitsap County shall:

a. Be responsible for the development, adoption and implementation of comprehensive plans and development regulations and the processing of land use permits for the unincorporated portions of the county.

b. Be responsible for coordinating water quality planning in multi-jurisdictional watersheds and for other environmental planning activities as agreed to by all affected and interested jurisdictions.

c. Be responsible for coordinating the response on the listing for the federal Endangered Species Act in multi-jurisdictional watersheds as agreed by all affected and interested jurisdictions.

d. Be responsible for being a regional sewer provider to the unincorporated areas of Kitsap County as needed to improve water quality consistent with levels of service outlined in the County Comprehensive Plan.

e. Maintain a geographic information system to serve as a regional planning data base.

f. Execute Urban Growth Area Management Agreements with each city to address joint issues identified in the Countywide Planning Policies and other matters agreed to be of mutual interest.

g. Define and implement procedures that assure opportunities for early and continuous public involvement throughout short and long range planning projects.

3. CITIES within Kitsap County provide a variety of services primarily to residents within their respective municipal boundaries. Cities shall:

a. Provide urban governmental services as identified in the Growth Management Act (Chapter 36.70A RCW) and adopted urban growth management agreements.

b. Be responsible for the development, adoption and implementation of comprehensive plans and development regulations and the processing of land use permits within the incorporated portion of the respective city.

c. Participate with other agencies in multi-jurisdictional planning activities including but not limited to environmental planning, e.g. water quality planning and coordinating the response on the listing for the Federal Endangered Species Act in multi-jurisdictional watersheds transportation planning, and growth management strategies.

d. Execute a separate Urban Growth Area Management Agreement with Kitsap County to address joint issues identified in the Countywide Planning Policies and other matters agreed to be of mutual interest.

e. Define and implement procedures that assure opportunities for early and continuous public involvement throughout short and long range planning projects.

4. **SPECIAL DISTRICTS are governmental subdivisions of the county that are usually established to provide a defined scope of services. Special districts shall:**

   a. Be responsible for service provision, capital facility planning and other activities as authorized by law and legal agreements.

   b. Coordinate capital planning and implementation strategies with local governments to assure consistency with comprehensive plan policies;

   c. Participate in service provision identification required in each urban growth management agreement;

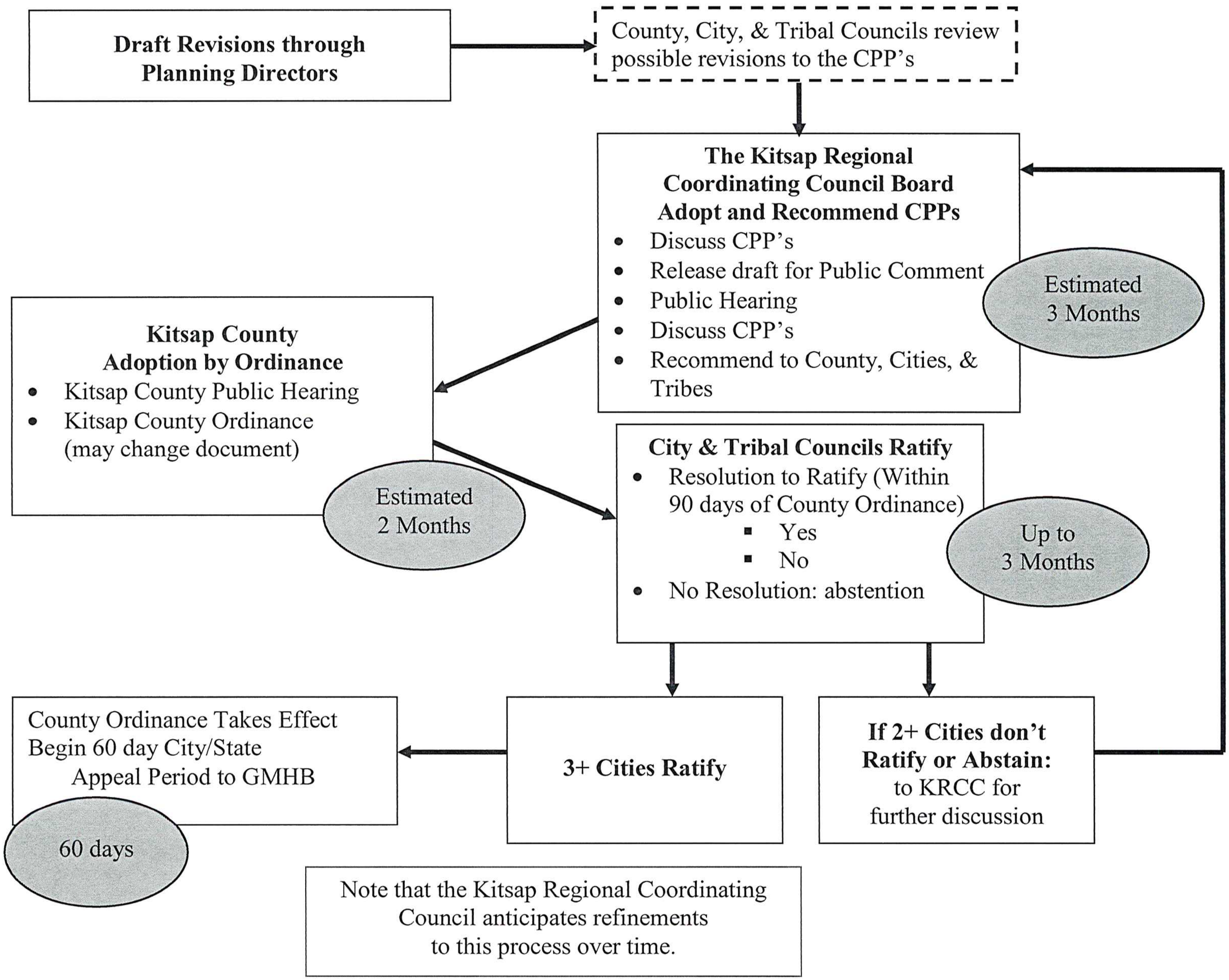
   d. Coordinate with other agencies as appropriate in multi-jurisdictional planning activities;

   e. Provide technical assistance as appropriate to assist local governments in comprehensive plan development, adoption and implementation;

   f. be encouraged to enter into cooperative agreements and consolidate when possible to formalize participation in local and regional processes;

   g. define and implement procedures that assure opportunities for early and continuous public involvement throughout short and long range planning projects.

Appendix A:
Kitsap Countywide Planning Policy Ratification Process



Adopted by Kitsap County Ordinance 403-2007
November 19, 2007

Appendix B: Population Distribution 2005 - 2025

Population Distribution 2005 through 2025		2000 Population	Through 2025 + New Population	= Total in 2025	Annual Growth Rate
Bremerton	City [2]	37,259	14,759	52,017	1.34%
	East UGA [1]	5,412	2,210	7,622	1.38%
	West UGA [1]	3,229	2,017	5,246	1.96%
Bremerton Port UGA [2]		68	-68	0	-100.00%
Central Kitsap UGA [1]		21,743	8,733	30,476	1.36%
Gorst UGA [1]		154	73	227	1.56%
Silverdale UGA [1]		15,276	8,059	23,335	1.71%
Bainbridge Island City [2]		20,308	8,352	28,660	1.39%
Kingston UGA [3]		1,871	3,135	5,006	4.02%
Poulsbo	City [2]	6,813	3,739	10,552	1.77%
	UGA [2]	901	3,355	4,256	6.41%
Port Orchard	City [2]	7,693	3,600	11,293	1.55%
	UGA [2]	11,570	3,375	14,945	1.03%
Port Orchard UGA Expansion Study Area [3]		0	6,334	6,334	
South Kitsap UGA: [2]		1,241	8,024	9,265	8.37%
UGA Population		133,537 ***58%***	75,697 ***76%***	209,234 ***63%***	1.81%
Non-UGA Population		98,432 ***42%***	23,905 ***24%***	122,337 ***37%***	0.87%
Total County Population		*231,969*	*99,602*	*331,571*	1.44%

OFM Projection through 2025			
	Low	268,573	0.59%
	Intermediate	**331,571**	**1.44%**
	High	412,391	2.33%

[1] Based on PSRC Model
[2] Based on City and/or County Comprehensive or Sub-area planning
[3] Target to be substantiated by further analysis and/or Sub-area planning
[4] Office of Financial Management official estimate

Kitsap County Historical Growth

	US Census	Annual Growth Rate
1960	84,176	
1970	101,732	1.91%
1980	147,152	3.76%
1990	189,731	2.57%
2000	231,969	2.03%
2004[4]	239,500	0.80%

Note: Population Banking as described in Kitsap County's Updated Comprehensive Plan LU-13 applies to the potential need in specific UGA's (*e.g.* Central Kitsap) to work with adjacent Cities to resolve unmet population growth targets through an UGAMA or to re-allocate population to other UGA's over time, through the Kitsap Regional Coordinating Council process.	Population distribution will be reviewed through the Kitsap Regional Coordinating Council process every five years. The review will include an analysis of the Cities' and County's progress in achieving target distributions. If the 76% UGA target mentioned above for new population growth and the overall population targets are met or exceeded, the target for new population will revert to five sixths (83%), as per the revised County-wide Planning Policies adopted by Kitsap County Ordinance #258-01 on August 20, 2001. Otherwise, the target may be reaffirmed or explicitly modified.

Appendix C: Urban Growth Area Management Agreements

The intent of the Urban Growth Area Management Agreement is to facilitate and encourage annexation and/or incorporation of urban areas over the 20 year planning period and to ensure compatibility of development within the unincorporated Urban Growth Area. Each Urban Growth Area Management Agreement shall:

1. Describe the goals and procedures of the joint planning process including roles and responsibilities for the unincorporated Urban Growth Area, with the goal of having compatible City and County plans, zoning, and development regulations. The following provisions should apply to the entire Urban Growth Area associated with the City unless mutually agreed otherwise by the City and County:

   a. The City's zoning code, densities, and development, sub-division, environmental, and construction standards.

   b. The City's Levels of Service.

   c. The Comprehensive Plan of the City should reflect land use planning for the entire Urban Growth Area.

2. Identify responsibility and mechanisms for comprehensive plan amendments, zoning changes and development applications within unincorporated Urban Growth Areas. Significant weight should be given to City preferences.

3. Identify services to be provided in the Urban Growth Area, the responsible service purveyors, and the terms under which the services shall be provided, including:

Fire	Storm Water	Solid Waste
Police	Potable Water	Park & Recreation Facilities
Transportation	Sewer	Schools

   Utilities: Power and Telecommunications, including broadband where available
   EMS

   All service providers, including special districts, and adjacent jurisdictions should be included in Urban Growth Area planning.

4. Reference the adopted Revenue Sharing Inter-local Agreement (see Appendix D).

5. Develop pre-annexation plans, which shall include:

   a. Conditioning City service extensions upon actual annexation for properties contiguous to the City boundary or to agreements of no protest to future annexation for properties not contiguous.

   b. Offering pre-annexation agreements to property owners interested in annexation and needing assurances from the City about services, planning, or other issues.

   c. Plans for tiering and/or phasing of infrastructure development, appropriate to the individual Urban Growth Area.

   d. City priorities for City-led annexation efforts, as appropriate.

6. Describe the development and implementation of a public involvement program that identifies roles and responsibilities for respective jurisdictions, including actions and timeline.

7. Be reflected in County and City Comprehensive plans.

Appendix D

Interlocal Agreement Between Kitsap County and the City of Bainbridge Island, City of Bremerton, City of Port Orchard and City of Poulsbo Concerning Revenue Sharing Upon Annexation and In Conjunction With Major Land Use Decisions Within a City's Urban Growth Area

(adopted by all parties in November-December, 2001)

This Agreement, made pursuant to Chapter 39.34 RCW, is between KITSAP COUNTY (hereinafter, the County), a political subdivision of the State of Washington, and the CITY OF BAINBRIDGE ISLAND, the CITY OF BREMERTON, the CITY OF PORT ORCHARD, and the CITY OF POULSBO, (hereinafter, the Cities), municipal subdivisions of the State of Washington.

WHEREAS, through the Kitsap Regional Coordinating Council, the County and the Cities have worked together constructively on revenue sharing issues that in the past have been adversarial; and

WHEREAS, the County and Cities sought a balanced set of revenue sharing provisions that would benefit both the County and the Cities and support the orderly evolution of logical land use patterns and jurisdictional boundaries; and

WHEREAS, the County and Cities reached accord on a set of Principles of Agreement for Revenue Sharing in Annexations and in Major Land Use Decisions; and

WHEREAS, the County and Cities desire to implement the Principles of Agreement through an interlocal agreement;

NOW, THEREFORE, in consideration of the mutual covenants, terms and conditions contained herein, the parties agree as follows:

SECTION 1 ANNEXATIONS

The purpose of this section is to provide a framework for logical and orderly annexations that are consistent with the Growth Management Act, Chapter 36.70A RCW (hereinafter GMA), and to mitigate the fiscal impact to the County of annexations initiated after the effective date of this agreement.

1.1 The Cities each confirm their willingness to eventually annex all land within their designated Urban Growth Area (hereinafter UGA) boundaries.

1.2 Each City shall encourage annexation of all lands equally, and will support logical and coordinated annexations, consistent with the intent of the GMA.

1.3 As part of the Kitsap Regional Coordinating Council's 2002 Work Program, the County and Cities will continue to address coordinated development within the UGAs, including infrastructure standards and funding.

1.4 Before the County constructs a major infrastructure improvement within a City's designated UGA, the County and the City will negotiate and execute an interlocal agreement that specifies the level at which the City shall reimburse the County for a portion of its investment in the infrastructure improvement if the area where the improvement is to be located is annexed within a specified period of time.

1.5 The County and the Cities anticipate that each specific proposed annexation will require negotiation of other issues particular to its time, place and geography. The Cities and the

County commit to completing these negotiations and executing an interlocal agreement on such issues in a timely manner.

1.6 As part of this agreement, the County will not oppose annexations within that City's designated UGA or invite the Boundary Review Board to invoke jurisdiction.

1.7 The Cities agree to share with the County revenue lost to the County and gained by the annexing City as follows:

A. Revenue sharing payments shall be based on the following three sources of revenue:

1. The County's portion of the local retail sales tax levied under Chapter 82.14 RCW.

2. The ad valorem property tax levied by the County pursuant to RCW 36.82.040 for establishment and maintenance of county transportation systems.

3. The admission tax levied by the County pursuant to Chapter 36.38 RCW.

B. For purposes of this Section, "lost revenue" means an amount computed as follows:

The combined total of the County's collections from all three sources within the annexation area during the calendar year preceding annexation

minus

The combined total of the County's collections from all three sources within the annexation area during the first full calendar year following annexation.

C. The amount of the payment from the City to the County will be based on a three-year "soft landing" approach as follows:

1. The Year 1 payment will be equal to 75% of the County's lost revenue.
2. The Year 2 payment will be equal to 50% of the County's lost revenue.
3. The Year 3 payment will be equal to 25% of the County's lost revenue.

D. The calculation of lost revenue pursuant to subsection B of this Section requires revenue data for one full year following annexation. Therefore, the County shall initiate a request for payment under this Section by written notice to the annexing City within two years of the effective date of the annexation.

SECTION 2 MAJOR LAND USE ACTIONS

The purpose of this section is to recognize that retail development near jurisdictional boundaries has an impact on neighboring jurisdictions and, in particular, on existing businesses and the demand for public services and facilities. This Section is designed to mitigate these impacts by providing that sales tax revenues from new major business development within a City's designated UGA, or from the relocation of an existing major business from a City to a location within the City's designated UGA, will be shared with the affected City.

2.1 For purposes of this Agreement, "major land use" means:

A. A new development within a City's designated UGA that houses any single retail tenant greater than 40,000 square feet.

B. The expansion of an existing retail business within the City's designated UGA if the expansion is greater than 40,000 square feet.

C. A retail business greater than 25,000 square feet that is relocated from a City to the City's designated UGA. Or

D. An automobile, truck, recreational vehicle, manufactured or mobile home, or boat dealership, regardless of the size of the building permitted, that is newly located within a City's designated UGA, or relocated from a City to the City's designated UGA.

2.2 The County agrees to share with the affected City revenue lost to the City and gained by the County due to a major land use, as follows:

A. Revenue sharing payments will be required only for local retail sales tax revenues generated from major land uses. Because there are limitations, related to confidentiality, on using a figure based on actual sales tax collections from the new or relocated business, the revenue sharing payment will be based on estimated sales tax revenues derived by using industry standards, such as the Washington State Department of Revenue or the Urban Land Institute, for taxable retail sales per square foot for businesses.

B. For purposes of this Section, "lost revenue" means an amount computed as follows:

Total gross enclosed building square footage of the major land use

x

Industry standard annual average retail sales per square foot for category of business that most closely resembles the major land use

x

Tax rate levied under Chapter 82.14 RCW

for the first full calendar year following the date on which the County issues a certificate of occupancy for the major land use.

C. The County will make revenue sharing payments for the first full three years after the major land use receives a certificate of occupancy.

D. The revenue sharing payment from the County to the affected City will be calculated according to the following formulas:

1. For the relocation of a major retail business from a City to the City's designated UGA:

a. The Year 1 payment will be equal to 75% of the City's lost revenue;

b. The Year 2 payment will be equal to 50% of the City's lost revenue; and

c. The Year 3 payment will be equal to 25% of the City's lost revenue.

2. For new development within a City's designated UGA that houses any single retail tenant greater than 40,000 square feet, the payment amount will be 50% of the City's estimated lost revenue each year for the first three years.

F. The calculation of lost revenue pursuant to subsection B of this Section requires revenue data for one full year following issuance of a certificate of occupancy. Therefore, the affected City shall initiate a request for payment under this Section by written notice to the County within two years of the date the major land use receives the County's permission to occupy the building.

SECTION 3 MISCELLANEOUS

3.1 **Duration.** This Agreement will remain in effect until the terms of the Agreement are fulfilled. There is no other term agreed to by the parties

3.2 **Reevaluation.** Any City or the County may request immediate reevaluation of this Agreement by the Kitsap Regional Coordinating Council Revenue Sharing Policy Committee. If the reevaluation fails to yield a resolution satisfactory to the requesting party within six months from the date the request for reevaluation was made, the requesting party may initiate the process for termination provided in this Agreement.

3.3 **Termination.** After completion of the Reevaluation process required by this Agreement, a party may terminate this Agreement by 12 months' written notice to the other parties. Termination does not extinguish the obligations of the terminating party under this Agreement for annexations initiated, or major land uses for which an application is filed, prior to the effective date of termination.

3.4 **Filing.** When fully executed, this Agreement shall be filed with the Kitsap County Auditor.

3.5 **Notices.** Any notices required by this Agreement shall be delivered, or mailed postage prepaid, and addressed to:

Kitsap County
Clerk to the Board
Office of the Kitsap County
Board of Commissioners
614 Division Street
Mailstop 4
Port Orchard, WA 98366

City of Bainbridge Island
City Clerk
City of Bainbridge Island
280 Madison Avenue N.
Bainbridge Island, WA 98110

City of Bremerton
City Clerk
City of Bremerton
345 6th Street, Suite 600
Bremerton, WA 98337

City of Port Orchard
City Clerk
City of Port Orchard
216 Prospect Street
Port Orchard, WA 98366

City of Poulsbo
Mayor
City of Poulsbo
19050 Jensen Way NE
P.O. Box 98
Poulsbo, WA 98370

Kitsap Regional Coordinating Council
Chair
Kitsap Regional Coordinating Council
P.O. Box 1934
Kingston, WA 98346

3.6 **Administration.** As this Agreement contemplates no joint or cooperative undertaking, each party shall administer the Agreement as to its own responsibilities under the Agreement. The Kitsap Regional Coordinating Council shall oversee the revenue sharing process provided for in this Agreement.

3.7 **Reporting.** The County and the Cities shall report to the Kitsap Regional Coordinating Council at the start of each calendar year any payments made or received by the reporting jurisdiction pursuant to this Agreement during the preceding calendar year.

3.8 **Waiver.** The failure by the County or any City to enforce any term or condition of this Agreement shall not be construed to constitute a waiver of any other term or condition, or of any subsequent breach of any provision, of this Agreement.

3.9 **Entire Agreement.** This Agreement includes the entire agreement of the parties with respect to any matter addressed in this Agreement

3.10 **Amendment.** This Agreement may be amended only upon the written agreement of the parties made with the same formalities as those required for its original execution.

3.11. **Countywide Planning Policy.** To the extent that anything in this Agreement may be found to be inconsistent with any part of the Kitsap County-wide Planning Policy, the County and City in 2002 will review the applicable parts of the County-wide Planning Policy and revise them in accordance with this Agreement.

3.12 **Review.** The County and the Cities shall review this Agreement within the Kitsap Regional Coordinating Council in December of 2003, and every five years thereafter.

3.13 **Effective Date.** This Agreement shall take effect retroactively to September 4, 2001, as this date has been expressly agreed upon by all the parties.

Kitsap Regional Coordinating Council

KITSAP REGIONAL COORDINATING COUNCIL
INTERLOCAL AGREEMENT

THIS AGREEMENT is made and entered into by and between the undersigned parties pursuant to provisions of the Interlocal Cooperation Act of 1967, Chapter 39.34 RCW.

WHEREAS, the undersigned members recognize the need and desirability to participate in a forum for intergovernmental coordination, cooperation, and consultation among member agencies in order to bring about a continuous and comprehensive regional planning process and efficient service delivery; and

WHEREAS, the undersigned members desire jointly to undertake continuous, cooperative study and planning of regional and governmental issues of mutual interest, including but not limited to development, land use, housing, capital facilities, service, utilities, finances, public buildings, water supply, water distribution and drainage, air and water pollution, parks and recreation, transportation planning, and economic development; and

WHEREAS, it is the belief of the undersigned members that regional deliberations, planning, and review can best be achieved with the creation of a separate legal entity whose function and activities are subject to policy direction from the undersigned member agencies according to the provisions of this Agreement; and

WHEREAS, the State Growth Management Act (GMA) requires local jurisdictions to coordinate and ensure consistency when developing comprehensive land use plans and the undersigned members desire to establish the Kitsap Regional Coordinating Council as a separate legal entity to facilitate coordination and consistency of comprehensive land use plans as required by the GMA; and

WHEREAS, the undersigned members desire to use the Kitsap Regional Coordinating Council for developing County-wide Planning Policies (CPPs) under the GMA as a framework to guide Kitsap County and cities situated within the County in developing their comprehensive land use plans.

THEREFORE, in consideration of mutual promises and covenants herein it is hereby agreed:

I. NAME

This Agreement establishes the KITSAP REGIONAL COORDINATING COUNCIL ("Council"), a separate legal entity.

II. DURATION

The Agreement shall remain in force and effect perpetually or until terminated by majority vote of the member agencies.

10/10/2007 Final

III. DEFINITIONS

For the purpose of this Interlocal Agreement, the following terms have the meaning prescribed to them in this section unless the context of their use dictates otherwise:

A. "*Member agency*" means a voting and dues paying municipal or other government entity located within Kitsap County which is a party to this Agreement.

B. "*State*" means the State of Washington.

C. "*Region*" means the territory physically lying within the boundaries of Kitsap County.

D. "*Kitsap Regional Coordinating Council*" or "*Council*" means the separate legal entity established by this Agreement to represent member agencies to carry out those powers and managerial and administrative responsibilities delegated pursuant to the provisions of this Agreement.

E. "*Majority vote*" means more than one-half of the votes cast when a quorum is present and must include a majority of votes from County commissioners and a majority of votes from the representatives of at least two separate cities.

F. "*Executive Board*" shall mean the representatives of member agencies of the Kitsap Regional Coordinating Council identified in Article IV.B. of this Agreement.

G. "*Cost Allocation*" means annual dues (the annual allocation among Member agencies of the cost of Council operations determined by the Executive Board for the purposes of calculating members' obligations to contribute to the funding of Council operations for the year, and for the purposes of calculating obligations and distributions in the event of withdrawal or termination).

H. "*Ex Officio Member*" means a non-voting, non-dues paying member of the Council.

I. "*Two-thirds majority vote*" means a majority vote and also requires a majority of votes from County commissioners and a majority of votes from the representatives from at least two separate cities.

J. "*Associate Member*" means a member of the Council which is not a party to this Agreement and who enters into a separate agreement with the Council that establishes the Associate Member's level of participation in Council activities.

K. "*Executive Director*" is the person appointed by the Executive Board to accomplish the work plan developed by the Executive Board.

IV. MEMBERSHIP AND REPRESENTATION

A. Membership. Membership (except for Associate Members and Ex Officio Members) is established by execution of this Agreement and payment of any required cost allocation as established by the Executive Board.

B. Executive Board. The Executive Board is comprised of the following representatives of member agencies:

1. County Government: three (3) members of the Kitsap County Board of Commissioners;

2. City Governments:

   a. The Mayor of each city having a population of 10,000 persons or less;

   b. The Mayor and one (1) member of the City Council of each city having a population between 10,001 persons and 30,000 persons;

   c. The Mayor and two (2) members of the City Council of each city having a population greater than 30,000 persons;

3. Port of Bremerton: one (1) representative consisting of a Port Commissioner.

4. City Council, and Port of Bremerton representatives may be selected by whatever means established by each specific member agency for a two (2) year term.

C. The determination of the population of cities will be the most recent annual population estimate of cities and towns prepared by the Washington State Office of Financial Management.

D. A municipal or government entity or a federally recognized Indian Tribe that desires to become a member of the Council must obtain permission to do so by majority vote of the Executive Board. The required permission applies to any entity that wishes to become a Member or Ex Officio Member. A municipal or government entity or a federally recognized Indian tribe that wishes to become an Associate Member must obtain permission to do so by a majority vote of the Executive Board, and must present a draft agreement for the Executive Board's consideration, establishing the proposed terms, duties, powers and privileges for Associate Member status.

V. POWER, AUTHORITY, AND PURPOSE

This Agreement does not confer additional substantive powers or authorities on member agencies. The powers and authorities conferred herein are limited to the powers that each member agency is authorized by law to perform. The Council has the following power, authority, and purpose:

A. Provide a regional forum for regional deliberations and cooperative decision-making by the region's elected officials in order to bring about a continuous and comprehensive planning process, and foster cooperation and mediate differences among governments throughout the region.

B. Consistent with the GMA, coordinate and ensure consistency when developing comprehensive land use plans.

C. Consistent with the GMA, develop CPPs to be used as a framework to guide the County and the Cities in developing their comprehensive land use plans;

D. Coordinate actions to provide for the distribution of state and federal grant funds, including but not limited to federal transportation funding, community development block grants, and low income housing grants.

E. Undertake continuous, cooperative study and planning of regional and governmental problems of mutual interest, including but not limited to development, land use, housing, capital facilities, services, utilities, finances, public buildings, water supply, water distribution and drainage, air and water pollution, parks and recreation and transportation planning.

F. Coordinate actions to provide for a sustainable economy and environment for the region.

G. Carry out such other planning and coordinating activities authorized by majority vote of the Council including participation in other forums and organizations.

H. Establish Bylaws, to be amended from time to time, that govern the procedures of the Council. The Bylaws, as may be amended, are incorporated into this Agreement by this reference as if fully set forth herein.

I. Appoint the Executive Director.

J. Enter into agreements appropriate and/or necessary to implement this Agreement.

K. Purchase, receive, lease, take by gift, or otherwise acquire, own, hold, improve, use and otherwise deal in and with real or personal property, or any interest therein, in the name of the Council.

L. Sell, convey, mortgage, pledge, lease, exchange, transfer, and otherwise dispose of its property and assets.

M. Sue and be sued, complain and defend, in all courts of competent jurisdiction in the Council's name.

N. To engage in any other activity necessary to further the Council goals and purposes to the extent authorized by chapter 39.34 RCW.

O. Apply for such federal, state, or private funding of any nature as may become available to assist the organization in carrying out its purposes and functions.

P. Identify and examine issues relating to governance, growth policies, development standards, service provision, revenue-cost sharing and municipal annexations in urban growth areas.

Q. Strive to represent the consensus of views on growth management and planning issues among member agencies. The Council makes recommendations on behalf of those jurisdictions to multi-county regional agencies and State government on behalf of member agencies, on proposed changes to multi-county regional plans, state plans and laws.

R. Represent the views or position of member agencies within the County on issues of consistency or the resolution of conflicts related to the multi-county regional growth strategy and transportation plan.

S. Make appointments to committees and boards of multi-county regional organizations (e.g. Puget Sound Regional Council, Peninsula Regional Transportation Planning Organization) where appointments are requested to represent more than one member agency of the Council. Members appointed to such committees and boards shall represent the consensus of the views of the Council. If consensus is not reached on a particular issue, the members appointed to such committees and boards shall represent all views of the Council, in order to accurately portray the status of discussions on that issue.

T. Employ personnel, adopt personnel policies, terminate personnel, and all other associated powers necessary for and relevant to employment matters.

U. Review the interlocal agreement no fewer than every 10 years with the assistance of legal counsel.

VI. FINANCING

A. Cost Allocation. All members shall pay the annual cost allocation as described in the Bylaws. If payment by a member is not paid timely after notice of the cost allocation is received, the member is subject to having its membership status revoked by majority vote of the Executive Board.

B. Local Government Accounting. All services and transfers of property to the Kitsap Regional Coordinating Council shall be paid and accounted for in accordance with RCW 43.09.210.

VII. FISCAL YEAR AND BUDGET

A. The Fiscal Year. The fiscal year shall coincide with the calendar year.

B. Adoption of Budget. By September of each year the Executive Board shall adopt a draft annual work program, budget, and cost allocation for the ensuing fiscal year that identifies anticipated activities, goals, revenues, and expenditures for completing the work program. The final work program, budget, and cost allocation for the ensuing year shall be adopted by the Executive Board no later than November of each year. After the Council has approved the final budget it is forwarded to the County for inclusion as a distinct agency fund within the Kitsap County Budget. No increase or decrease to the final budget shall occur without the approval of the Executive Board.

C. Notice of Budget. On or before September 30, the Executive Board shall provide written notice of the ensuing year's draft budget, work plan, and cost allocation to the designated representative(s) of each member agency. On or before November 30, the Executive Board shall provide written notice of the final budget, work plan, and cost allocation adopted for the ensuing fiscal year to the designated representative(s) of each member agency.

D. Accounting, Budgeting, and Reporting. The Council shall be subject to the Budgeting Accounting & Reporting System (BARS) applicable to Category 1 local governments.

E. Fiscal Agent. Kitsap County shall be the fiscal agent for the Council. After approval by the Executive Board, the Executive Board shall forward the final budget to the County for inclusion as a distinct agency fund within the Kitsap County Budget known as the Operating Fund of Kitsap Regional Coordinating Council.

F. Contracting. All contracts made by or on behalf of the Council shall be in accordance with state law, including, but not limited to: Chapter 39.04 RCW, and Chapter 42.23 RCW, and Chapter 42.24 RCW.

VIII. WITHDRAWAL FROM AGREEMENT

Any member agency has the right to withdraw from this Interlocal Agreement by giving the Executive Board six (6) months prior written notice. Unless otherwise provided by future agreement, any member agency that withdraws shall remain responsible for its financial and other obligations with regard to Council activities until the effective date of withdrawal and with regard to agreements to which the Council is a party and which exist at the time of such notice of withdrawal. Withdrawal by one member agency to this Interlocal Agreement shall not terminate the Agreement as to any other remaining member agencies. Except as provided in Article IX of this Agreement, any member agency that withdraws from this Agreement forfeits any rights it may have to the Council's assets; provided, however, such forfeiture shall not take effect if the Council dissolves within one (1) year of the date of the withdrawal notice.

IX. DISPOSAL OF ASSETS

Upon dissolution of the Council, any Council assets, after payment of all liabilities, costs, expenses, and charges validly incurred under this Agreement, shall be distributed to member agencies which are members of the Council on the date of dissolution. Distribution of assets shall be in proportion to the funding formula for cost allocation as described in the Bylaws, in accordance with Article VI.B. of the Agreement, and existing at the time of dissolution. The debts, liabilities, and obligations of the Council shall not constitute a debt, liability, or obligation of any member agency. If assets cannot reasonably be distributed in proportion to the funding formula, the Council shall declare the assets to be surplus, and shall offer the assets for sale according to the requirements of chapter 43.19 RCW, and shall distribute the proceeds from the sale in proportion to the funding formula established by the Executive Board in accordance with Article VI.B. of this Agreement.

X. LIABILITY AND INSURANCE

A. Any loss or liability to third parties resulting from negligent acts, errors, or omissions of the Council, Member agencies (excluding Associate Members), Ex Officio Members, and/or employees while acting within the scope of their authority under this Agreement shall be borne by the Council exclusively, and the Council shall defend such parties, at its cost, upon request by the member agency, ex officio agency, and/or employee.

B. The Executive Board shall obtain commercial general liability, and auto liability insurance coverage for the Council, Executive Board, and any staff employed by the Council, at levels no less than $1 million single occurrence and $2 million aggregate for each type of liability that is insured. The policy shall name each member agency, and their respective elected officials, officers, agents, and employees as additional insured's. The Executive Board shall annually evaluate the adequacy of the Council's insurance coverage.

C. The Executive Board shall require that all contractors and subcontractors utilized by the Council obtain insurance coverage consistent with Article X.B.

XI. LEGAL REPRESENTATION

The Kitsap County Prosecuting Attorney's Office shall provide day-to-day legal advice and act as legal counsel for the Council and its appointees; provided that in the event a conflict exists between the Council and it appointees and any other client represented by the Prosecutor's Office, then the Bremerton City Attorney's Office shall provide such representation; and provided further that in the event a conflict exists between the Council and its appointees and both a client represented by the Prosecutor's Office and a client represented by the Bremerton City Attorney's Office, then the attorney for the Cities of Bainbridge Island, Port Orchard, or Poulsbo shall provide such representation; and provided further that in the event a conflict exists between the Council and its appointees and a client represented by the Prosecutor's Office, and a client represented by the attorneys of the cities, the Council may retain outside legal counsel in that matter only. Additionally, and regardless of whether a conflict of interest exists as described in the preceding sentence, the Council may retain outside legal counsel concerning any matter the Council deems appropriate. An adjustment in cost allocation to Members will be made if the Council retains outside legal counsel.

XII. ENTIRE AGREEMENT

This Agreement supersedes all previous Kitsap Regional Coordinating Council interlocal agreements and all prior discussions, representations, contracts, and/or agreements between the parties relating to the subject matter of this Agreement and constitutes the entire contract between the parties.

XIII. MODIFICATION

Except as provided by Article XIX, the terms of this Agreement shall not be altered or modified unless agreed to in writing by all member agencies and such writing shall be executed with the same formalities as are required for the execution of this document.

XIV. WAIVER

The failure of any party to insist upon strict performance of any of the terms and conditions of this Agreement shall not be construed to be a waiver or relinquishment of same, but the same shall be and remain in full force and effect.

XV. NOTICE

Except as provided in Article XVIII of this Agreement, any notice required by this Agreement shall be made in writing to the representative(s) identified in Article IV.B. of this Agreement with a copy of such notice provided to the Executive Director. Notice is effective on the third day following deposit with the U.S. Postal Service, regular mail.

XVI. SEVERABILITY

If any of the provisions of this Agreement are held illegal, invalid or unenforceable, the remaining provisions shall remain in full force and effect.

XVII. CHOICE OF LAW AND VENUE

This Agreement shall be governed by the laws of the State of Washington, both as to its interpretation and performance. Any action at law, suit in equity, or other judicial proceeding arising in connection with this Agreement may be instituted and maintained only in a court of competent jurisdiction in Kitsap County, Washington.

XVIII. CLAIMS

A. Any claim for damages made under chapter 4.96 RCW shall be filed with the Chair of the Kitsap Regional Coordinating Council, c/o the Clerk of the Kitsap County Board of Commissioners, 614 Division Street, MS-4, Port Orchard, Washington, 98366.

B. Upon receipt of a claim for damages, or any other claim, a copy of the claim will be provided by the Clerk of the Board to the Executive Director and to each member of the Executive Board.

XIX. EXECUTION AND FILING

A. Counterparts. The parties agree that there shall be multiple original signature pages of this Agreement distributed for signature by the necessary officials of the parties. Upon execution, the executed original signature pages of this Agreement shall be returned to the Clerk of the Kitsap County Board of Commissioners, who shall file an executed original of this Agreement with the Kitsap County Auditor. The Clerk of the Board shall distribute duplicate conformed copies of the Agreement to each of the parties. Parties that sign on as Members at a later date will provide original signature pages of this Agreement to the Clerk of the Kitsap County Board of Commissioners, who shall file the signature pages provided with the Kitsap County Auditor. The Clerk of the Board shall distribute duplicate conformed copies of the signature pages filed later, to each of the parties. Addition of parties at a later date will not constitute a modification under Section XIII of this Agreement.

B. Later Approval and Filing. Later approval and filing of this Agreement by additional parties as set forth in Article IV, Section D, shall be deemed an authorized amendment to the Agreement already on file with the Kitsap County Auditor, without the need for reconsideration and approval by parties that have already approved and executed the Agreement.

XX. EFFECTIVE DATE

This Agreement shall go into effect among and between the parties upon its execution by all of the parties, as evidenced by the signatures and dates affixed below and upon its filing with the County Auditor as provided in Article XIX.

IN WITNESS WHEREOF, this Agreement has been executed by each party on the date set forth below:

Executed this 27th day of September, 2007.

City of Bainbridge Island

Darlene Kordonowy

Darlene Kordonowy, Mayor

Executed this ___ day of ______________, 2007.

City of Bremerton

____
Cary Bozeman, Mayor

Executed this ___ day of ______________, 2007.

City of Port Orchard

____
Kim Abel, Mayor

Executed this ___ day of ______________, 2007.

City of Poulsbo

____
Kathryn H. Quade, Mayor

Executed this ___ day of ______________, 2007.

Port of Bremerton

____
Mary Ann Huntington

XX. EFFECTIVE DATE

This Agreement shall go into effect among and between the parties upon its execution by all of the parties, as evidenced by the signatures and dates affixed below and upon its filing with the County Auditor as provided in Article XIX.

IN WITNESS WHEREOF, this Agreement has been executed by each party on the date set forth below:

Executed this ___ day of _______________, 2007.

City of Bainbridge Island

____
Darlene Kordonowy, Mayor

Executed this ___ day of _______________, 2007.

City of Bremerton

____
Cary Bozeman, Mayor

Executed this 24th day of October, 2007.

City of Port Orchard

Kim E. Abel
Kim Abel, Mayor

Executed this ___ day of _______________, 2007.

City of Poulsbo

____
Kathryn H. Quade, Mayor

Executed this ___ day of _______________, 2007.

Executed this ___ day of _______________, 2007.

City of Bremerton

____

Cary Bozeman, Mayor

Executed this ___ day of _______________, 2007.

City of Port Orchard

____

Kim Abel, Mayor

Executed this ___ day of _______________, 2007.

City of Poulsbo

____

Kathryn H. Quade, Mayor

Executed this 25th day of September, 2007.

Port of Bremerton

Mary Ann Huntington

Mary Ann Huntington

Executed this 8th day of October, 2007.

KITSAP COUNTY BOARD OF COMMISSIONERS

J. W. Brown
JOSH BROWN, Chair

NOT PRESENT
JAN ANGEL, Commissioner

ATTEST:

Opal Robertson
Opal Robertson, Clerk of the Board

Stephen Bauer
STEPHEN BAUER, Commissioner

Approved as to form:

Bainbridge Island City Attorney

Bremerton City Attorney

Port Orchard City Attorney

Poulsbo City Attorney

Port of Bremerton Attorney

Jacquelyn Aufderheide
Deputy Prosecuting Attorney for Kitsap County

Executed this ______ day of ________________, 2007.

KITSAP COUNTY BOARD OF COMMISSIONERS

____
JOSH BROWN, Chair

ATTEST:

____
JAN ANGEL, Commissioner

____
Opal Robertson, Clerk of the Board

____
STEPHEN BAUER, Commissioner

Approved as to form:

____
Bainbridge Island City Attorney

____
Bremerton City Attorney

____
Port Orchard City Attorney

____
Poulsbo City Attorney

____
Port of Bremerton Attorney

____
Deputy Prosecuting Attorney for Kitsap County

R:\Legal\Legal\Contracts\KRCC Proposed Interlocal Agreement(Final).doc

Executed this ______ day of __________________, 2007.

KITSAP COUNTY BOARD OF COMMISSIONERS

____
JOSH BROWN, Chair

ATTEST:

____
JAN ANGEL, Commissioner

____
Opal Robertson, Clerk of the Board

____
STEPHEN BAUER, Commissioner

Approved as to form:

____
Bainbridge Island City Attorney

____
Bremerton City Attorney

____
Port Orchard City Attorney

____
Poulsbo City Attorney

____
Port of Bremerton Attorney

____
Deputy Prosecuting Attorney for Kitsap County

10/10/2007 Final

Adopted by Kitsap County Ordinance 403-2007
November 19, 2007

Port of Bremerton

____
Mary Ann Huntington

Executed this ______ day of __________________, 2007.

KITSAP COUNTY BOARD OF COMMISSIONERS

____
JOSH BROWN, Chair

ATTEST:

____
JAN ANGEL, Commissioner

____
Opal Robertson, Clerk of the Board

____
STEPHEN BAUER, Commissioner

Approved as to form:

____
Bainbridge Island City Attorney

____
Bremerton City Attorney

GA Jorely
____
Port Orchard City Attorney

____
Poulsbo City Attorney

____
Port of Bremerton Attorney

____
Deputy Prosecuting Attorney for Kitsap County

Draft 10/18/2007

Executed this ______ day of ________________, 2007.

KITSAP COUNTY BOARD OF COMMISSIONERS

JOSH BROWN, Chair

ATTEST:

JAN ANGEL, Commissioner

Opal Robertson, Clerk of the Board

STEPHEN BAUER, Commissioner

Approved as to form:

Bainbridge Island City Attorney

Bremerton City Attorney

Port Orchard City Attorney

Poulsbo City Attorney

Port of Bremerton Attorney

Deputy Prosecuting Attorney for Kitsap County

Appendix F: Regional and Kitsap Designated Centers List

Adopted 2004

Regional (Adopted by PSRC)	City of Bremerton	Metro Center
	Silverdale Urban Core	Urban Center
	South Kitsap Industrial Area	Industrial/Employment Center

Jurisdiction	Jurisdiction's (Comp Plan) Designation	KRCC Center Designation
Kitsap County	Kingston	Town or City Center/Transportation Hub
Kitsap County	Southworth	Transportation Hub
Kitsap County	Suquamish	Activity/Employment Center~ Transportation Hub
City of Bremerton	Harrison Employment Center	Activity/Employment Center
City of Bremerton	NW Corporate Campus Employment Center	Activity/Employment Center
City of Bremerton	Port Blakely Employment Center	Activity/Employment Center
City of Bremerton	Upper Wheaton District Center	Mixed Use Center/ Neighborhood
City of Bremerton	Lower Wheaton District Center	Mixed Use Center/ Neighborhood
City of Bremerton	Sylvan/Pine Neighborhood Center	Mixed Use Center/ Neighborhood
City of Bremerton	Perry Avenue Neighborhood Center	Mixed Use Center/ Neighborhood
City of Bremerton	Manette Neighborhood Center	Mixed Use Center/ Neighborhood
City of Bremerton	Charleston Neighborhood Center	Mixed Use Center/ Neighborhood
City of Bremerton	Haddon Neighborhood Center	Mixed Use Center/ Neighborhood
City of Bainbridge Island	Winslow Core	Town or City Center
City of Bainbridge Island	Day Road Light Manufacturing Area	Activity/Employment Center
City of Bainbridge Island	Lynnwood - Neighborhood Service Centers*	Mixed Use Center/ Neighborhood
City of Bainbridge Island	Rolling Bay - Neighborhood Service Centers*	Mixed Use Center/ Neighborhood
City of Bainbridge Island	Island Center - Neighborhood Service Centers*	Mixed Use Center/ Neighborhood
City of Poulsbo	Poulsbo Town Center	Town or City Center
City of Poulsbo	Olhava	Mixed Use Center/ Neighborhood
City of Port Orchard	City of Port Orchard	Town or City Center/ Transportation Hub
City of Port Orchard	Tremont Community Services	Activity/Employment Center
City of Port Orchard	South Kitsap Mall – Mixed Use Center	Mixed Use Center/ Neighborhood
Kitsap Transit	Historic Mosquito Fleet Terminals	Transportation Hub

*- Special Planning Areas

Appendix G:
Centers & Local Areas of More Intensive Rural Development (LAMIRD) Matrix

	Type of Growth	UGA Criteria Apply (per GMA)	Mixed Use: High Density Residential with Jobs	Federal Funding Cycles PSRC- managed Transportation Funding : Centers & Corridors *
Incorporated UGA	**Urban**	**Yes**	Yes	N/A
Unincorporated UGA	Urban	Yes	Yes	N/A
PSRC Centers: • Regional • Industrial/Employment	Urban	Yes	Yes	Regional Competitive & Countywide
Kitsap Regional Coordinating Council Centers				Countywide
Town/City Center	Urban	Yes	Yes	
Mixed Use/ Neighborhood	Urban	Yes	Yes	
Employment/Activity	Urban if in UGA; Rural if outside UGA		Limited if not in UGA	
Transportation Hubs	Urban if in UGA; Rural if outside UGA			
Fully Contained Communities	Urban	Yes	Yes	Countywide if designated as Kitsap Center
Master Planned Resorts	Recreational	**No**	Limited	Rural set-aside **
LAMIRDs	In-fill Consistent with Existing Character	No	Limited to Existing density with no intensification of use	Rural set-aside **
Industrial in Rural	Employment/Activity Resource-based Industrial	No	No	Rural set-aside **
Rural	Non-urban Rural Character	No	No	Rural set-aside **
Resource Lands	No Residential Growth	Limited	No	Rural set-aside **

* Non-motorized/Enhancement Transportation Funding can be used anywhere in Kitsap County.
** 10% each funding cycle, set by federal statute (1991).

Adopted by Kitsap County Ordinance 403-2007
November 19, 2007

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Appendix E

Sanitary Sewer Inflow and Infiltration Preliminary Investigation Report

City of Poulsbo
Sanitary Sewer Inflow and Infiltration
Preliminary Investigation Report

Prepared for

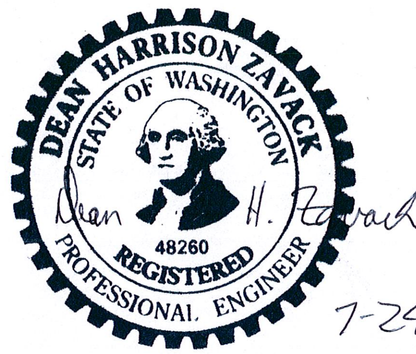
City of Poulsbo
City of Poulsbo
200 NE Moe Street
Poulsbo, Washington 98370

Prepared by

Dean Zavack, P.E.
Senior Utility Engineer
City of Poulsbo
200 NE Moe Street
Poulsbo, WA 98370

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.



7-24-15

Dean Zavack

Prepared by Dean Zavack, P.E.

Checked by Diane Lenius, P.E.

Approved by Andrzej Kasiniak, P.E.

Executive Summary

The City of Poulsbo has an on-going Infiltration and Inflow (I/I) Reduction Program. This program includes continuous monitoring of sewer pump station flow run times, I/I reduction, capital projects, and videotaping and inspection of the gravity sanitary sewer main as needed.

The following I/I sewer projects have already been completed by the city:

1. 6th Avenue I & I Improvement Project (2002)
2. 5th Ave. & Viewmont Sewer Project (2008)
3. Central Poulsbo I & I Improvements Project (2008)
4. Rainstopper™ Sewer Lids installed (2008 – 2015)
5. Sealed Four Sewer Manholes in vicinity of previous overflows and added vent lids per Ecology request to increase conveyance capacity (October, 2013)
6. Installed water level sensor and early warning system in Central Interceptor (April, 2013)

Based on the result of the projects mentioned above the preliminary evaluation inflow and infiltration results for the city do not exceed the EPA guidelines for excessive inflow or excessive infiltration. The 6th Avenue and Marine Science Center sanitary sewer basins, which have recent I/I repair and replacement show the lowest values of I/I per capita in the city. However, the city will pursue projects that will lead to an overall I/I reduction and a reduction of sewer flows out of the city.

The following sanitary sewer upgrade projects are currently under construction, under design, or scheduled for construction by the city:

1. Old Town Side Sewer Repairs (2015 – 2016)- Replace (80 – 100) existing side sewer connections to the sewer trunkline that showed through video inspection: poor fitting alignment, partial blockage, or high potential for failure due to excessive pipe deflection at the fitting.
2. 6th and 9th Avenue Lift Station Upgrades (2015)- New force main pipe, wet well restoration, new telemetry and flow sensors for real time data, which will enable higher level of I/I investigation at these two existing lift stations.
3. Liberty Bay & Viking Lift Station Upgrades (2015 – 2016)- New telemetry and flow sensors for real time data, which will enable higher level of I/I investigation at these two existing lift stations.
4. Brick Sanitary Sewer Manhole Restoration & Relining (2015 -)- Reline and seal existing brick sewer manholes throughout city with specialized chemical resistant cement liner to prevent sewer exfiltration and groundwater infiltration. City purchased new mortar spray equipment.
5. Upgrade Central Interceptor Monitoring Equipment (2015)- Upgrade existing flow meter, high level alarm systems, and telemetry for continuous real-time sewer flow and water level elevation data.
6. 2016 Sewer Comprehensive Plan Update (2015-) Update the 2008 Sewer Comprehensive Plan to include completed I/I projects, sewer lift station monitoring results, and future I/I Capital Projects.

The following sanitary sewer projects I/I projects have been identified in these lift station sanitary sewer basins:

- Applewood Basin- Investigate ongoing high pump run times, which may be related to sewer pump sealing of flange, check valves, or I/I.

- Alasund Basin- Investigate ongoing high pump run times, which may be related to sewer pump sealing of flange, check valves, or I/I.
- Village Basin- Investigate causes of inflow and infiltration using smoke testing & manhole video inspection within the mostly commercial basin.
- Liberty Pump Station- Correct observed tidal inflow as part of 2015 pump station rehabilitation project.

In addition to the I/I projects above (low hanging fruit) the city hired RH2 Engineers to investigate causes and solutions for areas with high I/I in the city and to identify future city capital I/I projects. The city will continue to evaluate individual sewer lift station basins using real time telemetry and hourly pump run time monitoring with data loggers and identify needed improvements to reduce inflow and infiltration into the sanitary sewer.

Summary of I/I Calculations and Methodology

Existing City Lift Station System

The existing city basin & lift station routing is shown in schematic form in Figure 1 below. Some of the basins are pumped to other basins, which pump to the gravity interceptor on SR 305. All city sewer flows leave the city through the Johnson Rd. Metering Station, then flows to the Lemolo Siphon to Kitsap County pump stations in Keyport, which pump to the Kitsap County Treatment Facility near Brownsville. The lift stations and corresponding basins are shown in Figure 2-Sewer Lift Station Basin Map.

Figure 1- Schematic Map of Sewer Lift Station Routing

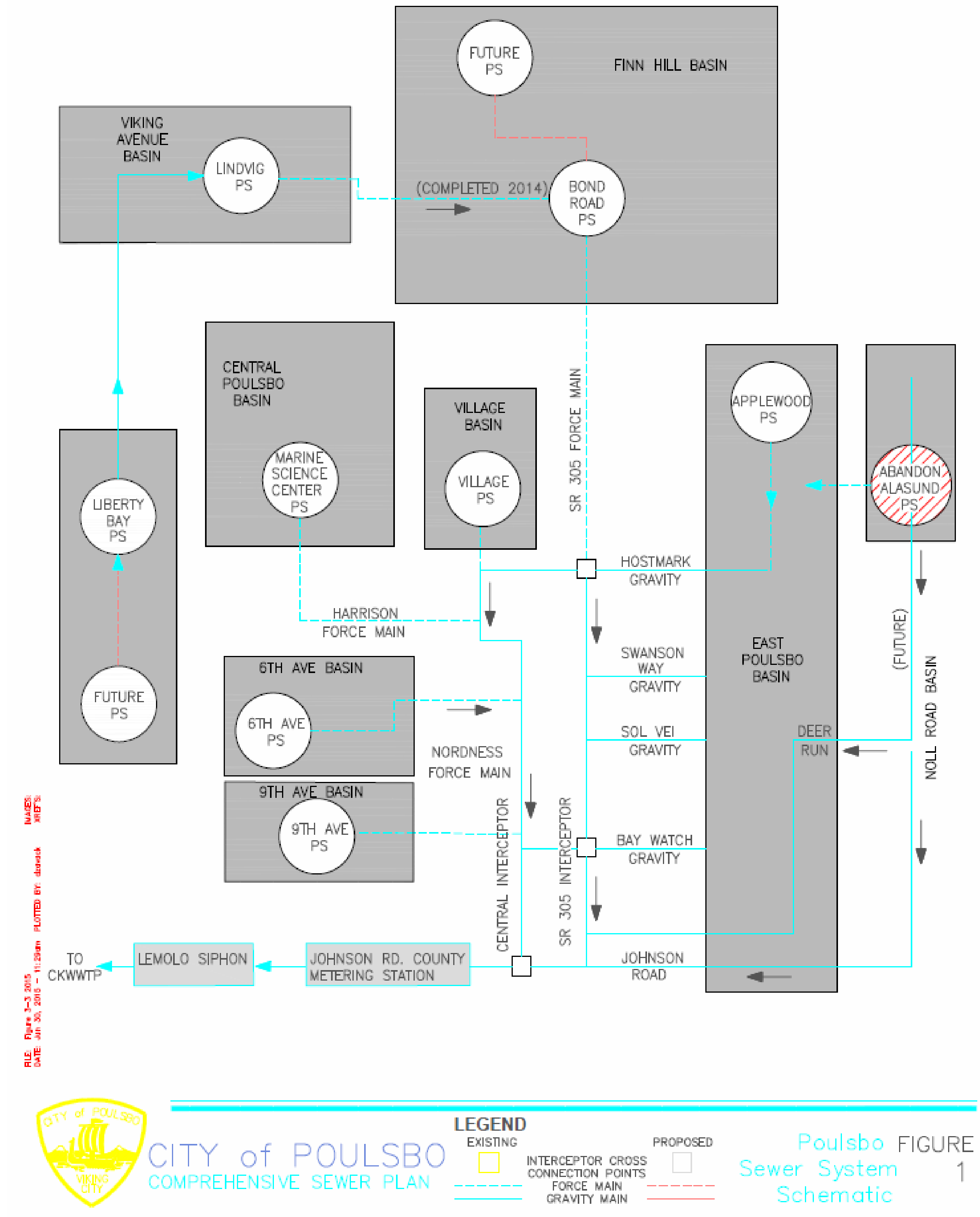
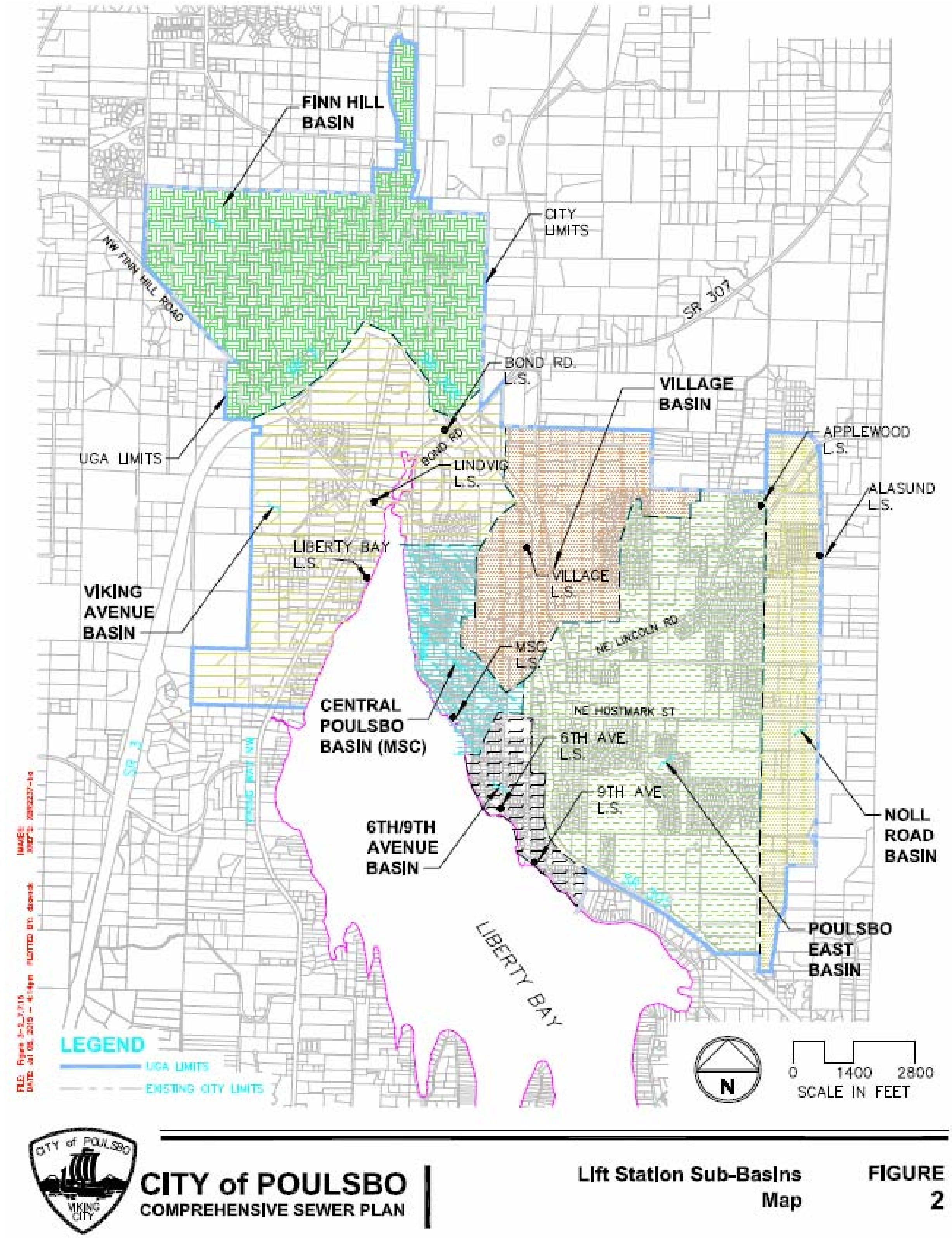


Figure 2- Sewer Lift Station Basin Map



I/I Study Background & Progress:

The city currently monitors daily sanitary sewer lift station pump run time for each pump in the city's nine sewer lift stations. The data collection is done in the field daily, by manually recording the pump time on the hours meter on each pump and comparing it to the previous day's reading. The pump station 24-hour run time data for all nine lift stations is then recorded in a master lift station monitoring spreadsheet (MLSM), see example below. The city also monitors precipitation daily at the Public Works Facility (PWF) using a rain gauge.

9th Ave. Lift Station Pump Runtime Data

H4397

1	Date	Time	AM PM	Pump hours #1	Pump hours #2	Elapsed Pump 1(hr)	Elapsed Pump 2 (hr)	Remarks/Maintenance Performed	High	Low	P2 High	P2 Low	Precip
4388	1/4/2015	7:55	AM	7863.2	6168.2	1.4	1.4			-0.2			0.01
4389	1/5/2015	8:20	AM	7864.6	6169.6	1.3	1.3						0.36
4390	1/6/2015	8:15	AM	7865.9	6170.9	1.1	1.2						0.03
4391	1/7/2015	8:05	AM	7867.0	6172.1	1.1	1.3						0.01
4392	1/8/2015	8:40	AM	7868.1	6173.4	1.0	1.1						0.00
4393	1/9/2015	8:20	AM	7869.1	6174.5	0.9	1.0						0.00
4394	1/10/2015	6:40	AM	7870.0	6175.5	1.1	1.2						0.02
4395	1/11/2015	6:40	AM	7871.1	6176.7	1.2	1.3						0.05
4396	1/12/2015	8:20	AM	7872.3	6178.0	1.0	1.1						0.08
4397	1/13/2015	8:15	AM	7873.3	6179.1	1.1	1.0						0.01
4398	1/14/2015	8:20	AM	7874.4	6180.1	1.0	0.9						0.00
4399	1/15/2015	9:10	AM	7875.4	6181.0	1.1	0.9						0.00
4400	1/16/2015	8:10	AM	7876.5	6181.9	1.2	1.1						0.96
4401	1/17/2015	8:10	AM	7877.7	6183.0	1.5	1.8						0.02
4402	1/18/2015	7:10	AM	7879.2	6184.8	1.7	1.9				0.4		1.21
4403	1/19/2015	8:30	AM	7880.9	6186.7	1.4	1.7		0.05		0.5		0.03
4404	1/20/2015	8:25	AM	7882.3	6188.4	1.3	1.5				0.3		0.00
4405	1/21/2015	8:10	AM	7883.6	6189.9	1.2	1.4				0.1		0.01
4406	1/22/2015	8:30	AM	7884.8	6191.3	1.2	1.3						0.04
4407	1/23/2015	8:10	AM	7886.0	6192.6	1.1	1.2						0.02
4408	1/24/2015	8:10	AM	7887.1	6193.8	1.4	1.4						0.01
4409	1/25/2015	8:05	AM	7888.5	6195.2	1.2	1.4						0.00
4410	1/26/2015	8:20	AM	7889.7	6196.6	1.1	1.2						0.01
4411	1/27/2015	8:10	AM	7890.8	6197.8	1.1	1.2						0.01
4412	1/28/2015	8:05	AM	7891.9	6199.0	1.1	1.3						0.08
4413	1/29/2015	9:00	AM	7893.0	6200.3								0.01
4414	1/30/2015												0.00
4415	1/31/2015												0.00

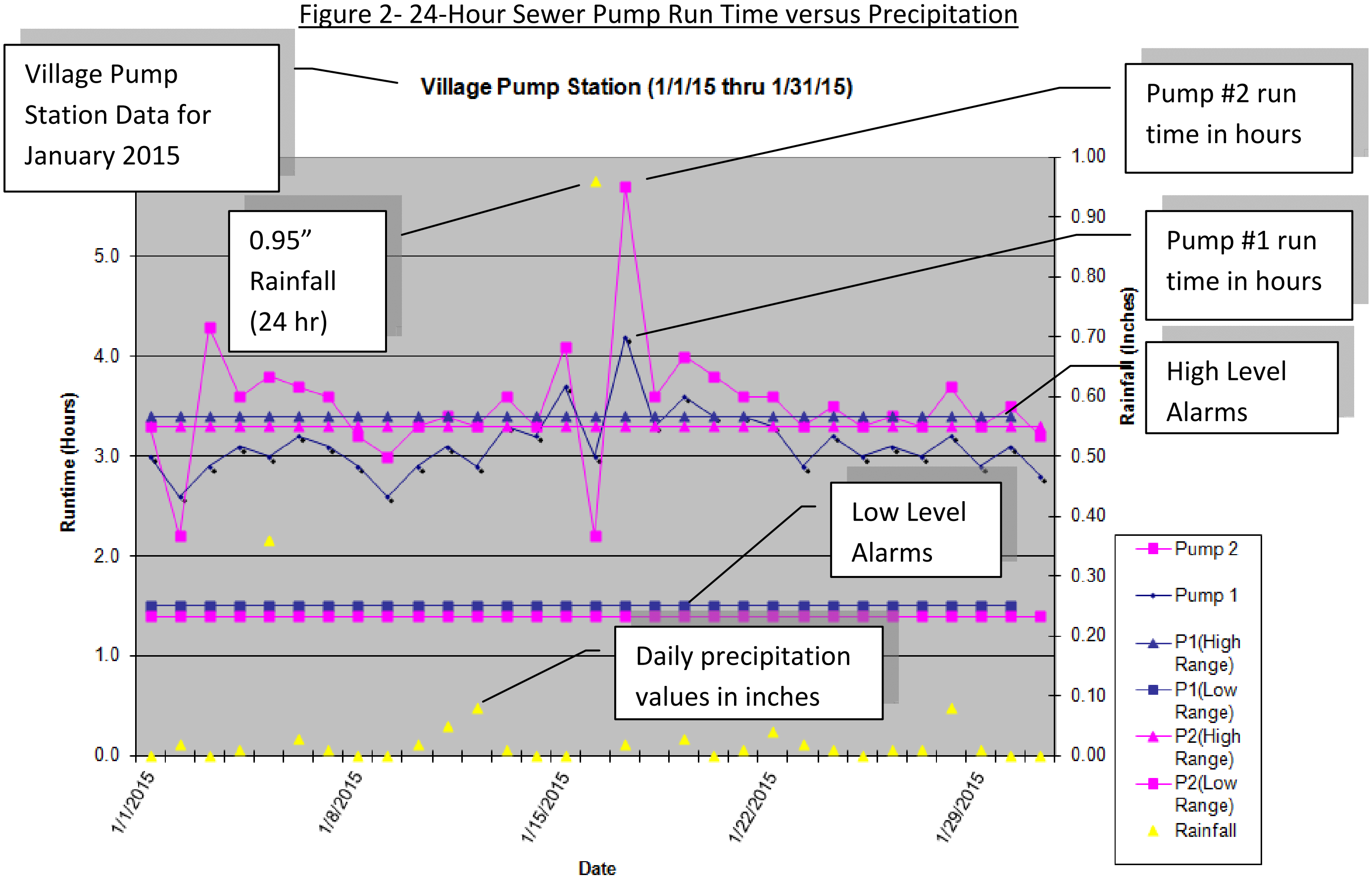
Pump #2 daily reading total hours

24-hr pump run time reading in hours

24-hr precipitation recorded in inches from PWF

The MLSM is used to monitor pump performance for maintenance and replacement and as a tool for infiltration and inflow analysis (I/I). The pump run time data from all nine lift stations is stored into the master lift station spread sheet. The spread sheet also plots the pump run time data (hours) and precipitation (inches) each day for each pump station in a graph. The city has also been continuously monitoring the Johnson Rd. metering station sewer flow data (minute intervals) since 2005. See lift station pump run time versus precipitation example in Figure 2 below:

Figure 2- 24-Hour Sewer Pump Run Time versus Precipitation



Viewing the pump run time data and graphs, it is easy to see how each lift station pump run time is effected by precipitation after it rains or how daily pump run time is consistently higher during the wet season than the dry season even with periods of no precipitation. Each of the nine city lift station graphs show a different degree of I/I, with some basins having more obvious stormwater inflow spikes than other basins. All basins show some significant degree of infiltration during the wet season.

The Johnson Rd. Metering Station monitors the sewer flow out of the city and records instantaneous flow readings every minute for 24 hours a day. The Johnson Rd. metering station measures the city sewer flow prior to discharge to the Lemolo Siphon accounts for 100% of the city's sewer flows to the Kitsap County Sewer Treatment Facility. The sewer flow data is kept in a HOBO data logger and downloaded every few weeks. This gives the city an accurate way to monitor and plot total sewer flow and calculate total sewer volume 24 hours a day. Kitsap County has its own flow monitoring equipment at the measuring station that plots the total sewer flow through the lift station from the City of Poulsbo. This information is used by Kitsap County for monthly billing the City of Poulsbo based on total mega gallons of sewage per month.

The city had a significant sewage overflow out of some of the gravity sewer manholes on the gravity main line to the Johnson Rd. metering station after a peak 24-hour rainfall event of 3.5" on Nov 19,

2012. The peak flow capacity of the existing Lemolo Siphon system is around 3 to 3.2 mega gallons per day (MGD) before a sewer overflow occurs further up the gravity sewer line. The flow monitoring equipment in Johnson Rd. only can monitor flow rates up to 2.5 MGD (1,735 gpm), so only the duration of the pump exceedence over 1,735 gpm can be monitored, not the peak flow. Since the majority of peak sewer flows during very large precipitation events is stormwater, the city is working on reducing inflow and infiltration into the sanitary sewer to prevent further sewer overflow discharges.

Without significant I/I reductions, it is estimated that the city will reach capacity of the existing sewer conveyance system by 2025 and would have increasing numbers of overflow events during large rainstorms as the conveyance system reaches its normal peaking capacity. Using Kitsap County Precipitation Maps (KSCWDM, 2005) for the last spill event, it is estimated that the Nov, 2012 spill occurred on a 5-year 24-hr Storm event that was preceded by smaller storms. Without further I/I reductions, it can be assumed that future storm events of less than 5-year 24-hr duration could trigger sewer spills, as the sewer total volume increases due to the projected population increase.

Determining if Existing I/I is Excessive

The USEPA guide for determining if a complete I/I analysis is required for a sanitary sewer system is 120 gallons per day per person for dry weather flow and 275 gallons per person per day for storm events. Averages that exceed these amounts are considered “excessive” by the I/I Analysis and Projection Certification, Ecology Publication No. 97-03. To determine if the City of Poulsbo has “excessive” infiltration or inflow the dry weather flows and storm event flows were calculated for the city using the sewer flows per capita per day for a comparison to the USEPA guidelines.

Methodology Used for Finding Problem I/I Basins

The following methodology and calculations were used in this analysis:

1. Define Lift Station Basins by Lift Station location, and sewer conveyance routing. The *2008 Comprehensive Sewer Plan 2008 Update* (Parametrix, 2008) was used for defining the lift station basin maps. Divide city into ten individual basins for the nine lift stations. The tenth sewer basin is a gravity only basin. The Johnson Rd. metering station is not used in the I/I basin analysis since it is a combination of all the flow from the other 9 lift stations and the gravity basins. The Johnson Metering Station is a good measuring indicator of city wide inflow during precipitation events. The lift station basin and flow path schematic is shown in Figure 1, some lift station basins flow to other basins but the basin can be monitored independently by subtracting the flows from the upstream lift station.

2. Define a method to compare lift station pump run time to lift station sewer basin flows. Estimate which basins have higher sewer flows caused by inflow and infiltration based on the recorded data in the master lift station spread sheet. It was decided that each individual lift station basins would compare gallons of sewer flow per capita per day (GPCD) to check which

individual lift station basins were higher in GPCD and had probable I/I. This would be calculated after high rainfall peak events, averaging the pump run time during the wet season, and during periods in the wet season with no rain.

3. Define a Method for Converting Commercial Use to Residential Use. Since some of the lift station basins have high amounts of commercial property and high density housing, compared to other basins in the city, it was decided to estimate the commercial property and high density housing areas as units of residential low density housing or Equivalent Resident Units (ERUs). Commercial, Medium, and High Density areas would be listed in units of residential single family housing or equivalent residential units (ERUs). Each lift station basin would total up the total number of ERUs. This should enable a more "apples to apples" comparison between basins for determining which basins have higher inflow and infiltration than other basins.

4. Calculating ERUs for the Commercial, Medium, and High Density lots. The goal is to calculate each basin sewer flows individually in gallons per capita per day and then compare between basins to see where I/I work should be prioritized. A conversion was used to estimate the ERUs for commercial property based on the water supply line size only. The Medium, High Density and Commercial properties in all the basins were converted to ERUs to calculate ERU sewer flows per capita per day in gallons or Gallons Per Capita per Day (GPCD), for an even comparison between basins.

The following conversion tables were used to determine equivalent ERUs based on the city's code and standard dislocation of ERUs by water meter size. The equivalent per capita water usage conversion factor was based on city standard water billing rates from historical water usage of residential, commercial, and medium to high density properties within the city based on meter size:

Table 1- Calculated Equivalent ERUs and Equivalent Population by Water Service Size

Water Service Size	Equivalent ERUs per water service	Equivalent Per Capita for the water service
5/8" by ¾"	1	2.15
1"	2.5	5.38
1-1/2"	5	10.75
2"	8	17.2
3"	16	34.4
4"	25	53.75

An additional ERU adjustment factor was used for multi-family housing and hotels/motels, see Table 2 below.

Table 2- ERU Adjustment Factors For Water Usage

Unit	Usage Adjustment Factor
Motel/Hotel	0.70
Duplex/Tri-Plex	0.85
Apartments 5 or more units	0.80
All Other Commercial Use	1.0

To calculate equivalent ERUs for commercial property for usage, the equivalent per capita from the meter size is multiplied by the adjustment factor to calculate the ERU for the parcel. All the ERUs from the parcels are added together within the lift station basin.

5. Count total Equivalent ERUs per basin using GIS mapping and Lift Station Basin maps. Using city GIS mapping, the lift station sewer map basin was added to the GIS map and each water service size was added to each lot in the GIS map in a map layer. Another map layer was created showing the Equivalent ERUs per lot. The Equivalent ERUs were counted up in each lift station basin using GIS, see example in Appendix _.
6. Calculate ERUs per each lift station basin based on above methodology. The following ERUs/Basin were calculated and summarized in Table 3 below:

Table 3- Equivalent ERUs per Basin

Lift Station Basin	ERUs	Equivalent ERUs
Liberty Bay	168	183
Lindvig	746	863
Marine Science Center	630	831
Sixth Ave.	295	320
Johnson Rd. Metering Station	Same as Total	Same as Total
9th Ave.	72	74
Alasund Meadows	92	92
Applewood	46	46
Village	292	460
Bond Rd.	429	1236
East Basin Gravity	1354	1533
	Total Equivalent ERUs	4541
	City Population (2014)	9,775
	Equivalent Per Capita/ERUs	**2.15**

7. Calculate the per capita for ERU for each lift station basin. From the city total ERUs, these can be converted to per capita, knowing the city population and total ERUs the ratio of per capita per ERUs can be calculated for the city. The ratio of Equivalent ERUs per capita for the city is listed in Table 3 above.
8. Define the duration of the wet season by looking at previous precipitation and flow data in the master lift station monitoring spread sheet through various years. The Wet Season was defined

from October 15 to April 15 for this I/I analysis as this is the period where the majority of the stormwater falls in Poulsbo and groundwater is also the highest.

9. Calculate lift station wet season Average Dry Flows (ADF) by using data logging for the wet season to calculate an average wet season pump run time per each lift station when there was an extended period with no rain. Using the known pumping rate the sewer flows can be calculated for the ADF for each lift station. Per the *Guide for Estimating Infiltration and Inflow* (EPA, 2014), the minimum time duration with no precipitation used for the ADF is 7 days during the wet season. The average pump time was calculated during the ADF period and used to calculate the ADF from the known lift station pump rates. The ADF is a good indicator for calculating and comparing the average infiltration rates into the sanitary sewer system (EPA, 2014).
10. Calculate the Average Wet Season Flows (AWS) by looking at the averaged pump readings during the wet season each year. The AWS gives us a method to check and compare the average I/I to the sewer systems between lift station basins on a year to year basis. This allows us to monitor the flow reduction performance of completed I/I projects, and to prioritize future I/I projects. The AWS includes both Inflow and Infiltration.
11. Calculate the City Water Usage per Basin and compare to the average sewer flows from the basins. The average water usage was compared between basins during the wet season. The water usage was compared to the sewer flows calculated using gallons per capita per day.
12. Present data results per basin in units of gallons per capita per day for evaluation of where the I/I is highest in the city. Here are some results of the AWS data collected so far:

Table 4- Average Wet Season Flows

Average Wet Season dates: 10/15 thru 4/15 (2011-2014)

Total Flows Gallons per Capita per Day (GPCD) for Wet Season (2011-2014)

WET SEASON PRECIP (IN.)	YEAR	LIBERTY BAY	LINDVIG	MSC	6th Ave.	9th Ave.	Alasund	Apple-wood	Village	Bond Rd.
29.54	**2011**	69.91	73.76	37.61	62.4	75.1	83.8	151.2	114.7	76.0
43.4	**2012**	77.61	75.68	43.91	63.3	93.7	113.5	177.3	132.6	75.9
13.2	**2013**	70.52	65.84	36.62	41.7	67.4	95.6	176.7	117.2	69.9
28.5	**2014**	75.23	65.82	44.22	54.3	79.3	122.3	155.4	138.3	75.6

As shown above, some sewer lift station basins have had significantly higher sewer flow per capita than other basins during the wet season. The GPCD can be compared for the last four years in the Wet Season where the precipitations per Wet Season have varied significantly. As expected, years with lower wet season precipitation generally showed less GPCD for each basin. Basins that showed the highest GPCD probably have the highest amount of infiltration and inflow. Basins that show the highest GPCD and also have the highest number of ERUs should be prioritized for I/I reduction. The average wet season dry flows are shown in Table 5 below:

Table 5- Average Wet Season Dry Flows (ADF)[1]

Average Wet Season dates: 10/15 thru 4/15 (2011-2014)

Total Flows Gallons per Capita per Day (GPCD) for Wet Season Ave. Dry Flows ADF for (2011-2014)

YEAR	WET SEASON PRECIP (IN.)	LIBERTY BAY	LINDVIG	MSC	6TH AVE.	MSC	6th Ave.	9th Ave.	Alasund	Apple-wood	Village	Bond Rd.
2008	20.8	58.6	70.6	29.5	35.4	29.5	35.4	122.7	58.1	173.0	106.0	56.1
2009	31.4	68.8	72.2	35.8	46.3	35.8	46.3	194.9	61.7	142.4	119.7	69.9
2010	38.4	58.6	68.7	37.3	42.4	37.3	42.4	159.7	58.1	176.1	116.5	65.7
2011	29.5	60.1	60.3	32.8	47.2	32.8	47.2	47.2	75.1	91.9	104.4	65.2
2012	43.4	59.7	66.1	35.7	47.7	35.7	47.7	67.0	70.5	128.6	111.7	66.3
2013	13.2	77.0	72.2	36.9	46.4	36.9	46.4	82.1	107.4	225.1	117.7	74.5
2014	28.5	75.0	43.3	33.8	44.6	33.8	44.6	69.8	110.6	83.4	128.6	77.7

1. Average Dry Flows calculated using a min. duration of 7 days with no precipitation during the Wet Season (Oct 15 to April 15)

The ADF are a good indicator of infiltration into the sanitary sewer system during the wet season since these sewer flows are during periods of high groundwater but with no precipitation. As shown in Table 5 above, some lift station basins have been reducing their ADF since 2008, and some have been increasing their ADF and these basins warrant some infiltration investigation. Large fluctuations in the ADF in a basin from high values to low values on a year to year basis are most likely a result of pump performance or malfunctioning equipment that needs replacement from age. For example, the pumps in 9th Ave. LS were replaced in Dec of 2010 after showing a steady increase in daily pump run time. Alasund and Applewood have removable Hydro-Dynamic™ Pump platforms which have been known to have sealing problems between the removable pump body and connecting pipe connections, resulting in pumped leakage back to the wet well and increased pump run times. Increased pump run times can also be a result of intermittent check valves that allow drain back of the sewer in the force main back into the wet well between pump ON cycles.

Results from Preliminary I/I Data

The results from the preliminary analysis show a significant amount of inflow and infiltration but only the Viking Village Basin exceeded the USEPA guideline for excessive infiltration of ADF of over 120 gallons per day per person. When pump run time was checked for yearly storm maximums, there were no basins that exceeded the 275 gallons per person per day threshold for peak inflow storm events.

Sanitary Sewer Basins with the Highest Amount of Infiltration

These basins were found to have the highest degree of infiltration, based on evaluation of the wet season average dry flows (ADF), see Table 6 below. The city recently completed an I/I project in the MSC and 6th Ave. Basins, where they used pipe bursting methods to replace a lot of the existing aging sanitary sewer mains and side sewers in the downtown corridor. The effectiveness in the repairs are evident in the collected data results, where the MSC and 6th Ave. Basin consistently shows the lowest sanitary sewer infiltration flows per day per capita.

Ranked in order of highest to lowest based on gallons of sewer flow per day per capita (GPCD) for 2014

Table 6- Basins with the Highest Infiltration Based on Average Dry Flows

Rank	Basin	ADF in (gpcd)
1	Village Basin	128.6
2	Alasund Basin	110.6
3	Applewood Basin	83.4
4	Bond Road Basin	77.7
5	Liberty Bay Basin	75.0
6	9th Ave. Basin	69.8
7	6th Ave. Basin	44.6
8	Lindvig Basin	43.3
9	Marine Science Center Basin	33.8

Sanitary Sewer Basins Which Show the Highest Amount of Stormwater Inflow

These basins were determined to have the highest amount of inflow based on Average Wet Season flows. Although the AWS include the infiltration flows, the high degree of inflow is very evident when viewing the monthly sewer pump run time graphs during precipitation, see Figure 2 for example.

Table 7- Highest Stormwater Inflow Basins Based on 2014 Average Wet Season Flows (AWS)[1]

Rank	Basin	AWS in (gcpd)
1	Applewood Basin	155.4
2	Village Basin	138.3
3	Alasund Basin	122.3
4	9th Ave. Basin	79.3
5	Bond Rd. Basin	75.6
6	Liberty Bay Basin	75.2
7	Lindvig Basin	65.8
8	6th Ave. Basin	54.3
9	MSC Basin	44.2

1 AWS Includes ground water infiltration flows (GWI)

Observed Progress From Completed I/I Projects

The basins which have had recent I/I projects are located in the oldest parts of the city:

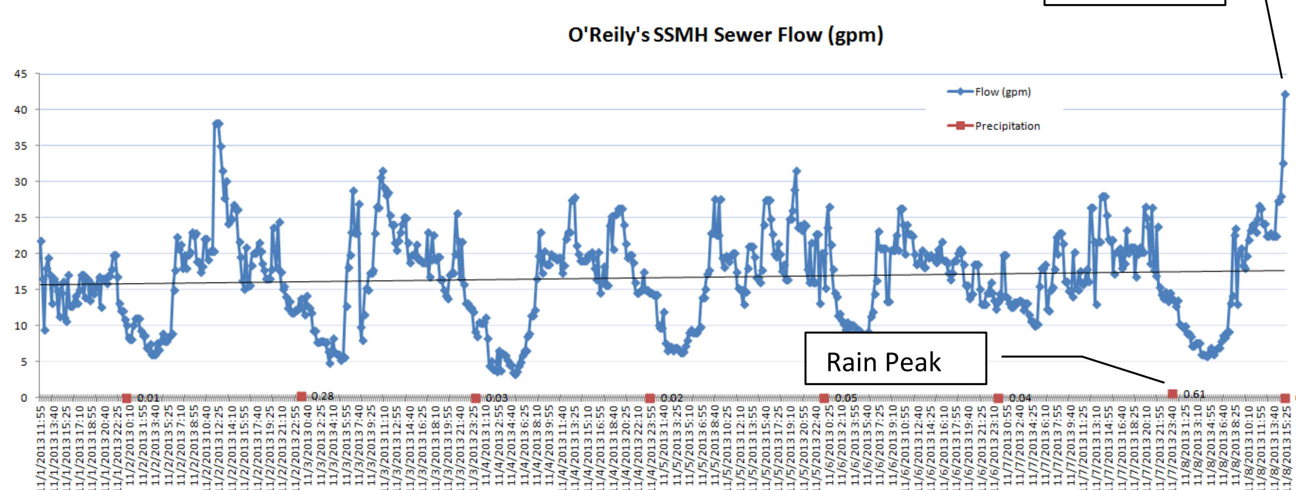
1. 6th Avenue I & I Improvement Project (2002) → 6th Ave. Basin
2. 5th Ave. & Viewmont Sewer Project (2008) → MSC Basin
3. Central Poulsbo I & I Improvements Project (2008) → MSC Basin

These two basins show significant lower values of sewer flow per capita during the Wet Season compared to the other basins, see Tables 5, 6, and 7. It has been shown that these projects which required replacement of the trunk lines, manholes, and side sewers had a profound impact on making these basins have the lowest amount of sewer flows per capita in the city. While this level of infrastructure repair and replacement is the best method of minimizing I/I, it is not cost effective or feasible to replace the entire sewer infrastructure in the other basins of the city. Only a portion of the existing sewer infrastructure in the other basins is significantly contributing to the I/I. Investigation is required to find the existing structures, connections, and conveyance that contribute the highest level of I/I and repair these problem areas.

Results from an Individual Sanitary Sewer Manhole Flow Monitoring in the Village Basin

In November 1-8 of 2013, sewer flow monitoring equipment was placed into a single SSMH in the Viking Village Basin check for possible inflow or infiltration. The flow equipment recorded flow readings every 15 minutes for a period of eight days where there were several precipitation events. The results are shown below in Figure 2.

Figure 2- SSMH Flow Monitoring Data in Viking Village



The sewer flow data above shows normal day and night fluctuations in sewer flows and also significant spikes in sewer flow rate directly after rainfall. Using real time precipitation data from a local weather station http://www.wunderground.com/personal-weather-station/dashboard?ID=KWAPOULS6#history, the sewer peak flows were found to occur within 15 minutes of any measured high intensity precipitation peaks. The sewer peak flows are very close aligned with the rainfall peaks. The most probably cause of this is a direct connection from a storm sewer conveyance pipe which drains stormwater from an impervious surface area to the sanitary sewer via an illicit sewer connection. It can be assumed that there are other numerous inflow points within the Viking Basin due to the total volume of sewer that increases during large precipitation events.

The Applewood & Alasund Pump Stations were field investigated based on abnormally high pump run times found in the results of this study, which showed that the Applewood & Alasund Pump Stations appear to have inflow or pump issues. In March of 2015 the city reviewed the flow into each of the pump stations in a period without precipitation and observed the following:

- Applewood P.S.- Steady clear flow from one of the inlet pipes indicating the potential for substantial infiltration of ground water on that sewer pipe.
- Alasund P.S.- Steady, clear flow on trunkline with occasional standard sewer discharge fluctuation indicating the potential for substantial infiltration of ground water into sewer main.

CH2 Engineers reviewed the Applewood and Alasund lift station pump specifications and recommended that the Hydro-Dynamic™ Pumps used in these two lift stations be modified to reduce leakage. These Hydro-Dynamic™ series pumps are mounted on a movable sled that allows removal of the pump only for O&M. These pumps are known to have poor sealing after removal and replacement due to poor realignment with the seals and fittings resulting in pressure leakages. It is recommended that the pumps to be strapped to the frame after each pump removal and replacement with hardware to prevent pump leakages during use.

Accuracy of I/I Analysis

The previous I/I analysis is conservative and may not be completely accurate due to the following:

- Conversion of commercial property to equivalent ERUs is based on the current city billing method of allocation of ERU's for billing of water usage and is approximate for calculating sewer flows. Some of the existing commercial property may not be using the water usage proportional to existing water main size on the property and may not be generating the predicted sewer flows. The installed water main may have been originally provided for a different owner and business type, than what is currently on the property. The commercial property water usage may be tied to irrigation or other process, in which the used water does not enter the sanitary sewer. However; the comparison to population used to generate sewer flow per capita is based on the actual population for the city of Poulsbo. Therefore the estimate per capita is conservative.
- Pump run time in a lift station increases over time as pump efficiency is reduced by wear of parts, corrosion, plugging of intakes, or increases in head of the force main over time between cleaning. Pump flow rate is also not constant and is dependent on head and water surface elevation, which varies depending on the amount of flow into the wet well and water surface elevation. This leads to inaccuracies in estimating the amount of gallons of sewer per day based on the pump run time alone. There are numerous examples in the data collected, where lift station pump #1 run time is much higher than the other alternating pump #2 in the same well, until pump usage becomes noticeably high and the pump with the much greater run duration is then repaired or replaced. Grease and sediments can seriously affect the pump flow and run time between scheduled maintenance. This is evident by comparing the pump run time between two pumps in the same lift station. Some pumps show consistent longer pump run time than the other pumps some days, then significantly lower than the other pump on other days. We believe this is due to sediments and

grease creating blockages in the intakes. Since these pumps alternate, the average run time of each pump per day should be similar when viewed over a long period of time. However; the increased pump run time would result in conservatively over estimating sewer flow, therefore the method is reasonable.

To increase the accuracy of predicted sewer pumped volume with this method, hourly pump run time should be logged, as well as monitoring and logging the depth of the water in the wet well using pressure transducer. With this added data, the amount of sewer flow pumped on a day to day basis in the lift stations can be more accurately calculated and compared to hourly rainfall from weather stations. This will enable to differentiate between high pump run times due to needed maintenance or high pump run times due to rainfall.

- Existing analysis does not compare sewer GPCD to lengths of sewer pipes in the basins. Comparing GPCD versus length of pipe (and diameter) may give different results when comparing GPCD between basins. Comparing large basins to small basins is not an "apples to apples" comparison since the large basins have considerably more possible points of entry in the sewer conveyance system for stormwater and infiltration. Since the city is looking simple projects to prevent I/I, the city needs to find basins where areas high in I/I are localized, easy to find, and easy to fix.

Conclusion

As shown from the collected data and analysis above, the City of Poulsbo has significant I/I into the sanitary sewer system, but only the Viking Village Basin is considered "excessive" by the standards of the USEPA for I/I. The existing sewer system reaches capacity during only a 5-year storm event due to the amount of stormwater inflow occurring. Reductions in stormwater inflow and sewer infiltration needs to be accomplished in key areas or the capacity of the Lemolo Siphon will need to be increased to handle the future sanitary sewer flows for the City of Poulsbo and prevent sanitary sewer overflows during significant precipitation events. Further analysis of data and field data collecting will be required to find specific I/I projects.

References:

City of Poulsbo, *2016 Comprehensive Plan Update- Draft,* Table Appendix A-1.1 Annual Population 1994-2015, July 2015.

Kitsap County Department of Public Works. Kitsap County Stormwater Design Manual- *Figures 5-1 through 5-6*, April 1997.

U.S. EPA-Office of Municipal Pollution Control- *Infiltration/Inflow- I/I Analysis and Project Certification*, Ecology Publication No. 97-03, May 1985.

U.S. EPA-Water Infrastructure Outreach, *Guide for Estimating Infiltration and Inflow*, June 2014.

Parametrix, Comprehensive *Sanitary Sewer Plan 2008 Update*, February 2008.

Central Market Poulsbo Weather Station KWAPOULS6, http://www.wunderground.com/personal-weather-station/dashboard?ID=KWAPOULS6#history.

Attachments

1. CIP: Annual Inflow Reduction Program
2. City of Poulsbo Population Estimates Per Year
3. Lift Station December 2014 Pump Run Time Graphs After Significant Precipitation Example
4. Equivalent ERUs Per Sewer Basin
5. Existing Lift Station Pump Capacities and Pump Data
6. Average Dry Flows Spreadsheet By Year
7. Average Wet Season Flows Spreadsheet by Year

$58K
Annual Inflow
$89K
I&I Eff.

Project Name: **Annual Inflow Reduction Program**

Project Description

Budget: $ 665,000 **Purpose:** Sewer

Location: City Wide **Project Manager:** Andrzej Kasiniak, P.E.

Description: The City will implement an annual inflow reduction program consisting of identifying and repairing inflow sources. Example: Installation of an I&I prevention devices such as manhole inserts, replacement of leaking pipes and replacement of manholes.

Justification: Flow monitoring data shows that the existing sewer system experiences high level of inflow during storm events.

Start Date: 2011 **Completion Date:** 2020

Capital Funding

Sources of Funding

			Six-Year Plan						
		Prior Years	2015	2016	2017	2018	2019	2020	Total
1	Federal Grants								-
2	State Grants								-
3	County								-
4	PWTF								-
5	Voted Bonds								-
7	City/Utility Reserves	45,000	20,000	200,000		200,000		200,000	665,000
	Total	45,000	20,000	200,000	-	200,000	-	200,000	665,000

Capital Costs

		Six-Year Plan						
	Prior Years	2015	2016	2017	2018	2019	2020	Total Costs
Planning & Design			20,000		20,000		20,000	60,000
Land/ Right of Way								-
Construction	45,000	20,000	180,000		180,000		180,000	605,000
Management								-
Total	45,000	20,000	200,000	-	200,000	-	200,000	665,000

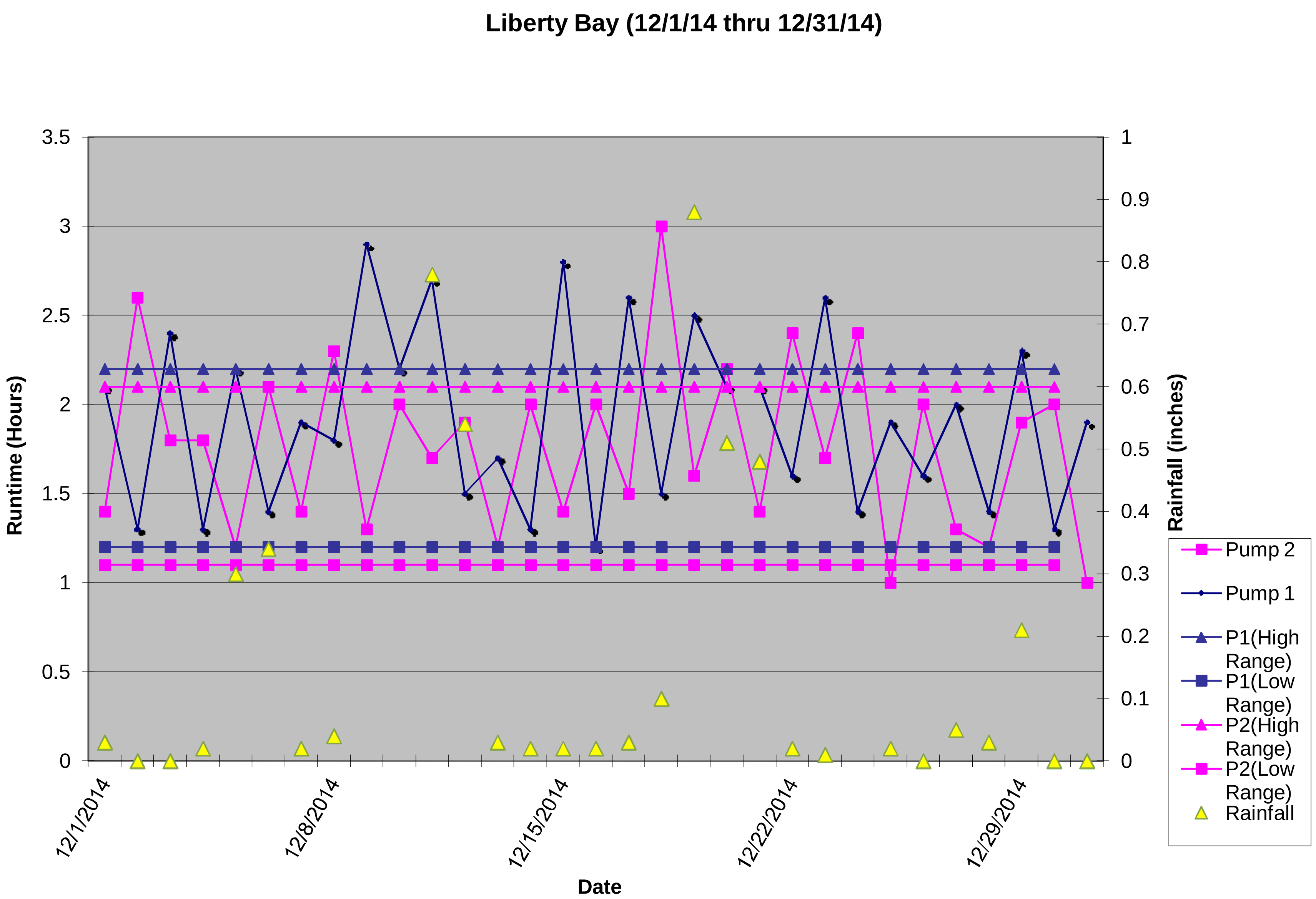
Estimated Impact on Future Operating Budgets

Notes: There will be no additional impact on future operating budgets.

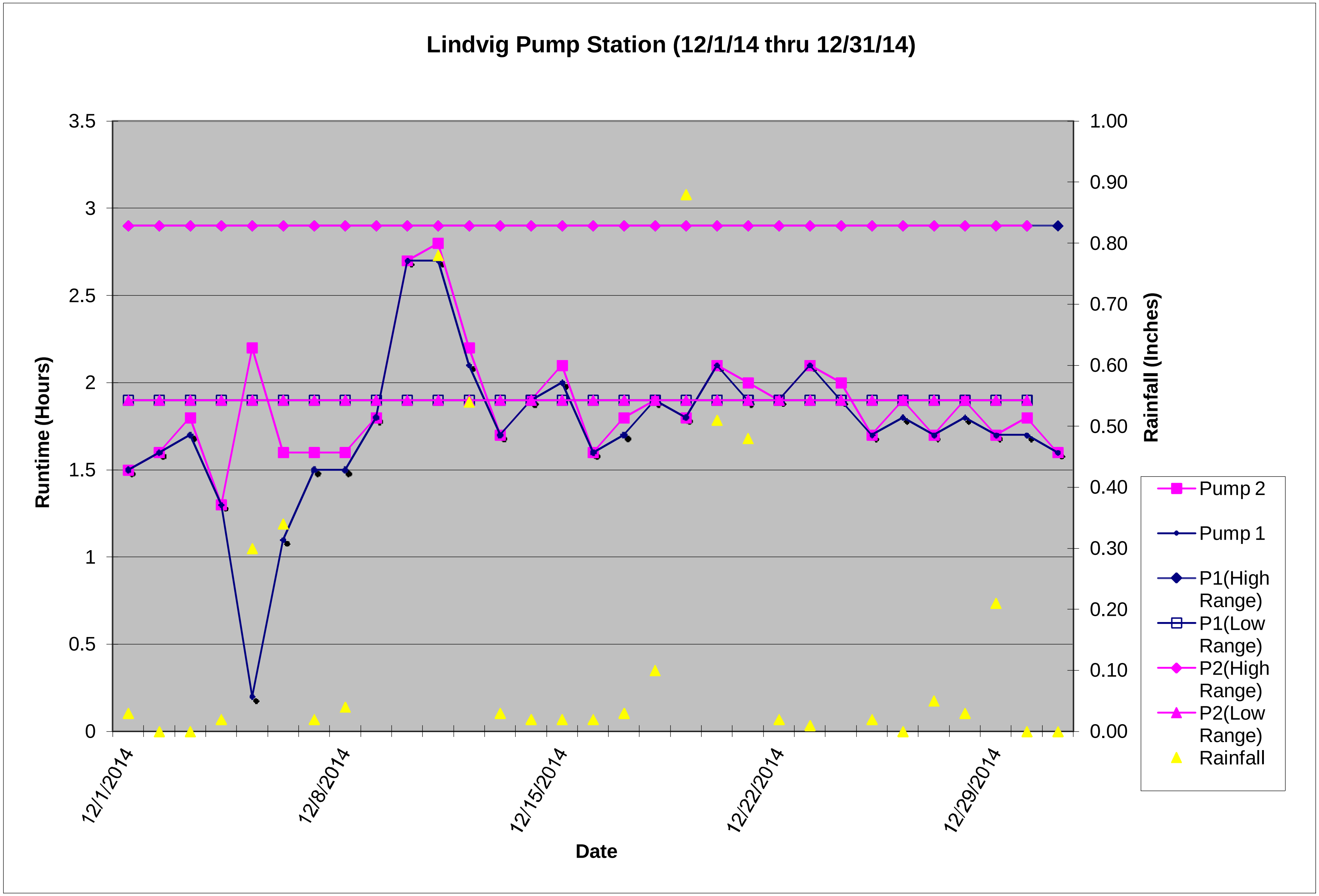
		Six-Year Plan						
	Prior Years	2015	2016	2017	2018	2019	2020	Total Costs
Operating								-
Debt								-
Total	-	-	-	-	-	-	-	-

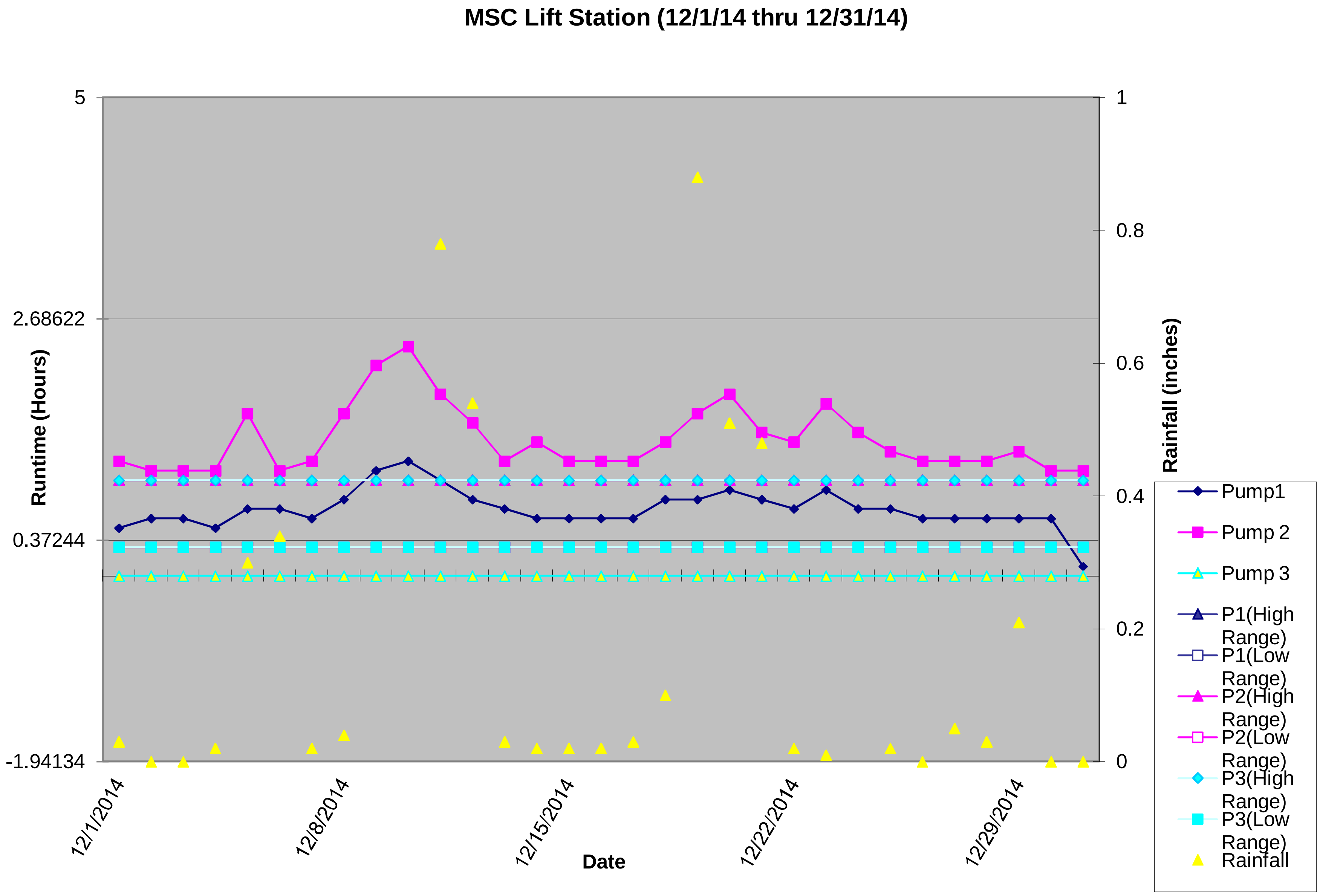
City of Poulsbo Population	
2008	8110
2009	9106
2010	9200
2011	9245
2012	9360
2013	9585
2014	9775
2015	9950

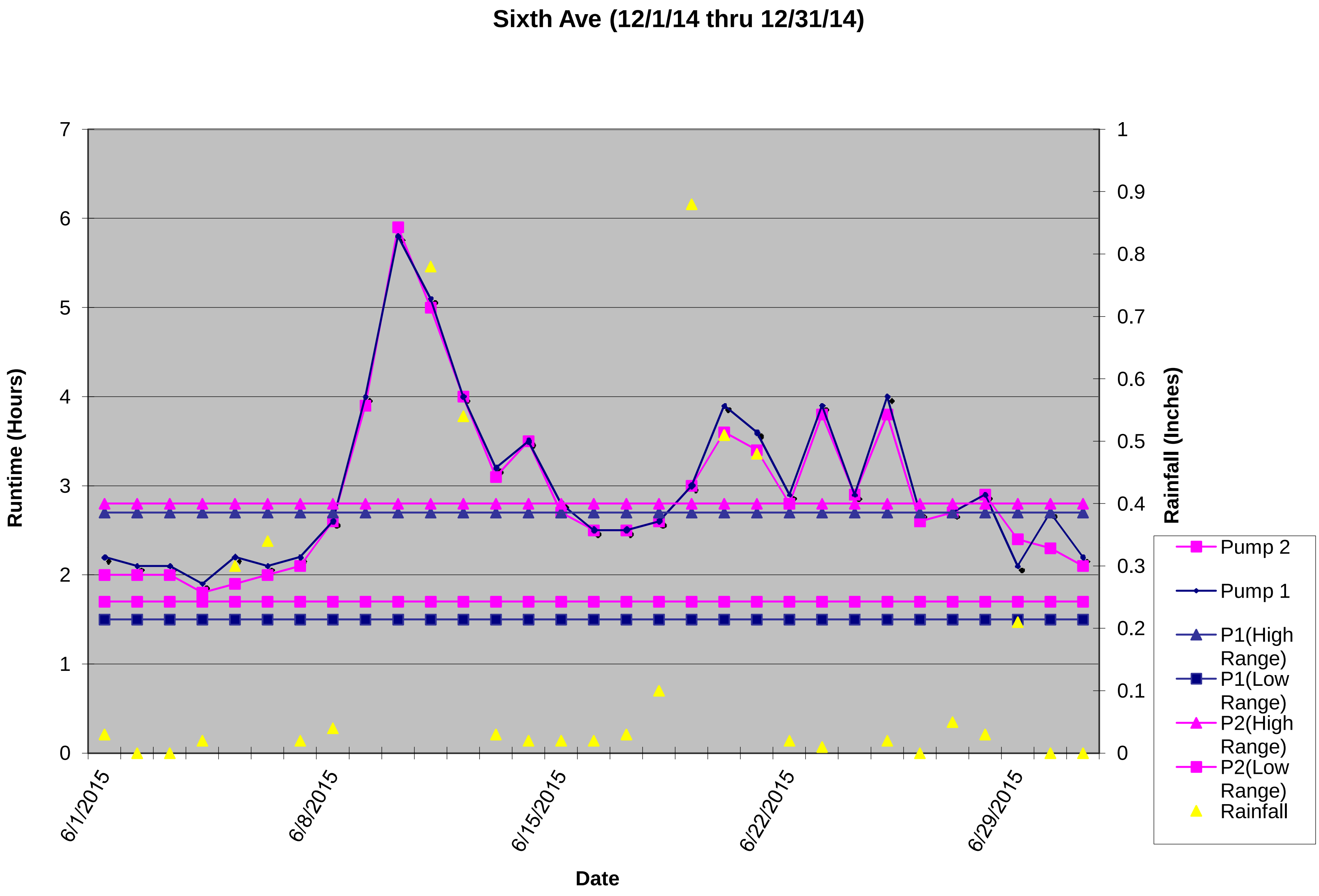
Source: Washington State Office of Financial Management



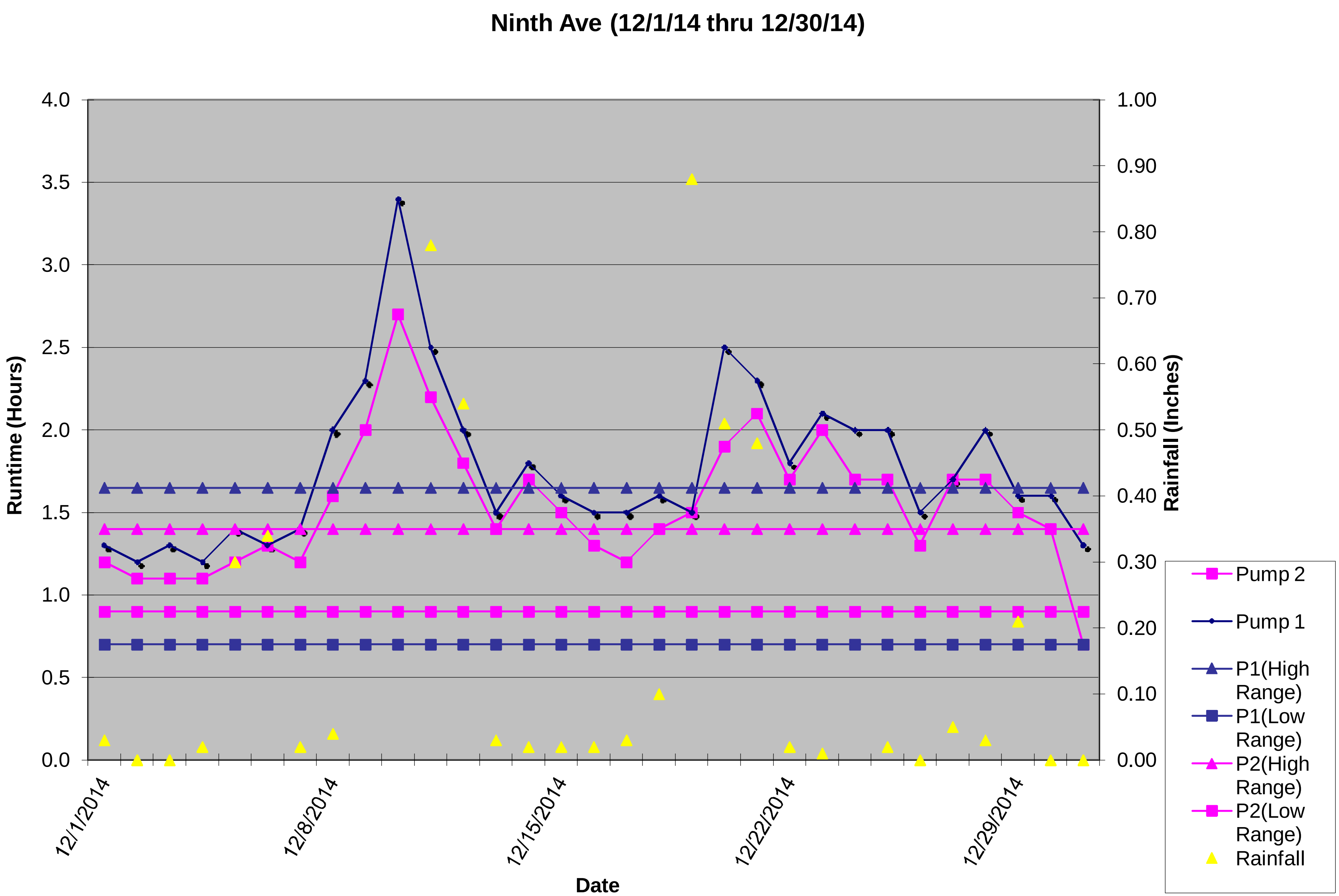
Liberty Bay (12/1/14 thru 12/31/14)
Runtime (Hours)
3.5
3
2.5
2
1.5
1
0.5
0
Rainfall (inches)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12/1/2014
12/8/2014
12/15/2014
12/22/2014
12/29/2014
Date
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall


Lindvig Pump Station (12/1/14 thru 12/31/14)
Runtime (Hours)
3.5
3
2.5
2
1.5
1
0.5
0
Rainfall (Inches)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
12/1/2014
12/8/2014
12/15/2014
12/22/2014
12/29/2014
Date
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall

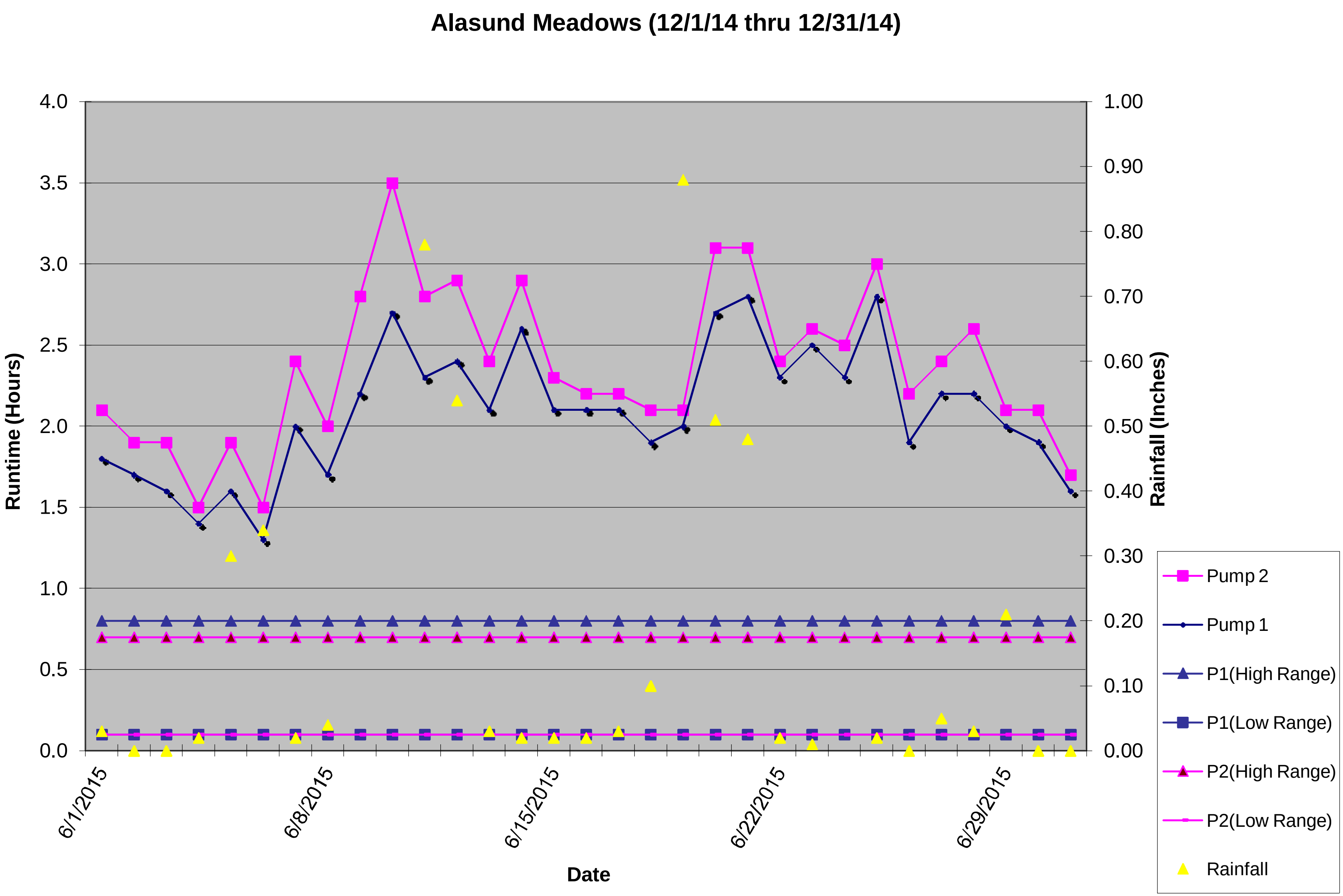

MSC Lift Station (12/1/14 thru 12/31/14)
Runtime (Hours)
5
2.68622
0.37244
-1.94134
Rainfall (inches)
1
0.8
0.6
0.4
0.2
0
12/1/2014
12/8/2014
12/15/2014
12/22/2014
12/29/2014
Date
Pump1
Pump 2
Pump 3
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
P3(High Range)
P3(Low Range)
Rainfall



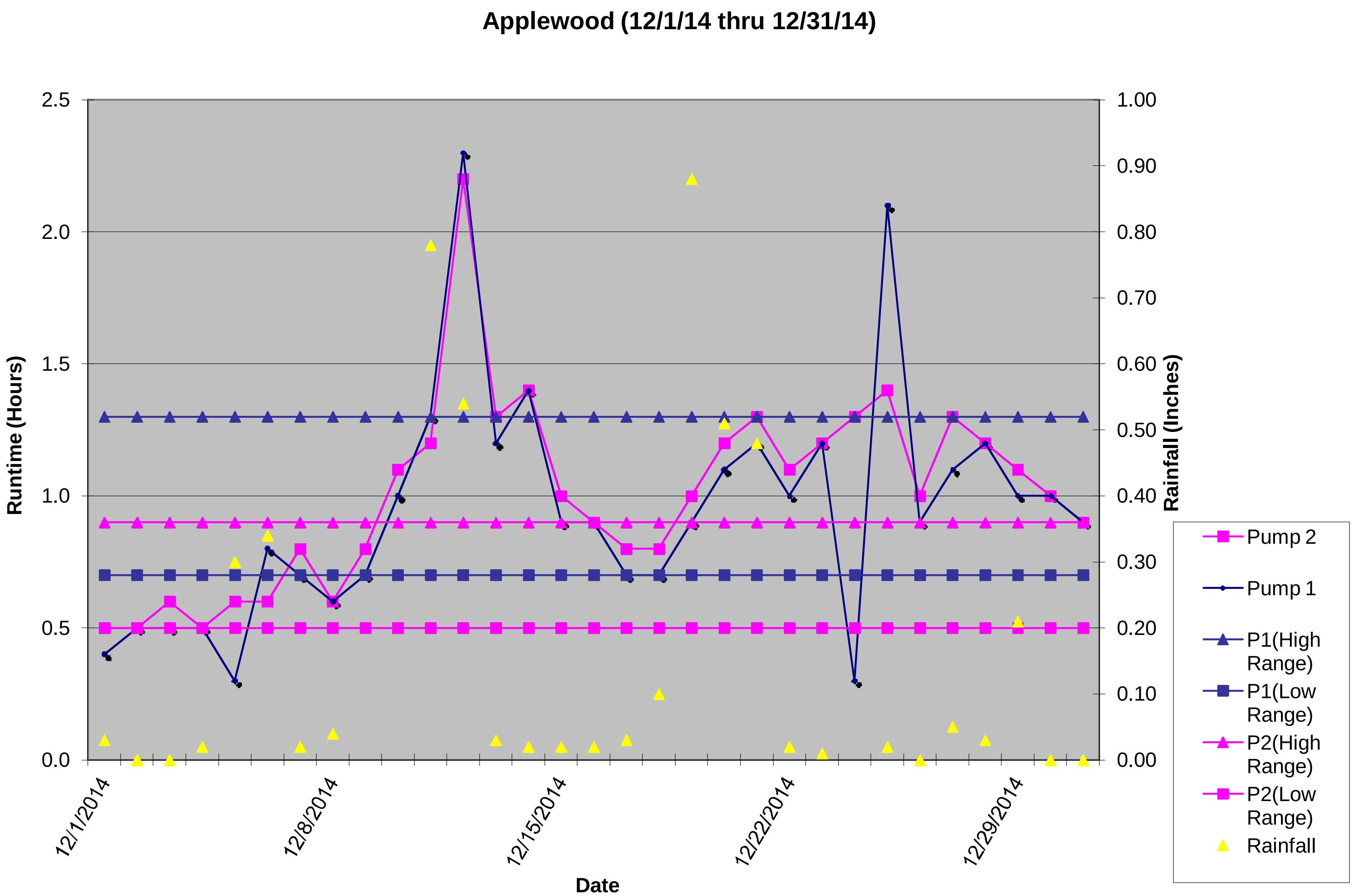
Sixth Ave (12/1/14 thru 12/31/14)
Runtime (Hours)
Rainfall (Inches)
Date
0
1
2
3
4
5
6
7
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
6/1/2015
6/8/2015
6/15/2015
6/22/2015
6/29/2015
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall


Ninth Ave (12/1/14 thru 12/30/14)
Runtime (Hours)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Rainfall (Inches)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
12/1/2014
12/8/2014
12/15/2014
12/22/2014
12/29/2014
Date
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall

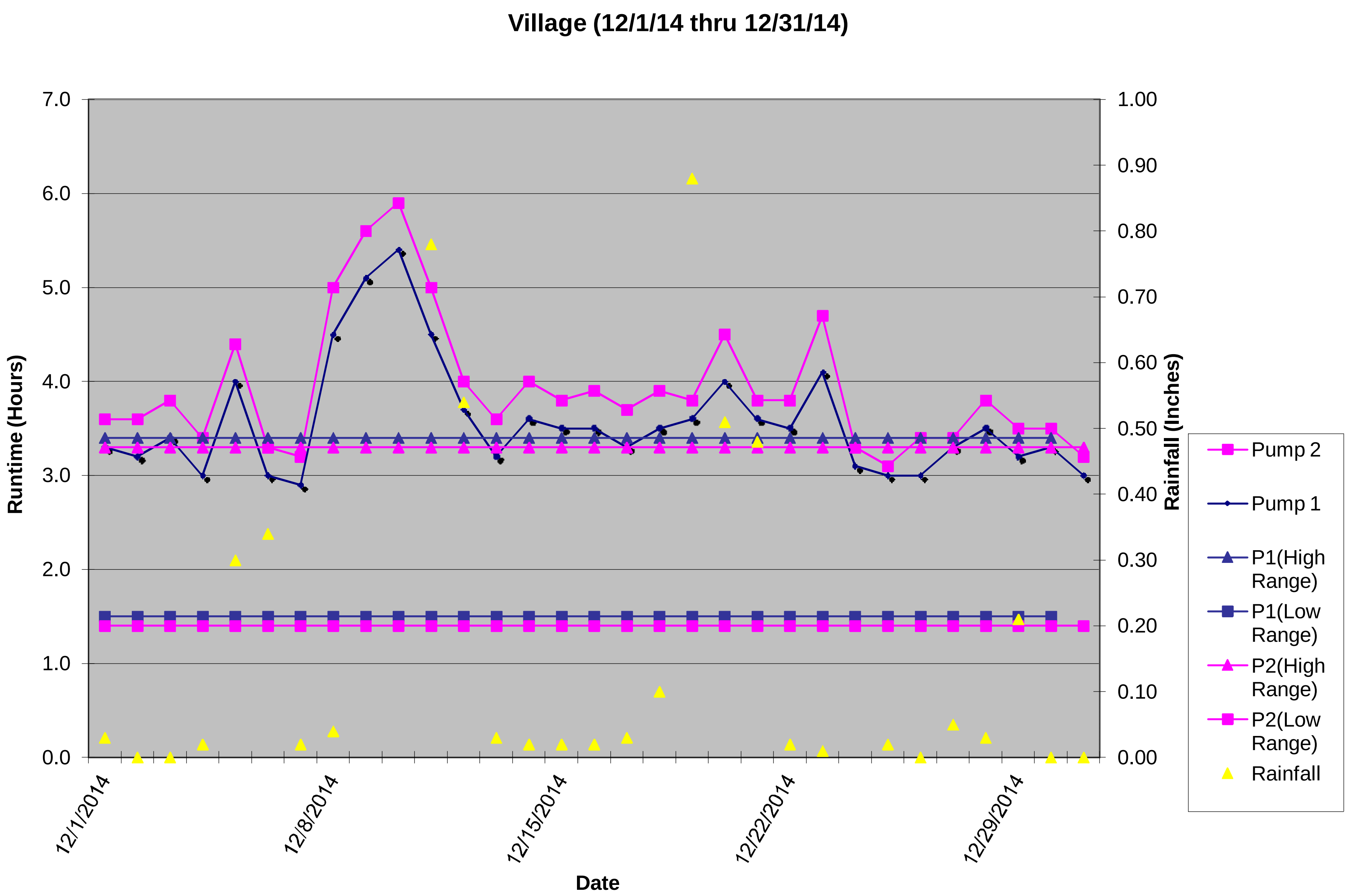
GR-Alasund



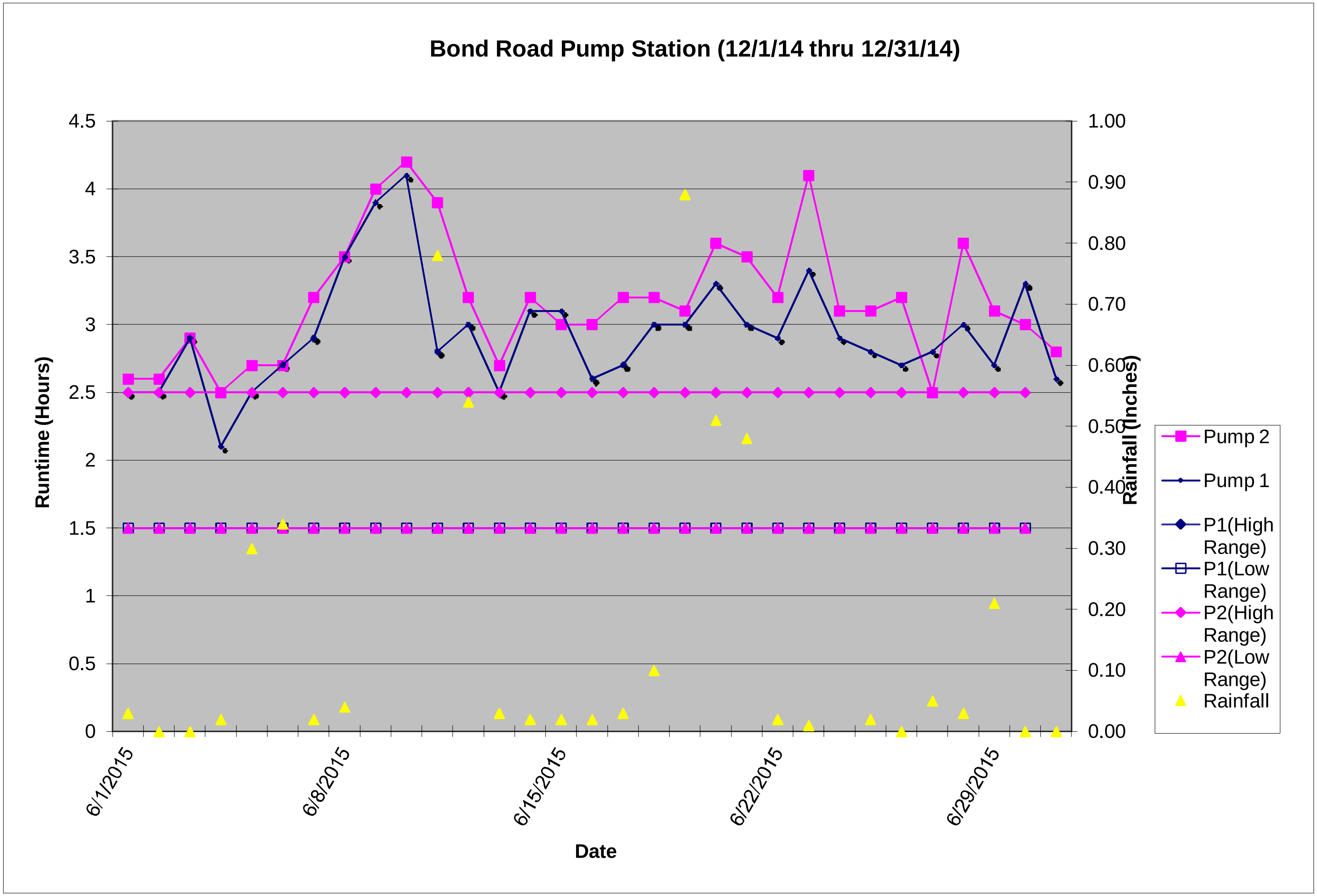
Alasund Meadows (12/1/14 thru 12/31/14)
Runtime (Hours)
Rainfall (Inches)
Date
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
6/1/2015
6/8/2015
6/15/2015
6/22/2015
6/29/2015
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall



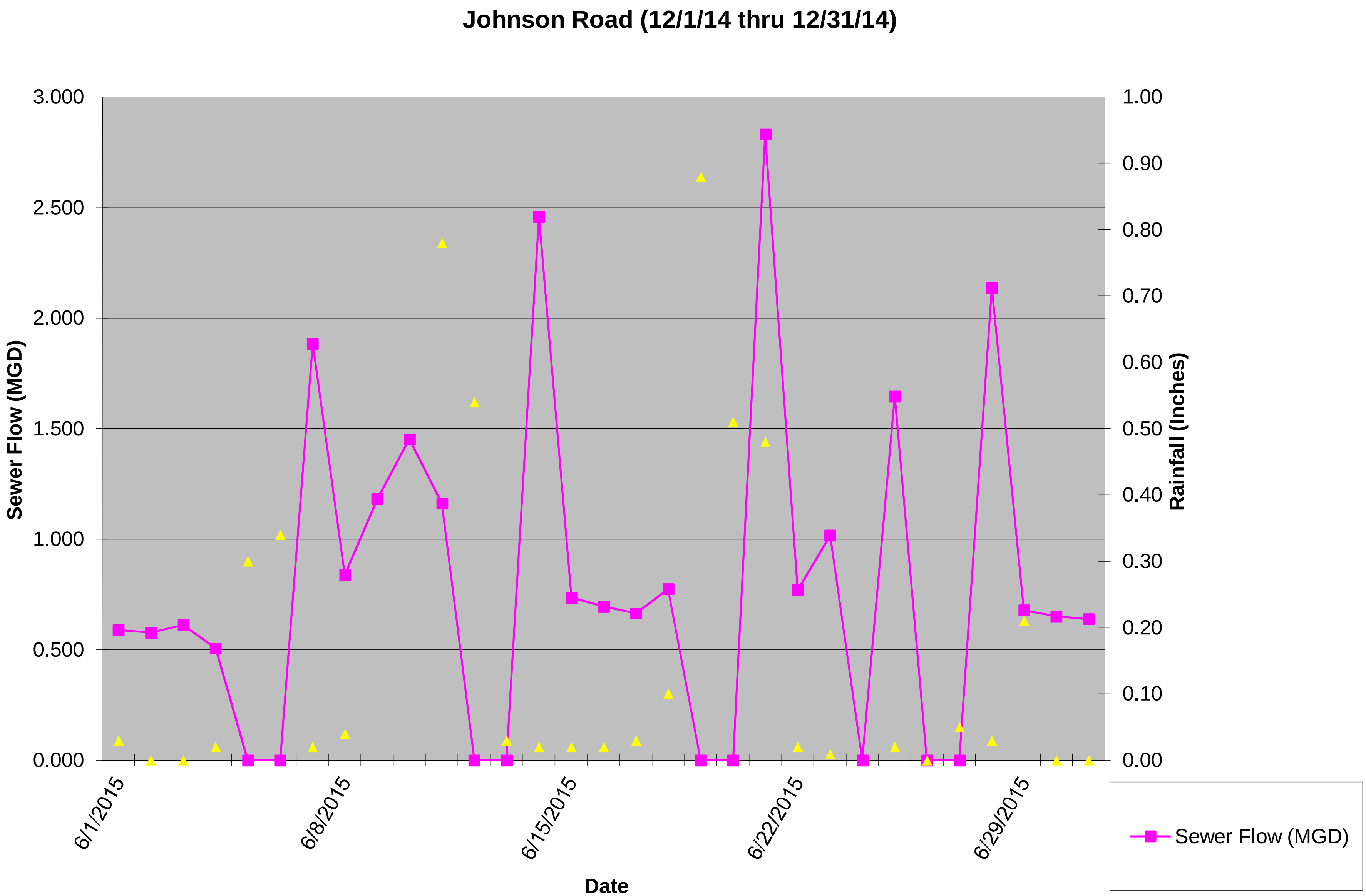
Applewood (12/1/14 thru 12/31/14)
Runtime (Hours)
Rainfall (Inches)
Date
2.5
2.0
1.5
1.0
0.5
0.0
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
12/1/2014
12/8/2014
12/15/2014
12/22/2014
12/29/2014
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall



Village (12/1/14 thru 12/31/14)
Runtime (Hours)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Rainfall (Inches)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
12/1/2014
12/8/2014
12/15/2014
12/22/2014
12/29/2014
Date
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall



Bond Road Pump Station (12/1/14 thru 12/31/14)
Runtime (Hours)
Rainfall (Inches)
Date
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
6/1/2015
6/8/2015
6/15/2015
6/22/2015
6/29/2015
Pump 2
Pump 1
P1(High Range)
P1(Low Range)
P2(High Range)
P2(Low Range)
Rainfall


Johnson Road (12/1/14 thru 12/31/14)
Sewer Flow (MGD)
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Rainfall (Inches)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
6/1/2015
6/8/2015
6/15/2015
6/22/2015
6/29/2015
Date
Sewer Flow (MGD)

Alturnative 5
connection charge information in PMC 13.70.130 & .140

City 4104 parcels in Basin 2978.45 GIS Acres (includes tidelands) 2869.11 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

ERU Adjustment Factor (PMC 13.70.140)

	# Parcels	Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes)						ERU Calculation by Category	
					5/8 X 3/4"	1"	1.5"	2"	3"	4"		Residential Total
Residential	2596	SFR	1.00	2859	2772	2.5	0	1	0	0	2859	
Residential	16	Duplex, Triplex, Four-plex	0.85	37	17	1	0	0	0	0	31.45	3677.65
Residential	23	Apartments-Condomiminums (5 or more units)	0.80	984	76	8	23	20	1	1	787.2	

	# Parcels	Category	Factor	Number of Meters by Commercial Category						Meter Flow Factor Equivalent ERU's (PMC 13.70.130)						ERU Calculation by Category	
				5/8 X 3/4"	1"	1.5"	2"	3"	4"	5/8 X 3/4"	1"	1.5"	2"	3"	4"		Commercial Total
Commercial	2	Motel-Hotel	0.70	0	0	2	2	1	0	1	2.5	5	8	16	25	29.4	
Commercial	263	Commercial-Industrial	1.00	168	60	29	27	7	1	1	2.5	5	8	16	25	816	863.9
Commercial	5	SFR & C-I [6 Units total]	1.00	6	1	2	0	0	0	1	2.5	5	8	16	25	18.5	

City Total ERU 4541.55

Equivalent ERU Worksheets- Conversion of Commercial to ERUs

connection charge information in PMC 13.70.130 & .140

Finn Hill Basin

489 parcels in Basin

600.99 GIS Acres (includes tidelands)

592.39 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

ERU Adjustment Factor (PMC 13.70.140)

	# Parcels	Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes) 5/8 X 3/4"	1"	1.5"	2"	3"	4"	ERU Calculation by Category	Residential Total
Residential	165	SFR	1.00	165	165	2.5	0	0	0	0	165	165
	0	Duplex, Triplex, Four-plex	0.85	0	0	0	0	0	0	0	0	
	0	Apartments-Condomiminums (5 or more units)	0.80	0	0	0	0	0	0	0	0	

	# Parcels	Category	Factor	Number of Meters by Commercial Category 5/8 X 3/4"	1"	1.5"	2"	3"	4"	Meter Flow Factor Equivalent ERU's (PMC 13.70.130) 5/8 X 3/4"	1"	1.5"	2"	3"	4"	ERU Calculation by Category	Commercial Total
Commercial	0	Motel-Hotel	0.70	0	0	0	0	0	0	1	2.5	5	8	16	25	0	79
	14	Commercial-Industrial	1.00	1	4	4	4	1	0	1	2.5	5	8	16	25	79	
	0	SFR & C-I [6 Units total]	1.00	0	0	0	0	0	0	1	2.5	5	8	16	25	0	

Finn Hill basin Total ERU **244**

Viking Basin

708 parcels in Basin

631.72 GIS Acres (includes tidelands)

608.55 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

ERU Adjustment Factor (PMC 13.70.140)

	# Parcels	Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes)						ERU Calculation by Category	
					5/8 X 3/4"	1"	1.5"	2"	3"	4"		Residential Total
Residential	336	SFR	1.00	345	341	0	0	0	0	0	345	
	10	Duplex, Triplex, Four-plex	0.85	23	11	1	0	0	0	0	19.55	801.35
	11	Apartments-Condomiminums (5 or more units)	0.80	546	18	7	19	12	0	1	436.8	

	# Parcels	Category	Factor	Number of Meters by Commercial Category						Meter Flow Factor Equivalent ERU's (PMC 13.70.130)						ERU Calculation by Category	
				5/8 X 3/4"	1"	1.5"	2"	3"	4"	5/8 X 3/4"	1"	1.5"	2"	3"	4"		Commercial Total
Commercial	0	Motel-Hotel	0.70	0	0	0	0	0	0	1	2.5	5	8	16	25	0	
	71	Commercial-Industrial	1.00	43	19	5	3	3	0	1	2.5	5	8	16	25	187.5	191
	1	SFR & C-I [6 Units total]	1.00	1	1	0	0	0	0	1	2.5	5	8	16	25	3.5	

Viking Basin Total ERU **992.35**

Alturnative 5
connection charge information in PMC 13.70.130 & .140

Central Basin 590 parcels in Basin 208.21 GIS Acres (includes tidelands) 165.15 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

	# Parcels	ERU Adjustment Factor (PMC 13.70.140) Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes)						ERU Calculation by Category	
					5/8 X 3/4"	1"	1.5"	2"	3"	4"		Residential Total
Residential	414	SFR	1.00	452	452	0	0	0	0	0	452	
	4	Duplex, Triplex, Four-plex	0.85	9	4	0	0	0	0	0	7.65	630.85
	8	Apartments-Condomiminums (5 or more units)	0.80	214	18	1	0	7	0	0	171.2	

	# Parcels	Category	Factor	Number of Meters by Commercial Category						Meter Flow Factor Equivalent ERU's (PMC 13.70.130)						ERU Calculation by Category	
				5/8 X 3/4"	1"	1.5"	2"	3"	4"	5/8 X 3/4"	1"	1.5"	2"	3"	4"		Commercial Total
Commercial	0	Motel-Hotel	0.70	0	0	0	0	0	0	1	2.5	5	8	16	25	0	
	81	Commercial-Industrial	1.00	65	13	4	6	0	1	1	2.5	5	8	16	25	190.5	200.5
	3	SFR & C-I [6 Units total]	1.00	5	0	1	0	0	0	1	2.5	5	8	16	25	10	

Central Basin Total ERU **831.35**

Alturnative 5
connection charge information in PMC 13.70.130 & .140

6th / 9th Basin 293 parcels in Basin 107.90 GIS Acres (includes tidelands) 88.68 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

	# Parcels	ERU Adjustment Factor (PMC 13.70.140) Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes) 5/8 X 3/4"	1"	1.5"	2"	3"	4"	ERU Calculation by Category	
Residential	260	SFR	1.00	267	262	0	0	0	0	0	267	Residential Total
Residential	2	Duplex, Triplex, Four-plex	0.85	5	2	0	0	0	0	0	4.25	367.25
Residential	1	Apartments-Condomiminums (5 or more units)	0.80	120	0	0	0	0	1	0	96	

	# Parcels	Category	Factor	Number of Meters by Commercial Category 5/8 X 3/4"	1"	1.5"	2"	3"	4"	Meter Flow Factor Equivalent ERU's (PMC 13.70.130) 5/8 X 3/4"	1"	1.5"	2"	3"	4"	ERU Calculation by Category	
Commercial	0	Motel-Hotel	0.70	0	0	0	0	0	0	1	2.5	5	8	16	25	0	Commercial Total
Commercial	4	Commercial-Industrial	1.00	3	1	0	2	0	0	1	2.5	5	8	16	25	21.5	21.5
Commercial	0	SFR & C-I [6 Units total]	1.00	0	0	0	0	0	0	1	2.5	5	8	16	25	0	

6th / 9th Basin Total ERU **388.75**

Alturnative 5
connection charge information in PMC 13.70.130 & .140

Village Basin 435 parcels in parcels in B 342.37 GIS Acres 338.08 Planning Acres from KC Assessor Table (land) (includes tidelands) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

	# Parcels	ERU Adjustment Factor (PMC 13.70.140) Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes) 5/8 X 3/4"	1"	1.5"	2"	3"	4"	ERU Calculation by Category	Residential Total
Residential	211	SFR	1.00	254	254	0	0	0	0	0	254	282.8
	0	Duplex, Triplex, Four-plex	0.85	0	0	0	0	0	0	0	0	
	1	Apartments-Condomiminums (5 or more units)	0.80	36	0	0	0	1	0	0	28.8	

	# Parcels	Category	Factor	Number of Meters by Commercial Category 5/8 X 3/4"	1"	1.5"	2"	3"	4"	Meter Flow Factor Equivalent ERU's (PMC 13.70.130) 5/8 X 3/4"	1"	1.5"	2"	3"	4"	ERU Calculation by Category	Commercial Total
Commercial	1	Motel-Hotel	0.70	0	0	0	0	1	0	1	2.5	5	8	16	25	11.2	177.2
	52	Commercial-Industrial	1.00	28	18	9	6	0	0	1	2.5	5	8	16	25	166	
	0	SFR & C-I [6 Units total]	1.00	0	0	0	0	0	0	1	2.5	5	8	16	25	0	

Village Basin Total ERU **460**

Alturnative 5
connection charge information in PMC 13.70.130 & .140

East Poulsbo Basin 1386 parcels in Basin 783.15 GIS Acres (includes tidelands) 771.8 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:
ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

	# Parcels	ERU Adjustment Factor (PMC 13.70.140) Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes)						ERU Calculation by Category	
					5/8 X 3/4"	1"	1.5"	2"	3"	4"		Residential Total
Residential	1118	SFR	1.00	1284	1206	0	0	1	0	0	1284	1338.4
	0	Duplex, Triplex, Four-plex	0.85	0	0	0	0	0	0	0	0	
	2	Apartments-Condomiminums (5 or more units)	0.80	68	40	0	4	0	0	0	54.4	

	# Parcels	Category	Factor	Number of Meters by Commercial Category						Meter Flow Factor Equivalent ERU's (PMC 13.70.130)						ERU Calculation by Category	
				5/8 X 3/4"	1"	1.5"	2"	3"	4"	5/8 X 3/4"	1"	1.5"	2"	3"	4"		Commercial Total
Commercial	1	Motel-Hotel	0.70	0	0	2	2	0	0	1	2.5	5	8	16	25	18.2	194.7
	41	Commercial-Industrial	1.00	28	5	7	6	3	0	1	2.5	5	8	16	25	171.5	
	1	SFR & C-I [6 Units total]	1.00	0	0	1	0	0	0	1	2.5	5	8	16	25	5	

East Poulsbo Basin Total ERU **1533.1**

Alturnative 5
connection charge information in PMC 13.70.130 & .140

Noll Road Basin 203 parcels in Basin 304.11 GIS Acres (includes tidelands) 304.46 Planning Acres from KC Assessor Table (land) (no tidelands)

Sewer ERU calculation:

ERU Calculation Residential = # of units per category X ERU Adjustment Factor
ERU Calculation Commercial = # of meters of each size X Meter Flow Factor Equivalent ERU's X ERU Adjustment Factor

ERU Adjustment Factor (PMC 13.70.140)

	# Parcels	Category	Factor	Number of Units by Residential Category	Number or Meters by Residential Category (for informational purposes)						ERU Calculation by Category	Residential Total
					5/8 X 3/4"	1"	1.5"	2"	3"	4"		
Residential	92	SFR	1.00	92	92	0	0	0	0	0	92	92
	0	Duplex, Triplex, Four-plex	0.85	0	0	0	0	0	0	0	0	
	0	Apartments-Condomiminums (5 or more units)	0.80	0	0	0	0	0	0	0	0	

	# Parcels	Category	Factor	Number of Meters by Commercial Category						Meter Flow Factor Equivalent ERU's (PMC 13.70.130)						ERU Calculation by Category	Commercial Total
				5/8 X 3/4"	1"	1.5"	2"	3"	4"	5/8 X 3/4"	1"	1.5"	2"	3"	4"		
Commercial	0	Motel-Hotel	0.70	0	0	0	0	0	0	1	2.5	5	8	16	25	0	0
	0	Commercial-Industrial	1.00	0	0	0	0	0	0	1	2.5	5	8	16	25	0	
	0	SFR & C-I [6 Units total]	1.00	0	0	0	0	0	0	1	2.5	5	8	16	25	0	

Noll Road Basin

92

Existing Pump Station Flow Capacities
Updated 2015

Table 3-2. Existing Pump Stations

Location	Design Flow (mgd)	Pump Data	Standby Power	Flow Metering
Liberty Bay PS	0.14	2 Pumps 7.5 HP 100 gpm @ 56 head (each)	Portable Generator Connection	No
Lindvig PS[a]	0.8	2 pumps 60 HP Pump 1: 515 gpm Pump 2: 500 gpm	On-site Generator	Yes
Marine Science Center PS[b]	1.4	3 pumps Pump 1: 50 HP, 705 gpm Pump 2: 50 HP, 725 gpm Pump 3: 30 HP, 383 gpm	On-site Generator	No
Bond Road PS[c]	1.0	2 Pumps 150 HP 700 gpm	On-Site Generator	Yes
Village PS	0.5	2 Pumps 20 HP 350 gpm @ 92' Head (each)	On-site Generator	No
Applewood PS	0.2	2 Pumps 10 HP 135 gpm @ 60' Head (each)	On-site Generator (located at Water Well)	No
Alasund Meadows PS	0.18	2 Pumps 15 HP 125 gpm @ 90' Head (each)	Portable Generator Connection	No
9th Avenue PS	0.14	2 Pumps 10 HP 100 gpm @ 80' Head (each)	Portable Generator	No
6th Avenue PS	0.2	2 Pumps 15 HP 142 gpm @ 83' Head (each)	Portable Generator	No

[a] Pump station rebuilt in 1999.
[b] Pumps replaced in 2000.
[c] Constructed in 2007.

WET SEASON INFILTRATION ANALYSIS (ADF)

Average Wet Season dates: 10/15 thru 4/15 (2011-2014)

Total Flows Gallons per Capita per Day (GPCD) for Wet Season Ave. Dry Flows (2011-2014)

YEAR	WET SEASON PRECIP (IN.)	LIBERTY BAY	LINDVIG	MSC	6TH AVE.	MSC	6th Ave.	9th Ave.	Alasund	Apple-wood	Village	Bond Rd.	Water Usage City/Month (100cf)	City Monthly Usage (gal)	City Usage Dry Period	Dry Weather Water Usage gal/cap/day	Year	City of Poulsbo Population
2008	**20.8**	58.6	70.6	29.5	35.4	29.5	35.4	122.7	58.1	173.0	106.0	56.1	23,051	17,242,148	3,893,388	68.4	2008	8,130
2009	**31.4**	68.8	72.2	35.8	46.3	35.8	46.3	194.9	61.7	142.4	119.7	69.9	25,236	18,876,528	5,480,282	73.5	2009	8,284
2010	**38.4**	58.6	68.7	37.3	42.4	37.3	42.4	159.7	58.1	176.1	116.5	65.7	30,053	22,479,644	5,076,049	78.1	2010	9,286
2011	**29.5**	60.1	60.3	32.8	47.2	32.8	47.2	47.2	75.1	91.9	104.4	65.2	23,719	17,741,812	4,006,216	61.2	2011	9,345
2012	**43.4**	59.7	66.1	35.7	47.7	35.7	47.7	67.0	70.5	128.6	111.7	66.3	25,632	19,172,736	5,566,278	65.9	2012	9,391
2013	**13.2**	77.0	72.2	36.9	46.4	36.9	46.4	82.1	107.4	225.1	117.7	74.5	22,400	16,755,200	4,323,923	56.8	2013	9,509
2014	**28.5**	75.0	43.3	33.8	44.6	33.8	44.6	69.8	110.6	83.4	128.6	77.7	32,678	24,443,144	6,307,908	80.7	2014	9,775

*used October, November had reading anamolies and incomplete month

2.3 Capita per ERU

gpcd gallons per capita per day

Est Inflow

Lift Station (Sewer Basin):

Liberty Bay	Pump 1 @ gpm= 100		Pump 2 @ 100		0		Pump 1	Pump 2		Total		Days	Gallons	Total Flows per ERU		Dry Weather Sewer Flows per Capita per day		Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	1.4	hrs	1.50	hrs			8400	9000	0	17,400	gal/day	7	121,800	134.9	Gal/ERU	58.6	gpcd	68.41	-16.7%
2009 Avg.DryWeather runtime	1.7	hrs	1.70	hrs			10200	10200	0	20,400	gal/day	9	183,600	158.1	Gal/ERU	68.8	gpcd	73.51	-6.9%
2010 Avg.DryWeather runtime	1.4	hrs	1.50	hrs			8400	9000	0	17,400	gal/day	7	121,800	134.9	Gal/ERU	58.6	gpcd	78.09	-33.2%
2011 Avg.DryWeather runtime	1.44	hrs	1.53	hrs			8640	9180	0	17,820	gal/day	7	124,740	138.1	Gal/ERU	60.1	gpcd	61.24	-2.0%
2012 Avg.DryWeather runtime	1.28	hrs	1.67	hrs			7680	10020	0	17,700	gal/day	9	159,300	137.2	Gal/ERU	59.7	gpcd	65.86	-10.4%
2013 Avg.DryWeather runtime	1.96	hrs	1.85	hrs			11760	11100	0	22,860	gal/day	8	182,880	177.2	Gal/ERU	77.0	gpcd	56.84	26.2%
2014 Avg.DryWeather runtime	0.96	hrs	2.75	hrs			5760	16500	0	22,260	gal/day	8	178,080	172.6	Gal/ERU	75.0	gpcd	80.66	-7.5%
ERUs in Basin	129	Capita	297																

Lindvig	Pump 1 @ gpm= 515		Pump 2 @ 500				Pump 1	Pump 2		Total		Days	Gallons	Total Flows per ERU		Dry Weather Sewer Flows per Capita per day		Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	2.28	hrs	2.32	hrs			70452	69600		140,052	gal/day	7	980,364	162.3	Gal/ERU	70.6	gpcd	68.41	3.0%
2009 Avg.DryWeather runtime	2.34	hrs	2.37	hrs			72306	71100		143,406	gal/day	9	1,290,654	166.2	Gal/ERU	72.2	gpcd	73.51	-1.7%
2010 Avg.DryWeather runtime	2.21	hrs	2.27	hrs			68289	68100		136,389	gal/day	7	954,723	158.0	Gal/ERU	68.7	gpcd	78.09	-13.6%
2011 Avg.DryWeather runtime	1.96	hrs	1.97	hrs			60564	59100		119,664	gal/day	7	837,648	138.7	Gal/ERU	60.3	gpcd	61.24	-1.6%
2012 Avg.DryWeather runtime	2.15	hrs	2.16	hrs			66435	64800		131,235	gal/day	9	1,181,115	152.1	Gal/ERU	66.1	gpcd	65.86	0.4%
2013 Avg.DryWeather runtime	2.33	hrs	2.38	hrs			71997	71400		143,397	gal/day	8	1,147,176	166.2	Gal/ERU	72.2	gpcd	56.84	21.3%
2014 Avg.DryWeather runtime	1.43	hrs	1.39	hrs			44187	41700		85,887	gal/day	8	687,096	99.5	Gal/ERU	43.3	gpcd	80.66	-86.4%
ERUs in Basin	863	Capita	1985																

MSC (Central Basin)	Pump 1 @ gpm= 705		Pump 2 @ 725		Pump 3 @ 383		Pump 1	Pump 2	Pump 3	Total		Days	Gallons	Total Flows per ERU		Dry Weather Sewer Flows per Capita per day		Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	0.46	hrs	0.41	hrs	0.83	hrs	19458	17835	19073.4	56,366	gal/day	7	394,565	67.8	Gal/ERU	29.5	gpcd	68.41	-132.0%
2009 Avg.DryWeather runtime	0.52	hrs	0.53	hrs	1.02	hrs	21996	23055	23439.6	68,491	gal/day	9	616,415	82.4	Gal/ERU	35.8	gpcd	73.51	-105.1%
2010 Avg.DryWeather runtime	0.54	hrs	0.54	hrs	1.09	hrs	22842	23490	25048.2	71,380	gal/day	7	499,661	85.9	Gal/ERU	37.3	gpcd	78.09	-109.1%
2011 Avg.DryWeather runtime	0.97	hrs	0.50	hrs	0	hrs	41031	21750	0	62,781	gal/day	7	439,467	75.5	Gal/ERU	32.8	gpcd	61.24	-86.4%
2012 Avg.DryWeather runtime	1.10	hrs	0.50	hrs	0	hrs	46530	21750	0	68,280	gal/day	9	614,520	82.2	Gal/ERU	35.7	gpcd	65.86	-84.4%
2013 Avg.DryWeather runtime	1.10	hrs	0.55	hrs	0	hrs	46530	23925	0	70,455	gal/day	8	563,640	84.8	Gal/ERU	36.9	gpcd	56.84	-54.2%
2014 Avg. Wet Season runtime	0.50	hrs	1.00	hrs	0	hrs	21150	43500	0	64,650	gal/day	8	517,200	77.8	Gal/ERU	33.8	gpcd	80.66	-138.5%
ERUs in Basin	831	Capita	1912																

6th Ave	Pump 1 @ gpm= 142		Pump 2 @ 142		0		Pump 1	Pump 2		Total		Days	Gallons	Total Flows per ERU		Dry Weather Sewer Flows per Capita per day		Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	1.50	hrs	1.56	hrs			12780	13291.2		26,071	gal/day	7	182,498	81.5	Gal/ERU	35.4	gpcd	68.41	-93.13%
2009 Avg.DryWeather runtime	1.96	hrs	2.04	hrs			16699	17380.8		34,080	gal/day	9	306,720	106.5	Gal/ERU	46.3	gpcd	73.51	-58.74%
2010 Avg.DryWeather runtime	1.79	hrs	1.87	hrs			15251	15932.4		31,183	gal/day	7	218,282	97.4	Gal/ERU	42.4	gpcd	78.09	-84.31%
2011 Avg.DryWeather runtime	2.04	hrs	2.04	hrs			17381	17380.8		34,762	gal/day	7	243,331	108.6	Gal/ERU	47.2	gpcd	61.24	-29.67%
2012 Avg.DryWeather runtime	1.92	hrs	2.20	hrs			16358	18744		35,102	gal/day	9	315,922	109.7	Gal/ERU	47.7	gpcd	65.86	-38.09%
2013 Avg.DryWeather runtime	2.30	hrs	1.71	hrs			19596	14569.2		34,165	gal/day	8	273,322	106.8	Gal/ERU	46.4	gpcd	56.84	-22.45%
2014 Avg. Wet Season runtime	1.94	hrs	1.91	hrs			16529	16273.2		32,802	gal/day	8	262,416	102.5	Gal/ERU	44.6	gpcd	80.66	-80.99%
ERUs in Basin	320	Capita	736																

9th Ave	Pump 1 @ gpm= 100	Pump 2 @ 100	0	Pump 1	Pump 2	Pump 3	Total	Days	Gallons	Total Flows per ERU	Dry Weather Sewer Flows per Capita per day	Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	1.64 hrs	1.84 hrs*		9840	11040		20,880 gal/day	7	146,160	282.2 Gal/ERU	122.7 gpcd	68.41	44.23%
2009 Avg.DryWeather runtime	3.30 hrs	2.23 hrs*		19800	13380		33,180 gal/day	9	298,620	448.4 Gal/ERU	194.9 gpcd	73.51	62.29%
2010 Avg.DryWeather runtime	2.59 hrs	1.94 hrs*		15540	11640		27,180 gal/day	7	190,260	367.3 Gal/ERU	159.7 gpcd	78.09	51.10%
2011 Avg.DryWeather runtime	0.53 hrs	0.81 hrs*		3180	4860		8,040 gal/day	7	56,280	108.6 Gal/ERU	47.2 gpcd	61.24	-29.65%
2012 Avg.DryWeather runtime	0.99 hrs	0.91 hrs		5940	5460		11,400 gal/day	9	102,600	154.1 Gal/ERU	67.0 gpcd	65.86	1.67%
2013 Avg.DryWeather runtime	1.13 hrs	1.20 hrs		6780	7200		13,980 gal/day	8	111,840	188.9 Gal/ERU	82.1 gpcd	56.84	30.80%
2014 Avg. Wet Season runtime	0.94 hrs	1.04 hrs		5640	6240		11,880 gal/day	8	95,040	160.5 Gal/ERU	69.8 gpcd	80.66	-15.56%
ERUs in Basin 74	Capita	171	*Omitted data from apparent bad impeller										

Alasund Meadows (Noll Rd. Basin)	Pump 1 @ gpm= 125	Pump 2 @ 125	Pump 1	Pump 2	Total	Days	Gallons	Total Flows per ERU	Dry Weather Sewer Flows per Capita per day	Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	0.81 hrs	0.83 hrs	6075	6225	12,300 gal/day	7	86,100	133.7 Gal/ERU	58.1 gpcd	68.41	-17.69%
2009 Avg.DryWeather runtime	0.90 hrs	0.84 hrs	6750	6300	13,050 gal/day	9	117,450	141.8 Gal/ERU	61.7 gpcd	73.51	-19.19%
2010 Avg.DryWeather runtime	0.84 hrs	0.80 hrs	6300	6000	12,300 gal/day	7	86,100	133.7 Gal/ERU	58.1 gpcd	78.09	-34.34%
2011 Avg.DryWeather runtime	1.11 hrs	1.01 hrs	8325	7575	15,900 gal/day	7	111,300	172.8 Gal/ERU	75.1 gpcd	61.24	18.50%
2012 Avg.DryWeather runtime	0.00 hrs	1.99 hrs	0	14925	14,925 gal/day	9	134,325	162.2 Gal/ERU	70.5 gpcd	65.86	6.63%
2013 Avg.DryWeather runtime	1.46 hrs	1.57 hrs	10950	11775	22,725 gal/day	8	181,800	247.0 Gal/ERU	107.4 gpcd	56.84	47.07%
2014 Avg. Wet Season runtime	1.61 hrs	1.51 hrs	12075	11325	23,400 gal/day	8	187,200	254.3 Gal/ERU	110.6 gpcd	80.66	27.06%
ERUs in Basin 92	Capita	212									

Applewood	Pump 1 @ gpm= 135	Pump 2 @ 135	Pump 1	Pump 2	Total	Days	Gallons	Total Flows per ERU	Dry Weather Sewer Flows per Capita per day	Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	2.26 hrs	0.00 hrs	18306	0	18,306 gal/day	7	128,142	398.0 Gal/ERU	173.0 gpcd	68.41	60.46%
2009 Avg.DryWeather runtime	0.97 hrs	0.89 hrs	7857	7209	15,066 gal/day	9	135,594	327.5 Gal/ERU	142.4 gpcd	73.51	48.38%
2010 Avg.DryWeather runtime	1.09 hrs	1.21 hrs	8829	9801	18,630 gal/day	7	130,410	405.0 Gal/ERU	176.1 gpcd	78.09	55.65%
2011 Avg.DryWeather runtime	0.66 hrs	0.54 hrs	5346	4374	9,720 gal/day	7	68,040	211.3 Gal/ERU	91.9 gpcd	61.24	33.34%
2012 Avg.DryWeather runtime	0.95 hrs	0.73 hrs	7695	5913	13,608 gal/day	9	122,472	295.8 Gal/ERU	128.6 gpcd	65.86	48.80%
2013 Avg.DryWeather runtime	1.96 hrs	0.98 hrs	15876	7938	23,814 gal/day	8	190,512	517.7 Gal/ERU	225.1 gpcd	56.84	74.75%
2014 Avg. Wet Season runtime	0.57 hrs	0.52 hrs	4617	4212	8,829 gal/day	8	70,632	191.9 Gal/ERU	83.4 gpcd	80.66	3.34%
ERUs in Basin 46	Capita	106									

Village (Village Basin)	Pump 1 @ gpm= 350	Pump 2 @ 350	Pump 1	Pump 2	Pump 3	Total	Days	Gallons	Total Flows per ERU	Dry Weather Sewer Flows per Capita per day	Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	2.61 hrs	2.73 hrs	54810	57330		112,140 gal/day	7	784,980	243.8 Gal/ERU	106.0 gpcd	68.41	35.45%
2009 Avg.DryWeather runtime	2.97 hrs	3.06 hrs	62370	64260		126,630 gal/day	9	1,139,670	275.3 Gal/ERU	119.7 gpcd	73.51	38.59%
2010 Avg.DryWeather runtime	2.81 hrs	3.06 hrs	59010	64260		123,270 gal/day	7	862,890	268.0 Gal/ERU	116.5 gpcd	78.09	32.98%
2011 Avg.DryWeather runtime	2.59 hrs	2.67 hrs	54390	56070		110,460 gal/day	7	773,220	240.1 Gal/ERU	104.4 gpcd	61.24	41.34%
2012 Avg.DryWeather runtime	2.77 hrs	2.86 hrs	58170	60060		118,230 gal/day	9	1,064,070	257.0 Gal/ERU	111.7 gpcd	65.86	41.07%
2013 Avg.DryWeather runtime	3.02 hrs	2.91 hrs	63420	61110		124,530 gal/day	8	996,240	270.7 Gal/ERU	117.7 gpcd	56.84	51.71%
2014 Avg. Wet Season runtime	3.32 hrs	3.16 hrs	69720	66360		136,080 gal/day	8	1,088,640	295.8 Gal/ERU	128.6 gpcd	80.66	37.29%
ERUs in Basin 460	Capita	1058										

Bond (Finn Hill Basin)	Pump 1 @ gpm= 700	Pump 2 @ 700	Pump 1	Pump 2	Pump 3	Total	Days	Gallons	Total Flows per ERU	Dry Weather Sewer Flows per Capita per day	Dry Weather Water Usage gal/cap/day	Est. % of Sewer in basin is Infiltration
2008 Avg.DryWeather runtime	1.90 hrs	1.90 hrs	79800	79800		159,600 gal/day	7	1,117,200	129.1 Gal/ERU	56.1 gpcd	68.41	-21.86%
2009 Avg.DryWeather runtime	2.42 hrs	2.31 hrs	101640	97020		198,660 gal/day	9	1,787,940	160.7 Gal/ERU	69.9 gpcd	73.51	-5.19%
2010 Avg.DryWeather runtime	2.31 hrs	2.14 hrs	97020	89880		186,900 gal/day	7	1,308,300	151.2 Gal/ERU	65.7 gpcd	78.09	-18.78%
2011 Avg.DryWeather runtime	2.27 hrs	2.14 hrs	95340	89880		185,220 gal/day	7	1,296,540	149.9 Gal/ERU	65.2 gpcd	61.24	6.00%
2012 Avg.DryWeather runtime	2.34 hrs	2.15 hrs	98280	90300		188,580 gal/day	9	1,697,220	152.6 Gal/ERU	66.3 gpcd	65.86	0.72%
2013 Avg.DryWeather runtime	2.60 hrs	2.44 hrs	109200	102480		211,680 gal/day	8	1,693,440	171.3 Gal/ERU	74.5 gpcd	56.84	23.67%
2014 Avg. Wet Season runtime	2.69 hrs	2.57 hrs	112980	107940		220,920 gal/day	8	1,767,360	178.7 Gal/ERU	77.7 gpcd	80.66	-3.80%
ERUs in Basin 1236	Capita	2843	subtract Viking Basin in Gal/ERU									
	Estimated 300 for Finn Hill Or											

WET SEASON INFILTRATION ANALYSIS (AWS)

Average Wet Season dates: 10/15 thru 4/15 (2011-2014)

Total Flows Gallons per Capita per Day (GPCD) for Wet Season (2011-2014)

WET SEASON PRECIP (IN.)	YEAR	LIBERTY BAY	LINDVIG	MSC	6th Ave.	9th Ave.	Alasund	Apple-wood	Village	Bond Rd.
29.54	**2011**	69.91	73.76	37.61	62.4	75.1	83.8	151.2	114.7	76.0
43.4	**2012**	77.61	75.68	43.91	63.3	93.7	113.5	177.3	132.6	75.9
13.2	**2013**	70.52	65.84	36.62	41.7	67.4	95.6	176.7	117.2	69.9
28.5	**2014**	75.23	65.82	44.22	54.3	79.3	122.3	155.4	138.3	75.6

2014 Poulsbo Total ERUs 4541.0

2.3 Capita per ERU

gpcd gallons per capita per day

Lift Station (Sewer Basin): Est Inflow

Liberty Bay	Pump 1 @ gpm= 100		Pump 2 @ gpm 100		Pump 1	Pump 2		Total		**Total Flows per ERU**		**Total Flows per Capita per day**	
2/19/2014 High runtime	2.5	hrs	2.20	hrs	15000	13200	0	28,200	gal/day	218.6	Gal/ERU	95.0	gpcd
4/8/2008 High runtime	2.5	hrs	2.80	hrs	15000	16800	0	31,800	gal/day	246.5	Gal/ERU	107.2	gpcd
2014 Avg. runtime	1.82	hrs	1.75	hrs	10920	10500		21,420	gal/day	166.0	Gal/ERU	72.2	gpcd
2011 Avg. Wet Season runtime	1.868	hrs	1.59	hrs	11208	9534	0	20,742	gal/day	160.8	Gal/ERU	69.9	gpcd
2012 Avg. Wet Season runtime	1.914	hrs	1.92	hrs	11484	11544	0	23,028	gal/day	178.5	Gal/ERU	77.6	gpcd
2013 Avg. Wet Season runtime	1.731	hrs	1.76	hrs	10386	10536	0	20,922	gal/day	162.2	Gal/ERU	70.5	gpcd
2014 Avg. Wet Season runtime	2.228	hrs	1.49	hrs	13368	8952	0	22,320	gal/day	173.0	Gal/ERU	75.2	gpcd
ERUs in Basin 129													

Lindvig	Pump 1 @ gpm= 515		Pump 2 @ gpm 500		Pump 1	Pump 2	Total		**Total Flows per ERU**		**Total Flows per Capita per day**	
2/19/2014 High runtime	2.8	hrs	2.80	hrs	86520	84000	170,520	gal/day	197.6	Gal/ERU	85.9	gpcd
4/8/2008 High runtime	3.8	hrs	3.90	hrs	117420	117000	234,420	gal/day	271.6	Gal/ERU	118.1	gpcd
2014 Avg. runtime	1.995	hrs	1.96	hrs	61645.5	58800	120,446	gal/day	139.6	Gal/ERU	60.7	gpcd
2011 Avg. Wet Season runtime	2.381	hrs	2.43	hrs	73572.9	72840	146,413	gal/day	169.7	Gal/ERU	73.8	gpcd
2012 Avg. Wet Season runtime	2.45	hrs	2.48	hrs	75705	74520	150,225	gal/day	174.1	Gal/ERU	75.7	gpcd
2013 Avg. Wet Season runtime	2.134	hrs	2.16	hrs	65940.6	64740	130,681	gal/day	151.4	Gal/ERU	65.8	gpcd
2014 Avg. Wet Season runtime	2.139	hrs	2.15	hrs	66095.1	64560	130,655	gal/day	151.4	Gal/ERU	65.8	gpcd
ERUs in Basin 863												

MSC (Central Basin)	Pump 1 @ gpm= 705		Pump 2 @ gpm 725		Pump 1	Pump 2	Pump 3	Total		**Excess Flows per ERU**	**Total Flows per ERU**		**Total Flows per Capita per day**	
2/18/2014 High runtime	1.00	hrs	2.20	hrs	42300	95700	0	138,000	gal/day		166.1	Gal/ERU	72.2	gpcd
4/8/2008 High runtime	2.60	hrs	1.30	hrs	109980	56550	91920	258,450	gal/day		311.0	Gal/ERU	135.2	gpcd
2014 Avg. runtime	0.80	hrs	0.90	hrs	33840	39150	2298	75,288	gal/day		90.6	Gal/ERU	39.4	gpcd
2011 Avg. Wet Season runtime	1.08	hrs	0.61	hrs	45557.1	26317.5	0	71,875	gal/day		86.5	Gal/ERU	37.6	gpcd
2012 Avg. Wet Season runtime	1.30	hrs	0.66	hrs	55032.3	28884	0	83,916	gal/day		101.0	Gal/ERU	43.9	gpcd
2013 Avg. Wet Season runtime	0.87	hrs	0.76	hrs	36927.9	33060	0	69,988	gal/day		84.2	Gal/ERU	36.6	gpcd
2014 Avg. Wet Season runtime	0.65	hrs	1.31	hrs	27664.2	56854.5	0	84,519	gal/day		101.7	Gal/ERU	44.2	gpcd
ERUs in Basin 831														

6th Ave	Pump 1 @ gpm= 142		Pump 2 @ gpm 142		Pump 1	Pump 2	Total		**Total Flows per ERU**		**Total Flows per Capita per day**	
2/18/2014 High runtime	4.90	hrs	4.40	hrs	41748	37488	79,236	gal/day	247.6	Gal/ERU	107.7	gpcd
4/8/2008 High runtime	2.20	hrs	2.50	hrs	18744	21300	40,044	gal/day	125.1	Gal/ERU	54.4	gpcd
2014 Avg. runtime	2.07	hrs	1.73	hrs	17636.4	14739.6	32,376	gal/day	101.2	Gal/ERU	44.0	gpcd
2011 Avg. Wet Season runtime	3.03	hrs	2.36	hrs	25824.12	20115.72	45,940	gal/day	143.6	Gal/ERU	62.4	gpcd
2012 Avg. Wet Season runtime	2.62	hrs	2.85	hrs	22279.8	24307.56	46,587	gal/day	145.6	Gal/ERU	63.3	gpcd
2013 Avg. Wet Season runtime	1.99	hrs	1.61	hrs	16912.2	13751.28	30,663	gal/day	95.8	Gal/ERU	41.7	gpcd
2014 Avg. Wet Season runtime	2.46	hrs	2.24	hrs	20942.16	19050.72	39,993	gal/day	125.0	Gal/ERU	54.3	gpcd
ERUs in Basin 320												

9th Ave	Pump 1 @ gpm= 100		Pump 2 @ gpm 100		Pump 1	Pump 2	Pump 3	Total		**Total Flows per ERU**		**Total Flows per Capita per day**	
2/17/2014 High runtime	1.80	hrs	2.00	hrs	10800	12000		22,800	gal/day	308.1	Gal/ERU	134.0	gpcd
4/8/2008 High runtime	2.10	hrs	1.90	hrs	12600	11400		24,000	gal/day	324.3	Gal/ERU	141.0	gpcd
2014 Avg. runtime	0.80	hrs	0.90	hrs	4800	5400		10,200	gal/day	137.8	Gal/ERU	59.9	gpcd
2011 Avg. Wet Season runtime	1.09	hrs	1.04	hrs*	6534	6252		12,786	gal/day	172.8	Gal/ERU	75.1	gpcd
2012 Avg. Wet Season runtime	1.35	hrs	1.31	hrs	8070	7872		15,942	gal/day	215.4	Gal/ERU	93.7	gpcd
2013 Avg. Wet Season runtime	0.91	hrs	1.00	hrs	5484	5988		11,472	gal/day	155.0	Gal/ERU	67.4	gpcd
2014 Avg. Wet Season runtime	1.05	hrs	1.20	hrs	6306	7194		13,500	gal/day	182.4	Gal/ERU	79.3	gpcd
ERUs in Basin 74													

*Omitted data from apparent bad impeller

Alasund Meadows (Noll Rd. Basin)	Pump 1 @ gpm= 125	Pump 2 @ gpm 125	Pump 1	Pump 2	Total		Total Flows per ERU	Total Flows per Capita per day
2/17/2014 High runtime	3.50 hrs	2.80 hrs	26250	21000	47,250 gal/day		513.6 Gal/ERU	223.3 gpcd
4/8/2008 High runtime	1.40 hrs	1.30 hrs	10500	9750	20,250 gal/day		220.1 Gal/ERU	95.7 gpcd
2014 Avg. runtime	1.60 hrs	1.30 hrs	12000	9750	21,750 gal/day		236.4 Gal/ERU	102.8 gpcd
2011 Avg. Wet Season runtime	1.17 hrs	1.19 hrs	8790	8947.5	17,738 gal/day		192.8 Gal/ERU	83.8 gpcd
2012 Avg. Wet Season runtime	1.44 hrs	1.76 hrs	10822.5	13192.5	24,015 gal/day		261.0 Gal/ERU	113.5 gpcd
2013 Avg. Wet Season runtime	1.50 hrs	1.20 hrs	11220	9015	20,235 gal/day		219.9 Gal/ERU	95.6 gpcd
2014 Avg. Wet Season runtime	1.72 hrs	1.73 hrs	12900	12975	25,875 gal/day		281.3 Gal/ERU	122.3 gpcd
ERUs in Basin 92								

Applewood	Pump 1 @ gpm= 135	Pump 2 @ gpm 135	Pump 1	Pump 2	Total		Total Flows per ERU	Total Flows per Capita per day
2/18/2014 High runtime	1.80 hrs	1.20 hrs	14580	9720	24,300 gal/day		528.3 Gal/ERU	229.7 gpcd
4/8/2008 High runtime	2.90 hrs	0.00 hrs	23490	0	23,490 gal/day		510.7 Gal/ERU	222.0 gpcd
2014 Avg. runtime	1.30 hrs	0.80 hrs	10530	6480	17,010 gal/day		369.8 Gal/ERU	160.8 gpcd
2011 Avg. Wet Season runtime	1.21 hrs	0.77 hrs	9760.5	6237	15,998 gal/day		347.8 Gal/ERU	151.2 gpcd
2012 Avg. Wet Season runtime	1.45 hrs	0.86 hrs	11777.4	6982.2	18,760 gal/day		407.8 Gal/ERU	177.3 gpcd
2013 Avg. Wet Season runtime	1.46 hrs	0.85 hrs	11809.8	6885	18,695 gal/day		406.4 Gal/ERU	176.7 gpcd
2014 Avg. Wet Season runtime	1.14 hrs	0.89 hrs	9234	7209	16,443 gal/day		357.5 Gal/ERU	155.4 gpcd
ERUs in Basin 46								

Village (Village Basin)	Pump 1 @ gpm= 350	Pump 2 @ gpm 350	Pump 1	Pump 2	Pump 3	Total		Total Flows per ERU	Total Flows per Capita per day
2/17/2014 High runtime	4.90 hrs	4.60 hrs	102900	96600	0	199,500 gal/day		433.7 Gal/ERU	188.6 gpcd
4/8/2008 High runtime	4.40 hrs	4.80 hrs	92400	100800	0	193,200 gal/day		420.0 Gal/ERU	182.6 gpcd
2014 Avg. runtime	3.10 hrs	2.90 hrs	65100	60900	0	126,000 gal/day		273.9 Gal/ERU	119.1 gpcd
2011 Avg. Wet Season runtime	3.16 hrs	2.62 hrs	66318	55083		121,401 gal/day		263.9 Gal/ERU	114.7 gpcd
2012 Avg. Wet Season runtime	3.23 hrs	3.45 hrs	67893	72387		140,280 gal/day		305.0 Gal/ERU	132.6 gpcd
2013 Avg. Wet Season runtime	3.00 hrs	2.91 hrs	63042	61005		124,047 gal/day		269.7 Gal/ERU	117.2 gpcd
2014 Avg. Wet Season runtime	3.62 hrs	3.35 hrs	76041	70308		146,349 gal/day		318.2 Gal/ERU	138.3 gpcd
ERUs in Basin 460									

Bond (Finn Hill Basin)	Pump 1 @ gpm= 700	Pump 2 @ gpm 700	Pump 1	Pump 2	Pump 3	Total		Total Flows per ERU	Total Flows per Capita per day
2/17/2014 High runtime	3.40 hrs	3.30 hrs	142800	138600	0	281,400 gal/day		227.7 Gal/ERU	99.0 gpcd
12/30/2008 High runtime	2.30 hrs	2.20	96600	92400	0	189,000 gal/day		152.9 Gal/ERU	66.5 gpcd
2014 Avg. runtime	2.41 hrs	2.26 hrs	101220	94920	0	196,140 gal/day		158.7 Gal/ERU	69.0 gpcd
2011 Avg. Wet Season runtime	2.67 hrs	2.48 hrs	111972	104118		216,090 gal/day		174.8 Gal/ERU	76.0 gpcd
2012 Avg. Wet Season runtime	2.64 hrs	2.49 hrs	111048	104622		215,670 gal/day		174.5 Gal/ERU	75.9 gpcd
2013 Avg. Wet Season runtime	2.44 hrs	2.29 hrs	102438	96306		198,744 gal/day		160.8 Gal/ERU	69.9 gpcd
2014 Avg. Wet Season runtime	2.64 hrs	2.47 hrs	110964	103824		214,788 gal/day		173.8 Gal/ERU	75.6 gpcd
ERUs in Basin 1236			subtract Viking Basin in Gal/ERU						

East Basin Gravity Only (Applewood and Alasund PS Flows subtracted)		Excess Flows per ERU	Total Flows per ERU	Total Flows per Capita
ERUs in Basin	1533	Gal/ERU	218.4 Gal/ERU	95.0 gpcd
	1482.0 total ERUs - Finn Hill - MSC - 6th - 9th - Applewood - Alasund - Village			

1,326,000 gal	Total from	991,206	gal
	Total Extra	0	gal
	total Gravity Peak QTY from interceptor	334,794	gal

Appendix F

Capacity Analyses

Parametrix ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

4660 KITSAP WAY, SUITE A
BREMERTON, WA 98312-2357
T. 360.377.0014 F. 360.479.5961
www.parametrix.com

TECHNICAL MEMORANDUM

Date:	September 25, 2007
To:	Andrzej Kasiniak, Jeff Bauman, City of Poulsbo
From:	Ken Brown, Phil Struck
Subject:	Poulsbo Sanitary Sewer Preliminary Capacity Analysis
cc:	file
Project Number:	237-2237-026 (01/04)
Project Name:	Comprehensive Sanitary Sewer Plan 2007 Update

SCOPE AND BACKGROUND

The purpose of this Technical Memorandum (TM) is to perform a preliminary evaluation of sanitary sewer pipes that have been identified by the City as having potential capacity concerns due to recent or future growth. Specifically, the City identified pipes in the following areas as needing capacity evaluation:

- Finn Hill and Olhava area, particularly the sewer mains in the Olhava shopping mall that are proposed to convey sewage from the Finn Hill housing areas located west of Olhava.
- Sewer trunk line from Olhava to the Bond Road pump station.
- Viking Avenue, both north and south of SR 305.
- Caldart Avenue from a location approximately 200 feet north of Lincoln Street to Hostmark Avenue, and then down Hostmark to Highway 305.
- 8th and 9th Avenue mains between the Village pump station and the point where the main feeds into the new main recently installed in Highway 305 at Harrison Avenue.
- Noll Road, including an evaluation of providing a new sewer to serve the eastern boundary of the service area and an evaluation of the sewer main between Deer Run and the Johnson Road Chlorination Station.

Figure 1 (attached) shows the general location of these sewer mains.

DATA SOURCES AND PLANNING ASSUMPTIONS

The City's Sewer Comprehensive Plan system map dated June 2005 provided the basic information for analysis of selected portions of the collection and conveyance system. This map does not generally show pipe slopes or invert elevations in manholes, however. Slopes are the primary factor influencing the sewer pipe capacity. Record drawings (construction and surveys) were used to determine slopes when available.

Pipe segments, where no as-built survey information was available, are identified in the calculations provided in Attachment A.

Projected sewer flows were developed based on the Washington State Department of Ecology Criteria for Sewage Works Design, December 1998 (Orange Book) criteria, the Poulsbo zoning code/map, and water use data (gallons per Equivalent Residential Unit [ERU]) provided by the City.

ASSUMPTIONS

The assumptions used to calculate estimated future sewage flows is the most significant variable factor in determining future sewer main adequacy. For this analysis, it was assumed that currently vacant land will be fully built out per the current land use zoning criteria. For established residential areas, the existing density is based on an approximate count of existing lots. For vacant land, 5 dwelling units per acre for Residential Low and 14 dwelling units for Residential High was assumed. This is considered conservative, because all property will probably not be built to the maximum density. However, the City Planned Residential Development code does allow bonus densities, so the lower base density was considered an appropriate criterion for this preliminary analysis.

Per Capita Flow

The Orange Book criteria for developing the sewage flow in pipes (Q_{gpm}) uses 2.5 persons per dwelling unit and 100 gallons per person per day (gpd). A peaking factor is multiplied to represent the maximum time for water usage, which generally occurs in the morning and evening hours. For small populations of less than 400 people, a peaking factor of 4.0 is used. For populations of 3,000 persons discharging to the pipe system, a peaking factor of 3.5 is used. For populations of 10,000 persons, a peaking factor of 3 is recommended. The following formula, which incorporates reasonable stormwater infiltration rates, can therefore be used to represent the flow in a pipe:

$$Q_{gpm} = \frac{\text{Dwelling Units X 2.5 persons X 100 gallons per day X 4.0 Peaking Factor}}{\text{1440 minutes per day}}$$

An alternative method of analysis is to base sewage flows on the actual metered use of water. City records show that water use in the average residential house in Poulsbo is 189 gallons per day. A portion of this water is used for irrigation and other purposes and does not enter the sewer. However, infiltration and inflow of stormwater does enter the system, and is assumed to offset water used for other purposes. The analysis presented in this TM therefore uses the actual 189 gallons per day water use measured in the City, instead of 250 gallons per day assumed in the Orange Book. This results in estimated peak flows of 76% of the Orange Book criteria. The formula is as follows:

$$Q_{gpm} = \frac{\text{Dwelling Units X 189 gallons per day X 4.0 Peaking Factor}}{\text{1440 minutes per day}}$$

Peaking Factor

A peaking factor is applied to the average daily sewage flow to account for early morning or evening periods when many households are simultaneously using water. For smaller population groups, the Orange Book recommends multiplying the average daily sewage flow by 4.0 (ie, a peaking factor of 4). For trunk lines well downstream from the primary home sources, a peaking factor of 3.5 can be used. A peaking factor of 3.5 would result in estimated peak flows of about 88% of those computed with a peaking factor of 4.0.

The Olhava Master Plan used a peaking factor of 2.5, which is considered low. The negotiated contract sewage flow rates, based on the Schedule B Parcel Development Plan, developed sewage flow rates more consistent with a higher peaking factor. This preliminary analysis treats Olhava similar to other Poulsbo areas by applying the Orange Book 4.0 peaking factor to commercial properties and the representative residential historical values to the homes.

Pipe Coefficient and Fullness

The "n" value is a representation of the pipe wall smoothness. The Orange Book recommends using 0.013. A more realistic value for new PVC pipe is 0.012. Over the years, as pipes deteriorate and become rougher, the 0.013 factor is more appropriate. To ensure a conservative analysis, the analysis presented in this TM uses the 0.013 value. If the 0.012 value was used, the capacity of individual pipes would increase by 0.013 / 0.012 = 1.083, or 8.3 percent.

This analysis computes the full flow Q based on the pipe running completely full, when actually, the maximum Q occurs when the pipe is 93.82% full. For an 8-inch pipe, this occurs when the pipe is running at a depth of 7.5 inches. At that depth the maximum Q is about 7% greater than what is shown on the tables. This factor has been ignored, resulting in an additional small factor of safety.

The City has indicated that given the above factors, a 100 percent maximum full flow is the acceptable upper limit for pipe capacity. It should be noted that this preliminary analysis is based on general computations and no backwater analysis was performed. A future more detailed analysis of specific problem sewer runs should therefore be accomplished to determine more precisely the maximum pipe capacity.

Slope

The primary factor for determining capacity of a pipe is the slope. The pipe slope is determined by surveying the manhole rims and then measuring down to the invert (or bottom) of the pipe. A small measurement error, especially in measuring down, could affect the slope. For example, a 100-foot pipe run that drops 6 inches has a slope of 0.5%. A measurement error of 1-inch would increase the drop to 7 inches, resulting in a slope of 0.58%. This would increase the pipe capacity by about 8%. Therefore, for relatively flat pipes that appear to be inadequate, it is recommended that the slope be reconfirmed by survey prior to planning for replacement.

ANALYTICAL METHODS

A spreadsheet was developed for each basin in order to individually analyze each pipe run. Pipe runs are keyed to a system map. The spreadsheet calculations (Attachment A) compute the theoretical full flow capacity based on the pipe diameter and pipe slope, and then compares the value to the projected flow. A percent of full flow capacity is then computed. An analysis of individual runs was made to determine how significant a near-capacity pipe run may be, based on the City's criteria of 100 percent maximum capacity. Specific pipe runs that should be considered as problem areas are highlighted with pipes that exceed 80 percent of capacity highlighted in orange, and pipes that exceed 100 percent of capacity are highlighted in red. Figures are provided in Attachment B showing segments that exceed 100 percent of capacity.

FINDINGS

A spreadsheet for each basin is provided in Attachment A. Each spreadsheet presents a summary of the system capacity by pipe segment. The following sections summarize the findings presented in the individual spreadsheets.

Finn Hill / Olhava Basin

The Olhava Master Plan estimated future flows of 294 gpm, based on a peaking factor of 2.5, which is considered low. The Finn Hill pump station design (N. L. Olsen & Assoc. 2007) computed future flows of 372 gpm for the service area based on a peaking factor of 4.0. Although Olson used a different method of analysis, his results are consistent with the analysis presented herein (365 gpm).

The Finn Hill pump station will serve about half of the Finn Hill Basin. The other half of the basin was computed to have a future flow of 375 gpm (which would enter Olhava next to Home Depot). These three flows add to 1041 gpm, which is the flow leaving Olhava and going down SR 305 towards the Bond Road pump station (increasing to 1161 gpm after the Viking Avenue flow enters the system).

Projected future peak flow would occur when the Olhava development is built-out, and residential portions of the basin outside of Olhava are also fully developed. The Olhava sewer system was originally designed to serve only the Olhava development. Pipes are all 8-inches in diameter, and at very flat slopes – less than 0.4 percent in several places.

The analysis indicates that up to 1,700 feet of pipe in Olhava may have insufficient capacity to convey flows at full build-out (see Attachment A and B for details). Using the Olhava system to convey flow from residential development outside the Olhava development is likely not feasible without increasing pipe diameter.

Key criteria for evaluating significance of the capacity issue in the Olhava Basin include the schedule for build-out, and build-out assumptions. Full build-out may not occur for 30 years or more, and may never build out to the full density of 5 dwelling units per acre. A build-out density of 4 dwelling units per acre would result in an estimated peak flow of 80 percent of that shown in the spreadsheet. This change in assumptions would likely eliminate capacity problems in many segments. It is therefore recommended that build-out assumptions be verified prior to decisions to increase capacity.

Pipes can be economically (about $50 per lineal foot, plus overhead, mobilization, and tax) increased in diameter by either pipe bursting, if located in a street, or by open trench replacement.

SR 305 and Bond Road Pipe Run

This 8-inch main carries all the flow from Olhava and the Finn Hill basin. It currently carries a very small 60 gpm; full build-out is projected to be 1041 gpm, increasing to 1161 gpm with the Viking Way inflow.

These flows will result in many of the pipe runs to be at about 85 percent of capacity. About 1,000 lineal feet of pipe between Viking Way and the Bond Road pump station will exceed 100 percent of capacity. Of particular concern is a flat segment (0.8 percent slope) on Bond Road just upstream of the branch into the Bond Road pump station. We estimate that this main is currently running at 31 percent of capacity and may exceed capacity in several years.

A possible alternative to increasing the pipe diameters downstream of Viking Avenue is to place a diversion structure in the SR 305/Viking Avenue intersection and route excess flow down the existing Viking Avenue sewer main to the Lindvig pump station.

Viking Basin

Both the north and south ends of the Viking Basin are expected to experience significant development (low and high density residential). No pipe segments were identified as exceeding capacity. The southern end of the Viking sewage distribution system is more significantly affected because of the flat terrain. Either a new pump station, or an expansion of the Liberty Bay Pump Station, will be required.

The northern distribution system slopes towards Lindvig, and therefore no capacity problems are anticipated.

Additional survey information is needed for several of the sewer mains prior to finalizing this analysis. Also, a more rigorous analysis of future growth at the south end of the basin should also be accomplished, including consideration or potential annexation areas.

Caldart Basin

The sewer main flowing south on Caldart Avenue likely has adequate capacity for the full build-out of the Caldart basin. However, there are two potential capacity concerns that should be investigated:

- Several of the mains located north of Lincoln are shown as 10-inch diameter on some references. We have assumed them to be 12-inch diameter, but this should be confirmed.
- Two sections of pipe in Caldart in front of the high school have computed slopes of 0.36% and 0.40%, marginally adequate to support future flows. Elevations and measure downs are based on Parametrix surveys in support of the Caldart Street construction. The rim elevations are most likely accurate. The measure downs should be reconfirmed and the slopes adjusted if necessary.

No slope information was available for the pipe run on Hostmark; however, since the street is steep in this area, there is likely low potential for capacity problems, nor any need to obtain slope information.

No as-built information was available for the pipe run across SR 305 to the point where it connects with the flow from the Village Pump Station. This segment could potentially be a concern if the slopes are flat. These mains, and especially the ones downstream of the combining of the Caldart and Village flows, should be surveyed to obtain accurate slopes.

8th and 9th Street Basin

No as-built or survey data showing pipe slopes was available. No capacity problems are expected in the pipes flowing north to the Village Pump Station because sewer flows are mostly from commercial areas, which typically generate low flows.

A potential capacity problem exists where the 4-inch force main from the Village pump station combines with the larger flow from Caldart and Hostmark. Although it flows into a 10-inch main, the flows could be near capacity if these pipes have a flat slope. It is recommended that these pipes (identified as pipe runs 50 through 53 and beyond to the new SR 305 interceptor) be surveyed to determine slope and to confirm capacity.

Noll Road Basin

To support development of property located east of Noll Road and beginning just south of Lincoln, a new 9,600 linear foot sewer trunk main must be installed. This new main will connect to the gravity main leaving the Deer Run housing area. This existing main flows to the Johnson Road Chlorination Station.

The new Noll Road sewer main is routed on terrain sloping gently to the south. The average slope of the main will be about 1.2%, sufficient to support an 8-inch main, and likely increasing to a 10-inch main near Deer Park.

This new main will connect to an existing 10-inch ductile iron sewer main just south of Deer Park. This 10-inch main flows at a relatively constant slope of 0.47 to 0.57 percent slope until dropping down a fairly steep slope leading to Johnson Road. This flat 10-inch main is currently operating at about 25% of full flow capacity. However, with the total build-out of the Noll Road basin, it will increase to 144% of capacity. At some time in the future, either a parallel main must be installed, or the existing 10-inch main replaced with a 15-inch diameter main.

CONCLUSIONS

It is likely that pipe segments in several areas of the City are potentially deficient within the next 5 to 10 years. The highest priority areas are within the Olhava basin, followed by the Noll Road basin. A single pipe segment in the Caldart basin marginally exceeds full build-out flows. Capacity in the Viking basin is adequate with the exception of the Liberty Bay pump station, which needs to be expanded.

Conveyance pipes in the Olhava basin that have long-term capacity concerns are currently flowing at about 20 percent of total capacity. Capacity issues in the Olhava basin will generally not occur until approximately 300 gpm (400+ ERUs) are added to the system. The proposed plat of Cook Addition and other residential development in the Finn Hill basin that is outside Olhava are estimated to add approximately 300 gpm so it may be appropriate for the future residential development outside of Olhava to fund conveyance capacity increases in this basin.

RECOMMENDATIONS

Confirm Assumptions

Capacity issues in the Olhava basin are largely related to residential development located outside the boundaries of the Olhava development. Residential development plans within the Olhava and Finn Hill basins should therefore be confirmed prior to planning for capacity expansion or replacement in this basin.

Slope is a primary factor for determining capacity of a pipe. A small measurement error, especially in measuring down from the rim, could affect the slope resulting in significant change in capacity. Therefore, for relatively flat pipes that appear to be inadequate, it is recommended that the slope be reconfirmed by survey prior to planning for capacity expansion or replacement.

Build-out assumptions should be verified. For example, a reduction in build-out density from 5 to 4 dwelling units per acre would decrease estimated peak flows by 20 percent. A change in build-out assumption would have a significant effect on the capacity analysis. It is therefore recommended that build-out assumptions be verified prior to decisions to increase capacity.

Additional As-Built Information

No as-built information was available for a number of pipe runs that could potentially be a concern if the slopes are flat. The following areas should be surveyed to obtain accurate slopes and then be evaluated to verify capacity:

- In the Caldart/Hostmark basin, the pipe run across SR 305 to the point where it connects with the flow from the Village Pump Station.
- In the 8th and 9th Street basins, pipes identified as pipe runs 50 through 53 and beyond to the new SR 305 interceptor.

Update Sewer System Hydraulic Model

The City's last hydraulic model of the sewer system was completed approximately 10 years ago. Because of the growth that has occurred during the last 10 years, and the need for a more precise capacity assessment, it is recommended that a new hydraulic model be developed to more accurately identify existing and potential future capacity concerns.

Update Capital Improvement Plan

Based on this assessment, the following projects in the Olhava basin are recommended to be added to the 6-year Capital Improvement Plan (CIP) that is included in the Sanitary Sewer Comprehensive Plan:

- Olhava basin near Wal-Mart, Pipe Run 18. Increase 246-ft of 8-inch diameter pipe to 10 or 12-inches diameter. The preliminary cost estimate for this project is $40,000.
- Olhava basin on Bond Road, Pipe Run 94. Increase 70-ft of 8-inch diameter pipe to 10 or 12-inches diameter. The preliminary cost estimate for this project is $25,000.

Projects to increase capacity of the other segments in the Olhava basin that exceed capacity for 100 percent of full build-out should be added to the CIP after development assumptions and as-built conditions are confirmed. These pipe segments appear to have adequate capacity in the near term to allow completion of a more detailed hydraulic model and back water analysis that would verify capacity conditions.

The following additional projects should be added to the CIP:

- Viking basin. Liberty Bay pump station. Increase capacity from 100 gpm to 400 gpm. The preliminary cost estimate for this project assumes a complete rebuild of the pump station at a cost of $250,000.
- Hydraulic model update. The preliminary cost estimate for this project is $50.000.

If you have any questions or need additional information, please contact us anytime at 360-377-0014. Thank you.

Attachments:

A Capacity Analysis
B Figures

ATTACHMENT A

Capacity Analysis

FINN HILL / OLHAVA BASINS

Three sub basins feed through the Olhava shopping center sewer system. Flow from the Finn Hill Lift Station installed to serve the Cook Residential Plat and other properties along Finn Hill was computed by Norm Olsen (Mar 2007) to be 372 gpm based on serving 105 acres of medium density housing. Based on Poulsbo guidance of 189 gpd per ERU, we have used a flow of 276 gpm for this area. The second basin is located north and east of the Cook Plat, is 107 acres of medium density housing, and is planned to be routed through Olhava. This sewer system would connect behind the Home Depot store. The estimated flow is 281 gpm (based on 189 gpd/ERU).

Current estimated peak flow is what is now flowing through the system, which is very small since no housing in any of the three basins flows through the system. **Projected estimated peak flow** is what will ultimately be flowing through the system when all housing in the Finn Hill area is complete, and all commercial development and housing in Olhava is complete.

Calculated full flow capacity is based on the Manning Equation Q=1.486/n(AR^2/3)S^1/2, where n = 0.013. The n value is conservative and is based on the Department of Ecology Orange Book. For the pipe in this system, an n value of 0.012 may be more realistic. Using the smaller value would provide a theoretical increase in Q capacity of about 8%. Our formula uses the more conservative n = 0.013 value.

Brief Summary and Conclusion of Findings: The Olhava sanitary sewer distribution system was designed to serve only the Olhava development. Pipes are all 8-inch diameter and many are placed on very flat slopes. Using the Olhava system to carry sanitary sewer flows from the Finn Hill developments to the east is not feasible without upsizing the pipes. Upsizing to 10- and 12-inch pipes by pipe bursting may be feasible. Also, the 8-inch main down SR 305 to the new Bond Road PS will eventually exceed capacity as new residential developments come on line. A flat section of pipe on Bond Road just upstream of the pump station is especially undersized and will reach capacity soon.

Shading indicates future sewer flows >/- 80% of pipe capacity.
Shading indicates future sewer flows >/- 100% of pipe capacity.

Basin: Finn Hill/Olhava		Pipe Run	10	COMMENTS
Dia:	8 in.	A =	0.349	Inflow from Finn Hill P.S.
Slope:	0.53 %	R =	0.167	
Current estimated peak flow			0 gpm	0 % of full capacity
Projected estimated peak flow			276 gpm	
Calculated full flow capacity			395 gpm	70 % of full capacity

Basin: Finn Hill/Olhava		Pipe Run	11	COMMENTS
Dia:	8 in.	A =	0.349	Walmart inflow added
Slope:	0.48 %	R =	0.167	
Current estimated peak flow			6 gpm	2 % of full capacity
Projected estimated peak flow			276 gpm	
Calculated full flow capacity			376 gpm	73 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 12	COMMENTS
Dia: 8 in.	A = 0.349	Future business inflow added
Slope: 0.37 %	R = 0.167	
Current estimated peak flow	6 gpm	2 % of full capacity
Projected estimated peak flow	282 gpm	
Calculated full flow capacity	330 gpm	86 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 13	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.72 %	R = 0.167	
Current estimated peak flow	6 gpm	1 % of full capacity
Projected estimated peak flow	292 gpm	
Calculated full flow capacity	460 gpm	63 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 14	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.49 %	R = 0.167	
Current estimated peak flow	6 gpm	2 % of full capacity
Projected estimated peak flow	292 gpm	
Calculated full flow capacity	379 gpm	77 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 15	COMMENTS
Dia: 8 in.	A = 0.349	Business inflow (Starbucks?)
Slope: 0.48 %	R = 0.167	
Current estimated peak flow	40 gpm	11 % of full capacity
Projected estimated peak flow	300 gpm	
Calculated full flow capacity	376 gpm	80 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 16	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.44 %	R = 0.167	
Current estimated peak flow	40 gpm	11 % of full capacity
Projected estimated peak flow	300 gpm	
Calculated full flow capacity	360 gpm	83 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 17	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.44 %	R = 0.167	
Current estimated peak flow	40 gpm	11 % of full capacity
Projected estimated peak flow	310 gpm	
Calculated full flow capacity	360 gpm	86 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 18	COMMENTS
Dia: 8 in.	A = 0.349	Home Depot, Olympic College, Housing
Slope: 0.45 %	R = 0.167	
Current estimated peak flow	50 gpm	14 % of full capacity
Projected estimated peak flow	760 gpm	
Calculated full flow capacity	364 gpm	209 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 19	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.76 %	R = 0.167	
Current estimated peak flow	50 gpm	6 % of full capacity
Projected estimated peak flow	760 gpm	
Calculated full flow capacity	901 gpm	84 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 20	COMMENTS
Dia: 8 in.	A = 0.349	Olympic College inflow from Pump Station
Slope: 0.67 %	R = 0.167	
Current estimated peak flow	61 gpm	14 % of full capacity
Projected estimated peak flow	61 gpm	
Calculated full flow capacity	444 gpm	14 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 21	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.36 %	R = 0.167	
Current estimated peak flow	61 gpm	7 % of full capacity
Projected estimated peak flow	65 gpm	
Calculated full flow capacity	833 gpm	8 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 22	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.94 %	R = 0.167	
Current estimated peak flow	61 gpm	7 % of full capacity
Projected estimated peak flow	65 gpm	
Calculated full flow capacity	929 gpm	7 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 23	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: xx %	R = 0.167	
Current estimated peak flow	0 gpm	#VALUE! % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	#VALUE! gpm	Need Olhava Sheet C3.17 from City

Basin: Finn Hill/Olhava	Pipe Run 24	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: xxd %	R = 0.167	
Current estimated peak flow	0 gpm	#VALUE! % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	#VALUE! gpm	Need Olhava Sheet C3.17 from City

Basin: Finn Hill/Olhava	Pipe Run 25	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 3.39 %	R = 0.167	
Current estimated peak flow	61 gpm	6 % of full capacity
Projected estimated peak flow	81 gpm	
Calculated full flow capacity	998 gpm	8 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 26	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.52 %	R = 0.167	
Current estimated peak flow	61 gpm	5 % of full capacity
Projected estimated peak flow	81 gpm	
Calculated full flow capacity	1274 gpm	6 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 27	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 6.02 %	R = 0.167	
Current estimated peak flow	61 gpm	5 % of full capacity
Projected estimated peak flow	81 gpm	
Calculated full flow capacity	1330 gpm	6 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 28	COMMENTS
Dia: 8 in.	A = 0.349	Future Finn Hill housing inflow at Home Depot
Slope: 2.81 %	R = 0.167	
Current estimated peak flow	61 gpm	7 % of full capacity
Projected estimated peak flow	362 gpm	
Calculated full flow capacity	909 gpm	40 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 29	COMMENTS
Dia: 8 in.	A = 0.349	Home Depot added
Slope: 0.53 %	R = 0.167	
Current estimated peak flow	75 gpm	19 % of full capacity
Projected estimated peak flow	380 gpm	
Calculated full flow capacity	395 gpm	96 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 30	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.38 %	R = 0.167	
Current estimated peak flow	75 gpm	22 % of full capacity
Projected estimated peak flow	380 gpm	
Calculated full flow capacity	334 gpm	114 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 31	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.39 %	R = 0.167	
Current estimated peak flow	75 gpm	22 % of full capacity
Projected estimated peak flow	380 gpm	
Calculated full flow capacity	339 gpm	112 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 32	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.37 %	R = 0.167	
Current estimated peak flow	75 gpm	23 % of full capacity
Projected estimated peak flow	380 gpm	
Calculated full flow capacity	330 gpm	115 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 33	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.54 %	R = 0.167	
Current estimated peak flow	75 gpm	19 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	398 gpm	100 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 34	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.50 %	R = 0.167	
Current estimated peak flow	75 gpm	20 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	383 gpm	104 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 35	COMMENTS
Dia: 8 in.	A = 0.349	Bank added
Slope: 0.44 %	R = 0.167	
Current estimated peak flow	80 gpm	22 % of full capacity
Projected estimated peak flow	410 gpm	
Calculated full flow capacity	360 gpm	114 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 36	COMMENTS
Dia: 8 in.	A = 0.349	Hotel/Resturant added
Slope: 0.68 %	R = 0.167	
Current estimated peak flow	80 gpm	18 % of full capacity
Projected estimated peak flow	430 gpm	Hotel/Resturant added
Calculated full flow capacity	447 gpm	96 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 37	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.48 %	R = 0.167	
Current estimated peak flow	80 gpm	6 % of full capacity
Projected estimated peak flow	450 gpm	Upper Finn Hill flow added
Calculated full flow capacity	1269 gpm	35 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 38	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 6.36 %	R = 0.167	
Current estimated peak flow	80 gpm	6 % of full capacity
Projected estimated peak flow	450 gpm	
Calculated full flow capacity	1367 gpm	33 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 41	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 1.31 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	620 gpm	2 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 42	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 6.00 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	1328 gpm	1 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 43	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 6.00 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	15 gpm	
Calculated full flow capacity	1328 gpm	1 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 44	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 3.70 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	20 gpm	
Calculated full flow capacity	1043 gpm	2 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 50	COMMENTS
Dia: 8 in.	A = 0.349	Housing and maybe portions of Oly College
Slope: 5.89 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	1316 gpm	1 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 51	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 6.01 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	1329 gpm	1 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 52	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.66 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	1290 gpm	1 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 53	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.88 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	15 gpm	
Calculated full flow capacity	1314 gpm	1 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 54	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 1.02 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	20 gpm	
Calculated full flow capacity	547 gpm	4 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 55	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 1.05 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	20 gpm	
Calculated full flow capacity	555 gpm	4 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 56	COMMENTS
Dia: 8 in.	A = 0.349	Housing along Road E
Slope: 2.80 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	50 gpm	
Calculated full flow capacity	907 gpm	6 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 57	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 6.27 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	50 gpm	
Calculated full flow capacity	1357 gpm	4 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 58	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.70 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	50 gpm	
Calculated full flow capacity	1294 gpm	4 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 59	COMMENTS
Dia: 8 in.	A = 0.349	Housing from Road D
Slope: 4.53 %	R = 0.167	
Current estimated peak flow	10 gpm	1 % of full capacity
Projected estimated peak flow	100 gpm	
Calculated full flow capacity	1154 gpm	9 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 60	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.32 %	R = 0.167	
Current estimated peak flow	10 gpm	1 % of full capacity
Projected estimated peak flow	100 gpm	
Calculated full flow capacity	826 gpm	12 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 61	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.86 %	R = 0.167	
Current estimated peak flow	10 gpm	2 % of full capacity
Projected estimated peak flow	121 gpm	
Calculated full flow capacity	503 gpm	24 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 70	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 1.93 %	R = 0.167	
Current estimated peak flow	10 gpm	1 % of full capacity
Projected estimated peak flow	121 gpm	
Calculated full flow capacity	753 gpm	16 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 71	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.99 %	R = 0.167	
Current estimated peak flow	60 gpm	5 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1211 gpm	73 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 72	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 5.77 %	R = 0.167	
Current estimated peak flow	60 gpm	5 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1302 gpm	68 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 73	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 5.33 %	R = 0.167	
Current estimated peak flow	60 gpm	5 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1251 gpm	70 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 74	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 6.07 %	R = 0.167	
Current estimated peak flow	60 gpm	4 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1335 gpm	66 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 75	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 8.83 %	R = 0.167	
Current estimated peak flow	60 gpm	4 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1611 gpm	55 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 76	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.93 %	R = 0.167	
Current estimated peak flow	60 gpm	5 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1204 gpm	73 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 77	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 11.5 %	R = 0.167	
Current estimated peak flow	60 gpm	3 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	1837 gpm	48 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 78	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 2.06 %	R = 0.167	
Current estimated peak flow	60 gpm	8 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	778 gpm	113 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 79	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 2.88 %	R = 0.167	
Current estimated peak flow	60 gpm	7 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	920 gpm	96 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 80	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 2.88 %	R = 0.167	
Current estimated peak flow	60 gpm	7 % of full capacity
Projected estimated peak flow	881 gpm	
Calculated full flow capacity	920 gpm	96 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 81	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 6.05 %	R = 0.167	Viking Ave Added
Current estimated peak flow	150 gpm	11 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1333 gpm	74 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 82	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.10 %	R = 0.167	
Current estimated peak flow	150 gpm	14 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1098 gpm	89 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 83	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 2.02 %	R = 0.167	
Current estimated peak flow	150 gpm	19 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	770 gpm	127 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 84	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 3.68 %	R = 0.167	
Current estimated peak flow	150 gpm	14 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1040 gpm	94 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 85	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 6.32 %	R = 0.167	
Current estimated peak flow	150 gpm	11 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1363 gpm	72 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 86	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 5.54 %	R = 0.167	
Current estimated peak flow	150 gpm	12 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1276 gpm	77 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 87	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.91 %	R = 0.167	
Current estimated peak flow	150 gpm	12 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1201 gpm	82 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 88	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.14 %	R = 0.167	
Current estimated peak flow	150 gpm	14 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1103 gpm	89 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 89	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 2.77 %	R = 0.167	
Current estimated peak flow	150 gpm	17 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	902 gpm	109 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 90	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.60 %	R = 0.167	
Current estimated peak flow	150 gpm	13 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1163 gpm	84 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 91	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 3.09 %	R = 0.167	
Current estimated peak flow	150 gpm	16 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	953 gpm	103 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 92	COMMENTS
Dia: 8 in.	A = 0.349	Down SR 305 to Bond Rd Pump Sta
Slope: 4.10 %	R = 0.167	
Current estimated peak flow	150 gpm	14 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1098 gpm	89 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 93	COMMENTS
Dia: 8 in.	A = 0.349	**BOND ROAD**
Slope: 2.68 %	R = 0.167	
Current estimated peak flow	150 gpm	17 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	887 gpm	110 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 94	COMMENTS
Dia: 8 in.	A = 0.349	**BOND ROAD**
Slope: 0.80 %	R = 0.167	
Current estimated peak flow	150 gpm	31 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	485 gpm	202 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 95	COMMENTS
Dia: 8 in.	A = 0.349	**BRANCH TO BOND PS**
Slope: 2.77 %	R = 0.167	
Current estimated peak flow	150 gpm	17 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	902 gpm	109 % of full capacity

Basin: Finn Hill/Olhava	Pipe Run 96	COMMENTS
Dia: 12 in.	A = 0.785	**BRANCH TO BOND PS**
Slope: 1.18 %	R = 0.250	
Current estimated peak flow	150 gpm	9 % of full capacity
Projected estimated peak flow	980 gpm	
Calculated full flow capacity	1736 gpm	56 % of full capacity

CALDART AND HOSTMARK BASIN

The majority of this basin has been built out and is low density residential. There are several high density residential zones, and they have been assumed to eventually be built out at 14 dwelling units per acre. The new Chateau Ridge and Talon Glenn housing areas at the end of Caldart flow down thru Forrest Rock and do therefore not enter this system. Snowberry Bungalow does enter this system.

Where actual housing lots exist, they were counted to determine the ERUs. Where vacant property exists, it is assumed that they will be developed at 5 dwelling units per acre for low density residential. The criteria of 189 gpd per ERU was used. In accordance with the Orange Book criteria, a peaking factor of 4.0 was used.

Current estimated peak flow is what is now flowing through the system. **Projected estimated peak flow** is what will ultimately be flowing through the system when all housing, including high density housing, is complete.

Calculated full flow capacity is based on the Manning Equation Q=1.486/n(AR^2/3)S^1/2, where n = 0.013.

Brief Summary and Conclusion of Findings: The City should reconfirm that all lines in Caldart are 12-inch. Reference to 10-inch lines is made in the survey. The 12-inch mains in the relatively flat Caldart Street carry the sewer flow adequately. The 8-inch mains in the relatively steep Hostmark Street are likely adequate, but slopes should be determined by survey or asbuilt information to confirm capacity.

Shading indicates future sewer flows >/- 80% of pipe capacity.
Shading indicates future sewer flows >/- 100% of pipe capacity.

Basin: Caldart/Hostmark	Pipe Run 10	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 1.46 %	R = 0.250	
Current estimated peak flow	350 gpm	18 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	1931 gpm	21 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 11	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 0.48 %	R = 0.250	
Current estimated peak flow	350 gpm	32 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	1107 gpm	36 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 12	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 0.89 %	R = 0.250	
Current estimated peak flow	350 gpm	23 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	1508 gpm	27 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 13	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 0.84 %	R = 0.250	
Current estimated peak flow	350 gpm	24 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	1465 gpm	27 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 14	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 0.58 %	R = 0.250	
Current estimated peak flow	350 gpm	29 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	1217 gpm	33 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 15	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 0.58 %	R = 0.250	
Current estimated peak flow	350 gpm	29 % of full capacity
Projected estimated peak flow	400 gpm	
Calculated full flow capacity	1217 gpm	33 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 16	COMMENTS
Dia: 12 in.	A = 0.785	
Slope: 0.85 %	R = 0.250	
Current estimated peak flow	450 gpm	31 % of full capacity
Projected estimated peak flow	585 gpm	
Calculated full flow capacity	1473 gpm	40 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 17	COMMENTS
Dia: 12 in.	A = 0.785	Caldart in front of NK High School
Slope: 0.40 %	R = 0.250	
Current estimated peak flow	450 gpm	45 % of full capacity
Projected estimated peak flow	585 gpm	
Calculated full flow capacity	1011 gpm	58 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 18	COMMENTS
Dia: 12 in.	A = 0.785	Caldart in front of NK High School
Slope: 0.63 %	R = 0.250	
Current estimated peak flow	485 gpm	38 % of full capacity
Projected estimated peak flow	620 gpm	
Calculated full flow capacity	1269 gpm	49 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 19	COMMENTS
Dia: 12 in.	A = 0.785	Caldart in front of NK High School
Slope: 0.36 %	R = 0.250	
Current estimated peak flow	485 gpm	51 % of full capacity
Projected estimated peak flow	620 gpm	
Calculated full flow capacity	959 gpm	65 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 20	COMMENTS
Dia: 8 in.	A = 0.349	Downstream of Caldart/Holstmark intersect
Slope: 1.80 %	R = 0.167	
Current estimated peak flow	600 gpm	83 % of full capacity
Projected estimated peak flow	770 gpm	
Calculated full flow capacity	727 gpm	106 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 21	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.20 %	R = 0.167	
Current estimated peak flow	660 gpm	59 % of full capacity
Projected estimated peak flow	830 gpm	
Calculated full flow capacity	1111 gpm	75 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 22	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.20 %	R = 0.167	
Current estimated peak flow	660 gpm	59 % of full capacity
Projected estimated peak flow	830 gpm	
Calculated full flow capacity	1111 gpm	75 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 23	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 11.2 %	R = 0.167	
Current estimated peak flow	670 gpm	37 % of full capacity
Projected estimated peak flow	840 gpm	
Calculated full flow capacity	1814 gpm	46 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 24	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 10.5 %	R = 0.167	
Current estimated peak flow	670 gpm	38 % of full capacity
Projected estimated peak flow	840 gpm	
Calculated full flow capacity	1756 gpm	48 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 25	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.50 %	R = 0.167	
Current estimated peak flow	670 gpm	53 % of full capacity
Projected estimated peak flow	840 gpm	
Calculated full flow capacity	1271 gpm	66 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 26	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 5.50 %	R = 0.167	
Current estimated peak flow	730 gpm	57 % of full capacity
Projected estimated peak flow	900 gpm	
Calculated full flow capacity	1271 gpm	71 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 27	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 3.31 %	R = 0.167	
Current estimated peak flow	740 gpm	75 % of full capacity
Projected estimated peak flow	900 gpm	
Calculated full flow capacity	986 gpm	91 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 28	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 7.00 %	R = 0.167	
Current estimated peak flow	740 gpm	52 % of full capacity
Projected estimated peak flow	900 gpm	
Calculated full flow capacity	1434 gpm	63 % of full capacity

Basin: Caldart/Hostmark	Pipe Run 29	COMMENTS
Dia: 8 in.	A = 0.349	Need data for this short connection
Slope: xx %	R = 0.167	Connects to inflow from Village PS
Current estimated peak flow	740 gpm	#VALUE! % of full capacity
Projected estimated peak flow	900 gpm	
Calculated full flow capacity	#VALUE! gpm	#VALUE! % of full capacity

VIKING NORTH AND SOUTH

Viking Way south of Finn Hill and Lindvig is relatively flat. All sewage south of Liberty Road flows to the Liberty Bay PS, where it is pumped back up to Viking Avenue in a 4-inch force main to a 10-inch main running north on Viking. There are 0.43% and 0.5% slopes upstream of the PS, and 0.35% slopes downstream of the PS. Flows to the Liberty Bay PS (100 gpm capacity) will exceed capacity in the relatively near future if new homes are constructed.

Current estimated peak flow is what is now flowing through the system. **Projected estimated peak flow** assumes a full build out of the residential zoning and includes a rebuild of the Liberty Bay pump station.

Calculations assume build-out of vacant land at 5 homes per acre and 189 gallons per day per ERU. In accordance with the Orange Book criteria, a peaking factor of 4.0 was used.

Calculated full flow capacity is based on the Manning Equation Q=1.486/n(AR^2/3)S^1/2, where n = 0.013.

Brief Summary and Conclusion of Findings: The analysis of this basin is not fully complete. Additional pipe data north of Finn Hill on Viking Ave is needed.

Shading indicates future sewer flows >/- 80% of pipe capacity.
Shading indicates future sewer flows >/- 100% of pipe capacity.

Basin: Viking South	Pipe Run 10		COMMENTS
Dia: 8 in.	A =	0.349	North on Viking
Slope: 0.53 %	R =	0.167	
Current estimated peak flow		30 gpm	8 % of full capacity
Projected estimated peak flow		142 gpm	
Calculated full flow capacity		395 gpm	36 % of full capacity

Basin: Viking South	Pipe Run 11		COMMENTS
Dia: 8 in.		A = 0.349	North on Viking
Slope: 1.93 %		R = 0.167	
Current estimated peak flow		30 gpm	4 % of full capacity
Projected estimated peak flow		307 gpm	
Calculated full flow capacity		753 gpm	41 % of full capacity

Basin: Viking South	Pipe Run 12	COMMENTS
Dia: 8 in.	A = 0.349	North on Viking
Slope: 0.43 %	R = 0.167	Retirement Center assumed to enter here
Current estimated peak flow	70 gpm	20 % of full capacity
Projected estimated peak flow	307 gpm	
Calculated full flow capacity	355 gpm	86 % of full capacity

Basin: Viking South	Pipe Run 13	COMMENTS
Dia: 8 in.	A = 0.349	North on Viking
Slope: xx %	R = 0.167	Poulsbo RV enters
Current estimated peak flow	75 gpm	#VALUE! % of full capacity
Projected estimated peak flow	307 gpm	No pipe slope available
Calculated full flow capacity	#VALUE! gpm	#VALUE! % of full capacity

Basin: Viking South	Pipe Run 14	COMMENTS
Dia: 8 in.	A = 0.349	North on Viking
Slope: xx %	R = 0.167	
Current estimated peak flow	75 gpm	#VALUE! % of full capacity
Projected estimated peak flow	307 gpm	No pipe slope available
Calculated full flow capacity	#VALUE! gpm	#VALUE! % of full capacity

Basin: Viking South	Pipe Run 15	COMMENTS
Dia: 8 in.	A = 0.349	Down Bay to Liberty Bay PS
Slope: xx %	R = 0.167	
Current estimated peak flow	75 gpm	#VALUE! % of full capacity
Projected estimated peak flow	317 gpm	No pipe slope available
Calculated full flow capacity	#VALUE! gpm	#VALUE! % of full capacity

Basin: Viking South	Pipe Run 16	COMMENTS
Dia: 8 in.	A = 0.349	Down Bay to Liberty Bay PS
Slope: 2.20 %	R = 0.167	
Current estimated peak flow	80 gpm	10 % of full capacity
Projected estimated peak flow	317 gpm	
Calculated full flow capacity	804 gpm	39 % of full capacity

Basin: Viking South	Pipe Run 17	COMMENTS
Dia: 8 in.	A = 0.349	Down Bay to Liberty Bay PS
Slope: 5.60 %	R = 0.167	
Current estimated peak flow	80 gpm	6 % of full capacity
Projected estimated peak flow	337 gpm	
Calculated full flow capacity	1283 gpm	26 % of full capacity

Basin: Viking South	Pipe Run 18	COMMENTS
Dia: 8 in.	A = 0.349	Down Bay to Liberty Bay PS
Slope: 5.34 %	R = 0.167	
Current estimated peak flow	80 gpm	6 % of full capacity
Projected estimated peak flow	337 gpm	
Calculated full flow capacity	1253 gpm	27 % of full capacity

Basin: Viking South	Pipe Run 19	COMMENTS
Dia: 8 in.	A = 0.349	Down Bay to Liberty Bay PS
Slope: 0.50 %	R = 0.167	
Current estimated peak flow	90 gpm	23 % of full capacity
Projected estimated peak flow	337 gpm	
Calculated full flow capacity	383 gpm	88 % of full capacity

Basin: Viking South	Pipe Run 20	COMMENTS
Dia: 8 in.	A = 0.349	North along beach
Slope: 0.50 %	R = 0.167	
Current estimated peak flow	100 gpm	26 % of full capacity
Projected estimated peak flow	337 gpm	
Calculated full flow capacity	383 gpm	88 % of full capacity

Basin: Viking South	Pipe Run 21	COMMENTS
Dia: 8 in.	A = 0.349	Discharges to Liberty Bay PS
Slope: 0.50 %	R = 0.167	
Current estimated peak flow	100 gpm	26 % of full capacity
Projected estimated peak flow	337 gpm	
Calculated full flow capacity	383 gpm	88 % of full capacity

Basin: Viking South	Pipe Run 30	COMMENTS
Dia: 10 in.	A = 0.545	Viking North after 4" force main enters
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	110 gpm	19 % of full capacity
Projected estimated peak flow	410 gpm	
Calculated full flow capacity	581 gpm	71 % of full capacity

Basin: Viking South	Pipe Run 31	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	110 gpm	19 % of full capacity
Projected estimated peak flow	410 gpm	
Calculated full flow capacity	581 gpm	71 % of full capacity

Basin: Viking South	Pipe Run 32	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	125 gpm	21 % of full capacity
Projected estimated peak flow	435 gpm	
Calculated full flow capacity	581 gpm	75 % of full capacity

Basin: Viking South	Pipe Run 33	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	125 gpm	21 % of full capacity
Projected estimated peak flow	435 gpm	
Calculated full flow capacity	581 gpm	75 % of full capacity

Basin: Viking South	Pipe Run 34	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	130 gpm	22 % of full capacity
Projected estimated peak flow	460 gpm	
Calculated full flow capacity	581 gpm	79 % of full capacity

Basin: Viking South	Pipe Run 35	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	140 gpm	24 % of full capacity
Projected estimated peak flow	460 gpm	
Calculated full flow capacity	581 gpm	79 % of full capacity

Basin: Viking South	Pipe Run 36	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	145 gpm	25 % of full capacity
Projected estimated peak flow	540 gpm	
Calculated full flow capacity	581 gpm	93 % of full capacity

Basin: Viking South	Pipe Run 37	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 0.35 %	R = 0.208	
Current estimated peak flow	145 gpm	25 % of full capacity
Projected estimated peak flow	540 gpm	
Calculated full flow capacity	581 gpm	93 % of full capacity

Basin: Viking South	Pipe Run 40	COMMENTS
Dia: 10 in.	A = 0.545	East on Lindvig Way
Slope: 1.48 %	R = 0.208	
Current estimated peak flow	260 gpm	22 % of full capacity
Projected estimated peak flow	890 gpm	
Calculated full flow capacity	1196 gpm	74 % of full capacity

Basin: Viking South	Pipe Run 41	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 5.13 %	R = 0.208	
Current estimated peak flow	260 gpm	12 % of full capacity
Projected estimated peak flow	890 gpm	
Calculated full flow capacity	2226 gpm	40 % of full capacity

Basin: Viking South	Pipe Run 42	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 4.00 %	R = 0.208	
Current estimated peak flow	260 gpm	13 % of full capacity
Projected estimated peak flow	895 gpm	
Calculated full flow capacity	1966 gpm	46 % of full capacity

Basin: Viking South	Pipe Run 43	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 2.60 %	R = 0.208	
Current estimated peak flow	265 gpm	17 % of full capacity
Projected estimated peak flow	900 gpm	
Calculated full flow capacity	1585 gpm	57 % of full capacity

Basin: Viking South	Pipe Run 44	COMMENTS
Dia: 10 in.	A = 0.545	
Slope: 1.10 %	R = 0.208	
Current estimated peak flow	265 gpm	26 % of full capacity
Projected estimated peak flow	900 gpm	
Calculated full flow capacity	1031 gpm	87 % of full capacity

Basin: Viking North	Pipe Run 50	COMMENTS
Dia: 8 in.	A = 0.349	Viking and SR 305
Slope: 5.10 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	5 gpm	
Calculated full flow capacity	1224 gpm	0 % of full capacity

Basin: Viking North	Pipe Run 51	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.01 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	769 gpm	1 % of full capacity

Basin: Viking North	Pipe Run 52	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 1.09 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	38 gpm	
Calculated full flow capacity	566 gpm	7 % of full capacity

Basin: Viking North	Pipe Run 53	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 3.32 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	38 gpm	
Calculated full flow capacity	988 gpm	4 % of full capacity

Basin: Viking North	Pipe Run 54	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 3.32 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	98 gpm	
Calculated full flow capacity	988 gpm	10 % of full capacity

Basin: Viking North	Pipe Run 55	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.33 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	98 gpm	
Calculated full flow capacity	1128 gpm	9 % of full capacity

Basin: Viking North	Pipe Run 56	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.42 %	R = 0.167	
Current estimated peak flow	50 gpm	4 % of full capacity
Projected estimated peak flow	148 gpm	
Calculated full flow capacity	1140 gpm	13 % of full capacity

Basin: Viking North	Pipe Run 57	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.53 %	R = 0.167	
Current estimated peak flow	50 gpm	4 % of full capacity
Projected estimated peak flow	148 gpm	
Calculated full flow capacity	1154 gpm	13 % of full capacity

Basin: Viking North	Pipe Run 58	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.20 %	R = 0.167	
Current estimated peak flow	50 gpm	5 % of full capacity
Projected estimated peak flow	148 gpm	
Calculated full flow capacity	1111 gpm	13 % of full capacity

Basin: Viking North	Pipe Run 59	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.29 %	R = 0.167	
Current estimated peak flow	60 gpm	5 % of full capacity
Projected estimated peak flow	158 gpm	
Calculated full flow capacity	1123 gpm	14 % of full capacity

Basin: Viking North	Pipe Run 60	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 4.32 %	R = 0.167	
Current estimated peak flow	60 gpm	5 % of full capacity
Projected estimated peak flow	168 gpm	
Calculated full flow capacity	1127 gpm	15 % of full capacity

Basin: Viking North	Pipe Run 61	COMMENTS
Dia: 8 in.	A = 0.349	East on Lindvig Way
Slope: 2.16 %	R = 0.167	
Current estimated peak flow	75 gpm	9 % of full capacity
Projected estimated peak flow	180 gpm	
Calculated full flow capacity	797 gpm	23 % of full capacity

Basin: Viking North	Pipe Run 62	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.22 %	R = 0.167	
Current estimated peak flow	75 gpm	9 % of full capacity
Projected estimated peak flow	190 gpm	
Calculated full flow capacity	808 gpm	24 % of full capacity

Basin: Viking North	Pipe Run 63	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.59 %	R = 0.167	
Current estimated peak flow	75 gpm	18 % of full capacity
Projected estimated peak flow	190 gpm	
Calculated full flow capacity	416 gpm	46 % of full capacity

Basin: Viking North	Pipe Run 64	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 0.90 %	R = 0.167	
Current estimated peak flow	75 gpm	15 % of full capacity
Projected estimated peak flow	200 gpm	
Calculated full flow capacity	514 gpm	39 % of full capacity

Basin: Viking North	Pipe Run 65	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.13 %	R = 0.167	
Current estimated peak flow	75 gpm	9 % of full capacity
Projected estimated peak flow	200 gpm	
Calculated full flow capacity	791 gpm	25 % of full capacity

Basin: Viking North	Pipe Run 70	COMMENTS
Dia: 8 in.	A = 0.349	Vetter Road south on Viking to SR 305
Slope: 2.00 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	10 gpm	
Calculated full flow capacity	767 gpm	1 % of full capacity

Basin: Viking North	Pipe Run 71	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.00 %	R = 0.167	
Current estimated peak flow	0 gpm	0 % of full capacity
Projected estimated peak flow	79 gpm	
Calculated full flow capacity	767 gpm	10 % of full capacity

Basin: Viking North	Pipe Run 72	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.20 %	R = 0.167	
Current estimated peak flow	50 gpm	6 % of full capacity
Projected estimated peak flow	79 gpm	
Calculated full flow capacity	804 gpm	10 % of full capacity

Basin: Viking North	Pipe Run 73	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.20 %	R = 0.167	
Current estimated peak flow	50 gpm	6 % of full capacity
Projected estimated peak flow	99 gpm	
Calculated full flow capacity	804 gpm	12 % of full capacity

Basin: Viking North	Pipe Run 74	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.20 %	R = 0.167	
Current estimated peak flow	50 gpm	6 % of full capacity
Projected estimated peak flow	99 gpm	
Calculated full flow capacity	804 gpm	12 % of full capacity

Basin: Viking North	Pipe Run 75	COMMENTS
Dia: 8 in.	A = 0.349	
Slope: 2.20 %	R = 0.167	
Current estimated peak flow	50 gpm	6 % of full capacity
Projected estimated peak flow	99 gpm	
Calculated full flow capacity	804 gpm	12 % of full capacity

NOLL ROAD BASIN

This basin does not currently have a gravity collection system. The Alasund development has a pump station that conveys sewage into the Caldart Basin. Most of the basin is zoned as residential low density. Further development cannot occur until a sewer system is installed. A new sewer main is proposed for installation along the east boundary of the basin. This new main will tie to the existing 10-inch sewer exiting the Deer Run housing area.

Projected flows are based on 189 gpd per ERU. In accordance with the Orange Book criteria, a peaking factor of 4.0 was used.

Current estimated peak flow is what is now flowing through the system. **Projected estimated peak flow** is what will ultimately be flowing through the system when all housing, including high density housing, is complete.

Calculated full flow capacity is based on the Manning Equation Q=1.486/n(AR^2/3)S^1/2, where n = 0.013.

Brief Summary and Conclusion of Findings: The new sewer main will be placed in an area with adequate slope. Final design will size the pipes and set the ie's to provide adequate flow. The existing 10-inch DI main from Deer Run to the Johnson Road Chlorination station is undersized for the future Noll Road flows and must be upsized by pipe bursting or installing a new parallel main.

Shading indicates future sewer flows >/- 80% of pipe capacity.
Shading indicates future sewer flows >/- 100% of pipe capacity.

Basin: Noll Road		Pipe Run 10		COMMENTS
Dia:	8 in.	A =	0.349	Future proposed sewer main
Slope:	1.14 %	R =	0.167	
Current estimated peak flow			0 gpm	
Projected estimated peak flow			145 gpm	
Calculated full flow capacity			579 gpm	25 % of full capacity

Basin: Noll Road		Pipe Run 11	COMMENTS
Dia:	8 in.	A = 0.349	Future proposed sewer main
Slope:	1.14 %	R = 0.167	
Current estimated peak flow		0 gpm	
Projected estimated peak flow		166 gpm	Alasund added
Calculated full flow capacity		579 gpm	29 % of full capacity

Basin: Noll Road	Pipe Run 12	COMMENTS
Dia: 10 in.	A = 0.545	Future proposed sewer main
Slope: 1.09 %	R = 0.208	
Current estimated peak flow	0 gpm	
Projected estimated peak flow	325 gpm	
Calculated full flow capacity	1026 gpm	32 % of full capacity

Basin: Noll Road	Pipe Run 13	COMMENTS
Dia: 10 in.	A = 0.545	Future proposed sewer main
Slope: 3.42 %	R = 0.208	
Current estimated peak flow	0 gpm	
Projected estimated peak flow	470 gpm	
Calculated full flow capacity	1818 gpm	26 % of full capacity

Basin: Noll Road	Pipe Run 14	COMMENTS
Dia: 10 in.	A = 0.545	Future proposed sewer main
Slope: 1.30 %	R = 0.208	
Current estimated peak flow	0 gpm	
Projected estimated peak flow	522 gpm	
Calculated full flow capacity	1121 gpm	47 % of full capacity

Basin: Noll Road	Pipe Run 15	COMMENTS
Dia: 12 in.	A = 0.785	Future proposed sewer main
Slope: 0.66 %	R = 0.250	
Current estimated peak flow	0 gpm	
Projected estimated peak flow	532 gpm	
Calculated full flow capacity	1298 gpm	41 % of full capacity

Basin: Noll Road	Pipe Run 16	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.47 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	24 % of full capacity
Projected estimated peak flow	655 gpm	
Calculated full flow capacity	674 gpm	97 % of full capacity

Basin: Noll Road	Pipe Run 17	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.49 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	24 % of full capacity
Projected estimated peak flow	670 gpm	
Calculated full flow capacity	688 gpm	97 % of full capacity

Basin: Noll Road	Pipe Run 18	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.50 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	23 % of full capacity
Projected estimated peak flow	682 gpm	
Calculated full flow capacity	695 gpm	98 % of full capacity

Basin: Noll Road	Pipe Run 19	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.57 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	22 % of full capacity
Projected estimated peak flow	697 gpm	
Calculated full flow capacity	742 gpm	94 % of full capacity

Basin: Noll Road	Pipe Run 20	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.48 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	24 % of full capacity
Projected estimated peak flow	697 gpm	
Calculated full flow capacity	681 gpm	102 % of full capacity

Basin: Noll Road	Pipe Run 21	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.45 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	25 % of full capacity
Projected estimated peak flow	721 gpm	
Calculated full flow capacity	659 gpm	109 % of full capacity

Basin: Noll Road	Pipe Run 22	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 0.90 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	17 % of full capacity
Projected estimated peak flow	721 gpm	
Calculated full flow capacity	932 gpm	77 % of full capacity

Basin: Noll Road	Pipe Run 23	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 13.00 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	5 % of full capacity
Projected estimated peak flow	721 gpm	
Calculated full flow capacity	3544 gpm	20 % of full capacity

Basin: Noll Road	Pipe Run 24	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 10.00 %	R = 0.208	Existing Ductile Iron pipe
Current estimated peak flow	162 gpm	5 % of full capacity
Projected estimated peak flow	741 gpm	
Calculated full flow capacity	3108 gpm	24 % of full capacity

Basin: Noll Road	Pipe Run 25	COMMENTS
Dia: 10 in.	A = 0.545	Deer Run and Meridith Heights
Slope: 1.04 %	R = 0.208	PVC Pipe
Current estimated peak flow	162 gpm	16 % of full capacity
Projected estimated peak flow	741 gpm	
Calculated full flow capacity	1002 gpm	74 % of full capacity

Basin: Noll Road	Pipe Run 26	COMMENTS
Dia: 10 in.	A = 0.545	PVC pipe acros hwy. No info available
Slope: 0.00 %	R = 0.208	
Current estimated peak flow	162 gpm	#DIV/0! % of full capacity
Projected estimated peak flow	760 gpm	
Calculated full flow capacity	0 gpm	#DIV/0! % of full capacity

8TH AND 9TH MAINS

This spreadsheet checks the 10- and 12-inch gravity mains in 8th and 9th Avenues downstream of where the 8-inch force main from the Village Pump Station connects.

The 8-inch gravity main flowing north along 8th Avenue to the Village pump station has very small flows. It primarily serves commercial buildings and future high density residential. Maximum flows are estimated to be 160 gpm. An 8-inch main with a 0.5% slope has a 383 gpm carrying capacity. If as-built drawings showing the slopes or ie's are provided, then the actual capacities can be computed.

Current estimated peak flow is what is now flowing through the system. **Projected estimated peak flow** is what will ultimately be flowing through the system when all housing, including high density housing, is complete.

Calculated full flow capacity is based on the Manning Equation Q=1.486/n(AR^2/3)S^1/2, where n = 0.013.

Brief Summary and Conclusion of Findings: Pipe slope information is not available. Capacity problems in the pipes leading to the Village pump station are not anticipated. However, there could be a capacity problem in the pipe run between the juncture of the flows from the Caldart basin and the Village pump station, and the location where the gravity main discharges to the SR 305 interceptor main.

Shading indicates future sewer flows >/- 80% of pipe capacity.

Basin: 8th 9th Mains	Pipe Run 10	COMMENTS
Dia: 10 in.	A = 0.545	Survey info needed.
Slope: xx %	R = 0.208	
Current estimated peak flow	0 gpm	
Projected estimated peak flow	450 gpm	Inflow from Finn Hill P.S.
Calculated full flow capacity	#VALUE! gpm	

Basin: 8th 9th Mains	Pipe Run 11	COMMENTS
Dia: 10 in.	A = 0.545	Survey info needed.
Slope: xx %	R = 0.208	
Current estimated peak flow	gpm	
Projected estimated peak flow	450 gpm	
Calculated full flow capacity	#VALUE! gpm	

Basin: 8th 9th Mains	Pipe Run 12	COMMENTS
Dia: 12 in.	A = 0.785	Survey info needed.
Slope: xx %	R = 0.250	
Current estimated peak flow	gpm	
Projected estimated peak flow	gpm	
Calculated full flow capacity	#VALUE! gpm	

Basin: 8th 9th Mains	Pipe Run 13	COMMENTS
Dia: 12 in.	A = 0.785	Survey info needed.
Slope: xx %	R = 0.250	
Current estimated peak flow	gpm	
Projected estimated peak flow	gpm	
Calculated full flow capacity	#VALUE! gpm	

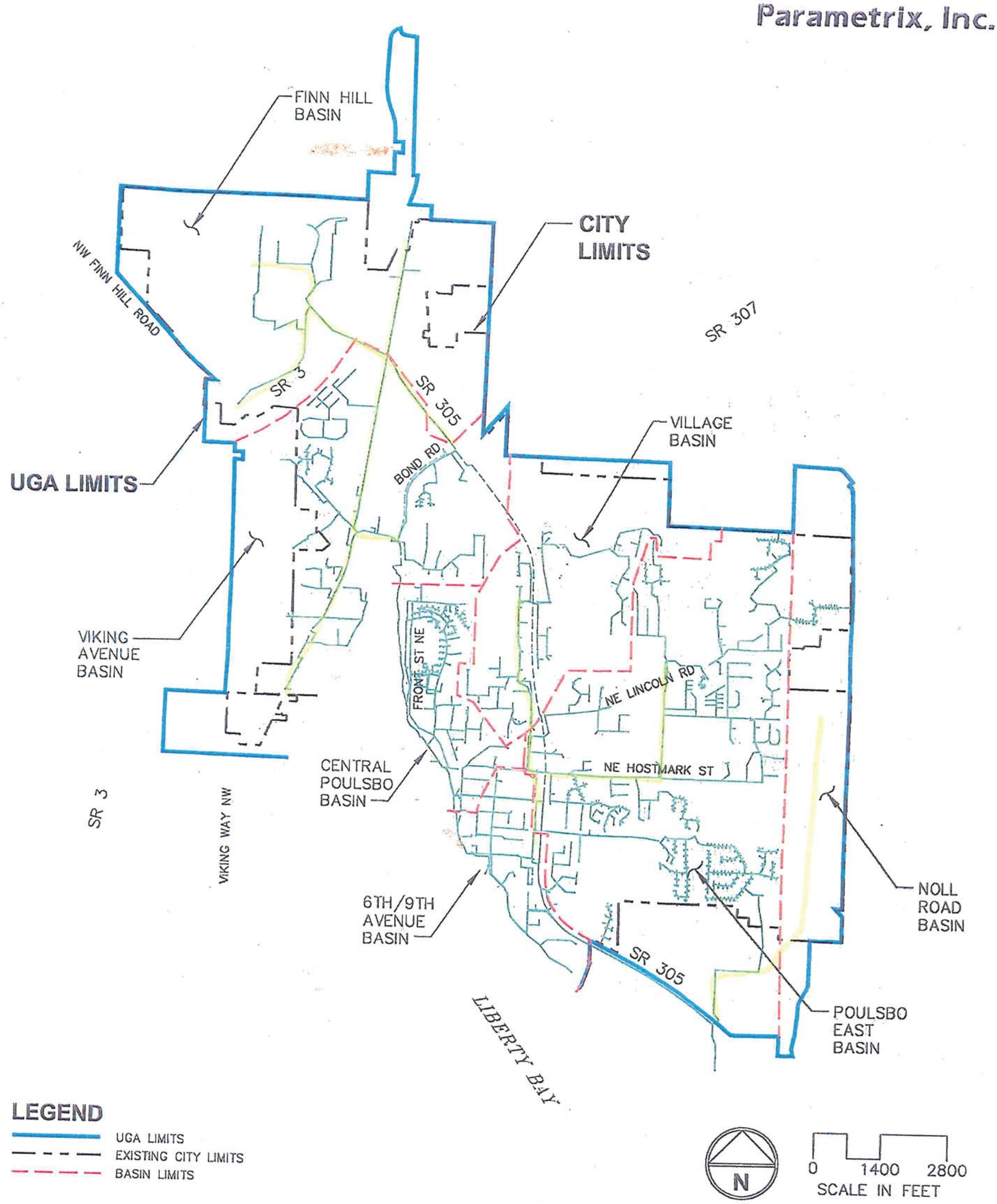
Basin: 8th 9th Mains	Pipe Run 14	COMMENTS
Dia: in.	A = 0.000	Survey info needed.
Slope: %	R = 0.000	
Current estimated peak flow	gpm	
Projected estimated peak flow	gpm	
Calculated full flow capacity	0 gpm	

Basin: 8th 9th Mains	Pipe Run 15	COMMENTS
Dia: in.	A = 0.000	Survey info needed.
Slope: %	R = 0.000	
Current estimated peak flow	gpm	
Projected estimated peak flow	gpm	
Calculated full flow capacity	0 gpm	

ATTACHMENT B

Figures

Parametrix, Inc.

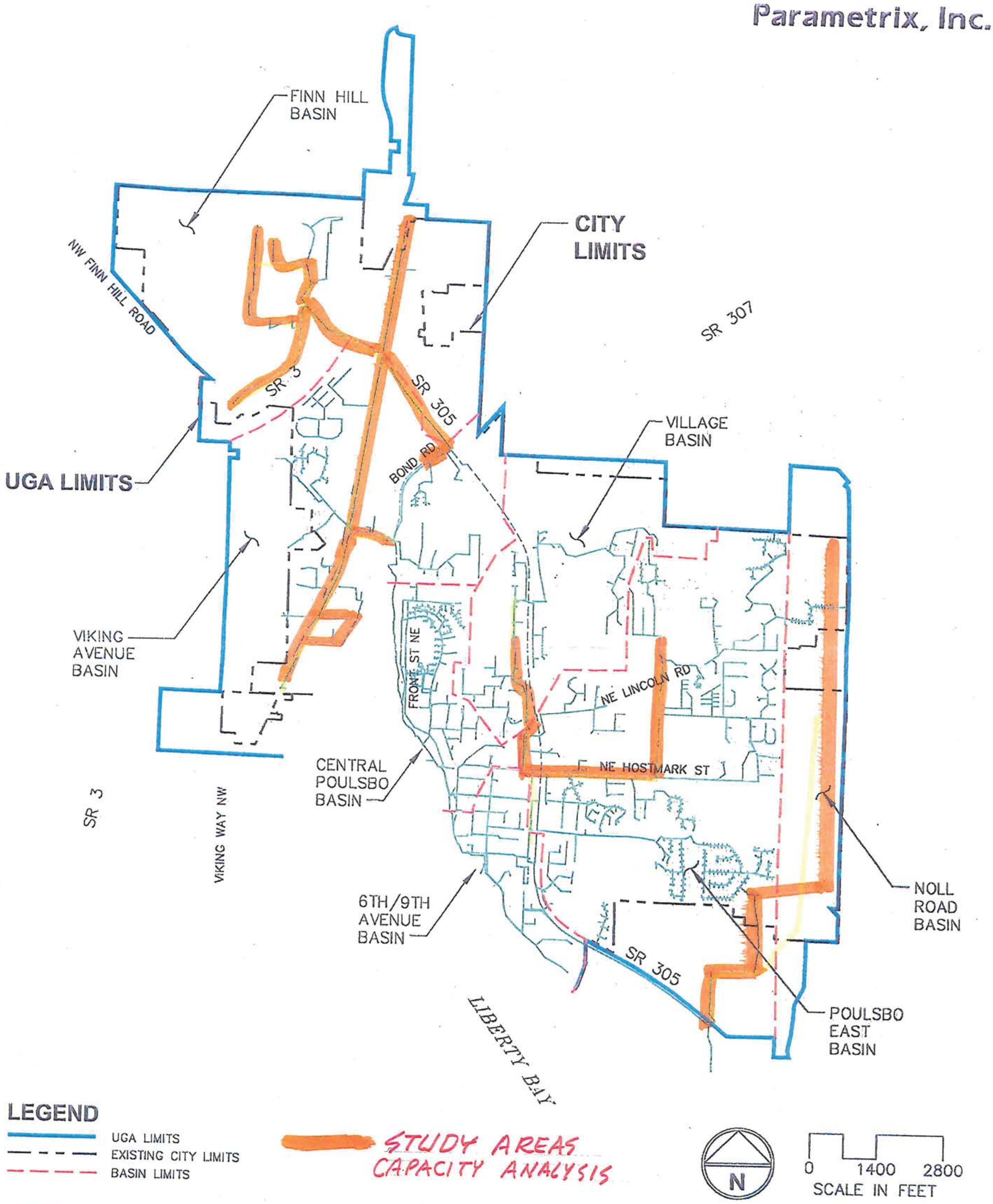


CITY of POULSBO
COMPREHENSIVE SEWER PLAN

Sewer Collection System Map

FIGURE 1

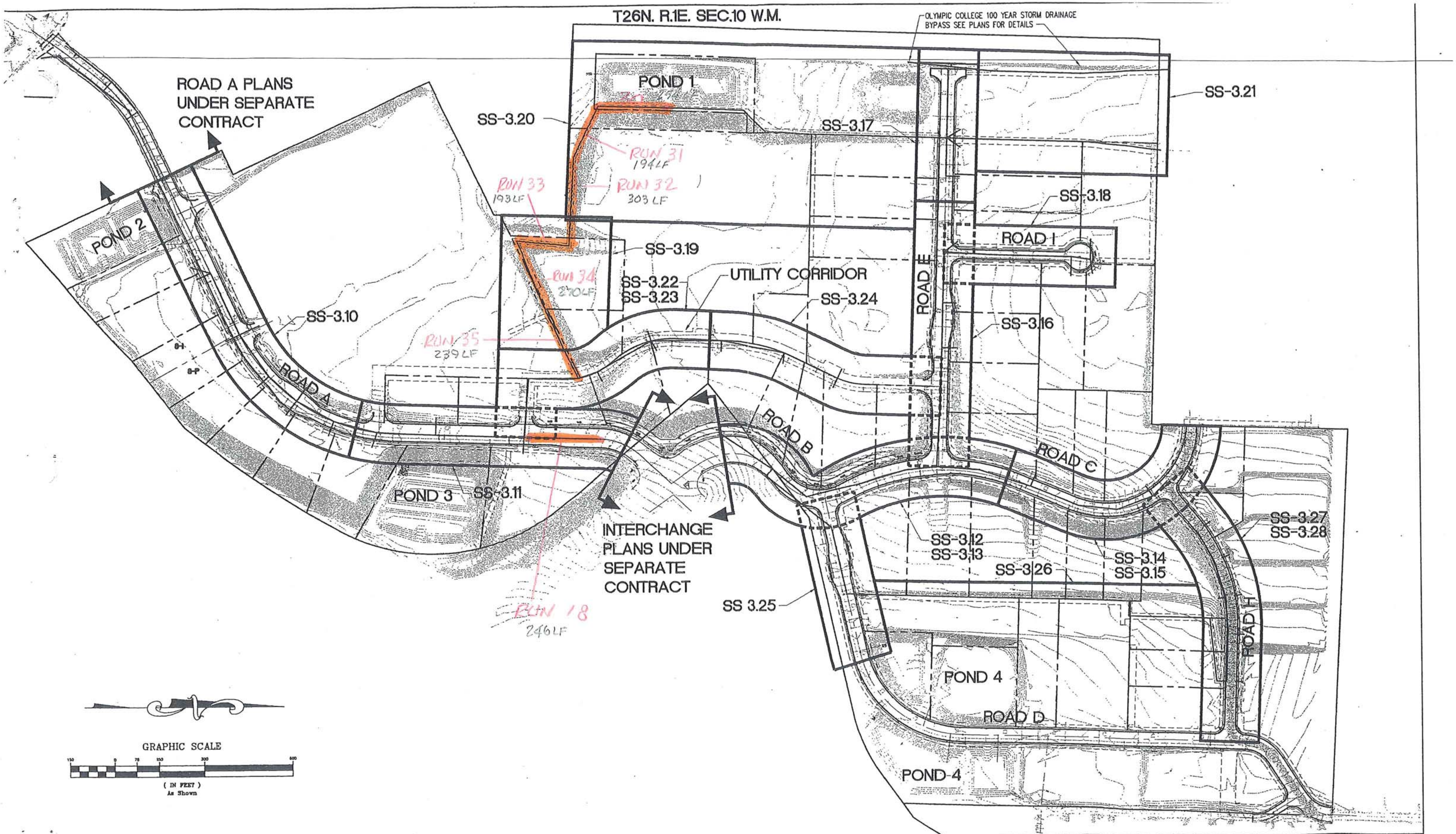
Parametrix, Inc.



FILE: BR2237026PC1TOIF-18
DATE: Mar 21, 2007 - 11:15am PLOTTED BY: stockvon
IMAGES:
XREF'S: XBR2237-bo | XBR2237-ptis

CITY of POULSBO
COMPREHENSIVE SEWER PLAN

Sewer Collection System Map **FIGURE 1**



AMERICAN LAND SCIENCE
PROFESSIONAL LAND SURVEYING
POB 547
6396 STATE ROUTE 19
CHIMACUM, WA. 98325
TELE: (360) 732-0311

FINIS H. BREWER
STATE OF WASHINGTON
36791
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES: 03 / 05 / 05

ASBUILT CERTIFICATE:
I HEREBY CERTIFY THAT THE HORIZONTAL AND VERTICAL LOCATIONS OF THE ON-SITE GRADING & UTILITIES SHOWN HERE ON ARE THE RESULT OF A FIELD SURVEY PERFORMED BY ME OR UNDER MY DIRECTION.

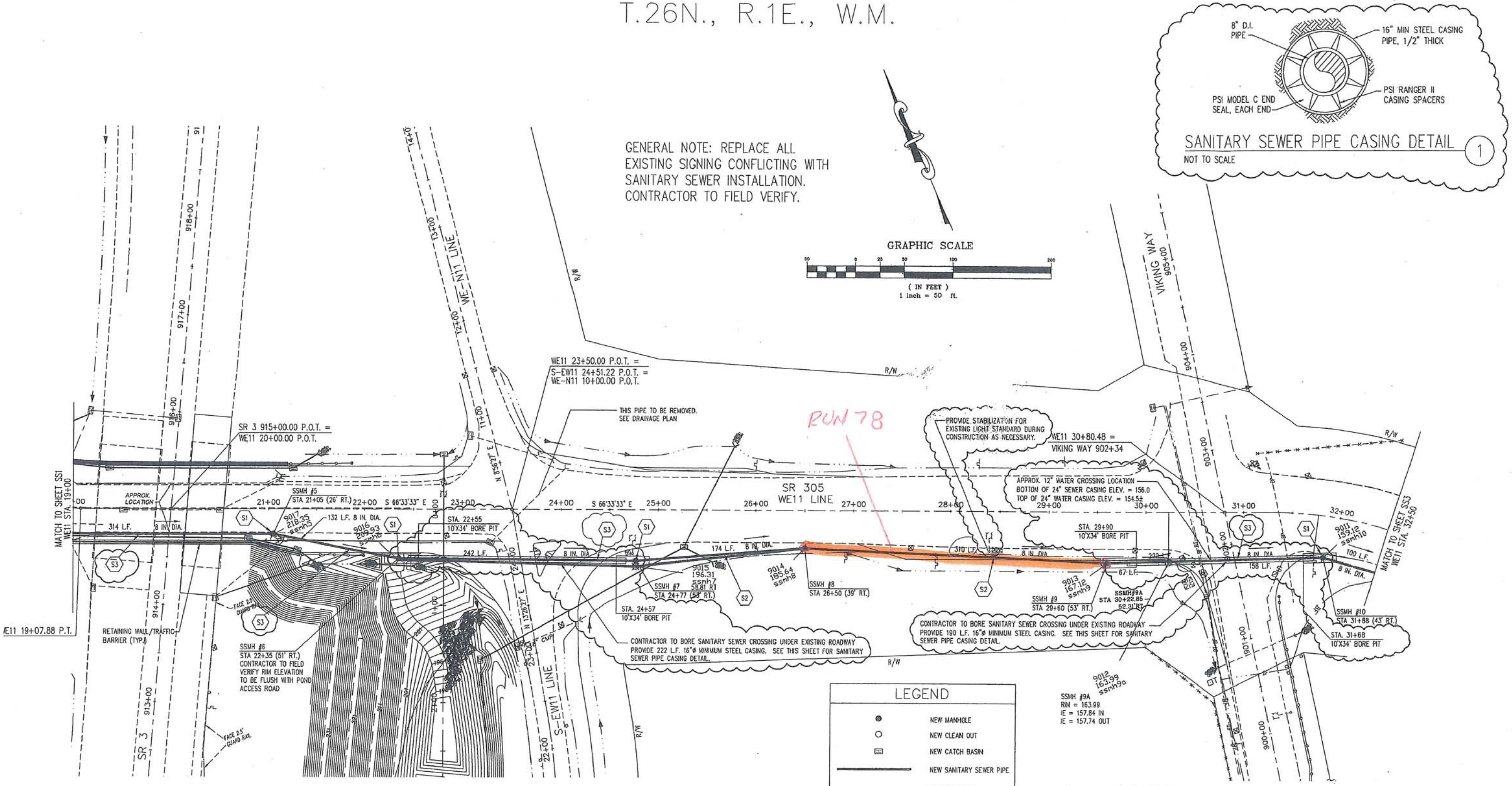
THIS CERTIFICATE IS BASED UPON MEASUREMENTS PERFORMED IN ACCORDANCE WITH THE SOUND PRINCIPLES AND METHODS OF LAND SURVEYING AND THE INFORMATION SHOWN HEREON IS TRUE AND CORRECT.

Finis Brewer 12/28/04
FINIS H. BREWER, NO. 36791

ASBUILT

OLHAVA ASSOCIATES ONSITE ROADWAY AND UTILITIES POULSBO, WASHINGTON	SEWER PLAN KEY MAP	SS-3.00

T.26N., R.1E., W.M.



LEGEND

- NEW MANHOLE
- NEW CLEAN OUT
- NEW CATCH BASIN
- NEW SANITARY SEWER PIPE
- NEW DITCH LINE
- NEW STORM DRAIN PIPE
- EXISTING CATCH BASIN
- EXISTING STORM LINE
- EXISTING DITCH LINE

ASBUILT CERTIFICATE

I HEREBY CERTIFY THAT I SUPERVISED ADJUSTMENT OF THE HORIZONTAL AND VERTICAL LOCATIONS OF THE ON-SITE GRADING & UTILITIES SHOWN HERE PROVIDED BY FINIS H. BREWER, PLS NO. 36791 TO REFLECT COMMENTS PROVIDED BY THE CITY OF POULSBO. THE PROFESSIONALLY ENGINEERS STAMP PROVIDED BELOW IS PROVIDED AS ASBUILT CERTIFICATION ONLY.

TAMARAH E. KNAPP, P.E. NO 30622

ASBUILT

EXPIRES 9/4/2006

SHEETS SSP2, SSP3, & SSP4 FOR PROFILE.
HEET SS1 FOR CONSTRUCTION NOTES.

NOTE: ALL DIMENSIONS ARE IN FEET.

DATE	BY	REVISION DESCRIPTION
1/28/03	PACLAND	REVISED PER CITY OF POULSBO COMMENTS
11/25/02	PACLAND	REVISED PER WSDOT COMMENTS
8/22/02	PACLAND	REVISED PER CITY OF POULSBO COMMENTS

DESIGNED BY: REJ/KAS
DRAWN BY: KAS/WHL
CHECKED BY: REJ
ISSUE DATE: 09/27/01
PROJECT NO. 2001096.010

PREPARED FOR
OLHAVA ASSOCIATES L.P.

SR 3/SR 305 INTERCHANGE
MP 52.29 TO MP 53.15
SANITARY SEWER PLAN

SS2

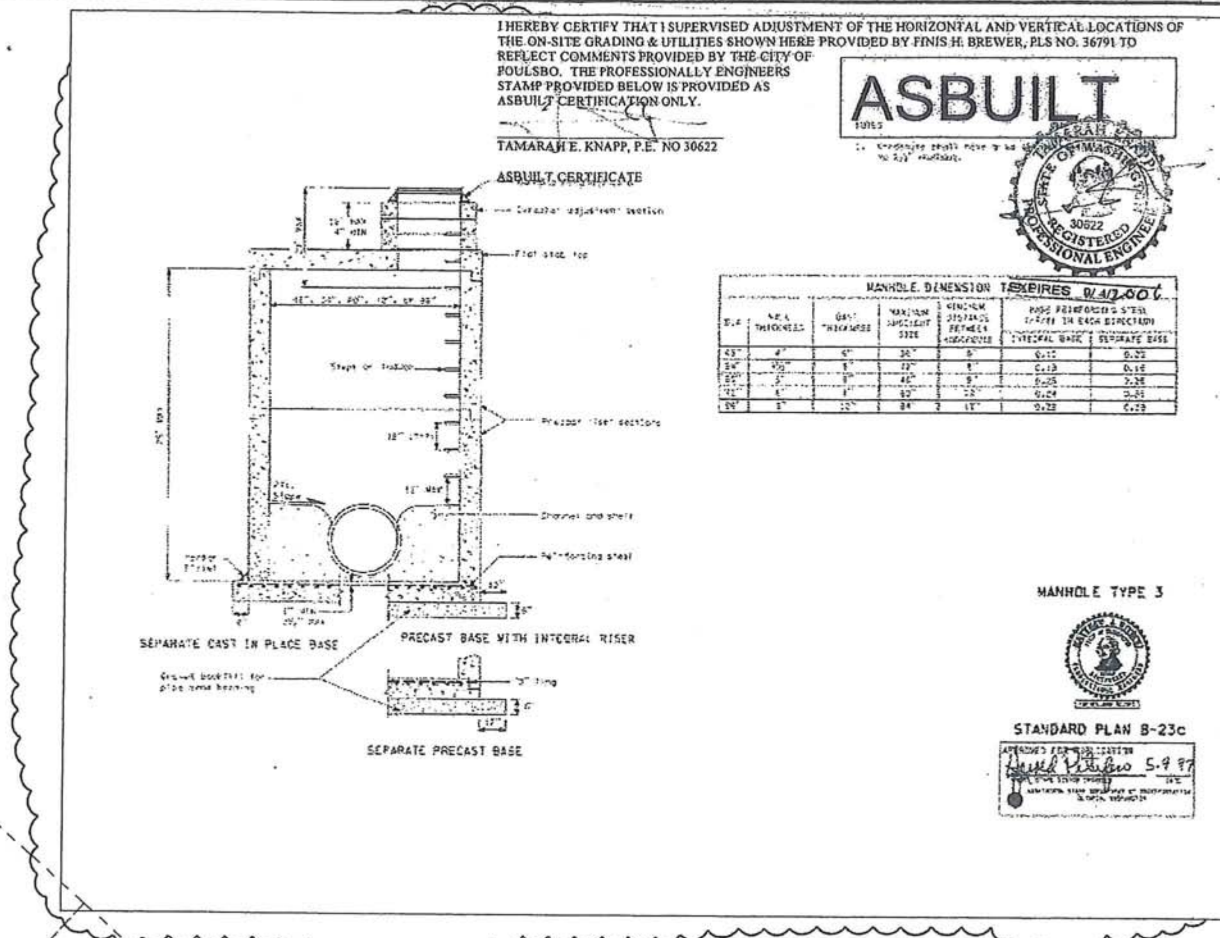
5 OF 16

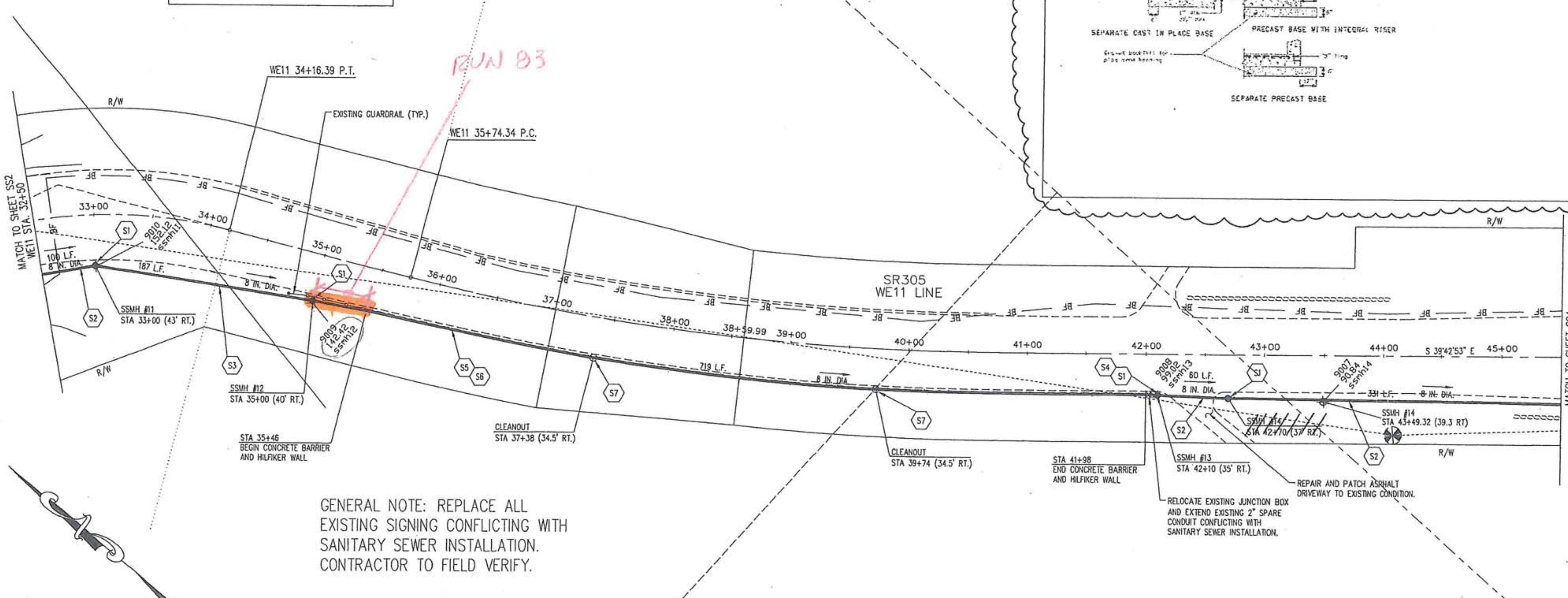
CURVE DATA						SPIRAL DATA		
STATION	DELTA	RADIUS	TANGENT	LENGTH	S	a	DE	Ls
32+72.76	11° 19' 30"	1909.86'	336.61'	377.50'	0.04 ft/ft	1.5	3	2
+16.51	41° 10' 10"	399.88'	150.18'	287.33'	0.04 ft/ft			

T.26N., R.1E., W.M.

LEGEND

●	NEW MANHOLE
○	NEW CLEAN OUT
▭	NEW CATCH BASIN
━━━	NEW SANITARY SEWER PIPE
— · —	NEW DITCH LINE
———	NEW STORM DRAIN PIPE
▭	EXISTING CATCH BASIN
— — —	EXISTING STORM LINE
— · · —	EXISTING DITCH LINE





GENERAL NOTE: REPLACE ALL EXISTING SIGNING CONFLICTING WITH SANITARY SEWER INSTALLATION. CONTRACTOR TO FIELD VERIFY.

GRAPHIC SCALE

(IN FEET)
1 inch = 50 ft.

NOTES:
1. CONTRACTOR TO REPLACE EXISTING GUARDRAIL/ANCHOR ATTACHED TO EXISTING CONCRETE BARRIER CONFLICTING WITH SEWER INSTALLATION.
2. EXISTING DITCHLINE NEEDS TO BE REPLACED IN DISTURBED AREAS WITH SOD OR RIP RAP WITHIN 48 HOURS.

ALL DIMENSIONS ARE IN FEET.

SEE SHEETS SSP4 & SSP5 FOR PROFILE.
SEE SHEET SS1 FOR CONSTRUCTION NOTES

DATE	BY	REVISION DESCRIPTION
1/28/03	PACLAND	REVISED PER CITY OF POULSBO COMMENTS
8/22/02	PACLAND	REVISED PER CITY OF POULSBO COMMENTS

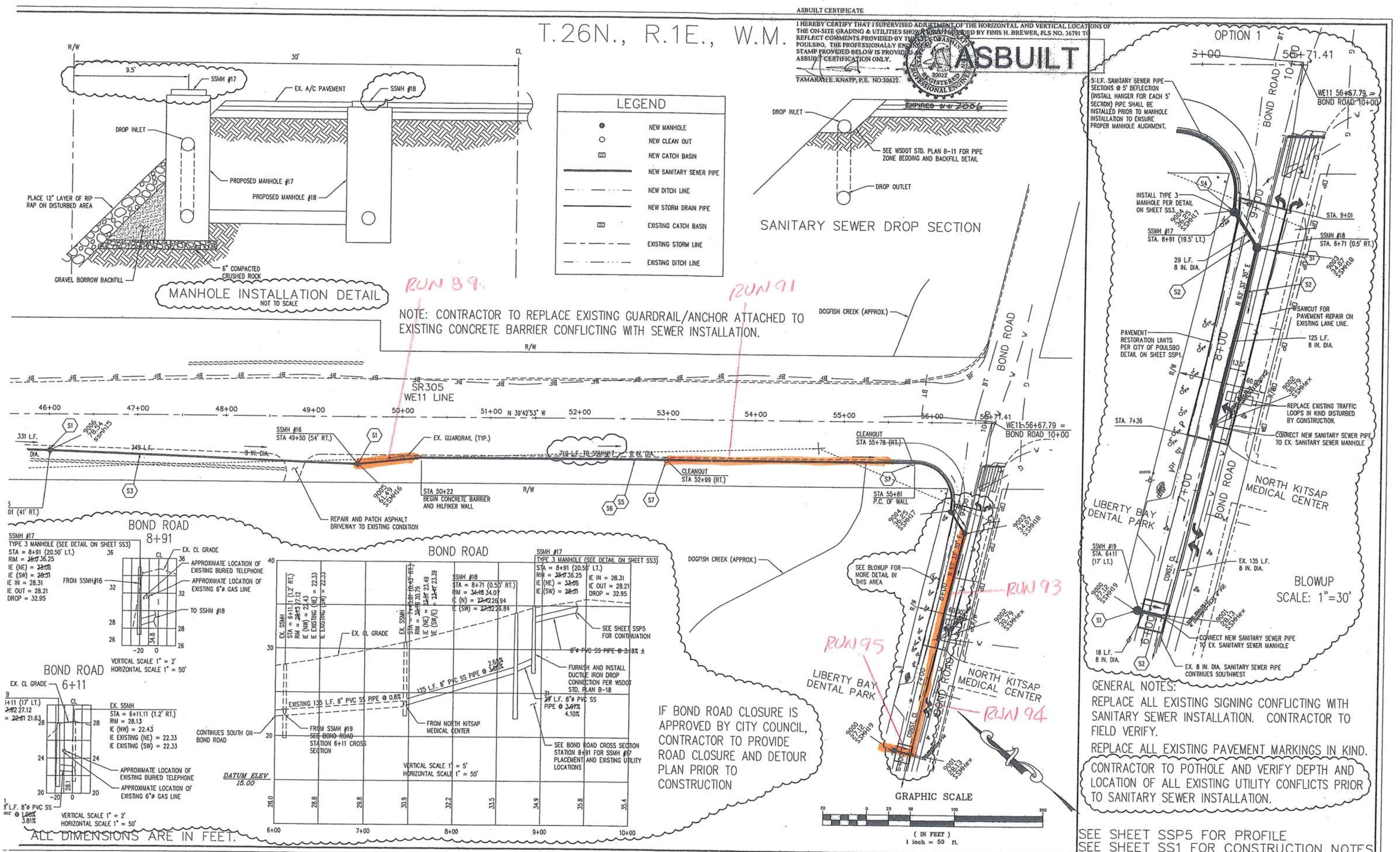
DESIGNED BY: REJ/KAS	ISSUE DATE: 09/27/01
DRAWN BY: JRM/WHL	PROJECT NO. 2001096.010
CHECKED BY: REJ	

PREPARED FOR
OLHAVA ASSOCIATES L.P.

SR 3/SR 305 INTERCHANGE
MP 52.29 TO MP 53.15
SANITARY SEWER PLAN

SS3

6 OF 16



DATE	BY	REVISION DESCRIPTION
1/28/03	PACLAND	REVISED PER CITY OF POULSBO COMMENTS
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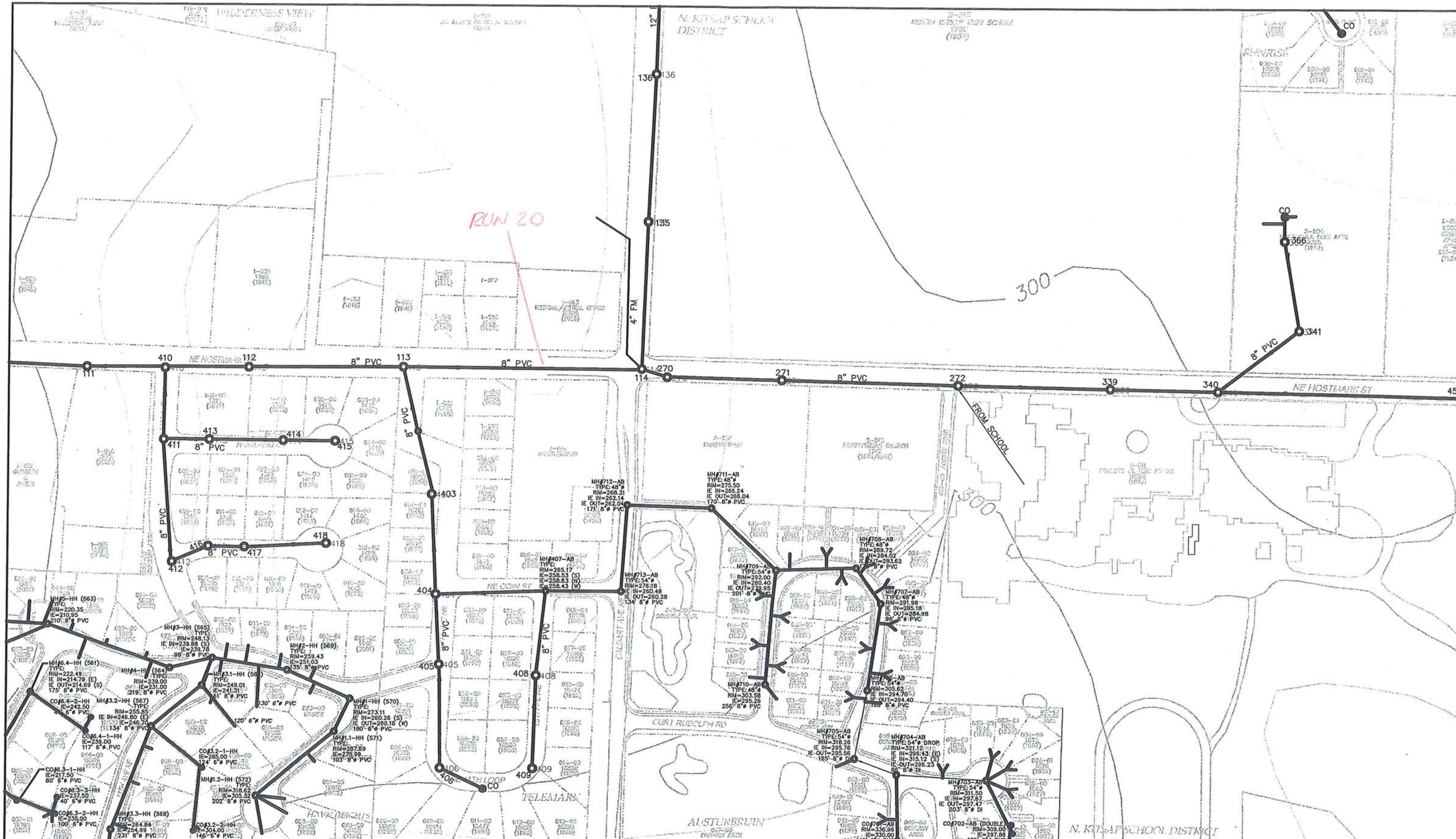
8/22/02	PACLAND	REVISED PER CITY OF POULSBO COMMENTS

DESIGNED BY: REJ/KAS
DRAWN BY: JRM/WHL
CHECKED BY: REJ
ISSUE DATE: 09/27/01
PROJECT NO. 2001096.010

PREPARED FOR
OLHAVA ASSOCIATES L.P.

SR 3/SR 305 INTERCHANGE
MP 52.29 TO MP 53.15
SANITARY SEWER PLAN

SS4



SEWER COMPREHENSIVE PLAN

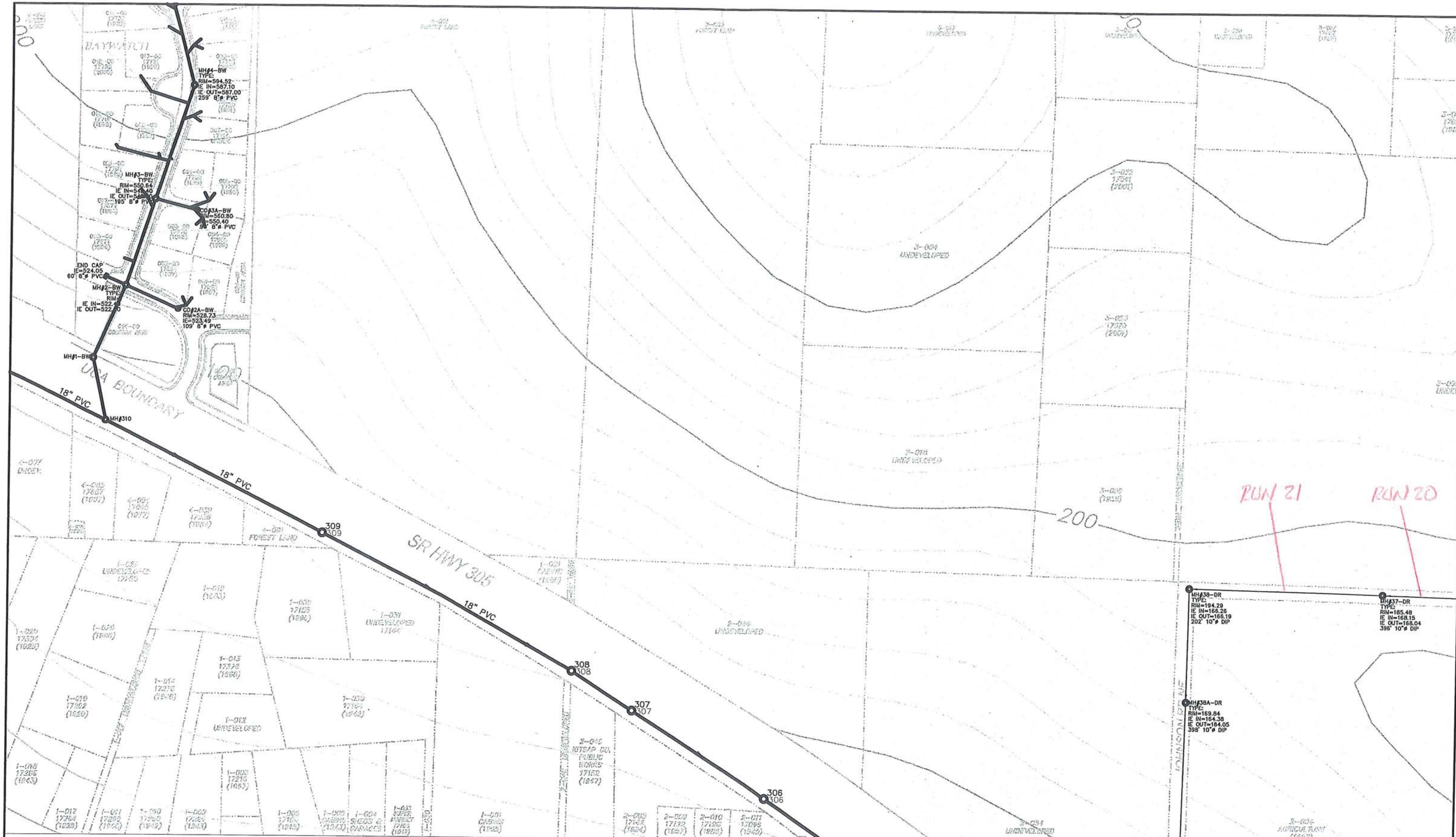
DEPARTMENT OF PUBLIC WORKS & UTILITIES

LEGEND

- MANHOLE (MH)
- LIFT STATION
- COUPLING
- GATE VALVE
- CLEAN OUT (CO)
- DIRECTION OF FLOW
- END CAP
- EASEMENT/SETBACK
- GRAVITY MAIN (SEE CONNECTIONS FOR SIZE AND MATERIAL)
- FORCE MAIN (SEE CONNECTIONS FOR SIZE AND MATERIAL)

SCALE: 1" -200'
UPDATED: 06/22/05

51 65 79
52 — 80
53 67 81



SEWER COMPREHENSIVE PLAN

DEPARTMENT OF PUBLIC WORKS & UTILITIES

LEGEND

- MANHOLE (MH)
- LIFT STATION
- COUPLING
- GATE VALVE
- CLEAN OUT (CO)
- DIRECTION OF FLOW
- END CAP
- EASEMENT/SETBACK
- GRAVITY MAIN (SEE CONNECTIONS FOR SIZE AND MATERIAL)
- FORCE MAIN (SEE CONNECTIONS FOR SIZE AND MATERIAL)

SCALE: 1" - 200'
UPDATED: 06/22/05

53	67	81
54		82
55	69	83

June 4, 2007

CITY OF POULSBO – PUBLIC WORKS DIVISION
P.O Box 2275
Poulsbo, WA 98370

Attn: Jeff Bauman
Director of Public Works

Re: City of Poulsbo
Draft Comprehensive Sanitary Sewer Plan 2007 Update

Dear Mr. Bauman,

The Lemolo Citizens Club appreciates your invitation to comment on the Draft Comprehensive Sanitary Sewer Plan 2007 prepared for the City of Poulsbo by Parametrix of Bremerton, Washington, dated March 2007. Six members of the Lemolo Citizens Club reviewed the Draft Comprehensive Sanitary Sewer Plan 2007 Update and concluded that it is a well organized document that offers a conservative, worst case analysis of the problems facing the City of Poulsbo regarding upgrades to their sanitary sewer system.

We believe the conservative nature of the document could lead to greater expenditures of rate payer funds than is necessary and offer the following comments for your consideration:

- The empirical data provided in the document suggests the City of Poulsbo has a significant Inflow problem into the sanitary sewer system rather than an Infiltration problem; however a minimal amount of funding is committed to address this problem (See Table ES-3).
- The long-term flow projections analysis performed by Parametrix utilizes a very conservative peaking factor of 4.02., until the year 2050. The utilization of this peaking factor to the year 2050 overstates the problem as new sanitary sewer pipe technologies installed in areas of new development will lower this rate. We suggest that the City of Poulsbo apply their criteria for pump stations to their entire sanitary sewer conveyance system. The first paragraph on page 3-13 notes that "The City's policy is to identify and implement the ultimate design of a collection and conveyance system to eliminate the proliferation of interim facilities and pump stations. In the future, all pump stations shall be designed according to Ecology and City standards …". EPA and Department of Ecology recommend the peaking factor not exceed 3.08. How long could the existing sanitary sewer system function if this peaking factor were utilized? What improvements would need to be implemented to achieve this peaking factor? at what cost?
- The cost analysis need to provide a clear comparison of the alternatives – "apples to apples" and as currently stated over inflates the cost of the West Side alternative by eliminating the split flow alternative discussed in previous documents. The Lemolo Citizens Club continues to advocate for system redundancy and does not concur with eliminating this option.
- Costs for slip lining the existing piping appear woefully inadequate.
- Can Parametrix identity in their basin by basin summary the type of material utilized for the existing pipes and the percentage of each type? This information would help the City of Poulsbo determine where resources should be spent to address inflow and infiltration problems.

I have also attached several informal e-mails from other members of the Lemolo Citizens Club that either amplify questions posed above or provide further comments or questions for your consideration. Again, we appreciate your soliciting our comments concerning this draft document and look forward to working with you to successfully resolve this matter.

If you have any questions, please contact me at 360-779-4943 (home) or 360-662-8275 (work).

Sincerely,

LEMOLO CITIZENS CLUB

Richard Best, President

City of Poulsbo,

I get the impression that the City people are more interested in Infiltration than in Inflow. I suspect, without any hard evidence, that this is because it is easier to just fix the deteriorated and obsolescent pipes than it is to deal with individual property owners, even though it would probably be less costly, in dollars per mgd to work on the Inflow than on the Infiltration.

Actually both need to be done. Infiltration sets up a base flow during the rainy season which, added to the actual sewage flow, leaves less room for the short duration peaks that come with a rain storm. The result is that a large peak can push the total flow beyond the short term capacity limit, and the base flow plus the peaks can push the monthly average above the 0.95 mgd reserved in the County treatment facilities for Poulsbo.

The contract with the County establishes that if the Poulsbo average flow for any month exceeds 0.95 mgd Poulsbo must pay an extra amount for not only that month but for every month for the rest on the contract year. The contract year starts on the first of October, just at the beginning of the rainy season. This means that if the flow is going to exceed the allotted limit at any time during the year it is almost certain to happen near the beginning of the year and thus will maximize the cost to the taxpayers of Poulsbo.

It looks to me as if the people who set up the contract, and those who are planning for future sewer capacity requirements, expect the sewer flow rates to depend solely on population and have nothing to do with weather or the condition of the sewer system, i.e. I&I.

Table 4-4 says that -"I&I has been almost eliminated" from the Central Poulsbo Basin. There is still more than a normal amount of I&I in the Poulsbo system as a whole as indicated in table 2-6 on page 2-29. Where is all this coming from?

The projected flow requirements indicated in table 2-6 are based on the assumption that any new sewer construction done to meet population growth requirements will be no better in quality than the present condition of the pipes that were installed many decades ago and made of the materials that were normally used at that time, but are now obsolete and decayed.

Paragraph 2.4.2.1 points out that as of Jan 2006 I&I flow was still excessive in the Poulsbo system.

The Peaking Factor used in table 2-6 i.e. 4.02 seems high. With the data given there is no direct way to calculate this but comparing the ratio between Poulsbo's wet season average monthly flow for Jan. '06, 1.10 mgd (table 2-5) and the peak hourly flow for '06, 2.70 (table 2-6), which is 2.45, with the ratio between the USEPA figures for high groundwater conditions and storm events, 120 and 275 gpcd, a ratio of 2.29 (paragraph 2.4.2), we see that Poulsbo's peak flows are high.

Paragraph 7.4.1 says that "I&I reduction will be a high priority--".
Paragraph 7.4.1.2 says that "An approximately $20,000 budget is allocated --" for identifying and repairing inflow sources. THAT'S PEANUTS.
The next paragraph says that $110,000is provided in 2009 for I&I assessment and possibly design of capacity improvements. TOO LITTLE AND TOO LATE.

Allan Saunders

City of Poulsbo,

I would like to follow Allan's comments on I & I and flow growth in general.

Table ES-2 provides summary flow rate projections for "Executive" review. I believe it overstates the estimates of future flows for the following reasons:

GALLONS PER CAPITA PER DAY

1) the gallons per capita per day should not be on the increase. New appliances and plumbing are more efficient and utilize less water.

2) I & I per capita will decrease since the newly built houses and infrastructure will not be susceptible to nearly as much I & I. Note:

Design goal is no I & I. There will be 9000 to 17000 (double to triple) more water efficient homes in 2050. This should reduce the I & I per capita by half (moderately improved old I & I and twice as many "capitas")
Conclusion: The per capita I & I for the out years should not be 91 but more like something in the 80's.

PEAKING FACTOR

As discussed above all new infrastructure and homes will have absolutely minimal I & I. This will reduce the peaking factor (ratio of peak flow to base flow). As the base flow increases due to new water efficient homes (as in double or triple by 2050), the I & I portion of peak flow will reduce slightly due to Poulsbo's I&I program. The peaking factor ratio could gradually drop below 3.0 in 2050 vice the 4.1 presented.

Using the 2006 peak flow (which includes base flow of .67mgd for the 2006 calculation year) and a doubled 2050 population in water efficient homes (which adds an additional .67mgd; a peaking factor 1st order approximation for 2050 would look like:

Current Peak Flow plus an additional 'average daily rate' (for 2006) of .67 mgd (to account for the twice people) divided by twice the current average daily flow (to account for doubling of the population in 2050) equals peaking factor for 2050 Or (2.7 + .67) divided by (2 x .67) = 2.5 peaking factor.

WEST SIDE ALTERNATIVE

The west side alternative was never meant to be the only conveyance; we applauded the proposal that included completely redundant path. I suspect that the City wished to make it a completely impractical alternative by mandating that the new West side proposal include vacating the Lemolo Siphon. When I dropped the expenses associated with vacating the Lemolo Siphon, I came out with $29,450K vice the $52,034K presented in the Draft Plan. A redundant West Side conveyance should still be in play.

POTENTIAL CAPACITY UPGRADES TO EXISTING

5.3.1 We need to have the City/County explain the details of how they plan to push the siphon to 4.4 and 5.1 mgd.

Don Anderson

City of Poulsbo,

Just a bit concerned about two things:

1. Poulsbo Public Works wants to believe that the inflow problem is at the manholes. (questionable)

2. The program calls for "slip lining" after pressurizing on the assumption that the technology will improve in the two year lapse. (maybe)

Tom

City of Poulsbo,

I still think that the cost estimates for the slip lining projects are unrealistic, please confirm

Luis

City of Poulsbo
Sewer Plan Update
Central Interceptor Elevations and Piping
Prepared By: Peter Cunningham
Reviewed By:
10/14/2015

305 Interceptor based on WSDOT Asbuilts										
Upstream MH #	Upstream IE	Upstream Rim (approx)	Depth (ft)	Length to downstream MH (ft)	Slope (calculated)	Capacity (gpm)	Capacity (mgd)	Slope (from asbuilts)	Capacity (gpm)	Capacity (mgd)
321	82.97	102	19.03	242	0.24%	2,288	3.29	0.12%	1,633	2.35
320	82.4	92.19	9.79	190	0.21%	2,136	3.08	0.30%	2,582	3.72
319A	82.01	88	5.99	40	12.43%	16,618	23.93	12.20%	16,467	23.71
319	77.04	87	9.96	250	1.17%	5,095	7.34	1.17%	5,099	7.34
318	74.12	80.5	6.38	196	1.16%	5,085	7.32	1.17%	5,099	7.34
317	71.84	77	5.16	130	0.12%	1,654	2.38	0.12%	1,633	2.35
316	71.68	77	5.32	171	0.11%	1,530	2.20	0.12%	1,633	2.35
315	71.5	77	5.5	306	0.11%	1,571	2.26	0.12%	1,633	2.35
312	71.16	82	10.84	400	0.13%	1,683	2.42	0.12%	1,633	2.35
311	70.65	84	13.35	400	0.13%	1,667	2.40	0.12%	1,633	2.35
310	70.15	88	17.85	472	0.10%	1,503	2.16	0.12%	1,633	2.35
309	69.67	91	21.33	455	0.11%	1,531	2.20	0.12%	1,633	2.35
308	69.19	87	17.81	325	0.14%	1,754	2.53	0.12%	1,633	2.35
307	68.74	79	10.26	400	0.13%	1,732	2.49	0.12%	1,633	2.35
306	68.2	74	5.8	400	0.12%	1,633	2.35	0.12%	1,633	2.35
305	67.72	74	6.28	400	0.11%	1,599	2.30	0.12%	1,633	2.35
304	67.26	77	9.74	237	0.12%	1,620	2.33	0.12%	1,633	2.35
303	66.98	80	13.02	219	0.13%	1,686	2.43	0.12%	1,633	2.35
Johnson Road	66.7	76	9.3							

Appendix G

Pump Station Photographs

6th Avenue Pump Station

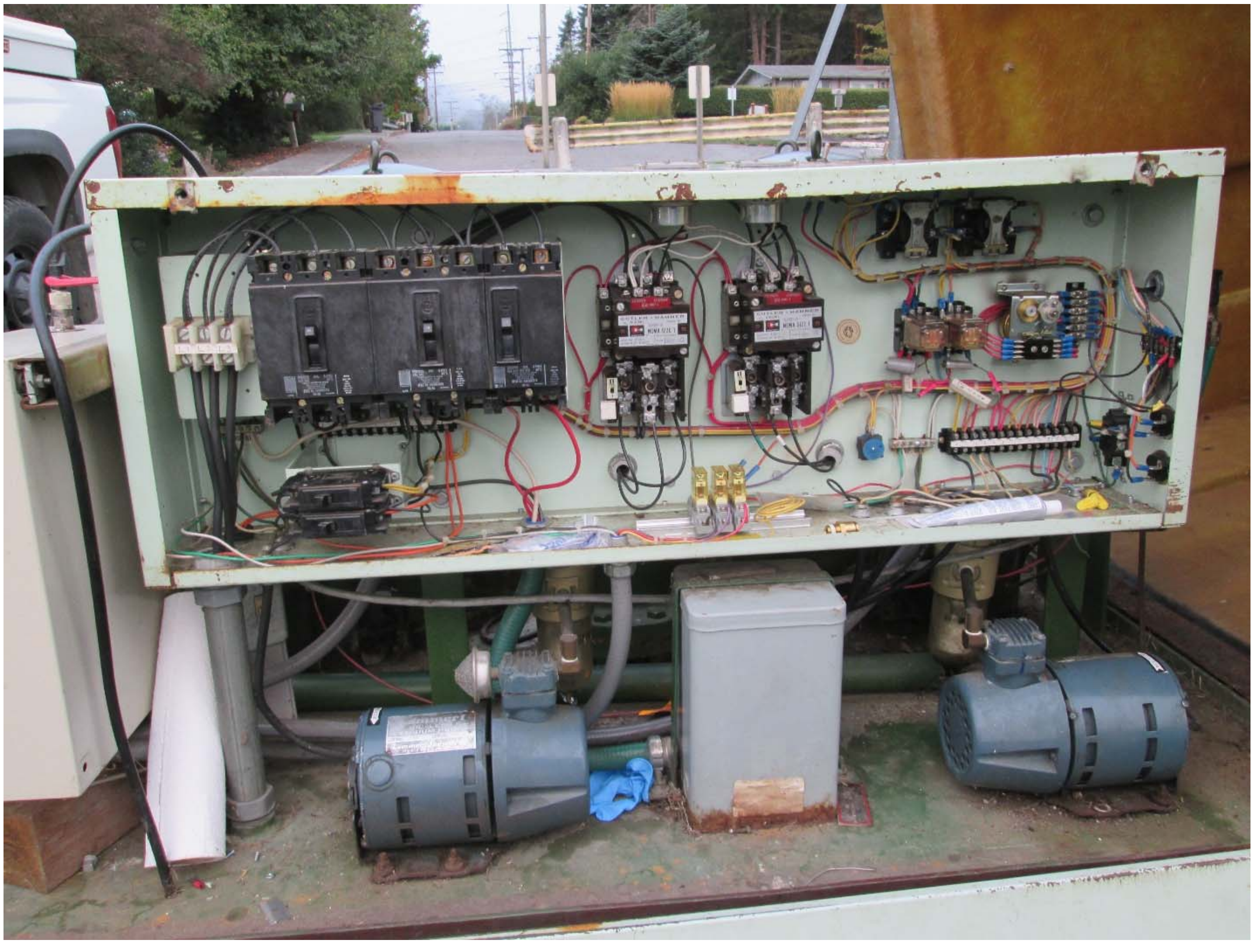
9th Avenue Pump Station

Alasund Meadows Pump Station

Applewood Pump Station

Bond Road Pump Station

Liberty Bay Pump Station



Lindvig Pump Station

Marine Science Pump Station

Village Pump Station

Appendix H

Kitsap Facilities Plan Lemolo Siphon

BHC CONSULTANTS

MEMORANDUM

Date: July 24, 2013

To: Barbara Zaroff, P.E.

From: Tony Fisher, P.E.

CC: George Radebaugh, Dave Marquist, Martin Harper, P.E., Rudy Vigilia, P.E.

Subject: Pump Station 16 and 67 Upgrades
Lemolo Inverted Siphon Hydraulic Analysis

This memorandum discusses potential upgrades to the wastewater conveyance system on the north and south end of the Lemolo Inverted Siphon to increase capacity to meet future demands. The possible improvements include increasing the pipe size and/or sealing manholes on the northern Poulsbo end of the siphon; and changes to Pump Station 16 (PS-16), Pump Station 67 (PS-67) and associated piping on the southern end of the siphon located on the Keyport Peninsula. As part of this investigation, improvement options are described along with associated budgetary cost estimates. In addition, the hydraulic performance of the existing siphon with various improvements is evaluated.

Background

The Lemolo Siphon conveys flow generated by the City of Poulsbo south under Liberty Bay to the Keyport Peninsula. The County's conveyance system begins at the Poulsbo Manhole located near the intersection of Peterson Way NE and SR 305. From that manhole, a 24-inch concrete sewer conveys flows from the City of Poulsbo along Peterson Way NE to a metering manhole (G22-2007) that is located near the intersection of Peterson Way NE and Johnson Way NE. The main decreases to 18-inch diameter concrete pipe south of the metering manhole and conveys flow along Peterson Way about 175 feet to a rock trap manhole (G22-2008).

The flow exits the rock trap manhole through a 14-inch ductile iron tightline (a pipe that normally operates like a gravity sewer, but may be pressurized in order to drive flow through the Lemolo Inverted Siphon) that extends south along Peterson Way NE to Lemolo Shore Drive NE. The pipe continues along Lemolo Shore Drive NE to Brauer Road NE and then along Brauer Road NE to Tuk-Wil La Road NE. Approximately 100 feet south of the intersection of Peterson Way NE and Lemolo Shore Drive NE is a 14-inch pig launch that the County uses to clean the 14-inch pipe.

At Tuk-Wil La Road NE, the tightline turns southwest and passes through G22-3001. G22-3001 is a partially sealed manhole with a half pipe strapped to the top of the manhole channel to counter surcharging under normal flow conditions and to facilitate passage of a pig through the manhole. According to the County, when it cleans the system, this manhole will still flood since the half pipe does not make a watertight seal. Downstream of G22-3001, the flow continues through the 14-inch diameter tightline, along Tuk-Wil La NE to G22-3002. G22-3002 is a manhole that is used for pig retrievals when the upstream system is cleaned. From the pig retrieval manhole, the 14-inch main continues along Tuk-Wil La Road NE to Norum Road NE where it turns south and continues to a valve vault (G22-3003). The valve vault marks the beginning of the twin 12-inch inverted siphon lines under Liberty Bay. Immediately south of the valve vault are pig launch ports for each of the siphon pipes. The 12-inch inverted siphon lines convey the flow under Liberty Bay to PS-16, which is located in the Town of Keyport on the shoreline of Liberty Bay. Figure 1 is a map of this system.

Most of the area tributary to the 14-inch diameter tightline is currently served by onsite septic systems. However, some grinder pump systems discharge into the main along the portion that lies within Tuk-Wil La Road. The tightline does not have any gravity sewer connections at this time and as discussed later in this memorandum, gravity connections downstream of the Poulsbo Manhole should be avoided.

PS-16, which was built in 1980 and has a pumping capacity of about 2,000 gallons per minute (gpm), then conveys the flow from the inverted siphon along with flows from the Keyport Mercantile and Sandwich Shop and two water front properties through a 16-inch and 24-inch force main to Pump Station 24 (PS-24). The 16-inch force main also receives flow from PS-67 and runs along SR 308 to the Brownsville Highway and then south along the Brownsville Highway to NE Tagholm Road. Flow from PS 17 is then added to the force main and the force main increases to 24-inch diameter pipe, which then conveys the combined flow to PS-24 (see Figure 1). PS-24 pumps the flow to the Central Kitsap Wastewater Treatment Plant for subsequent treatment. Located about 500 feet south of PS-16, PS-67 receives wastewater flow from the rest of the Keyport community and the Keyport Naval Base and has a current pumping capacity of about 700 gpm. The Technical Memorandum on Flows dated April 12, 2013 provides more information regarding the flows through this part of the County's conveyance system (see Appendix C for a copy of this memorandum).

The inverted siphon operates by allowing the flow to backup in the 14-inch gravity sewer main on the Poulsbo side of Liberty Bay until there is sufficient head to push the flow under the Bay to PS-16. As the flows increase, the head needed to push the flow through the inverted siphon correspondingly increases. The resultant backwater quickly reaches an elevation that pressurizes the valve vault (G22-3003), the pig retrieval manhole (G22-3002) and Manhole G22-3001 in Poulsbo and would cause them to overflow if they are not sealed. The valve vault has a vent pipe that extends about 8 feet above the ground surface, which represents the maximum allowable pressure at this point unless the vent is closed.

The rock trap manhole (G22-2008) effectively represents the maximum available pressure gradient elevation to push flow through the siphon without having to seal several additional manholes and impacting the measurement of flows in the metering manhole (G22-2007). The metering manhole uses a Miltronics OCM III ultrasonic open channel flow meter in conjunction with a Parshall flume to measure the flows so surcharging this structure would flood the Parshall flume and impact the ability of the meter to measure the flows. In addition, allowing the 14-inch tightline to surcharge as needed to drive flows through the inverted siphon would impact the ability of adjacent properties to connect to the system via gravity. In order to prevent the potential for sewage to backup into the individual services, the service connections would need to be pumped connections. This could occur via individual grinder pump systems or a separate force main connection from a local pump station that is constructed to serve the tributary area.

To address PS-16's need for upgrades or replacement, two options were evaluated to improve performance of the upstream Poulsbo sewer main and the downstream operation of PS-16 and PS-67. These options are summarized as follows:

> **Option 1 –** Constructing a 30-inch gravity sewer from PS-16 to PS-67 that removes PS-16 from service by redirecting the flow to PS-67 (see Figure 2). The invert of the new manhole near MH G21-2000 would be set at an elevation that would allow the Mercantile and two residential connections to be served by the new gravity sewer, thus removing the need for PS-16. The pumping capacity of PS-67 would be increased to handle the larger flows.
>
> **Option 2 –** Extending the Lemolo Siphon directly to PS-67, bypassing PS-16 and then replacing PS-16 with a small 100 gpm pump station that provides service to the two waterfront homes and the Keyport Mercantile and Sandwich Shop by conveying the flow to MH G21-2040. Flow from the inverted siphon would be conveyed to PS-67 through the existing 16-inch force main to NE Pacific Avenue, where it would be intercepted by a new gravity sewer that directs the flow to PS-67. The pumping capacity of PS-67 would be increased to handle the larger flows (see Figure 3).

Modifications to PS-16 and the conveyance system between PS-16 and PS-67 will impact the discharge elevation for the inverted siphon and thus have a direct impact on hydraulic grade line in the Poulsbo sewer main and the resultant head available to push flows through the siphon and as such are the focus of this memo.

Flow Conditions

Existing and projected flows for the Lemolo Inverted Siphon, PS-16, and PS-67 are taken from Table 3-6 of the March 2011 Central Kitsap County Wastewater Facility Plan and the Technical Memorandum on Flows dated April 12, 2013. These documents provide the basis of the annual flow projections and show how peak hour flows are calculated. The average flows and peak flows necessary for piping and or pump station design for Option 1 and Option 2 are summarized in Tables 1 and 2, respectively. These flows are slightly different than the flows summarized in Table 1 of the Technical Memorandum on Flows. For the Existing Flow Conditions, a minor error was found in the calculations for the peak flows entering PS-16 and PS-67. That error is corrected and reflected in Tables 1 and 2 below. The peak hourly flows into PS-67 for the 2030 Flow Conditions in this memo are also slightly different than the peak hourly flows describe in Table 1 of Technical Memorandum on Flows. This is primarily due to modifications to the model that were performed to mimic the improvements being made under this project. The modifications included upsizing the pipe on the Lemolo side of the inverted siphon to 18-inch diameter pipe and incorporating the modifications associated with Options 1 and 2. The Technical Memorandum on Flows did not include those modifications, which changes how the flows arrive at PS-67.

Table 1 – Existing and Projected Wastewater Design Flow Conditions – Option 1

Flow Scenario	Lemolo Siphon	Pump Station 16	Pump Station 67
Existing Flow Conditions			
Average Hourly Inflow	1,240 gpm	1,335 gpm	215 gpm
Peak Hourly Inflow	1,745 gpm	1,915 gpm	430 gpm
2015 Flow Conditions*			
Average Hourly Inflow	1,240 gpm	0 gpm	1,550 gpm
Peak Hourly Inflow	1,745 gpm	0 gpm	2,215 gpm
2030 Flow Conditions*			
Average Hourly Inflow	2,530 gpm	0 gpm	2,840 gpm
Peak Hourly Inflow	3,115 gpm	0 gpm	3,650 gpm

* PS-16 is replaced with a gravity sewer that conveys the flow from the Lemolo Inverted Siphon, the Mercantile, and the two waterfront properties to PS-67.

Table 2 – Existing and Projected Wastewater Design Flow Conditions – Option 2

Flow Scenario	Lemolo Siphon	Pump Station 16	Pump Station 67
Existing Flow Conditions			
Average Hourly Inflow	1,240 gpm	1,335 gpm	215 gpm
Peak Hourly Inflow	1,745 gpm	1,915 gpm	430 gpm
2015 Flow Conditions*			
Average Hourly Inflow	1,240 gpm	5 gpm	1,550 gpm
Peak Hourly Inflow	1,745 gpm	20 gpm	2,315 gpm
2030 Flow Conditions*			
Average Hourly Inflow	2,530 gpm	5 gpm	2,840 gpm
Peak Hourly Inflow	3,115 gpm	20 gpm	3,750 gpm

* Flow from the Lemolo Inverted Siphon bypasses PS 16 and is routed to PS 67. The existing PS-16 is replaced with a new 100 gpm pump station that serves the Mercantile and the two waterfront properties.

Tables 1 and 2 shows that the peak hour flows from the City of Poulsbo are about 1,745 gpm currently and are predicted to increase to approximately 3,115 gpm under the 2030 Flow Conditions. On the Keyport end of the siphon, peak hour flows from local contributions to PS-16 are less than 20 gpm. If the small local pump station alternative (Option 2) is desired, a 100 gpm pump station is required at the new PS-16 in order to be in compliance with the Department of Ecology's standards for flushing velocities through a 4-inch force main, which is the minimum size force main necessary to convey a 3-inch solid. Given the limited inflow into the station, a duplex configuration with submersible, non-clog pumps and constant speed motors should be sufficient.

The diversion of the Lemolo flows from PS-16 to PS-67 requires the pumping capacity of PS-67 to be increased to at least 3,700 gpm or 3,800 gpm depending on which option is selected. PS-67 is currently a 700 gpm triplex station with submersible pumps and variable speed motors. A similar configuration with larger pumps is being considered for the upgraded PS-67 (triplex station with submersible pumps and variable speed motors).

The flows into PS-67 for the 2030 Flow Conditions that are reflected in Tables 1 and 2 represent a contribution of about 2,915 gpm (4.2 mgd) from the City of Poulsbo, which is consistent with Table ES-2 for the year 2025 planning horizon. However, the new gravity sewer in Option 1 and the wet well at PS-67 should be sized to handle the flows for the 2050 planning horizon (2050 Flow Conditions) from the City of Poulsbo in order to avoid future disruptions to Washington Avenue NE, Pacific Avenue, and the surrounding neighborhood. Per Table ES-2 in the City of Poulsbo's Comprehensive Sanitary Sewer Plan 2008 Update dated September 2008 (See Appendix D for a copy of the Executive Summary of this plan), the 2050 Flow Projections from the City of Poulsbo will be about 5,270 gpm (7.59 mgd), which is about 80% higher than the flows included in Tables 1 and 2. The 2050 Flow Projections would require substantial modifications to the City's conveyance system and the Lemolo Inverted Siphon before flows of this magnitude can reach PS-67. It is likely that the pumps at PS-67 will need to be replaced due to wear and tear over the years before those higher flows are reached. Larger pumps can then be installed at that future date.

Summary of Hydraulic Model Results

Hydraulic modeling was conducted for existing and future 2030 peak hour flows to predict the hydraulic grade line in the sewer system with various improvements made to the system from PS-67 to the northern end of the Poulsbo gravity sewer main. The modeling efforts are described as follows with the resulting output contained in Appendix A:

Existing Flow Model

For the existing flows under Option 1, two model runs were performed: one with just one of the 12-inch siphon barrels in service and one with both 12-inch siphon barrels in operation. The existing flow conditions were not simulated under Option 2. The following conditions were incorporated into these model runs to determine the resultant hydraulic grade line in the conveyance system:

- No upgrades to Poulsbo sewer main
- PS 16 is replaced with a 30-inch diameter gravity sewer main leading to PS-67 as shown on Figure 2 (Option 1)
- PS-67 is upgraded to handle the increased flow

The model predicts the existing peak hour flows with one barrel in operation will result in surcharging of the 14-inch Poulsbo sewer main. The valve vault (G22-3003) and G22-3001 on the Poulsbo side of Liberty Bay are surcharged to within a foot of the ground surface. The pig retrieval manhole (G22-3002) appears to be surcharged roughly 2 feet above ground. The surcharging dissipates within about 300 to 400 feet upstream of MH G22-3001. Therefore, G22-3001 and G22-3002 will need to be sealed. Downstream of the siphon, the 30-inch gravity system is shown as flowing freely with no surcharging indicating the line has adequate capacity.

For the existing flows with two barrels in operation, the model shows the 14-inch Poulsbo sewer main to be operating near full capacity with pipes running slightly less than full, except at manholes where entrance and exit losses cause the hydraulic grade line to reach the crown of the pipe. Therefore, no upgrades to the Poulsbo Sewer are necessary to convey the current flows when both siphon barrels are utilized. The proposed 30-inch gravity system downstream of the inverted siphon appears to have sufficient capacity to convey the existing flows. The results of this model run are included in Appendix A under Model Run A.

2030 Flow Modeling – Option 1

For Option 1, which involves replacing PS-16 with a deep 30-inch gravity sewer main, models were run to see how the system would perform with either the existing 14-inch Poulsbo sewer main remaining in service or an upgraded 18-inch Poulsbo sewer main. The model runs were based on:

- Both 12-inch siphon barrels are in service
- PS-16 is replaced with a 30-inch diameter gravity sewer main leading to PS-67 as shown on Figure 2
- PS-67 is upgraded to handle the increased flow

The 2030 flows conveyed through the existing 14-inch Poulsbo sewer main are predicted to surcharge the full length of the Poulsbo main with both 12-inch inverted siphon barrels in operation. All structures on the Poulsbo sewer main up to the Poulsbo manhole, except the valve vault (G22-3003) and the metering manhole (MH G22-2007), are surcharged above the ground surface. The valve vault and the metering manhole surcharge to within 6 feet of the ground surface. Therefore, all of the structures on the Poulsbo Sewer would need to be sealed and the metering manhole would need to be replaced with a different metering mechanism. The proposed 30-inch gravity system downstream of the inverted siphon appears to have adequate capacity to convey the predicted 2030 flows. The hydraulic profile for this scenario is shown in Appendix A, Model Run B.

Upgrading the Poulsbo gravity sewer to 18-inch diameter pipe eliminates the surcharging upstream of G22-3001. However, the conveyance system between G22-3003 and MH G22-3001 remains significantly surcharged due to a backwater effect driven by inadequate capacity in the two 12-inch inverted siphon barrels. Therefore, the pig retrieval manhole (G22-3002) and G22-3001 would need to be sealed. The hydraulic profile for this scenario is shown in Appendix A, Model Run C.

2030 Flow Modeling – Option 2

The hydraulic grade line was estimated for Option 2, which replaces PS-16 with a small local pump station and diverts the siphon around PS-16 to PS-67 using the existing force main (see Figure 3). The existing force main is assumed to be intercepted by a new gravity sewer along NE Pacific Avenue at an elevation that is about 25 feet higher than the inverted siphon's current discharge elevation into PS-16. The hydraulic grade line was then estimated based on:

- The Poulsbo sewer main is upsized to 18-inch diameter pipe (See Notes on Figure 1)
- Both 12-inch siphon barrels are in service
- Flows from the Lemolo Inverted Siphon bypass PS-16 and are conveyed to PS-67 through the existing 16-inch force main as shown on Figure 3.
- A small PS-16 is constructed to serve the Mercantile and the two waterfront properties
- PS-67 is upgraded to handle the increased flow

Utilizing the existing force main to convey the flows from the inverted siphon to PS-67 does not perform well hydraulically. Starting at the intersection of Washington Avenue NE and NE Pacific Avenue, where a new gravity sewer would intercept flow from the existing force main, the depth of the existing force main sets the hydraulic grade line about 20 to 25 feet above sea level. The resultant hydraulic grade line associated with the higher discharge elevation for the inverted siphon and the dynamic head losses through the existing 16-inch force main and the existing inverted siphon would result in significant surcharging of the system to a point about 600 feet south of the rock trap manhole (G22-2008). This option would nearly exhaust the available head needed to drive flows through the inverted siphon and would provide little capacity for increased flows from the City of Poulsbo beyond the projected 2030 flow conditions. These conditions would be significantly aggravated under the 2050 Flow Projections from the City of Poulsbo and velocities in the existing 16-inch force main between PS-16 and PS-67 would be about 8.4 feet per second, which is fairly high and would contribute significant friction losses.

Conclusions and Recommendations

Under either option, the existing 14-inch main between the rock trap MH (G22-2008) and the valve vault (G22-3003) will surcharge under the 2030 Flow Conditions and all structures on that section of the main will need to be sealed. This would include G22-3001 and the pig retrieval manhole (G22-3002). Pigs will still need to be retrieved when the 14-inch main is cleaned, so provisions should be made to maintain the retrieval functions when the pig retrieval manhole is sealed.

The valve vault (G22-3003) is already sealed when its vent pipe is closed. However, conversations with County field staff have revealed some dissatisfaction with the valve vault. Therefore, consideration should be given to replacing the valve vault with a pig retrieval structure that would then allow the 14-inch main between the current pig retrieval vault (G21-3002) and the valve vault (G21-3003) to be cleaned. Currently, this segment of the system cannot be pigged.

There are no gravity service connections to the 14-inch main (the few current services are all individual pressure systems), so surcharging the system would not result in sewage backups in side sewers. Because the system will surcharge in the future, future connections should be restricted to pressurized systems such as individual grinder pumps or force mains.

When the 14-inch main is upsized to 18-inch diameter pipe in the future, structures south of G22-2008 should remain sealed and service connection should remain restricted to pressurized connections in order to maintain the system head that is available to operate the inverted siphon. This will become even more necessary under the 2050 Flow Projections of 5,270 gpm from the City of Poulsbo.

The existing 12-inch inverted siphon under Liberty Bay, from G22-3001 to PS-16 is operating near its peak capacity under the current peak flow with both barrels of the siphon in operation. Constraining the existing peak flows to one siphon barrel so that the other barrel may be used as a redundant pipe in compliance with the Department of Ecology's standards would result in surcharging of the southern portions of the existing Poulsbo sewer main to about G22-3001. While this may be acceptable under the current flows, as growth occurs, the hydraulic grade line will extend north up the system and would soon surcharge the system to the Poulsbo Manhole and beyond. Therefore, operating both barrels of the inverted siphon is necessary to convey the future flows. This is consistent with the County's Wastewater Facility Plan.

Replacing PS-16 with a gravity sewer that would convey the flows from the City of Poulsbo, the Mercantile, and two waterfront properties to PS-67 along with upgrading the pumping capacity of PS-67 would provide sufficient capacity to convey the projected flows on the Keyport side of the inverted siphon. To avoid surcharging upstream of the Poulsbo Manhole, the 14-inch sewer on the Poulsbo side of the inverted siphon will need to be upsized to 18-inch diameter pipe within the next 5 to 10 years, depending on the rate of actual growth in the City of Poulsbo. This option would eliminate one pump station from the County's conveyance system and would address the project's goal of eliminating the existing pump station along the shoreline of Liberty Bay.

To facilitate the operation of the inverted siphon until the 14-inch sewer is replaced, G22-3001 and pig retrieval manhole (G22-3002) will need to be sealed. As previously mentioned, the valve vault (G22-3003) is already sealed when its vent pipe is closed. Side sewer connections via gravity should not be allowed to the system downstream of G22-2008. Pressurized connections are acceptable.

Option 2 does not appear to be a good solution as it would use up the head available to drive flows through the inverted siphon under the 2030 Flow Conditions and would result in significant surcharging between G22-3003 and the valve vault (G22-3001). Therefore, the following improvements are recommended.

- Replace PS-16 with a gravity sewer set at an elevation that would allow the Mercantile and the two waterfront properties to be served via gravity.
- Upgrade the pumping capacity of PS-67
- Seal G22-3001 and the pig retrieval manhole (G22-3002)
- Upgrade the Poulsbo gravity sewer to 18-inch diameter pipe within the next 5 to10 years

Improvement Costs

Budgetary cost projections were prepared for Option 1 (replacing PS-16 with a 30-inch gravity sewer) and Option 2 (replacing PS-16 with a small local pump station and conveying the Poulsbo flows through the existing 16-inch force main to PS-67). These estimates are shown in Appendix B. The capital costs include the County's standard 35% contingency factor that has been used on budget level cost projections. The construction cost projection for Option 1 is about $560,000, which includes sales tax at a rate of 8.6%. These costs include an HMA patch over the sewer trench, but do not include any overlay. The cost of the overlay is assumed to be included as part of the Storm LID portion of the project for purposes of this memo since Washington Avenue NE would be overlaid due to the LID improvements whether Option 1 or Option 2 is selected.

The construction cost projection for Option 2 is about $1,013,000, which also includes sales tax at a rate of 8.6%. Option 2 appears to be significantly more expensive than Option 1 and provides less capacity for future flows from the City of Poulsbo. Therefore, this memorandum recommends Option 1 become the preferred alternative.

LEGEND

- EXISTING LIFT STATION
- EXISTING MANHOLE
- EXISTING FORCE MAIN
- EXISTING GRAVITY SEWER

Existing Sewer System Kitsap County 2012
Aerial Photo: Kitsap County 2007
GIS Base Data: Kitsap County.

This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

NORTH

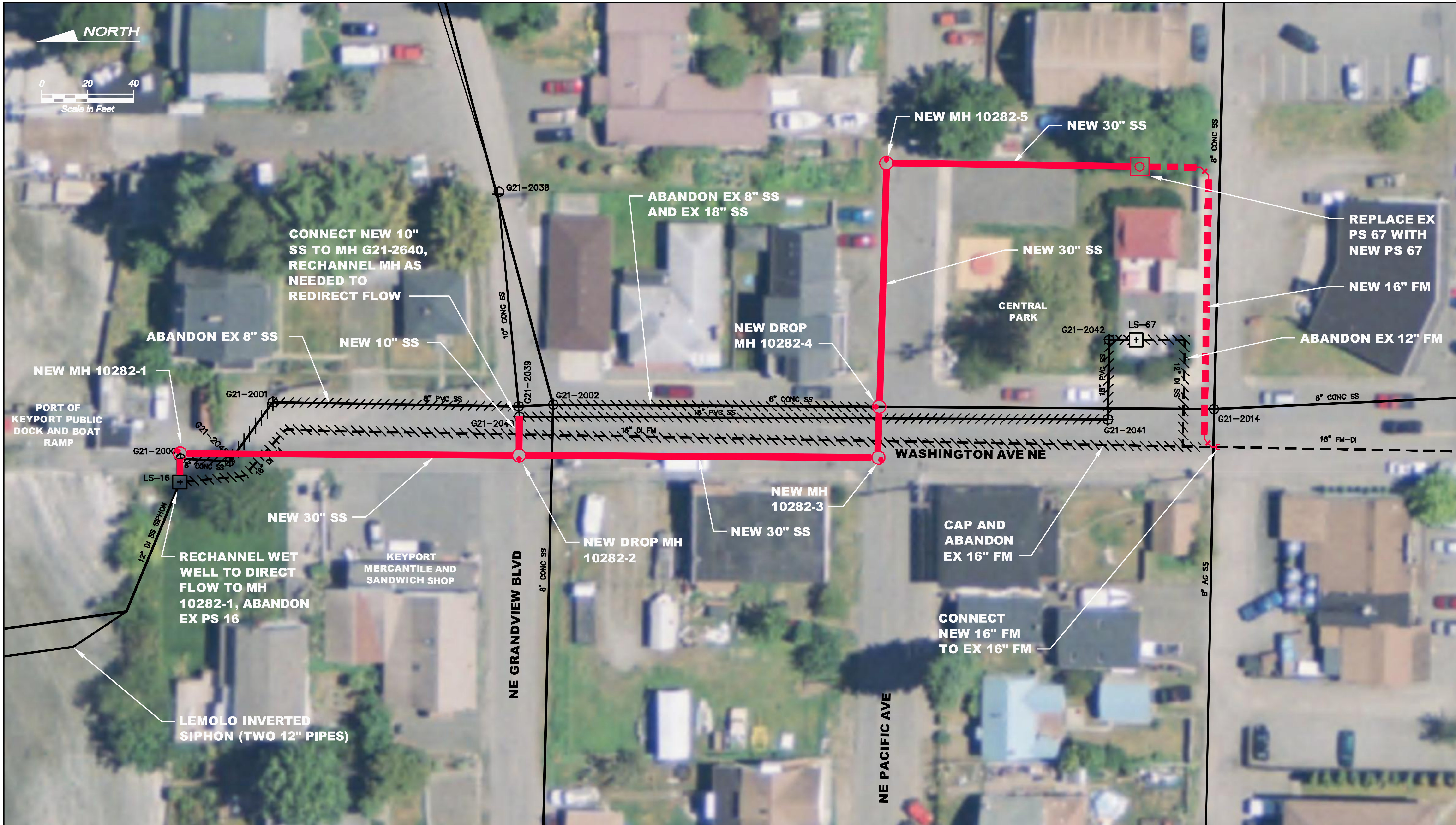
Feet
0 300 600

BHC CONSULTANTS
BHC Consultants, LLC
1601 Fifth Avenue, Suite 500
Seattle, Washington 98101
206.505.3400
206.505.3406 (fax)
www.bhcconsultants.com

HDR

PUMP STATION 16 & 67 UPGRADES
KITSAP COUNTY PUBLIC WORKS
CONVEYANCE UPGRADES
POULSBO SEWER VICINITY MAP

DATE	JULY 2013
FIGURE	1



PLOT DATE & TIME
JUL 12 2013 09:31:55

FILE NAME (UPDATED BY)
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XREFS: X13-10282_EX SSFM, X13-10282_Parcels

LEGEND

○	EXISTING MANHOLE	◉	NEW MANHOLE
□	EXISTING PUMP STATION	▬	NEW SEWER IMPROVEMENTS
—	EXISTING FORCE MAIN	⫽⫽⫽	TO BE REMOVED OR ABANDONED
—	EXISTING GRAVITY SEWER		

BHC CONSULTANTS
BHC Consultants, LLC
1601 Fifth Avenue, Suite 500
Seattle, WA 98101
206.505.3400 206.505.3406 (fax)
www.bhcconsultants.com

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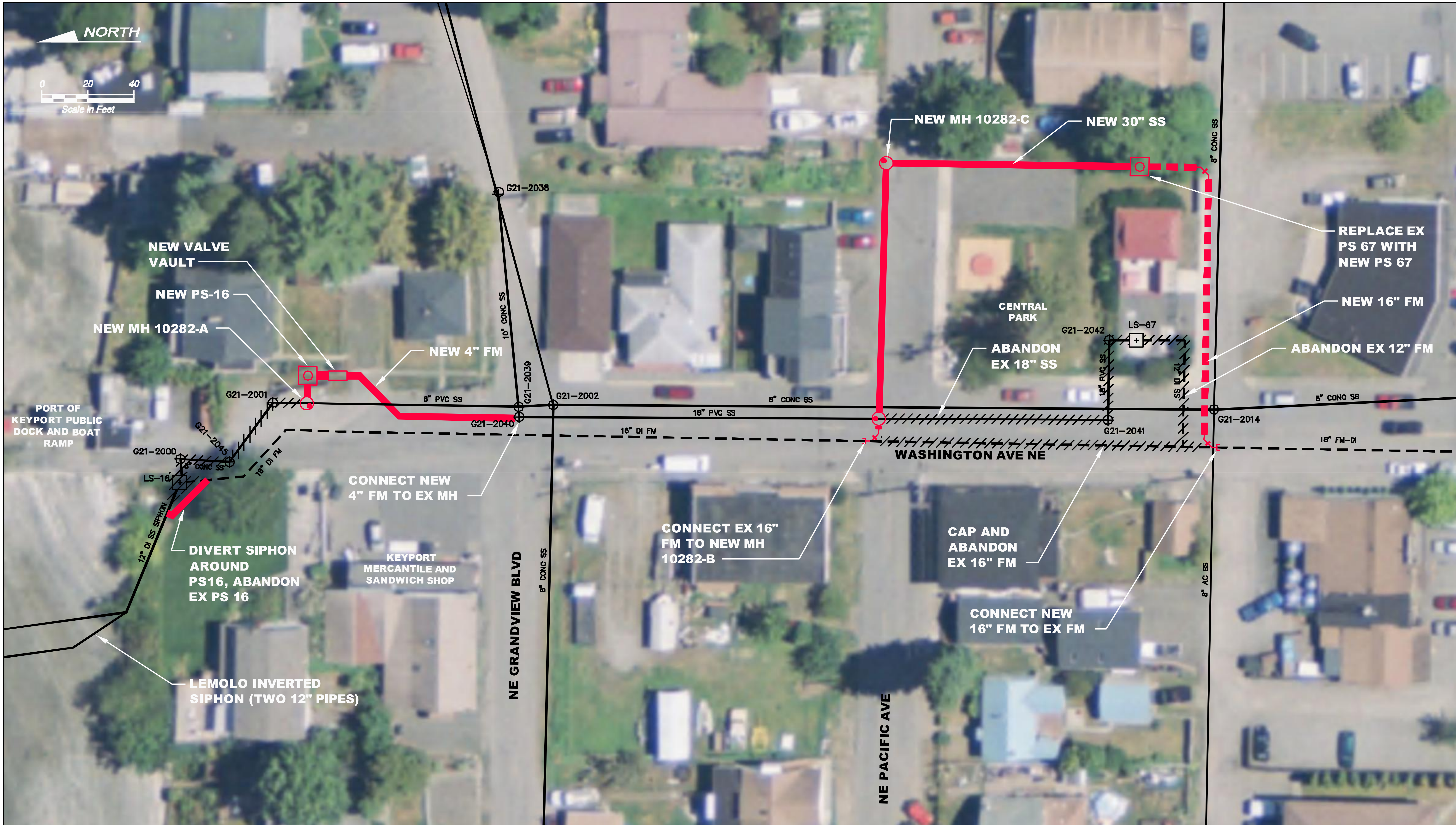
PUMP STATION 16 AND 67 UPGRADES
KITSAP COUNTY PUBLIC WORKS
CONVEYANCE UPGRADES
OPTION 1

DATE
JULY 2013

FIGURE
2



LEGEND

○	EXISTING MANHOLE		NEW MANHOLE
□	EXISTING PUMP STATION		NEW SEWER IMPROVEMENTS
	EXISTING FORCE MAIN		TO BE REMOVED OR ABANDONED
	EXISTING GRAVITY SEWER		

BHC CONSULTANTS
BHC Consultants, LLC
1601 Fifth Avenue, Suite 500
Seattle, WA 98101
206.505.3400 206.505.3406 (fax)
www.bhcconsultants.com

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PUMP STATION 16 AND 67 UPGRADES
KITSAP COUNTY PUBLIC WORKS
CONVEYANCE UPGRADES
OPTION 2

DATE
JULY 2013

FIGURE
3

FILE NAME (UPDATED BY) S:\CAD\KITSAP COUNTY\13-10282 PS 16-67 MTG FIGS\DWGS\KEYPORT MEETING EXHIBIT.DWG (MTC)
XREFS: X13-10282_EX SSFM, X13-10282_Parcels
PLOT DATE & TIME JUL 12 2013 09:31:55

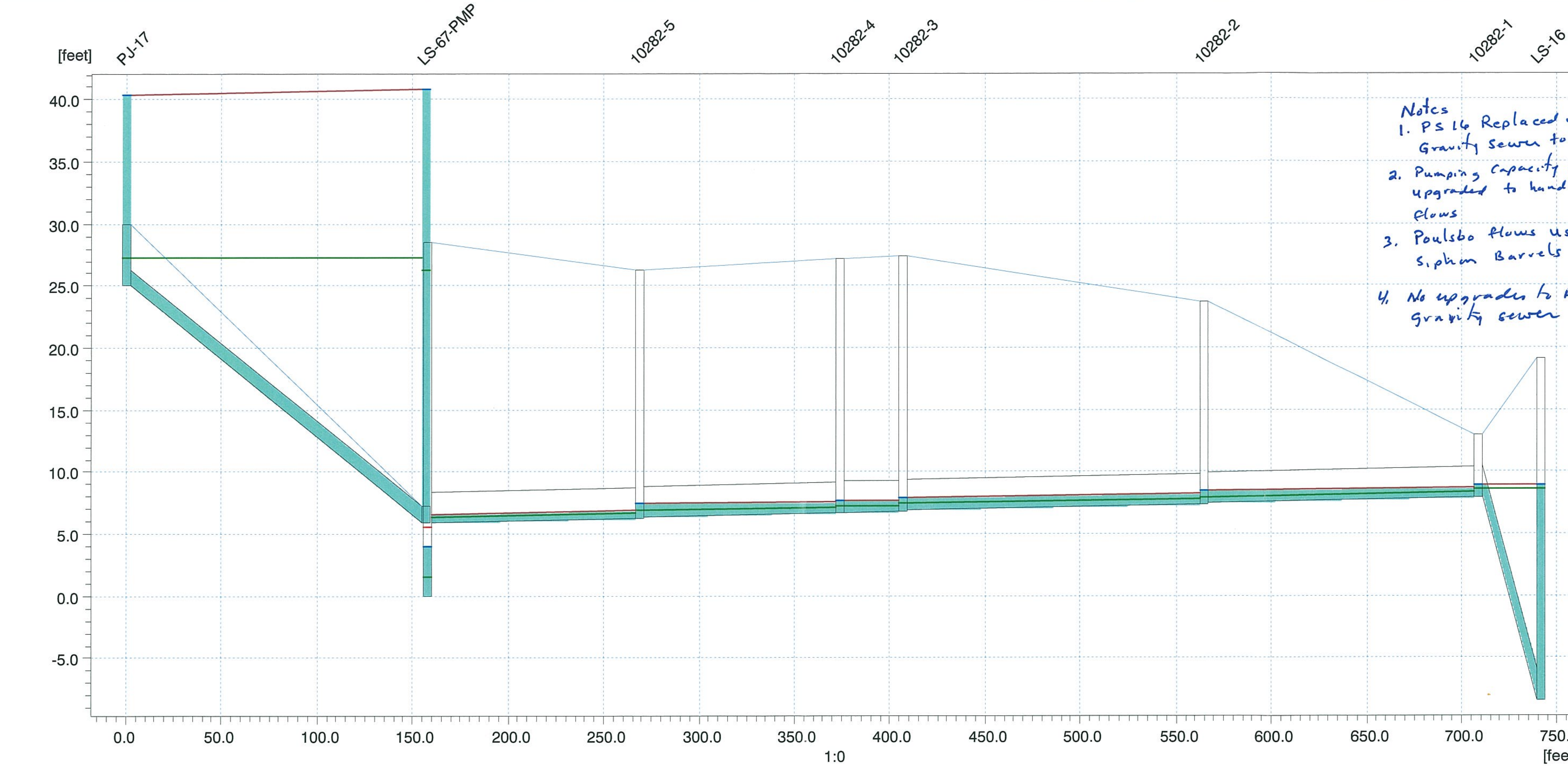
APPENDIX A

HYDRAULIC PROFILES

EXISTING CONDITIONS
OPTION 1
14" Poulsbo Sewer

Link Water Level - 1-1-2007 19:47:40 Baseline_Peak_Day_PROBaseline Peak Day.PRF

Discharge	4.936	4.936	4.935	4.847	4.846	3.639	3.635	cfs



Notes
1. PS 16 Replaced with 30"φ Gravity sewer to PS 67 Per Figure
2. Pumping capacity at PS 67 upgraded to handle increased flows
3. Poulsbo flows using both siphon Barrels
4. No upgrades to Poulsbo gravity sewer

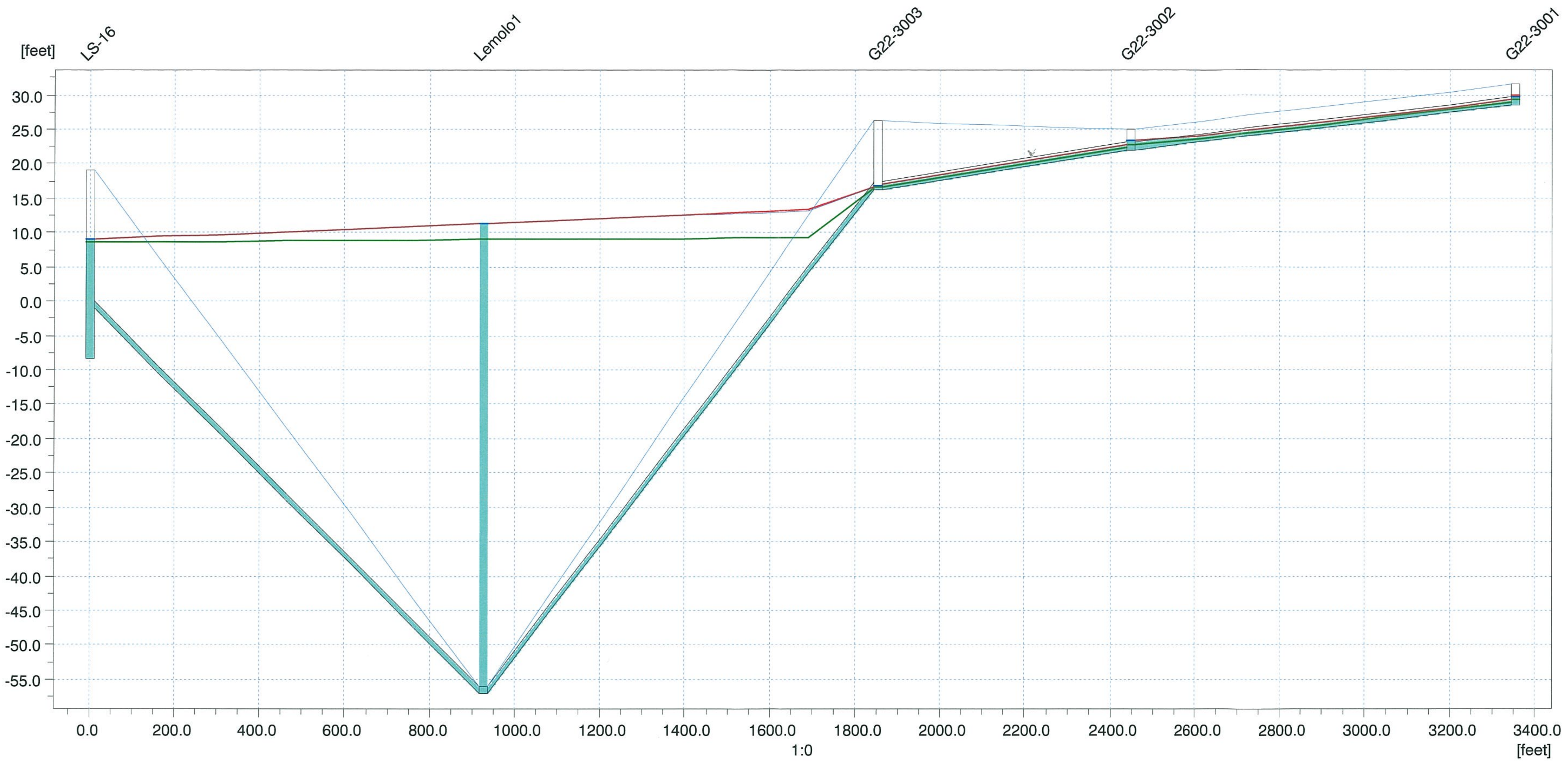
	PJ-17	LS-67-PMP	10282-5	10282-4	10282-3	10282-2	10282-1	
Ground Lev.	30.00	7.23	26.32	27.14	27.39	23.67	13.00	[m]
Invert lev.	25.00	5.89	6.22	6.64	6.79	7.37	7.90	[m]

Length	157.00	111.00	105.00	32.81	158.00	144.00	32.81	[m]
Diameter	1.33	2.50	2.50	2.50	2.50	2.50	2.50	[m]
Slope o/oo	121.72	2.97	3.05	1.52	3.04	2.99	498.65	

MODEL RUN A

Link Water Level - 1-1-2007 19:47:40 Baseline_Peak_Day_PROBaseline Peak Day.PRF

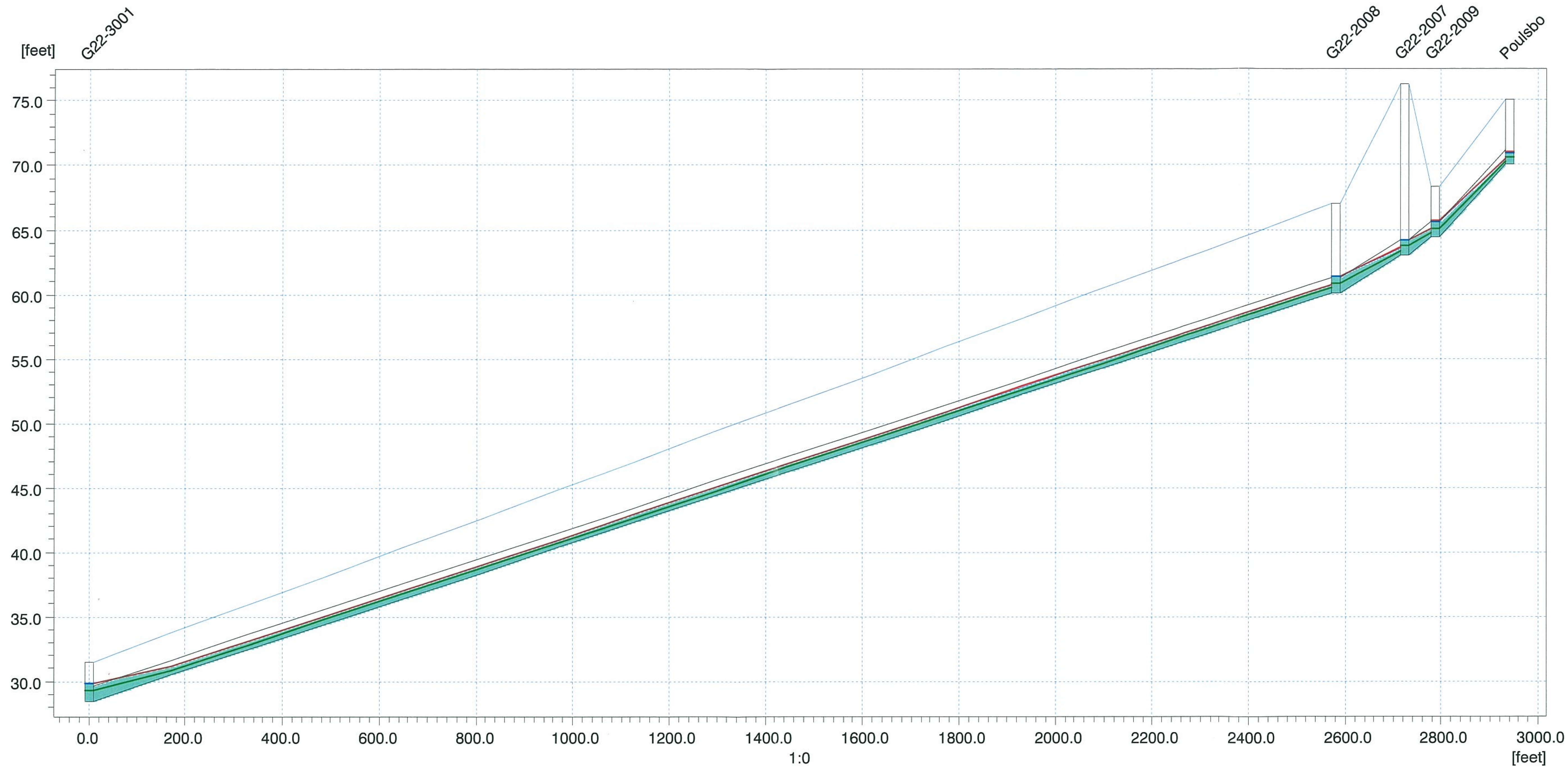
Discharge	1.917	1.935	3.720	3.710	cfs



	LS-16		Lemolo1		G22-3003		G22-3002		G22-3001	
Ground Lev.	19.14		-56.00		26.20		25.00			[m]
Invert lev.	-8.36		-57.00		16.30		22.00			[m]
Length		926.00		926.00		595.15		907.49		[m]
Diameter		1.00		1.00		1.17		1.17		[m]
Slope o/oo		60.48		79.16		9.58		7.16		

Link Water Level - 1-1-2007 19:47:40 Baseline_Peak_Day_PROBaseline Peak Day.PRF

Discharge	3.690	3.682		3.676	cfs

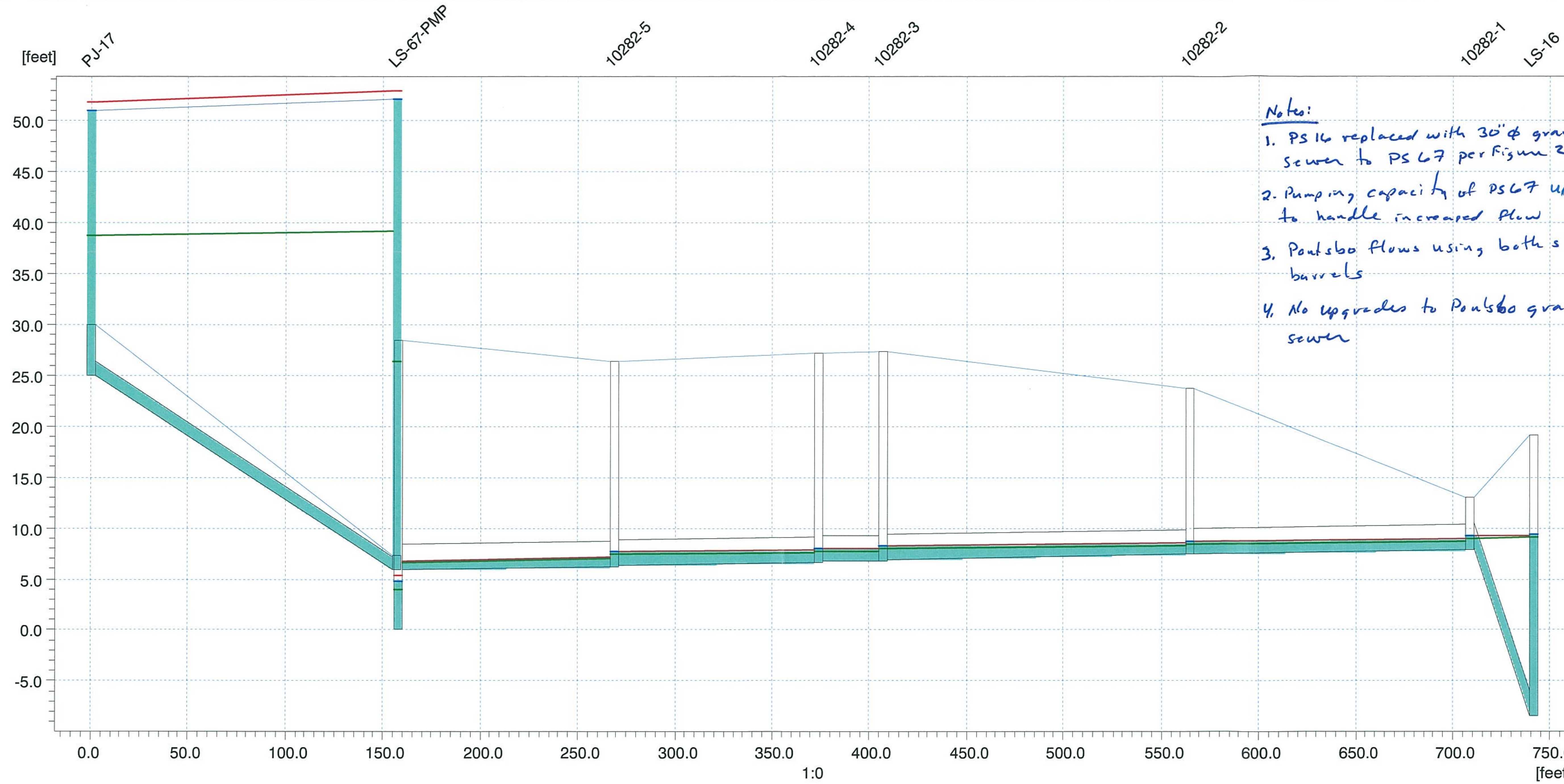


	G22-3001		G22-2008	G22-2007	G22-2009		
Ground Lev.	31.50		67.00	76.30	68.30		[m]
Invert lev.	28.50		60.10	63.00	64.40		[m]
Length		2579.70		143.63		155.18	[m]
Diameter		1.17		1.17		1.17	[m]
Slope o/oo		12.25		20.19		36.09	

2030 FLOW CONDITIONS
OPTION 1
14" Poulsbo sewer

Link Water Level - 1-1-2007 19:19:40 2030_Peak_Day_PRO2030 Peak Day.PRF

Discharge	7.163	7.171	7.170	7.072	7.072	5.822	5.817	cfs



Notes:
1. PS 16 replaced with 30"Φ gravity sewer to PS 67 per Figure 2
2. Pumping capacity of PS67 upgraded to handle increased flow
3. Poulsbo flows using both siphon barrels
4. No upgrades to Poulsbo gravity sewer

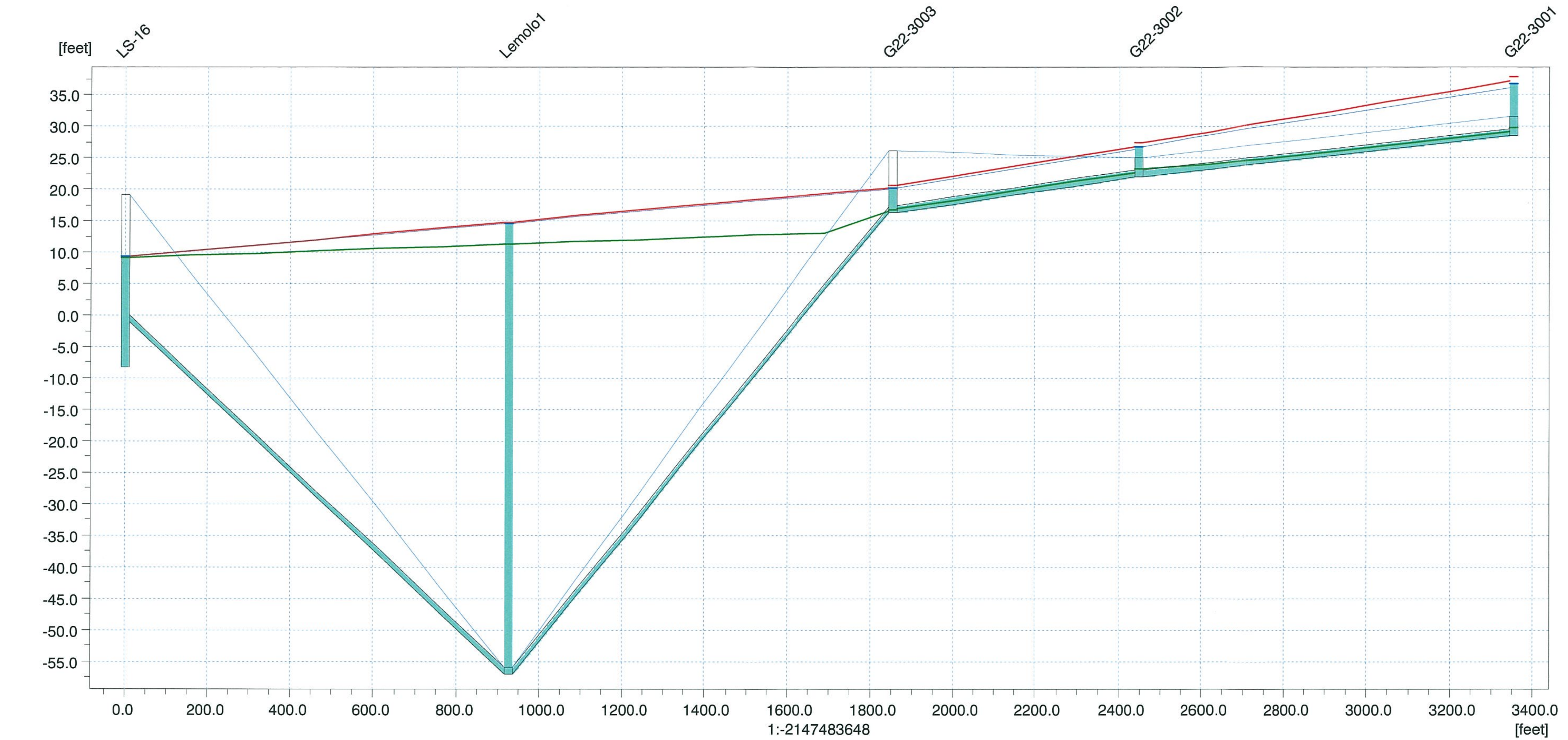
	PJ-17	LS-67-PMP	10282-5	10282-4	10282-3	10282-2	10282-1	
Ground Lev.	30.00	7.23	26.32	27.14	27.39	23.67	13.00	[m]
Invert lev.	25.00	5.89	6.22	6.64	6.79	7.37	7.90	[m]

Length	157.00	111.00	105.00	32.81	158.00	144.00	32.81	[m]
Diameter	1.33	2.50	2.50	2.50	2.50	2.50	2.50	[m]
Slope o/oo	121.72	2.97	3.05	1.52	3.04	2.99	498.65	

MODEL RUN B

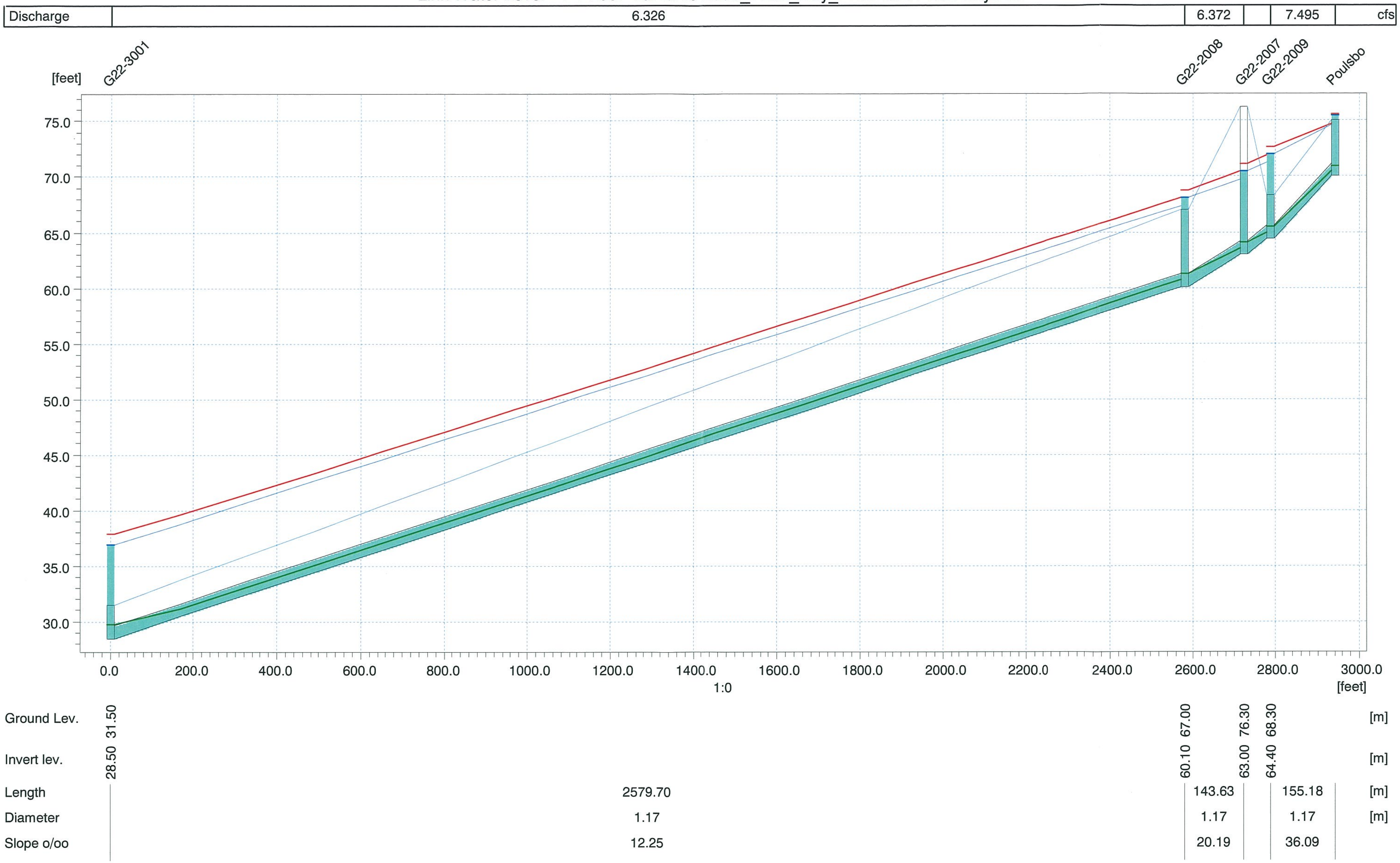
Link Water Level - 1-1-2007 19:19:40 2030_Peak_Day_PRO2030 Peak Day.PRF

Discharge	2.919	2.919	5.838	5.906	cfs



	LS-16		Lemolo1		G22-3003		G22-3002		G22-3001	
Ground Lev.	19.14		-56.00		26.20		25.00			[m]
Invert lev.	-8.36		-57.00		16.30		22.00			[m]
Length		926.00		926.00		595.15		907.49		[m]
Diameter		1.00		1.00		1.17		1.17		[m]
Slope o/oo		60.48		79.16		9.58		7.16		

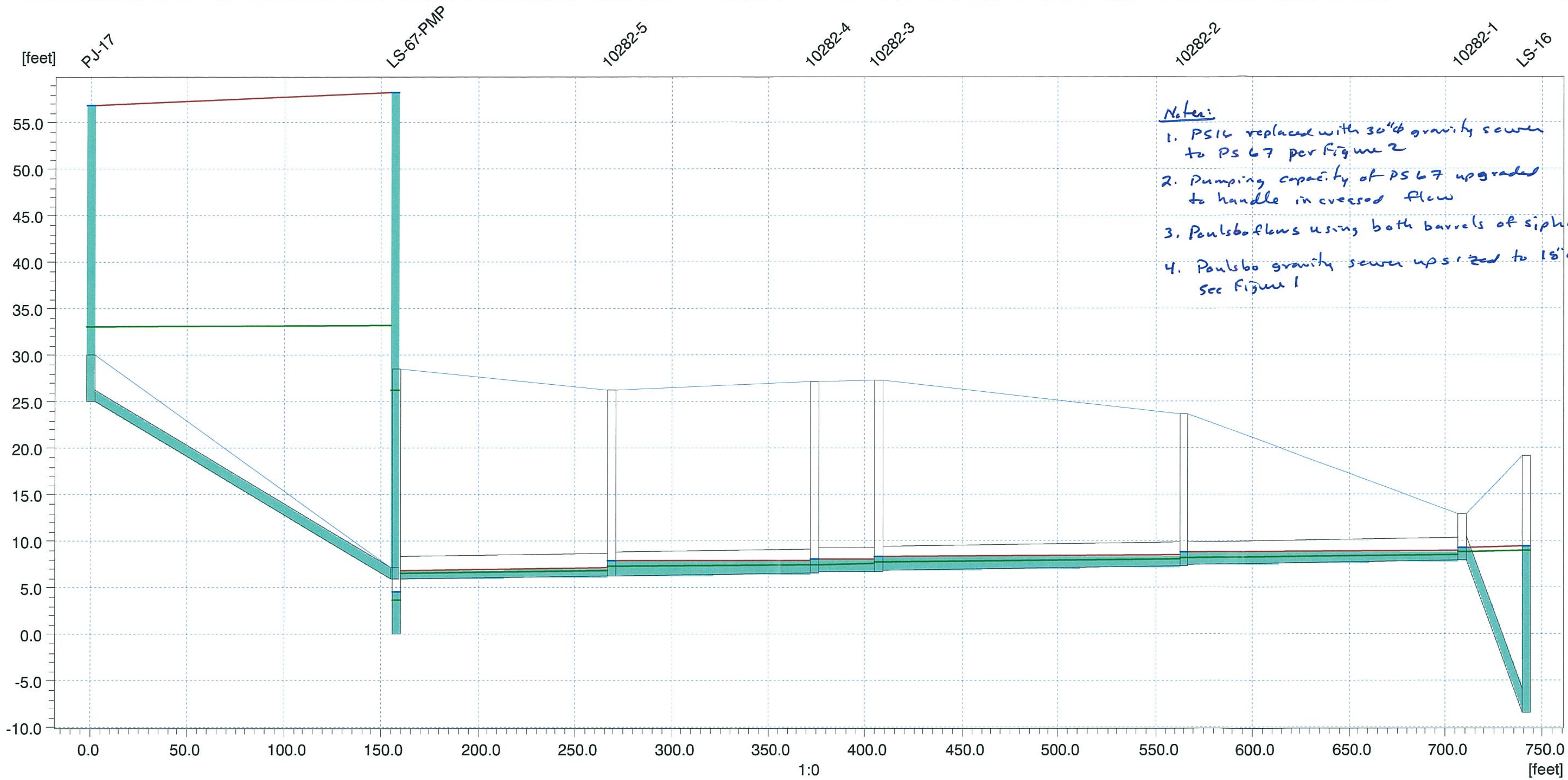
Link Water Level - 1-1-2007 19:19:40 2030_Peak_Day_PRO2030 Peak Day.PRF



OPTION 1
2030 Flow Conditions
18" Poulsbo Sewer

Link Water Level - 1-1-2007 19:47:59 2030_Peak_Day_PRO_Poulsbo_182030 Peak Day.PRF

Discharge	8.122	8.135	8.134	8.036	8.036	6.822	6.817	cfs



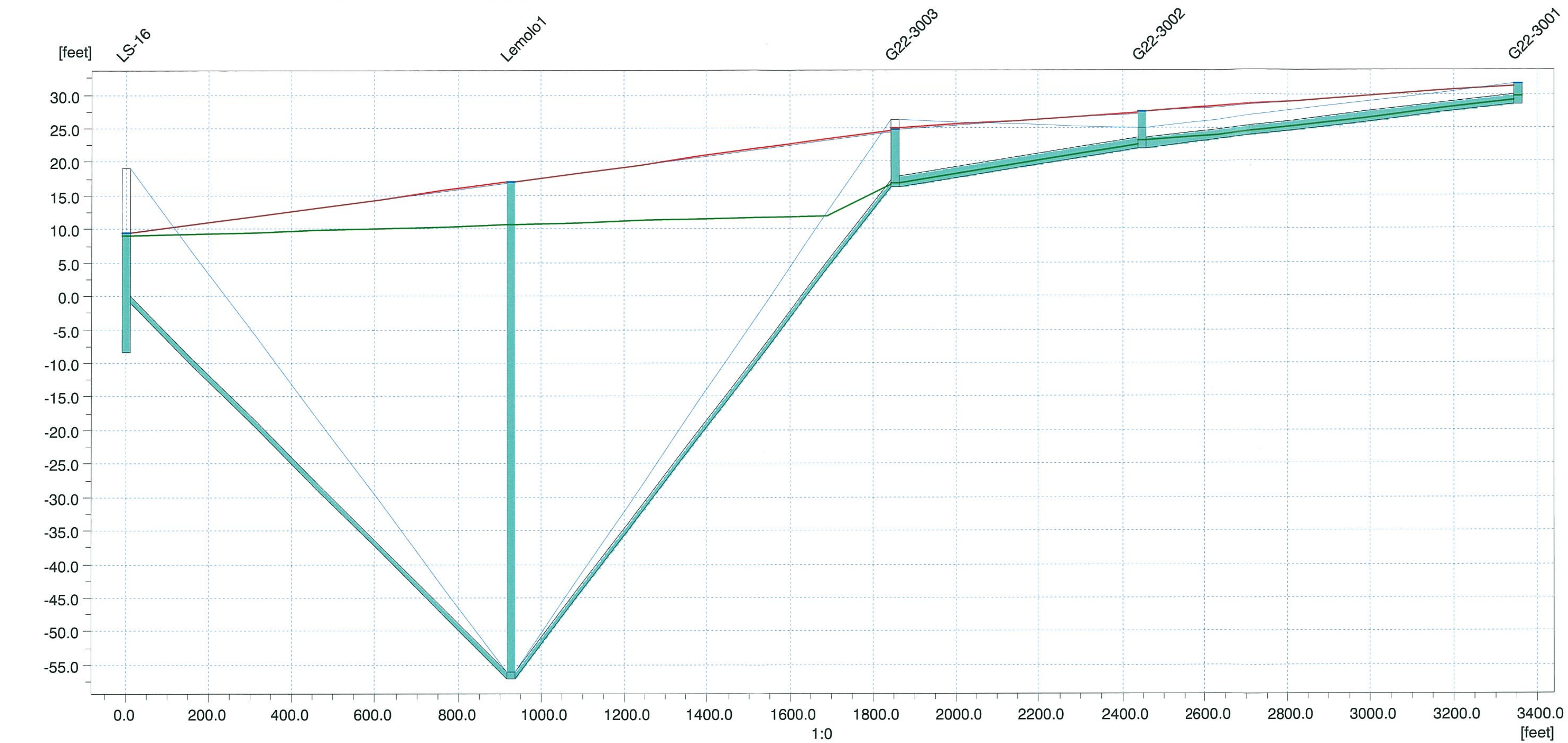
Notes:
1. PS16 replaced with 30"⌀ gravity sewer to PS 67 per Figure 2
2. Pumping capacity of PS 67 upgraded to handle increased flow
3. Poulsbo flows using both barrels of siphon
4. Poulsbo gravity sewer upsized to 18"⌀ pipe. See Figure 1

	PJ-17		LS-67-PMP		10282-5		10282-4		10282-3		10282-2		10282-1		
Ground Lev.	30.00		7.23		26.32		27.14		27.39		23.67		13.00		[m]
Invert lev.	25.00		5.89		6.22		6.64		6.79		7.37		7.90		[m]
Length		157.00		111.00		105.00		32.81		158.00		144.00		32.81	[m]
Diameter		1.33		2.50		2.50		2.50		2.50		2.50		2.50	[m]
Slope o/oo		121.72		2.97		3.05		1.52		3.04		2.99		498.65	

MODEL RUN C

Link Water Level - 1-1-2007 19:47:59 2030_Peak_Day_PRO_Poulsbo_182030 Peak Day.PRF

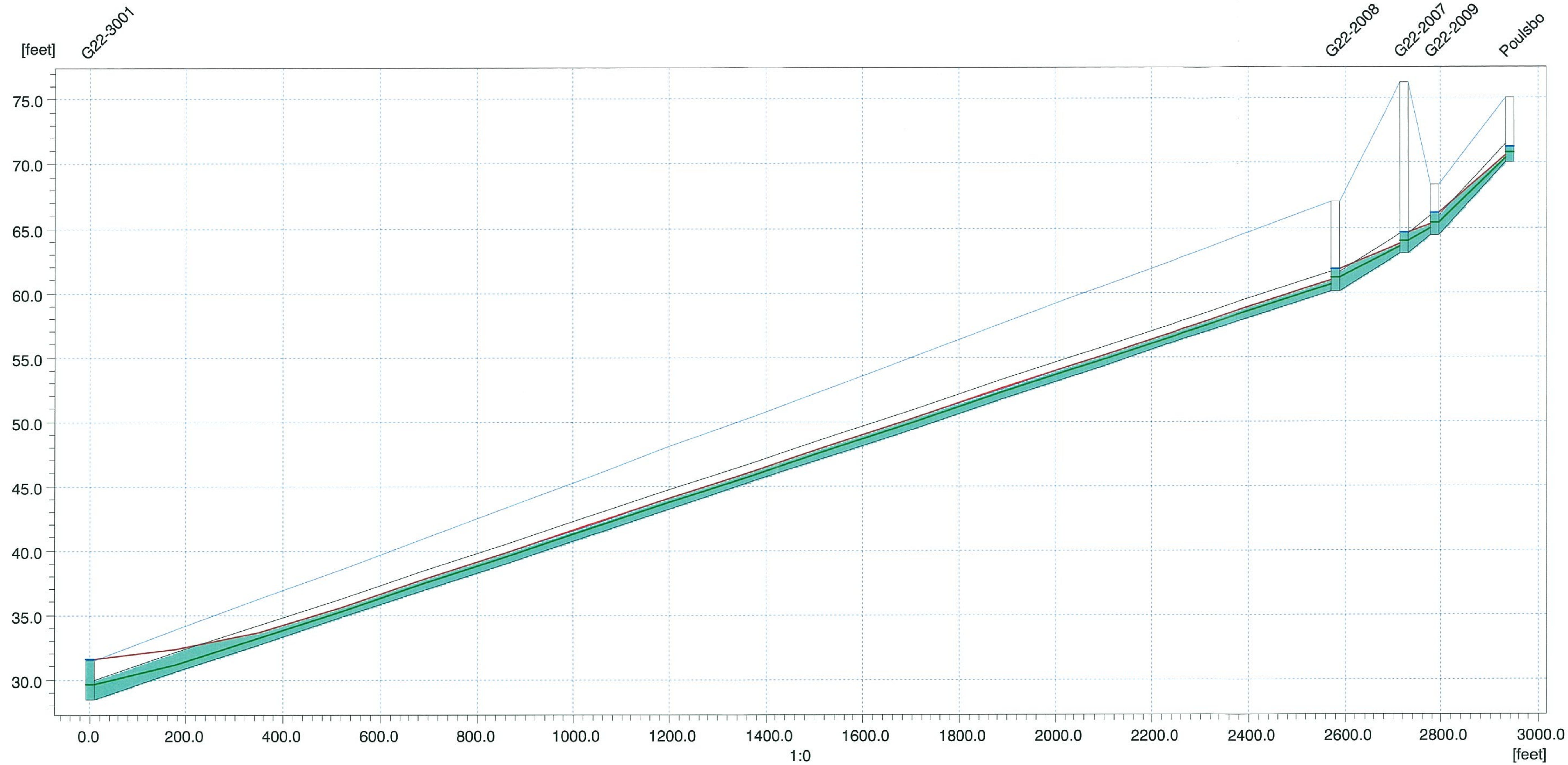
Discharge	3.458	3.459	6.919	7.393	cfs



	LS-16		Lemolo1		G22-3003		G22-3002		G22-3001	
Ground Lev.	19.14		-56.00		26.20		25.00			[m]
Invert lev.	-8.36		-57.00		16.30		22.00			[m]
Length		926.00		926.00		595.15		907.49		[m]
Diameter		1.00		1.00		1.50		1.50		[m]
Slope o/oo		60.48		79.16		9.58		7.16		

Link Water Level - 1-1-2007 19:47:59 2030_Peak_Day_PRO_Poulsbo_182030 Peak Day.PRF

Discharge	7.359	7.349		7.342	cfs

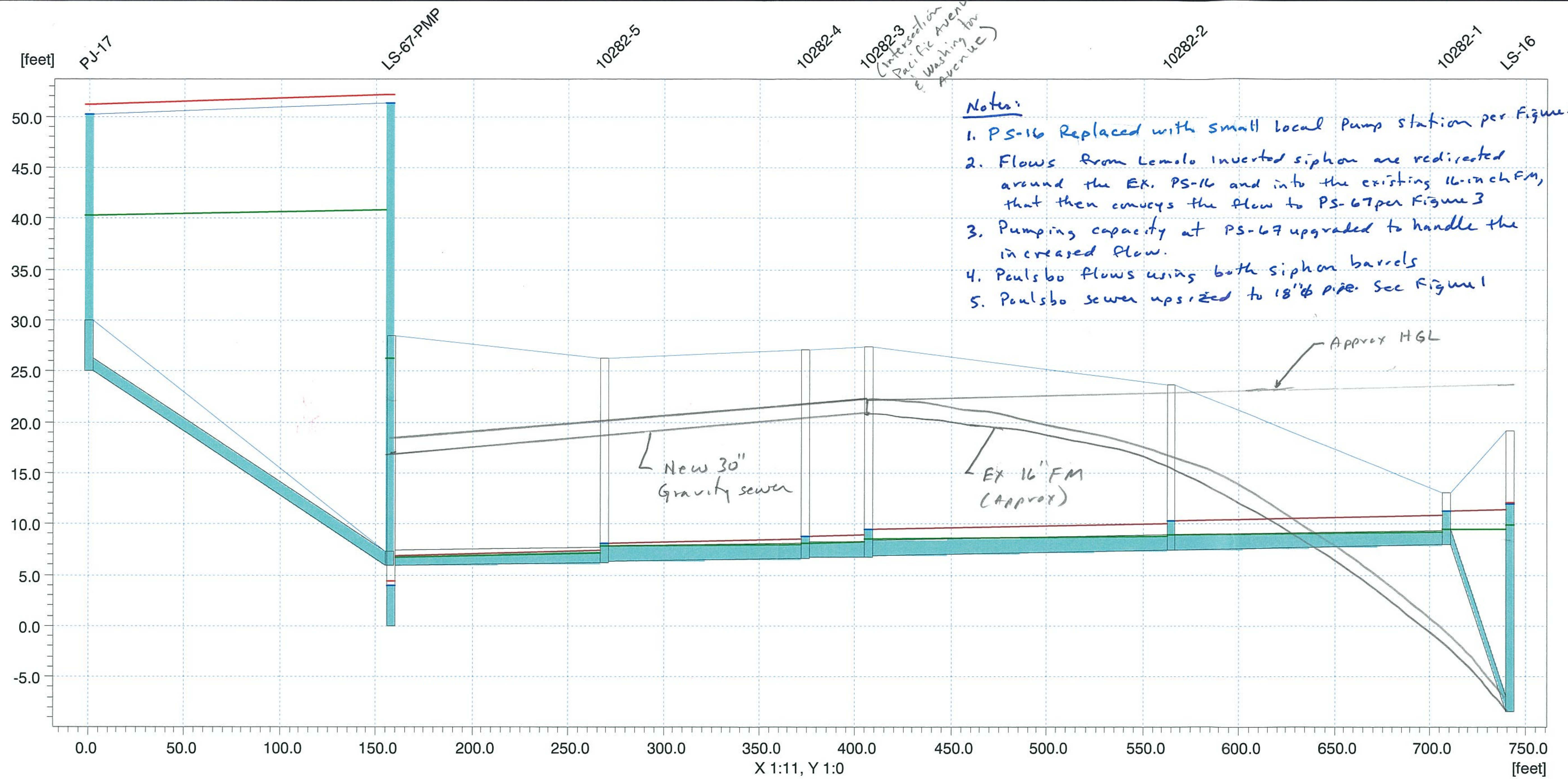


	G22-3001		G22-2008		G22-2007	G22-2009		
Ground Lev.	31.50		67.00		76.30	68.30		[m]
Invert lev.	28.50		60.10		63.00	64.40		[m]
Length		2579.70		143.63			155.18	[m]
Diameter		1.50		1.50			1.50	[m]
Slope o/oo		12.25		20.19			36.09	

OPTION 2
2030 FLOW CONDITIONS
18" Poulsbo sewer

Link Water Level - 1-1-2007 22:05:00 2030_Peak_Day_PRO2030 Peak Day.PRF

Discharge	7.067	7.067	7.066	6.982	6.982	6.577	6.577	cfs
Length	157.00	111.00	105.00	32.81	158.00	144.00	32.81	[m]
Diameter	1.33	1.50	1.50	1.50	1.50	1.50	1.50	[m]
Slope o/oo	121.72	2.97	3.05	1.52	3.04	2.99	498.65	

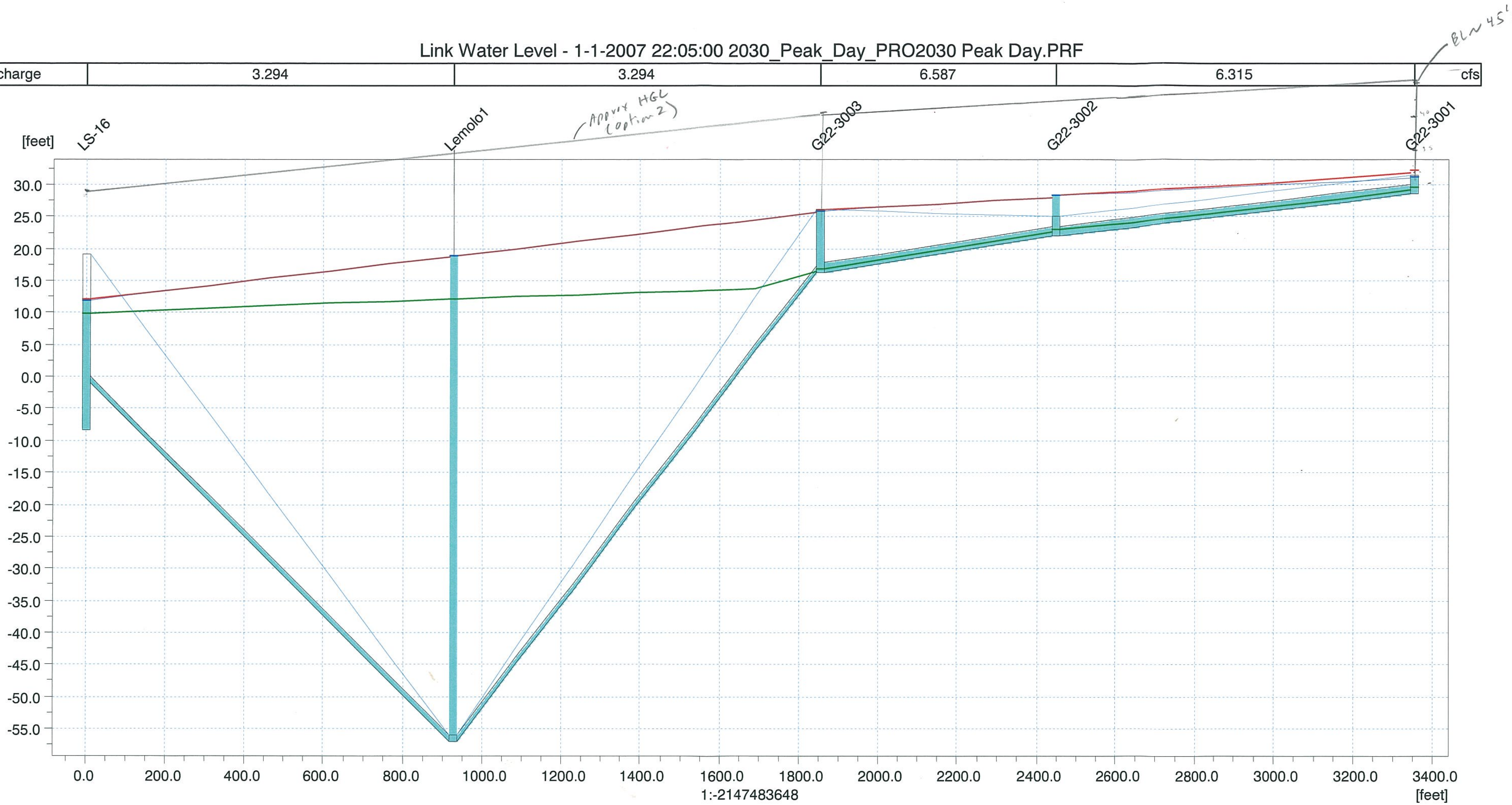


	PJ-17	LS-67-PMP	10282-5	10282-4	10282-3	10282-2	10282-1	
Ground Lev.	30.00	7.23	26.32	27.14	27.39	23.67	13.00	[m]
Invert lev.	25.00	5.89	6.22	6.64	6.79	7.37	7.90	[m]

MODEL RUN D

Link Water Level - 1-1-2007 22:05:00 2030_Peak_Day_PRO2030 Peak Day.PRF

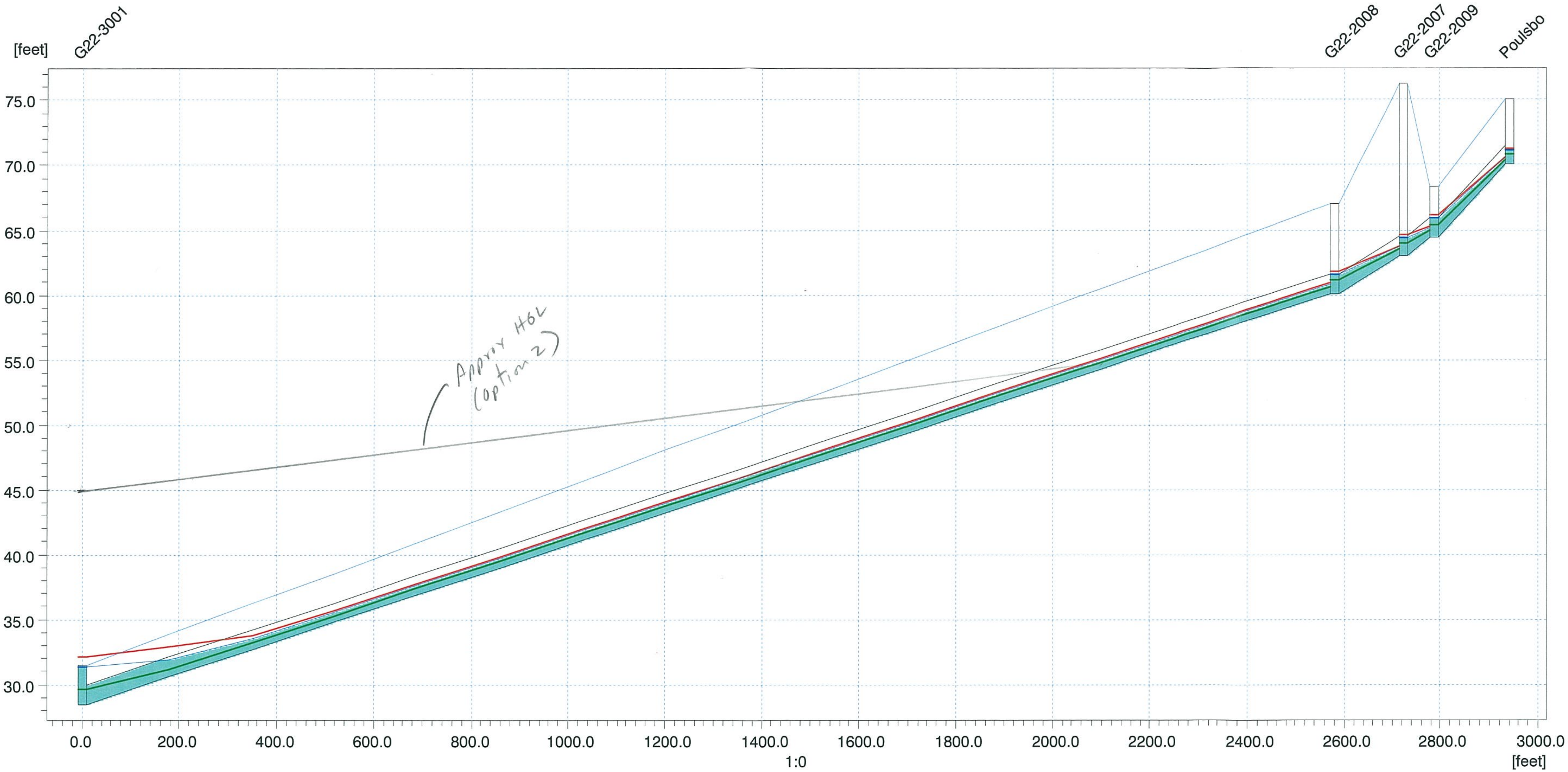
Discharge	3.294	3.294	6.587	6.315	cfs



	LS-16		Lemolo1		G22-3003		G22-3002		G22-3001	
Ground Lev.	19.14		-56.00		26.20		25.00			[m]
Invert lev.	-8.36		-57.00		16.30		22.00			[m]
Length		926.00		926.00		595.15		907.49		[m]
Diameter		1.00		1.00		1.50		1.50		[m]
Slope o/oo		60.48		79.16		9.58		7.16		

Link Water Level - 1-1-2007 22:05:00 2030_Peak_Day_PRO2030 Peak Day.PRF

Discharge	6.235	6.226		6.218	cfs



	G22-3001		G22-2008		G22-2007	G22-2009		
Ground Lev.	31.50		67.00		76.30	68.30		[m]
Invert lev.	28.50		60.10		63.00	64.40		[m]
Length		2579.70		143.63			155.18	[m]
Diameter		1.50		1.50			1.50	[m]
Slope o/oo		12.25		20.19			36.09	

APPENDIX B

BUDGETARY COST PROJECTIONS

Pump Station 16/67 Upgrades
Option 1
Opinion of Probable Project Cost
July 2, 2013

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Temporary Bypass	$10,000	1	LS	$10,000
2	Pump Station Demolition and Wet Well Overhaul	$15,000	1	LS	$15,000
3	12" Gravity Sewer	$77	15	LF	$1,155
4	30" Gravity Sewer	$248	560	LF	$138,880
5	60" Diameter Manhole	$10,000	5	EA	$50,000
6	60" Diameter Manhole - Extra Depth Beyond 10'	$600	38	VF	$22,800
7	Reconnect to Existing Sewer Connections	$3,000	3	EA	$9,000
8	Connection to Existing MH's	$3,000	1	EA	$3,000
9	Abandon Existing Sewer Lines	$5,000	1	LS	$5,000
10	Imported Trench Backfill	$15	1,070	Ton	$16,050
11	CSTC	$23	360	Ton	$8,280
12	HMA Trench Patch	$120	200	Ton	$24,000
	Subtotal				**$303,165**
	Utilities	5%			$15,158
	TESC	3%			$9,095
	Traffic Control	3%			$9,095
	Surveying	2%			$6,063
	Cleanup/Restoration	3%			$9,095
	Mob/Demob, Bonds, Insurance	10%			$30,317
	Subtotal				$381,988
	Sales Tax	8.6%			$32,851
	Subtotal				$414,839
	Contingency	35%			$145,194
	Total Construction Cost				**$560,032**

Pump Station 16/67 Upgrades
Option 2
Opinion of Probable Project Cost
July 2, 2013

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	30" Gravity Sewer	$248	220	LF	$54,560
2	60" Diameter Manhole	$10,000	2	EA	$20,000
3	60" Diameter Manhole - Extra Depth Beyond 10'	$600	14	VF	$8,400
4	Cut-in 16" x 16" Tee & Connect to 60" MH	$5,000	1	LS	$5,000
5	New Pump Station 16*	$400,000	1	LS	$400,000
6	Inverted Siphon Diversion	$25,000	1	LS	$25,000
7	Abandon Pump Station 16	$10,000	1	LS	$10,000
8	Abandon Ex Gravity Sewers	$1,900	1	LS	$1,900
9	Imported Trench Backfill	$15	410	Ton	$6,150
10	Crushed Surfacing	$23	190		$4,370
11	HMA Trench Patch	$120	110		$13,200
	Subtotal				**$548,580**
	Utilities	5%			$27,429
	TESC	3%			$16,457
	Traffic Control	3%			$16,457
	Surveying	2%			$10,972
	Cleanup/Restoration	3%			$16,457
	Mob/Demob, Bonds, Insurance	10%			$54,858
	Subtotal				$691,211
	Sales Tax	8.6%			$59,444
	Subtotal				$750,655
	Contingency	35%			$262,729
	Total Construction Cost				**$1,013,384**

APPENDIX C

PUMP STATION 16 AND 67 UPGRADES TECHNICAL MEMORANDUM ON FLOWS APRIL 12, 2013

MEMORANDUM

Date: April 12, 2013

To: Barbara Zaroff, P.E.

From: Tony Fisher, P.E.

CC: George Radebaugh, Dave Marquist, Martin Harper, P.E., Rudy Vigilia, P.E.

Subject: Pump Station 16 and 67 Upgrades
Technical Memorandum on Flows

This memorandum discusses the influent flows (existing and future) at Pump Station 16 (PS-16) and Pump Station 67 (PS-67) as well as the existing and projected flows that will be conveyed by the Lemolo Inverted Siphon. Recommended pumping rates to address those flow conditions are also summarized. The existing and future inflow rates were taken from the *Central Kitsap County Wastewater Facility Plan* dated March 2011 (hereinafter referenced as "2011 Facility Plan") and were verified by a review of the wastewater hydraulic model developed by BHC Consultants for the County. Flow projections are peak hour flows during wet weather conditions.

Background

The City of Poulsbo contracts with the Kitsap County Department of Public Works Wastewater Division to treat its wastewater at the Central Kitsap Wastewater Treatment Plant (CKWWTP). The wastewater from Poulsbo is conveyed to the treatment plant through an inverted siphon that passes from the Lemolo peninsula south beneath Liberty Bay to PS-16 on the Keyport Peninsula. In addition to the flow from the Lemolo Inverted Siphon, three properties (the Keyport Mercantile and Sandwich Shop, and two water front properties) contribute flow to PS-16 via gravity sewers. Consequently, the flow from the Lemolo Inverted Siphon comprises nearly all of the flow currently entering PS-16.

PS-16 is a triplex station that conveys wastewater to Pump Station 24 through a 16-inch and 24-inch force main that is approximately 3,900 feet long. The station's current pumping capacity is about 2,000 gallons per minute (gpm). The station was constructed in 1980, is reaching the end of its design life, and needs to be replaced or upgraded. Conversations with County staff has indicated that the existing wet well is in poor condition and would require substantial repairs before it could be reused for an new pump station. Upgrading or replacing the station in its current location is also inadvisable due to its close proximity to the shoreline of Liberty Bay.

Constructed in 1999, PS-67 is a triplex station that receives wastewater flow from the Keyport community and the Keyport Naval Base. Its pumping capacity is currently about 700 gpm. PS-67 pumps its flows into the force main from PS-16, which then conveys the combined flow to

Pump Station 24. Pump Station 24 then pumps the flow through a 24-inch force main to the CKWWTP for treatment. Figure 1 shows the relative locations of these facilities.

The 2011 Facility Plan investigated two options for increasing the capacity of the system to convey the projected flows from the City of Poulsbo, Keyport community and the Keyport Naval Base. These options included:

- Improving or replacing PS-16 to achieve greater capacity for the anticipated flows from the Lemolo pipeline and inverted siphon.
- Redirect flow from the Lemolo pipeline and inverted siphon to PS-67 and convert PS-16 to a small pump station that conveys the local flow to PS-67. The wet well at PS-67 is about 10 feet higher than the PS-16 wet well.

Both options would include upsizing the 14-inch Lemolo pipeline, either concurrently or as part of a future project, to accommodate the projected higher flows. The investigation recommended redirecting the flow from the Lemolo pipeline and inverted siphon to PS-67 and replacing PS-16 with a small local pump station. This option will require the pumping capacity of PS-67 to be increased.

Two alternatives for diverting the flow from the Lemolo pipeline and inverted siphon are being considered. The first alternative involves extending the siphon uphill at normal depths of about 5 to 8 feet to PS-67. This alternative would raise the hydraulic grade line on the upstream end of the inverted siphon, reducing the amount of head available to drive the flow through the siphon and decreasing the future capacity of the siphon. The increased head would require some manholes on the Poulsbo side of the inverted siphon to be sealed to prevent overflows.

The second alternative would involve constructing a deep gravity sewer from PS-16 that would convey the flow from the Lemolo pipeline and would allow PS-16 to be completely removed from service. The gravity sewer main would likely need to be about 35 to 40 feet deep. Using open trench construction methods to install a gravity sewer this deep would be devastating to the street and impractical given the current use of Washington Avenue. The gravity sewer would only be about 500 to 600 feet long so using trenchless construction methods may be feasible. A review of the construction and long term operating costs of the two options would be warranted to determine which of these two options is preferred.

Flow Conditions

The hydraulic model that was developed for the 2011 Facility Plan was used to identify the current flows into Pump Stations 16 and 67 as well as to project the future flows that will need to be addressed. The model was used to evaluate the existing conditions and two future conditions. These scenarios are summarized as follows:

<u>Existing Conditions (Existing Scenario)</u>

The existing flows were determined by using parcel based population data from the model developed for the 2011 Facility Plan. The existing population is based on population data for the year 2010. The model reviewed historical flow data from the years 2002-2006 divided by the associated Equivalent Residential Unit (ERU) population for each year to obtain the historical average annual flow (AAF) and average design flow (ADF) based on the average daily flow during the peak month of the historical flow data at the CKWWTP. The resultant AAF and ADF was computed to be 76 gallons per capita per day (gpcd) and 92 gpcd, respectively. A peaking factor for the peak day flows was then determined by dividing the all time peak day flow (9.82 million gallons per day (mgd) at the CKWWTP on December 3, 2007) by the average annual flow (3.63 mgd). The resultant peaking factor is 2.71. The peak day flows were then multiplied by a peaking factor of 1.27 (peak hour flows/max day flows) to determine peak hour flows. A more detailed discussion of these conditions and assumptions may be found in the 2011 Facility Plan.

Wastewater flows from the City of Poulsbo are based on the *City of Poulsbo Comprehensive Sewer Plan 2008 Update*, Parametrix, February 2008 (Sewer Plan Update). Based on the flow projections in the City of Poulsbo's Sewer Plan Update, the peak hour flow from Poulsbo and the Poulsbo UGA was estimated at 2.70 mgd (1,875 gpm) in 2006. The influent flows to PS-16 and PS-67 for the Existing Conditions are shown on Figures 2 and 3 and summarized in Table 1.

Future Conditions (2030 Flow Scenario and Full Development Scenario)

The 2011 Facility Plan also investigated future flow projections. That study presented year 2025 flow projections with the assumption that all existing onsite sewage systems (i.e., septic tank systems) would be replaced with direct connections to the County’s wastewater collection system by the year 2025. In this memorandum, that approach is described as the “Full Development Scenario”. The Full Development Scenario assumed a value of 100 gallons per capita per day (gpcd) for new connections. The 100 gpcd is based on the Washington State Department of Ecology’s *“Criteria for Sewage Works Design”* recommendations for minimum per capita AAF and includes allowances for infiltration and inflow. A peaking factor of 2.71, similar to the factor used for the existing flow conditions, was used to determine the peak daily flows. Peak hourly flows were then determined by multiplying the peak daily flows by a factor of 1.27, resulting in a ratio of peak hour flows to average annual flows of 3.44.[1]

During the development of the 2011 Facility Plan, the assumption of 100% conversion of the onsite sewage systems within a 20-year planning horizon was thought to be overly conservative and a less aggressive, partial conversion of 5% of the septic systems was adopted. In addition, the Department of Ecology’s per capita flow rate of 100 gpcd for new connections was thought to be too high based on County historical flow records. The lower historical per capita flow data (76 gpcd) was used then used to create the “2030 Flow Scenario". In addition, the 2025 population projections were extrapolated to the year 2030. Similar peaking factors of 2.71 and 1.27 were applied to the average daily flows to determine the peak daily flows and peak hourly flows at the CKWWTP.

The less aggressive onsite sewer system conversion assumption was subsequently overruled by the Management Hearing Board and the assumption of 100% connection of all such systems

[1] Brown and Caldwell, BHC Consultants, “Central Kitsap County Wastewater Facility Plan”, March 2011, Appendix 7B.1, Pages 13 & 14.

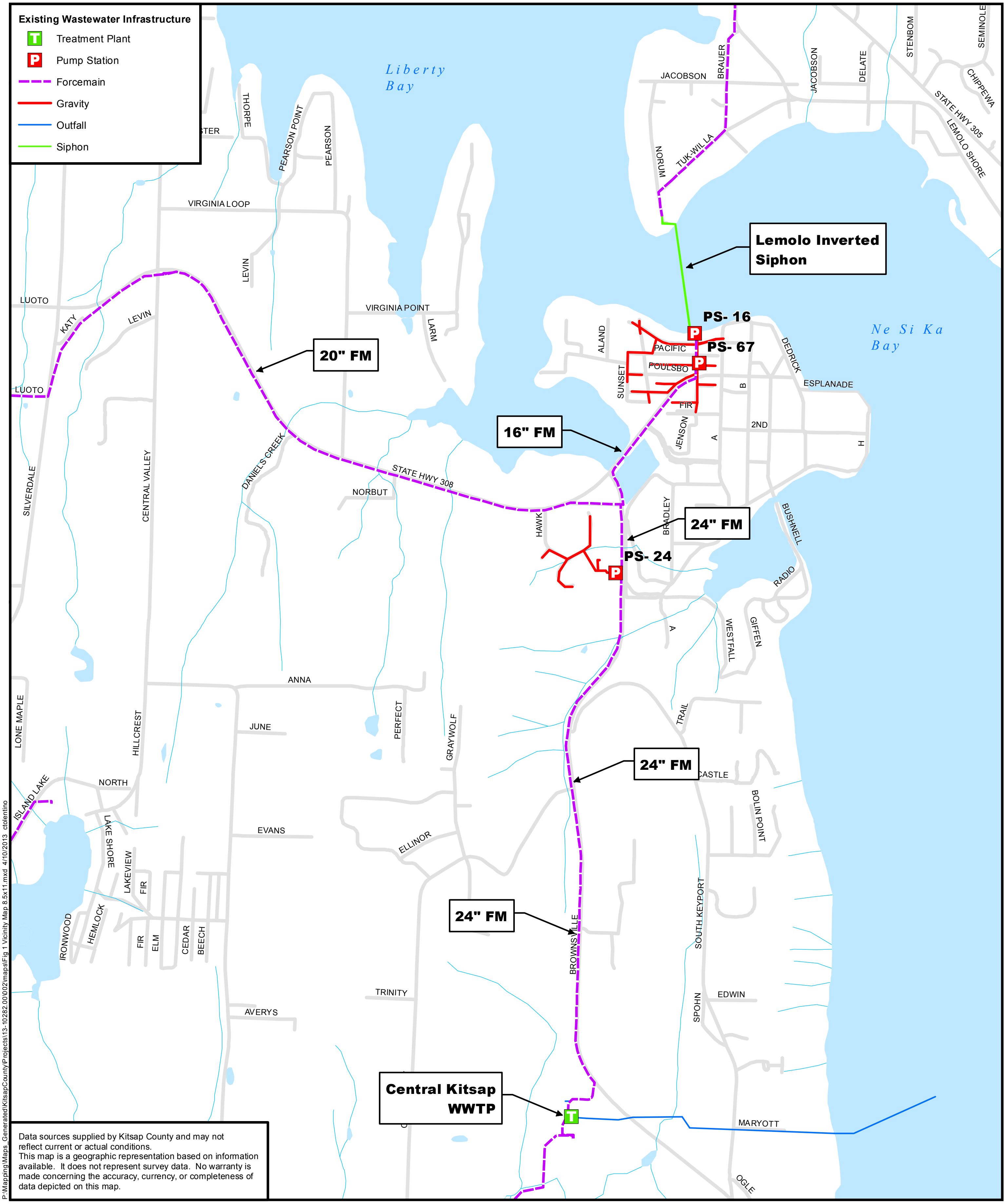
by the year 2025 was reinstated to create a revised "2030 Flow Scenario". In addition, the Remand process undertaken by the County revised its growth projections to increase the population densities within the Urban Area and reduced densities in some of the Rural Areas. The projected flows from Poulsbo were unaffected by the Remand process. The resultant future influent flows for Pump Stations 67 are shown on Figures 4 and 5 and summarized in Table 1.

Table 1 – Existing and Projected Wastewater Flow Conditions

Flow Scenario	Pump Station 16	Pump Station 67
Existing		
Average Inflow	1,330 gpm	215 gpm
Peak Hourly Inflow	2,030 gpm	290 gpm
2030 Flows*		
Average Inflow	5 gpm	2,840 gpm
Peak Hourly Inflow	20 gpm	3,815 gpm
Full Development Flows*		
Average Inflow	5 gpm	2,740 gpm
Peak Hourly Inflow	20 gpm	4,080 gpm
New Pumping Capacity	100**	4,100 gpm

* Flow from the Lemolo Inverted Siphon is routed to PS-67.
**A minimum design capacity of 100 gpm is needed in order to maintain flushing velocities through a 4-inch force main, which is the minimum size force main necessary to convey a 3-inch solid in conformance with Department of Ecology standards.

As this table shows, the diversion of the flows from the Lemolo pipeline requires the pumping capacity of PS-67 to be increased. PS-67 is currently a triplex station with submersible pumps and variable speed motors. A similar configuration is being considered for the upgraded PS-67 (triplex station with submersible pumps and variable speed motors). Given the limited inflow into the new PS-16, a duplex station with submersible, non-clog pumps and constant speed motors should be sufficient. Grinder pumps with a pumping capacity of about 20 to 25 gpm may also be a viable option since the grinder pumps would allow a smaller diameter (2-inch) force main to be used. This memo also notes that an alternative of installing a deep gravity sewer that would allow the three local services to be conveyed to PS-67 without being pump is being considered. If the results of that investigation determines the deep gravity approach is feasible and more cost effective than constructing a new PS-16, then PS-16 could be removed completely from service.



HDR BHC CONSULTANTS

999 3rd Avenue
Suite 900
Seattle, WA 98104-4039

1601 Fifth Avenue, Suite 500
Seattle, Washington 98101

206.505.3400
206.505.3406 (fax)
www.bhcconsultants.com

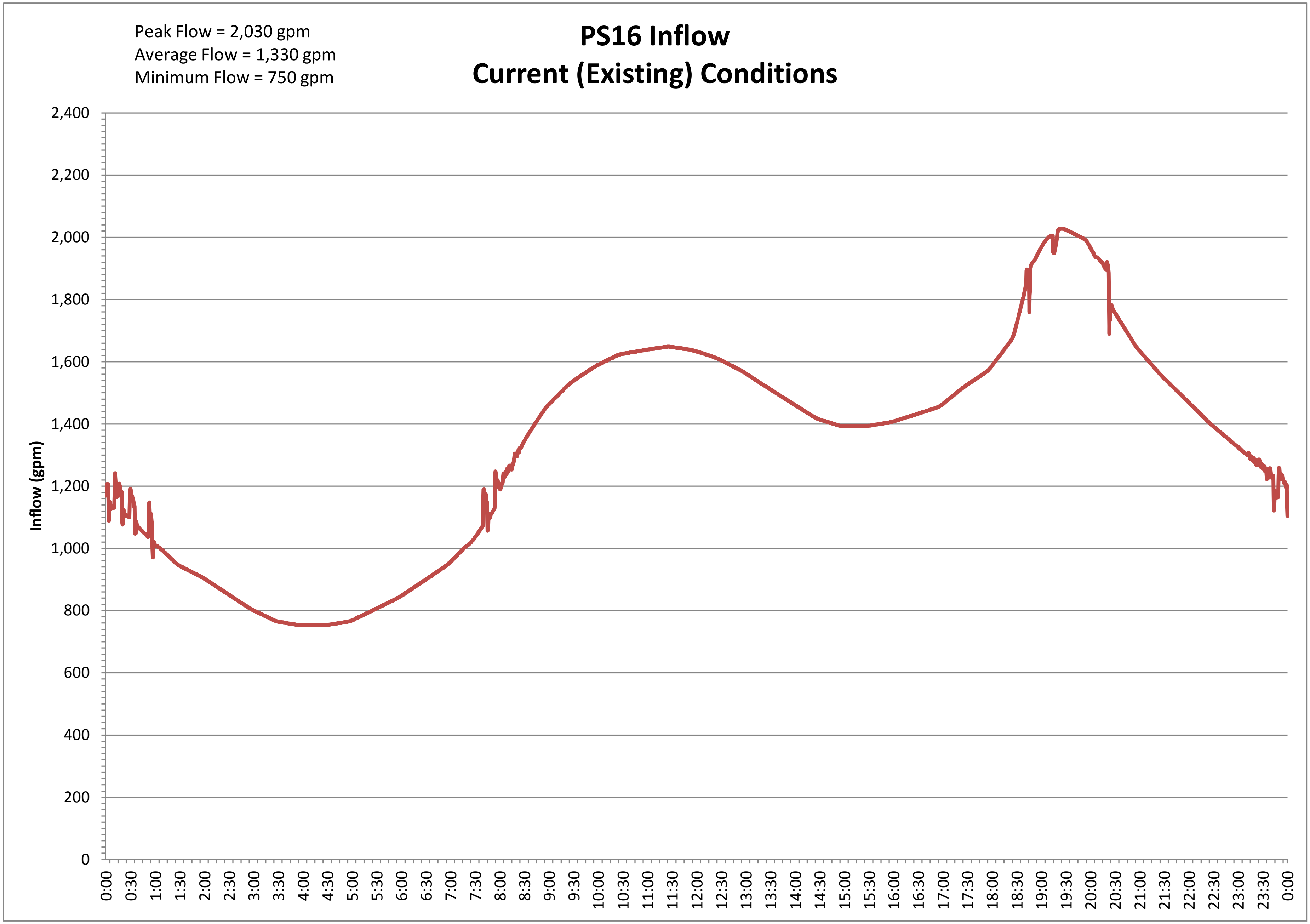
KITSAP COUNTY 18 57 WASHINGTON

Vicinity Map

Kitsap County Public Works
April 2013

Figure **1**

Figure 2



Peak Flow = 2,030 gpm
Average Flow = 1,330 gpm
Minimum Flow = 750 gpm
PS16 Inflow
Current (Existing) Conditions
Inflow (gpm)
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
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6:00
6:30
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16:00
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18:30
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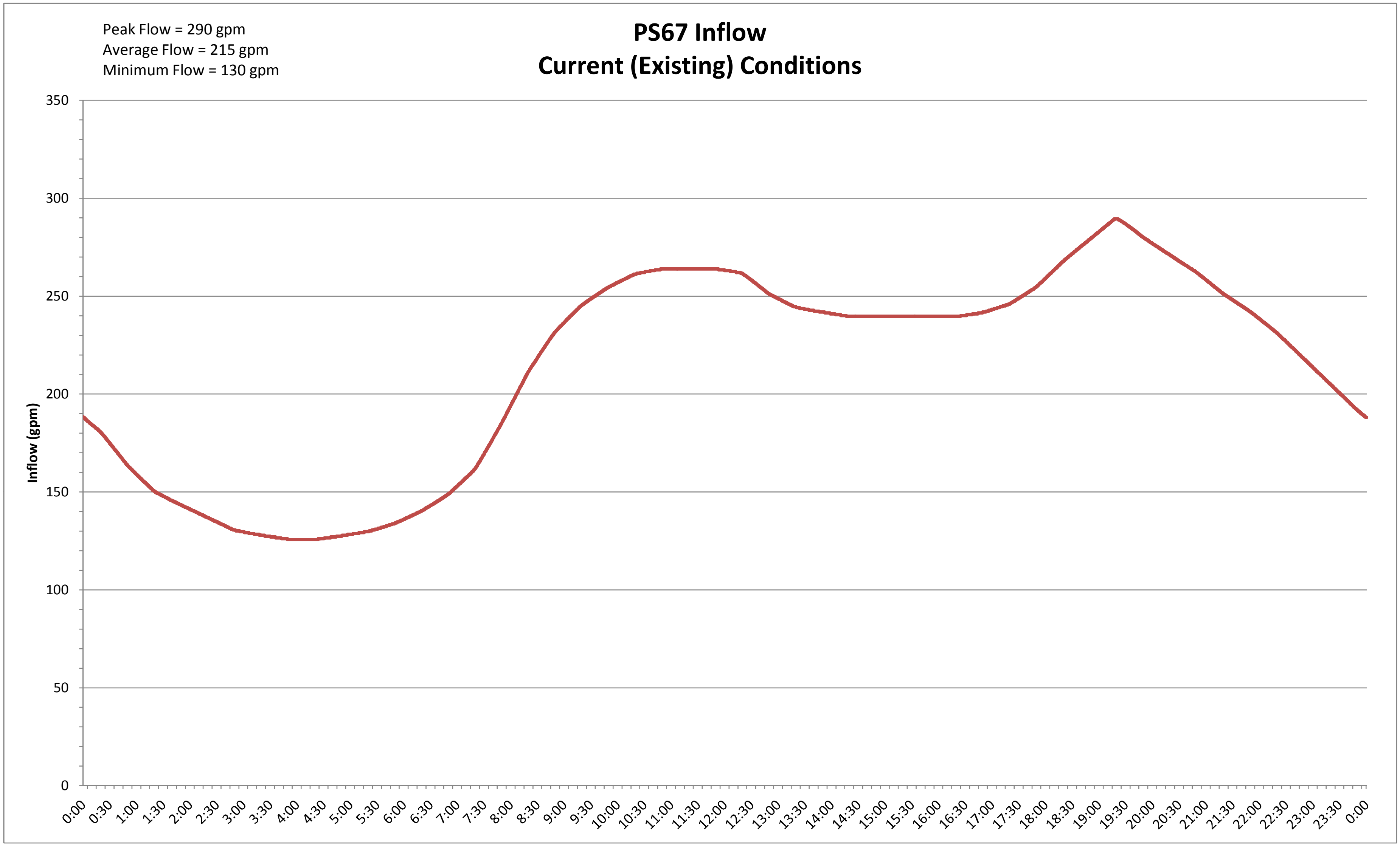
23:30
0:00

Figure 3


Peak Flow = 290 gpm
Average Flow = 215 gpm
Minimum Flow = 130 gpm
PS67 Inflow
Current (Existing) Conditions
Inflow (gpm)
350
300
250
200
150
100
50
0
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
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11:00
11:30
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15:30
16:00
16:30
17:00
17:30
18:00
18:30
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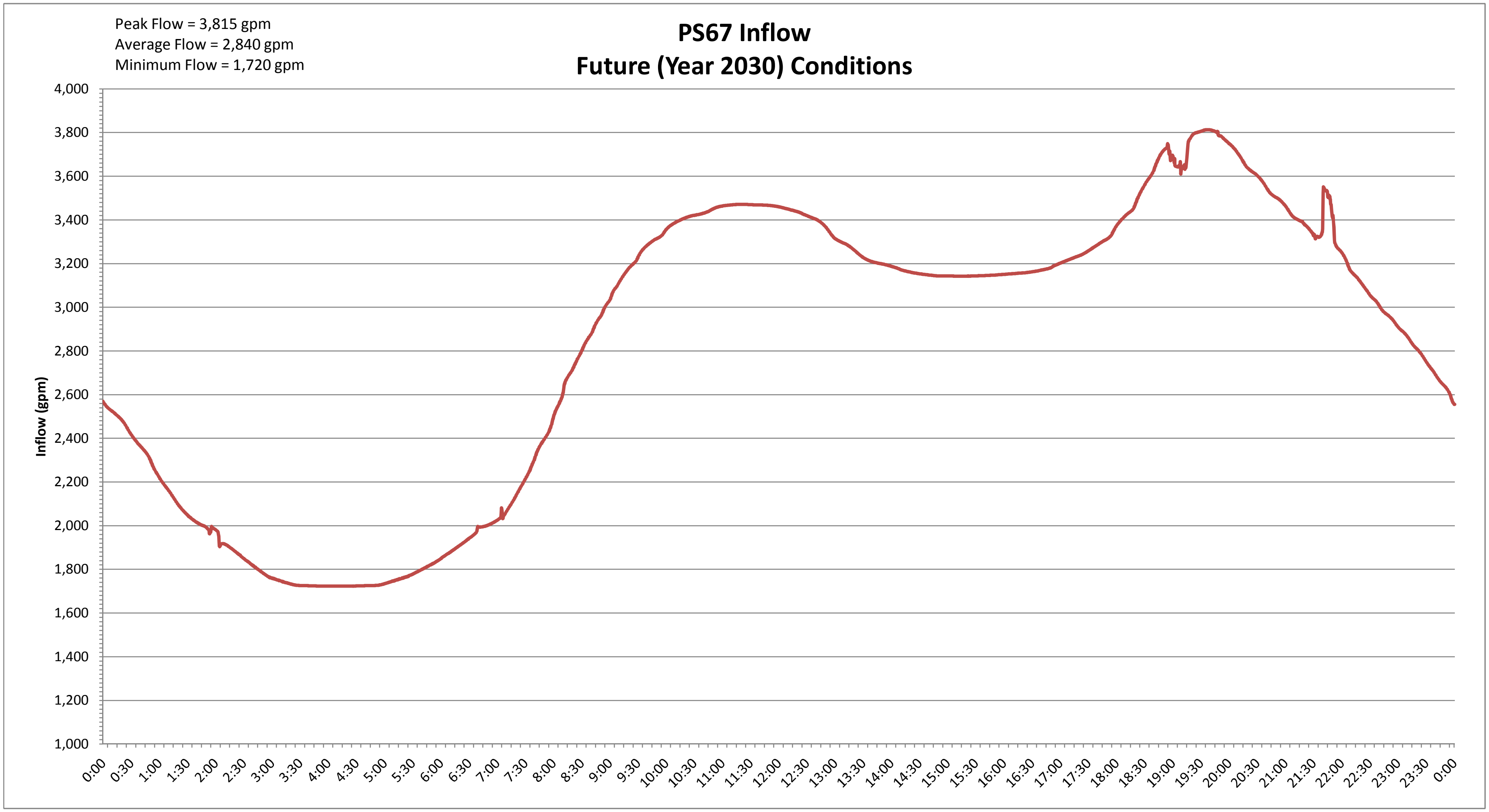
23:30
0:00

Figure 4


Peak Flow = 3,815 gpm
Average Flow = 2,840 gpm
Minimum Flow = 1,720 gpm
PS67 Inflow
Future (Year 2030) Conditions
Inflow (gpm)
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
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11:00
11:30
12:00
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13:00
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17:00
17:30
18:00
18:30
19:00
19:30
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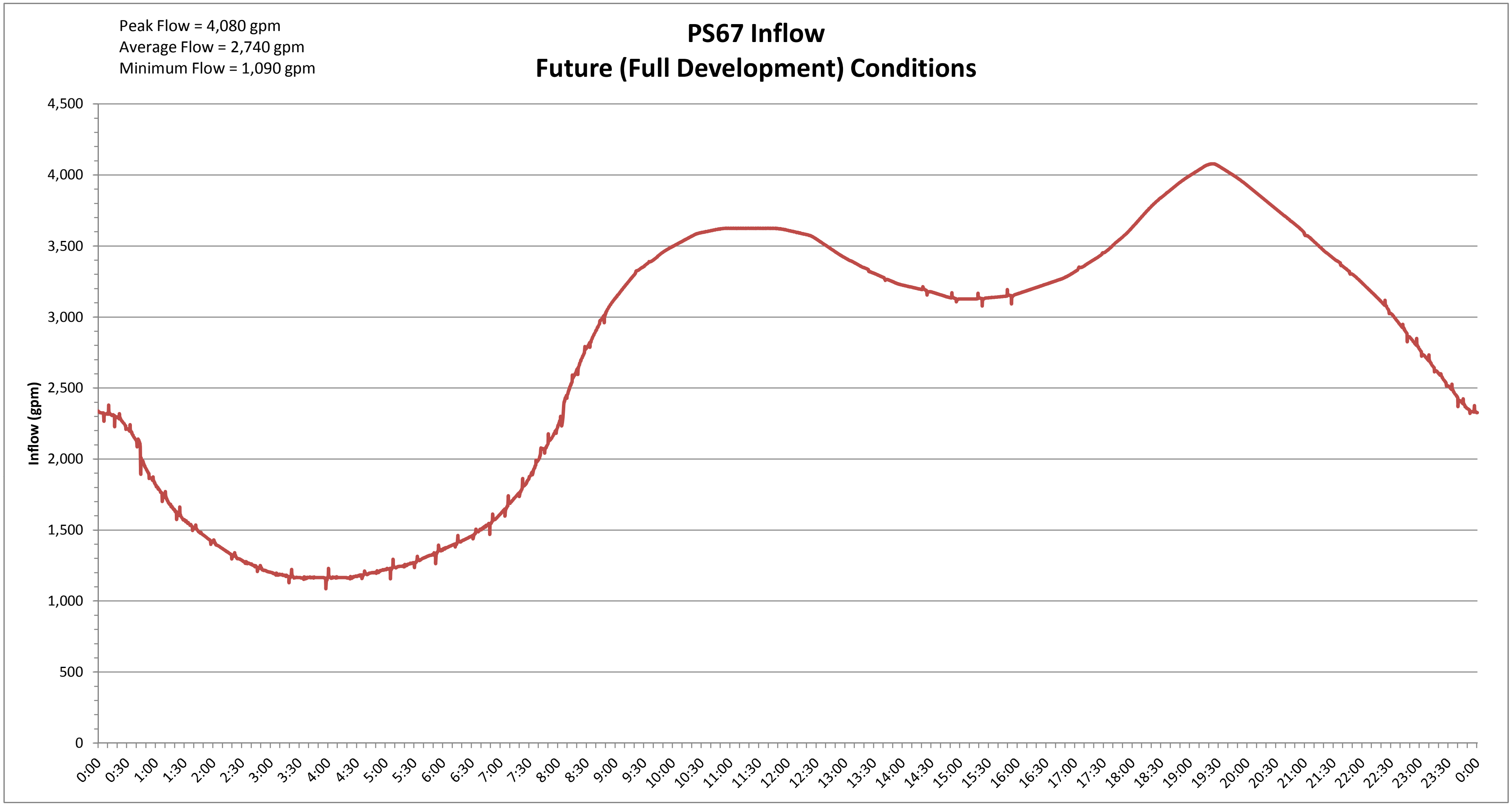
20:30
21:00
21:30
22:00
22:30
23:00
23:30
0:00

Figure 5


Peak Flow = 4,080 gpm
Average Flow = 2,740 gpm
Minimum Flow = 1,090 gpm
PS67 Inflow
Future (Full Development) Conditions
Inflow (gpm)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
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APPENDIX D

CITY OF POULSBO
COMPREHENSIVE SANITARY SEWER PLAN – 2008
EXECUTIVE SUMMARY

Comprehensive Sanitary Sewer Plan - 2008

City of Poulsbo

September 2008

Parametrix

EXECUTIVE SUMMARY

BACKGROUND

The City of Poulsbo's sanitary sewer system was largely constructed during the 1930s and 1940s. The system's age, general condition and the significant population growth over the last decade have combined to raise concerns regarding the system's adequacy for the future and the potential financial impacts for repairs and improvements. By the late 1980s, City leaders agreed that the first step would be the update of the Comprehensive Sewer Plan (CSP). A plan was commissioned and a draft completed in 1992. Updates to the plan were completed in 1998 and 2002.

A requirement for any city to upgrade or expand its sewage facilities is the preparation and adoption of a comprehensive plan under Revised Code of Washington (RCW) 35.67. An additional driving force is the land use planning process mandated under the Growth Management Act (GMA). Poulsbo adopted their Comprehensive Land Use Plan in 1994 and is in the process of preparing an update. One of the key elements of this land use plan as required by the GMA is a Capital Facilities Plan (CFP). The CFP is a six-year plan for capital improvements that support Poulsbo's current and future population and economy. An integral part of the CFP is sanitary sewer service.

PLANNING PROCESS

In 1996, the City retained the services of a consulting engineer, Parametrix, Inc., and authorized them to revise the 1992 Draft Plan and assist the City with preparation of a six-year capital improvement plan, rate analysis, and amendment of the City's existing sewer service agreement with Kitsap County.

A draft of this plan was completed in 1998 and was reviewed by the Washington State Department of Ecology (Ecology). This plan identified several alternatives for providing long-term service. However, further study of these long-term service alternatives was deemed necessary. These studies included preparation of an Environmental Impact Statement and the preparation of a Bond Road Pump Station and Force Main Study, both of which were completed in 2000. In 2002, a Draft CSP was completed that reflected the results of the studies conducted since 1998.

RELATIONSHIP TO OTHER PLANS

This document is an update to the 2002 Draft CSP. The following documents have been reviewed in the preparation of this document:

- 1994 Central Kitsap County Wastewater Facilities Plan
- 1994 City of Poulsbo Comprehensive Plan
- 1998 City of Poulsbo Draft Comprehensive Sewer Plan Update
- 2000 Final Supplemental Environmental Impact Statement to the Final Environmental Impact Statement for the Central Kitsap County Wastewater Facilities Plan
- 2002 Poulsbo Subarea Plan
- 2006 Kitsap County Comprehensive Plan
- 2007 City of Poulsbo Draft Comprehensive Water Plan

The planning and evaluation process associated with these reports has identified the need for sewer system improvements to meet the needs of the City and the Urban Growth Area for the next 20 years.

SERVICE AREA AND POPULATION

Study Area

Under the Growth Management Act, the City's sanitary sewer service area is defined as the Urban Growth Area boundary (UGA). The UGA as accepted by the City of Poulsbo and Kitsap County is shown in Figure ES-1.

Population

Population data for the study area is shown in Table ES-1. The City's 2005 population of 7,450 residents is expected to increase to 10,552 residents by 2025. Total UGA population is projected to increase to 14,808 in 2025 with an annual growth rate of 2.7 percent.

Table ES-1. Poulsbo Population Forecast

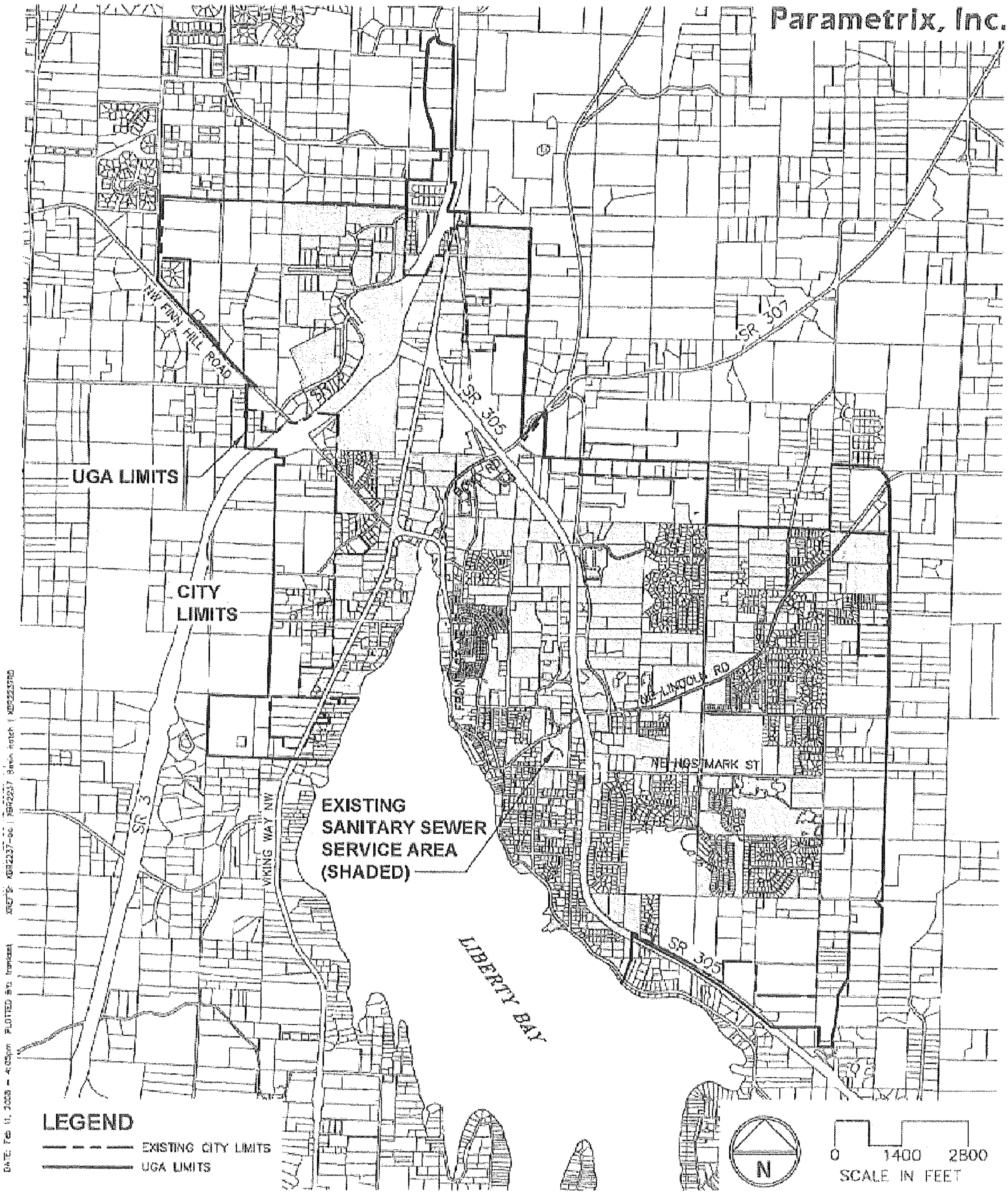
Population Distribution	Year			Annual Growth Rate
	2000	2005	2025	
City Limits	6,813	7,450	10,552	1.8%
UGA	901	1,230	4,256	6.4%
Total	**7,714**	**8,680**	**14,808**	2.7%

Source: Kitsap County Comprehensive Plan 10 Year Update 2006.

Existing and Projected Wastewater Flows

Corresponding to the anticipated growth in population for Poulsbo will be an increase in wastewater flows. Assuming a conservative annual growth rate of 2.7 percent over the 20-year planning period, Poulsbo's sewage flows (average daily flow) are expected to increase from 0.67 million gallons per day (mgd) to approximately 1.16 mgd. Peak hourly flows are estimated to increase from approximately 2.7 mgd in 2006, to approximately 4.2 mgd in 2025. Table ES-2 summarizes wastewater flow components for the planning period.

Table ES-2 presents a range of population growth for evaluating flow projections. The use of a range of growth rates reflects the uncertainty about how sewer service would be provided outside the City limits in the County portion of the UGA. At present, there are only 13 sewer connections outside the City limits. Therefore, the population growth projections for the City portion of the UGA (1.8 percent per year) are appropriate to use as the low-end estimate of growth in projected sewer flows. It is assumed that over the 20-year planning period a portion of the UGA outside of the City limits may become served by City sewer. The combined City and County UGA annual growth rate, 2.7 percent, is therefore used as the upper conservative end of the growth range. This upper range estimate is also used for capital project planning.



CITY of POULSBO
COMPREHENSIVE SEWER PLAN

Existing Sanitary Sewer Service Area

FIGURE ES-1

Table ES-2. Poulsbo Comprehensive Sewer Plan Flow Projections

		Actual		Projected			
Item	**Description**	**2005**	**2006**	**2010**	**2015**	**2025**	**2050**
1.	Sewered Population at a 2.7 % Annual Growth Rate[1]	7,450		8,512	9,724	12,693	24,707
2.	Sewered Population at a 1.8 % Annual Growth Rate	7,450		8,145	8,905	10,522	16,627
3.	Gallons per Capita per Day	87	88	91[2]	91	91	91
4.	Peaking Factor	3.71	4.02[3]	4.02/3.1[4]	4.02/3.1	4.02/3.1	4.02/3.1
5.	Annual Average Daily Flow, mgd	0.65	0.67				
	2.7 % Annual Growth Rate			0.77	0.88	1.16	2.25
	1.8 % Annual Growth Rate			0.74	0.81	0.97	1.51
6.	Peak Hourly Flow, mgd (gpcd)	2.40	2.70				
	2.7 % Annual Growth Rate			3.02	3.36	4.20	7.59
	1.8 % Annual Growth Rate			2.92	3.13	3.62	5.31

1 Sewered population is assumed same as City population, and does not include existing population within County portion of UGA where sewer service is not available.

2 Projected gallons per capita per day based on average gallons per capita per day from 2000-2005 period.

3 Peaking factor based on highest observed 2006 hourly flow (2.7 mgd) compared to average daily flow in 2006 (0.67 mgd).

4 Peaking factor of 4.02 is applied to 2005 population. A peaking factor of 3.1 is applied to population that is added after 2005, and assumes lower I&I rate due to new construction.

Projections shown in Table ES-2 are based on current conditions and do not reflect future flow reductions that will result from the Central Poulsbo I&I reduction project that will occur in 2008-2009, and the annual inflow reduction program that will be implemented in 2008. The flow projections should therefore be considered conservative estimates of potential future conditions.

DESCRIPTION OF EXISTING SEWER SYSTEM

The City of Poulsbo sewer collection system was initially constructed during the 1930s and 1940s. In 1942, a primary wastewater treatment plant was constructed near the City's business district. The City-owned treatment plant discharged to Liberty Bay until the late 1970s. In 1978, the Central Interceptor was constructed along SR 305 to transport flows to facilities owned by Kitsap County. The County facilities transport wastewater from Lemolo to the Central Kitsap Wastewater Treatment Plant (CKWWTP) in Brownsville. The flow crosses Liberty Bay via two 12-inch gravity siphons and is routed south to the CKWWTP.

The collection system contains a variety of pipe materials including concrete, PVC, and ductile iron. Over time, sewers in the oldest part of the City have been replaced, which has reduced infiltration/inflow. Eight pump stations transport flow throughout the collection system. The existing system transports flow to the Kitsap County Metering Station at Johnson Road and Peterson Way. From that point, flow is directed to the CKWWTP through County conveyance facilities.

SYSTEM DEFICIENCIES

Evaluation of the existing system consisted of interviewing City engineering staff, field review of the City pump stations with maintenance staff, review of previous reports, and evaluation of flows and downstream conveyance capacity.

Primary deficiencies consist of high inflow and infiltration (I&I), and potential capacity constraints in the downstream conveyance system owned by Kitsap County. Previous I&I reduction projects in the 6th Avenue basin have been successful in reducing peak flow. Flow data indicates the 6th Avenue project may have resulted in an overall 15 percent reduction in average flow from the City, and a 35 percent reduction in peak flow in the 6th Avenue basin.

Capital improvement projects have been identified to address deficiencies, including the Central Poulsbo I&I Reduction project, a new inflow reduction program, and increasing the capacity of the Lemolo pipeline that conveys flow under Liberty Bay to the CKWWTP. Without recommended improvements, and based on projected flows, capacity of the downstream conveyance system may be exceeded by approximately 2013. With recommended improvements, downstream capacity appears sufficient to support growth that would occur over the next 20 years.

SYSTEM EXPANSION

System upgrades are anticipated to accommodate growth. The Olhava and Finn Hill developments in the north and the Noll Road development to the east are the principle areas of growth. Recommended system upgrades to accommodate this growth include:

- Lindvig to Bond Road force main to replace deteriorated beach force main
- Finn Hill collection system
- Noll Road collection system

Other smaller system expansion projects are proposed for other basins in the City. The CSP evaluates the capital improvement needs of the sewer system. The cost of each project has been scheduled over a six-year period to reflect priorities and to balance annual capital costs. Projects identified in the 6-year Capital Improvement Plan (CIP) are listed in Table ES-3. The sewer upgrade project costs are often shared between the City and the developer as both parties benefit from the completed infrastructure. Developer and City funding for CIP projects is shown in Table ES-3.

FINANCIAL PLAN

A preliminary sewer utility financial analysis for the 20-year study period is shown in Table ES-4. The summary includes capital improvement costs, treatment plant capital allocation, funding sources, ending fund balances, and revenue and expenses.

Based on Table ES-4, it appears a rate adjustment will likely be necessary in 2009 and beyond in order to maintain adequate fund balances, and meet projected capital expenditures, operation and maintenance, and contract services to Kitsap County for treatment of wastewater. It should be noted that the City and County will need to renegotiate the conveyance and treatment contract in 2008 or later, after Kitsap County completes its update to the County Comprehensive Sewer Plan.

Table ES-3. Capital Improvement Plan

Project	2008	2009	2010	2011	2012	2013	2014	Not Scheduled
Sewer Utility Funded Projects								
Replace Johnson Road Metering Station	$25,000							
Portable Trash Pumps – Bond Rd, Lindvig, MSC	$167,000							
Bond Rd Force Main	$849,000							
Central Poulsbo I&I Reduction	$535,000	$536,000						
9th Avenue Pump Station Upgrade		$241,000						
6th Ave Pump Station Upgrade		$138,000						
Village Pump Station Upgrade			$81,000					
Replace 6th to 9th Force Main			$380,000					
Marine Science Center Pump Station Repair			$54,000					
Replace Force Main Between MSC & Harrison Street					$328,000			
Replace 175 ft 18-in RCP with 24 in PVC – Johnson Rd				$58,000				
I&I Effectiveness and Downstream Capacity Engineering Study				$110,000				
Lemolo Pipeline Improvements					$50,000			
Slipline Beach Force Main						$180,000	1,120,000	
Olhava Pipe Run 18 Capacity Increase								$40,000 [3]
SR305 to Bond Rd Pump Station Capacity Increase								$30,000 [3]
Pump Station 16 Capacity Increase								$250,000 [4]
Non-Construction Sewer Utility Funded Projects								
Annual In-Flow Reduction Program	$20,000	$40,000	$21,000	$22,000	$23,000	$24,000	$25,000	
Kitsap County Contract Renewal Technical & Legal Services			$50,000					
Rate Study	$25,000							
Comprehensive Plan Update						$50,000	$50,000	
Total Sewer Utility Funded Projects	$1,621,000	$955,000	$586,000	$190,000	$401,000	$254,000	$1,195,000	$320,000

(Table Continues)

Table ES-3. Capital Improvement Plan (Continued)

Project	2008	2009	2010	2011	2012	2013	2014	Not Scheduled
Developer or LID Funded Projects[1]								
Noll Road North Collection System		$1,445,000						
Finn Hill Collection System		$1,756,000						
Liberty Bay Pump Station Upgrades		$250,000						
Central Viking Way Collection System			$677,000					
South Viking Way Collection System								$1,106,000
Noll Road South Collection System								$1,306,000
Total Developer/LID Funded Projects		**$3,451,000**	**$677,000**					**$2,412,000**
TOTAL ALL PROJECTS[2]	**$1,621,000**	**$4,406,000**	**$1,263,000**	**$190,000**	**$401,000**	**$254,000**	**$1,195,000**	**$2,732,000**

1 Schedule & costs for Developer/LID funded projects are estimated.
2 Costs are escalated 5% from 2007 to the year of construction.
3 Schedule is dependant upon build out within the basin.
4 Cost is estimated. Project assumed to be needed by 2020.
5 Estimated to be needed by 2030.

City of Poulsbo

Table ES-4. City of Poulsbo Sewer Fund Financial Summar

Sewer Fund Element	Actual				Budgeted		
	2003	2004	2005	2006	2007	2008	20
Capital							
Capital Projects [1]	$ 165,913	$ 149,941	$ 15,602	$ 38,367	$ 1,055,000 [8]	$ 1,621,000	$ 955,0
Equipment Replacement	$ -	$ -	$ -	$ 56,368	$ 110,000	$ 100,000	$ 100,0
New Public Works Complex [2]	$ -	$ -	$ -	$ -	$ -	$ 64,000	$ 64,0
Total Capital Costs	**$ 165,913**	**$ 149,941**	**$ 15,602**	**$ 94,734**	**$ 1,165,000**	**$ 1,785,000**	**$ 1,119,0**
Fund Balances							
Operating Fund	$ 865,332	$ 1,225,013	$ 1,634,380	$ 1,978,097	$ 2,145,966 [9]	$ 1,145,966	$ 1,145,9
Sewer Capital Reserve [3]	$ 392,894	$ 180,753	$ 661,576	$ 870,738	$ 1,255,116	$ 2,255,116	$ 1,136,1
Debt Service Fund	$ 477,302	$ 669,344	$ 454,233	$ 467,686	$ 467,686	$ 467,686	$ 467,6
Total Fund Balance	**$ 1,735,528**	**$ 2,075,110**	**$ 2,750,189**	**$ 3,316,521**	**$ 3,868,768**	**$ 3,868,768**	**$ 2,749,7**
Revenues							
Service Charges [4]	$ 1,852,713	$ 1,756,729	$ 1,794,011	$ 1,846,416	$ 1,751,000	$ 1,821,740	$ 1,895,3
Restricted Revenues	$ 144,351	$ 11,506	$ 14,020	$ 112,287	$ 42,000	$ 20,000	$ 20,0
Connection Charges	$ 143,782	$ 182,206	$ 267,732	$ 225,805	$ 100,000	$ 150,000	$ 150,0
City Share of SR350 FM and Bond Rd PS [5]	$ -	$ -	$ -	$ -	$ -	$ (334,665)	$ (334,6
Revenue Bond Proceeds	$ -	$ -	$ 2,444,520	$ -	$ -	$ -	$
Total Revenues	**$ 2,140,846**	**$ 1,950,441**	**$ 4,520,283**	**$ 2,184,508**	**$ 1,893,000**	**$ 1,657,075**	**$ 1,730,6**
Expenses							
Operation & Maintenance [6]	$ 671,381	$ 688,280	$ 729,224	$ 787,389	$ 891,889	$ 909,727	$ 927,9
Contracted Services *(Sewage Treatment)*	$ 464,292	$ 473,641	$ 492,956	$ 505,001	$ 500,000	$ 510,000	$ 520,2
Regional Sewage Treatment Capital System [7]	$ 156,521	$ 216,896	$ -	$ -	$ 220,000	$ 400,000	$ 400,0
Debt Service	$ 484,546	$ 481,357	$ 2,795,646	$ 483,986	$ 398,343	$ 372,011	$ 373,4
Total Expenses	**$ 1,776,740**	**$ 1,860,174**	**$ 4,017,826**	**$ 1,776,376**	**$ 2,010,232**	**$ 2,191,738**	**$ 2,221,5**
TOTAL SEWER UTILITY BALANCE	**$ 1,933,721**	**$ 2,015,436**	**$ 3,237,044**	**$ 3,629,919**	**$ 2,586,536**	**$ 1,549,106**	**$ 1,139,9**

Notes:
1. Refer to Table 7.1 for breakdown of CIP costs and schedule. CIP costs escalated at 5% per year per historical Construction Cost Index (CCI).
2. Estimated sewer utility share of debt service for new Public Works complex (25 percent of total).
3. Sewer capital reserves for 2007 through 2014 period calculated as prior years reserve less current years capital costs.
4. Service charges for period 2008 through 2013 based on average 2.0% growth per year, and 2.0% CPI adjustment per year.

Table ES-5 summarizes sewer rates for wastewater service providers in Kitsap County. Higher monthly rates are due to Poulsbo's generally smaller population compared to other local utilities and the associated requirement to spread costs to a smaller rate payer base. The long conveyance system from the City to the CKWWTP, and the high I&I from the old City sewer system also contribute to higher rates compared to other local utilities. However, facility charges in Poulsbo are lower than many other nearby communities.

Table ES-5. Summary of Residential Monthly Sewer Rate in Kitsap County

	Monthly Rate			
Jurisdiction	Fixed	Commodity (per 600 cf)	Total	Facility Charge
Poulsbo	$29.61	$3.89	$52.95	$5,319
Bainbridge Island	$28.13	$4.80	$56.93	$5,123
Shelton	$20.80	$4.16	$45.76	$7,240
Port Orchard	$36.00	$ -	$36.00	$7,240
Kitsap County				
Central Kitsap	$48.33	$ -	$48.33	$2,840
Kingston	$48.33	$ -	$48.33	$7,182
Suquamish	$48.33	$ -	$48.33	$4,506
Bremerton	$22.08	$3.68	$44.16	$3,586

The financial analysis indicates sewer rates may need to be increased within the next several years to cover costs associated with system upgrades and normal O&M. A rate analysis to determine the extent of a potential rate increase is outside the scope of this CSP update. It is therefore recommended that the City initiate a rate study in 2008 to evaluate financial needs in greater detail. Based on the proposed CIP, sewer rates may need to be increased in 2009 and beyond in order to generate sufficient revenue to fund identified improvements.

As part of the recommended rate study, the City should evaluate the adequacy of the sewer connection (facility) charge. Costs for future conveyance and capacity improvements needed to accommodate growth should be reflected in connection charges to ensure that new customers are paying their fair share of capital facilities. Increasing the connection charge for new customers, if warranted, may reduce the magnitude of the rate increase that may need to be borne by all system users.

Appendix I

Emergency Procedures

CITY of POULSBO VIKING CITY	City of Poulsbo **Public Works Department** Policy / Procedure

Title: Central Interceptor Surcharge Response		
Number of Pages: 2	**Effective Date:** May 1, 2013	**Revisions:** 4-9-15; 8-5-15; 10-9-15
Approved by: Andrzej Kasiniak, City Engineer AK		

POLICY:
The purpose of this Central Interceptor Surcharge Response Procedure is to outline the procedure for responding to potential wastewater overflow events in the central interceptor from approximately Tollefson Street to Johnson Road.

PURPOSE:
The intent of this policy is to prevent the overflow of sewage from manholes along the central interceptor from approximately Tollefson Street to Johnson Road. Historical events have shown that the interceptor can become surcharged during extreme rain events usually involving over 2" of rainfall in a 24-hr period. Central Interceptor manholes have overflowed in the vicinity of Nordnes Street and sewage has been discharged onto private property as well as into the storm drainage system. Discharges to the storm drainage system are considered an illicit discharge and can create a water quality violation in Liberty Bay.

GUIDELINES:
It is the policy of the City of Poulsbo Public Works Department to respond to potential overflow situations as follows:

Section I: Alarm System and Response

A manhole monitoring and alarm system has been installed in Manhole #311 in the shoulder of SR305 near the intersection with Baywatch Court. The system constantly monitors the sewage flow levels in the 18-inch Central Interceptor at 5-minute intervals and provides continuous updates via the website: PoulsboData

https://fsdata.hach.com/ Username: **~~KSvarthumle~~** Password: **HachWebData**

The system will send notifications as follows in the event overflow levels are detected in the pipe, and manhole surcharge conditions are present. In the event of any system notification, flow levels in the pipe shall be investigated and possible manhole overflow locations shall be spot-checked to insure that all overflows are discovered and mitigated.

1. Utilities Foreman and Services Foreman will receive text messages @ 360-509-1881 and 360-662-6435. Also an e-mail to ksvarthumle@cityofpoulsbo.com.

2. The on–call pager phone will receive a text message at 360-265-5036 and 360-478-6584.

3. Dean Zavack will receive an e-mail at dzavack@cityofpoulsbo.com.

Section II: Collection Berm

A collection berm has been constructed below manhole #317 near the end of Nordnes Street at SR305. There is a trash-catcher cage installed over two overflow pipes in the berm. If an overflow event is anticipated either by weather forecast or by notification from the alarm system, the lower 8-inch overflow pipe will be plugged to allow runoff to collect in the berm below the higher 12-inch overflow pipe.

Section III: Vactor Response

In the event of an alarm condition from the manhole Alarm System a vactor truck will be deployed to the collection berm area. The berm will be monitored and any sewage overflow will be collected by the vactor truck. In the event the overflow is of greater quantity than can be contained by the truck, the truck will collect as much as possible before proceeding to the nearest point of disposal to decant the load from the truck. The vactor will continue to return to the berm and collect as much of the overflow as possible until the Central Interceptor is again able to contain the flows and the flow conditions recede.

Section IV: Overflow Reporting

If sewage overflows from any manhole and/or into the berm, IMMEDIATELY report it to *both*:

Kitsap Public Health Dept.
(360) 337-5235

- Call 24/7 then select "O" for the operator.
- After-hours, selecting "O" routes the call to an answering service.

and

Dept. of Ecology
(425) 649-7000

If sewage ALSO enters the storm drain system, IMMEDIATELY report it to:

State Dept. of Health
(360) 236-3330 After-hours: (360) 789-8962

REVISION CRITERIA:

A change in this policy may be initiated in the form of a memorandum to the City Engineer.

CITY of POULSBO VIKING CITY	City of Poulsbo **Public Works Department** Policy / Procedure

Title: Sewer Spill Emergency Response		
Number of Pages:	**Effective Date:** October 2005	**Revision Date:** , 2015
Approved by: Mike Lund, Assistant Superintendent, Public Works		

PURPOSE:
The intent of this sewer spill response procedure/policy is to outline the reporting and response procedure for responding to a sewer spill or a sewer line break to prevent public exposure to sewage spills through public information and notification and protect receiving water quality in the case of spills to surface waters.

SCOPE:
It will be the policy of the City of Poulsbo, Public Works Department to respond to a sewer emergency response as follows:

A. Immediately respond to sewer emergency location to assess damages.
   1. Always be calm and professional.
   2. Never admit or deny liability.
   3. Call Sewer Department Operator

B. Call-Out List:

   1. Bill Meyer: Will assess, isolate and call Foreman Keith Svarthumle.
   2. Keith Svarthumle (Foreman): Will start log of events and assist with planning, and call Operations Manager (Dan Wilson).
   3. Dan Wilson: Will assess, plan, coordinate event and maintain open communications. Will call Joe Walker (Foreman) to coordinate any equipment requirements, and Jeff Lincoln (P.W. Director).
   4. Joe Walker: Will assist with manpower and equipment requirements. Will make call to personnel required on-site.
   5. Jeff Lincoln: Will set up communications and notifications to applicable agencies.

      a. If sewage overflows from any manhole, IMMEDIATELY report it to:
      Kitsap Public Health Dept. (360) 337-5235
      Call 24/7 then select "O" for the operator. After hours, selecting "O" routes the call to an answering service.

      Dept. of Ecology (425) 649-7000

      b. If sewage ALSO enters the storm drain system or flows into surface waters IMMEDIATELY report it to:
      State Dept. of Health (360) 236-3330 After hours: (360) 789-8962

POLICY:

The City of Poulsbo has adopted the **Kitsap County Health Department's Policy and Procedure "Sewage Spill Reporting and Response Procedures"** which is attached to this procedure as Exhibit A.

Appendix J

SR-305 Interceptor Surcharge Analysis

TECHNICAL MEMORANDUM

Date: April 25, 2016

To: Diane Lenius, P.E., City of Poulsbo

From: Peter Cunningham, P.E., Chris Kelsey, P.E., BHC Consultants, LLC (BHC)

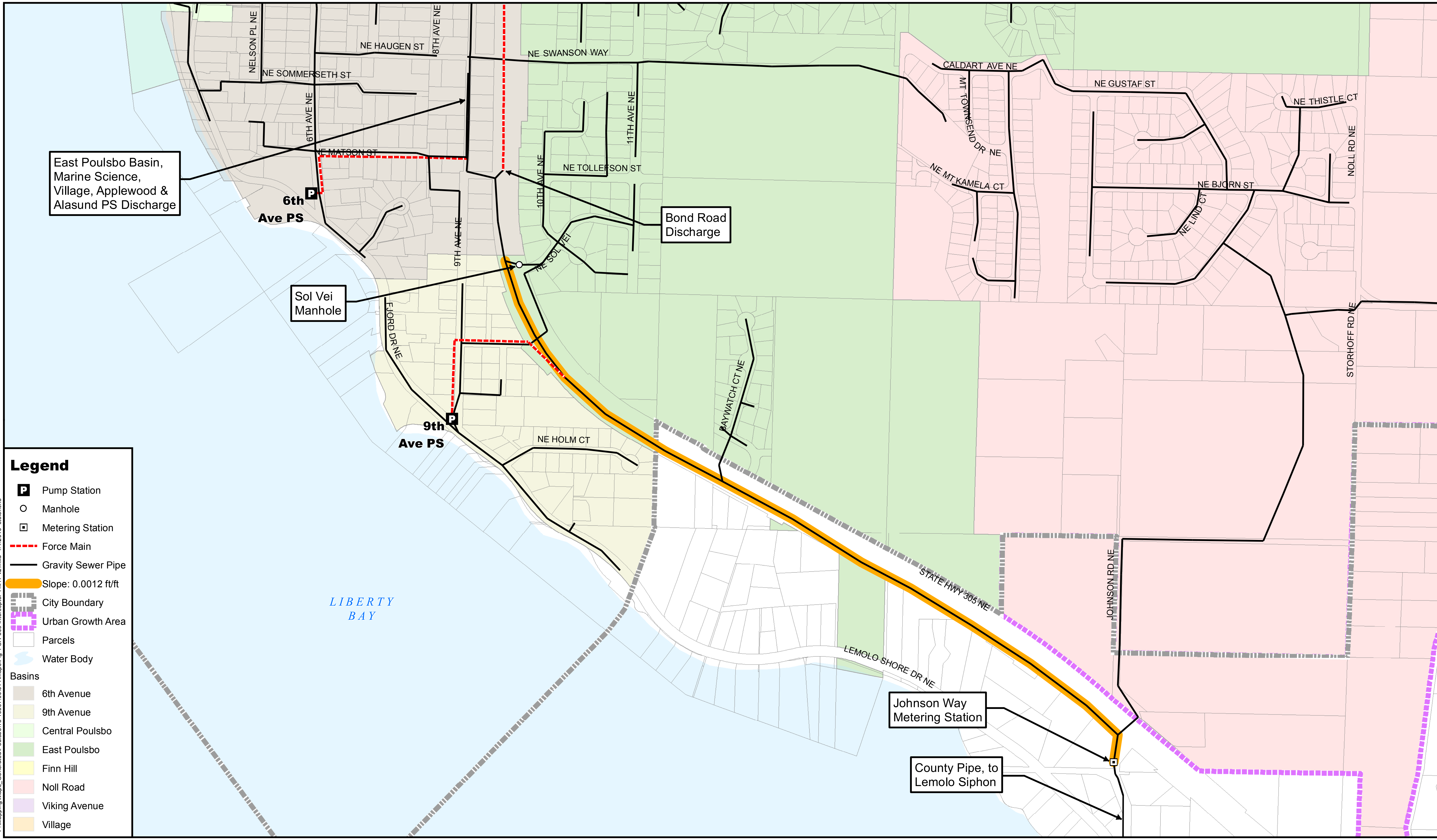
CC: Andzrej Kasiniak, P.E., Dean Zavack, P.E., City of Poulsbo

Subject: SR-305 Interceptor Surcharge Analysis

Project No: 15-10397.00

<u>Purpose:</u>

The collection system analysis performed as part of developing the Comprehensive Sewer Plan (CSP) identified potential capacity limitations associated with the main sewer system trunk, the SR-305 interceptor. Potential capacity limitations are supported by observed and recorded wet weather surcharge conditions, resulting in full pipe flow restrictions that back up manholes. During notable storm events in 2012, and more recently on January 21, and March 13, 2016, the surcharge has been sufficient to completely fill manholes, dislodge a manhole lid, and allow spillage of untreated wastewater. This sanitary sewer overflow condition, or SSO, appears to occur most prevalently at the intersection of SR-305 and NE Sol Vei Street. The location of this manhole, referred to as the Sol Vei manhole, is shown on Figure 1.



BHC CONSULTANTS

GIS Data: City of Poulsbo & Kitsap County
This map is a geographic representation based on information available.
No warranty is made concerning the accuracy, currency, or completeness
of data depicted on this map.

N W E S

0 500 1,000 Feet

SR-305 Interceptor
City of Poulsbo
April 2016

Figure
1

The draft CSP Capital Improvement Program (CIP) recommended construction of a Bond Road force main extension past the minimally sloped, capacity limited section of the SR-305 interceptor to accommodate future growth and address these developing capacity concerns. In light of the recent spill event, the City requested that BHC evaluate available data for the recent and past storm events and establish "best fit" methodologies to identify the future storm frequency/duration that might be anticipated to result in potential future SSOs. The analysis will also assess volumes of surcharge that might be anticipated from greater design storm events that are typically used to size conveyance and detention facilities.

This Technical Memorandum includes the data review and calculations associated with this analysis, and the development of interim recommendations that might be appropriate to implement in advance of construction of additional conveyance capacity in the SR-305 corridor.

Data Review and Analysis:

Data from a variety of sources was reviewed with a focus on the period from January to March 2016. These sources included as-builts, rainfall, pump station runtimes, level and flow in the SR-305 Interceptor, flow at the Johnson Road Metering Station, and anecdotal data from City and Kitsap County (County) staff.

As-Builts

As-builts for the SR-305 Interceptor are included as Appendix A. The majority of the 18-inch pipe was built at a 0.0012 ft/ft slope, with steeper sections located near the Sol Vei manhole. The asbuilts show the location of the overflow at the Sol Vei manhole. The depth from rim to invert at the Sol Vei manhole is 5.98 feet, based on the as-builts. The rim elevation is also lower than the surrounding manholes. Therefore, high flows would be expected to cause an SSO at the Sol Vei manhole prior to overflowing at other manholes.

An 18-inch pipe at a slope of 0.0012 ft/ft has a flowing full gravity capacity of approximately 2.35 mgd. Flow exceeding 2.35 mgd will surcharge the pipe and cause surcharging in the manholes. Once flows are sufficiently high, overflows will occur at manholes. The capacity of the 18-inch pipe after fully surcharged was calculated by the City to be approximately 1.6-1.7 mgd, based on flowmeter and level monitor in SR-305 directly downstream from the Sol Vei manhole. The reduction in flow is based on inlet and exit losses, which are assumed to be minimal when flowing through a channeled manhole but may be higher once the pipe is surcharged.

Johnson Road Metering Station

The Johnson Road Metering Station uses a Parshall flume to record flow at the downstream end of the SR-305 Interceptor. Flow in excess of 2.5 mgd surcharges the flume and the metering station no longer reliably measures flow, and often records a flow of 0 mgd.

The meter is read manually, and flows are calculated based on the difference in daily recorded total readings. Some days the meter isn't read, which then results in a measured flow of 0 mgd and a correspondingly higher flow following the missed day.

The average measured flow during this January to March 2016 period was 0.86 mgd. The daily flow on 1/21/2016 was estimated by the County to be 3.02 mgd, and the flow on 3/12/2016 was 1.33 mgd. The actual instantaneous flows on those days would have been higher. Peak instantaneous flow on 3/12 was measured at up to 2.52 mgd at the Johnson Road Metering Station, however, the Parshall flume meter does not reliably read at flows above 2.5 mgd, and higher flows may have occurred.

Daily flow data at the Johnson Road Metering Station was obtained from 1/3/2016 to 3/24/2016 and is shown on Figure 2. Sustained rainfall occurred prior to 3/13/2016. After the sustained rainfall, flows were higher than normal, and declined for several days. This indicates that groundwater may be high, and despite little to no rainfall, infiltration was still higher than usual. Rainfall occurred again on 3/20/2016, and flows rose somewhat in response.

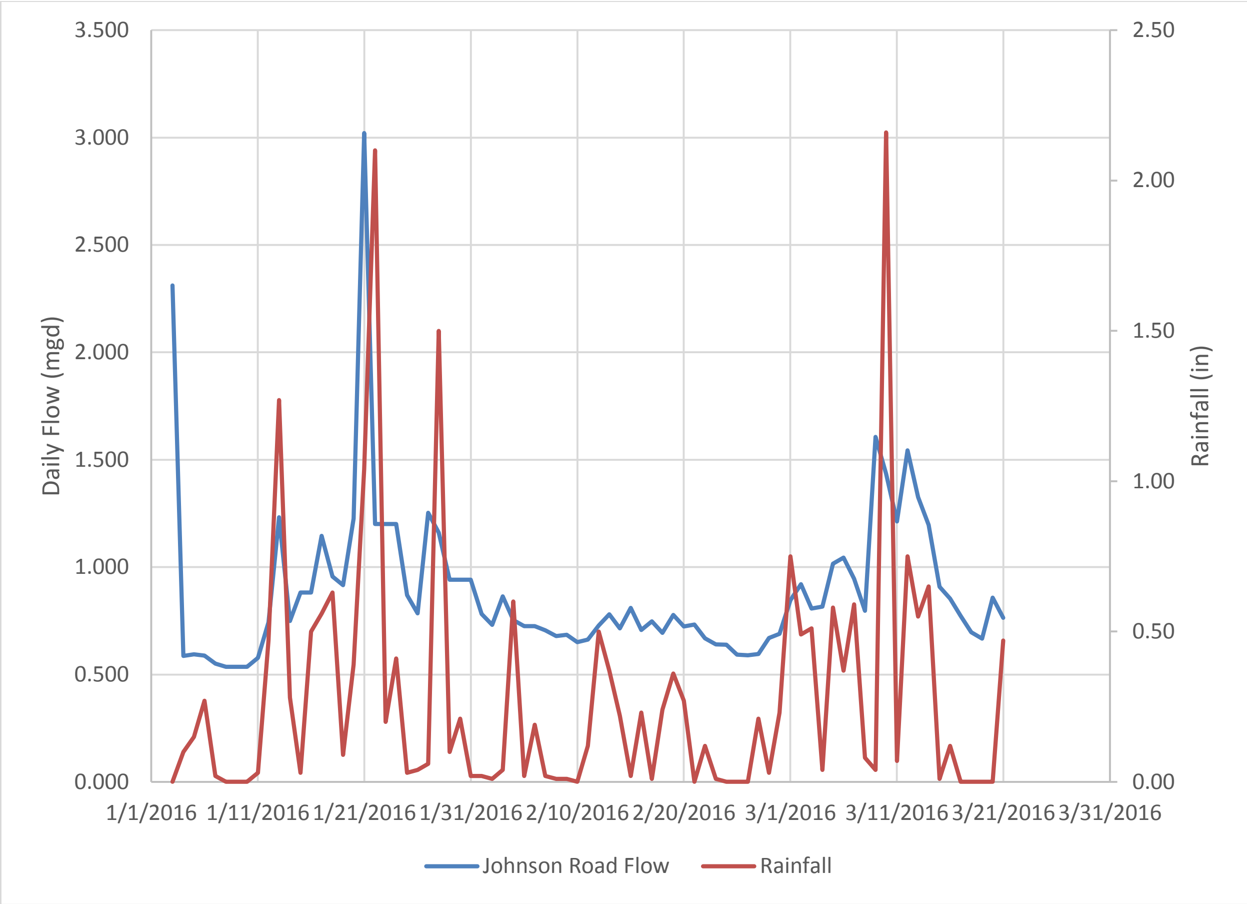


Figure 2: Johnson Road Flow Meter

Rain Gauges

The James Lumber, Virginia Point, and Central Market rain gauges were used to analyze the approximate return interval of the storm events, as well as cumulative rainfall accumulation for the water year beginning in October 2015. There are several other rainfall gauges in the area that appeared to be unreliable, and were not used. The rainfall measured at the rain gauges were compared with the approximate 2-, 10-, and 100-year 24-hour rainfall totals and are presented on Figure 3. The 2-, 10-, and 100-year 24-hour rainfall totals were based on isopluvials from the Department of Ecology 2014 Stormwater Management Manual for Western Washington and are included as Appendix B.

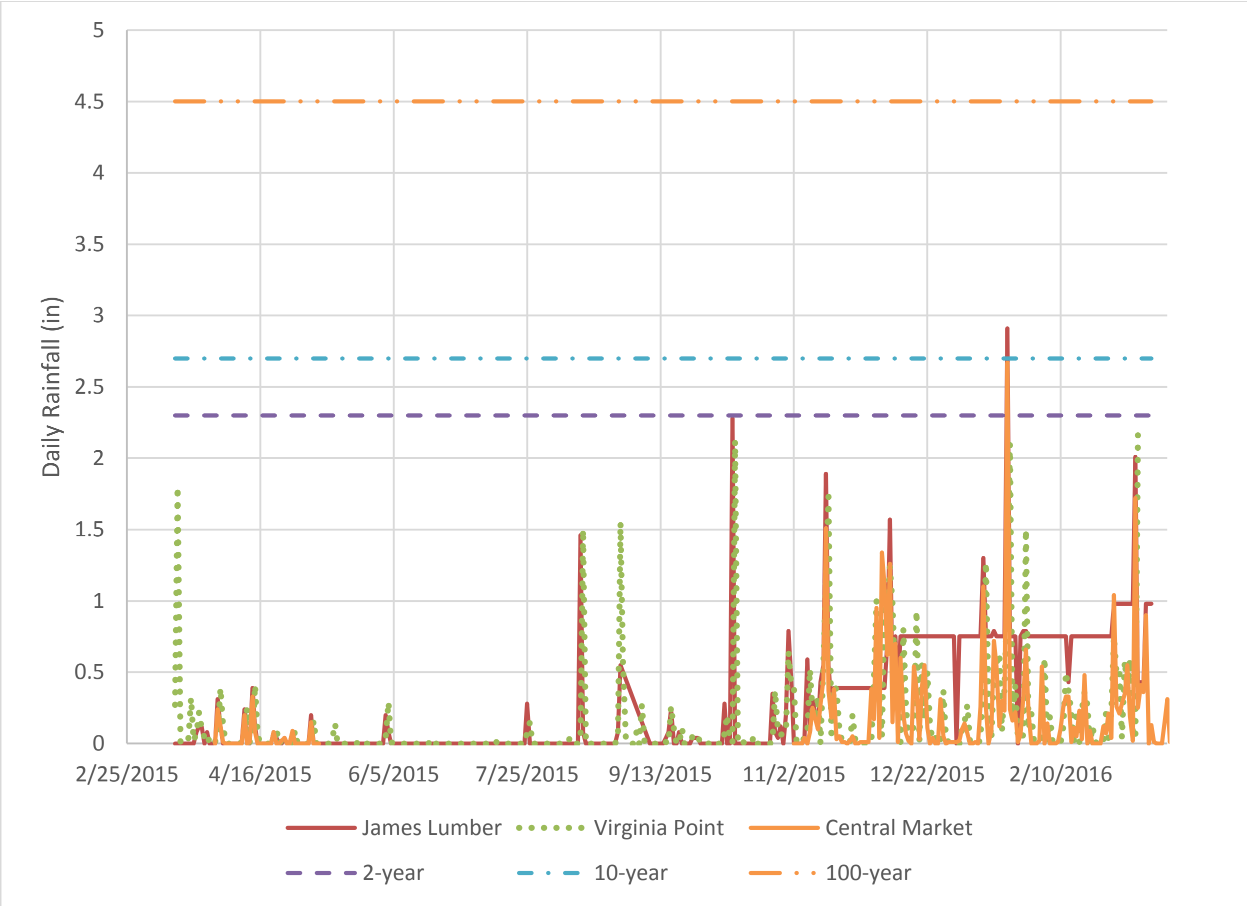


Figure 3: Total Daily Rainfall Comparison

The 1/21/2016 rainfall was measured as somewhat less than a 2-year event at Virginia Point, a 10-year event at Central Market, and somewhat more than a 10-year event at James Lumber. This difference could be due to spatial variations in rainfall for a given event, or due to measuring errors at the rain gauges. The James Lumber rain gauge recorded 0.75 inches of rain on most days starting around 12/13/2015, and may be over measuring the rainfall.

Rainfall on 3/11/2016 was below a 2-year event at all three rain gauges.

Average total rainfall between October and March was 25.12 inches, measured at the Central Market gauge. Cumulative rainfall from 10/1/2015-3/13/2016 was 43.52 inches at the Virginia Point rain gauge and 33.79 inches at Central Market. Rainfall at both gauges exceed the average rainfall for this period, and rainfall at Virginia Point is 24% higher than the previous highest total of 35.11 inches. This indicates a particularly wet winter, which can increase groundwater levels and make I/I more sensitive to additional rain events. This might explain why an overflow occurred on 1/21/2016 and 3/12/2016 but not on 10/11/2015, despite similar levels of rainfall.

Rainfall on 3/12 was not particularly high and there were larger events on the preceding days that raised the sewer base flows. The highest rainfall immediately prior to the overflow event on 3/12/2016 occurred on 3/9 and 3/10/2016, with additional but lower amounts occurring on 3/11 and 3/12. This further indicates the potential that high groundwater levels are reducing capacity for additional rainfall.

Pump Stations

Daily pump run times from 12/31/2015 to 3/21/2016 were analyzed to determine if any pump stations were pumping excessively during the overflow events. Daily pump flows were calculated based on run times and estimated pump capacity. The maximum daily flow was compared with the average flow from January to March 2016 to locate basins where higher than usual flow increases may have occurred. The comparison is included as Appendix C.

The ratio of maximum to average flow measured at the Johnson Road Metering Station was 3.5 for this time period.

The Marine Science Pump Station maximum to average flow ratio was 3.4, indicating that there was potentially more significant I/I at that station or within that basin. The Village Pump Station maximum to average ratio was 2.4, which is still higher than the other stations. The Village Pump Station is known to have I/I issues, and the wet well fills rapidly when rain events occur.

The 6th Avenue Pump Station was recently rebuilt. During the 1/21/2016 event, both pumps ran simultaneously for a total of approximately 5 hours 45 minutes, indicating that one pump was insufficient to convey the incoming sewage. No more than one pump operated at a time during the 3/12/2016 event, indicating that there was sufficient pump capacity for the 3/12 flows.

The Bond Road Pump Station (BRPS) discharges to the SR-305 Interceptor approximately 600-700 feet upstream of the Sol Vei manhole, and is the largest pump station in the City. After the high level alarm was triggered on the SR-305 Interceptor, the BRPS was shut off and the 10,000 gallon auxiliary tank was used to try to prevent an overflow. City staff observed overflows at the Sol Vei manhole during the 1/21/2016 event even when the pumps at the BRPS were off, and saw a noticeable difference in flows when the pumps cycled on and off. This indicates that extending the Bond Road force main may not be sufficient to eliminate SSOs because the SR-305 Interceptor did not have sufficient capacity even without the BRPS contributing flows. Additionally, it indicates that attenuation from the discharge manhole to the Sol Vei manhole may be limited, at least during events of the magnitude experienced on 1/21/2016.

Gravity Basins

Wastewater from the East Poulsbo and Noll Road basins drain by gravity to the SR-305 Interceptor, and aren't measured directly. Gravity basin flow can be approximated as the flow measured at the Johnson Road Metering Station less the flow calculated from the pump stations. Because the flow from the pump stations isn't measured directly, but is calculated based on pump capacity and pump run time, there is uncertainty in the flow from the gravity basins. Nonetheless, it was calculated to determine if there is significant I/I from the basins. The daily flow occurring on 1/21/2016 is approximately 7.9 times as high as the average daily flow from 12/31/2015 to 3/21/2016.

This is much greater than the maximum to average ratio measured at Johnson Road of 3.5. Similarly, this gravity basin ratio was 2.99 for the 3/12/2016, approximately 67% higher than the ratio at Johnson Road of 1.79.

Some of the data was removed because the calculated pumped flow was higher than the measured flow at Johnson Road, and some was removed because Johnson Road flows hadn't been recorded, which skewed the calculations. Despite these uncertainties, the potential exists that I/I is problematic in the gravity basins, and additional evaluations should be performed. It is recommended that a flow meter and/or level monitor be installed to supplement existing data collection on the East Poulsbo and Noll Road basins. This data would help confirm if I/I is significant in the basins, and if I/I reduction efforts should be focused on these basins.

Kitsap County Facilities

Due to the connectivity of the Poulsbo collection system to Kitsap County facilities within the Lemolo area and the siphon beneath Liberty Bay, BHC conducted a telephone conversation on March 23 with the County's sewer utility Senior Program Manager to identify issues associated with County facilities during the 1/21/16 or 3/12/16 storm events. The following points were relayed:

- The County experienced SSO occurrences within the Lemolo area for the same storm events, reporting surcharge from a manhole located at 16128 Norum Road on January 21, March 9, and March 13. This manhole is shown on Figure 1.
- During the January 21 event, the County did report abnormally high operational pump settings (wet well call-on levels) to their Pump Station 16 (PS-16). The Lemolo Siphon currently discharges to PS-16 within the Keyport area. The wet well level settings have since been lowered so that the HGL will be lower on the Lemolo side, which will prevent the station from playing a role in potential future SSO events, but the higher wet well levels that were maintained on January 21 could have played a role in the surcharge experienced at 16128 Norum Road.
- The County performs preventative maintenance on the Lemolo sewer pipe from the Johnson Road metering station down to the siphon to ensure that full capacity is retained. This includes annual pigging of the lines from the metering station down to the location of a 3-way valve before the siphon crossing under Liberty Bay. The County was going to verify similar preventative maintenance procedures that operations staff might have in place specifically for the siphon.
- Similar to Poulsbo, the County has a developed protocol under their SSO response plan to contain spill volumes in a timely and efficient manner.
- Overflows from a SSMH lid at Lemolo restricted the capacity of the siphon by limiting the amount of head buildup upstream of the manhole. Replacing this manhole with a pipe would allow for higher heads to build up, and would increase the capacity through the Lemolo siphon.

The low elevation, shoreline location of the County's SSO events is an area that might be more susceptible to surcharge, due to a higher groundwater table influenced by the adjacent water body providing potential for higher I/I. Pipe slopes near the shoreline also become flatter and limit the localized flow capacity. The County has and will perform upgrades to this infrastructure that includes bolting and sealing manhole lids, such that surcharge is contained and backs up the hill more to a point where a steeper slope of pipe can catch up with the hydraulic gradient. However, since surcharging was not observed within all County manholes up to the Johnson Road metering station during these events, it is believed that some portion of the Kitsap facilities retained adequate capacity and gravity flow conditions associated with a non-full pipe.

Therefore, it is not believed that County capacity limitations within the Lemolo area during these events directly contributed to the surcharging that occurred within Poulsbo's SR 305 interceptor at the intersection of NE Sol Vei Street. Several other factors specific to the Poulsbo system could have provided the necessary conditions for an SSO to occur, as summarized in Section 3 below.

Design Storm

Conveyance facilities are often sized based on a design storm. A particular design storm may result in greatly varying I/I flow rates depending on when it occurs. A large storm after a long dry period may result in less I/I than a smaller storm after a long period of sustained rainfall. The winter of 2015-2016 has seen unusually large amounts of precipitation, which increase the groundwater elevation and sensitivity to additional storms. Infiltration into an underground pipe is based on available head of the groundwater table above the pipe point of intrusion. The higher the groundwater table, the higher the rate of infiltration into the pipe. Since groundwater travels at a slow rate (inches or feet per day), a single storm event will not significantly increase infiltration during a storm event, due to the lag from the peak storm flows to the peak infiltration flows. Long duration storms, or prolonged weekly rainfall has the most significant increase in infiltration, since it typically takes days for surface water to migrate underground and enter the sewer system by infiltration. Table 1 compares the January 21 and March 12 events with the 2-, 10-, and 100-year storms, and estimates the collection system flow for these events.

Table 1
Storm Event Comparison

Storm Event/Recurrence Interval(1)	Daily Rainfall(2) (in)	Estimated Collection System Flow(3) (mgd)
March 12, 2016 (1.2 year)	2.16	1.33
2-year	2.3	2.52
10-year	2.7	2.85
January 21, 2016 (20-year)	2.91	3.02
100-year	4.5	4.33

Notes:
1) Recurrence interval was interpolated for March 12 and January 21.
2) Daily rainfall was from the rain gauge with the highest recorded rainfall.
3) Collection system flow was estimated for the 2-, 10-, and 100-year flows by assuming all flows greater than the average annual flow of 0.62 mgd are directly proportional to the rainfall on January 21. It was calculated as 0.62 mgd + (3.02 mgd – 0.62 mgd) * (Daily Rainfall in / 2.91 in). Flows were measured at the Johnson Road Metering Station.

Potential Contributing Factors to SSO Rise:

Rainfall

A contributing factor to the increase in SSOs in 2016 is very likely a particularly wet winter with multiple long duration storms. The increased rainfall likely resulted in higher groundwater levels, which increased infiltration into the sewer system. The City has been implementing an I/I reduction program to locate and repair leaking sewer pipes and manholes which will help reduce I/I into the system to increase capacity.

Bolted and Sealed Lids

After the SSO in 2012, the lids of some manholes located downstream of the Sol Vei manhole were bolted down and sealed to prevent additional SSOs at those same locations. Sealing these lids would allow for a higher hydraulic grade line in the system at those manholes and could move the overflow location to other locations, specifically the Sol Vei manhole.

Pump Stations

Sixth Avenue and Ninth Avenue pump stations were recently upgraded. Capacities of these stations before and after the upgrades are shown on Table 2.

Table 2 Pump Station Firm Capacity Before and After Upgrades		
Pump Station	**Previous Capacity(1) (gpm)**	**Current Capacity(1) (gpm)**
Sixth Avenue	142	200
Ninth Avenue	100	160
Notes: 1) Pump station capacity is the capacity with the largest pump out of service. In the case of the Sixth and Ninth avenue duplex pump stations, this is equivalent to a single pump in operation.		

Higher capacity pumps would pump greater flows for a shorter period of time, but with an overflow of 8 hours a pump would cycle on and off, and an increase in pump capacity would not result in overall higher flows. The pumps at the Sixth Avenue Pump Station could be considered undersized because a single pump was not able to handle the entire flow coming in to the station. This increased capacity may have resulted in higher flows to the SR-305 during the 1/21/2016 event, as the previous pumps had a lower capacity. However, had the pumps not been upgraded, flooding could have been experienced at the Sixth Avenue Pump Station unless there was sufficient storage in the wet well.

The additional pump capacity could also create more non-laminar turbulent flow patterns within the discharge manhole that could exacerbate surcharging and extend periods of restricted flow. This was not analyzed as part of this project.

The pump stations that had the largest relative increase in pump run times are the Sixth Avenue Pump Station, Marine Science Pump Station, and Village Pump Station.

Gravity Basins

Flows from the East Poulsbo and Noll Road basins were calculated as total flows from Johnson Road minus the pumped flows. Data and measurement limitations do not make it possible to calculate either pumped or gravity basin flows. However, even with these inaccuracies, review of the estimated flows indicates that there may be significant I/I in one or both of these basins. It is recommended that the City monitor the flow in the gravity basins to determine the potential for I/I reduction projects. It is more likely that the excessive I/I is in the East Poulsbo basin because it connects upstream of the Sol Vei manhole and would therefore have a greater effect on the hydraulic grade line in that area. East Poulsbo is also an older system, which typically correlates with higher I/I. Flows from the Noll Road basin could still influence the hydraulic grade by creating turbulent flow in downstream manholes, thereby causing additional backwater up the SR-305 Interceptor. Construction to replace approximately 2,000 feet of old gravity sewer pipe in Hostmark will be started in summer of 2016, and is expected to help reduce I/I in the East Poulsbo basin.

Recommendations:

Pipeline and Manhole Inspection and Cleaning

It is recommended that inspection and cleaning of the SR-305 Interceptor be considered. Grease buildup can limit the capacity of pipes by effectively reducing the inside diameter of the pipe. Additionally, inspecting the pipe with CCTV to determine the condition of the pipe can provide useful information prior to design of capital facilities.

Both inspection and cleaning may require bypassing. It would be ideal to perform these tasks during a period of dry weather, when flows are lower and more easily bypassed.

Pump Station Operation and Control Strategies

Some sewer systems have pump stations that coordinate their operations by limiting either the time or flow rates when multiple pump stations are pumping. This can sometimes reduce the peak flows experienced within a gravity sewer being fed by multiple pump stations by staggering operation. This may require an upgrade to pump control and SCADA systems in order to implement this. The SR-305 interceptor may benefit if this was implemented at the Bond Road Pump Station, Sixth Avenue Pump Station, Marine Science Center Pump Station, and Village Pump Station. A more detailed review and analysis should be performed to determine the degree of benefit that this might achieve.

Offline Storage

A near term solution would be to construct offline storage in the vicinity of the Sol Vei manhole to store excess sewage that would otherwise contribute to an SSO. The offline storage could be sized based on the 1/21/2016 event, which is approximately a 2- to 10-year 24-hour storm occurring after a long period of high rainfall. In addition, a safety factor of 2 is recommended to account for unknowns in the volume of overflow, as well as rainfall intensity and groundwater conditions.

Kitsap County Health District estimated the 1/21/2016 SSO at 100 gpm for 8 hours. Accounting for pump fluctuations of 80%, the City estimated the total spilled amount to be 40,000 gallons (see Appendix D for email and calculations). A volume of 80,000 gallons would provide sufficient storage for a 2- to 10-year storm, with a factor of safety of 2. More detailed and accurate evaluations would be necessary to confirm a storage volume during preliminary design of the facility. This facility would not eliminate pipe surcharging, but it would substantially reduce the likelihood of an SSO of the size experienced on 1/21/2016 or 3/12/2016. In addition, the off-line storage could be designed within a pipe configuration, such that it would be utilized as a portion of a future parallel interceptor. A single downstream storage facility could also eliminate surging that occurs from multiple pump stations discharging at the same time. The four lift stations could discharge to a single tank, where the discharge to the SR-305 Interceptor could be metered out, at a rate that is below the gravity capacity of the SR-305 Interceptor to prevent surcharging. The gravity capacity of the SR-305 Interceptor is approximately 40% greater than the capacity when fully surcharged.

An 80,000-gallon storage facility equates to a vault approximately 50’ x 20’ x 11’, or 850 lf of 4-foot diameter pipe. These may be difficult to locate within the existing ROW, and coordination with WSDOT would be required.

Increased SR-305 Capacity

Capacity can be increased by either extending the Bond Road Force Main to Johnson Road in order to bypass the capacity limited section of pipe, or by constructing a second gravity pipe.

Because there was still overflow at the Sol Vei manhole on 1/21/2016 with the Bond Road Pump Station pumps off, extending the force main does not appear as if it would entirely solve the SSO issue with existing flows, and would need to be built in conjunction with an offline storage facility. This project will be postponed until after the offline storage is constructed.

I/I Reduction

The City has been implementing an ongoing I/I reduction program, and purchased a TV truck to assist in determining I/I trouble areas. They recently smoke tested and performed sewer manhole inspections in the Village Basin, which is known to have high I/I. The primary sources of I/I in the Village basin were broken side sewers and leaky manholes. It is recommended that the City continue this effort and focus future programs on the East Poulsbo Basin, Central Poulsbo Basin (which contributes to the Marine Science Center Pump Station), and the Sixth Avenue Basin. In particular, monitoring the flow from the East Poulsbo Basin would be useful in determining if that basin is a significant contributor of I/I.

Appendix A

SR-305 Interceptor Asbuilts

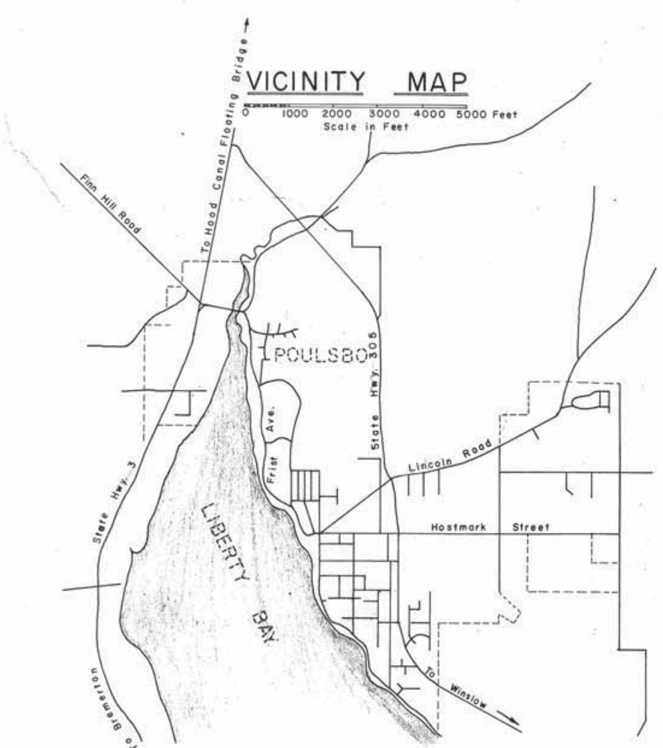
CITY OF POULSBO
1978 SEWERAGE FACILITIES

EPA PROJECT NO. C-53-0548-03

CONTRACT C

HIGHWAY 305 GRAVITY MAIN

PREPARED BY
ROATS ENGINEERING



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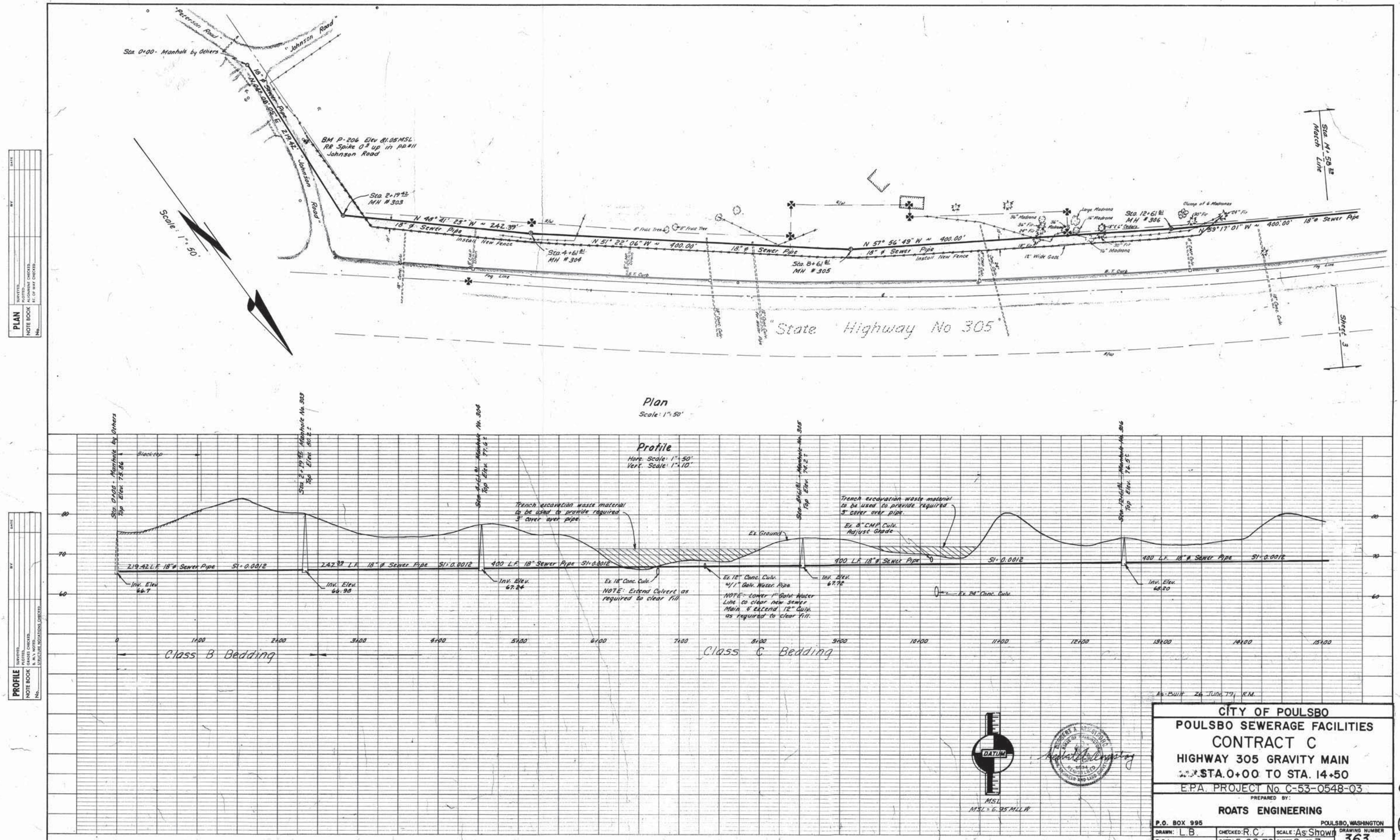

CITY OF POULSBO

POULSBO SEWERAGE FACILITIES

CONTRACT C

HIGHWAY 305 GRAVITY MAIN

STA. 0+00 TO STA. 14+50

E.P.A. PROJECT No. C-53-0548-03

PREPARED BY:

ROATS ENGINEERING

P.O. BOX 995 POULSBO, WASHINGTON

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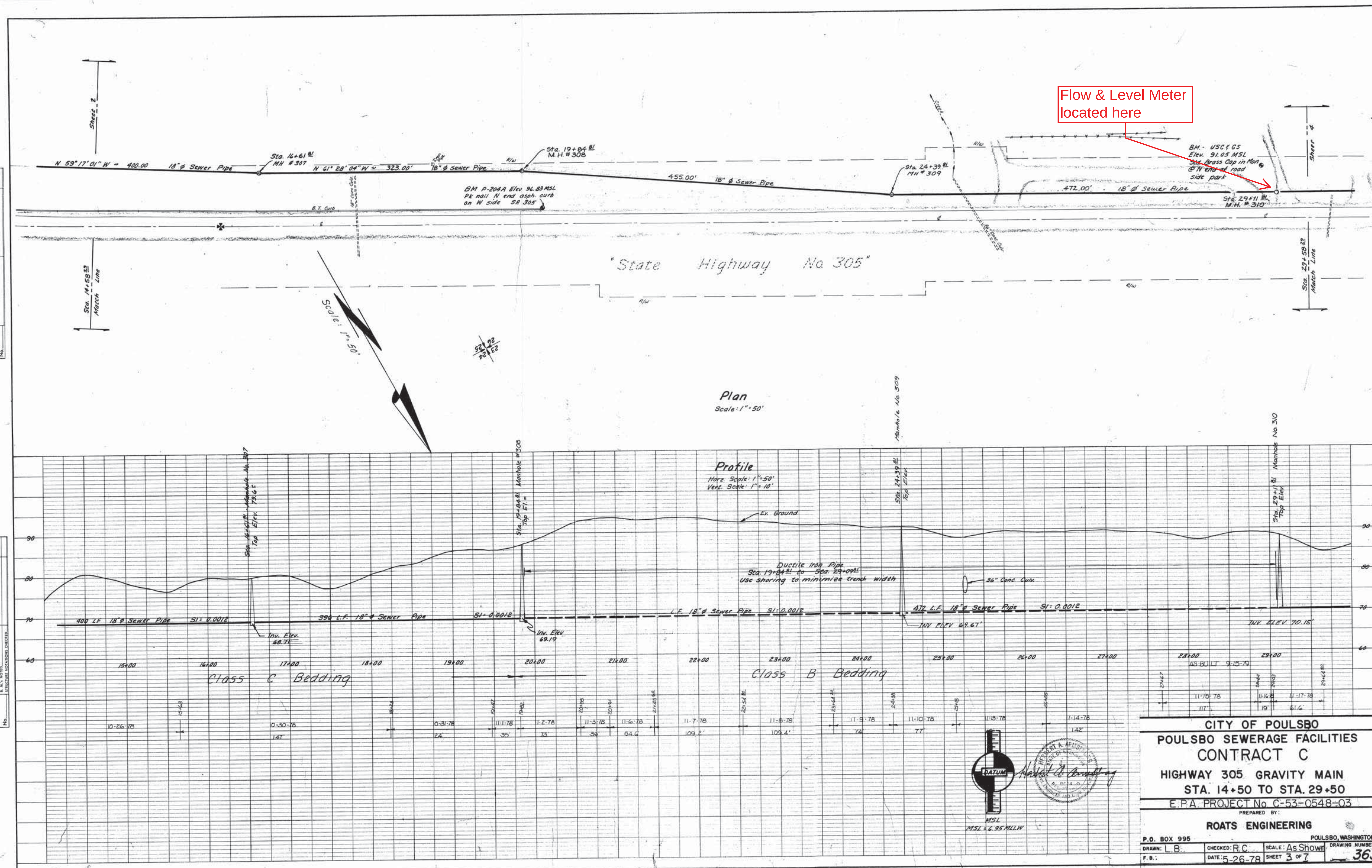

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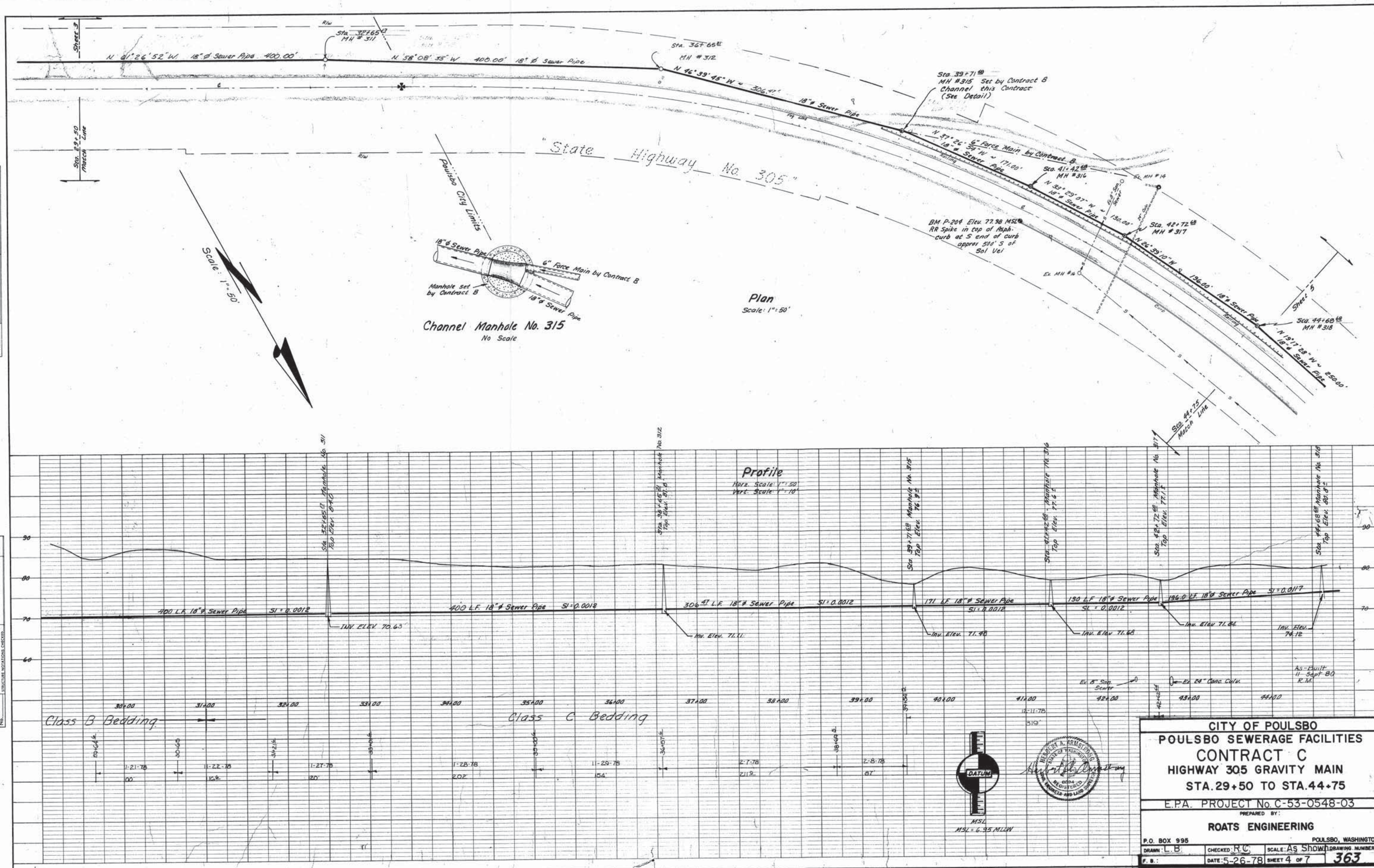

CITY OF POULSBO

POULSBO SEWERAGE FACILITIES

CONTRACT C

HIGHWAY 305 GRAVITY MAIN

STA. 29+50 TO STA. 44+75

E.P.A. PROJECT No. C-53-0548-03

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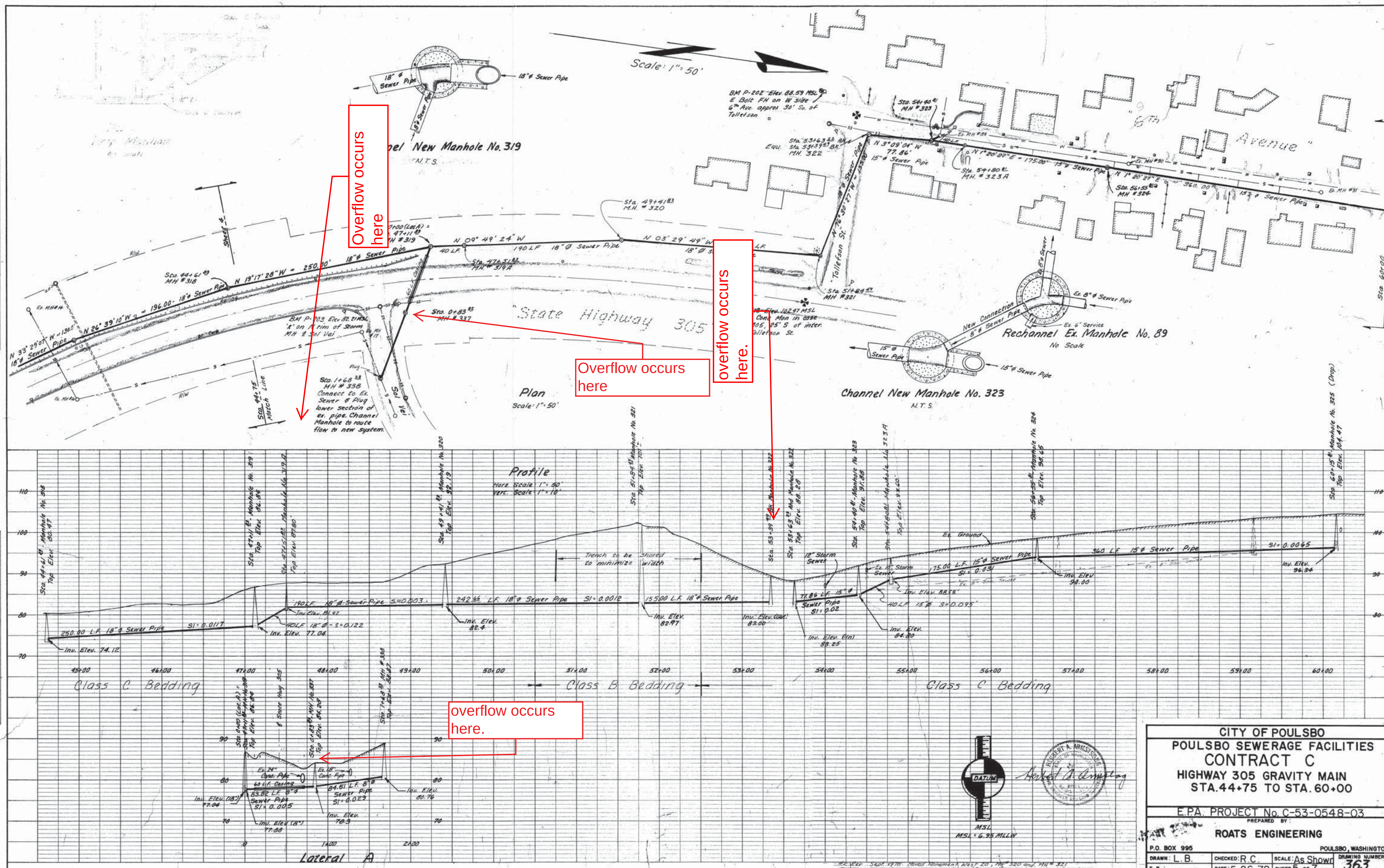

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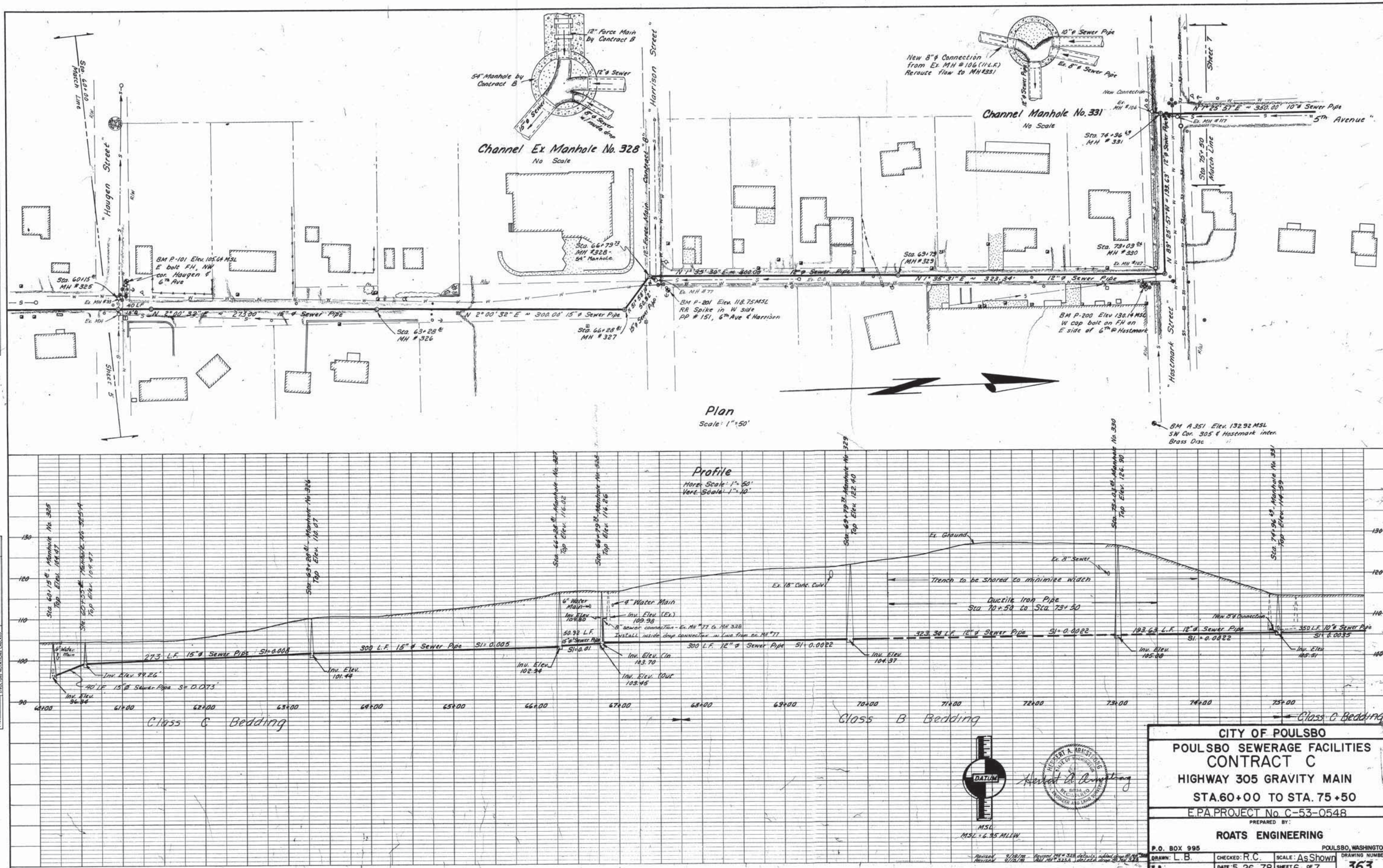

CITY OF POULSBO

POULSBO SEWERAGE FACILITIES

CONTRACT C

HIGHWAY 305 GRAVITY MAIN

STA. 60+00 TO STA. 75+50

E.P.A. PROJECT No. C-53-0548

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K+E PLATE 1, PLAN-PROFILE KEUFFEL & ESSER CO. 48 7008 MADE IN U.S.A.

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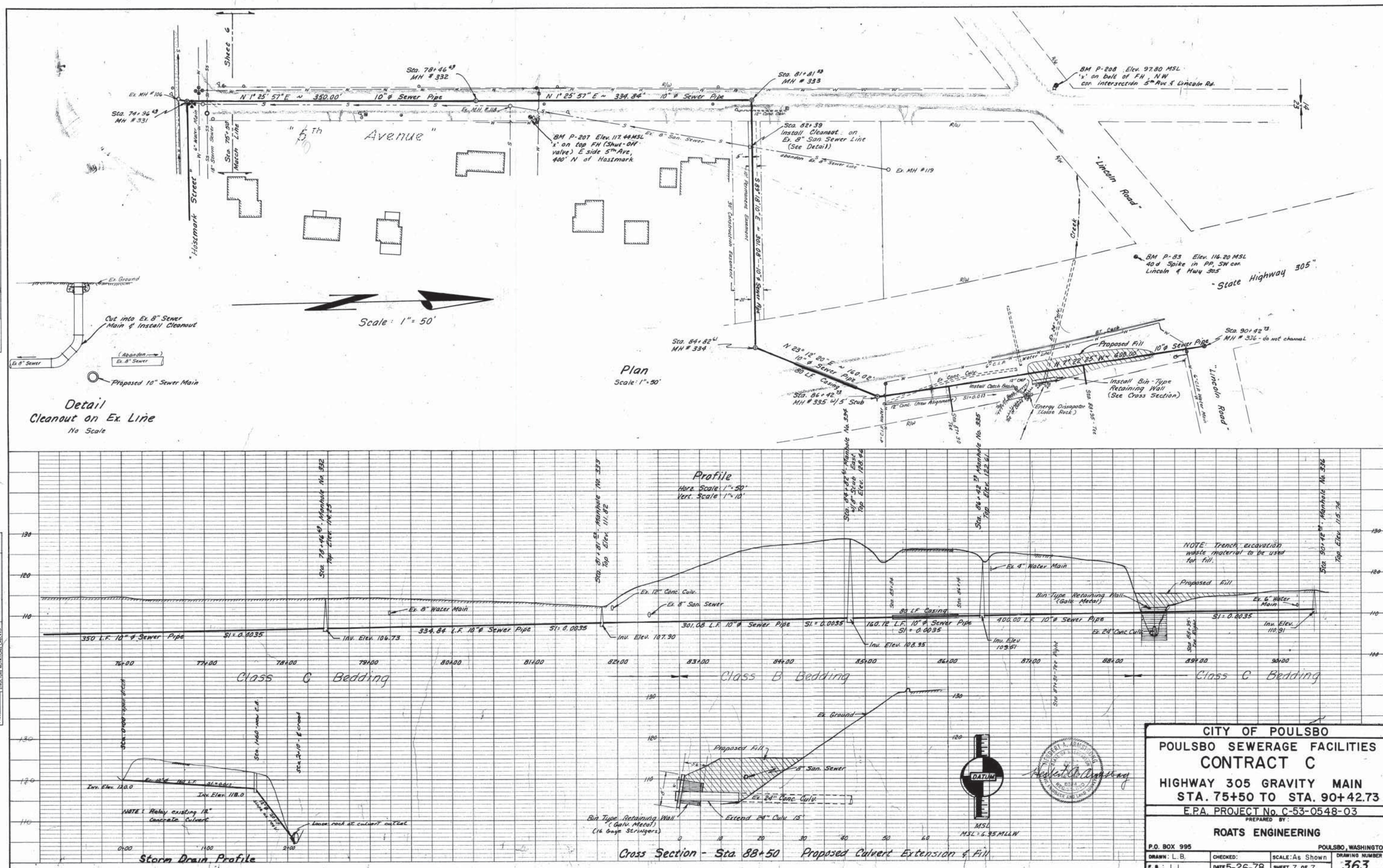
CITY OF POULSBO
POULSBO SEWERAGE FACILITIES
CONTRACT C
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PREPARED BY:
ROATS ENGINEERING
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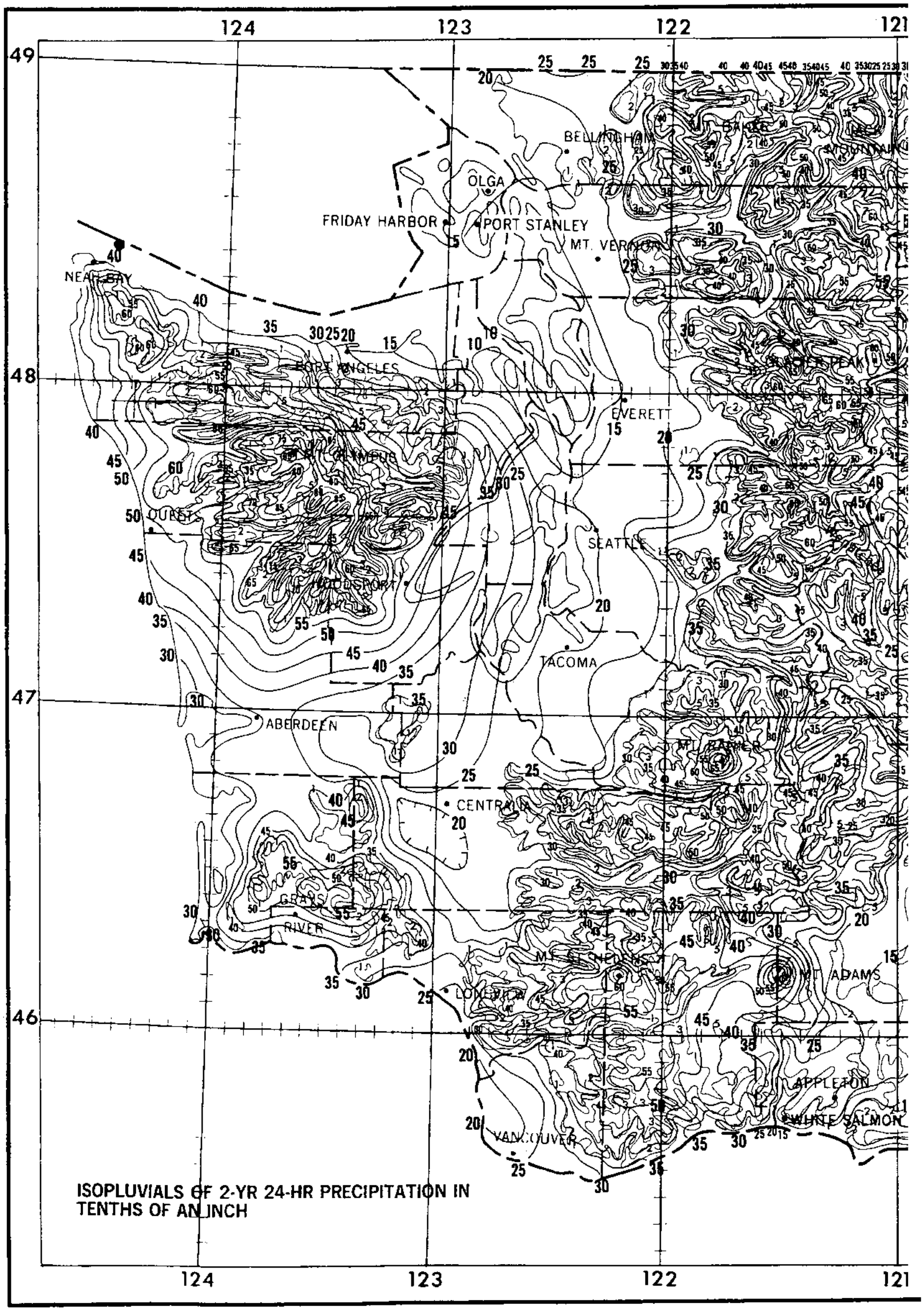
DATE 5-26-78
SHEET 7 OF 7
D0005
SANITARY SEWER
Plan
Scale: 1" = 50'
Profile
Horz. Scale 1" = 50'
Vert. Scale 1" = 10'
"5th Avenue"
"Hostmark Street"
"Lincoln Road"
"State Highway 305"
Sta. 74+96.43 MH # 331
Sta. 78+46.43 MH # 332
Sta. 81+81.43 MH # 333
Sta. 84+82.41 MH # 334
Sta. 86+42.73 MH # 335 w/5' Stub
Sta. 90+42.73 MH # 336 - do not channel
N 1° 25' 57" E ~ 350.00' 10" ϕ Sewer Pipe
N 1° 25' 57" E ~ 334.84' 10" ϕ Sewer Pipe
BM P-207 Elev. 117.44 MSL 'x' on top FH (Shut-Off valve) E side 5th Ave, 400' N of Hostmark
BM P-208 Elev. 97.80 MSL 'x' on bolt of FH, NW cor. intersection 5th Ave & Lincoln Rd.
BM P-83 Elev. 116.20 MSL 40d Spike in PP, SW cor. Lincoln & Hwy 305
Sta. 82+39 Install Cleanout on Ex. 8" San Sewer Line (See Detail)
Install Bin-Type Retaining Wall (See Cross Section)
Energy Dissipator (Loose Rock)
Detail
Cleanout on Ex. Line
No Scale
Cut into Ex. 8" Sewer Main & Install Cleanout
Proposed 10" Sewer Main
350 L.F. 10" ϕ Sewer Pipe Sl = 0.0035
334.84 L.F. 10" ϕ Sewer Pipe Sl = 0.0035
301.08 L.F. 10" ϕ Sewer Pipe Sl = 0.0035
160.12 L.F. 10" ϕ Sewer Pipe Sl = 0.0035
400.00 L.F. 10" ϕ Sewer Pipe Sl = 0.0035
Inv. Elev. 106.73
Inv. Elev. 107.90
Inv. Elev. 108.95
Inv. Elev. 110.91
NOTE: Trench excavation waste material to be used for fill.
Class C Bedding
Class B Bedding
Class C Bedding
Storm Drain Profile
NOTE: Relay existing 12" Concrete Culvert
Loose rock at culvert outlet
Cross Section - Sta. 88+50 Proposed Culvert Extension & Fill
Bin Type Retaining Wall (Galv. Metal) (16 Gage Stringers)
Extend 24" Culv. 15'
DATUM
MSL
MSL = 6.95 MLLW

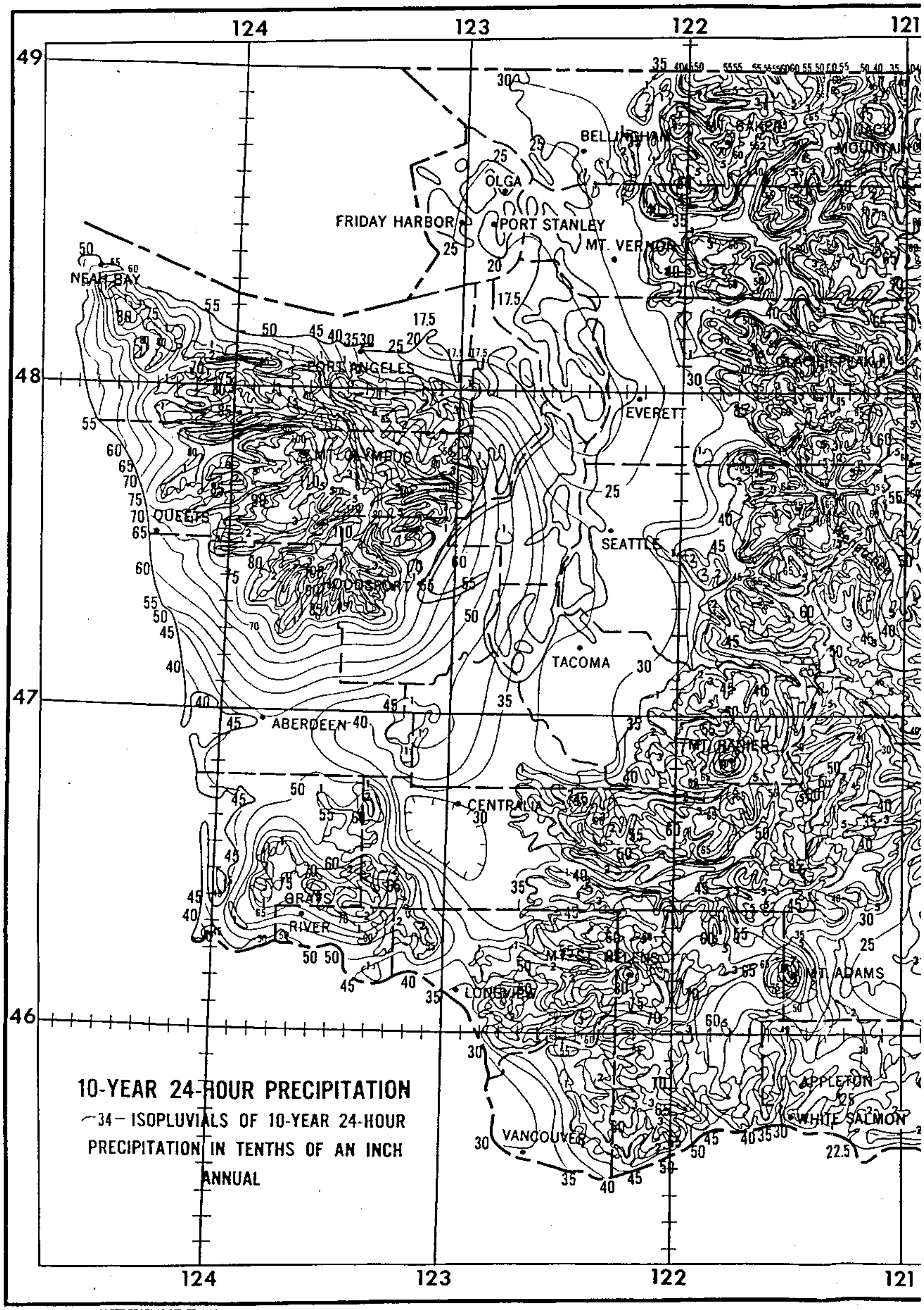
Appendix B

Isopluvials

Western Washington Isopluvial 2-year, 24 hour



Western Washington Isopluvial 10-year, 24 hour



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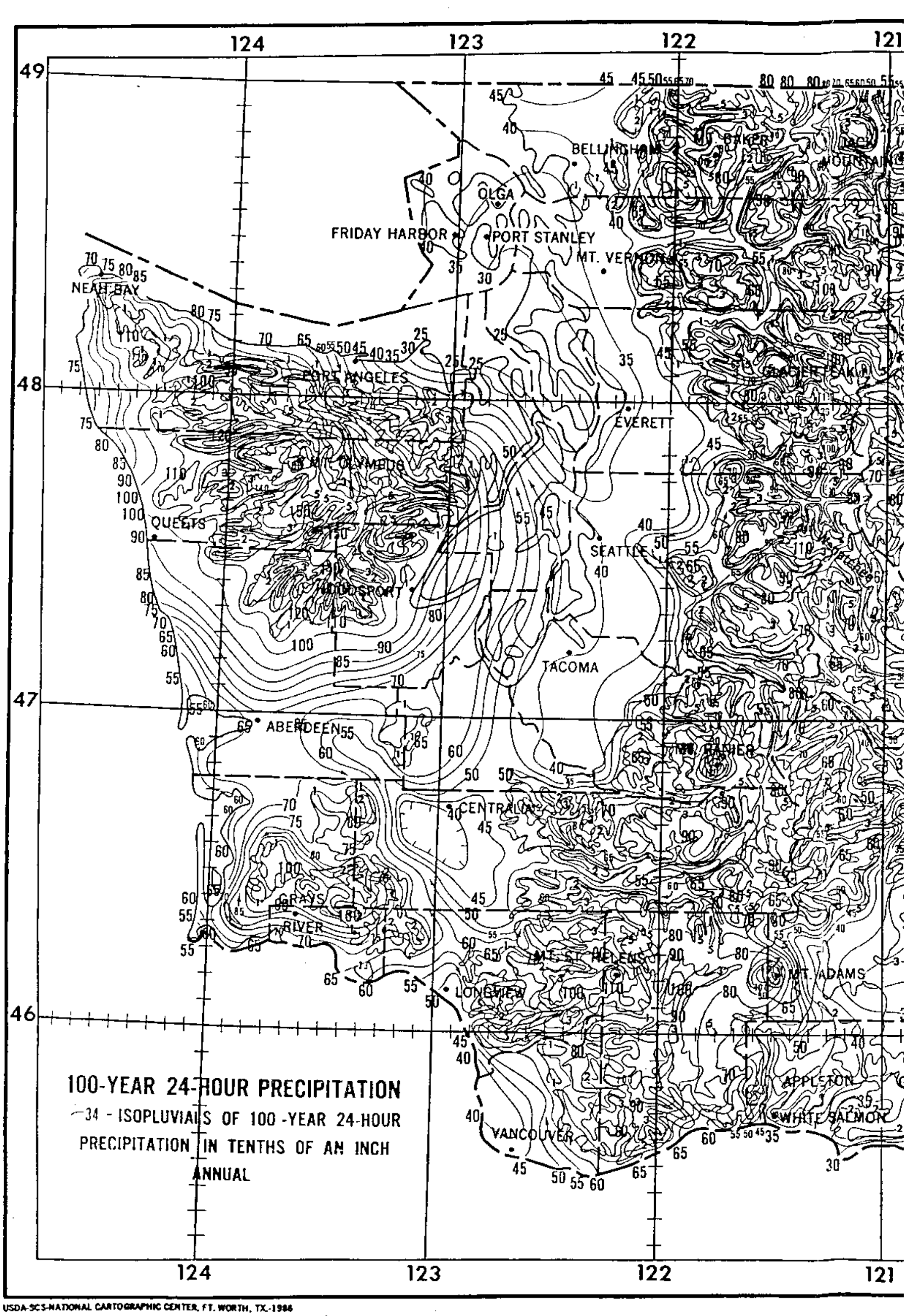
Western Washington Isopluvial 100-year, 24 hour



Appendix C

Pump Station Comparison

City of Poulsbo
Central Interceptor Analysis
Lift Station Summary
Prepared by: Peter Cunningham
Reviewed by: Chris Kelsey
3/30/2016

	Rainfall	Johnson Road	Liberty Bay Runtime (hours)			Lindvig Runtime (hours)			Marine Science Runtime (hours)				Sixth Avenue Runtime (hours)			Ninth Avenue Runtime (hours)			Alasund Meadows Runtime (hours)			Applewood Runtime (hours)			Village Runtime (hours)			Bond Road Runtime (hours)			Total Pump Station Flow (mgd)	Johnson Road Flow (mgd)	Gravity Basin Flow (mgd)
Date	(in)	(gallons)	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Pump 3	Cumulative	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Cumulative	Pump 1	Pump 2	Cumulative			
12/31/2015	0.00	0	1.0	1.4	2.4	2.5	2.3	4.8	1.2	0.0	1.1	2.3							2.1	2.0	4.1	0.0	2.2	2.2	4.1	3.2	7.3	2.8	2.8	5.6	0.5		
1/1/2016	0.00	0	2.8	2.4	5.2	2.8	2.8	5.6	1.1	0.0	1.1	2.2	1.3	4.4	5.7	1.1	1.1	2.2	1.7	1.6	3.3	0.0	2.1	2.1	3.3	2.6	5.9	3.2	3.2	6.4	0.6		
1/2/2016	0.00	0	1.2	2.0	3.2	2.1	2.1	4.2	1.0	0.0	0.9	1.9	1.3	4.1	5.4	1.2	1.1	2.3	1.9	2.2	4.1	0.0	2.6	2.6	4.0	3.0	7.0	2.7	1.7	4.4	0.5		
1/3/2016	0.00	2,310,700	1.8	1.6	3.4	2.7	2.7	5.4	1.0	0.0	1.0	2.0	6.3	7.1	13.4	1.5	1.4	2.9	2.2	1.7	3.9	0.0	2.4	2.4	3.5	2.6	6.1	3.4	4.3	7.7	0.8	2.3	1.6
1/4/2016	0.10	586,300	1.4	2.1	3.5	2.3	2.4	4.7	1.1	0.0	1.1	2.2	6.3	7.1	13.4	1.5	1.4	2.9	1.8	1.7	3.5	0.0	1.9	1.9	4.0	3.1	7.1	3.0	2.8	5.8	0.7	0.6	
1/5/2016	0.15	593,600	2.0	1.8	3.8	2.6	2.5	5.1	1.2	0.0	1.1	2.3	6.3	7.1	13.4	1.5	1.4	2.9	2.0	1.8	3.8	0.0	2.1	2.1	4.2	3.2	7.4	3.2	3.0	6.2	0.7	0.6	
1/6/2016	0.27	588,400	1.9	2.5	4.4	2.7	2.7	5.4	1.2	0.0	1.3	2.5	6.3	7.1	13.4	1.5	1.4	2.9	1.8	1.8	3.6	0.0	2.0	2.0	4.1	3.1	7.2	3.1	2.9	6.0	0.7	0.6	
1/7/2016	0.02	551,100	2.2	1.7	3.9	2.2	2.2	4.4	1.0	0.0	0.9	1.9	6.3	7.1	13.4	1.5	1.4	2.9	1.8	1.9	3.7	0.0	2.1	2.1	3.8	3.0	6.8	2.9	2.9	5.8	0.7	0.6	
1/8/2016	0.00	0	1.5	1.9	3.4	2.8	2.8	5.6	1.1	0.0	1.1	2.2	6.3	7.1	13.4	1.5	1.4	2.9	1.4	1.2	2.6	0.0	1.6	1.6	3.6	2.9	6.5	2.8	2.9	5.7	0.7		
1/9/2016	0.00	0	2.2	1.7	3.9	2.3	2.3	4.6	1.0	0.0	1.0	2.0	6.3	7.1	13.4	1.5	1.4	2.9	1.6	1.6	3.2	0.0	1.7	1.7	3.3	2.7	6.0	2.7	2.4	5.1	0.6		
1/10/2016	0.00	1,607,600	1.2	2.1	3.3	2.5	2.6	5.1	1.1	0.0	1.0	2.1	6.3	7.1	13.4	1.5	1.4	2.9	2.1	2.1	4.2	0.0	2.3	2.3	3.7	3.0	6.7	3.2	3.1	6.3	0.7	1.6	0.9
1/11/2016	0.03	578,200	2.3	1.7	4.0	2.5	2.5	5.0	1.1	0.0	1.4	2.5	6.3	7.1	13.4	1.5	1.4	2.9	1.6	1.6	3.2	0.0	1.7	1.7	3.7	3.0	6.7	2.9	2.9	5.8	0.7	0.6	
1/12/2016	0.47	742,400	2.3	3.1	5.4	3.1	3.0	6.1	1.8	0.0	1.4	3.2	6.3	7.1	13.4	1.5	1.4	2.9	1.9	2.0	3.9	0.0	2.0	2.0	5.2	4.8	10.0	4.5	3.8	8.3	0.9	0.7	
1/13/2016	1.27	1,232,400	2.6	1.9	4.5	3.1	3.1	6.2	1.9	0.0	1.9	3.8	6.3	7.1	13.4	1.5	1.4	2.9	2.3	2.5	4.8	0.0	2.1	2.1	6.3	4.3	10.6	3.1	3.6	6.7	0.9	1.2	0.4
1/14/2016	0.28	748,500	2.0	2.3	4.3	2.6	2.6	5.2	1.4	0.0	1.3	2.7	6.3	7.1	13.4	1.5	1.4	2.9	2.1	2.2	4.3	0.0	2.8	2.8	4.0	3.3	7.3	3.2	3.1	6.3	0.7	0.7	
1/15/2016	0.03	0	2.0	1.9	3.9	2.7	2.8	5.5	1.3	0.0	1.4	2.7	6.3	7.1	13.4	1.5	1.4	2.9	2.5	2.6	5.1	0.0	1.9	1.9	5.0	4.0	9.0	3.4	3.3	6.7	0.8		
1/16/2016	0.50	1,762,200	2.0	2.7	4.7	3.2	3.1	6.3	1.7	0.0	1.8	3.5	6.3	7.1	13.4	1.5	1.4	2.9	2.1	2.3	4.4	0.0	2.6	2.6	5.8	4.5	10.3	3.6	3.4	7.0	0.9	1.8	0.9
1/17/2016	0.56	1,145,600	2.4	2.0	4.4	3.3	3.4	6.7	1.8	0.0	1.8	3.6	6.3	7.1	13.4	1.5	1.4	2.9	2.7	2.9	5.6	0.0	3.4	3.4	6.2	5.1	11.3	4.0	3.8	7.8	0.9	1.1	0.2
1/18/2016	0.63	956,000	2.1	2.9	5.0	3.3	3.3	6.6	1.5	0.0	1.6	3.1	6.3	7.1	13.4	1.5	1.4	2.9	2.7	2.6	5.3	0.0	3.1	3.1	4.7	4.0	8.7	4.1	3.9	8.0	0.9	1.0	0.1
1/19/2016	0.09	916,600	1.8	2.2	4.0	3.0	3.1	6.1	1.5	0.0	1.5	3.0	6.3	7.1	13.4	1.5	1.4	2.9	2.4	2.5	4.9	0.0	3.0	3.0	4.6	4.0	8.6	3.8	3.6	7.4	0.8	0.9	0.1
1/20/2016	0.39	1,225,900	2.0	2.4	4.4	3.3	3.3	6.6	1.6	0.0	1.7	3.3	6.3	7.1	13.4	1.5	1.4	2.9	2.5	2.6	5.1	0.0	3.2	3.2	4.7	4.1	8.8	4.5	4.1	8.6	0.9	1.2	0.3
1/21/2016	1.04	3,021,000	5.3	3.2	8.5	5.5	5.5	11.0	3.2	0.0	6.3	9.5	14.2	9.4	23.5	2.7	2.5	5.2	3.7	3.4	7.1	0.0	5.1	5.1	13.6	5.4	19.0	6.6	5.9	12.5	1.6	3.0	1.5
1/22/2016	2.10	0	1.7	2.3	4.0	3.6	3.5	7.1	1.9	0.0	2.4	4.3	6.8	7.3	14.1	2.4	2.2	4.6	2.9	2.8	5.7	0.0	4.0	4.0	5.3	4.4	9.7	3.6	3.1	6.7	0.9		
1/23/2016	0.20	0	3.1	3.1	6.2	3.5	3.6	7.1	1.7	0.0	1.8	3.5	5.3	5.6	10.9	2.4	2.2	4.6	2.7	3.1	5.8	0.0	4.6	4.6	5.4	4.5	9.9	4.2	3.9	8.1	0.9		
1/24/2016	0.41	3,601,600	2.2	2.7	4.9	3.9	4.0	7.9	1.7	0.0	1.7	3.4	5.3	5.4	10.7	2.7	2.4	5.1	3.8	3.5	7.3	0.0	5.3	5.3	5.9	4.7	10.6	4.6	5.0	9.6	1.0	3.6	
1/25/2016	0.03	869,500	2.8	1.9	4.7	3.2	3.2	6.4	1.4	0.0	1.3	2.7	3.6	4.4	8.0	2.1	1.9	4.0	2.8	2.7	5.5	0.0	4.0	4.0	4.8	3.7	8.5	3.9	3.0	6.9	0.8	0.9	0.1
1/26/2016	0.04	784,700	1.1	2.2	3.3	3.1	3.2	6.3	1.4	0.0	1.3	2.7	0.4	7.0	7.4	2.0	1.7	3.7	2.6	2.4	5.0	0.0	3.6	3.6	4.6	3.4	8.0	3.7	3.5	7.2	0.7	0.8	0.0
1/27/2016	0.06	1,253,400	3.3	3.1	6.4	3.5	3.4	6.9	1.7	0.0	1.9	3.6	4.9	6.6	11.5	2.3	2.1	4.4	2.6	2.9	5.5	0.0	4.9	4.9	5.9	5.1	11.0	4.5	4.2	8.7	1.0	1.3	0.3
1/28/2016	1.50	1,160,900	0.7	3.9	4.6	3.7	3.8	7.5	1.9	0.0	1.8	3.7	5.2	5.6	10.8	2.2	2.0	4.2	3.0	2.9	5.9	0.0	5.0	5.0	5.2	4.2	9.4	4.4	4.4	8.8	0.9	1.2	0.2
1/29/2016	0.10	0	2.1	3.7	5.8	3.4	3.4	6.8	1.6	0.0	1.4	3.0	4.6	4.8	9.4	1.8	1.7	3.5	2.6	2.4	5.0	0.0	4.2	4.2	4.3	3.5	7.8	3.9	3.3	7.2	0.8		
1/30/2016	0.21	0	1.8	2.5	4.3	3.5	3.6	7.1	1.4	0.0	1.2	2.6	1.3	7.3	8.6	1.9	1.9	3.8	3.1	3.0	6.1	0.0	4.6	4.6	3.9	3.2	7.1	3.2	3.9	7.1	0.8		
1/31/2016	0.02	2,824,500	2.0	2.5	4.5	3.7	2.9	6.6	1.5	0.0	0.9	2.4	0.0	8.5	8.5	1.9	1.7	3.6	3.5	3.3	6.8	0.0	5.0	5.0	5.1	3.8	8.9	5.0	4.0	9.0	0.9	2.8	
2/1/2016	0.02	781,400	2.1	2.2	4.3	2.9	3.8	6.7	1.1	0.0	0.6	1.7	0.0	7.2	7.2	1.6	1.4	3.0	2.3	2.3	4.6	0.0	4.5	4.5	4.4	3.5	7.9	3.7	3.5	7.2	0.7	0.8	0.1
2/2/2016	0.01	731,800	2.1	1.8	3.9	3.0	3.0	6.0	1.2	0.0	0.8	2.0	3.0	3.6	6.6	1.5	1.5	3.0	2.2	2.3	4.5	0.0	3.5	3.5	4.1	3.3	7.4	3.4	3.3	6.7	0.7	0.7	0.1
2/3/2016	0.04	863,900	1.9	2.5	4.4	3.3	3.3	6.6	1.4	0.0	1.2	2.6	3.4	3.5	6.9	1.6	1.6	3.2	2.4	2.3	4.7	0.0	3.5	3.5	4.8	3.5	8.3	3.9	3.7	7.6	0.8	0.9	0.1
2/4/2016	0.60	753,400	2.0	2.0	4.0	3.0	3.0	6.0	1.3	0.0	0.9	2.2	2.7	2.9	5.6	1.4	1.4	2.8	2.4	2.3	4.7	0.0	3.4	3.4	4.3	3.1	7.4	3.7	3.5	7.2	0.7	0.8	0.1
2/5/2016	0.02	0	2.3	2.0	4.3	2.8	2.8	5.6	1.1	0.0	0.9	2.0	2.5	2.6	5.1	1.4	1.3	2.7	1.9	1.8	3.7	0.0	3.0	3.0	3.9	2.9	6.8	2.8	2.3	5.1	0.6		
2/6/2016	0.19	1,450,100	2.2	2.0	4.2	3.1	3.1	6.2	1.3	0.0	1.0	2.3	3.0	3.0	6.0	1.4	1.4	2.8	2.5	2.4	4.9	0.0	3.4	3.4	4.1	3.0	7.1	4.0	4.0	8.0	0.7	1.5	
2/7/2016	0.02	706,400	1.6	1.9	3.5	3.0	2.9	5.9	1.1	0.0	0.8	1.9	2.8	2.8	5.6	1.4	1.4	2.8	2.5	2.5	5.0	0.0	3.6	3.6	3.8	2.8	6.6	4.2	3.4	7.6	0.7	0.7	0.0
2/8/2016	0.01	678,400	2.1	2.1	4.2	2.8	2.8	5.6	1.2	0.0	0.9	2.1	2.7	2.7	5.4	1.3	1.4	2.7	2.0	2.0	4.0	0.0	3.0	3.0	4.0	2.9	6.9	2.7	3.1	5.8	0.6	0.7	0.1
2/9/2016	0.01	685,200	2.0	2.0	4.0	3.0	2.8	5.8	1.1	0.0	0.9	2.0	2.5	2.5	5.0	1.4	1.3	2.7	2.1	1.9	4.0	0.0	2.8	2.8	4.0	3.0	7.0	3.3	4.0	7.3	0.7	0.7	0.0
2/10/2016	0.00	650,600	2.4	2.2	4.6	2.7	2.8	5.5	1.1	0.0	0.9	2.0	2.4	2.4	4.8	1.3	1.4	2.7	1.9	2.0	3.9	0.0	2.8	2.8	3.8	2.9	6.7	3.4	2.4	5.8	0.6	0.7	0.1
2/11/2016	0.12	663,100	1.8	2.3	4.1	2.7	2.7	5.4	1.2	0.0	1.0	2.2	2.5	2.5	5.0	1.3	1.2	2.5	1.6	1.6	3.2	0.0	2.3	2.3	4.0	3.1	7.1	3.2	3.0	6.2	0.6	0.7	0.1
2/12/2016	0.50	728,800	2.6	2.6	5.2	2.7	2.8	5.5	1.3	0.0	1.3	2.6	2.6	2.6	5.2	1.3	1.3	2.6	1.9	1.9	3.8	0.1	2.0	2.1	4.5	3.2	7.7	3.3	2.9	6.2	0.6	0.7	0.1
2/13/2016	0.37	780,100	1.6	1.8	3.4	3.1	3.0	6.1	1.4	0.0	1.3	2.7	2.9	2.9	5.8	1.4	1.5	2.9	2.1	2.1	4.2	0.0	2.6	2.6	4.5	3.3	7.8	3.7	3.3	7.0	0.7	0.8	0.1
2/14/2016	0.22	714,300	2.3	1.7	4.0	2.9	2.8	5.7	1.3	0.0	1.3	2.6	2.7	2.7	5.4	1.4	1.4	2.8	2.1	2.2	4.3	0.0	2.5	2.5	3.9	2.9	6.8	3.3	3.2	6.5	0.6	0.7	0.1
2/15/2016	0.02	810,200	2.2	2.2	4.4	3.3	3.2	6.5	1.3	0.0	1.4	2.7	3.0	3.1	6.1	1.5	1.4	2.9	2.6	2.5	5.1	0.0	2.9	2.9	4.5	3.5	8.0	4.1	3.9	8.0	0.8	0.8	0.1
2/16/2016	0.23	707,300	2.1	2.0	4.1	2.8	2.8	5.6	1.3	0.0	1.2	2.5	2.4	2.5	4.9	1.4	1.4	2.8	2.2	2.2	4.4	0.0	2.6	2.6	4.1	3.1	7.2	3.4	3.2	6.6	0.6	0.7	0.1
2/17/2016	0.01	747,100	2.2	2.2	4.4	3.0	3.0	6.0	1.2	0.0	1.2	2.4	2.6	2.5	5.1	1.5	1.4	2.9	2.3	2.2	4.5	0.0	2.6	2.6	4.2	3.4	7.6	3.6	3.4	7.0	0.7	0.7	0.1
2/18/2016	0.24	693,200	2.3	2.7	5.0	2.8	2.8	5.6	1.2	0.0	1.2	2.4	2.5	2.6	5.1	1.4	1.4	2.8	2.1	2.0	4.1	0.0	2.3	2.3	4.1	3.2	7.3	3.4	3.3	6.7	0.6	0.7	0.0
2/19/2016	0.36	776,600	1.3	2.5	3.8	2.7	2.7	5.4	1.3	0.0	1.3	2.6	2.9	2.8	5.7	1.5	1.5	3.0	2.0	2.0	4.0	0.0	2.0	2.0	4.4	3.5	7.9	3.2	3.1	6.3	0.7	0.8	0.1
2/20/2016	0.27	724,300	2.7	1.8	4.5	2.8	2.7	5.5	1.3	0.0	1.3	2.6	2.7	2.8	5.5	1.4	1.4	2.8	2.3	2.3	4.6	0.0	2.5	2.5	4.0	3.2	7.2	3.3	3.2	6.5	0.7	0.7	0.1
2/21/2016	0.00	732,100	1.8	1.8	3.6	2.9	3.0	5.9	1.2	0.0	1.2	2.4	3.0	3.0	6.0	1.3	1.4	2.7	2.6	2.5	5.1	0.0	2.8	2.8	3.8	3.0	6.8	3.5	3.3	6.8	0.7	0.7	0.1
2/22/2016	0.12	669,100	2.1	3.0	5.1	2.7	2.7	5.4	1.1	0.0	1.1	2.2	2.5	2.5	5.0	1.3	1.2	2.5	2.0	2.2	4.2	0.0	2.2	2.2	4.1	3.1	7.2	3.3	3.2	6.5	0.6	0.7	0.0
2/23/2016	0.01	640,500	2.1	2.5	4.6	2.6	2.6	5.2	1.2	0.0	1.1	2.3	2.6	2.5	5.1	1.3	1.3	2.6	1.8	2.0	3.8	0.0	2.2	2.2	3.7	3.1	6.8	3.3	3.1	6.4	0.6	0.6	0.0
2/24/2016	0.00	639,200	2.1	2.4	4.5	2.6	2.6	5.2	1.2	0.0	1.1	2.3	2.3	2.5	4.8	1.2	1.2	2.4	1.8	1.9	3.7	0.0	2.2	2.2	3.7	2.9	6.6	3.2	3.1	6.3	0.6	0.6	0.0
2/25/2016	0.00	592,100	2.3	2.3	4.6	2.5	2.5	5.0	1.1	0.0	1.1	2.2	2.5	2.4	4.9	1.2	1.2	2.4	1.6	1.7	3.3	0.0	2.0	2.0	3.0	3.0	6.0	3.2	3.1	6.3	0.6	0.6	0.0
2/26/2016	0.00	589,800	1.8	1.9	3.7	2.4	2.3	4.7	1.2	0.0	1.1	2.3	2.2	2.2	4.4	1.2	1.1	2.3	1.5	1.6	3.1	0.0	2.0	2.0	3.6	2.9	6.5	3.0	2.6	5.6	0.6	0.6	0.0
2/27/2016	0.21	595,900	1.6	2.1	3.7	2.5	2.4	4.9	1.2	0.0	0.7	1.9	2.3	2.4	4.7	1.2	1.2	2.4	1.7	1.9	3.6	0.0	2.1	2.1	3.6	2.9	6.5	3.0	2.9	5.9	0.6	0.6	0.0
2/28/2016	0.03	669,500	1.8	1.9	3.7	2.8	2.8	5.6	1.2	0.0	1.1	2.3	2.6	2.7	5.3	1.3	1.3	2.6	1.9	2.0	3.9	0.0	2.3	2.3	3.9	3.0	6.9	3.5	3.3	6.8	0.6	0.7	0.0
2/29/2016	0.23	690,100	1.7	1.9	3.6	2.6	2.6	5.2	1.3	0.0	1.3	2.6	2.6	2.7	5.3	1.2	1.2	2.4	1.9	1.9	3.8	0.0	2.0	2.0	4.4	3.5	7.9	3.4	3.3	6.7	0.7	0.7	0.0
3/1/2016	0.75	845,800	2.8	1.0	3.8	2.7	2.7	5.4	1.7	0.0	1.7	3.4	3.3	3.4	6.7	1.6	1.4	3.0	1.7	2.2	3.9	0.0	2.2	2.2	4.6	3.6	8.2	4.2	1.9	6.1	0.7	0.8	0.2
3/2/2016	0.49	920,300	2.1	2.2	4.3	3.0	3.0	6.0	1.7	0.0	1.7	3.4	3.1	3.1	6.2	1.5	1.5	3.0	2.4	2.5	4.9	0.0	2.6	2.6	5.2	3.9	9.1	4.0	3.9	7.9	0.8	0.9	0.1
3/3/2016	0.51	807,200	1.8	1.8	3.6	2.8	2.8	5.6	1.6	0.0	1.4	3.0	2.8	2.8	5.6	1.6	1.6	3.2	2.1	2.4	4.5	0.0	2.6	2.6	4.3	3.4	7.7	3.4	3.3	6.7	0.7	0.8	0.1
3/4/2016	0.04	815,700	1.5	2.3	3.8	2.9	2.8	5.7	1.6	0.0	1.4	3.0	3.0	3.1	6.1	1.5	1.4	2.9	2.0	2.1	4.1	0.0	2.5	2.5	4.4	3.6	8.0	3.6	3.4	7.0	0.7	0.8	0.1
3/5/2016	0.58	1,015,300	2.4	1.9	4.3	3.3	3.4	6.7	1.7	0.0	1.5	3.2	3.6	3.6	7.2	1.8	1.7	3.5	2.5	2.6	5.1	0.0	2.3	2.3	5.2	4.1	9.3	4.0	3.8	7.8	0.8	1.0	0.2
3/6/2016	0.37	1,044,900	1.6	2.0	3.6	3.4	3.4	6.8	1.7	0.0	1.5	3.2	3.9	4.0	7.9	1.9	1.7	3.6	2.9	3.1	6.0	0.0	4.7	4.7	5.1	4.2	9.3	4.2	4.1	8.3	0.9	1.0	0.2
3/7/2016	0.59	946,400	2.0	1.9	3.9	3.2	3.2	6.4	1.6	0.0	1.4	3.0	3.5	3.6	7.1	1.7	1.7	3.4	2.4	2.6	5.0	0.0	3.2	3.2	4.8	4.0	8.8	3.9	3.8	7.7	0.8	0.9	0.2
3/8/2016	0.08	797,300	1.6	2.3	3.9	3.0	3.1	6.1	1.4	0.0	1.2	2.6	3.1	3.0	6.1	1.6	1.5	3.1	2.1	2.3	4.4	0.0	2.8	2.8	3.9	3.3	7.2	3.5	3.9	7.4	0.7	0.8	0.1
3/9/2016	0.04	1,606,600	2.4	2.4	4.8	4.0	4.0	8.0	2.2	0.0	2.4	4.6	6.5	6.9	13.4	3.0	2.5	5.5	2.6	2.8	5.4	0.0	4.1	4.1	8.4	5.3	13.7	5.1	4.2	9.3	1.1	1.6	0.5
3/10/2016	2.16	1,434,400	1.7	2.5	4.2	3.7	3.8	7.5	2.0	0.0	1.8	3.8	6.2	6.2	12.4	2.5	2.2	4.7	2.7	2.8	5.5	0.0	4.1	4.1	5.0	4.4	9.4	4.3	4.2	8.5	0.9	1.4	0.5
3/11/2016	0.07	1,212,400	2.3	1.8	4.1	3.6	3.5	7.1	1.7	0.0	1.8	3.5	5.3	5.2	10.5	2.5	2.2	4.7	2.6	2.8	5.4	0.0	4.1	4.1	5.2	4.4	9.6	4.3	4.3	8.6	0.9	1.2	0.3
3/12/2016	0.75	1,544,000	1.6	2.8	4.4	3.9	4.0	7.9	1.9	0.0	1.8	3.7	6.0	6.0	12.0	2.8	2.2	5.0	2.8	3.2	6.0	0.0	4.3	4.3	5.3	4.3	9.6	4.6	4.0	8.6	1.0	1.5	0.6
3/13/2016	0.55	1,325,800	2.8	1.8	4.6	4.5	4.5	9.0	2.0	0.0	2.5	4.5	7.5	7.7	15.2	3.0	2.9	5.9	4.0	3.8	7.8	0.0	5.0	5.0	6.1	4.8	10.9	5.2	4.7	9.9	1.1	1.3	0.2
3/14/2016	0.65	1,196,900	1.6	2.7	4.3	3.7	3.9	7.6	1.6	0.0	1.6	3.2	5.7	5.5	11.2	2.5	2.3	4.8	2.8	2.8	5.6	0.0	4.0	4.0	4.4	3.6	8.0	4.2	3.9	8.1	0.9	1.2	0.3
3/15/2016	0.01	908,900	2.4	1.5	3.9	3.6	3.5	7.1	1.4	0.0	1.4	2.8	4.8	4.8	9.6	2.2	2.1	4.3	2.6	2.5	5.1	0.0	3.7	3.7	4.3	3.7	8.0	4.0	3.7	7.7	0.8	0.9	0.1
3/16/2016	0.12	853,400	1.5	2.5	4.0	3.4	3.6	7.0	1.3	0.0	1.3	2.6	4.3	4.2	8.5	2.2	2.0	4.2	2.5	2.4	4.9	0.0	4.6	4.6	4.3	3.6	7.9	3.9	3.8	7.7	0.8	0.9	0.1
3/17/2016	0.00	772,700	1.7	2.3	4.0	3.4	3.3	6.7	1.4	0.0	1.2	2.6	3.7	3.9	7.6	2.0	2.0	4.0	2.2	2.2	4.4	0.0	4.8	4.8	4.0	3.2	7.2	3.7	3.6	7.3	0.7	0.8	0.0
3/18/2016	0.00	697,400	1.3	2.1	3.4	2.9	3.0	5.9	1.1	0.0	1.1	2.2	3.1	3.0	6.1	1.9	1.8	3.7	2.0	2.1	4.1	0.0	4.4	4.4	4.3	3.4	7.7	3.4	3.1	6.5	0.7	0.7	0.0
3/19/2016	0.00	667,600	2.0	1.7	3.7	3.0	2.9	5.9	1.1	0.0	1.0	2.1	2.8	2.9	5.7	2.2	2.2	4.4	2.0	1.9	3.9	0.0	4.2	4.2	2.8	2.2	5.0	3.2	3.0	6.2	0.6	0.7	0.1
3/20/2016	0.00	858,400	1.8	2.3	4.1	3.8	3.8	7.6	1.4	0.0	1.0	2.4	3.7	3.8	7.5	2.8	2.6	5.4	2.6	2.6	5.2	0.0	4.9	4.9	4.4	3.0	7.4	5.0	4.2	9.2	0.8	0.9	0.0
3/21/2016	0.47	764,300	2.2	1.7	3.9	3.3	3.5	6.8	1.4	0.0	0.0	1.4	2.9	3.0	5.9	2.2	2.2	4.4	2.0	2.0	4.0	0.0	2.7	2.7	3.9	3.9	7.8	3.2	3.5	6.7	0.7	0.8	0.1
Average	0.28	860,504	2.0	2.2	4.2	3.1	3.1	6.1	1.4	0.0	1.4	2.8	4.1	4.7	8.8	1.7	1.6	3.3	2.3	2.3	4.6	0.0	3.1	3.1	4.5	3.5	8.1	3.7	3.5	7.1	0.8	1.0	0.20
Max	2.16	3,021,000	5.3	3.9	8.5	5.5	5.5	11.0	3.2	0.0	6.3	9.5	14.2	9.4	23.5	3.0	2.9	5.9	4.0	3.8	7.8	0.1	5.3	5.3	13.6	5.4	19.0	6.6	5.9	12.5	1.6	3.6	1.56
Max/Average	7.84	3.5	2.6	1.8	2.0	1.8	1.8	1.8	2.3		4.6	3.4	3.5	2.0	2.7	1.8	1.8	1.8	1.7	1.6	1.7	82.0	1.7	1.7	3.0	1.5	2.4	1.8	1.7	1.8	2.2	3.6	7.88
Pump Flow Rate (mgd)			0.1	0.1		0.8	0.8		1.0	1.0	0.6		0.3	0.3		0.2	0.2		0.2	0.2		0.2	0.2		0.5	0.5		1.0	1.0				
Average Flow (mgd)			0.0	0.0	**0.0**	0.1	0.1	**0.2**	0.1	0.0	0.0	**0.1**	0.0	0.1	0.1	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.1	0.1	**0.2**	0.2	0.1	**0.3**	0.8		
Max Flow (mgd)			0.0	0.0	**0.1**	0.2	0.2	**0.4**	0.1	0.0	0.1	**0.3**	0.2	0.1	0.3	0.0	0.0	**0.1**	0.0	0.0	**0.1**	0.0	0.0	**0.0**	0.3	0.1	**0.4**	0.3	0.2	**0.5**	1.6		
Max/Average Flow					2.2			1.8				3.1			2.7			1.8			1.7			1.7			2.4			1.8	2.2		

Appendix D

1/21/2016 SSO Volume Calculations

Peter Cunningham

From:	Dean Zavack <dzavack@cityofpoulsbo.com>
Sent:	Tuesday, March 22, 2016 9:03 AM
To:	Peter Cunningham
Cc:	Diane K. Lenius; Chris Kelsey
Subject:	RE: Poulsbo Central Interceptor - Additional data/questions
Attachments:	Sewer Overflow calcs.1.21.16.pdf

My responses in blue:

From: Peter Cunningham [mailto:Peter.Cunningham@bhcconsultants.com]
Sent: Monday, March 21, 2016 4:44 PM
To: Dean Zavack
Cc: Diane K. Lenius; Chris Kelsey
Subject: Poulsbo Central Interceptor - Additional data/questions

Dean,
I've started analyzing all of the data you've sent over, thanks again for providing that to us.

Can you send the PS6 and PS9 runtime data? It's my understanding that the City has recorded data at those stations on a more frequent basis than daily – I think it records the minute that the pumps turn on and off. That would help fill a gap in pump run times.
I will try to collect the pump run time data today and send it to you.
The Marine Science Center has three pumps, two larger 1 mgd pumps (Pump 1 and 2) and one smaller 0.55 mgd pump (Pump 3). It looks like only pump 1 and pump 3 operate. Do those two pumps alternate operation during normal conditions? Pump 1 runs every day which I wouldn't expect if the larger pumps were only reserved for high flow conditions.
Normally pump 1 and pump 2 alternate. Pump 3 is to increase capacity if needed. Pump 2 line currently has a frozen check valve so it is shut down until they have time to replace it. Pump 1 and Pump 3 are used alternately.
During the 1/21/2016 event, how was the overflow spill rate of 300 gpm estimated? And is that the correct spill rate?
I have calcs you can have, see attached. I calculated the overflow at 164 gpm. I estimated the flow over the rim as a sharp crested weir and used the perimeter of the rim as the length. I estimated the height over the rim as ¾". This is a rough estimate only, as I didn't actually wade out into the sewer overflow and measure the height over the rim, just estimated it in the field. The overflow increased significantly when the Bond Rd. station kicked on. It was probably 60 – 100 gpm when the Bond Rd. Pump was off.

Kitsap County Health District was at the site to observe and they estimated the spill at 100 gpm. We used 100 gpm and 8 hours x 80% (to account for pump fluctuation) to estimate the total spill as 40,000 gallons, which is the number we reported to Ecology.

I also looked at the Lemolo Siphon hydraulic calculations spreadsheet, by Parametrix, to estimate the capacity of the siphon when the concrete manhole lid came off at Lemolo by the siphon causing the Kitsap County sewer spill. It seems like 3.3 MGD peak flow is enough to put about 2' of head on the roof of the 48" i.d. concrete manhole lid. We estimated that 3' head was enough to lift up the concrete lid through the pavement and cause the sewer spill at Lemolo. With the lid popped and leaking, it looks like the capacity of the siphon is around 3.3 MGD. Kitsap County is going to upsize this force main from Johnson Rd. metering station to the siphon and remove the manholes in an upcoming project.

Lastly, can you send pump runtime data and flow data from 3/10 to now, so that we can take a look at the event on the weekend of 3/12/2016?
I will send you the spread sheet as soon as I update it, today. I will also update the Johnson Rd. metering station data, since it has the last 3/12/16 flow numbers in it.

Thanks,
Peter

Peter Cunningham
Project Engineer

BHC Consultants, LLC
1601 Fifth Avenue, Suite 500
Seattle WA 98101

206. 357.9905 Direct
206. 505.3400 Office
206. 505.3406 Fax
http://www.bhcconsultants.com

Locations in Seattle and Tacoma.

Appendix K

CIP

City of Poulsbo
Wastewater Comprehensive Plan Update
Planning Level Opinion of Probable Project Costs
Bond Road Force Main Extension
Prepared by: P. Cunningham
Reviewed by: C. Kelsey
10/27/2015

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization	$124,800	1	ls	$124,800
2	Temporary Erosion & Sediment Control	$25,000	1	ls	$25,000
3	Dewatering	$25,000	1	ls	$25,000
4	12-inch Force Main	$139	5,170	lf	$718,630
5	Air release/vacuum valve stations	$29,000	2	ea	$58,000
6	HMA Restoration	$200	2,355	tn	$471,044
7	Traffic Control	$25,000	1	ls	$25,000
8	General Restoration	$25,000	1	ls	$25,000
	Subtotal				$1,472,474
	Sales Tax	8.7%			$128,105
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$1,600,580

Planning	5%	$80,000
Design and Permitting	15%	$240,000
Services During Construction	15%	$240,000
TOTAL OPINION OF PROBABLE ALLIED COST		$560,000
Contingency	30%	$648,000
TOTAL OPINION OF PROBABLE PROJECT COST		$2,810,000

Notes
1. Import backfill assumed to be 100%
2. Foundation Gravel assumed to be 100%
3. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
4. Mobilization is assumed to be 10% of Construction
5. Pipe costs includes all fittings, pipe, bedding, excavation, haul, and pavement restoration
6. Force main is assumed to have 6 feet of cover per WSDOT requirements
7. Costs are in 2015 dollars

The opinion of probable cost herein is based on our perception of current conditions at the project location. This opinion reflects our professional opinion of costs at this time and is subject to change as the project design progresses. BHC Consultants has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. BHC Consultants cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

Appendix L

Pump Station Flow Calculations

Liberty Bay LS Pump Sizing for Full Buildout of Basin

Usage Design Rate per Person (Based on Previous Calculations 2015)

71	gpd/person	2.19	person/DU, ERU basin analysis 2014

Liberty Bay LS full Buildout

area	Area (sf)	(acres)	DU/AC	DU					
Residential Medium Density (RM) {6-10 DU/ac}									
1	23,120	0.53	8	5					
2	21,998	0.51	8	5					
3	9,223	0.21	8	2					
4	17,503	0.40	8	4					
	Total RM	1.65		16	DU	2,488	gpd	35.0	Population
Residential High Density (RH) {11-14 DU/ac}									
5	278,688	6.40	12.5	80					
6	276,617	6.35	12.5	80					
	Total RH	12.75		160	DU	24,878	gpd	350.4	Population
Residential Low Density (RL) {4-5 DU/ac}									
7	275,931	6.33	4.5	29					
8	275,942	6.33	4.5	29					
9	128,926	2.96	4.5	14					
10		0.00	4.5	0					
11		0.00	4.5	0					
	Total RL	15.63	4.5	72	DU	11,195	gpd	157.7	Population

Commercial C-2

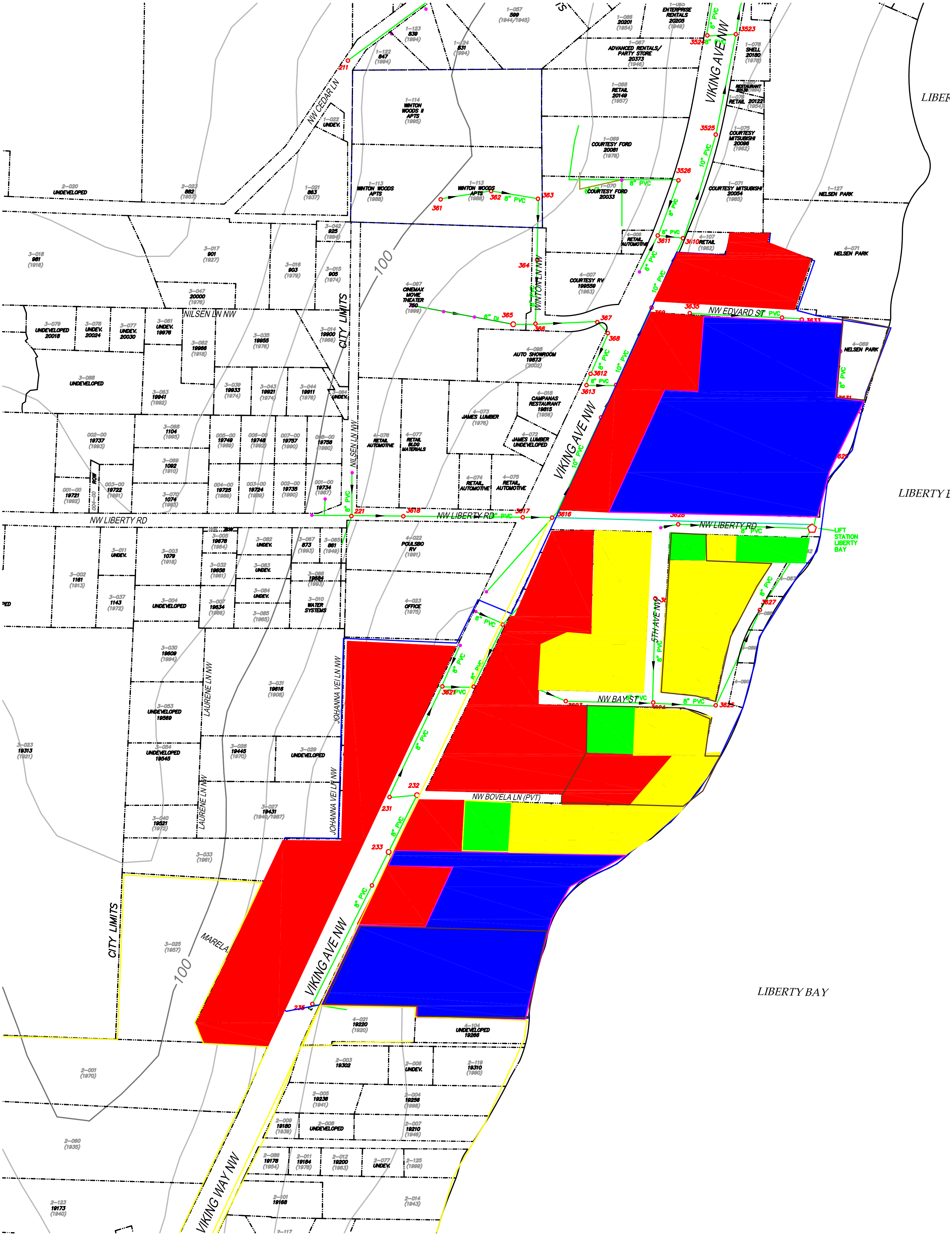
	Area (sf)	(acres)
12	27,534	0.63
13	291,226	6.69
14	37,726	0.87
15	108,409	2.49
16	80,134	1.84
17	258,884	5.94
18		0.00
Total C-2 Commercial		18.46 acres

Commercial gpd per acre		
1,200 gpd	142.4	equiv. DU
	7.72	equiv. DU/ac
Conserv. Est. for com.	311.9	equiv. population

Total C-2 Commercial: 22,146 gpd

Total Basin Area: 48.48 ac — Excludes some ROW and Nelson Park

Total DU per Liberty Bay Basin	390.4 DU	855.0	Population
Total gpd per Liberty Bay Basin	60,708 gpd	0.86	P in thousands
Average Flow Rate	42.16 gpm		
Peaking Factor (P)	3.84	where P = (18 +√P)/(4 + √P), Orange Book	
Liberty Bay LS Peak Hourly Flows for Design)	**162.0 gpm**	**Use 160 gpm for Design**	



VIKING AVE NW
NW CEDAR LN
NILSEN LN NW
NW LIBERTY RD
CITY LIMITS
WINTON LN NW
NILSEN LN NW
NW EDVARD ST
LIBERTY BAY
5TH AVE NW
NW BAY ST
NW BOVELA LN (PVT)
JOHANNA VEI LN NW
LAURENE LN NW
VIKING WAY NW
LIFT STATION LIBERTY BAY
8" PVC
10" PVC
NELSEN PARK
COURTESY FORD
COURTESY MITSUBISHI
WINTON WOODS APTS
CINEMAX MOVIE THEATER
AUTO SHOWROOM
CAMPANAS RESTAURANT
JAMES LUMBER
POULSBO RV
UNDEVELOPED

Poulsbo Village LS Existing Peak Flows

Poulsbo Village LS Existing Cond. , calculate DU for Village LS

area	Area (sf)	(acres)	DU/AC	DU		Usage		Population
Residential Medium Density (RM) {6-10 DU/ac}								
1		0.00	8	0				
2	23,918	0.55	8	5				
	Total RM	0.55		5	DU	777	gpd	11.0 Population
Residential High Density (RH) {11-14 DU/ac}								
3	1,259,596	0.00	12.5	0				
4		0.00	12.5	0				
	Total RH	0.00		0	DU	-	gpd	0.0 Population
Residential Low Density (RL) {4-5 DU/ac}								
5	1,487,638	34.15	4.5	154				
6	604,276	13.87	4.5	63				
	Total RL	48.02	4.5	217	DU	33,741	gpd	475.2 Population
Industrial Light Density (IL)								
7	450,715	10.35						66.5 Equiv. DU
	Total LI	10.35 acres IL				10,347	gpd	145.7 Equiv. Population
								6.43 Equiv. DU/ac
Commercial C-3								
	Area (sf)	(acres)						
8	790,909	18.16						
9	3,433,989	78.83						
10	32,089	0.74						
11	1,630,634	37.43						
12	177,943	4.09						
13	396,777	9.11						
14	89,642	2.06						
Total C-3 Commercial		150.41 acres				150,413	gpd	
Total Basin	209.33	acres						

Usage Design Rate per Person Based on Previous Calculations 2015

71 gpd/person | 2.19 person/DU, ERU basin analysis 2014

unused com. Land
757,093 sf
17.38 ac

Undeveloped Areas	**(ac)**		
2,043,170	46.90		
3,875,826	88.98		
total	135.88	ac	From CAD
	65%	Undeveloped in basin	

Commercial & Light Industrial gpd per acre

1,000 gpd or 6.43 C-3 equiv. DU/ac
2,118.5 equiv. population
967.3 equiv. DU

gpd
135,586 From 5-year ave. AWSF
94.16 ave gallons per min.

Design Values			
Total DU per Village Basin	1255.9 DU	2,750.4	Village Basin Equiv. Population Total
Total gpd per Village Basin	135,586 gpd	2.75	P (in thousands)
Average Flow Rate	94.16 gpm	= Total gpd/24hr/60min	
Peaking Factor (P)	3.47	where P = (18 +√P)/(4 + √P) from Orange Book; and Average Flow Rate during Wet Season Used	
Village LS Peak Hourly Flows for Design)	**327.1 gpm**		

Average Wet Season Sewer Flows AWSF in (gal/day)*

2015 AWSF	2014 AWSF	2013 AWSF	2012 AWSF	2011 AWSF	5 Year AWSF
145,855	146,349	124,047	140,280	121,401	135,586

*Based on Daily Sewer Pump Run Time, assuming 350 gpm

DEAN HARRISON ZAVACK
STATE OF WASHINGTON
48260
REGISTERED
PROFESSIONAL ENGINEER
1-26-16

Prepared by dzavack 1/26/2016

Poulsbo Village LS Pump Sizing For Full Buildout

Village LS full Buildout , calculate DU for Village LS

area	Area (sf)	(acres)	DU/AC	DU	
Residential Medium Density (RM) {6-10 DU/ac}					
1	80,062	1.84	8	15	
2	23,918	0.55	8	5	
	Total RM	2.39		20	DU
Residential High Density (RH) {11-14 DU/ac}					
3	45,634	1.05	12.5	14	
4		0.00	12.5	0	
	Total RH	1.05		14	DU
Residential Low Density (RL) {4-5 DU/ac}					
5	1,487,638	34.15	4.5	154	
6	4,480,102	102.85	4.5	463	
	Total RL	137.00	4.5	617	DU
Industrial Light Density (IL)					
7	450,715	10.35			
	Total LI	10.35 acres IL			
Commercial C-3					
	Area (sf)	(acres)			
8	790,909	18.16			
9	3,433,989	78.83			
10	32,089	0.74			
11	2,387,727	54.81			
12	177,943	4.09			
13	396,777	9.11			
14	89,642	2.06			
Total C-3 Commercial		167.79 acres			

Usage Design Rate per Person Based on Previous Calculations 2015

71	gpd/person	**2.19**	person/DU, ERU basin analysis 2014

Residential Medium Density Only

3,110	gpd	43.8	Population

Residential High Density Only

2,177	gpd	30.7	Population

Residential Low Density Only

95,937	gpd	1,351.2	Population

Light Industrial Only		66.5	Equiv. DU
10,347	gpd	145.7	Equiv. Population
		6.43	Equiv. DU/ac

Undeveloped Areas	**(ac)**
2,043,170	46.90
3,875,826	88.98
total	135.88
% Undev.	43%

Commercial & Light Industrial gpd per acre

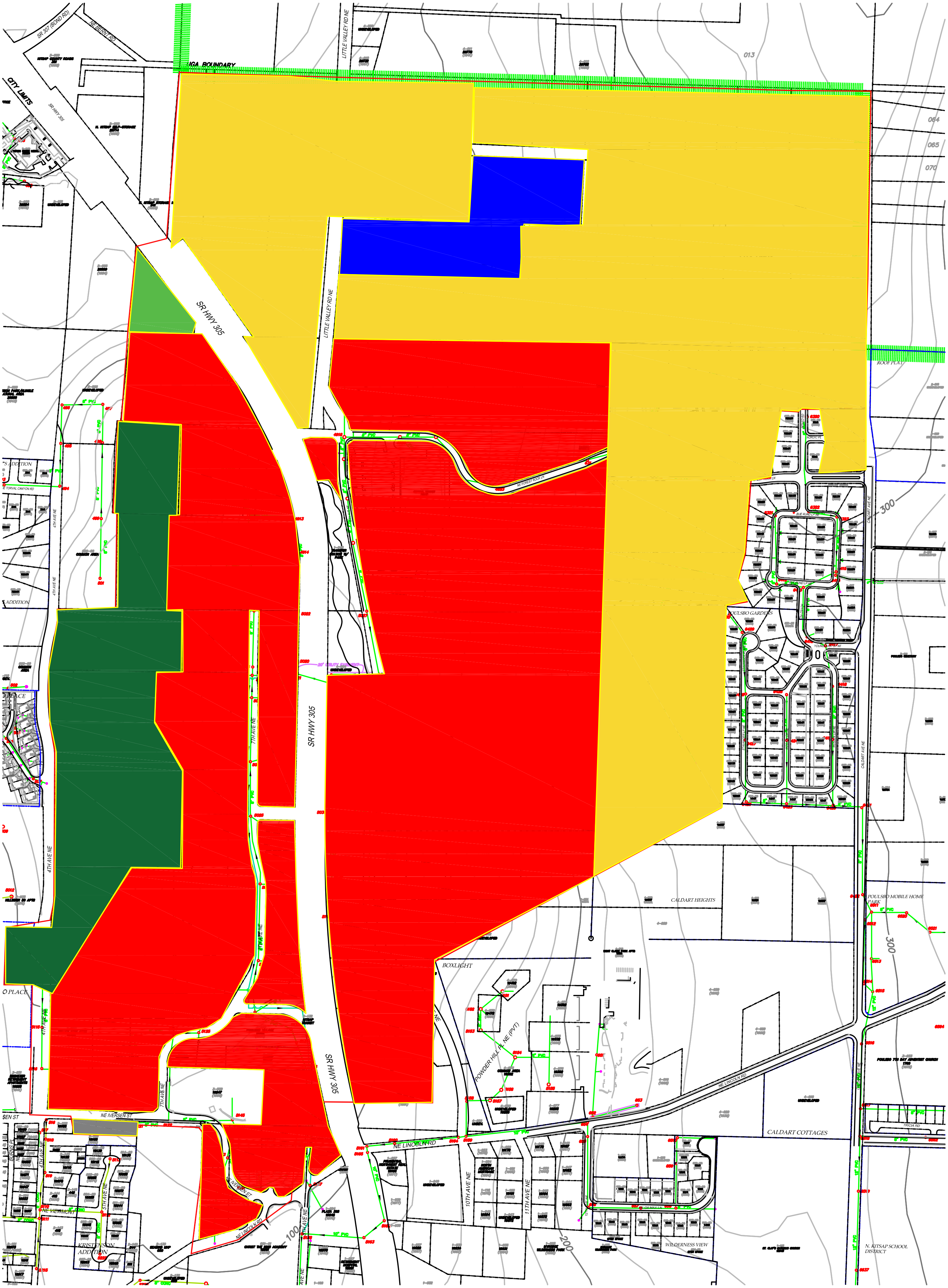
1,000	gpd	or	6.43	C-3 equiv. DU/ac
			2,363.3	equiv. population
			1,079.1	equiv. DU

167,793 gpd, commercial only

Total Basin 318.58 acres	**Design Values**			
Total DU per Village Basin	1796.7 DU	3,934.7	Village Basin Equiv. Population Total	
Total gpd per Village Basin	279,364 gpd		3.93	**P** (in thousands)
Average Flow Rate	194.00 gpm	= Total gpd/24hr/60min		
Peaking Factor (P)	3.34	where P = (18 +√P)/(4 + √P) from Orange Book		
Village LS Peak Hourly Flows for Design)	**647.9 gpm**	For Full Buildout, except unstable critical areas		

Use 500 gpm for Design, which is the capacity of the existing 6" FM

DHZ 1.26.16


UGA BOUNDARY
CITY LIMITS
SR 307 (BOND RD)
LITTLE VALLEY RD NE
SR HWY 305
013
064
065
070
ROOF PLAT
POULSBO GARDENS
CALDART AVE NE
300
CALDART HEIGHTS
POULSBO MOBILE HOME PARK
BOXLIGHT
POWDER HILL PL NE (PVT)
NE LINCOLN RD
CALDART COTTAGES
7TH AVE NE
8TH AVE NE
4TH AVE NE
NE IVERSEN ST
NE VIEWMONT
KRISTENSON ADDITION
10TH AVE NE
11TH AVE NE
200
100
WILDERNESS VIEW
N. KITSAP SCHOOL DISTRICT
NE FOREST ROCK CT
TRICIA RD

Appendix M

Industrial Discharge Evaluation

City of Poulsbo

Engineering Division

200 NE Moe Street, Poulsbo, Washington 98370
Phone (360) 779-4078

November 21, 2014

Patrick Kongslie
Kitsap County Public Works-Sewer Utility Division
614 Division Street (MS-26)
Port Orchard, WA 98366-4699

Dear Patrick,

Per your request, the City of Poulsbo has reviewed the current customer accounts to identify potential industrial users. The Department of Ecology defines a significant industrial user as a user which discharges an average of 25,000 gallons per day or more of process wastewater to the Publicily Owned Domestic Wastewater Facility (POTW). The City has confirmed that it does not have any significant industrial users.

In an effort to evaluate potential minor industrial users, the City utilized the following methodology:

1. Identified all businesses with a water usage exceeding 2500 gallons per day. The attached list contains 25 customers that exceed 2500 gallons per day.
2. Screened the listed customer accounts exceeding 2500 gpd to determine if "the contents disposed down the drain are typical of domestic wastewater discharge". Based on the screening of the customers, the city eliminated multi-family, restaurants, and traditional retail establishments. The nature of this discharge is consistent with domestic wastewater discharge and restaurants with grease generating food handling are required to install and maintain grease traps.
3. Two medical facilities were identified as potential industrial users and our field staff completed a site visit and interviewed the business in accordance with the Industrial Survey.

The comments on the attached spreadsheet provide a summary of our findings. **The City did not identify any industrial users for further consideration.** The City of Poulsbo Municipal Code Section 13.06.340 addresses Unlawful discharge.If you have any questions regarding the sewer collection system, feel free to contact me or Keith Svarthumle, our Operations Foreman.

Sincerely,

Diane K. Lenius, P.E.
Assistant City Engineer

Keith Svarthumle
Operations Foreman

cc. Stella Vakarcs, Kitsap County Senior Program Manager
Andrzej Kasniak, City Engineer, City of Poulsbo

City of Poulsbo - Customers exceeding 2500 gpd

stomer Acc	Customer Name	Results	Service Address	Comments
	Commercial Users - Domestic Discharge			
00893-01	LAURELHURST APARTMENTS CO	Eliminated	19425 & 19505 7TH AVE NE	Shopping Center/Poulsbo Village - domestic discharge
01291-01	MENTOR J P	Eliminated	18881 FRONT ST NE	Retail/Gallery/Coffee Shop - domestic discharge- grease trap clean
01297-01	RDTF LLC	Eliminated	18928 FRONT ST NE #100	Retail/Restaurant - grease trap cleaned quarterly
01284-01	XENOS JOHN E	Eliminated	18779 FRONT ST NE	Restaurant/Bar/Retail - Grease trap cleaned weekly
00898-01	ALBERTSONS INC SITE #466	Eliminated	19561 7TH AVE NE	Grocery
00903-01	BURGER KING	Eliminated	19655 7TH AVE NE	high flows during the summer. Grease trap cleaned regularly
03361-00	PETCO #1242	Eliminated	21700 MARKET PLACE NW	Retail (Pet Store)
00014-01	GVA KIDDER MATHEWS UTILITY BPCC	Eliminated	17771 FJORD DR NE & 17791 FJORD DR NE	Liberty Bay Marina - domestic discharge
00301-01	WAL MART TRS LLC STORE 5272	Eliminated	21200 OLHAVA WAY NW	Retail
00303-01	FACILITY IQ MS 222	Eliminated	21750 MARKET PLACE NW	Home Depot
00570-02	SAFEWAY INC	Eliminated	19245 10TH AVE NE	Grocery
00575-01	TOWN & COUNTRY MARKETS INC	Eliminated	20148 10TH AVE NE	Grocery
02421-01	POULSBO INN LLC	Eliminated	18680 STATE HIGHWAY 305	Hotel - domestic discharge
01563-01	NK SCHOOL DIST-SENIOR	Eliminated	1780 NE HOSTMARK ST	School - domestic discharge
02414-01	NK SCHOOL DIST-P MIDDLE SCHOOL	Eliminated	2003 NE HOSTMARK ST	School - domestic discharge
00157-02	PACIFIC MEDICAL BUILDING LLC	Eliminated	20669 BOND RD NE	Medical Office - Field Interview - Domestic Discharge
00721-01	CURRENT DEVELOPMENT LLC	Eliminated	19472 NE POWDER HILL PL	Office Space - Field Interview - Domestic Discharge
	Mutli-Family Users - Domestic Discharge			
00464-01	KITSAP CO CONS HOUSING AUTH	Eliminated	377 NW EDVARD ST #OS	Apt Bldg-Windsong - domestic discharge
00850-01	CFA PROPERTIES INC	Eliminated	20026 NE VIKING CREST RD #OS	Apt Bldg-Viking Crest domestic discharge
00978-01	HILLSIDER 50 APTS	Eliminated	19630 ASH CREST LP NE #OS	Apt Bldg - domestic discharge
01319-01	MARTHA & MARY HEALTH SERVICES	Eliminated	19160 FRONT ST NE	Retirement Center - domestic discharge
01322-01	MARTHA & MARY HEALTH SERVICES	Eliminated	19160 FRONT ST NE	Retirement Center - domestic discharge
00429-01	LIBERTY SHORES RETIREMENT CENTER	Eliminated	19360 VIKING AVE NW	Retirement Center - domestic discharge
00489-02	EMERITUS SENIOR LIVING SITE 0642	Eliminated	1250 NE LINCOLN RD	Retirement Center - domestic discharge
02256-01	PROFESSIONAL PROPERTY MANAGEM	Eliminated	703 NE HOSTMARK ST #OS	Hostmark Apartments - domestic discharge

Eliminated = Does not meet criteria for Industrial Discharge

Appendix N

SEPA Checklist

City of Poulsbo Environment Checklist

A. Background

Name of proposed project, if applicable:		Date Prepared:
City of Poulsbo 2016 Sewer Comprehensive Plan (SCP)		Sept. 20, 2016
Name of Applicant: City of Poulsbo	**Address:** 200 NE Moe St., Poulsbo, WA 98370	**Phone Number:** 360-779-4078
Contact: Diane Lenius, P.E. City Engineer	**Agency Requesting Checklist:** City of Poulsbo	

Proposed timing or schedule (including phasing, if applicable)

This is a non-project action. This action is subject to phased environmental review and subsequent improvements and site specific permit applications will require further SEPA review and a threshold determination pursuant to WAC 197-11-060.

Do you have any plans for future additions, expansions, or further activity related to or connected with this proposal? If yes, explain.

Not at this time.

List any environmental information you know about that has been prepared, directly related to this proposal.

None.

Do you know whether applications are pending for governmental approvals or other proposals directly affecting the property covered by your proposal? If yes, explain.

None

List any government approvals or permits that will be needed for your proposal, if known.

The Comprehensive Sewer Plan must be approved by the Dept. of Ecology.
The Poulsbo City Council will adopt the 2016 Sewer Comprehensive Plan (SCP) as part of the City Comprehensive Plan.

Necessary governmental approval will vary by project. The determination of what approvals will be required will be made during individual site plan and environmental review process. Approvals that may be required include Army Corps of Engineers 404(b) (2), FHWA, WSDOT, DOE, Department of Fish and Wildlife, SEPA, and City of Poulsbo.

Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

The SCP is a non-project proposal addressing the comprehensive sewer system needs with the City of Poulsbo and it's proposed Urban Growth Area (UGA). The plan includes projections of waste generation through 2036, review of system facilities, recommendations for improvements and replacement to the system, and discussion of operations and maintenance.

Individual projects will be subject to detailed site plan and environmental review.

Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The service area covered by the 2016 SCP includes area within the current City of Poulsbo City limits and the designated Urban Growth Area (UGA).

B. Environmental Elements		Agree	Disagree	Mitigate
1. Earth				
a.	**General description of the site (check one):** ☐ flat, ☐ rolling, ☐ hilly, ☐ steep, ☐ slopes, ☐ mountainous, ☐ other. Varies by project and will be determined during site and environmental review for each individual project.			
b.	**What is the steepest slope on the site (approximate percent slope)?** Unknown at this time, to be determined during site plan and environmental review for each individual project.			
c.	**What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.** Varies by project and will be determined during site and environmental review for each individual project.			
d.	**Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.** Varies by project and will be determined during site plan and environmental review.			

e.	**Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.** Varies by project and will be determined during site and environmental review for each individual project.			
f.	**Could erosion occur as a result of clearing, construction or use? If so, generally describe.** The chance that erosion could occur is present during the construction of any project, and will vary by project. An erosion control plan will be implemented for every project to minimize erosion.			
g.	**About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?** Varies by project and will be determined during site plan and environmental review for each individual project.			
h.	**Proposed measures to reduce or control erosion, or other impacts to the earth, if any.** Varies by project. Individual projects subject to detailed site plan and environmental review. Silt and erosion control methods are subject to Best Management Practices.			

2. Air				
a.	**What types of emissions to the air would result from the proposal (i.e. dust, automobile, odors, industrial, wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.** Varies by project, but generally some dust and emissions from heavy construction equipment may be expected from any construction project. To be determined at time of individual project review.			
b.	**Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.** Unknown at this time. To be determined during site plan and environmental review for each individual project.			

c.	**Proposed measures to reduce or control emissions or other impacts to air, if any.** Varies by project, but generally best management practices will be employed. Measures to be determined on a project by project basis. Individual projects subject to detailed site plan and environmental review.			
	3. Water			
a.	**Surface:**			
	1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into. Varies by project and will be determined during site plan and environmental review for each individual project. Some projects may occur within 200 feet of water bodies.			
	2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans. Varies by project and will be determined during site plan and environmental review for each individual project. Some projects may occur within 200 feet of water bodies.			
	3) Estimate the amount of fill and dredge that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material. Varies by project and will be determined during site plan and environmental review for each individual project.			
	4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities, if known. Varies by project and will be determined during site plan and environmental review for each individual project.			
	5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan. Varies by project and will be determined during site plan and environmental review for each individual project.			
	6) Does the proposal involve any discharges of waste			

	materials to surface waters? If so, describe the type of waste and anticipated volume of discharge. No.			

b.	**Ground:**				
	1)	**Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.** No. Generally these types of projects will not withdraw from or discharge to ground water.			
	2)	**Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals..; agricultural; etc...). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.** N/A. This non-project action will not require any discharge of waste material to groundwater. Existing health regulations control the location, type and density of development which utilizes septic tanks.			
c.	**Water Runoff (including storm water):**				
	1)	**Describe the source of runoff (including storm water) and method of collection and disposal, if any (including quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.** N/A. This non-project action will not impact surface and stormwater. Stormwater flow, runoff of any type and capital improvement projects will be evaluated as part of site-specific project review and SEPA analysis .			
	2)	**Could waste materials enter ground or surface waters? If so, generally describe.** N/A. This non-project action will not impact ground or surface waters and the goals are to minimize the effects of discharge of waste materials. Possible contamination of ground or surface waters with waste materials will be evaluated as part of site-specific project review and SEPA analysis.			
d.	**Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:** N/A. This non-project action will not have a effect on surface, ground				

	or runoff waters. Possible impacts to surface, ground, and runoff water will be evaluated as part of site-specific project review and SEPA analysis.			
4. Plants				
a.	**Check types of vegetation found on the site:** ☐ **Deciduous tree: alder, maple, aspen, other** ☐ **Evergreen tree: fir, cedar, pine, other** ☐ **Shrubs** ☐ **Grass** ☐ **Pasture** ☐ **Crop or grain** ☐ **Wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other** ☐ **Water plants: water lily, eelgrass, milfoil, other** ☐ **Other types of vegetation** Unknown at this time, to be determined during site plan and environmental review for each individual project.			
b.	**What kind and amount of vegetation will be removed or altered?** Varies by project and will be determined during site plan and environmental review for each individual project.			
c.	**List threatened or endangered species known to be on or near the site.** Unknown at this time, to be determined during site plan and environmental review for each individual project.			
d.	**Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any.** At time of site plan review and environmental review, site specific projects would comply with the City's landscaping requirements. Utilization of native plants in projects will be determined on a case by case basis.			
5. Animals				
a.	**Check any birds and animals which have been observed on or near the site or are known to be on or near the site:** ☐ **Birds: hawk, heron, eagle, songbirds, other:** ☐ **Mammals: deer, bear, elk, beaver, other:** ☐ **Fish: bass, salmon, trout, herring, shellfish, other:** Unknown at this time, to be determined during site plan and environmental review for each individual project.			

b.	**List any threatened or endangered species known to be on or near the site.** Unknown at this time, to be determined during site plan and environmental review for each individual project.			
c.	**Is the site part of a migration route? If so, explain.** Unknown at this time, to be determined during site plan and environmental review for each individual project.			
d.	**Proposed measures to preserve or enhance wildlife, if any.** None proposed at this time, to be determined during site plan and environmental review for individual projects. HPA's would be obtained from the Department of Fish and Wildlife, if applicable.			

6. Energy and Natural Resources

a.	**What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.** No energy is required for this non-project action. Energy consumption will be evaluated as part of site-specific project review and SEPA analysis and in accordance with the Washington State Energy Code which the City has adopted.			
b.	**Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.** No. This non-project action will have no effect on solar access. Solar access will be evaluated as part of site-specific project review and SEPA analysis.			
c.	**What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any.** None. Energy conservation features will be evaluated as part of site-specific project review and SEPA analysis.			

7. Environmental Health

a.	**Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill or hazardous waste, that could occur as a result of this proposal? If so, describe.** This non-project action will not cause any environmental health			

	hazards. Environmental health hazards will be evaluated as part of site-specific project review and SEPA analysis.			
	1) Describe special emergency services that might be required. This non-project action will not have an effect on any known or possible contamination sites. Effects of individual proposals on contamination sites will be evaluated as part of site-specific project review and SEPA analysis.			
	2) Proposed measures to reduce or control environmental health hazards, if any. This non-project action will not have an effect on any known hazardous chemicals/conditions. Effects of individual proposals on existing hazardous chemicals/conditions that might effect project development and design will be evaluated as part of site-specific project review and SEPA analysis.			

b.	**Noise**				
	1)	**What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?** None.			
	2)	**What types of levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.** These types of projects will generate some short-term noise from the use of heavy construction equipment and the actual construction phase of the project.			
	3)	**Proposed measures to reduce or control noise impacts, if any.** This would be determined at the time of site plan and environmental review for the specific project. As projects are built, increased traffic may result leading to higher noise levels.			

8. Land and Shoreline Use

a.	**What is the current use of the site and adjacent properties?** Varies by project and will be identified at the time of site plan and environmental review for each individual project.			

b.	**Has the site been used for agriculture? If so, describe.** Varies by project and will be identified at the time of site plan and environmental review for each individual project.			
c.	**Describe any structures on the site.** Varies by project and will be identified at the time of site plan and environmental review for each individual project. Generally there will be no structures at the project location and therefore no demolition of buildings will occur.			
d.	**Will any structures be demolished? If so, what?** Varies by project and will be identified at the time of site plan and environmental review for each individual project. Generally there will be no structures at the project location and therefore no demolition of buildings will occur.			
e.	**What is the current zoning classification of the site?** Specific zoning would be identified at the time of specific project site plan and environmental review.			
f.	**What is the current comprehensive plan designation of the site?** Specific comprehensive plan designation would be identified at the time of specific project site plan and environmental review.			
g.	**If applicable, what is the current shoreline master program designation of the site?** Unknown at this time, those projects near of adjacent to Liberty Bay and/or Dogfish Creek would be identified at the time of site plan and environmental review and subject to the requirements of the City's Shoreline Master Program.			
h.	**Has any part of the site been classified as "environmentally sensitive area? If so, specify**. Unknown at this time, those projects near or adjacent to a critical area would be identified at the time of site plan and environmental review and subject to the requirements of the City's Critical Areas Ordinance. The shoreline of Liberty Bay and Dogfish Creek have been identified as environmentally sensitive by the City's Critical Area Map and development in these corridors would be subject to the City's Critical Areas Ordinance and Shoreline Master Program.			
i.	**Approximately how many people would reside or work in the**			

	completed project? None.			
j.	**Approximately how many people would the completed project displace?** Generally none although this will vary by project and will be determined at the time of specific project site plan and environmental review.			
k.	**Proposed measures to avoid or reduce displacement impacts, if any.** To be determined, individual projects subject to detailed site plan and environmental review.			
l.	**Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any.** To be determined, individual projects subject to detailed site plan and environmental review. Projects will comply with all applicable land use regulations.			
9. Housing				
a.	**Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.** None.			
b.	**Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.** Generally none although this will vary by project and will be determined during each individual site plan and environmental review.			
c.	**Proposed measures to reduce or control housing impacts, if any.** To be determined at time of site plan and environmental review on a project by project basis.			
10. Aesthetics				
a.	**What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?** N/A. The sewer projects are typically constructed below grade.			

b.	**What views in the immediate vicinity would be altered or obstructed?** None.			
c.	**Proposed measures to reduce or control aesthetic impacts, if any.** To be determined, individual projects subject to detailed site plan and environmental review.			

11. Light and Glare

a.	**What type of light or glare will the proposal produce? What time of day would it mainly occur?** None.			
b.	**Could light or glare from the finished project be a safety hazard or interfere with views?** No.			
c.	**What existing off-site sources of light or glare may affect your proposal?** None.			
d.	**Proposed measures to reduce or control light and glare impacts, if any.** To be determined, individual projects subject to detailed site plan and environmental review.			

12. Recreation

a.	**What designated and informal recreational opportunities are in the immediate vicinity?** Parks, trails and other recreational facilities exist in the immediate vicinity of many of the projects;			
b.	**Would the proposed project displace any existing recreational uses? If so, describe.** None known.			

c.	**Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any.** This information would be identified during environmental review for individual projects. Many projects include recreational amenities.			

13. Historic and Cultural Preservation

a.	**Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.** None known, though this will vary project by project and will be determined at time of individual project site plan and environmental review.			
b.	**Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.** None known, though this will vary project by project and will be determined at time of individual project site plan and environmental review.			
c.	**Proposed measures to reduce or control impacts, if any.** None proposed at this time. To be determined, individual projects subject to detailed site plan and environmental review.			

14. Transportation

a.	**Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.** The City has an extensive system of arterials, suburban and local public streets. Location of, and access to, public streets and highways will be evaluated as part of site-specific project review and SEPA analysis.			
b.	**Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop**. Will vary from project to project. This information would be identified at the time of site plan and environmental review for specific projects.			
c.	**How many parking spaces would the completed project have? How many would the project eliminate?**			

	No new parking spaces are generally constructed for these types of projects.			
d.	**Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).** Projects are improvements to public sewer collection and conveyance system. Access roads may be required for sewer maintenance. This information would be identified at the time of site plan and environmental review for specific projects.			
e.	**Will the project use (or occur in the immediate vicinity of) water, rail or air transportation? If so, generally describe.** No.			
f.	**How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.** The sewer capital projects will not generate any new vehicular trips.			
g.	**Proposed measures to reduce or control transportation impacts, if any.** This information would be identified at the time of site plan and environmental review for specific projects.			

15. Public Services

a.	**Would the project result in an increased need for public service (for example fire protection, police protection, health care, schools, other)? If so, generally describe.** This non-project action will have no effect on public services, except as would normally be required for individual proposals. The need for public services will be evaluated as part of site-specific project review and SEPA analysis.			
b.	**Proposed measures to reduce or control direct impacts on public services, if any.** Will vary project by project. To be determined, individual projects subject to detailed site plan and environmental review.			

16. Utilities

a.	**Check the utilities currently available at the site: ☐ electric, ☐ natural gas, ☐ water, ☐ refuse service, ☐ telephone,**			

	☐ **sanitary sewer,** ☐ **septic system,** ☐ **other.** Varies project to project. To be determined, individual projects subject to detailed site plan and environmental review.			
b.	**Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.** Identification of utilities would come at time of the site plan and environmental review of the specific projects.			

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Diane Hames **Date Submitted:** Sept 20, 2016

D. Supplemental Sheet For Non-Project Actions

(DO NOT USE THIS SHEET FOR PROJECT ACTIONS)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent of the proposal, or the types of activities likely to result from the proposal that would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. **How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substance; or production of noise?**

Unknown at this time. Each individual project will be reviewed and all associated impacts will be mitigated.

Proposed measures to avoid or reduce such increases are:

Will vary by project, but generally BMP's will be employed.

2. **How would the proposal be likely to affect plants, animals, fish, or marine life?**

To be reviewed on a project by project basis.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

Will vary by project, but generally BMP's will be employed.

3. **How would the proposal be likely to deplete energy or natural resources?**

N/A

Proposed measures to protect or conserve energy and natural resources are:

N/A

4. **How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?**

Unknown at this time, to be determined on a project by project basis.

Proposed measures to protect such resources or to avoid or reduce impacts are:

Site plan and environmental review at project stage will determine appropriate mitigation.

5.	**How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?** Unknown at this time, to be determined on a project by project basis.
	Proposed measures to avoid or reduce shoreline and land use impacts are: Site plan and environmental review at project stage will determine appropriate mitigation.
6.	**How would the proposal be likely to increase demands on transportation or public services and utilities?** N/A
	Proposed measures to reduce or respond to such demand(s) are: N/A
7.	**Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.** N/A