

COMPREHENSIVE WATER SYSTEM PLAN



June 2019
Revised June 2020



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COMPREHENSIVE WATER SYSTEM PLAN

BIRCH BAY WATER AND SEWER DISTRICT WHATCOM COUNTY, WASHINGTON

June 2019
Revised June 2020

CHS ENGINEERS, LLC

This report was prepared under the supervision of a
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Birch Bay Water and Sewer District

COMPREHENSIVE WATER SYSTEM PLAN

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Birch Bay Water and Sewer District

Comprehensive Water System Plan

EXECUTIVE SUMMARY

INTRODUCTION

This *Comprehensive Water System Plan Update* for Birch Bay Water and Sewer District presents an evaluation of existing facilities, system operation, water quality, projected water demands, and existing and future capital and operational requirements. The culmination of the plan is the update of the District's water system Capital Improvement Plan (CIP). This plan has been prepared in accordance with the requirements of the Washington Administrative Code (WAC) 246-290-100, as revised pursuant to the 2003 "Municipal Water Law", the April 1997 Washington Department of Health (DOH) *Water System Planning Handbook*, and the December 2009 DOH *Water System Design Manual*, and in the context of the following planning documents:

- September 2004 (revised May 2009) *Whatcom County Birch Bay Community Plan* (BBCP)
- *Whatcom County Population and Employment Projection and Urban Growth Area Allocations Phase I Technical Report* (revised November 1, 2013, BERK)
- 2016 *Whatcom County Coordinated Water System Plan*
- *Whatcom County Comprehensive Plan* (updated 2017)
- November 2015 *Whatcom County 2016 Comprehensive Plan and Development Regulations Update and Urban Growth Areas Review Environmental Impact Statement*
- *Whatcom County Comprehensive Plan* (2016)¹

Birch Bay Water and Sewer District, formerly Whatcom County Water District No. 8, is a municipal special purpose district formed in 1968. The District is located in northwest Whatcom County and the boundary includes approximately 6,570 acres. The District services the area around Birch Bay, including Point Whitehorn and Birch Point, immediately south of the City of Blaine, in unincorporated Whatcom County.

EXISTING SYSTEM

The District purchased the Birch Bay Water Company water system in 1970, and merged with Whatcom County Water District No. 6 in 1987. Over the past 48 years, the District has expanded and improved the system, with District projects and developer extensions, to include two wells, three reservoirs, four booster pump stations and nearly

¹ The 2016 and 2017 versions of the County Comprehensive Plan were current at the time this section of the WSP was prepared and are the basis for the information presented herein. The County Comprehensive Plan was subsequently updated in 2018.

82 miles of water mains. The District's water source is the City of Blaine (wells). In 2002, the District negotiated a new water supply contract with Blaine. The contract was amended in 2008, 2010, 2013, and 2016. The contract provides for up to 3.73 million gallons per day (mgd). The contract term is 40 years, with option for renewal of up to 20 additional years.

The District's water system is a Group A Community System (DOH System No. 95904U) serving approximately 5,292 connections or 7,649 residential customer equivalents (as of 12/31/2018).

The District also has an emergency supply intertie with Bell Bay Jackson Water Association.

The current water service area has an irregular boundary generally described as the Blaine City Limits to the north, Bell Bay Jackson Water Association to the east and the southern limit of the Birch Bay urban growth area to the south (see Figure 1.3). The land use within the service area is predominately residential, with some commercial and rural areas. The estimated population for the District's water service area, based on County estimates for year-end 2013, is approximately 8,810. The latest District-specific population estimate was completed by the County for year-end 2013. The District added service for 154 equivalent living units from 2013 through 2017. At approximately 1.17 persons per equivalent living unit, the population at the end of 2017 is estimated to be approximately 8,990.

Annual water usage (not including distribution system leakage, as Average Day Demand or ADD, in mgd) from 2009 to 2017 is shown in Table 1. The breakdown of water demand by customer type is indicated in Table 2. An Equivalent Residential Unit (ERU) represents the amount of water consumed by a typical single-family residence in this system. For forecast purposes, the average water usage for a single-family residence was determined to be 120 gallons per day for Birch Bay's system. Actual use varied from 103 to 123 with an average of 110 gpd for years 2009-2017. The ratio of Maximum Day Demand (MDD) to ADD is forecast to be 2.19. The ratio of peak hour demand (PHD) to MDD is approximately 1.65.

Table 1. Historical Water Use - Average Day Demand

2009	2010	2011	2012	2013	2014	2015	2016	2017
0.861	0.768	0.724	0.724	0.719	0.733	0.733	0.749	0.738

(million gallons per day)

Table 2. Percentage of Annual Water Demand by Customer Type

Customer Type	Percentage
Single Family residential	68%
Multi-family residential	20%
Commercial	3%
Other	8%
Total	100%

Year end, 2017

FUTURE WATER DEMAND AND WATER CONSERVATION

Future water demands for the District were estimated by forecasting growth in customer classes. Water demands were calculated by estimating the number of future connections then multiplying that number by the water demand per ERU. Water demands were calculated for each customer type then combined for a total system demand. Residential population was forecast to increase at the rate of 2.3353% per year from 2013 through 2036, and 1% per year through 2038. The recent historical and projected annual distribution system leakage is 8% of the annual volume of water supply.

The projected total ADD and MDD (with allowance for distribution system leakage) are as indicated in Table 3 (without additional projected savings or conservation impacts) and Table 4 (with additional projected savings). Figure 2.2 presents a graph of historical and forecast water demand.

Table 3. Forecast Water Demands

	2018	2019	2020	2021	2022	2023	2024
ADD	0.89	0.91	0.94	0.96	0.99	1.02	1.04
MDD	1.86	1.91	1.96	2.02	2.08	2.13	2.19
PHD	2,127	2,185	2,244	2,305	2,367	2,431	2,497

	2025	2026	2027	2028	2033	2038
ADD	1.07	1.10	1.13	1.17	1.34	1.50
MDD	2.25	2.32	2.38	2.45	2.80	3.15
PHD	2,565	2,635	2,707	2,780	3,180	3,568

(MDD and ADD in million gallons per day, PHD in gallons per minute)

Table 4. Forecast Water Demands, with Additional Savings

	2018	2019	2020	2021	2022	2023	2024
ADD	0.86	0.87	0.90	0.92	0.94	0.97	0.99
MDD	1.80	1.84	1.88	1.93	1.98	2.03	2.08
PHD	2,057	2,099	2,152	2,205	2,261	2,317	2,375

	2025	2026	2027	2028	2033	2038
ADD	1.02	1.04	1.07	1.10	1.25	1.39
MDD	2.14	2.19	2.25	2.31	2.62	2.92
PHD	2,435	2,496	2,559	2,623	2,972	3,305

(MDD and ADD in million gallons per day, PHD in gallons per minute)

The District has had a water conservation program ongoing since 1992. In an effort to reduce the MDD, an aggressive conservation program, both in the District and with the City of Blaine, has been ongoing since 1998.

The District's first Water Use Efficiency (WUE) Program was prepared in January 2008 in accordance with the Municipal Water Law and DOH rules (WAC 246-290-800). The WUE Program identifies goals and measures for enhanced water conservation. The WUE Program was reviewed and updated in July 2014 and has also been updated as part of this plan. The goals of the 2019-2028 program at the District are to:

- Maintain 116 gpd per single family residence through 2019, and less than 120 gpd through 2028
- Meet Distribution System Leakage standard of 10% or less.

SYSTEM ANALYSIS AND CAPITAL IMPROVEMENT PROGRAM

The Blaine water supply contract is anticipated to provide adequate water supply through 2038. Additionally, the District may be able to use more than their contract demand amount, but such use would be subject to premium pricing and penalties per the City supply contract. However, supply upgrade projects will be necessary in both the Blaine and District systems over the 20-year planning period in order to supply the water to the District at adequate rate and pressure.

The City of Blaine is primarily responsible for the quality of water currently used by the District's customers. Blaine disinfects the water as necessary for system residual and no other treatment is necessary at this time. The District performs disinfectant residual and coliform bacteria testing at various points within its distribution system. The District has also completed lead and copper and asbestos testing as required to date. The District's water is in compliance with all the monitored water quality parameters. In accordance with the federal regulations requiring annual Consumer Confidence

Reports, the District publishes an annual Water Quality Report for distribution to its entire customer base. Copies of recent reports are included in Appendix H.

The District has adopted water system design and construction standards that are consistent with DOH requirements and the minimum standards in the Whatcom County *CWSP*. The standards, including standard details and technical specifications, are included in a separate document, the *BBWSD Developer Project Manual*, latest edition. Design criteria for storage tanks and booster pump stations will be developed in project reports for specific project applications, for review and approval by DOH.

The storage and transmission and distribution system was analyzed to determine its ability to provide for existing and forecast water demand, while providing appropriate service pressure to all customers.

The storage requirements are a function of operational parameters, water demand and fire flow requirements. Five elements of storage must be considered: Operational, (OS), Standby (SB), Equalizing (ES), Fire Flow (FSS) and Dead (DS). With the approval of the fire marshal, the District may use the larger of SB or FSS. As a seismic risk mitigation measure, the District lowers the water level in each steel reservoir in the winter, thereby increasing the OS volume. The District presently has 3.126 million gallons of storage and a system-wide deficiency in storage capacity is forecast by year 2025. Additional supply projects will reduce the long-term deficiency forecast but replacement and additional reservoirs are recommended to increase storage capacity. A potential storage sharing solution has been identified to enhance the reliability of both the City of Blaine and District systems in the Birch Point area. Further evaluation is recommended.

The District's water system hydraulic model was used in the analysis for this Plan, for the following conditions, for current demand and forecast demand for PHD, MDD and MDD with fire flow, for even years through the year 2028 then again for years 2033 and 2038. The fire flow requirements range from zero to 2,500 gpm. The evaluation criteria were based on maintaining a minimum pressure of 30 psi in any point in the distribution system during PHD and MDD conditions, or 20 psi during MDD with fire flow conditions. Additionally, the analysis focused on avoiding reliance on storage to meet MDD.

The hydraulic analysis revealed deficiencies in the ability to meet MDD (hence reliance on storage) by 2022, in 2028 and again by 2038. Various solutions were considered to improve supply of water to the system, until a series of phased improvements was selected to address the hydraulic deficiencies.

System deficiencies are summarized in Section 3.4 and proposed improvements are discussed in Section 3.5 and Chapter 8. The primary projects necessary to address water system deficiencies are summarized in Table 5.

Table 5. Summary of 10-Year Capital Improvement Plan

ID	Project Description¹	Estimated Project Cost (2019)	Recommended Year of Completion
SU-1	Supply/Storage Pre-design study with Blaine (District share at 50%)	\$ 18,000	2019
SU-4	Annual Allowance for Water Rights and Source of Supply Efforts	\$ 200,000	2019-2028
ST-1	Seismic Analysis - Kickerville and Semiahmoo Reservoirs	\$ 125,000	2019
T-1a	Relocate meters and abandon parallel mains on Birch Bay Dr.	\$ 132,000	2019
T-1b	Relocate meters and abandon parallel mains on Birch Bay Dr.	\$ 46,000	2020
T-1c	Remove existing main from Loft Lane to Gemini St.	\$ 10,000	2020
T-2	Shintaffer Road 8" Main Extension	\$ 249,000	2020
T-3	10 year Water Main Upgrade Program	\$ 478,000	2019-2028
O-1	Complete AMR Program (not including District labor costs for installation)	\$ 1,500,000	2019-2022
O-3	Update Financial Management Policy	\$ 7,500	2019
O-5	Facility Gates Upgrade/Building Upgrades	\$ 29,000	2019
O-6	Digital Records Project	\$ 9,000	2019
O-7	Upgrade Phone System	\$ 15,000	2019
ST-2	Kickerville Reservoir seismic upgrades	\$ 260,000	2019-2020
ST-3	Semiahmoo Reservoir seismic upgrades (allowance)	\$ 162,000	2019-2020
T-4	Upgrade 225 lf 2.5" to 8" and replace meter and PRV with 8"	\$ 185,000	2020
O-4	Blaine Water Supply Contract Renewal	\$ 50,000	2021
O-8	Upgrade Vehicles	\$ 319,000	2019-2028
T-5	Connect Zone 2 to portion of Birch Bay Village, with PRVs	\$ 325,000	2022
Blaine	Additional Supply - equip PW-2 including treatment and 5,210 lf 12" and 8" pipeline	Blaine Project*	2023
SU-2	Add 1,400 gpm BPS (no generator) at Portal Way Intertie.	\$ 962,000	2023

T-6	Replace 1,000 lf 8" AC with DI pipe from PW BPS to Point Whitehorn Rd.	\$ 289,000	2023
SU-3	New Birch Point BPS with standby power, 250 gpm for District, joint with Blaine, serve Zone 2 and Blaine 330 Zone (District share at 50%)	\$ 440,000	2024
T-7	Integrate Zone 5 with Zone 2 with connection along Birch Point Road - 8" DI (7,300 lf)	\$ 2,110,000	2024
ST-4	Add Zone 3 Reservoir, 0.169 MG, ground level, with T-4 and T-5	\$ 375,000	2025
T-8	Upgrade BPS for lower supply HGL to increase Zone 3 HGL	\$ 176,000	2025
ST-5	Replace Birch Point Reservoir with 1.65 MG, ground level, share with Blaine (District share at 80%)	\$ 2,123,000	2028
T-9	Relocate WWTP supply meter and add PRV	\$ 57,000	2028
O-2	Comprehensive Water System Plan Update	\$ 150,000	2028
T-10	Booster pump station for close future high pressure zone	\$ 723,000	2027, with DE
T-11	Transmission main for redundancy - Alderson to DE 11-A (Church 14" extension north of Bay Rd) - 3,300 lf 12" DI	\$ 1,208,000	2027, with DE
Total		\$ 12,732,500	

1 - See Table 8.1 for detailed description.

OPERATION AND MAINTENANCE

The District General Manager is responsible for overall system management under the direction of the District's elected Board of Commissioners. The District Operations Manager and Water System Foreman operate the water system. The Water System Foreman is certified as a Water Distribution Manager 2, Water Distribution Specialist and Cross Connection Control Specialist. He is responsible for the day-to-day operation of the system. He is supported by two operators that are also meter readers and certified by the State as Water Distribution Specialists.

The water system operates automatically, with the option for manual override, via a telemetry system. The Operations Manager and Foreman have the ability to monitor and control operations of the system from a remote personal computer. Reservoir levels are continuously monitored and control operation of system supply pumps. Supply to separate pressure zones is automatic through pressure reducing valves, or

automated booster pump stations. The Water Department performs preventative maintenance and monitoring on a regular schedule, and stocks a moderate inventory of water system components for maintenance and/or repair as necessary. Water Department staff is responsible for implementation of the *Coliform Monitoring Plan* (see Appendix F).

The District's *Cross Connection Control Program* was previously approved by DOH in a separate document. The District's approach to cross connection control is premise-isolation. The District has adopted its *Cross Connection Control Program* by resolution (No. 648) and incorporated it into the District Code as Chapter 7.08.

The District has a vulnerability analysis and emergency response plan that were prepared and updated as a result of the Public Health Security and Bio-Terrorism Preparedness and Response Act (HR 3448). The District has adopted a *Water Shortage Response Plan* that identifies four different stages and procedures that are to be followed depending on the severity of a water shortage situation (see Appendix J).

Other recommendations for the operation and maintenance program include negotiate a reciprocal emergency intertie agreement with the City of Blaine and update the emergency intertie agreement with Bell Bay Jackson Water Association. Also identified were measures for the inspection of steel water storage tanks, fire hydrants, valves, flushing and leak detection.

FINANCIAL PLAN

Birch Bay Water and Sewer District is an independent special purpose district, assuming the duties of its own treasury from Whatcom County in 1988. The District has and continues to maintain a strong financial base. All previous debt (extensive water and sewer system improvements in the mid to late 1970s and in the 1990s) has been retired and current Public Works Trust Fund debt is backed by operating revenue and connection charge revenue.

The District relies on developer financing, revenue bonds and connection charges to fund capital improvements to the system. Grant and low-interest loans are used as available for certain projects. Water service charges support operation and maintenance of the water system, with some transfer to the construction and debt service funds. The District has developed a comprehensive financial model, updated annually to consider the impact of capital projects and operation and maintenance expenditures on District finances and rates. Water service charges are adjusted periodically to adequately support the revenue needs. The water connection charge will be adjusted following adoption of this plan.

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CHAPTER 1

DESCRIPTION OF WATER SYSTEM

This report sets forth the studies, findings and recommendations for the Birch Bay Water and Sewer District (BBWSD) *Comprehensive Water System Plan*. The purpose of the *Comprehensive Water System Plan* (WSP) is to identify the retail service area, existing system, service policies, future needs and related issues, in a manner which is consistent with the *Whatcom County Comprehensive Plan*, the Growth Management Act, WAC 246-290, and applicable other local, state and federal laws.

Recognizing the need for the continuing development of Birch Bay Water and Sewer District's water facilities, the District's Commissioners authorized CHS Engineers, LLC to proceed with the studies required to prepare an updated comprehensive water system plan, which will guide an orderly development of facilities within the District.

The studies leading to the preparation of this report included:

1. A review of the District's 2009 *Comprehensive Water System Plan*.
2. A review of existing planning data and material pertaining to the study area.
3. A projection of anticipated population in the District service area to forecast water usage through year 2038.
4. A review and update of the water service area.
5. An examination of existing water facilities to determine their current and future adequacy, and the updating of existing design criteria to meet future needs.

1.1 Ownership and Management

The Birch Bay Water and Sewer District water system, identification number 95904U, is owned, operated and maintained by Birch Bay Water and Sewer District (BBWSD). The District is a municipal special purpose district formed under authority of Title 57 RCW, with the original name of Whatcom County Water District No. 8. The District is governed by an elected board of three commissioners, with staggered six-year terms. The Board of Commissioners set policy for implementation by the District's General Manager and Operations Manager. The District is a purchasing purveyor. BBWSD purchases all of its water supply from the City of Blaine. The District owns and maintains the distribution system including a main supply pump station, three reservoirs and three booster pump stations. The Washington State Department of Health (DOH) Water Facilities Inventory form for this system is included at the end of this chapter.

1.2 System Background

1.2.1 History of Water System Development and Growth

In the first part of 1960, Birch Bay residents began to consider prospects for creating a public utility to provide service for anticipated community growth. Two private water companies were serving the majority of the Birch Bay area: Birch Bay Water Company and Birch Point Water Association. The residents of Birch Bay were concerned about the ability of these water companies to meet future water needs.

The registered voters in the Birch Bay area petitioned Whatcom County to place a proposition on the ballot to form a water district and, in September of 1960, Whatcom County Water District No. 5 was voted into existence. With the creation of this district, area residents had the vehicle through which the necessary financing could be obtained to meet the demands for future water supply and transmission for the developing community.

Problems were encountered almost immediately after the formation of the district when it tried to acquire the larger of the two existing private water systems by condemnation. The condemnation proceedings created an undesirable atmosphere that led to the eventual dissolving of Water District No. 5 by the voters in September of 1964. In the years following, various modifications and extensions were made to the private system in an attempt to meet increased demands for water.

The increase in residents and resort activity continued in the Birch Bay area and, in 1966, a problem of even greater intensity than the water shortage became apparent. Birch Bay was becoming polluted by overloaded or failed septic and drainfield waste systems. A sewage system was needed to abate the pollution of the shallow bay on which the economic livelihood of the community depended. The urgent nature of the pollution problem was impressed upon the residents by the Washington State Health Department, which precipitated efforts to correct the worsening condition through formation of a public utility.

In 1967, the State Legislature enacted legislation authorizing water districts to perform the dual function of operating and maintaining both a water system and a sewage system, thereby dispensing with the necessity of forming two utility districts. Whatcom County Water District No. 8 was subsequently formed by a majority vote of the people on February 6, 1968, to solve the community's water and sewage problems.

Federal funds for a preliminary engineering study for water and sewer systems were acquired and negotiations for acquisition were begun with the owner of the Birch Bay Water Company. On September 16, 1969, a minimum scope comprehensive plan and its attendant proposed bond authorization was put

before the people and passed by a substantial margin. On January 1 of the following year, the Birch Bay Water Company was sold to Water District No. 8, at which time the District commenced operation of the water system.

Water District No. 8 applied for and received a non-interest bearing loan from the Housing and Urban Development division of the federal government in the early part of 1969. The loan was for the financing of an engineering report on a comprehensive water and sewerage plan. Hill, Ingman, Chase & Co. was directed to proceed with the report on May 26, 1969. The report was completed and accepted by the water district in May of 1970.

The water system received major improvements in 1972 with the addition of a new supply pumping station and 500,000-gallon reservoir. In 1977 and 1978, the water system again underwent substantial construction with the addition of over 10 miles of transmission and distribution mains and a 2.5 million gallon reservoir.

Further construction since 1981 has resulted in a system comprised of over 82 miles of transmission and distribution mains.

Twenty-two annexations have occurred since the formation of the District, with the first in 1971 and the most recent in September 2011. Water District No. 6 merged with Birch Bay Water District No. 8 on December 15, 1987.

Whatcom County Water District No. 8 changed its name to Birch Bay Water District No. 8 on October 20, 1983. The name changed again on January 1, 1988 to Birch Bay Water and Sewer District.

1.2.2 Geography

BBWSD encompasses the unincorporated resort, recreational and permanent residential community of Birch Bay. It is located in Whatcom County in the northwest portion of Washington State in Townships 39, 40 and 41 North, Ranges 1 East and 1 West (see Figure 1.1). The Birch Bay area is approximately six miles south of the Canadian Border and immediately south of the City of Blaine. The Bay is easily reached from Interstate Highway 5, which passes approximately four miles to the east. At the present time, BBWSD contains approximately 6,570 acres. The District boundary is shown on Figures 1.2 and 1.3.

The majority of the District is comprised of lowlands that rise to 40 to 50 feet above sea level. The highest points in the immediate Birch Bay area are Birch Point and Point Whitehorn. They have relatively steep sided bluffs that define the shoreline of Birch Bay to the north and south, respectively. At these locations, the ground elevation is 150 to 200 feet above sea level (topography is indicated on Figure 1.4).

Birch Bay is a large semi-circular body of water making a prominent recess in the shoreline of the Strait of Georgia. The bay is characterized by long, flat beaches and extremely shallow water that reaches a maximum depth of approximately 40 feet near its center. This shallow water is quickly warmed by the sun, resulting in a popular aquatic recreation area.

Large bodies of water in the vicinity of the District include Birch Bay, Drayton Harbor, the Strait of Georgia, Dakota Creek, California Creek, Terrell Creek and Lake Terrell. Each of these is indicated on Figure 1.2. There are many additional unnamed streams and ponds along or adjacent to Terrell, California and Dakota Creeks, and significant areas identified by Whatcom County as wetlands, all as indicated on the same figure.

1.2.3 Neighboring/Adjacent Purveyors

Neighboring water purveyors include the City of Blaine, Bell Bay Jackson Water Association, Grandview Beach Water Association, and Public Utility District (PUD) No. 1 of Whatcom County (see Figure 1.3).

City of Blaine: The City is located immediately north of the District, and sells water to both the District and Bell Bay Jackson Water Association. The District takes delivery of water from Blaine south of Dakota Creek on Blaine Road and on Portal Way, and south of Semiahmoo Parkway on Semiahmoo Drive.

Bell Bay Jackson Water Association: The Bell Bay Jackson Water Association lies east and south of Birch Bay. It supplies approximately 120 services and purchases its water from the City of Blaine. The Bell Bay Jackson pressure gradient is within 20 feet of the District's main pressure zone.

Grandview Beach Water Association: The Grandview Beach Water Association is located south of Birch Bay near Point Whitehorn. It supplies approximately 17 homes from a well located within its boundaries.

Public Utility District No. 1 of Whatcom County: The PUD serves the industrial developments southeast of the District with partially treated water.

There are other present or former water systems in the area, summarized as follows:

- Birch Bay State Park operates a Group A system for service within the Park boundary. It is supplied by BBWSD but the District provides no oversight, monitoring or support beyond the service meter. DOH reports this system as inactive as of 2001.
- The Birch Bay View Water Association operated a Group A system in the northwest part of the District until 1979. Following replacement of the local distribution system through a utility local improvement district, the District now provides direct retail service to that area.

- The District provides potable water service by agreement (see Appendix C) to the BP Cherry Point Refinery. Service is provided at a meter at the intersection of Grandview Road and Jackson Road, near the northwest corner of the refinery. The refinery operates a water system to distribute this supply throughout the refinery property. The District provides no oversight, monitoring or support beyond the service meter. The BP-Cherry Point Refinery Group A water system is listed by DOH as an inactive system, effective 2011.
- Puget Sound Energy previously operated a Group B system southwest of the intersection of Jackson Road and Grandview Road. DOH reports it has been inactive since 2005. The District has not researched how this facility is presently served.
- There are two active Group B water systems in the water service area. One serves a single property near the Birch Point Reservoir and one serves an industrial customer southeast of the Cherry Point Refinery. Each is served by a well. Each was established before the District established its RWSA in 2009.
- The District provides potable water service to several large private developments within the service area (typically mobile home and/or RV parks). Service is provided as a retail customer via a meter at the border of the property. Each park has a water distribution system for service within the development, for service to buildings and other uses. The District provides no oversight, monitoring or support beyond the service meter.

1.2.4 Ordinances/Bylaws

The Public Water Systems Coordination Act of 1977 codified as Chapter 70.116 RCW, and the standards presented in the *Whatcom County Coordinated Water System Plan* (CWSP) provide a set of minimum design and performance criteria for new water utilities and for all existing utilities planning to install capital facilities for expansion purposes.

The District, following Title 57 RCW, adopts resolutions to develop, manage and operate the water utility. Key water system standards and requirements are described throughout this report. Copies of the resolutions are available at the District office. The resolutions are codified and Chapter 7 (Water Supply System) of District Code is included as Appendix G.

1.3 Inventory of Existing Facilities

The District purchases water from the City of Blaine. The District has five wells, water rights for a well transferred to the City of Blaine, three reservoirs, four pump stations and a complete water transmission and distribution system (see Figure 1.4). In 2002, the District negotiated a new contract with the City of Blaine, providing for up to 2.11 million gallons per day of water supply to the

District. This is a 40-year contract, with options for renewal of up to 20 more years. The water supply contract was amended in 2008 to provide for mutual efforts to secure additional water supply and provide additional supply quantity to the District once such additional supply is secured. The second amendment, in 2010, increased the maximum supply available to 3.73 million gallons per day. The third amendment revised details of the cost-sharing methodology. The fourth amendment extended the term from 30 to 40 years. One additional system intertie exists but is not used to provide water to District customers (an emergency supply for Bell Bay Jackson Water Association).

1.3.1 Existing System Facilities and Major Components

The Birch Bay Water and Sewer District water system consists of a fully metered distribution system, three ground level reservoirs and four booster pump stations. There are nearly 86 miles of water main, and approximately 868 valves and 532 fire hydrants in the system.

Table 1.1 is a list of water system construction projects completed since 1972. The District projects listed are those that were undertaken and funded by the District. The developer extension projects were initiated and funded by developers and were conveyed to the District to become part of the District's facilities upon project completion.

Table 1.1
HISTORY OF WATER PROJECTS

District Project	Description
ULID No. 1 (1972)	6" & 8" water distribution mains
Contract 72-A	500,000 gal. Reservoir (Birch Point)
Contract 72-B	Supply booster pump station (Blaine Road)
Contract 72-C	10" water transmission main
Contract 76-A	10" & 12" water transmission mains
Contract 76-F, ULID No. 5	10", 12" & 14" water transmission mains
Contract 76-G, ULID No. 5	8", 10", 12" & 14" water transmission mains
Contract 77-A, ULID No. 5	2.5 MG Reservoir (Kickerville)
Contract 77-B, ULID No. 6	6" & 10" water distribution mains with booster pump station (Bayvue)
Contract 79-A	10" water transmission main
Contract 82-A	12" water transmission main
Water District No. 6 Merger	8" and 6" distribution mains, 126,000 gallon reservoir (Semiahmoo), Well P1
(1987)	4" and 12" distribution mains (Terrell Creek Crossing)
Contract 89-A	2-1/2" water transmission main (Birch Point – Blaine Intertie)
Contract 89-B	6" water system improvements (Project #4)
Contract 90-A, ULID No. 8	12" transmission main, 8" distribution main
(1990)	8" water system improvements (Project #2)
(1991)	8" water system improvements (Project #1)
(1992)	8" water system improvements (Project #3)
Contract 93-B	16" transmission, California Creek Crossing
Contract 93-C, ULID No. 11	8" distribution main, Sunday Harbor
Contract 93-D	8" distribution main, Birch Point Road Water Line Replacement
Contract 93-E	8" water system improvements, Project No. 5/6

District Project	Description
Contract 94-B, ULID No. 14	8" & 10" distribution main, 14" transmission main, Double R Ranch
Contract 96-D	Point Whitehorn Booster Pump Station
Contract 97-B	8" distribution main, water system improvements, Project #7
(2000)	Drilling and development of PW-2, a test well in the Dakota Creek watershed
(2000)	Drilling and development of PW-1R, a replacement well in that area of former WD #6
Contract 02-B	12" transmission main, Birch Point Water System Improvements, Project #8
(2002)	Birch Point Temporary Booster Pump Station
Contract 03-B	Jackson Road Water Main replacement of 10" transmission main for a 12" HDPE main
Contract 04-A	Drayton Harbor & Harbor View Road water main replacement - 16" transmission main
(with DE 06-A)	200 and 300 Zone Interties
Contract 05-D	8" water main replacement
(2007)	Drayton Harbor water main replacement
Contract 08-A	18" water transmission mains
Contract 08-01 (2010)	Birch Bay Drive (State Park) Watermain, 3" slip line of 4" water line Replacement
Contract 16-A	Blaine Road 16" & 12" Water Main Replacement
Developer Extension Project	Description
1. Birch Bay Village Div. 9, 10, & 10A	4", 6" & 8" distribution mains
2. Robbins & Nelson Replat	6" & 8" distribution mains
3. Hoyt Street	6" distribution mains
4. Birch Bay Village Div. 11 & 11A	6" & 8" distribution mains
5. Birch Bay Village Div. 11B	6" distribution main
6. Holiday Park Phase I, DE 75-A	10" transmission main; 6" & 8" distribution mains
7. Birch Bay Village Div. 11C, DE 76-B	6" distribution main

District Project	Description
8. Birch Bay Village Div. 12M, DE 76-C	6" & 8" distribution mains
9. Birchmont, DE 76-D	6" distribution main
10. Birch Bay Village Div. 12, 12A, 12C, 12D, DE 76-E	6" & 8" distribution mains
11. Woodhaven, DE 76-J	4", 6" & 8" distribution mains
12. Holiday Park Phase II, DE 76-K	4" & 6" distribution mains
13. Birch Bay West End Estates, DE 76-L	6" & 8" distribution mains
14. Bay Ridge Estates, DE 76M	10" transmission main; 4", 6" & 8" distribution mains
15. Birch Bay Village Div. 4, 13 & 14, DE 77-C	4", 6" & 8" distribution mains
16. Birch Bay Park First, DE 77-D	4", 6" & 8" distribution mains
17. Harbor View Estates, DE 77-E	4", 6" & 8" distribution mains
18. Richmond Park, DE 77-F	4" & 8" distribution mains
19. Bay Rim Park, DE 78-A	4", 8" & 10" distribution mains
20. Birch Bay Village #15, DE 78-B	4", 6" & 8" distribution mains
21. Bay Ridge Estates, DE 78-C	10" transmission main
22. Whatcom County Housing Authority, DE 82-C	6" & 8" distribution mains
23. Mariners Cove, 1982	8" distribution main
24. Sea-Links, DE 83-A	4" & 8" distribution mains
25. Whatcom County Parks Dept., DE 84-A	10" distribution main
26. Naco West, DE 86-A	4", 6" & 8" distribution mains
27. Pointe on Semiahmoo, DE 88-A	12" transmission main
28. Latitude 49, DE 90-A	6" and 8" distribution mains
29. PUD #1 – BP Refinery Service Main 1990	10" transmission main
30. Semiahmoo Center, DE 91-A	12" transmission main
31. Dixon, DE 91-B	8" distribution main
32. Sealinks Phase II, DE 92-A	8" distribution main
33. Vitalis (Elaine St.), DE 92-C	8" distribution main
34. Loomis Trail Offsite Water, DE 92-D	16" transmission and Blaine Rd. Booster Station Improvements

District Project	Description
35. Loomis Trail Clubhouse & Maint., DE 93-A	8" distribution main
36. Lincoln Green Phase I (Bayshore & Moonglow), DE 94-A & 94-D	8" distribution main
37. Goldstar, DE 94-C	10" distribution main
38. Maple Leaf Village, DE 95-B	8" distribution main
39. Plat of Point Whitehorn, DE 96-A	8" distribution main
40. Anchor Manor Ph. 1A, DE 96-B	4" & 8" distribution mains, 12 and 14" transmission main
41. Plaza Park Mobile Home Court, DE 97-A	8" distribution main
42. Richmond Park Div. II – Ph. 1, 99-A	4" and 8" distribution main
43. Anchor Manor Phase 1B, DE 00-A	8" distribution main, 14" main transmission main
44. Muskoka-Rosseau, DE 00-B	8" distribution main
45. Plaza Park RV Park, DE 01-A	8" distribution main
46. Drayton Heights Phase I, DE 01-B	8" distribution main
47. Anderson Park Phase 1A, DE 02-A	8" distribution main
48. Drayton Heights Phase II, DE 02-C	8" distribution main
49. Richmond Park Div. II, Ph. II, DE 02-D	8" distribution main
50. Bay-Crest, Phase 1A, 1B, 2A, Water Main Extension, DE 02-E	2" and 8" distribution main
51. Anchor Manor, Phase II Water Main Extension, DE 03-A	8" distribution main
52. Greens at Loomis Trail Phase 1 - Water, DE 03-C	8" distribution main
53. Anchor Village, DE 03-D	8" distribution main
54. Baycrest North, Phase 2,4 - Water, DE 04-B	2" and 8" distribution main
55. Baycrest North, Phase 1A, 1B, 1C, 3, DE 04-C	8" distribution main
56. Anderson Park, Phase 1B - Water, DE 04-D	8" distribution main
57. Baycrest, Phase 2B - Water, DE 04-E	8" distribution main

District Project	Description
58. Sandcastle Condos - Water, DE 04-F	3", 4" and 6" distribution main
59. Greens at Loomis Trail, Phase 2 - Water, DE 04-G	8" distribution main
60. Bayview Terrace - Water, DE 04-H	8" distribution main
61. Malibu Water Extension, DE 05-A	8" distribution main
62. Baycrest South Water Extension, DE 05-C	2", 4", and 8" distribution main
63. Grand Bay Resort on the Beach, DE 05-B	6", 8" and 10" distribution main
64. Lincoln Green Tract C, DE 05-E	10" water main extension
65. Terrell Creek Landing, DE 06-A	6" and 8" water main extension
66. Horizon at Semiahmoo Phase 1, DE 06-B	8" water main extension
67. Karber Rd. water extension, DE 06-C	2" water main extension
68. Bay Breeze Cluster Subdivision, DE 06-E	4" distribution main and 10" water main extension
69. Shintaffer/Drayton Farms Water Extension, DE 06-F	8" and 12" water main extension
70. Kamal Short Plat Water Extension, DE 07-B	8" water main extension
71. Birch Bay Condominiums Phase 2 Water Extension, DE 07-E	6" and 10" water main extension
72. Van Luven SP Water Extension, DE 08-C	2" supply main extension
73. Tides at Birch Bay Phase 1 Water Extension, DE 08-D	8" water main extension
74. Bleakney Mini Storage Water Extension, DE 10-A	8" water main extension
75. Bay Road 3 Lots Water Extension, DE 10-B	2" and 8" water main extension

District Project	Description
76. Birch Bay Bible Community Church Water Extension, DE 11-A	14" water main extension
77. Calluna Beach/Shores Water Extension, DE 14-A	8" water main extension
78. Tides at Birch Bay Phase 2 Water Extension, DE 16-B	8" water main extension

The District has formed seven water utility local improvement districts (ULIDs) to finance and construct portions of the existing system. The locations of the ULIDs are shown on Figure 1.5.

1.3.2 Service Connections

As of the end of 2018, the District had approximately 5,292 meters serving all the District's accounts. The breakdown by customer type is presented in Table 1.2.

Table 1.2
DISTRICT CUSTOMERS

Customer Category	District Meters
Single family residential	4,607
Multi-family residential	539
Commercial	92
Other	54
Total	5,292

As of December 31, 2018

1.3.3 Existing Interties

The District presently has six existing and active interties with other water purveyors:

- City of Blaine on Blaine Road
- City of Blaine on Portal Way
- City of Blaine on Semiahmoo Drive
- City of Blaine on Semiahmoo Parkway (two connections)
- Birch Bay State Park on Birch Bay Drive

The Blaine intertie on Semiahmoo Parkway (the 300 Zone Intertie) is for emergency supply from the Blaine water system to one of the District's pressure zones in anticipation of a future District booster pump station replacement project

(essentially for fire flow or other short-term supply emergencies in the District's 300 Pressure Zone, including failure of the single pump serving this area). The other intertie on Semiahmoo Parkway (the 200 Zone Intertie) is for reciprocal supply between the two systems. The primary purpose of the 200 Zone Intertie is for emergency supply between the systems. In the near future, the 200 Zone Intertie may be used for short-term peaking supply until other system improvements are completed.

Service to Birch Bay State Park is through a single meter on Birch Bay Drive.

The District and Whatcom County PUD No. 1 previously shared an intertie on Jackson Road. The use of that intertie was governed by an agreement, with several amendments, with the PUD. The agreement provided for delivery of potable water, on a limited basis, to the BP Cherry Point Refinery. With the increase in contract supply from Blaine, the District, BP and PUD cooperated to convert BP to be a direct retail customer of the District. An agreement to supply potable water directly to BP was executed in 2008. Conditions for retail service, termination of the PUD agreement and inactive status of the intertie were satisfied in 2010.

There is an additional intertie between the Birch Bay system and the Bell Bay Jackson water system that could allow wheeling of water to Bell Bay Jackson Water Association if necessary. At the present time, this intertie is not active, but is connected and available for emergency water supply to the Association. Further discussion of interties is included in Chapter 4.

1.4 Related Plans

There are several planning documents that impact water system planning by the District.

- *Whatcom County Comprehensive Plan*, Whatcom County, updated in 2017. This study provides planning information for future development in unincorporated Whatcom County.¹
- *Urban Growth Area Review – Birch Bay UGA Proposal*, Whatcom County. June 24, 2015. This report discusses the growth and development of the Birch Bay UGA as part of the *Whatcom County Comprehensive Plan* update. In the *Comprehensive Plan* update in 2016 the County determined the UGA Reserve Area should remain as is.
- *Whatcom County 2016 Comprehensive Plan and Development Regulations and Urban Growth Areas Review – Final EIS*, Whatcom County, November

¹ The 2016 and 2017 versions of the County Comprehensive Plan were current at the time this section of the WSP was prepared and are the basis for the information presented herein. The County Comprehensive Plan was subsequently updated in 2018.

2015. This EIS was prepared for the *Comprehensive Plan* update and addresses growth in the County including the Birch Bay UGA.

- *Birch Bay Community Plan (BBCP)*, Whatcom County, September 2004 (revised May 2009). This study was prepared by the County and a broad-based community group to more specifically plan for growth and development of the Birch Bay unincorporated UGA.
- *Whatcom County Coordinated Water System Plan Update*, Whatcom County, Whatcom County Water Utility Coordinating Committee and Economic and Engineering Services, Inc., September 2016. This plan was completed with the intent to meet the public drinking water supply needs of Whatcom County and achieving coordination between water service and the Growth Management Act (GMA).
- *Water System Comprehensive Plan*, City of Blaine, CHS Engineers, LLC, November 2009. The plan was updated to reflect the water system demands in the community and 2002 wholesale agreement with BBWSD, as required by DOH. The City's plan is concurrently being updated with the District's plan.
- *Comprehensive Sewer System Plan*, Birch Bay Water and Sewer District, CHS Engineers, LLC, May 2009. The sewer plan addresses urban growth areas as delineated at that time and addresses changes in the District since their 2000 sewer plan. This plan is concurrently being updated.

1.5 Service Area Characteristics

1.5.1 Existing Service Area

The existing water system is indicated on Figures 1.4 and 3.1. Most of the system is in the main pressure zone with high water level at elevation 200 feet. There are three other significant separate pressure zones:

- between City of Blaine and Birch Bay Village, along Semiahmoo Drive and Birch Point Road, served by the Semiahmoo Reservoir and the temporary Birch Point Booster Pump Station
- a portion of the subdivision immediately southwest of the intersection of Selder and Bayvue Roads, served by the Bayvue Booster Pump Station; and
- the area including and west of the District's wastewater treatment plant to Point Whitehorn, served by the Point Whitehorn Booster Pump Station.

There are additional separate pressure service zones controlled by pressure reducing valves; however, these are necessary only due to age and pressure capacity of existing pipe, rather than topography.

1.5.2 Land Use and Zoning

Land Use: Whatcom County has jurisdiction over land use and zoning in unincorporated areas such as Birch Bay. The 1990 Washington State Growth

Management Act (GMA) and subsequent revisions thereto have changed the way land use planning is completed in higher population counties of the State. The GMA requires Whatcom County to prepare and adopt a comprehensive plan that provides for and manages the growth projected for the next twenty years in a manner that is consistent with the goals of the Act.

Under the GMA, the County Comprehensive Plan must contain Urban Growth Area (UGA) designations, within which urban growth shall be encouraged and outside of which growth can occur only if it is not urban in nature. These areas include existing incorporated areas such as Blaine along with their projected growth areas. A UGA may also be designated in an unincorporated area not contiguous to an existing city if the area is already characterized by urban growth or is adjacent to territory already characterized by urban growth. The Birch Bay area fits this description and under the *Whatcom County Comprehensive Plan*, a large portion of the District's service area is designated as a UGA.

The Public Facilities and Services goal under GMA is to "[E]nsure that those public facilities and services necessary to support development shall be adequate to serve the development at the time development is available for occupancy and use without decreasing current service levels below locally established minimum standards" (RCW 36.70A.020 (12)).

Whatcom County designated Birch Bay as a UGA in 1997. The Birch Point area and land south of Point Whitehorn were removed from the UGA when the Birch Bay Community Plan was adopted in 2004. The Birch Bay UGA was further reduced in the 2009 UGA review, when lands in the eastern part of the UGA were removed. Currently, the UGA consists of these zoning classifications:

- Urban Residential four units/acre (UR4)
- Urban Residential Medium Density six units/acre (URM6)
- Urban Residential Medium Density 24 units/acre (URM24)
- General Commercial (GC)
- Resort Commercial (RC)
- Neighborhood Commercial (NC)

Whatcom County has also designated an Urban Growth Area Reserve area adjacent to the current Birch Bay UGA. In the 2016 UGA review process, the County had considered changing this UGA Reserve to UGA in order to support the projected population increase in the Birch Bay UGA without expanding the UGA into the adjacent Rural areas. Ultimately the County decided to retain the UGA Reserve Area as is and to lower the future target population for the Birch Bay UGA.

Whatcom County adopted the *Birch Bay Community Plan* (BBCP) as an amendment to the County *Comprehensive Plan* on September 28, 2004. The BBCP evaluated the conditions at the time, projected future growth and established planning criteria for the Birch Bay area, including evaluation of land

use, utilities, housing, transportation, public education, governance, etc. The BBCP projected the population and number of housing units for the Birch Bay Urban Growth Area (UGA) in the year 2022. It also adopted revised land use designations for portions of the area. The BBCP is still in effect but population forecasts and UGA boundaries have been superseded by the *Whatcom County Comprehensive Plan*.

Zoning: The present population distribution pattern generally matches the zoning map in that the majority of the populace is concentrated around the Bay within approximately a mile of the shoreline. The majority of development activity in the area should continue to center around the Bay itself, although growth is also expected on the main travel routes into the Birch Bay area as well. Figure 1.7 presents the current zoning within the District's service area.

Consistency: The District's comprehensive water plan must be consistent with the adopted plans, regulations and policies of Whatcom County and the City of Blaine, as required by GMA, and also per the 2003 Municipal Water Law (MWL). This plan has been prepared to provide service to existing development and development allowed under current land use and zoning designations of the County and City as discussed herein. Where the water system exists or is extended to areas designated as Rural, such extensions and service shall be provided at rural levels of service. Additionally, the population and growth forecasts used by the County have been reviewed and compared to growth patterns in the District's history (as measured by water and sewer system connections) for development of the water demand forecast presented in Chapter 2. The District has requested confirmation of such consistency from the County and City. Copies of their responses are included in Appendix A.

1.6 Retail Service Area

The State Public Water System Coordination Act of 1977, as amended, is codified at Chapter 70.116 RCW. It was adopted to address water supply and coordinated planning in areas of the state where water supply resources are particularly constrained. The Act requires DOH to evaluate water supply conditions and establish critical water supply service areas that meet specific thresholds. Western Whatcom County was designated as a critical water supply service area in 1993 concurrent with the preparation of the County's first CWSP. One purpose of a CWSP is to coordinate the designation of and planning for water supply in specific geographic areas of the critical water supply service area. The current CWSP notes that the purveyor has the exclusive legal right and obligation to provide water service in its designated and approved water service area.

The 2003 MWL is codified at Chapter 43.2 RCW. It establishes the duty to serve provisions for the designated water service provider, as described in more detail below.

The existing Birch Bay Water and Sewer District boundary is shown on Figures 1.2 and 1.3. The previously declared retail water service area (RWSA) is depicted on Figure 1.3. The District's proposed RWSA, shown on Figures 1.6, 1.7 and 1.8, was outlined based upon consideration of the following elements:

1. Currently approved future water service area boundaries (2009 *Comprehensive Water System Plan*, BBWSD).
2. Whatcom County Land Use designations.
3. Service areas of adjacent water purveyors.

Changes are limited to serving two additional properties at the southeast corner of the intersection of Bay and Jackson Roads and all the parcels outside the present service area west of Jackson Road, between Helweg Road and Grandview Road.

Whatcom County has recently updated its *Coordinated Water System Plan* (CWSP) which, in part, addresses how and where water systems expand. With the update of its 2009 water plan, the District submitted a revised Declaration of Water Service Area to the County (see Figure 1.3). The proposed service area for the District is shown on Figure 1.8 and a revised Declaration of Water Service Area will be submitted to the County concurrent with completion of this Plan (see Appendix A).

A few parcels within the City of Blaine southwest of Drayton Harbor are included in the District service area. The Blaine UGA south of Dakota Creek is also in the District service area.

The District has decided to plan for the proposed water service area as declared in 2009 and adjusted herein to designate that area as its “retail service area” as required under the 2003 MWL and supporting regulations. Therefore, the District’s position is that all properties requiring potable water supply within the retail service area designated concurrently with adoption of this plan will be served by the District, subject to standard terms and conditions and consistently-applied policy and practice for expansion of the system by the developers and property owners seeking such service.

Per RCW 43.20.260, municipal water suppliers have a duty to provide service to all new connections within their retail service area if the following thresholds are met:

1. The supplier has sufficient capacity to serve water in a safe and reliable manner.
2. The service request is consistent with adopted local plans and development regulations.
3. The supplier has sufficient water rights to provide service.

4. Service can be provided in a timely and reasonable manner.

The basis for meeting each threshold is summarized as follows, with specific determination to be made with each application for service².

Capacity: Capacity of the system is discussed in detail in Chapter 3. A key objective of water system planning is to reasonably anticipate and provide capacity for growth in the system. Based on the needs identified from development of this water system plan, the District has prepared a capital improvement plan (Chapter 8) for implementation to maintain system capacity for those that desire service in the future. The District has adequate contractual water supply capacity throughout the planning period and the report presents a plan to maintain adequate physical capacity (source and storage) ahead of anticipated growth and increasing water demand.

Land Use Consistency: The District has prepared this plan to support full development of the retail service area at the land use currently adopted by Whatcom County and the City of Blaine. Confirmation of consistency with local planning documents is described at the end of Section 1.5 above. Applications for new water service are individually reviewed for consistency with the WSP. However, it is presumed that applications for service for new development are being reviewed by the local land use authority for conformance with appropriate development regulations, as enforcement of such is not under the District's jurisdiction.

Water Rights: The District presently purchases all of its water from the City of Blaine. Water rights sufficiency is not directly applicable to the District. However, the District does regularly monitor its existing and forecast demand against contractual limitations, that are presumed to be and have been reviewed by the District to be not inconsistent with the supplier's water rights. The District has adequate contractual water supply capacity for the planning period.

Timely and Reasonable: The District provides water service to new connections following review of application for service. Applications are initiated by developers or property owners and must be complete and submitted with the current application review fee. The application describes the service desired. Applications are reviewed by the General Manager and, at the Manager's discretion, the District Engineer or consulting engineer for consistency with this water system plan, as may be amended, and the ability for existing infrastructure to provide the desired service. The review process includes confirming the area to be served is within the current RWSA and determining if specific conditions for service or completion of capital improvements identified in the water system plan are warranted, in addition to the standard service policies presented below or in District Code. Single family residential service (e.g. new connection on existing

² This summary has been prepared to be consistent with the Conditions of Service Criteria adopted in 2019 by the Whatcom County Water Utility Coordinating Committee and the CWSP Section 6.3.

vacant lot) applications are reviewed over the counter whereas commercial and development projects require more detailed review under the District's developer extension procedure (see Chapter 7). More specifically, if the owner of a vacant parcel abutting an existing water main with adequate pressure and flow rate applies for service for a single-family residence, service will be provided without requirement to complete system improvements. For applications for one or more residential unit or for commercial development in an area not presently served, application for a water developer extension must be made. The developer extension review process will identify specific requirements and conditions for service. Developer extension applications are typically reviewed and presented to the Board for approval within 60 days of receipt of application. Unusual situations including extensive or remote developments or challenges by the applicant to draft conditions may require additional time to review and confirm by Board action. The approved conditions for service are considered to be reasonable as they are established per policy and commonly administered review procedure. Once the conditions are approved, the timing of delivery of service is subject to the action of the property owner or developer seeking the service. The developer extension process is established in a published manual and key terms of the developer extension agreement are the developer's responsibility for project management and funding of the necessary improvements. Additional service area policies are discussed below.

The above discussion of retail service area meets the objectives of RCW 43.20.260. In addition to providing service within the retail service area, the District has and will continue to provide potable water service to an area outside the retail service area, by agreement. The District provided wholesale potable water supply to the PUD, which in turn sold the water to BP, from 1990 until 2010. The actual water supply was through pipes and a meter owned only by the District, for direct connection to BP's private water system. Following satisfaction of certain contractual conditions, the District began direct potable supply to BP, by agreement, through the same pipes and meter, without involvement of the PUD in 2010. The District provided notice of satisfaction of the first of two conditions on August 17, 2010 and of the second condition on September 27, 2010. The BP supply agreement (May 2008) became fully effective thirty days following the second notice of satisfaction. Thus, the area served by the District has been and will be larger than the retail service area discussed above. See Section 4.3 for further discussion.

1.7 Service Area Agreements

There are currently no service area agreements with adjacent water purveyors. The City of Blaine provides water to BBWSD under a wholesale water supply contract. This contract does not specifically address service area limitations. However, it does obligate the District to require potential customers with property in the Blaine UGA to sign "no-protest" annexation agreements with the City, before the District will certify water availability or provide water service. Also,

Blaine agrees not to assume portions of the District upon annexation, except by separate agreement. This document, or subsequent related document, may address service area issues where the District's boundary and retail service areas extend into Blaine's Urban Growth Area (UGA).

1.8 Service Area Policies

The following are the District's service area policies.

1.8.1 Wholesaling of Water

The District presently does not provide wholesale water supply to other purveyors.

1.8.2 Wheeling of Water

An existing intertie between the Birch Bay system and the Bell Bay Jackson water system could allow wheeling of water to Bell Bay Jackson Water Association if necessary. At the present time this intertie is not active, but is available for use.

1.8.3 Annexation/Service by Agreement

The District Commissioners review requests for annexation, or service outside the District by agreement, on a case by case basis, considering a variety of factors, State and County land use requirements and all other applicable State and County regulations. Factors to be considered when reviewing annexation requests include:

- Location relative to urban growth area
- Contiguity of area with District
- Reasonableness of size and shape
- Present or future system capacity
- Public health and environmental impacts
- Financial impacts

The complete process is addressed in District Code Section 1.12.

For annexation requests from areas in the City of Blaine's UGA and within the District's existing and retail water and/or sewer service areas, the District also considers the following factors:

- Location of area with respect to District's service area and the City's UGA
- City of Blaine's policy regarding water and sewer service with respect to existing residences and this area
- City of Blaine's policy regarding uniform rates or need for separate customer class

- Need for agreements between the District and the City regarding service and finances
- Need for substantial change to the operation and maintenance of the overall system

1.8.4 Direct Connection and Satellite/Remote Systems

The District is not pursuing receivership or management of any satellite or remote water systems at this time.

1.8.5 Design and Performance Standards

Chapters 3 and 7 of this report address the existing system analysis, including design and performance standards. Chapter 3 includes discussion of the minimum service pressure and maximum flow velocity under maximum day and peak hour demand conditions, and for the unusual condition of providing the maximum day demand concurrent with water supply for fire suppression. The District has identified a fire flow target for specific areas around the service area, based on land use designation and other factors. The minimum pressures, maximum flow velocity and fire flow targets are the proposed level of service and the basis for the analysis of the system in Chapter 3, and the projects recommended to address deficiencies as identified in Chapters 3 and 8. Although a higher level of service may be available at a specific location at a specific point in time, such level of service may not be available in the future due to growth, changes in the distribution system or other factors.

1.8.6 Surcharge for Outside Customers

The District's rate schedule includes surcharges for water base and use charges for customers outside the District boundary. The District does provide service to unique customers under the terms of negotiated agreements (e.g. BP).

1.8.7 Formation of Utility Local Improvement Districts (ULIDs) Outside Legal Boundaries

The District does not form ULIDs outside its boundaries.

1.8.8 Urban Growth Area

As discussed under Section 1.6.3, the *Whatcom County Comprehensive Plan* must contain UGA designations. This Plan has been prepared to provide potable water service throughout the Birch Bay UGA, a portion of the Blaine UGA and adjacent rural areas. It is the District's policy that all new developments will be financed by the developer and not be the financial responsibility of the District. However, the District may initiate or participate in projects to install or upgrade general water system facilities which will benefit a portion of the District that has

or is expected to grow. Such projects and expenditures are incorporated in the calculation of the water general facilities charge, paid by all new customers.

1.8.9 Late-Comer Agreements

Latecomer or payback agreements may be executed where a developer or owner has made water service available to the properties of others. Such agreements are completed in accordance with the procedure and documents in the District's *Developer Project Manual*.

1.8.10 Oversizing

As discussed in Section 1.8.8 above, the District may participate in the cost of projects that benefit other or larger portions of the water system. For instance, if a developer is required to install a 12-inch water main rather than an 8-inch main based on the water system plan, the developer would receive credit against the normal water general facilities charges in the amount of the cost of oversizing the water main from 8 to 12-inch. This credit procedure is incorporated in the developer extension process in accordance with the procedure and documents in the District's *Developer Project Manual*.

1.8.11 Cross-Connection Control Program

The District has established a cross-connection control program by Resolution No. 648, June 9, 2005. This resolution was incorporated into the District's Code as Chapter 7.08. The District relies on Premise Isolation and In Premises Protection as defined in WAC 246-290-010 to protect the potable water system.

1.8.12 System Extension

Water system extensions are usually accomplished through the developer extension process or utility local improvement district (ULID) process. Developers are responsible for all costs in developer extension projects, except as noted in Sections 1.8.9 and 1.8.10, and convey the extension to the District for operation and maintenance. ULID project costs are financed by the District which, in turn, assesses the ULID costs to property owners. Design is done in accordance with the District Standards and specifications as outlined in the District's *Developer Project Manual* (see Chapter 7).

1.8.13 Other Service Area Policies

The District will not provide fire flow service without also providing water service, where such water service can be provided (January 22, 1987).

The District will not supply partially treated or potable water for the express purpose of irrigating new golf courses (November 13, 1997).

The District allows property owners to furnish, install and maintain private water pressure booster systems for service in those areas where existing District facilities do not provide the minimum or adequate water pressure. Such service and installation are also subject to the property owner signing an indemnification agreement (March 4, 1998).

The District has a policy allowing provision of both domestic potable water and supply for residential fire suppression sprinkler system through a common line and meter, provided the property owner signs an indemnification agreement (October 24, 2002).

The District has adopted a policy addressing the conditions under which it will consider provision of water service outside its water service area (August 12, 2010).

The District has implemented standards for approval of irrigation plans for new development, including standards for plant selection, soil preparation, irrigation system design and agreement to convert to reclaimed water system in the future (February 9, 2012).

1.9 Satellite Management Agencies

The District is not pursuing receivership or management of any satellite or remote water systems at this time.

1.10 Conditions of Service

The conditions of service are identified in District Code, Title 7 (Water Use Regulations and Fees, see Appendix G) and the *Developer Project Manual*. These conditions are updated from time to time. The responsibility of a purveyor is to provide water service to customers at a point of service, verify customers' compliance with code, collect fees and charges, monitor water quality and plan for adequate water availability. The customer's responsibility is to follow District Code, make payment of fees and charges, participate in conservation practices, be compliant with the cross-connection control plan for the District and State, and notify the purveyor of water quality problems or issues.

Table 1.3 lists the current fees for water system connections.

Table 1.3
CURRENT CONNECTION AND FACILITIES CHARGES

Service Connection charge	Meter-only Charge	District Water General Facilities Charge	City/District Regional Capacity Charge
\$1,175*	\$300*	\$2,970/ELU*	\$854/ELU***

For 3/4" residential service

*Effective January 1, 2009

**Effective January 11, 2018

***Blaine updated its Regional Capacity Charge to \$871.08 in 2018.

The District has not yet adopted the higher value.

ELU = equivalent living unit, per District Code

Latecomer payback provisions and developer extension requirements are further discussed in the District's *Developer Project Manual*. There are currently no consent agreements for inspection, maintenance and repair activities which may disrupt water service.

1.11 Complaints

The District will occasionally get complaints regarding the water system, primarily in regard to taste or odor. Where customer service staff cannot resolve the issue over the phone, such as by explaining that the issue was due to flushing, a recent main break, or a localized issue within the residence, staff will prepare a work order for the Water Department to investigate and document.

Water Department staff will investigate, ensure that the problem is an issue with the distribution system, and if so, resolve the problem by following accepted water system practices and operational procedures. Water Department personnel may contact the customer as necessary to obtain more information or otherwise ensure the problem was resolved. District personnel may also make contact with customers in regard to education and tests at the residence, including chlorine residual, turbidity (clarity), pH, hardness, and pressure tests.

While District personnel are strongly discouraged from going on private property, in rare cases, such as numerous and frequent water quality complaints at the same residence, personnel may ask the resident's permission to look around within the residence more closely to help them identify a potential source of the problem, such as under-sink filters, faucet screens, and hot water heaters. The primary purpose of such a visit is to ensure that the problem is a localized issue within the residence, and not a distribution issue. Water Department personnel are not allowed to correct or fix any problems on the customer's side of the water service. An educational handout (see sample in Appendix H) in regard to water

complaints, causes, and correction suggestions is also available for all personnel and customers.

For the period 2008–2017, the District received about 82 documented complaints (about nine per year on average).

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WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
95904 U	BIRCH BAY WATER & SEWER DISTRICT	WHATCOM	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)		6206	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or more per year)	2475		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	2194		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	480		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	615		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	922		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	45	45	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	55	55	
	28. TOTAL SERVICE CONNECTIONS	6306	

29. FULL-TIME RESIDENTIAL POPULATION
A. How many residents are served by this system 180 or more days per year? 6798

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?	24	28	776	642	1383	1747	2865	2534	1663	563	563	1018
B. How many days per month are they present?	31	28	31	30	31	30	31	31	30	31	30	31

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?	10	10	15	35	90	675	1605	1025	45	20	25	75
B. How many days per month is water accessible to the public?	31	28	31	30	31	30	31	31	30	31	30	31

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?	520	520	520	520	520	520	520	520	520	520	520	450
B. How many days per month are they present?	22	22	22	22	22	22	22	22	22	22	22	22

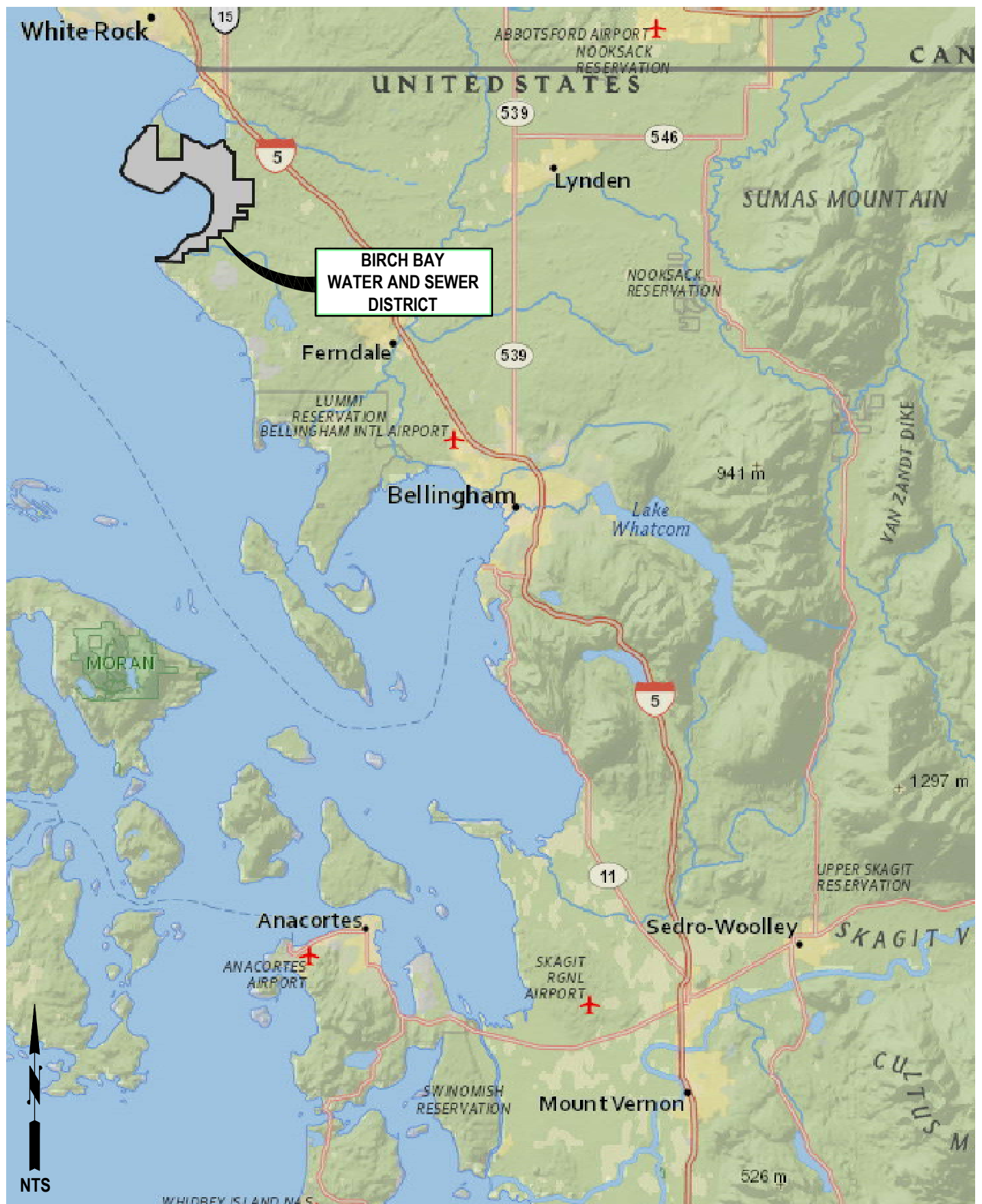
33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	8	8	9	9	10	10	10	10	10	9	9	9

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

35. Reason for Submitting WFI:
☐ Update - Change
 ☐ Update - No Change
 ☐ Inactivate
 ☐ Re-Activate
 ☐ Name Change
 ☐ New System
 ☐ Other _____

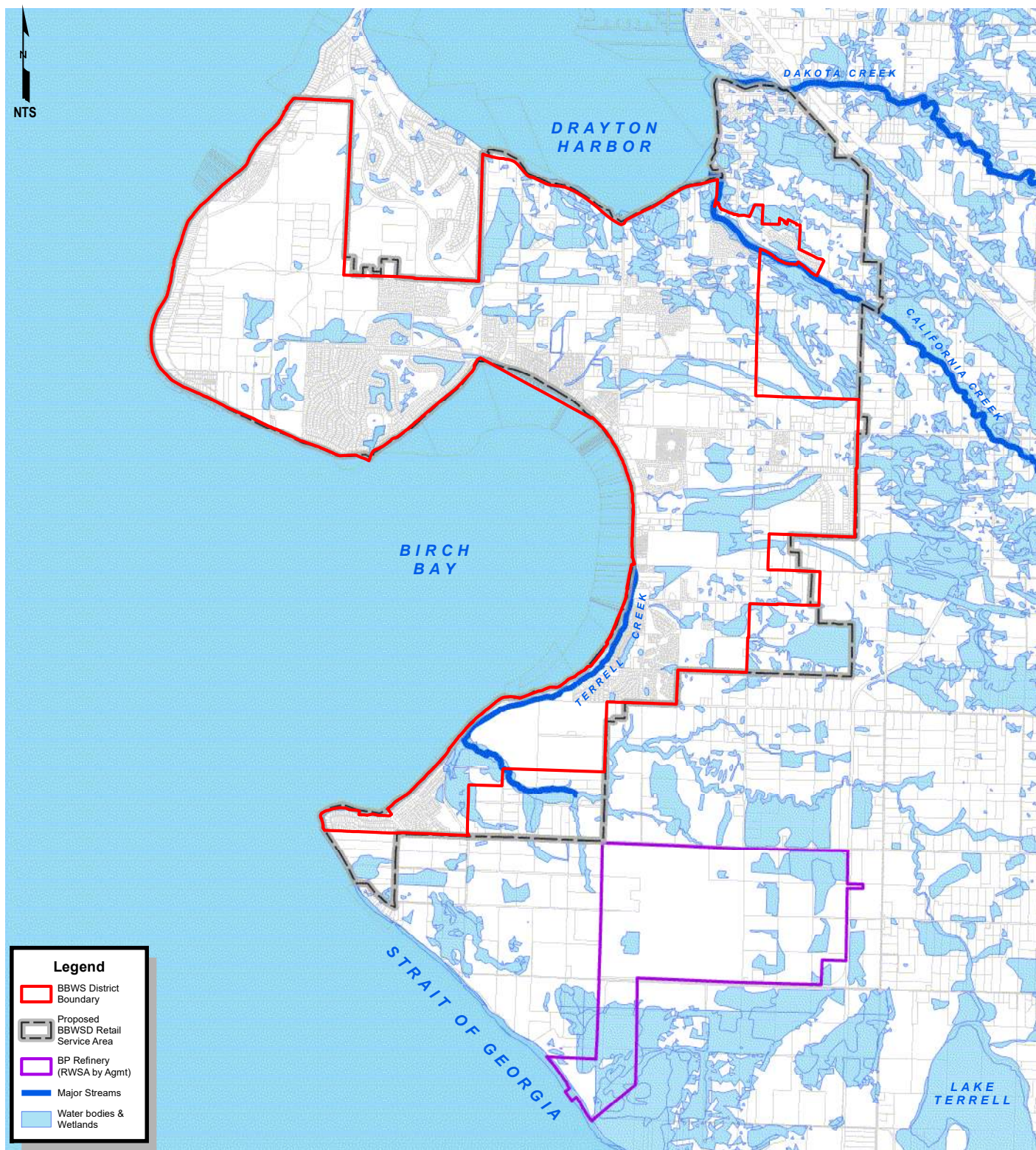
36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: _____	DATE: _____
PRINT NAME: _____	TITLE: _____



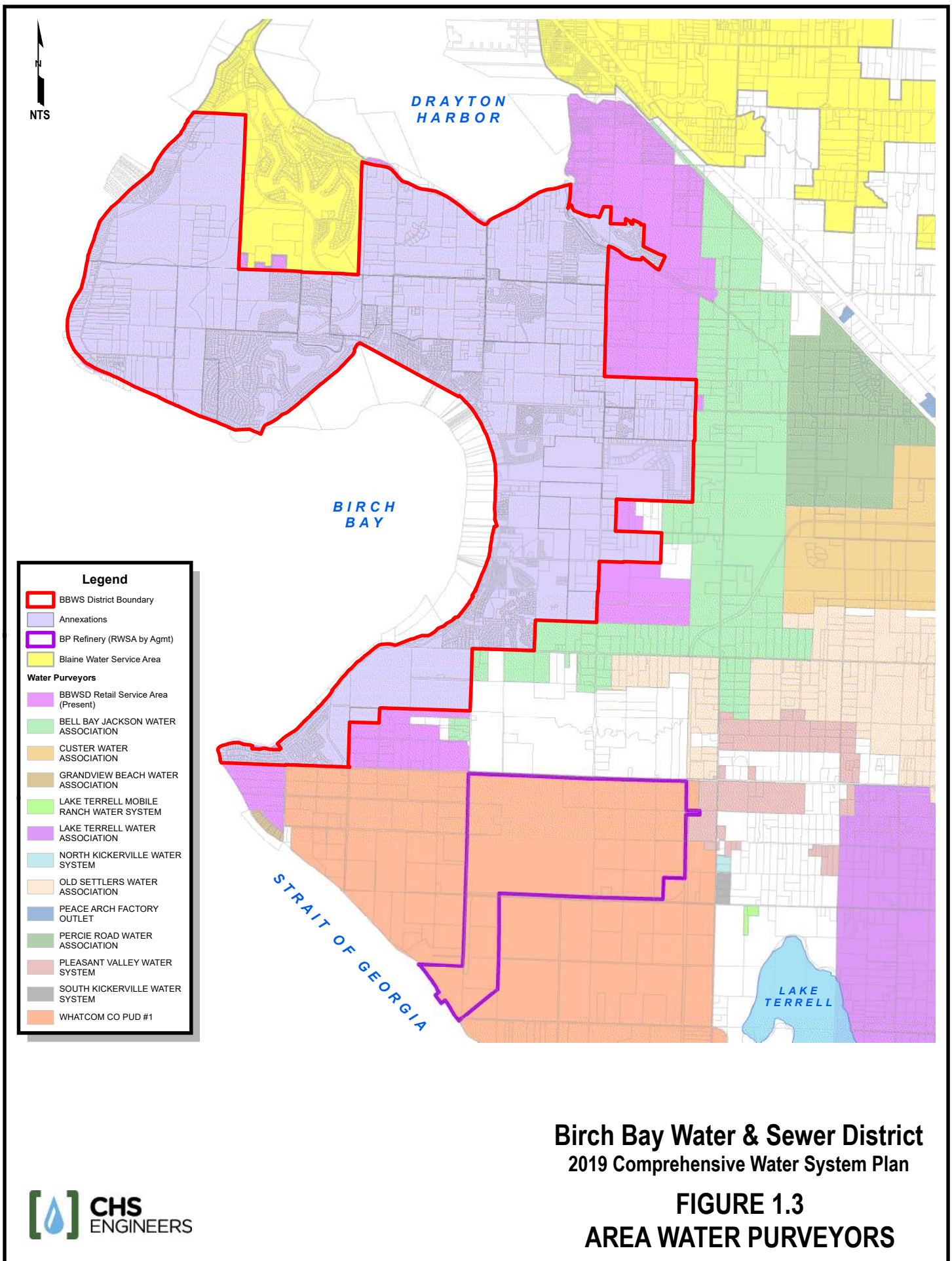
Birch Bay Water and Sewer District
2019 Comprehensive Water System Plan

FIGURE 1.1
LOCATION MAP

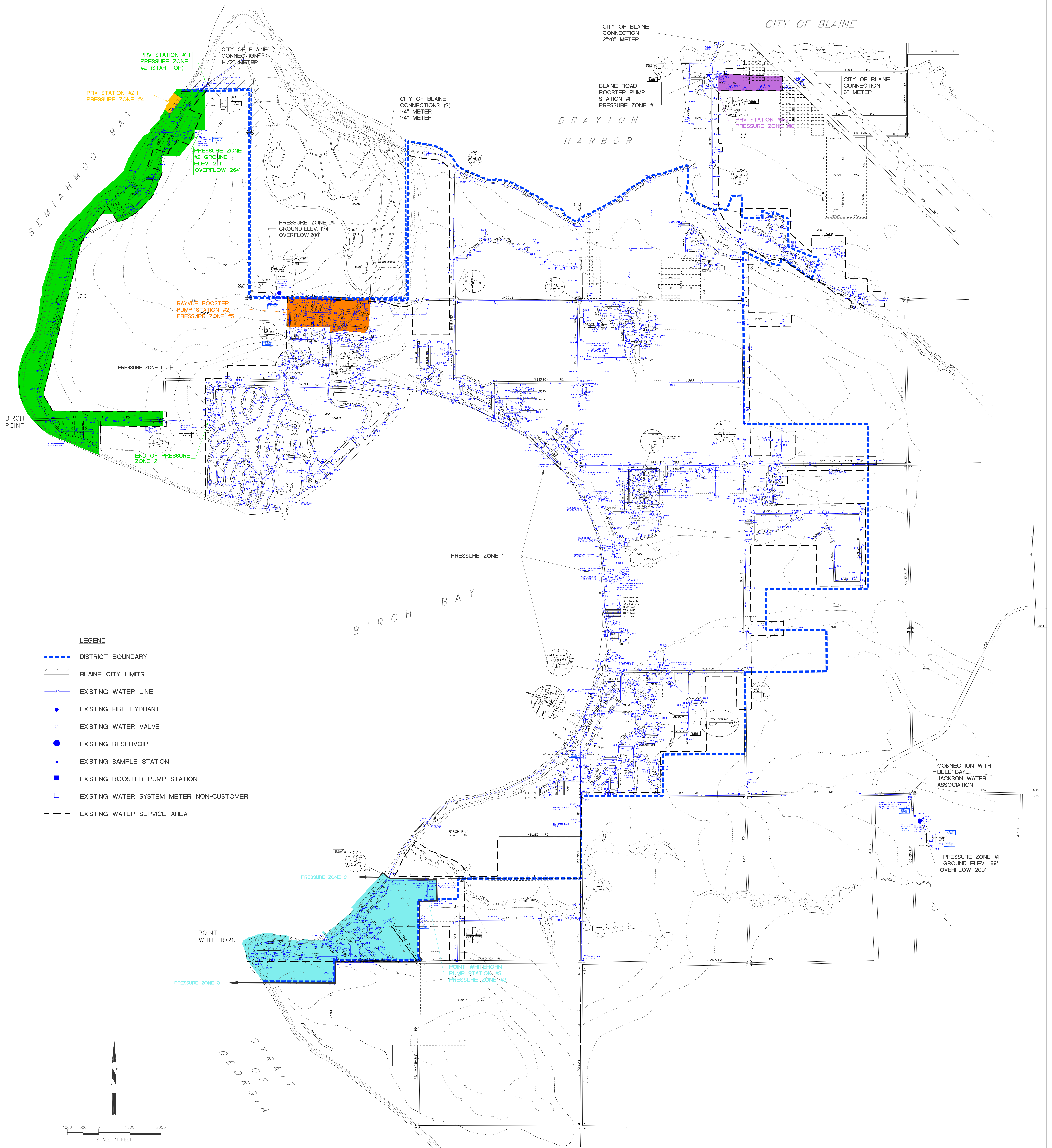


Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

FIGURE 1.2
WATER BODIES



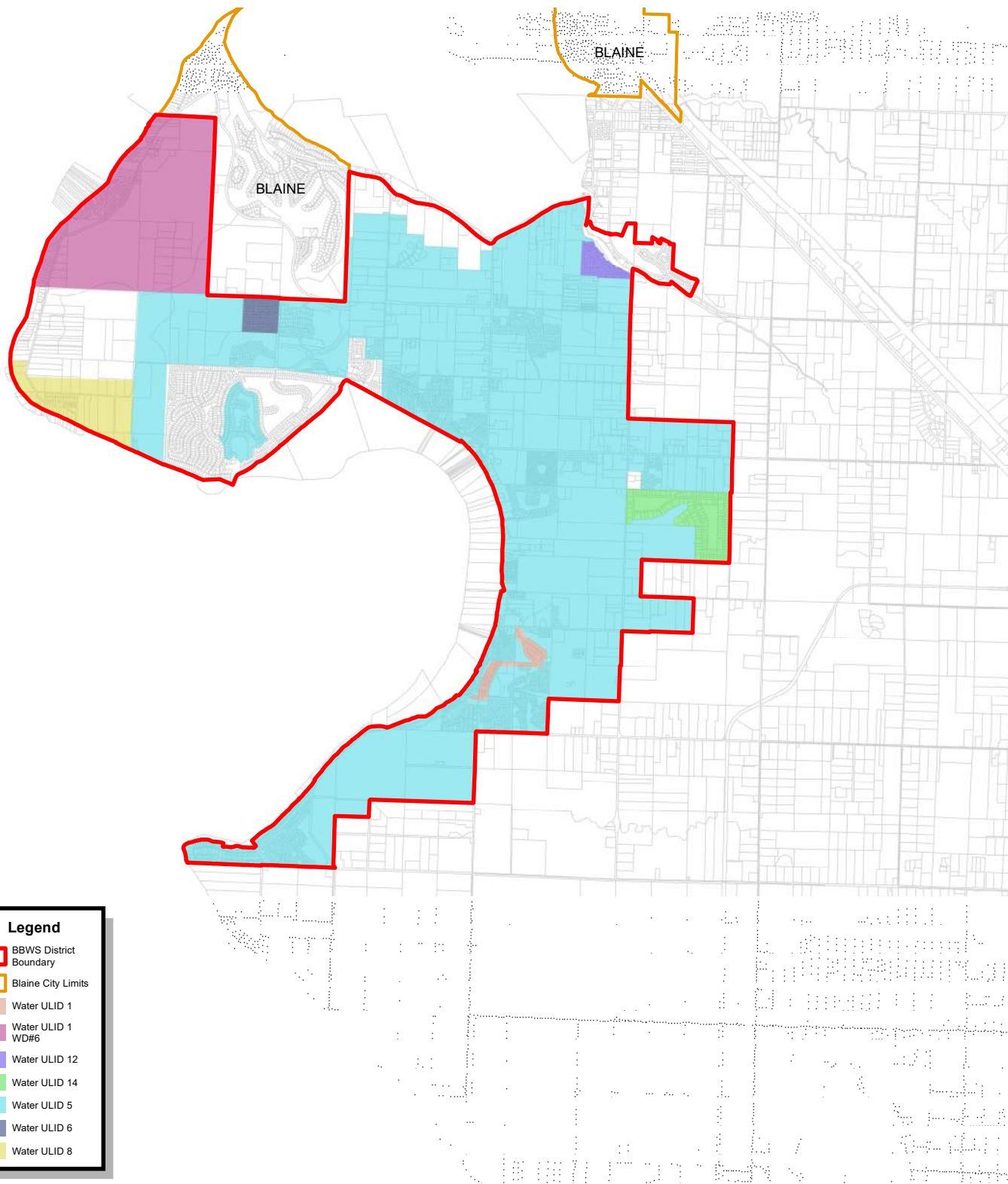
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Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

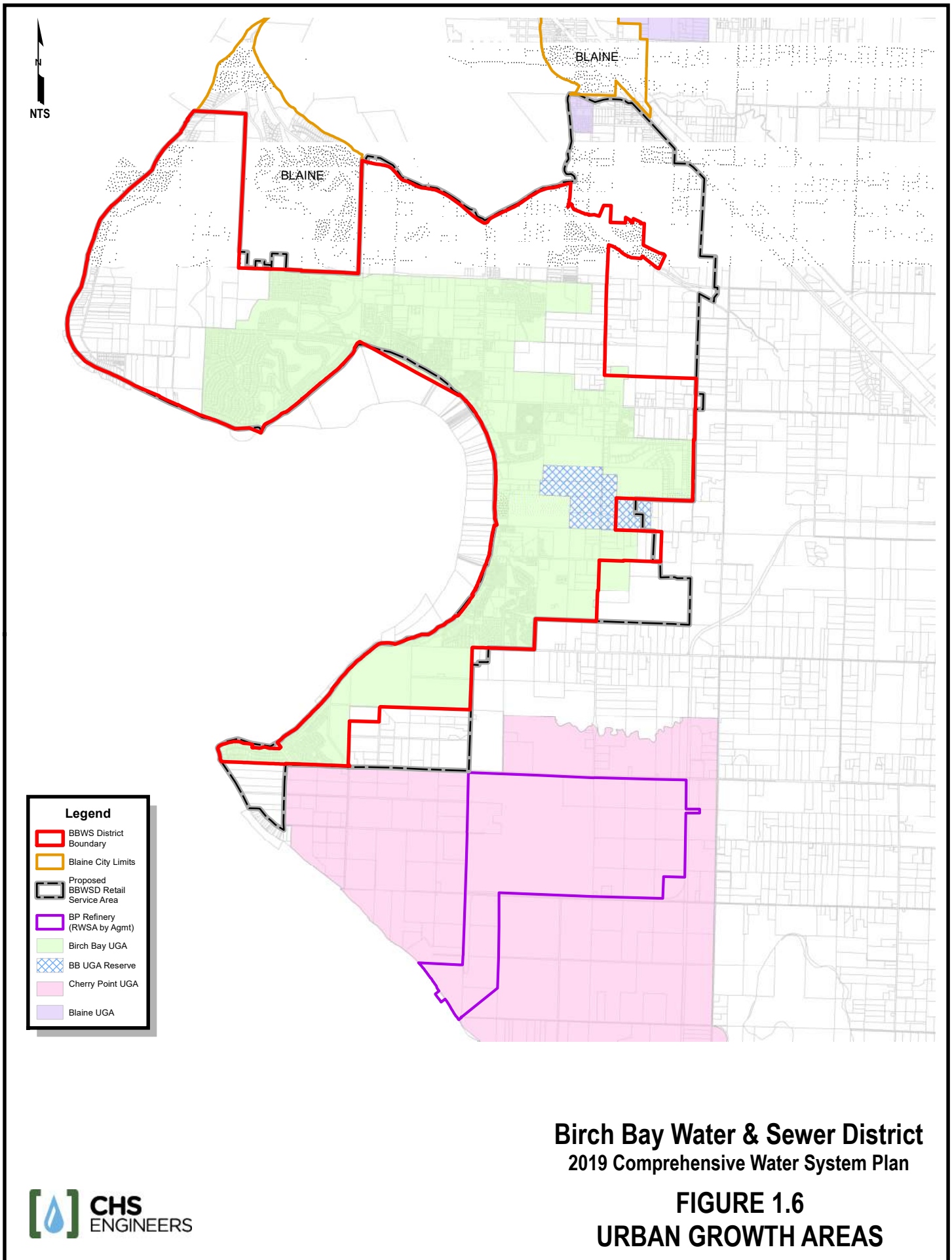
FIGURE 14

EXISTING WATER SYSTEM



Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

FIGURE 1.5
WATER ULIDs



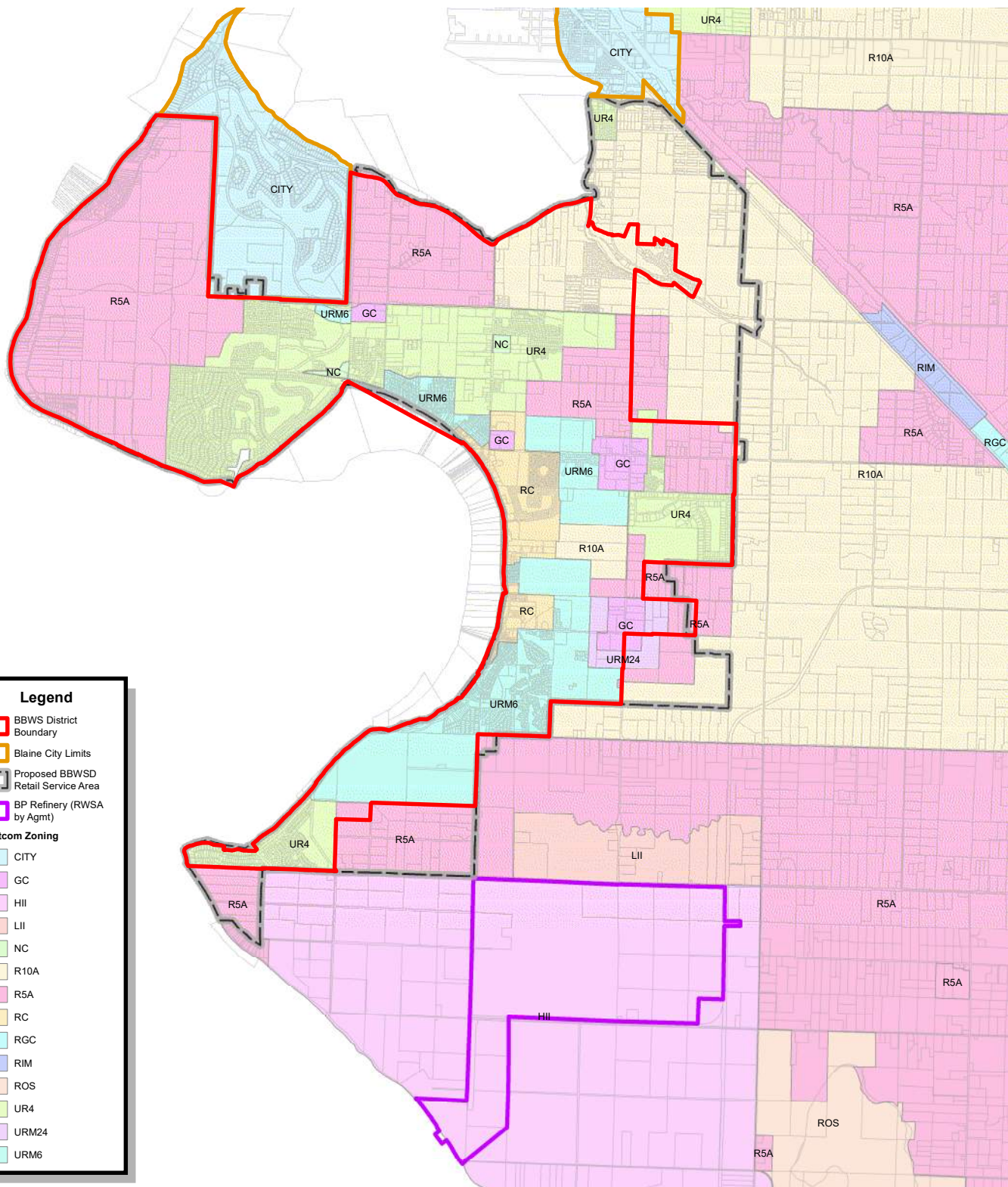


Legend

- BBWS District Boundary
- Blaine City Limits
- Proposed BBWS Retail Service Area
- BP Refinery (RWSA by Agmt)

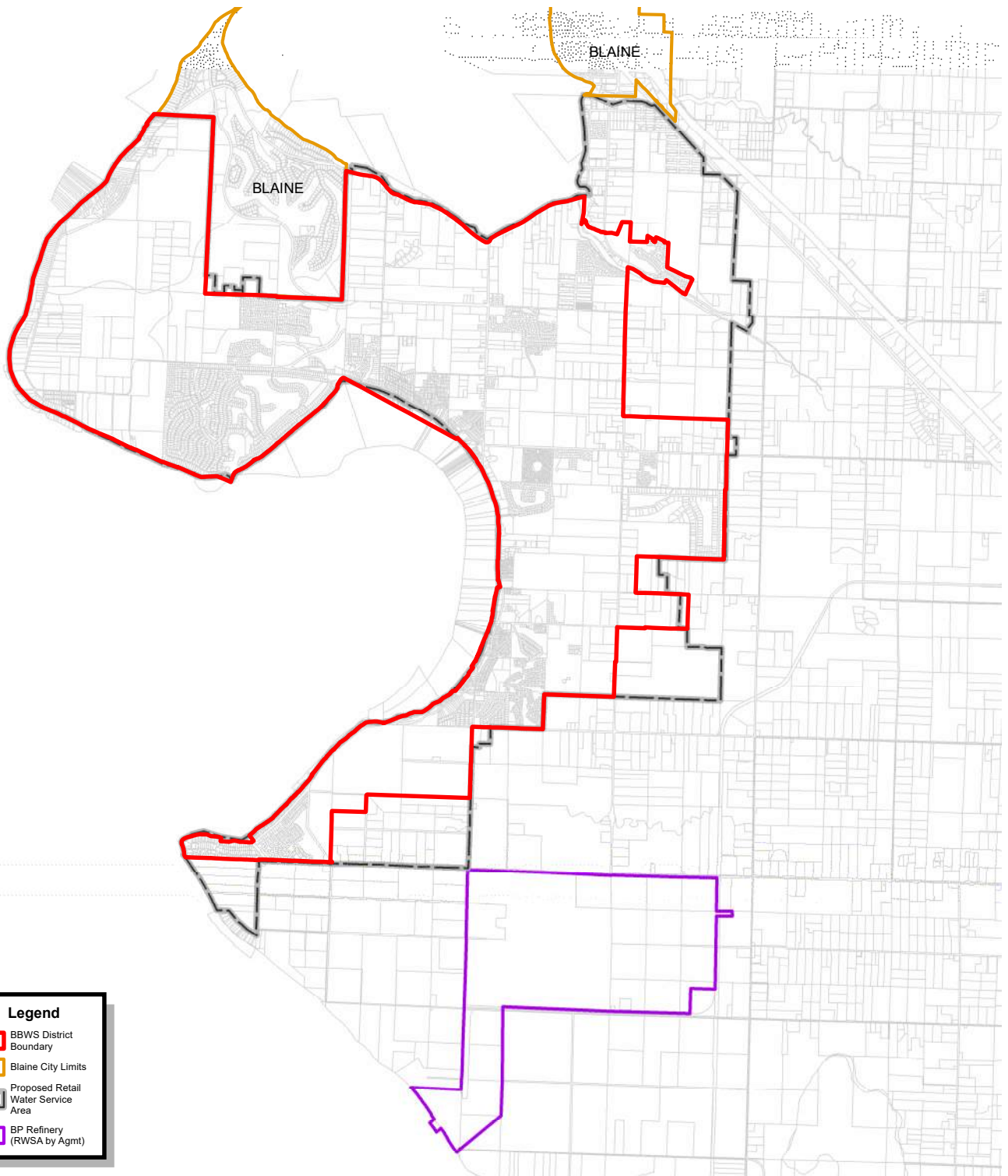
Whatcom Zoning

- CITY
- GC
- HII
- LII
- NC
- R10A
- R5A
- RC
- RGC
- RIM
- ROS
- UR4
- URM24
- URM6



**Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan**

**FIGURE 1.7
ZONING DISTRICTS**



Legend

- BBWS District Boundary
- Blaine City Limits
- Proposed Retail Water Service Area
- BP Refinery (RWSA by Agmt)

Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

FIGURE 1.8
RETAIL WATER SERVICE AREA

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CHAPTER 2

BASIC PLANNING DATA AND WATER DEMAND FORECAST

In order to project water supply needs for a system over a given period of time, it is necessary to establish a reasonable estimate of the system demand. This can be accomplished in most service areas by a study of the historic and projected population trends and land use. This chapter presents historical population and water use data with population estimates and future water usage forecast based on current land use designations.

This chapter also describes elements of the District's Water Use Efficiency (WUE) Program. The WUE Program has been prepared in response to the requirements of WAC 246-290 and the DOH *Water Use Efficiency Guidebook* (WUE Guidebook, 2011), issued per the requirements of the 2003 Municipal Water Law. In particular, data collection, distribution system leakage and demand forecasting are presented in Chapter 2. Other elements of the District WUE Program are presented in Chapters 3, 4 and 9. The District's first WUE Program was prepared and approved by the District in January 2008, updated in 2014 and updated concurrent with this Plan (see Chapter 4 and Appendix I).

2.1 Current Population, Service Connections, Water Use and ERUs

Population changes occur naturally or by migration. Natural changes are those resulting from births or deaths; migratory changes are those resulting from the movement of people into or out of an area. The varieties of factors which influence such changes are innumerable.

Perhaps the factors which have the most impact on natural population changes are economic conditions, social attitudes and medical technology. With improved economic conditions and medical care, people tend to live longer and, until recently, have had more children. In the past few years, however, with a change in social attitudes, the natural birth rate has been decreasing even though economic conditions generally have been good.

The dominant influences acting to produce migratory change are economic conditions, transportation and climate. The desire for better economic opportunity or a more suitable climate results in moves of relatively long distances, such as from one state to another or from one region to another. The adequacy of transportation facilities is a factor in the rather localized migration of people seeking desirable locations in which to reside.

Migratory change in the Birch Bay area is probably more affected by economic conditions than in most communities. Because the area is a second home or vacation spot for most of the seasonal population, economics play an important

role in their ability to come to Birch Bay. In making the forecasts for the area, a continued, stable economic picture for the Pacific Northwest is assumed.

Birch Bay is situated between two large metropolitan areas, Vancouver, B.C., a little over half an hour north, and the Seattle area, about two hours south by automobile. With the continued growth of these two areas, there will be an increasing demand for recreational facilities. Birch Bay, with its unique recreational resources, should continue to serve a good share of this demand.

At this time, Birch Bay's recreational industry is mainly a summer industry. It would seem reasonable to assume that as the area continues to develop, there will be more activities to attract people on a year-round basis. This would establish a stronger economic base and promote new development.

The industrial area southeast of Birch Bay should contribute to a stable year-round economic base for the area. Assuming that a portion of the people involved with the industries establish permanent homes in the area, other businesses such as food stores and miscellaneous shops will also be needed to support these new residents.

Residential development of the Birch Bay area is expected to continue over the next twenty years, also increasing the permanent population. In view of the changes taking place in the area, Birch Bay should continue to grow as a recreational and residential area as well as broaden its economic base.

2.1.1 Current Population

From 2000-2010, Whatcom County's population grew by 20.6% with an annual growth rate of 1.9%. The population of Whatcom County in 2010 was 201,140. Whatcom County significantly updated their Comprehensive Plan in 2016. As part of that process, the County commissioned a population and employment projection: Whatcom County Population and Employment Projection and Urban Growth Area Allocations, Phase I Technical Report (Revised November 1, 2013) by BERK (hereafter referred to as the BERK Report). The BERK Report analyzed the Washington Office of Financial Management (OFM) May 2012 population forecasts, which projected Washington State and Whatcom County population out to 2040. The purpose of the evaluation was to provide information relating to Whatcom County population distribution between UGAs and Rural areas. The BERK Report studied OFM's low, medium and high projections versus the actual growth from 1970 to 2010. Actual average annual growth between 2000 to 2010 was 1.9% for the County. They further projected alternative low (1.1%) and high (1.5%) future growth rates, while holding the medium projection the same as OFM at 1.3% for Whatcom County.

The BERK Report presents the historical average annual growth rate of the Birch Bay UGA as 6.4% for the period 1990-2010. Between 1990-2000 the average annual growth rate was 6.9% and between 2000-2010 the average annual

growth rate was 5.9%. These estimates were based on the 2013 UGA boundary, not the previous, larger UGA boundary. From 1990-2010, the Birch Bay UGA had the second highest share of growth (7.2%) in the city and unincorporated UGAs in the County, outside of Bellingham. From 2000-2010, the Birch Bay UGA had the highest share (9.4%) of growth (not including Bellingham).

The District measures its growth in terms of water and sewer system connections and equivalent living unit (ELU's) totals for each system. The average annual increase in water ELU's from the end of 1990 thru 2000 was 3.3%. From 2001 through 2010, the average annual increase in water ELU's was 2.6% and from 2011 through 2014, the average annual increase in water ELU's was only 0.53%. The District experienced significant development activity in the early part of this century, but that rate of new lot preparation has dropped sharply.

Because Birch Bay is both a permanent residential and resort community, estimating and forecasting population is difficult and subject to significant fluctuations depending, to a large degree, upon economic and climatic conditions.

The geographic area for the population figures presented in this WSP is the District's water service area as indicated on Figure 1.3. The estimated population for the service area is presented in Table 2.1. The population for the Birch Bay UGA is from the BERK Report as adjusted and reported in the March 2015 Draft EIS. The 2013 population and housing units count for the subareas was determined from GIS data provided by Whatcom County. The 2013 average household population density in the Birch Bay UGA was approximately 1.43 and the average for the water service area was 1.49.

Table 2.1
POPULATION ESTIMATE

Area	1990	2000	2010	2013	2013 Housing Units
Birch Bay UGA ¹	2,141	4,163	7,391	7,540	5,257
UGA Reserve Area	(4)	(4)	(4)	36	12
City of Blaine ²	(4)	(4)	(4)	2	3
Blaine UGA ³	(4)	(4)	(4)	36	22
Rural lands	(4)	(4)	(4)	1,196	601
Total - Water Service Area	2,141	4,163	7,391	8,810	5,895

1 - Birch Bay UGA as defined as of 2013. Population figure for Birch Bay UGA per the BERK report, 11/13, as adjusted by County Draft EIS, 3/15.

2 - Area in Blaine City Limits south of Semiahmoo development.

3 - Area in Blaine UGA south of Dakota Creek.

4 - For 1990, 2000 and 2010, population in the remaining subareas was not determined.

2.1.2 Total Service Connections

The District has kept accurate metered (production and consumption) water use records for many years and uses that information to establish consumption trends and forecast District water demands. The District classifies customers into approximately 26 different groups, such as single-family residences, commercial, RV parks, etc. and monitors water use within each customer class. These 26 groups are combined into four different customer classes: single-family residential units, multi-family residential units, commercial, and other, which includes wholesale large water users and other miscellaneous account types. The District does have several hobby farms within their service area but these are not considered agricultural connections. The large water user subcategory includes several water customer accounts that could be considered commercial accounts but were included in the “other” category because of their high water usage (irrigation-commercial, irrigation-residential, marina/swimming pool/water park). Specific discussion as to how the District is working with these customer types is in Section 2.2.3.

As of the end of 2018, the District had approximately 5,292 meters serving all the District’s water accounts (Table 2.2). ELUs are identified by the District for each customer class (see Section 2.1.4 for further discussion). Only the BP Refinery and Bell Bay Jackson Water Association are considered non-residential/wholesale connections and ELUs have not been calculated for these customers.

Using 2013 estimated residential population (Table 2.1) and 2013 ELU count for single and multi-family residential customers (7,078), the estimated residential population density is 1.24 persons per ELU.

Table 2.2
TOTAL SERVICE CONNECTIONS AND ELUs

Customer Class	Number of Meters	Number of Equivalent Living Units (ELUs)
Single family residential	4,607	4,626
Multi-family residential	539	2,761
Commercial	92	175.5
Other	54	86
Total	5,292	7,649

As of December 31, 2018

2.1.3 Water Use Data Collection

DOH requires that public water systems collect water use data for use in forecasting demand, system planning, evaluating conservation program success and other objectives (WUE Guidebook). Birch Bay is collecting data as summarized in Table 2.3.

Birch Bay currently purchases all of its water from the City of Blaine. The District keeps daily and weekly readings of the volume of water delivered to their system from the City of Blaine. Both the non-revenue and revenue water volumes are calculated on a monthly basis using daily, weekly and bi-monthly readings. Service meter readings are done on a bi-monthly basis and averaged over the two-month period of service. All five City of Blaine interties are metered and readings are taken bimonthly or more often as data is needed. Only one emergency intertie is physically connected at this time.

Table 2.3
WATER USE DATA COLLECTION

Type of Data	Units of Measurement	Notes
Source of Supply Meter Readings	Cubic feet	Read daily; reported monthly and annually
Interties-amount imported	Cubic feet	Read monthly or more often depending on usage
Wholesale-amount purchased	Cubic feet	Read daily; reported monthly and annually
Peak Day/Peak Month	Cubic feet	Determined annually
<i>Non-Revenue Water</i>		
Distribution System Leakage	Cubic feet	Calculated monthly
Authorized Consumption	Cubic feet	Measured bi-monthly, monthly totals estimated
<i>Service Meter readings</i>		
Single-family	Total cubic feet used by this customer class	Measured bi-monthly, monthly totals estimated
Multi-family	Total cubic feet used by this customer class	Measured bi-monthly, monthly totals estimated
Commercial/Government/Industrial	Total cubic feet used by this customer class	Measured bi-monthly, monthly totals estimated
Interties-amount exported	Cubic feet	Read monthly or more often depending on usage
Wholesale-amount sold	Cubic feet	Measured bi-monthly, monthly totals estimated
Population serviced	ERUs and connections	Population varies seasonally-ERUs and connections tabulated monthly
Economic data	Rates reviewed annually for each customer class	Existing water rates for each customer class
WUE Program		Annual report prepared by District Water Conservation Specialist

The District has always metered each point of supply. The District implemented a detailed water use monitoring program beginning in 1998 to calculate and monitor daily water usage and storage volumes. Beginning in May 1998, the District began to read the meter at Blaine Road on a daily basis. The Birch Point meter is read daily via telemetry. The additional Blaine interties are also metered and can be read daily as needed. The water level is monitored continuously at the three reservoirs. From the daily supply data and the change in volume of water in storage, the demand for water in the system can be calculated each day and estimated hourly.

All water connections served by the District have been metered since time of original connection. Multiple unit accounts such as RV parks, mobile home parks, apartments, condos, timeshare condos, and platted associations built after May 1994 are required to be individually metered. The District has divided their service area into eight sections or billing cycles, made up of 17 “books” or “routes”. The meters in each section are read once every two months. The District then bills all the customers in that section. This allows the District to more evenly distribute the meter reading and billing workload as well as the revenue coming into the District over a two-month period.

Prior to 2008, the District compared the volume of water delivered to the District to the monthly consumption records from service meters to determine the volume of water that was accounted and unaccounted for on a monthly basis. The difference between the volume of water purchased and the amount used (metered to customers) in any given month was designated as “water lost.” Beginning in 2008, the District began measuring “distribution system leakage” (DSL) per Appendix D of the WUE Guidebook. Total volume purchased and sold is noted as before. Other authorized uses are estimated, including flushing, firefighting and training, sewer cleaning, meter rental, etc. The total authorized usage volume is compared to the total volume purchased to determine percentage and volume lost on a monthly and annual basis.

The District also collects additional data not required by DOH. This information is useful in further implementing the District Water Conservation Plan that was first developed in 1991. The District determines the maximum summer month and peak week demand during the months of June through September. Precipitation totals and temperatures for each day are also recorded. This information can be used by the District for estimating peak water demands during the summer months under various weather conditions, and for evaluating the effect of climate on peak and summer water usage.

Figure 2.1 summarizes the historical water use for the District since 1970. The summer average use is defined as the average water volume used from June through September each year. Water use data is summarized in Appendix D, including the annual volume used by customer class.

2.1.4 Equivalent Residential Units

The District establishes the number of ELUs for each service connection based on the type and quantity of residential living units, estimated daily water use, meter size, plumbing fixture units or other factors. In this Plan, ELUs are converted to the estimated number of equivalent single family residential units that the District could serve, in accordance with DOH planning requirements. The basis of the conversion is the amount of water used by a single-family residence in this water system. An equivalent residential unit (ERU) is defined as the unit of measure to equate non-residential or multi-family residential water use to a specific number of single family residences.

The District serves a mix of full-time and part-time residences and this has been the case since the formation of the District. Anecdotal evidence suggests there is a general trend to a higher percentage of full-time residents over time, and there is no specific indication that the rate of change will increase significantly. However, the District is not able to reliably identify which customers are full-time or part-time. Therefore, there is no distinction between full or part-time residences in determining the water use of one ERU in this system.

The District's water use data for single family residences for the past nine years was evaluated. The average day demand (ADD) for single family residences was determined for each year in the period 2006 through 2017. The ADD per residential connection ranged from 103 (in 2013) to 125 (in 2006) gallons per day (gpd). Since 2013, the value has been between 106 and 114 gpd.

The value of 120 gpd/ERU was selected as the ADD for Birch Bay. The previous plan used 126 gpd/ERU. This value was then used to determine the equivalent number of residential units for multi-family, commercial and other customer classes. For example, assuming the condominium/park model trailers customers used 2,000,000 cubic feet of water in a given year, there would then be 342 ERUs in that customer category that year. The total number of ERUs for the past nine years is presented in Table 2.4.

The customer classes indicated in Table 2.4 will be used for demand forecasting. There is significant variability in the number of ERUs in the non-residential classes. This is due to variables such as the local and Canadian economy, precipitation and temperature in the summer months and other factors. The maximum number of ERUs during the past three years for the single-family residences was used as the baseline for the demand forecast. The number of ERUs were calculated by customer category, rather than customer class, because of the similarities in water use between other customers in the same category.

The water use records were reviewed and ADD system-wide was determined as well as the maximum day demand (MDD in gpd). The ratio of MDD/ADD was

determined for each year since 1990. The data is summarized in Table 2.5. The ratio used in this plan was determined by reviewing the three average numbers indicated at the bottom of Table 2.5. The historical data in Table 2.5 presents an effective MDD/ADD ratio. The highest ratio was 2.37 in 2015. As evident from review of Table 2.5 and Figure 2.1, the peak use that year was an anomaly. Over the past 10 years the ratio has exceeded 2.0 four times, and the second highest was 2.10. The three-, five-, and ten-year averages are very similar. The data for 2010 (MDD/ADD of 2.10) was selected as the basis for the ratio to be used in the demand forecast. The forecast was developed based on growth in ERUs, use per ERU and distribution system leakage as a constant annual average amount. To replicate the actual MDD value for 2010, a forecast MDD/ADD ratio (each without distribution system leakage) of 2.19 was selected.

The Peak Hour Demand (PHD) expressed in gallons per minute (gpm) is determined with an equation developed by DOH: $(MDD/1440)[(C)(N)+F] + 18$. The factor "C" is 1.6 and "F" is 225, for systems with more than 500 ERUs. N is the number of ERUs. The resulting ratio of PHD to MDD, with appropriate unit conversion is approximately 1.65. The ratio drops to 1.64 in year 2020, then 1.63 in 2031.

Table 2.4
ERUs BY CUSTOMER TYPE FOR 2009-2017

Customer Class	2009	2010	2011	2012	2013	2014	2015	2016	2017
Single-family residential	4,561	4,489	4,523	4,537	4,580	4,528	4,528	4,528	4,786
<i>Residential ADD per ERU (gpd)</i>	<i>120</i>	<i>120</i>	<i>120</i>	<i>120</i>	<i>120</i>	<i>120</i>	<i>120</i>	<i>120</i>	<i>120</i>
Multi-family residential	1,643	1,340	1,334	1,406	1,409	1,416	1,212	1,123	1,247
Commercial	182	165	152	162	187	189	181	182	180
Other*	682	626	572	493	465	437	532	549	515
Total	7,067	6,620	6,580	6,598	6,641	6,569	6,453	6,382	6,729

All ERUs are based on 120 gpd/ERU ADD.

*Includes wholesale, large water users, Birch Bay Water and Sewer District and low water users/inactive connections.

Table 2.5
WATER DEMAND FOR 1990-2018

Year	ADD (gpd)	MDD (gpd)	Ratio MDD/ADD
1990	510,378	1,500,000	2.94
1991	516,038	1,433,000	2.78
1992	520,046	1,275,000	2.45
1993	632,169	1,115,000	1.76
1994	683,186	1,470,000	2.15
1995	625,576	1,360,000	2.17
1996	678,475	1,647,000	2.43
1997	643,565	1,390,000	2.16
1998	675,237	1,375,000	2.04
1999	660,316	1,220,000	1.85
2000	641,196	1,531,000	2.39
2001	656,191	1,379,000	2.10
2002	711,473	1,335,000	1.88
2003	756,255	1,522,000	2.01
2004	820,357	1,634,000	1.99
2005	836,223	1,704,183	2.04
2006	884,177	1,857,000	2.10
2007	895,692	1,933,000	2.16
2008	890,768	1,769,823	1.99
2009	917,227	1,845,594	2.01
2010	826,090	1,737,403	2.10
2011	766,875	1,496,222	1.95
2012	761,713	1,548,496	2.03
2013	776,260	1,508,320	1.94
2014	804,684	1,523,472	1.89
2015	847,418	2,010,777	2.37
2016	850,552	1,548,080	1.82
2017	855,110	1,587,872	1.86
2018	853,335	1,619,440	1.90

3-yr average	852,999	1,585,131	1.86
5-yr average	842,220	1,657,928	1.97
10-yr average	825,926	1,642,568	1.99

(1) Flows are in gallons per day (gpd), ADD is Average Day Demand, and MDD is Maximum Day Demand.

(2) Annual volumes obtained from source meters.

(3) Peak day volumes (MDD) estimated from pump station flows and change in tank levels.

(4) Three-year average is over the years of 2016 through 2018.

(5) Five-year average is over the years of 2014 through 2018.

(6) Ten-year average is over the years of 2009 through 2018.

2.2 Projected Land Use, Future Population and Water Demand

The projection of future water demands is a key element in the water system planning process. It determines the timing and sizing of required facilities. Typically, this projection is based on population projections converted to water demand on an ERU basis. Although adequate for planning purposes in typical urban or rural areas, forecasting future population is difficult in an area such as Birch Bay due to high seasonal population fluctuations during the summer.

The District is required to prepare two demand forecasts as part of its WUE Program, one with and one without anticipated savings from the WUE Program and water conservation measures. If a purveyor serving more than 1,000 connections does not implement all cost-effective WUE measures it has evaluated, a third forecast is required. The District has implemented all evaluated measures (see Chapter 4) so only two forecasts are required. The two forecasts presented herein are distinguished as “without additional projected savings” and “with additional projected savings.”

2.2.1 Projected Land Use

Whatcom County has jurisdiction over land use and zoning in unincorporated areas of the County such as Birch Bay. Land use policies and requirements are discussed in further detail in Section 1.5.2.

Retail Water Service Area

The existing water service area and the retail service area are discussed in Section 1.5.1 and 1.6 of this Plan.

2.2.2 Projected Population

The BERK Report presents the population allocation by growth area for the low, medium and high projections for the period from 2013 to 2036. The county-wide low projection of 1.1% average annual growth results in an average annual growth rate of 2.3% for the Birch Bay UGA. Outside of the unincorporated UGAs, average annual growth is projected as 0.8%. For the county-wide medium projection of 1.3% average annual growth, the report suggests a 2.7% average annual growth for the Birch Bay UGA and 1.0% for the areas outside the UGAs. For the county-wide high projection of 1.5% average annual growth, the report suggests Birch Bay UGA with an average annual growth rate of 3.2% and 1.2% for areas outside the UGAs.

Population projections for the District presented in Table 2.6 are based on the County Draft EIS (March 2015) 2013 population in the Birch Bay UGA of 7,540. Whatcom County previously adopted Resolution 2014-013 with a population increase for the Birch Bay UGA of 5,500 for the period 2013 to 2036. However, the County Council subsequently reduced the Birch Bay UGA growth population allocation from 5,500 to 5,282 (by motion, May 10, 2016 meeting). Using these numbers, an average annual growth of 2.3353% was applied for the period 2013 to 2036 for the Birch Bay UGA to achieve the County UGA target population. An average annual growth was applied to the small areas of water service in the City of Blaine and City of Blaine UGA population numbers from Table 2.1.

For areas outside of the UGA, a growth projection of 0.822% is used in Table 2.6. The growth rate used was the same ratio above the BERK Report's low projection used in the UGA calculations, based on the allocation by resolution in 2014. The BERK Report has a low growth projection of 0.8% and a medium growth projection of 1.0%.

The water demand forecast extends through year 2038. An urban area growth rate of 1% has been applied for the Birch Bay and Blaine UGAs for years 2037 and 2038. This factor presumes some potential infill or rezoning in the present UGAs. The 2013-2036 rural-area growth rates are extended through year 2038.

The County, as part of its *Comprehensive Plan* update process in 2016, considered adding the UGA Reserve Area along Blaine Road to the Birch Bay UGA. Ultimately the County Council decided to retain the UGA Reserve Area as is and reduce the population allocation for the Birch Bay UGA to 5,282. Therefore, growth in the UGA Reserve Area is forecast as for other Rural lands.

The population projections in Table 2.6 have been provided to show anticipated population growth within the Birch Bay water service area thru the year 2038. It is anticipated that about 95% of the growth in population and in water demand will occur within the Birch Bay UGA (see Figure 1.6).

Table 2.6
WATER SERVICE AREA POPULATION PROJECTION

Area	2013	2015	2016	2017	2018	2019	2020	2021	
Birch Bay UGA ¹	7,540	7,896	8,081	8,269	8,462	8,660	8,862	9,069	
UGA Reserve Area ²	36	37	37	37	38	38	38	38	
City of Blaine ³	2	2	2	2	2	2	2	2	
Blaine UGA ⁴	36	38	39	40	41	42	43	45	
Rural Lands	1,196	1,216	1,226	1,236	1,246	1,256	1,267	1,277	
Total Water Service Area	8,810	9,188	9,384	9,585	9,789	9,999	10,213	10,432	
Area	2022	2023	2024	2025	2026	2027	2028	2033	2038
Birch Bay UGA ¹	9,281	9,498	9,720	9,947	10,179	10,417	10,660	11,964	13,080
UGA Reserve Area ²	39	39	39	40	40	40	41	42	44
City of Blaine ³	2	3	3	3	3	3	3	3	4
Blaine UGA ⁴	46	47	48	50	51	52	54	62	68
Rural Lands	1,287	1,298	1,309	1,319	1,330	1,341	1,352	1,409	1,468
Total Water Service Area	10,656	10,885	11,119	11,358	11,603	11,853	12,110	13,480	14,663

1 - Birch Bay UGA as defined as of 2016. Population figure for Birch Bay UGA in 2013 is per the County Draft EIS, 3/15. The County growth allocation for Birch Bay UGA is 5,282 (projected growth from 2013-2036) per Whatcom County. The revised growth allocation was confirmed by the County in its 2016 Comprehensive Plan. The 2016 County Comprehensive Plan was updated in 2017 and again in 2018.

2 - UGA Reserve Area to remain outside the UGA and is considered Rural land for this forecast.

3 - Area in Blaine City Limits south of Semiahmoo development.

4 - Area in Blaine UGA south of Dakota Creek.

The latest District-specific population estimate was completed by the County for year-end 2013. The District added service for 309 residential ELUs from 2013 through 2018. At approximately 1.24¹ persons per residential equivalent living unit, the population at the end of 2018 is estimated to be approximately 9,190. The water service area population is therefore about 600 persons or about 6.1% below the forecast for 2018. This can be interpreted that growth is lagging behind the forecast by about just over three years.

2.2.3 Projected Residential and Non-residential Water Demand

Future annual average water demand projections are based on patterns observed in water use records from prior years. Projected water demand for the wholesale and other high-volume water users is addressed separately.

The average number of ERUs per customer type was determined for each of the most recent 27 years. The percent change from the prior year in both the number of ERUs and the volume of water used by each customer class was calculated. Similar customer categories were then combined into the customer classes as presented in Table 2.4. As indicated in Table 2.7, the number of years with total volume increase is about equal to the number of years of decreased water use. The ten-year average change in total water use is nearly zero.

¹ See basis for this figure in Section 2.1.2.

Table 2.7
ANNUAL WATER USE PERCENT CHANGE BY CUSTOMER CLASS
BASED ON ANNUAL CONSUMPTION

Year	SFR % Δ Volume	MFR % Δ Volume	Comm % Δ Volume	Other % Δ Volume	Total % Δ Volume
1991	16.61	(4.11)	90.71	10.97	12.39
1992	1.55	(13.91)	0.43	9.35	(3.10)
1993	5.89	5.43	(7.23)	(41.68)	(1.96)
1994	7.32	4.25	45.52	113.61	18.74
1995	2.76	(4.73)	(30.62)	(47.44)	(10.96)
1996	1.41	4.32	(2.86)	(12.00)	0.78
1997	3.22	(2.72)	(2.15)	33.34	2.88
1998	4.26	(1.86)	(47.71)	34.18	0.08
1999	2.87	(15.47)	12.00	(2.97)	(2.94)
2000	5.27	(11.32)	(7.16)	(6.96)	(1.35)
2001	2.38	0.82	27.98	14.34	4.83
2002	7.60	4.03	(16.20)	5.84	4.96
2003	13.88	10.70	(14.25)	(4.82)	9.24
2004	12.84	11.63	8.23	(5.75)	10.28
2005	(0.81)	(0.38)	(18.35)	3.87	(0.99)
2006	11.25	6.53	(9.86)	4.41	8.74
2007	(3.13)	0.36	1.48	(0.97)	(2.00)
2008	(2.93)	1.09	0.74	10.77	(0.55)
2009	13.60	4.98	(7.45)	(4.75)	8.93
2010	(8.64)	(18.41)	(9.17)	(8.25)	(10.85)
2011	(6.75)	(0.50)	(8.05)	(8.68)	(5.66)
2012	(0.13)	5.43	6.86	(13.77)	(0.02)
2013	(1.14)	0.19	15.67	(5.71)	(0.75)
2014	3.42	0.50	0.97	(6.05)	1.92
2017	0.64	11.07	(0.69)	(6.21)	1.91
3-yr avg.	1.25	(3.55)	(1.56)	6.30	0.29
5-yr avg.	1.20	(1.99)	2.39	1.43	0.40
10-yr avg.	0.12	(1.74)	(0.51)	(1.75)	(0.61)

Notes:

% Δ - Indicates change in percent over data for prior year

SFR – Single family residential MFR – Multi-family residential Comm – Commercial

Other – Wholesale, irrigation (both residential and commercial), marina, swimming pool, water park and clubhouse, standby, and BBWSD

Averages – 3-yr: 2015-17, 5-yr: 2013-17, 10-yr: 2008-17

The number of single and multi-family residential (SFR and MFR respectively) customers is forecast to increase at the same annual rate as population growth in the Birch Bay UGA (2.3353 percent) through 2036, then at 1.0 percent thereafter. The UGA forecast population growth rate for the future is significantly higher than the historical three and five-year average growth rates in District SFR ERUs of less than one percent annually. While some SFR growth is forecast in non-urban portions of the service area, such growth will be a very small share of total residential growth. Such future customers are conservatively included in the same class as urban SFR for purposes of water demand forecasting. Single family residential ERUs are forecast to increase from end of year 2017 ERU count. ERU counts for all other classes are forecast to increase from the average ERU count for that class for years 2014-2017.

The future water demand projections for the “commercial” and “other” class of water users (non-residential) can be better addressed individually as each are dependent on different factors. For the following discussion of users in the commercial or other classes, some customer groups, as defined by the District, have been combined together because they have similar water use or growth patterns. (Refer to Table 2.4 for the complete list of customer classes and categories.) The following discussion focuses on projected non-residential water use.

Historical water usage volumes were divided by an ADD/ERU of 120 gpd to get normalized growth rates.

The following seven classes combined represent just over ten percent of the total water use in the system.

Commercial – Large Short-Term Users

Within the last five years (2012-2017), there has been a fluctuation in water use between 39% annual increase and 31% annual decrease in water use. There are few users in this class so changes in volume appear to be more significant than in the residential class. The average change in annual water use over the past five years is an 8 percent increase. Due to its small share of use the ERU count for this class is projected to increase slightly at three percent per year.

Commercial - General Business

The average change in annual water use over the past five years in this customer class was an increase of nearly 1.8 percent. The ERU count for this

small customer class is forecast to increase at a rate of one-half of one percent per year.

Commercial - Food Business

The amount of water use in this class decreased by over eight percent over the past three years but increased over six percent over the last five years. The ERU count is forecast to increase at the rate of two percent per year.

Other - Wholesale

Beginning in 1998, water supplied to the BP refinery was re-classified as wholesale water use in the “other” class and this supply was the only customer in this class. Over the past five years there has been significant variability in the annual volume delivered in this class, with an average annual decrease of one-third of one percent. However, for the past three years, water usage has increased over five percent annually. For the past three years the annual average water use by the refinery was about 36,000 gpd. The refinery water supply agreement limits annual supply to an average of 76,212 gpd. The ERU count is forecast to increase at the rate of one-half of one percent per year for the BP refinery. This forecast results in just over 45,000 gpd in year 2038, when the future higher use per ERU is factored in (see Section 2.2.6).

Other – Large Water Users

The average change in annual water use over the past five years was a increase of approximately six percent, with significant swings each year. The ERU count is forecast to remain unchanged.

Other – Birch Bay Water and Sewer District

The water volume used by the District itself has fluctuated significantly over the past five years with the average change decreasing by about eight percent. No significant water-demand facilities are proposed. The District’s ERU count is forecast to remain unchanged.

Other – Low Water Users

Initially, there was a large number of ERUs which were reclassified or converted to more appropriate categories. Since most of these accounts are inactive, and would be reclassified if they were activated, no growth is forecast for these accounts.

There are presently no schools served by the District. The Blaine School District approved their Capital Facilities Plan on December 15, 2015 for the 20-year planning period through 2036. They assume a school district growth over the period of 0.74% per year, based on school district growth between the 1997-98 school year and the 2013-14 school year. Using this growth, they anticipate the existing school facilities, with planned capital projects, will be adequate for the 20-year planning period. The school district has identified a contingency plan in case growth exceeds the assumptions. The contingency plan includes, as an

option, siting a school in the Birch Bay area, although this is not scheduled or funded at this time.

2.2.4 Projected Non-revenue Water

The District has occasional water leaks or situations during construction when they are filling, testing, or flushing water and sewer lines. Although this volume is unpredictable because of many unknowns, the District is expected to keep the non-revenue water volumes as low as possible. Beginning in January 2008, the District began to measure Distribution System Loss (DSL) on a monthly basis per the WUE Guidebook. DSL is calculated by taking the difference between the total water purchased (TP) and the authorized consumption (AC) (metered to customers and otherwise accounted for or estimated) on an annual basis.

Water “loss” can occur during low flow periods at a master meter for a “multi-family” customer (i.e. multiple living units under one ownership). For example, an RV park owner had service meters installed in 1998 for the individual lots within the park. The residents of the park have had accounts established, making them responsible for their water use. There were differences between the total water used for all of the individual service meters as compared to what was recorded at the master meter into the park. The differences resulted from lack of sensitivity to low flows in the larger master meters. In 2005, the District replaced the master meters with meters that will register both the lower and high flow rates.

The District monitors and tabulates the quantity of water purchased versus how much water was sold to customers. The difference in the two numbers is considered DSL and can be attributed to many factors: leaks, differences in timing of various meter readings, flow too low for larger meters to accurately measure, and system operations are examples. This number is shown as a percentage of the total amount of water purchased. Table 2.8 shows the percentage of DSL for the period 2005-2017. With the exception of 2005, 2008, and 2016, the District has recorded a loss of less than ten percent of the annual volume purchased. Beginning in January 2008, the District began to measure DSL on a monthly basis per Appendix D of the WUE Guidebook. Under WUE regulations, all municipal water suppliers must maintain their DSL at or below ten percent of their production, based on a rolling three-year average. Leakage must be reported as a percentage and as a volume. If municipal water suppliers are not meeting the DSL standard they must develop and implement a Water Loss Control Action Plan. The Plan outlines steps and timelines needed to reduce DSL. The average loss for the three years 2015-2017 is 9.0 percent, demonstrating the District is already in compliance.

Table 2.8
ANNUAL DISTRIBUTION SYSTEM LEAKAGE

Year	Percent Loss
2005	11.5%
2006	8.3%
2007	9.6%
2008	10.6%
2009	6.1%
2010	7.1%
2011	5.0%
2012	5.2%
2013	7.8%
2014	9.0%
2015	7.4%
2016	10.2%
2017	9.4%
3-yr average	9.0%
5-yr average	8.7%
10-yr average	7.7%

Three-year average over the years of 2015 through 2017.

Five-year average over the years of 2013 through 2017.

Ten-year average over the years of 2008 through 2017.

Based on the ten-year average historical data, the projected DSL is estimated to be eight percent of the annual volume purchased. The District completed the replacement of about 10,000 feet of AC pipe in 2017. Most of the water main breaks in the system over the past 20 years were along the main that was replaced. That project, and the District's continued focus on metering accuracy and system monitoring, support maintaining the goal for DSL at eight percent.

2.2.5 Water Rates and Rate Impacts on Water Demand

The following tables present the historic and present water rates and connection charges in effect at the District. The District has a three-tiered block rate structure: a monthly basic charge for each account of \$15.40, and water use is \$3.20 per hundred cubic feet (ccf) over five to 20 ccf and \$5.95/ccf for 21 ccf or more.

Water rates are summarized in Table 2.9. Table 2.10 summarizes connection and general facilities charges.

Table 2.9
HISTORY OF WATER RATES

Year	Base/Month	Cu ft Allowed	Commodity Charge/ 100 Cu ft	Bill with Monthly Usage of 500 Cu Ft	Notes
1970	\$5.00	700	\$0.50	\$11.50	1
1974	\$5.00	500	\$0.60	\$13.00	1
1977	\$6.00	500	\$0.60	\$15.00	2
1979	\$3.50	0	\$0.60	\$13.00	3
1982	\$4.50	0	\$0.65	\$15.50	
1983	\$5.00	0	\$0.70	\$17.00	
1985	\$5.00	0	\$0.80	\$18.00	
1987	\$6.00	0	\$0.80	\$20.00	
1991	\$6.00	0	\$1.00	\$22.00	
1992	\$6.00	0	\$1.05	\$22.50	
1993	\$6.00	0	\$1.20	\$24.00	
1994	\$6.20	0	\$1.50	\$27.40	
1997	\$6.80	0	\$1.60	\$29.60	
1999	\$7.21	0	\$1.70	\$31.42	
2001	\$7.45	0	\$1.75	\$32.40	
2003	\$7.65	0	\$1.80	\$33.30	
2006	\$5.95	0	\$1.60	\$27.90	6
2008	\$7.96	0	\$1.66	\$32.52	
2009	\$8.04	0	\$1.68	\$32.88	7
2011	\$9.45	400	\$2.27	\$32.52	8
2011	\$10.20	400	\$2.45	\$35.10	9
2012	\$10.70	400	\$2.60	\$37.00	10
2013	\$11.25	400	\$2.65	\$38.40	11
2014	\$13.70	400	\$2.80	\$44.20	12
2015	\$13.70	400	\$2.80	\$44.20	13
2016	\$14.23	400	\$2.95	\$46.16	14

2017	\$14.80	400	\$3.05	\$47.90	15
2018	\$15.40	400	\$3.20	\$50.00	16
2019	\$15.90	400	\$3.30	\$51.60	17

Notes:

(1) Primary-Secondary customer rate system: primary charged all year and secondary charged for six-month period including summer.

(2) Secondary charge period was extended to seven months effect 9-1-77.

(3) On 3-1-79, the primary-secondary customer rate system was eliminated. All were charged on a year-round basis. The District also began billing from the first 100 cu ft of use.

(4) On 1-1-87, based on a 1986 rate study, the residential/unit rate went down to \$4.50, but added a billing charge of \$1.50/month/account, thus the base of \$6.00.

(4) Commodity charge increased to \$1.00/100 cu ft & to \$1.50/100 cu ft after the first 1000 cu ft/unit/month.

(5) 50% surcharge on commodity charge over 1,000 cu ft per month.

(6) A new rate structure went into effect January 1, 2006: three tiers depending on water usage.

(7) Water use charge within the District, billed every two months is \$1.68/100cf up to 1300cf, \$2.41/100cf from 1400cf to 2500cf and \$3.10/100cf for 2600cf or more.

(8) Water use charge within the District, billed every two months is \$0.00/100cf up to 400cf, \$2.27/100cf from 500cf to 2000cf and \$4.30/100cf for 2100cf or more.

(9) Water use charge within the District, billed every two months is \$2.45/100cf from 500cf to 2000cf and \$4.65/100cf for 2100cf or more.

(10) Water use charge within the District, billed every two months is \$2.60/100cf from 500cf to 2000cf and \$4.85/100cf for 2100cf or more.

(11) Water use charge within the District, billed every two months is \$2.65/100cf from 500cf to 2000cf and \$4.95/100cf for 2100cf or more.

(12) Water use charge within the District, billed every two months is \$2.80/100cf from 500cf to 2000cf and \$5.20/100cf for 2100cf or more.

(13) Water use charge within the District, billed every two months is \$2.80/100cf from 500cf to 2000cf and \$5.20/100cf for 2100cf or more.

(14) Water use charge within the District, billed every two months is \$2.95/100cf from 500cf to 2000cf and \$5.50/100cf for 2100cf or more.

(15) Water use charge within the District, billed every two months is \$3.05/100cf from 500cf to 2000cf and \$5.70/100cf for 2100cf or more.

(16) Water use charge within the District, billed every two months is \$3.20/100cf from 500cf to 2000cf and \$5.95/100cf for 2100cf or more.

(17) Water use charge within the District, billed every two months is \$3.30/100cf from 500cf to 2000cf and \$6.20/100cf for 2100cf or more.

Table 2.10
HISTORICAL CONNECTION AND FACILITIES CHARGES

Service Area Charge ¾" Service (typical)	Meter Only Charge	Water General Facilities Charge	Charge-in-Lieu of Assessment for Local Facilities	Dates Effective	Notes
\$225	-	-	Share of construction cost of main	1/1/70 to 1/31/74	
\$150	\$100	\$.02/ft ²	\$4/front foot	2/1/74 to 10/31/74	1
		(\$150 min.)			
\$200	\$100	\$.02/ft ²	\$8/front foot	11/1/74 to 3/26/80	2
		(\$150 min.)			
\$210	\$100	\$.02/ft ²	\$8/front foot	3/27/80 to 3/16/81	
		(\$150 min.)			
\$375	\$100	\$.02/ft ²	\$10/front foot	3/17/81 to 7/10/91	3
		(\$150 min.)			
\$475	\$325	\$300/RCE ¹	\$20/front foot	7/11/91 to 6/16/93	4
\$475	\$325	\$1,119/RCE	\$20/front foot	6/17/93 to 6/30/97	
\$475	\$325	\$1,540/RCE	\$30/front foot	7/1/97 to 3/27/02	
\$475	\$325	\$1,540/RCE	\$35/front foot	3/28/02 to 11/23/04	
\$475	\$325	\$2,480/ELU	\$35/front foot	11/23/04 to 6/9/05	5
\$475	\$325	\$2,480/ELU	Project specific	6/9/05 to 11/9/06	6
\$475	\$325	\$2,620/ELU	Project specific	11/9/06 to 12/31/08	
\$475	\$325	\$2,620/ELU plus \$854/ELU for RCC	Project specific	Effective 1/1/09	7

Service Area Charge 3/4" Service (typical)	Meter Only Charge	Water General Facilities Charge	Charge-in-Lieu of Assessment for Local Facilities	Dates Effective	Notes
\$575	\$175	\$2,620/ELU plus \$854/ELU for RCC	Project specific	Effective 6/11/09	
\$575	\$175	\$2,620/ELU plus \$854/ELU for RCC	Project specific	In place 1/7/13	
\$850	\$200	\$2,620/ELU plus \$854/ELU for RCC	Project specific	Effective 9/24/13	
\$1,075	\$225	\$2,869/ELU plus \$854/ELU for RCC	Project specific	Effective 1/9/15	
\$1,175	\$300	\$2,970/ELU plus \$854/ELU for RCC	Project specific	Effective 2/20/18	8

Notes:

- (1) \$100 for each additional primary or secondary unit hooked through the primary meter; \$50 for each extended service connected through a primary meter.
- (2) 1 dwelling unit allowed per 6000 ft², \$100/unit above that.
- (3) 1 dwelling unit allowed per 6000 ft², \$150/unit above that.
- (4) 1 dwelling unit allowed per 6000 ft², \$300/unit above that.
- (5) Units for General Facility Charge equivalency renamed from RCE to ELU in District Code.
- (6) Front footage charge eliminated except for specific projects as determined by District resolution.
- (7) Regional Capacity Charge effective January 1, 2009 to be charged by City of Blaine and District for water supply and transmission capital improvements.
- (8) Blaine updated its RCC to \$871.08 in 2018. The District has not yet adopted the higher value.

2.2.6 Water Demand Forecast

The demand forecast is the culmination of the information presented in this Chapter. To summarize, water use records were collected for the past 27 years and reviewed with particular emphasis on the past nine years. The ADD for one ERU in this District is established, for forecast purposes, as 120 gpd for 2018. For forecast purposes this is estimated to increase in a linear manner to 135 gpd/ERU by year 2038. The end-of-year 2017 number of single-family residential customers is the base line for the demand forecast for the single-family residence class. Residential customer growth is estimated to increase as targeted by Whatcom County for growth in the Birch Bay UGA through 2036, then at one percent per year through 2038. The number of non-residential ERUs was averaged for the past three years based on the ADD/ERU of 120 gpd to

determine a base line for the demand forecast in each of those non-residential customer classes. The growth rate of ERUs in each non-residential customer class was projected based on water use growth patterns for that category. The ratio of MDD to ADD was reviewed for the past decade, and a future ratio of 2.19 was selected. Table 2.11 summarizes the water demand forecast growth rates by customer class for the period 2019 to 2038.

Table 2.11
PROJECTED GROWTH RATE BY CUSTOMER CLASS

Customer Type	Projected Annual Growth Rate (percent)
Single Family residential	2.3353 through 2036; 1.0 2037 through 2038
<i>Multi-Family residential</i>	
Mobiles/RV parks	2.3353 through 2036; 1.0 2037 through 2038
Condominiums/Park Model Trailers	
Rentals	
<i>Commercial</i>	
Large short-term users (bingo, churches & cemeteries)	3
General business	0.5
Food business	2
<i>Other</i>	
Wholesale	0.5
Large water users - golf courses and nurseries, residential irrigation, marina, pools, water park, clubhouse	0
BBWSD	0
2-month standby, inactive, etc.	0

The final step in the demand forecast is calculation of the projected ADD, MDD, and PHD based on the information developed in this Chapter. Table 2.12 presents the demand forecast assuming a constant increase from 120 gpd in 2019 to 135 gpd in 2038. Table 2.13 presents the demand forecast with the same growth rates as indicated in Table 2.12, but assumes the ADD per ERU will remain constant at 116 gpd/ERU through 2019, then increase linearly to 125 gpd in 2038. The projected ADD and MDD, with and without additional projected savings (conservation benefits), are presented on Figure 2.2. The determination

of the base line for all projections is discussed in Section 2.1.4 and Table 2.4. The projected MDD for the year 2038 is 3.15 mgd with no additional projected savings, or 2.92 mgd assuming additional projected savings. As reflected on Figure 2.2, the forecast MDD for year 2038 approaches the present supply contract limit. Extrapolation of the forecast trend suggests that additional supply will be needed just beyond the current planning period. The District should continue to pursue additional water rights or contract supply.¹

The forecast demand for year 2038 is represented as ERUs in Table 2.14.

¹ A draft forecast of 3.05 mgd for year 2036 was provided to Whatcom County for use in completing their 2016 *Comprehensive Plan* update. This revised forecast is based on final adjustments to growth by customer class and the MDD/ADD ratio, and extension through 2038.

Table 2.12
PROJECTED WATER DEMAND 2019 – 2038
(Without Additional Projected Savings, flow increase per capita through 2038)

Type	2019	2020	2021	2022	2023	2024
Single-Family Residential	605,217	623,197	641,687	660,701	680,253	700,358
Multi-Family Residential	150,999	155,485	160,098	160,098	169,720	174,736
Commercial	22,306	22,669	23,039	23,039	23,798	24,189
Other	64,618	65,204	65,792	65,792	66,980	67,578
Dist. System Leakage	67,451	69,324	71,249	73,227	75,260	77,349
ADD (mgd)	0.91	0.94	0.96	0.99	1.02	1.04
MDD (mgd)	1.91	1.96	2.02	2.08	2.13	2.19
PHD (gpm)	2,185	2,244	2,305	2,367	2,431	2,497

Type	2025	2026	2027	2028	2033	2038
Single-Family Residential	721,031	742,288	764,144	786,616	908,823	1,021,958
Multi-Family Residential	179,894	185,198	190,651	196,257	226,747	261,761
Commercial	24,587	24,992	25,405	25,826	28,056	30,514
Other	68,180	68,785	69,394	70,005	73,116	76,313
Dist. System Leakage	79,495	81,701	83,967	86,296	98,939	111,244
ADD (mgd)	1.07	1.10	1.13	1.17	1.34	1.50
MDD (mgd)	2.25	2.32	2.38	2.45	2.80	3.15
PHD (gpm)	2,565	2,635	2,707	2,780	3,180	3,568

1. Flow in gallons per day for each customer class/category
2. ADD per ERU increases at a constant rate to 135 gpd in 2038.

Table 2.13
PROJECTED WATER DEMAND 2019 – 2038
(With Additional Projected Savings)

Type	2019	2020	2021	2022	2023	2024
Single-Family Residential	581,409	597,416	613,854	630,734	648,067	665,866
Multi-Family Residential	145,059	149,053	153,154	157,365	161,690	166,131
Commercial	21,428	21,731	22,039	22,353	22,672	22,998
Other	62,076	62,506	62,939	63,373	63,810	64,250
Dist. System Leakage	64,798	66,456	68,159	69,906	71,699	73,540
ADD (mgd)	0.87	0.90	0.92	0.94	0.97	0.99
MDD (mgd)	1.84	1.88	1.93	1.98	2.03	2.08
PHD (gpm)	2,099	2,152	2,205	2,261	2,317	2,375

Type	2025	2026	2027	2028	2033	2038
Single-Family Residential	684,143	702,910	722,181	741,968	849,146	946,257
Multi-Family Residential	170,691	175,373	180,181	185,118	211,858	242,371
Commercial	23,329	23,666	24,010	24,360	26,214	28,254
Other	64,692	65,136	65,583	66,032	68,315	70,661
Dist. System Leakage	75,428	77,367	79,356	81,398	92,443	103,003
ADD (mgd)	1.02	1.04	1.07	1.10	1.25	1.39
MDD (mgd)	2.14	2.19	2.25	2.31	2.62	2.92
PHD (gpm)	2,435	2,496	2,559	2,623	2,972	3,305

1. Flow in gallons per day for each customer class/category
2. ADD per ERU is 116 gpd from 2015-2019 and then increases at a constant rate to 125 gpd in 2038
3. The projected water demand, without and with conservation benefit is expressed in terms of annual volume and total ERUs, in Tables D-4 and D-5.

Table 2.14
WATER SYSTEM CONNECTIONS CORRELATED TO ERUs - 2038

Service Class	Total Demand, gpd	Total Connections	ERUs
Residential (MDD)			
Single-family	2,234,998	7,570	7,570
Multi-family	572,464	1,939	1,939
Nonresidential (MDD)			
Commercial	66,733	226	226
Other	166,896	565	565
DSL (ADD)	111,244		377
Total ERUs (Residential + Nonresidential + DSL)			10,677

Average Day Demand = 135 gpd/ERU in 2038

Maximum Day Demand = 295 gpd/ERU in 2038

Figure 2.1
Historical Water Use 1970-2018

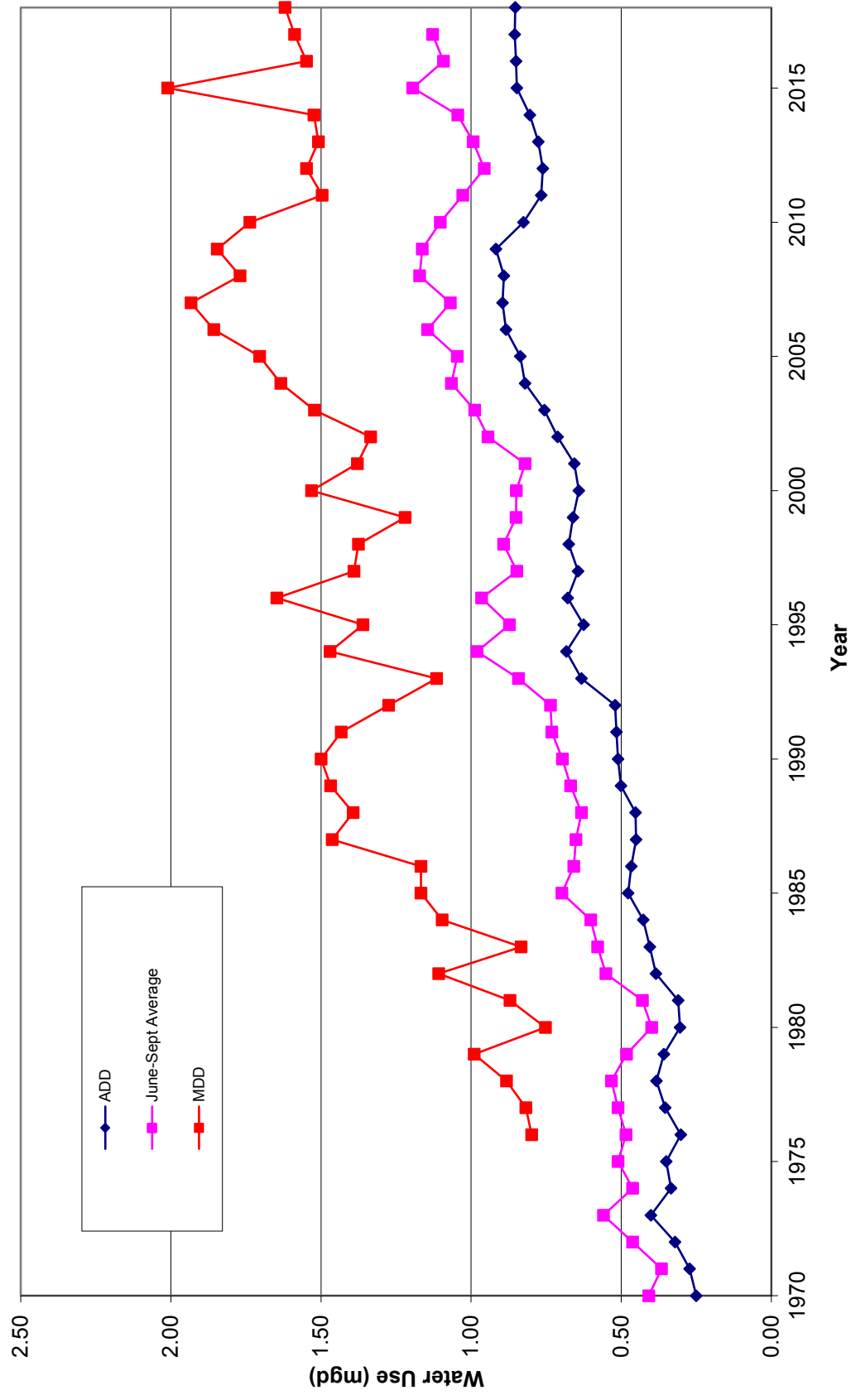


Figure 2.2
Historical Water Use and Projected Demand 1970-2038

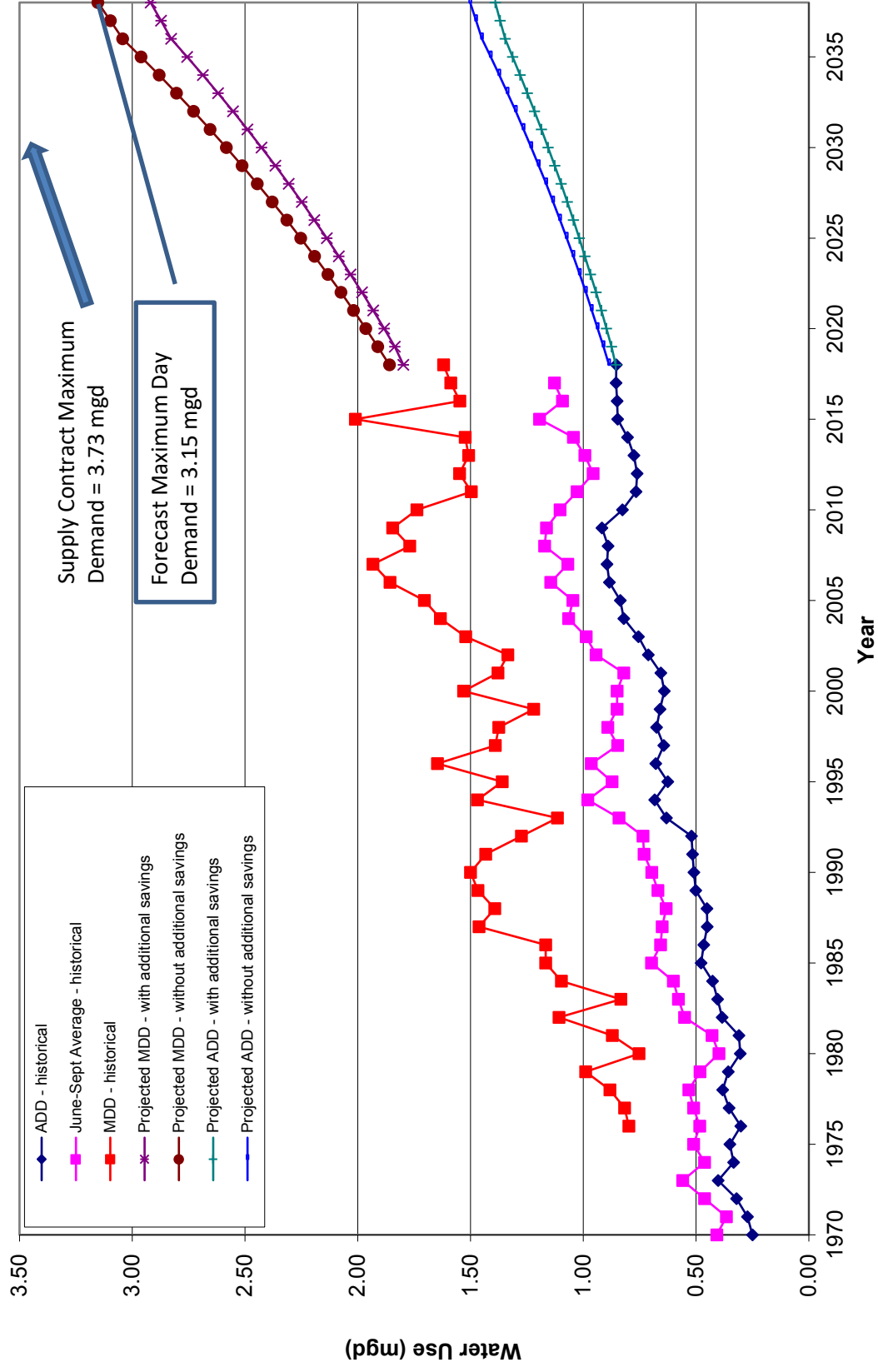
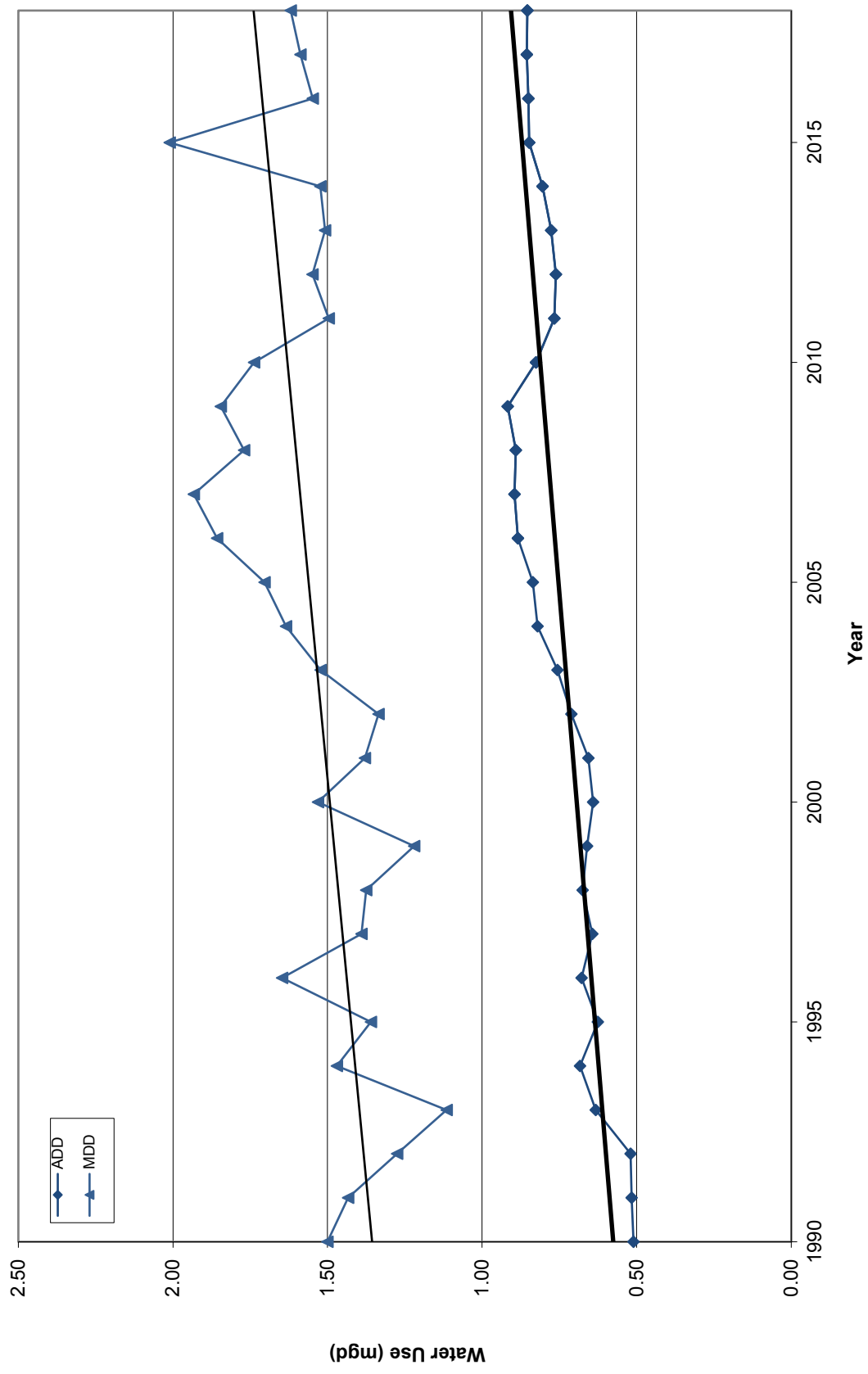


Figure 2.3
Historical Water Use - Trend of ADD and MDD - 1990-2018



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CHAPTER 3

SYSTEM ANALYSIS

The purpose of this chapter is to determine if the existing system facilities are capable of supplying sufficient quality and quantity of water to meet existing and projected demands in the District's water service area. In this section, five planning elements will be reviewed in detail:

- system design standards
- water quality analysis
- system description and analysis
- summary of system deficiencies and
- selection and justification of proposed improvements

The design standards establish the design criteria that apply to the Birch Bay water system facilities. The design and water quality standards for Group A public water systems are summarized in Chapter 246-290 WAC. These standards provide a set of minimum design and performance criteria for new water utilities and for all existing utilities planning to install capital facilities for expansion purposes. System description and analysis includes a description of the configuration, general condition and deficiencies of the components of the District's water system. The discussion is summarized with identification of the improvements proposed to eliminate existing and anticipated deficiencies.

3.1 System Design Standards

The performance and design criteria address the size and reliability requirements for source, storage, and distribution to meet the domestic and fire flow water demands of the system. Construction standards set forth the actual materials and construction standards that contractors, developers and the District must follow when constructing water system facility improvements. The design standards include the Department of Health (DOH) standards as presented in the December 2009 *Water System Design Manual* (WSDM), the standards identified in the 2016 *Whatcom County Coordinated Water System Plan* (CWSP), and the Birch Bay Water and Sewer District *Developer Project Manual* (DPM), latest edition. In case of conflict between these standards, the most stringent standards shall apply.

3.1.1 Water Quality

Public water systems are obligated to supply their customers with healthful, palatable water. Water quality must conform to the water quality requirements in the federal Safe Drinking Water Act (SDWA) as monitored and enforced by DOH. WAC 246-290-200, Design Standards, lists various criteria allowed by DOH.

These water quality parameters include maximum contaminant levels (MCLs) for a variety of potential organic, inorganic and radioactive constituents in the water supply. The water supply must be free from pathogenic bacteria and carry a residual of chlorine for disinfection throughout the water system. There are also secondary MCL's for constituents which may not result in health problems, but may lead to taste, odor and other aesthetic objections from water system customers. Additionally, the water must be periodically tested for asbestos, lead and copper, to determine the interaction of the water with the distribution piping and private service/plumbing piping used for delivery of water to the customer's tap. DOH and EPA have also recently adopted rules for monitoring disinfectants and disinfectant byproducts.

3.1.2 Average Day, Maximum Day and Peak Hour Demands

The Average Day and Maximum Day Demands (ADD and MDD, respectively) are discussed in Chapter 2, Section 2.2.6. The water demand for the District's system is forecast through the year 2038 based on historical water use patterns by customer class and projected growth within each customer class, both with and without estimated impact of future water conservation efforts. The ADD per equivalent residential unit (ERU) has been forecast to be 116 gallons per day (gpd) through 2019 then increasing to 125 gpd by year 2038 (with projected additional savings), or 120 gpd increasing to 135 gpd by 2038 (without projected additional savings).

The District is relying on the equation for determination of Peak Hour Demand (PHD), expressed in gallons per minute (gpm), from the *Water System Design Manual* (WSDM). The equation, for systems with more than 500 connections, is a function of MDD and the number of service connections.

$$\text{PHD} = (\text{MDD}/1440)[(1.6)(\# \text{ ERUs}) + 255] + 18 \quad \{\text{WSDM Equation 5-3}\}$$

For Birch Bay, the resulting ratio of PHD to MDD is presently approximately 1.65 and gradually decreases to 1.63 over the next 20 years.

The detailed projections are presented in Tables 2.12 and 2.13, and the key results are summarized in Table 3.1 for reference.

Table 3.1
SUMMARY OF FORECAST ADD, MDD AND PHD

Demand	2019	2020	2021	2022	2023	2024
<i>Without Additional Projected Savings</i>						
ADD	0.91	0.94	0.96	0.99	1.02	1.04
MDD	1.91	1.96	2.02	2.08	2.13	2.19
PHD	2,185	2,244	2,305	2,367	2,431	2,497
Demand	2025	2026	2027	2028	2033	2038
<i>Without Additional Projected Savings</i>						
ADD	1.07	1.10	1.13	1.17	1.34	1.50
MDD	2.25	2.32	2.38	2.45	2.80	3.15
PHD	2,565	2,635	2,707	2,780	3,180	3,568

Demand	2019	2020	2021	2022	2023	2024
<i>With Additional Projected Savings</i>						
ADD	0.87	0.90	0.92	0.94	0.97	0.99
MDD	1.84	1.88	1.93	1.98	2.03	2.08
PHD	2,099	2,152	2,205	2,261	2,317	2,375
Demand	2025	2026	2027	2028	2033	2038
<i>With Additional Projected Savings</i>						
ADD	1.02	1.04	1.07	1.10	1.25	1.39
MDD	2.14	2.19	2.25	2.31	2.62	2.92
PHD	2,435	2,496	2,559	2,623	2,972	3,305

Units for ADD and MDD are million gallons per day and units for PHD are gallons per minute

3.1.3 Storage Requirements

There are five types of storage that must be considered when designing a community water system. The criterion for sizing each component of storage is established by DOH in the WSDM. Each component is explained below, with the respective equation or criteria for determining the required value.

Operating Storage (OS): Operating storage is the volume of storage devoted to supplying the water system while the source(s) of supply, usually pumps, are “off.” The volume will vary according to the sensitivity of the sensors controlling the pumps filling the reservoir and the settings of the pump “on-off” points to limit the pump motor starts to less than six per hour.

Equalizing Storage (ES): Equalizing storage provides water during periods of peak demand when the source of supply cannot meet the MDD. The volume of ES necessary is a function of the supply mode, diurnal variations in peak demand and source capacity. The minimum volume of ES is determined by an equation in the WSDM:

$$ES = (PHD - Q_s)(150 \text{ min}), \text{ always } > 0 \quad \{\text{WSDM Equation 9-1}\}$$

The term Q_s is the sum of all sources of supply capacities in gallons per minute.

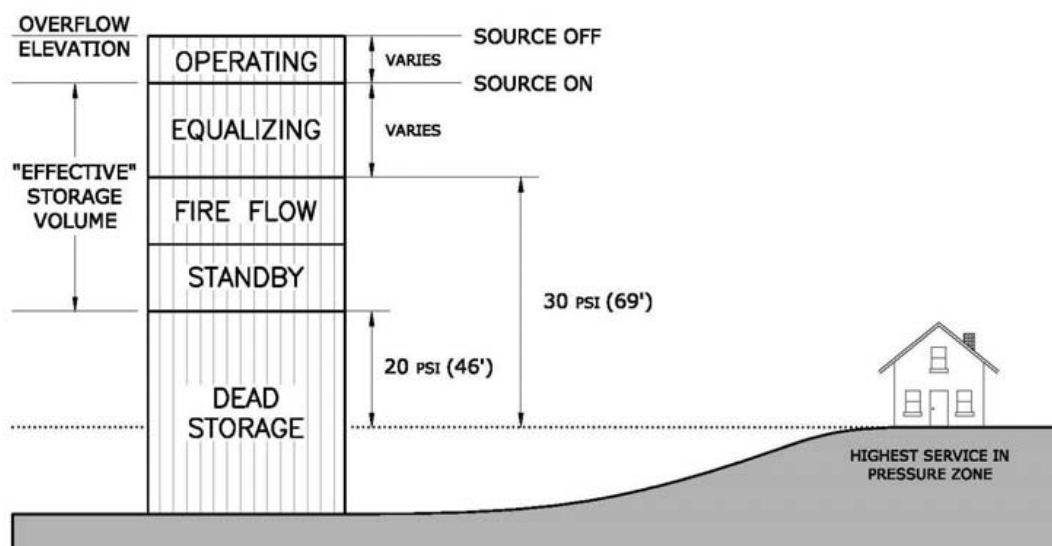
Standby Storage (SB): Standby storage is the storage necessary to augment the available supply in the event that the system's largest or only source is out of service for a period of time. While the District is a single source system, standby storage must be provided under the assumption that no water is being supplied by its source. When analyzing a two-source system it is assumed the source with the highest capacity is not operating. For systems with a single source the recommended standby storage is two times the ADD. In any event, SB storage shall not be less than 200 gallons per ERU.

Fire Suppression Storage (FSS): The fourth component of storage is the amount needed for fire suppression. The volume of required FSS is the product of the maximum fire flow rate and the fire flow duration. The source of supply should be adequate to replenish fire suppression storage within 72 hours while concurrently supplying the system MDD. Unless required otherwise by the local fire official, FSS may be nested with SB.

Dead Storage (DS): Dead storage is that water within a reservoir, tank or standpipe that, due to topography, piping configuration and proximity to the distribution system and connections, is not available to the system at adequate pressure under usual operating conditions.

Operating and Equalizing storage volumes must be available to the highest service in the associated pressure zone at 30 psi or greater. Standby and Fire Suppression storage volumes must be available at 20 psi or greater. See Figure 3.1.

**Figure 3.1
STORAGE COMPONENTS**



3.1.4 Fire Flow Rate and Duration

The fire flow rates and durations in Table 3.2 have been selected by the District for purposes of system design and analysis, and as the basis for level of service to existing and proposed development in the water service area. The criteria are based on the CWSP, the WAC, coordination with the Whatcom County Deputy Fire Marshal, and previous fire flow determinations for existing structures in the District.

The District has existing water mains and fire hydrants in areas that are not presently zoned for urban land use. The District is not planning to provide fire flow service to rural areas. There are three exceptions to this position:

- service to parcels previously served by mains 6" and larger and previously included in a UGA
- service to parcels abutting existing distribution and transmission mains 6" and larger through rural-zoned lands
- parcel-specific prior commitments to provide fire suppression service.

Pressure Zone 2 is the area of Birch Point along the existing 6" and larger water mains along Birch Point Road, Semiahmoo Drive and the local streets between those roads and the shoreline (see Figure 1.4). Those mains have been in service for 20 years or more and include fire hydrants. The area in Pressure Zone 2 was previously included in the Birch Bay or Blaine UGA and/or was zoned as UR4 (urban residential) as designated by Whatcom County. That area has been removed from the UGAs and is presently zoned for rural residential land use.

Additional rural portions of the water service area, particularly north of Lincoln Road and along Blaine and Loomis Trail Roads, are served by 8" and larger distribution and transmission mains. All of those areas were previously in a UGA and/or development occurred at a density requiring fire suppression service. The District's office, shops and wastewater treatment facility are in the rural area but have historically been provided fire flow service.

The Loomis Trail Clubhouse was committed a particular flow rate at the time of its development and a developer extension to serve the facility. Two additional parcels have commitments for fire flow service outside the water service area, along the transmission main along Bay Road from the Kickerville Reservoir.

The District is planning to continue to provide fire flow service, up to 500 gpm for 60 minutes in the rural area, and at higher rates and durations for three specific parcels, for such areas with existing facilities. More specifically, such service will be provided along the frontage of parcels that abut right-of-way or District easement with water mains 6" and larger, all as existing as of January 1, 2018. If there is not an existing fire hydrant within 250 feet of a point along the frontage, measured along the right-of-way or easement, and the local fire official requires such, the property owner shall install a fire hydrant per District requirements for a developer extension (see Chapter 7). The District will not allow extension of water mains or fire hydrant laterals for the purposes of placing fire hydrants more than 50 feet from an existing main.

Figure 3.2 depicts the targeted fire flow level of service, per Table 3.2. The area zoned as URM6 but developed as Birch Bay State Park, the Beachwood Resort and the undeveloped area immediately south of the Beachwood Resort are not included in the area to be provided fire flow service. The State Park and Resort each have their own water distribution systems serving those areas. Similarly, the District does not provide water service within Leisure Park, an area also zoned URM6 in the central part of the District with its own water distribution system. Figure 3.2 is also intended to indicate areas of fire flow deficiencies. There are no areas where the existing system (areas served by mains 6" and larger) cannot provide the indicated fire flow. However, conveyance of fire flow from the distribution system to a specific parcel or structure requires more detailed review to confirm appropriate location and size of mains, and location and capacity of fire hydrants in specific circumstances. See Section 3.4 for more details regarding the evaluation of the system under fire flow conditions.

Upon request for confirmation of fire flow availability, the District will consult Figure 1.4 (or more current map of the existing system if available) and Figure 3.2. If an existing water main 6" and larger serves and abuts the property per the District's water availability policy and no fire flow service deficiencies are noted at the subject location, the District may confirm the level of fire flow service per Figure 3.2 and Table 3.2. If a proposed development requires confirmation of any of the following conditions the applicant may request a location-specific

evaluation, concurrent with an application for water system developer extension, all at the applicant's expense:

- fire flow rate greater than indicated in Table 3.2
- fire flow service in vicinity of a deficiency indicated on Figure 3.2
- product of the required rate and duration is greater than 30,000 gallons for Birch Point or Point Whitehorn area pressure zones, or greater than 300,000 gallons elsewhere (see Section 3.3.3)
- provision of new fire hydrant(s) and/or fire sprinkler service lines

Confirmation of the required rate and/or duration may be conditioned upon completion of system improvements and/or extension by the developer extension process to support the required level of service.

If a request is made for confirmation of available flow and pressure for design of fire sprinkler services, the District will initiate a location-specific evaluation, at the requester's expense.

Table 3.2
FIRE FLOW CRITERIA

Land Use/Zoning Description	Fire Flow (gpm)	Duration (minutes)
Rural – R5A, R10A	None	None
Except - Previous UGA or parcel-specific per Figure 3.2	500	60
	750	60
	1,750	60
	2,500	120
Residential – UR4	500	60
Residential – URM6	750	60
Residential – URM24	750	60
Commercial – RC, NC, GC (not along Birch Bay Dr. or at intersection of Alderson and Blaine Roads)	1,000	120
Commercial -- GC at intersection of Blaine and Alderson Roads	1,250	120
Commercial – RC, GC, NC (along Birch Bay Drive, Birch Point Road and Birch Bay-Lynden Road)	1,500	120
Industrial - HII	n/a – no fire flow service to existing developed areas	

3.1.5 System Pressure

Water systems shall be designed to maintain a minimum residual pressure of 30 pounds per square inch (psi) at the meter, or property line if there is no meter, under MDD or PHD conditions, excluding fire demand. A residual pressure of 20

psi shall be provided throughout the system under combined fire flow and MDD conditions. Transmission mains with no service connections must be designed to maintain five psi or more except when directly adjacent to storage tanks.

DOH recommends a maximum system pressure at the point of customer connection of 100 psi. The District system is segregated into pressure zones to manage the normal range of pressure between 30 and 80 psi. However, due to local topography and/or proximity to a booster pump station, system pressure can exceed 80 psi at times in the system. The Uniform Plumbing Code (UPC) requires installation of an individual pressure reducing valve (PRV) at customer connections where static system pressure exceeds 80 psi. Individual or end-user PRVs are installed for individual customer pressure regulation and are the property and responsibility of the customer. Whatcom County, and the City of Blaine for only a few parcels, have authority and responsibility for administration of the UPC.

The DOH WSDM includes the recommendation that the velocity in the distribution system not exceed eight feet per second (fps) under PHD conditions, or 10 fps under fire flow conditions. As stated in the District's DPM (see Chapter 7), the size of a new water line shall be as necessary to provide minimum required fire flow with MDD or PHD, whichever is greater, with maximum velocity of eight fps, minimum pressure of 20 psi throughout the system or pressure zone during fire flow with MDD operating conditions and 30 psi during MDD or PHD conditions. For analysis of the existing system, acceptance of velocity up to 10 fps will be considered, for fire flow with MDD conditions.

Booster pump stations (BPSs) should be designed with multiple pumps of such capacity that the MDD of the service area will be provided, at 30-psi minimum, with the largest pump out of service. The station should be designed to provide a minimum of 30 psi at the pump suction manifold under fire flow plus MDD conditions. The station should include an automatic shutdown feature should the suction pressure drop below the minimum required net positive suction head for each pump.

3.1.6 Minimum Pipe Sizes/Looping

Water line extensions shall be continued through and/or along the property being developed for potential future connection or extension, in accordance with District Design Standards (see Chapter 7, Section 7.3).

Water mains shall be a minimum of 8" diameter if providing fire flow, or larger in accordance with this Plan (see Chapter 8). Mains not providing fire flow may be smaller under certain conditions. Details are presented in the District DPM. Engineering analysis should be completed for each extension considering the specific fire flow requirements and hydraulic conditions for the subject and adjacent existing and potential development.

Velocities in the pipe system should not exceed eight feet per second (fps) under PHD conditions, but all pipes shall be capable of being flushed at 2.5 fps under ADD conditions.

The water mains shall be “looped” where feasible within the proposed development and/or designed with multiple connections to the existing water distribution system in accordance with this plan or as required by the District or as required to provide the required adequate flow and pressure to the most remote hydrant and service in the proposed water extension.

3.1.7 Telemetry and Control Systems

Telemetry and control systems shall be included with each reservoir and BPS. These systems shall be designed for local or remotely controlled automatic operation.

In the Birch Bay system, telemetry communication is by the existing radio system. Critical levels, flow, pressure, function, etc. are continuously monitored and unusual conditions are annunciated locally, to the water headquarter office and to the “on-call” operator.

There are remote telemetry units (RTUs) at the following facilities/locations:

- Kickerville Reservoir
- Birch Point Reservoir
- Semiahmoo Reservoir
- Blaine Road (supply) BPS
- Point Whitehorn BPS
- Birch Point temporary BPS
- Bayvue BPS
- Birch Point Supply Meter
- Portal Way Supply Meter
- 200 and 300 Zone Interties

The Blaine Road and Birch Point BPSs are controlled by the system in response to reservoir water levels. The telemetry system includes an automated operator notification system for 24-hour reporting of alarm conditions to the District system operators.

3.1.8 Standby Power Requirements

The main objective of standby power requirements is to assure that the system is pressurized at all times to minimize cross-connection contamination concerns and maintain minimum service pressures. Each BPS should contain no less than two pumps with capacities such that peak demand can be satisfied with the

largest pump out of service. For closed systems, standby power shall be provided from at least two independent sources or a standby or an auxiliary source should be provided.

3.1.9 Valve and Hydrant Spacing

Fire hydrants shall be installed along all 8" and larger water mains serving urban land in the distribution system and shall be spaced at distances appropriate for the type of development with a maximum distance of 250 feet from the hydrant to the furthest structure, measured along the street frontage, or as approval by the local fire district.

Valves shall be installed at two of three branches of "tee" connections, at three of four branches of "cross" connections, and at changes in pipe diameter. Additional valves may be required at each connection, at the District's discretion, to facilitate flushing or other operation and maintenance needs. Valves shall be installed at intersections, at intervals not to exceed 800 feet in the distribution system and 1,320 feet in transmission mains. Valve spacing in commercial, industrial, and multiple-family districts shall not exceed 500 feet. Auxiliary valves shall be installed on each hydrant branch.

Details regarding hydrant materials and installation are included in the District DPM (see Chapter 7).

3.2 Water Quality Analysis

Group A public water systems must comply with the provisions of the federal Safe Drinking Water Act (SDWA). DOH enforces the SDWA and regulates bacteriological contaminants, inorganic chemicals (IOC's), inorganic physical parameters, volatile organic chemicals (VOC's), synthetic organic chemicals (SOC's), lead and copper, radionuclides, trihalomethanes, arsenic and asbestos. DOH has recently adopted the Stage 1 Disinfectants and Disinfectant Byproducts Rule (D-DBPR) which is applicable for systems that chlorinate on a regular basis (e.g. over 15 days per year). EPA directly administers the Stage 2 D-DBPR. Additional drinking water regulations will become effective in the next several years. These regulations will impose new regulatory requirements for sulfate, radionuclides, additional IOC's and SOC's, and bacteriological contaminants.

The District presently purchases all of its water from the City of Blaine. Blaine's water supply is a system of groundwater wells, which is not considered groundwater under the influence of surface water (GWI). Since the City of Blaine provides the water to the District, the City of Blaine is responsible for source water quality.

The District has purchased groundwater from the City of Blaine for several decades. The water is good quality water and complaints have been few. Blaine

chlorinates their water at a sufficient level to maintain the required disinfectant residual in the District's distribution system. Blaine is required to disinfect their groundwater at their source and they are required to maintain a detectable chlorine residual at the remote point(s) in their distribution system. The District has standby chlorination capabilities at the Blaine Road Booster Station, where the Blaine supply enters the District system. Samples near the booster station consistently have concentrations of about 0.08 mg/L and samples taken from the District's water system near the wastewater treatment plant consistently have concentrations of at least 0.02 mg/L.

As a purchasing water system, the District is required to perform the following under WAC 246-290-300(2)(b):

- Coliform sampling and analysis
- Distribution system residual disinfectant concentration monitoring per WAC 246-290-451
- Lead and copper monitoring
- Asbestos monitoring

The District currently conducts coliform and residual disinfectant sampling per their Coliform Monitoring Plan (see Chapter 6). The District has been monitoring for lead and copper and has entered the reduced monitoring phase of the program. Sampling and analysis for lead and copper is required every three years. Asbestos monitoring was last completed in 2015 and is conducted every nine years. The detected level of asbestos was below the maximum contaminant level.

As referenced above, WAC 246-290-451 addresses water system disinfection. This regulation addresses the District's need to maintain a detectable residual disinfectant concentration in all parts of the distribution system. The residual concentration is to be monitored on a daily basis at representative points in the system. The District is currently doing this by their daily monitoring at the wastewater treatment plant and by checking the residual concentration at other locations in the system as coliform samples are collected as part of their routine sampling program.

The Stage 1 D-DBPR requirements include submitting a disinfectant byproducts monitoring plan to DOH. Systems serving 500 to 10,000 people are required to collect one quarterly sample for both total trihalomethanes (TTHMs) and haloacetic acids (HAA5) from the location of maximum residence time within the distribution system. A daily sample of the chlorine residual within the system is also required as part of disinfectant byproduct monitoring.

The District is also subject to Stage 2 D-DBPR. The requirement to complete an initial distribution system evaluation (ISDE) standard monitoring plan has been completed. The District's plan has been approved by EPA and includes reduced

monitoring of TTHM and HAA5 once per year. A copy of the approved plan is included in Appendix F with the Coliform Monitoring Plan.

A review of water quality reports for the period 2008 through June 2018 as maintained in the DOH Sentry database for both the Blaine and Birch Bay water systems indicates the water supply is of good quality with very few incidents of contaminant level exceedances. For the Blaine system, the only sample results of note are one exceedance for arsenic at the Lincoln Park Well (2008) and two samples with presence of total coliform in 2011. For the Birch Bay system, the only reports of note are eight isolated samples with presence of total coliform. Four were taken at Sample Station #2 in Pressure Zone 2. The latest unsatisfactory test was in November 2016. The District has evaluated each situation and acted to reduce the risk of contamination, typically by improved management of water supply to isolated parts of the distribution system.

Copies of the 2013-2018 District and 2014-2017 City of Blaine Consumer Confidence Reports are included in Appendix H.

In 2016 the Governor issued Directive 16-06 which, in part, directed Group A water systems to identify all lead service lines and lead components in their systems, and plan to remove them within 15 years. It should be noted that the use of lead piping started declining in the 1930s, with very few (or no) lead lines installed after the 1940s. As described in Chapter 1, the District was formed in 1968 and purchased the assets of Birch Bay Water Company in 1970. The District has no known water mains, service taps, or saddles that were installed prior to the 1960s. The District Manager has consulted with employees who have worked for the Birch Bay Water Company and were employed since the Company was purchased and merged with District. The employees (and former employees) report that no lead service lines were installed, nor have they been observed in the system at any time. The District has completed numerous water main replacement projects since the early 1990s and all projects included replacement of the main and service lines with materials that conformed to the Federal Clean Water and Safe Drinking Water Act requirements. In addition, all of the District's numerous lead and copper samples have tested well below the MCL for lead, and the water system's average pH of 7.8-8.0 is such that it decreases the solubility of lead, minimizing the risk of *any* lead, including that which may be present in low-lead residential fixtures, from leaching into residential piping.

3.3 System Description and Analysis

Figure 3.3 presents a schematic of the existing water system.

3.3.1 Source

Birch Bay Water and Sewer District purchases water from the City of Blaine, primarily through transmission mains along Blaine Road and Portal Way. The water is pumped from two interties with the Blaine system to the District system by a booster pump station (BPS) on Blaine Road. The station is owned and operated by the District. A small amount of water can also be delivered to the District through the line and meter on Semiahmoo Drive (approximately 90 gpm maximum). The station on Blaine Road is presently capable of pumping up to about 1,425 gpm, with both pumps in service. Water supply is limited by existing transmission main and pumping equipment as noted above, and by the contract between the City and the District to 3.73 mgd (2,590 gpm).

Per the wholesale water supply contract, including its four amendments (see Appendix C), the District has provided written notice of its estimated maximum day demand for delivery from the City's water system, for the five-year period beginning in 2017. This is updated annually in August. The supply was estimated to be 2.16 mgd in 2017, gradually increasing to 2.47 mgd in 2022, with corresponding increase in annual quantity. This estimated MDD for delivery by Blaine is a contractual limit established as the basis for the financial terms of the contract, and to facilitate cooperative long-term water supply planning. The District may take delivery of higher daily or annual volumes, subject to availability under existing water rights and City-system demand but will pay a penalty or premium for such additional delivery.

The District has two additional connections to the City of Blaine on Semiahmoo Parkway, the 200 and 300 Zone interties. Each is supplied water from the City's 330 zone with higher hydraulic grade line through PRVs and flow meters. The 200 Zone intertie is for supplemental delivery to the District's system and it has been operated at up to approximately 200 gpm, although hydraulically higher capacity is available. The District operates this connection only in cooperation with Blaine as supply volume is available in the City's 330 and 360 pressure zones. The 300 Zone Intertie is designed for approximately 600 gpm capacity for fire flow and domestic supply, in anticipation of future development in the area. At the present time this connection functions as a standby or supplemental source for the local service area, which is primarily served by the District's Bayvue BPS. The capacity of each intertie should be limited to 800 gpm, the rated capacity of each PRV. The velocity in the short segments of station piping will be greater than 10 fps but only during emergency supply conditions.

Birch Bay's water system is able to continue regular service during power outages, relying on standby storage in the main pressure zone (Zone 1). There are provisions at the Blaine Road BPS to allow connection of a portable generator for supply from Blaine during extended power outages. The Point Whitehorn BPS (serving Zone 3) and the telemetry system headquarters unit are served by the on-site standby power generator at the District's wastewater treatment plant. There are currently no standby power provisions at the Bayvue (Zone 5) or Birch Point (Zone 2) pump stations. Each telemetry system RTU has backup battery power. The battery power only lasts about four hours, so the District has added provisions at all but one site for temporary portable generator connection to keep the RTUs in service and recharge the batteries. The Bayvue BPS serves a small area of the District and has a low-pressure gravity flow bypass. The emergency intertie with the Blaine system (300 Zone Intertie) can provide emergency supply to this pressure zone. Therefore, a generator receptacle will not be added at this site. Zone 2 is served by the Birch Point BPS and the Blaine intertie on Semiahmoo Drive. Each source has approximately the same capacity so standby power is not necessary.

The RTUs at the reservoirs are a key element in the automatic operation of the system. At the Kickerville reservoir site, a third party wireless communication facility is situated next to the reservoir. The District has an agreement with the carrier, and cabling in place, to allow a temporary connection to the facility's standby power generator, to keep the District RTU in service during extended power outages. The District is working on a similar agreement and installation for a wireless facility proposed near the Birch Point Reservoir. For the Semiahmoo Reservoir, the water level can be measured at the reservoir and can be interpreted based on the Birch Point BPS discharge pressure. In the event of a communication failure or other unusual level indication for the Semiahmoo Reservoir, the station controls automatically switch to the local pressure sensor mode. In the event there is no power for the Birch Point BPS facility, a PRV will open upon low pressure in Zone 2, for automatic supply from the Birch Point intertie with the City of Blaine water system.

Refer to Section 4.3 for discussion of water rights.

The District has completed drilling and testing a well PW-2 (approximately 530 feet deep) in the vicinity of Dakota Creek and I-5, northeast of the District service area. This is an artesian well capable of yielding at least 500 gpm. The well is completed within a confined "deep aquifer". Water quality is generally excellent, with low salinity but somewhat elevated levels of arsenic. The District secured a water right to allow development of this new source for 500 gpm of additional supply. Initial water quality testing indicated the presence of arsenic at approximately the MCL. It is not known if the concentration will decrease or increase once the well is placed in service. The well and an easement over the property on which the well is located has been transferred to the City of Blaine for management for the mutual benefit of the City and District (see Appendix C).

The District has supported City efforts to replace or enhance existing City well production and will continue to do and has completed additional work to identify potential additional water supply resources. These efforts are described in Chapter 4.

DOH recommends the following for source reliability:

1. Development of two or more sources of supply with a total capacity to allow replenishment of depleted fire suppression storage within a 72-hour period, while concurrently supplying MDD.
2. Source capable of providing MDD with only 18 hours of pumping.
3. With largest source out of service, remaining sources able to provide a minimum of ADD for the system.
4. Pump stations with second power sources.

As discussed below, the FSS storage volume for the District is 300,000 gallons. A 24-hour flow rate of 70 gpm (93 gpm if only over 18 hours each day) in addition to MDD will satisfy recommendation 1 above, but only from the current single source. The District will not be able to satisfy recommendations 2 and 3 throughout the planning period until a second source of supply is in service. Operation of the system per source reliability recommendation 2 above will impact both the District and City water system and requires a 33% increase in pumping and transmission main capacity. The current Water Supply Contract with Blaine does not reference reduced hours of operation with higher instantaneous delivery rate. The Blaine Road BPS is equipped with a generator receptacle to allow power supply from a portable generator (recommendation 4).

DOH recommends the following for booster pump station reliability:

1. Multiple pumps with capacity to provided MDD with the largest pump out of service.
2. Provision of 20-psi minimum at the pump suction manifold under fire flow plus MDD flow rate conditions.
3. Automatic shut off when intake pressure drops below 10 psi.
4. Pump stations with second power sources.

At the Blaine Road BPS (current main point of supply) booster pump station reliability recommendations 2, 3, and 4 are satisfied. When actual demand reaches and exceeds the BPS capacity, the District will not be able to satisfy recommendation 1 until additional capacity can be developed with station, pump and adjacent transmission main upgrades. In the meantime, the District would need to utilize a portion of its storage capacity to supplement “supply” to meet MDD under such condition. This is not recommended in the near term due to anticipated deficiencies in the minimum required storage, as discussed in more detail below.

Specific groups of pressure zones receive water from common sources and/or rely on the same storage facility. Therefore, the source and storage analyses are based on pressure zone groups, identified by the primary zone in that group. Table 3.3 indicates the three zone groups and the pressure zones in each group.

Table 3.3 presents a summary of the source adequacy review for MDD, by pressure zone. Refer to Figures 1.4 and 3.3 for the location of each pressure zone. Supply to the Zone 2 and Zone 3 zone groups is anticipated to be adequate through the planning period. However, supply to Zone 1, the majority of the District, is forecast to be deficient relative to the demand forecast starting in 2021. Supply is limited by the physical capacity of the Blaine Road BPS, and the supply capacity of the transmission mains serving that station. The forecast deficiency will only be an actual deficiency when the total system MDD reaches about 2.25 mgd. As evident from Figure 2.2, that value has not yet been experienced, but may be reached in the near future with a high demand day. The timing of need for additional supply is dependent on the rate of increase in ERUs, the ADD/ERU and ratio of MDD/ADD. The District will need to regularly evaluate these water demand factors to refine the schedule for supply and other growth-dependent improvement projects. Additional supply capacity of about 1.0 mgd or about 695 gpm is recommended, to meet the 2038 forecast demand. An increase of 500 gpm would meet the forecast demand thru about year 2033. The timing of these capacity needs is a function of the flow and supply pressure, as further evaluated in the distribution system analysis below.

Table 3.3
EVALUATION OF SOURCE CAPACITY VS. MDD

	Year		
	2019	2028	2038
Zone 3 Zone Group			
Projected ERUs and Demand ¹			
Equivalent Residential Units (ERUs)	306	408	523
Average Day Demand (mgd)	0.040	0.056	0.076
Maximum Day Demand (mgd)	0.084	0.118	0.160
Supply from Zone 1 Pressure Zone Group (mgd) ³			
PW BPS Pump 1	0.032	0.032	0.032
PW BPS Pump 2	0.064	0.064	0.064
PW BPS Pump 3	0.064	0.064	0.064
Total Available Source (mgd)	0.160	0.160	0.160
Zone 3 Pressure Zone Group Source Surplus/(Deficiency) (mgd)	0.08	0.04	0.00
Zone 2 Zone Group <i>(Includes Pressure Zones 2 and 4)</i>			
Projected ERUs and Demand ¹			
Equivalent Residential Units (ERUs)	197	357	517
Average Day Demand (mgd)	0.026	0.049	0.075
Maximum Day Demand (mgd)	0.054	0.103	0.158
Available Existing Sources (mgd) ²			
Semiahmoo Intertie	0.110	0.110	0.110
Birch Point BPS	0.049	0.049	0.049
Total Available Source (mgd)	0.158	0.158	0.158
Zone 2 Pressure Zone Group Source Surplus/(Deficiency) (mgd)	0.10	0.06	0.00

Zone 1 Zone Group (Includes Pressure Zones 1, 5, 7, and 10)			
Projected ERUs and Demand ¹			
Equivalent Residential Units (ERUs)	6,479	7,696	9,260
Average Day Demand (mgd)	0.84	1.06	1.35
Maximum Day Demand (mgd)	1.77	2.22	2.83
Available Existing Sources (mgd) ²			
Blaine Road BPS	2.05	2.05	2.05
Less Demand for Zone 2 supply pump			
Birch Point BPS	(0.05)	(0.05)	(0.05)
Less Demand for Zone 3 supply pumps			
PW BPS	(0.16)	(0.16)	(0.16)
Total Available Source (mgd)	1.84	1.84	1.84
Zone 1 Pressure Zone Group Source Surplus/(Deficiency) (mgd)	0.07	(0.38)	(0.99)

Displayed values rounded in some instances.

Pressure Zones 6, 8, and 9 have been eliminated, and their areas merged with the remaining zones.

1. Projected demands as presented in Chapter 2.
2. Supply from lower zone booster pump station determined as the minimum necessary to meet forecast demand for year 2038. Supply per pump is allocated by relative capacity of each pump in a station.

3.3.2 Water Treatment

The City of Blaine is responsible for treatment of the District's current water supply.

The District previously maintained chlorinator equipment at the Blaine Road BPS. However, it was removed due to very infrequent use and the unsealed tank resulted in corrosion of materials in the station building. To provide a means for supplemental disinfection in the distribution system the District has completed improvements at three supply locations to allow use of a portable chlorinator at those sites. Injection quills have been installed at Blaine Road BPS, the Portal Way meter vault and the Birch Point BPS. There is a dedicated electrical outlet that only allows the chlorinator to operate when there is flow at that point in the system. The Blaine Road and Portal Way sites can also be controlled remotely by the telemetry system. The District owns and maintains two self-contained portable electric chlorinators, which are stored at the Water Shop. Each unit has adjustable speed peristaltic pumps and 15-gallon tanks, ready for deployment. The District maintains a small supply (several gallons) of 12.5% NSF-rated hypochlorite. The small quantity is to ensure a fresh supply and two local suppliers maintain additional supply in stock. One person can deploy a chlorinator. The District also has a meter idler set-up, such that the operator can inject hypochlorite through a meter setter by removing the meter and installing

the idler, for connection to the chlorinator. In addition, the District has a gas-powered feed pump/injector, for chlorination at remote locations.

In 2001, EPA promulgated an MCL for arsenic of 0.010 mg/l. Preliminary testing of the water in PW-2 indicates the presence of arsenic. The City and District may need to blend the PW-2 water to achieve lower arsenic concentrations or install arsenic removal equipment at the PW-2 site when that source is placed in service.

3.3.3 Storage

The majority of the District's system (Zone 1) is served by two reservoirs, which are filled by "call-on-demand" pumping from Blaine, while the Birch Point area (Zone 2) is served continuously from one or two points of delivery. The District Semiahmoo Reservoir can be filled from a higher City pressure zone through a PRV located at the City Limits on Semiahmoo Drive and/or via the temporary Birch Point BPS (transfers water from District Zone 1). The District currently has storage capacity of approximately 3.126 million gallons (MG) in three reservoirs: Kickerville – 2.5 MG (Zone 1), Birch Point – 0.5 MG (Zone 1), and Semiahmoo – 0.126 MG (Zone 2). Actual storage volumes are presented in the tables and supporting analysis, whereas nominal volumes are used to reference each storage facility. The actual volume exceeds nominal capacity by 1.4 percent.

The location of the reservoirs is shown in Figure 1.3. The "Birch Point" (0.5 MG) reservoir is located approximately 500 feet west of the intersection of Bayvue and Treevue Roads. It was constructed in 1972 for the main pressure zone and serves the north end of the District. The overflow level is 200.0 feet above sea level. The "Kickerville" (2.5 MG) reservoir is located 830 feet south of the intersection of Bay Road and Kickerville Road. It was constructed in 1977 for the main pressure zone and serves the south and central portion of the District. The overflow for this reservoir is at the same level as for the Birch Point reservoir and both reservoirs are equipped with altitude valves. The "Semiahmoo" (0.126 MG) reservoir located near the north end of Birch Point was acquired by the District from Water District No. 6 in 1987 (constructed about 1975). The overflow level is at 254.9 feet above sea level.

A single mixer has been installed in the Kickerville Reservoir to circulate water from the combined inlet/outlet. Temperature probes are installed at varying levels in all three reservoirs to confirm there is no stratification. Table 3.4 presents a summary of the three existing reservoirs.

TABLE 3.4
GENERAL DESCRIPTION AND CONDITION OF RESERVOIRS

	Birch Point	Kickerville	Semiahmoo
Type of reservoir	above ground	above ground	above ground
Material type	Steel	Steel	Concrete
Nominal Capacity (gallons)	500,000	2,500,000	126,000
Pressure zone (HWL elevation)	200 ft.	200 ft.	254 ft.
30 psi Elevation (ft)	189.3	189.3	249.3
20 psi Elevation (ft)	166.2	166.2	226.2
Min Pump Suction Elev. (ft) ¹	175.33	172.33	201.30
Outlet Elev. (Ft)	175.33	172.33	201.30
Base Elevation (ft)	174.5	169.5	201.3
Height to Overflow (ft)	25.5	30.5	53.6
Diameter (ft)	60	118.25	20
Volume per foot (gal)	21,149	82,147	2,350
Capacity (gal)	539,300	2,505,500	125,960
Operating Range Summer (ft)	9.50	5.75	7.60
Operating Range Winter (ft)	9.50	8.50	8.60
Equalizing Range (ft) ²	1.14	3.28	3.14
Fire Flow Range (ft)	2.4	3.0	12.8
Standby Range (ft) ²	22.2	27.2	44.0
Dead Storage (gal)	17,554	232,477	58,513
Dead Storage (ft)	0.83	2.83	24.9
Age/future life expectancy	45 yrs/25 yrs	40 yrs/25 yrs	42 yrs/25 yrs
Last Painting – Interior	2009	2009	1975±
Exterior	2009	2009	N/A
Last inspection/ cleaning	2018	2018	2018
Isolation valves	Yes	Yes	Yes
Sample tap	Yes	Yes	Yes
High & low-level alarms	Yes	Yes	Yes
Local level indication	Yes	Yes	Yes
Drain facilities	Yes	Yes	No
Overflow pipe	Yes	Yes	Yes

TABLE 3.4
GENERAL DESCRIPTION AND CONDITION OF RESERVOIRS

	Birch Point	Kickerville	Semiahmoo
Air Gap on overflow/drain	Yes/Yes	Yes/Yes	Yes N/A
Tank atmospheric vents w/ non-corroding insect screen	Yes	Yes	Yes
Locks/fences to prevent unauthorized entry	Yes	Yes	Yes
Water tight, insect proof access hatches, vents	Yes	Yes	Yes
Access ways and ladders for maintenance access	Yes	Yes	Yes
Removable silt-stop on the outlet pipe	Yes	No – intake above floor	No - intake above floor
Slope of Reservoir roof	Sloped	Domed	None
Piping material below reservoir & extending 10'	CI	DI	CI
Separate inlet and outlet pipes	Internally yes, Externally No	No, Internally Mixed	Internally yes, Externally No
Seismic Restraint	Upgrades Recommended	Upgrades Recommended	To be evaluated

A study completed in 2004 concluded that the Kickerville and Birch Point steel reservoirs are vulnerable to damage during a seismic event. The study included recommendations for structural improvements and operational strategies to reduce this risk. One risk is associated with wave action and sloshing that may impact the roof/wall joint. As a result, the District has increased the operating setpoint ranges to provide added freeboard in the reservoirs to mitigate for seismic risk. The operating range is further increased in the winter months, when equalizing storage is typically not necessary. The study recommended reinforcement of the lower rings of each tank, and addition of sidewall to foundation anchors for the Birch Point tank. The ring reinforcement and foundation anchor recommendations are independent of the additional freeboard recommendation.

As discussed in Section 3.1.3, there are five types of storage that must be provided: a) Operating Storage, b) Standby Storage, c) Equalizing Storage, d) Fire Suppression Storage, e) Dead Storage.

Operating storage (OS) is the volume of the reservoir devoted to supplying the water system while, under normal operating conditions, the source(s) of supply are in “off” status. OS also includes the unused volume between the overflow

elevation and the highest pump “off” setpoint. At Birch Bay, the system supply pumps are controlled by the water level in the District’s three reservoirs. To keep the water supply circulating in each reservoir, the District has increased the OS volume in service. In addition, the automated control system includes a reservoir balancing program to support regular supply to both the Kickerville and Birch Point reservoirs. The balancing program monitors system demand and Birch Point level to deliver just enough water to increase that level very slowly, thus ensuring that the volume stored in Kickerville is used more readily (Kickerville is further from the system source than Birch Point). Otherwise, Birch Point would fill rapidly and shut off the supply pumps, with little turn-over of the volume stored at Kickerville. The Kickerville setpoints are 5.75 to 8.5 feet below overflow, summer and winter, respectively. The summer value represents the setting used during warm weather in anticipation of peak demand periods or if there are known supply constraints. OS is increased by 1.5 feet during summer non-peak periods to support seismic-risk mitigation. The Birch Point Reservoir relies on an altitude valve which closes when the tank is full and opens when the reservoir level drops about one foot. Birch Point level sensors will call for supply upon falling to a level 9.5 feet below the overflow level. The operation of the Birch Point temporary BPS is a function of the level in the Semiahmoo Reservoir. The level is allowed to drop 8.6 feet in winter and 7.6 feet in summer. A PRV at the Blaine Semiahmoo/Birch Point intertie is set to open if the zone pressure should fall to a level lower than the typical low-level reservoir elevation.

For systems with a single source the recommended standby storage (SB) is two times the ADD. For multiple sources of supply, the volume of SB storage would decrease as a function of the capacity of the second and additional sources. In either case, SB storage should not be less than 200 gallons per ERU. Although the supply capacity at the Birch Point intertie is relatively minor, the Birch Bay system, as whole, is evaluated as a multi-source system. As discussed below, the system is also evaluated by pressure zone groups, associated with specific reservoirs. The Zone 2 group (Birch Point area) is evaluated as a multi-source system, with supply from Blaine and the temporary Birch Point BPS. Zones 1 and 3, when evaluated individually, are each analyzed as single-source systems due to their source configurations.

ES is a function of PHD relative to source capacity and represents the volume of demand that will be met by drawing down storage to meet diurnal peak demands that exceed total available source capacity.

For BBWSD, the volume of fire flow suppression storage (FSS) necessary is 300,000 gallons, for a 120-minute fire flow of 2,500 gpm at a specific parcel along Bay Road. The FSS for the Birch Point and Point Whitehorn pressure zones is 500 gpm for 60 minutes, or 30,000 gallons.

All the storage in the District’s reservoirs is available to customers, by gravity in most cases and by booster pump in the immediate vicinity of the Semiahmoo and

Birch Point reservoirs. Some Dead Storage exists in the Birch Point and Kickerville Reservoirs due to the outlet configurations. Dead Storage in the Semiahmoo Reservoir is controlled by the elevation of the highest directly-supplied customer in that zone.

The total volume of storage required for BBWSD is the sum of OS, ES, SB, FSS, when considered relative to availability at 20 and 30 psi (see Figure 3.1 and Table 3.5). However, as approved by the County Fire Marshal, the District may “nest” SB and FSS storage, configuring the system to maintain the greater of the two volumes in storage, with appropriate minimum delivery pressures.

**Table 3.5
STORAGE ANALYSIS - ENTIRE SYSTEM**

Storage Type	Required Volume (gallons) By Year		
	2019	2028	2038
Operational Storage			
Summer	691,124	691,124	691,124
Winter	919,379	919,379	919,379
Equalizing Storage	100,429	189,791	308,012
Total Required 30 psi			
Summer	791,553	880,915	999,136
Winter	1,019,808	1,109,170	1,227,391
Available 30 psi			
Birch Point	226,296	226,296	226,296
Kickerville	878,977	878,977	878,977
Semiahmoo	13,160	13,160	13,160
Total Available 30 psi	1,118,433	1,118,433	1,118,433
30 psi Surplus/Deficit, Summer	326,880	237,518	119,297
30 psi Surplus/Deficit, Winter	98,625	9,263	(108,958)
Standby Storage	1,821,181	2,330,004	3,003,579
Fire Suppression Storage	300,000	300,000	300,000
Total Required 20-30 psi*	1,691,581	2,200,404	2,873,979
Available 20-30 psi			
Birch Point	295,454	295,454	295,454
Kickerville	1,394,041	1,394,041	1,394,041
Semiahmoo	54,283	54,283	54,283
Total Available 20-30 psi	1,743,779	1,743,779	1,743,779

Surplus/Deficit 20-30 psi	52,198	(456,625)	(1,130,200)
Net Surplus/Deficit 30 psi			
Summer	326,880	(219,107)	(1,010,904)
Winter	98,625	(447,363)	(1,239,159)

All volumes in gallons.

*Not including FSS (nested with SB) and assuming single-source of supply for SB volume.

The most significant element of storage, in the early part of the planning period, is SB at over 1.8 MG, followed by winter OS at over 0.9 MG. SB storage can be reduced when an additional source of supply is placed in operation. However, due to the minimum volume recommended per ERU, even if significant additional supply was added (i.e. more than necessary for year 2038 MDD), additional source capacity alone will not fully address the storage deficiency in 2038. SB volume does increase directly proportional to the number of connections and ADD, so growth that is slower than forecast or water use per ERU lower than forecast will defer the timing of the need for additional storage. There is essentially no opportunity to decrease OS without significant modification of the steel reservoirs, or replacement of the Birch Point reservoir with a facility with increased capacity and appropriate freeboard, and thus lower OS.

The winter-time increase in OS results in deficient storage by 2022, system-wide. The District may address this deficiency temporarily in the winter by increasing the winter operating level. Alternatively, it can be presumed that ES is not required in the winter, thus reducing the required volume of storage and stretching winter capacity another couple of years. This approach defers the timing of need for additional storage capacity until 2024. As discussed further in Section 3.5, a new reservoir should be considered at Point Whitehorn for Pressure Zone 3, and additional or replacement storage capacity should be considered at Birch Point for Zones 1 and 2.

The DOH recommendations for storage reliability are essentially the same as the sizing criteria for standby and equalizing storage discussed above.

The Birch Point and Kickerville reservoirs presently provide storage for all pressure zones except 2 and 4 (see Figures 1.4 and 3.2). Storage is available to Zones 7 and 10 through PRVs and is provided to Zones 3 and 5 via BPS. Standby power is provided for Point Whitehorn BPS (Zone 3). Both Zones 3 and 5 can receive water via gravity from Zone 1 through the BPSs, although only at low pressure. Potential future reservoirs at Birch Point (replacement of or supplement to Semiahmoo Reservoir capacity) and Point Whitehorn will provide storage within Zones 3 and 5. (Zone 9 was eliminated in 2007 and Zones 6 and 8 were eliminated in 2017 with completion of the Blaine Road 16" Water Main Replacement Project.)

Storage is recommended for Pressure Zone 3 because the BPS for that area is served by a single 8" asbestos cement water main that traverses an unimproved

right of way west of Jackson Road. If this main were out of service, very limited supply (flow and pressure) could be provided by an existing 3" main along Birch Bay Drive, but such supply would not support fire flow and is presently not configured to be a source of supply for the Point Whitehorn BPS. In addition, the distribution main from the station discharge to Zone 3 should be replaced to support service reliability. The asbestos cement main was completed in 1976 and is the sole source of supply. It is routed through a forested wetland area, not readily accessible year-round for repairs or leak detection.

The existing Semiahmoo Reservoir provides storage for Pressure Zones 2 and 4. Alternatives to address needs in this area are discussed below.

Table 3.6 presents a summary of storage requirements by existing pressure zone group, and for Zone 3 in anticipation of future storage in that zone.

Table 3.6
STORAGE ANALYSIS – BY EXISTING PRESSURE ZONE

Storage Type	Required Volume (gallons) By Year		
	2019	2028	2038
<i>Pressure Zone 1 (including Zones 5 and 10, excluding Zone 3)</i>			
Operational Storage			
Summer	673,265	673,265	673,265
Winter	899,170	899,170	899,170
Equalizing Storage	123,469	198,769	300,626
Total Required 30 psi			
Summer	796,734	872,034	973,891
Winter	1,022,640	1,097,939	1,199,796
Available 30 psi			
Birch Point	226,296	226,296	226,296
Kickerville	878,977	878,977	878,977
Total Available 30 psi	1,105,274	1,105,274	1,105,274
Surplus/Deficit, Summer 30 psi	308,539	233,240	131,382
Surplus/Deficit, Winter 30 psi	82,634	7,335	(94,523)
Standby Storage	1,689,953	2,119,517	2,700,350
Fire Suppression Storage*	300,000	300,000	300,000
Total Required 20-30 psi	1,689,953	2,119,517	2,700,350
Available 20-30 psi			
Birch Point	295,454	295,454	295,454
Kickerville	1,394,041	1,394,041	1,394,041
Total Available 20-30 psi	1,689,496	1,689,496	1,689,496
Surplus/Deficit 20-30 psi	(458)	(430,022)	(1,010,854)
Net Surplus/Deficit 30 psi			
Summer	308,082	(196,782)	(879,472)
Winter	82,176	(422,687)	(1,105,377)

Storage Type	Required Volume (gallons) By Year		
	2019	2028	2038
<i>Pressure Zones 2 and 4 (Birch Point)</i>			
Operational Storage			
Summer	17,859	17,859	17,859
Winter	20,209	20,209	20,209
Equalizing Storage	-	-	7,386
Total Required 30 psi			
Summer	17,859	17,859	25,245
Winter	20,209	20,209	27,595
Available 30 psi			
Semiahmoo	13,160	13,160	13,160
Total Available 30 psi	13,160	13,160	13,160
Surplus/Deficit, Summer 30 psi	(4,700)	(4,700)	(12,086)
Surplus/Deficit, Winter 30 psi	(7,050)	(7,050)	(14,435)
Standby Storage**	39,421	71,314	103,475
Fire Suppression Storage*	30,000	30,000	30,000
Total Required 20-30 psi	69,421	101,314	133,475
Available 20-30 psi			
Semiahmoo	54,283	54,283	54,283
Total Available 20-30 psi	54,283	54,283	54,283
Surplus/Deficit 20-30 psi	(15,138)	(47,031)	(79,192)
Net Surplus/Deficit 30 psi			
Summer	(19,838)	(51,731)	(91,278)
Winter	(22,188)	(54,081)	(93,628)

Storage Type	Required Volume (gallons) By Year		
	2019	2028	2038
<i>Pressure Zone 3 (Pt. Whitehorn)</i>			
Operational Storage	11,291	11,291	11,291
Equalizing Storage	-	-	-
Total Required 30 psi	11,291	11,291	11,291
Available 30 psi Zone 3 future storage	-	-	-
Total Available 30 psi	-	-	-
Surplus/Deficit, 30 psi***	(11,291)	(11,291)	(11,291)
Standby Storage	79,818	112,287	152,362
Fire Suppression Storage*	30,000	30,000	30,000
Total Required 20-30 psi	79,818	112,287	152,362
Available 20-30 psi Zone 3 future storage	-	-	-
Total Available 20-30 psi	-	-	-
Surplus/Deficit 20-30 psi	(79,818)	(112,287)	(152,362)
Net Surplus/Deficit 30 psi	(91,110)	(123,579)	(163,653)

All volumes in gallons.

Forecast by zone assumes each zone grows consistently throughout system.

* For Pressure Zones 1 and 3, nesting the FSS with SB is recommended; whereas, for the Birch Point areas (Zone 2), with significantly smaller reservoirs, providing for both SB and FSS volumes is recommended.

** Depending on the final configuration of storage and BPS reliability at Birch Point, a portion of this SB storage can be provided in Zone 1 storage.

*** No storage currently exists in Zone 3. Listed Operating Storage is based on estimated tank geometry and drawdown level. Estimated minimum tank geometry for 20 year growth forecast is water level of 30', wall height of 34', internal diameter of 31', OS draw down of 2' - 169,000 gallons.

The storage deficiencies by zone group and potential general solutions as described above for the entire system are essentially the same as for Zone 1. By 2038, up to 1.1 MG of additional storage is required (less, with a second source). Pressure Zone 2 is deficient in storage volume throughout the planning period. About 0.094 MG gallons of additional storage volume is required by 2038. Approximately 0.17 MG is necessary for Zone 3.

A potential configuration for Zone 3 is a ground-level reservoir near the Point Whitehorn BPS, on its supply side. A reservoir with sidewall height of 31 feet (water level of 30 feet with four feet of freeboard) and 34 feet in diameter would provide the minimum required volume. If storage is not constructed in Zone 3, the need in Zone 1 increases by nearly the same volume. At the time of final planning and design for a Zone 3 reservoir, consideration may be given to planning for one day of SB volume and a reduced volume per ERU, with the

reduced volume offset by additional volume in Zone 1. This reduction may be supported by confirming the District has equipment and resources to repair a leak or break in the Zone 3 supply main in less than one day.

Although the whole-system analysis summarized in Table 3.5 indicates storage is adequate for several years, the zone-specific analysis presented in Table 3.6 indicates the need for additional storage capacity is more immediate. The zone-specific analysis considers the existing sources unique to each zone, and considers Zone 3 separate from Zone 1, with no storage. When the near-term surplus in Zone 1 is compared to the current and increasing deficiency in Zone 3, it is apparent that additional capacity should be added by year 2024, based on summer operating conditions.

Given the significant near-term and increasing storage deficiency, and reliability concern for Zone 3 with a single source, the recommended priority for storage improvements are as follows:

- a. confirm needs and complete seismic upgrades at Kickerville Reservoir to protect largest storage structure
- b. add facility at Point Whitehorn (Zone 3) for reliable service and to minimize Zone 1 deficiency
- c. work with Blaine to temporarily rely on their surplus 330 Zone storage for Zone 2, including piping improvements increase capacity of the existing intertie from Blaine to Zone 2¹
- d. increase supply to Zone 1 to reduce deficiency
- e. replace Birch Point Reservoir to address long-term Zone 1 and Zone 2 needs, and potentially to support Blaine's 330 Zone long-term storage needs
- f. evaluate Semiahmoo Reservoir for seismic load vulnerability and complete reasonable-cost upgrades.

The improvements recommended to support the prioritized storage improvements are described in more detail below.

3.3.4 Distribution System

General Description and Inventory:

Water is purchased from Blaine at three primary points of delivery: a 10" line on Blaine Road at Dakota Creek, a 10" line on Portal Way at Dakota Creek, and a 2-½" line on Semiahmoo Drive at Birch Point. Water is transferred throughout the District primarily by gravity but also by four booster pump stations (BPS) – Blaine Road, Birch Point, Bayvue and Point Whitehorn. Water is supplied "on demand"

¹ Blaine has limited surplus if they do not nest FSS and SB storage, or several years of surplus capacity if FSS and SB volumes are nested. Additional capacity can be made available by completion of a pump system supported by standby power, to allow supply from the District to the City through the 200 Zone intertie.

from the City of Blaine with the Blaine Road BPS. The District's distribution lines provide connections from the Blaine system to the reservoirs, businesses and residential units throughout the District. Six pressure-reducing valves (PRVs) are located throughout the system to ensure the pressure at the businesses and the residences is between 30 and 80 psi. There is a total of six different pressure zones throughout the system. A schematic of the District's system is presented in Figure 3.3.

The District water system includes approximately 535 fire hydrants, 869 valves, 34.7 miles (42%) of ductile iron pipe, 36.6 miles (44%) of AC pipe, 10.9 miles (13%) of PVC and HDPE pipe, and 0.7 miles of steel pipe. The distribution of pipe by diameter is presented in Table 3.7.

Table 3.7
EXISTING WATER SYSTEM PIPE QUANTITIES

Pipe Diameter (inches)	Length (feet)
18	5,458
16	19,416
14	15,866
12	31,013
10	68,083
8	161,568
6	63,841
4	27,304
3	7,346
2 ½	278
2	36,162
Total	436,335
Total (Miles)	82.6

The majority of the primary water mains have been constructed since 1968 and the system is in good physical condition. Several District-funded water system replacement projects and two utility local improvement district projects have resulted in removal and replacement of most of the undersized or substandard meters and water mains in the system.

The existing water distribution system is shown in Figure 1.4.

All water mains installed by the District have been inspected by District staff, pressure tested and disinfected. The District has developed and maintained detailed construction standards from its inception. Water and sewer mains are

installed with separation as required by the Department of Ecology *Criteria for Sewage Works Design*. Normally, the separation is ten feet horizontally, unless other conditions are met where ten feet is not available.

There are a number of “dead-end” water mains throughout the system. A blow-off assembly and/or hydrant is available at the end of each for flushing as necessary.

The District’s most leak-prone line, a thin-wall AC pipe likely installed in the 1950s, was replaced in 2016 and 2017. Approximately 30 leaks were recorded from 2011 through August 2018 that were not a result of contractor or storm damage to the water system. About two-thirds of the leaks were associated with deteriorating saddles or PVC pipe fittings. These locations are tracked and mains with recurrent leaks are identified for inclusion in the annual water main improvement program.

The District monitors pressure in the system in several ways. The level of each reservoir is automatically monitored via telemetry and the suction and discharge pressures at each BPS are also monitored via telemetry. The District maintains a permanent pressure gauge on the system at the Water Shop for daily observation.

The distribution system is recorded in a collection of “as-built” drawings and on a series of computer-generated maps (general system map). The general system map (see Figure 1.4) is updated as projects are completed. Prints of construction drawings are maintained in District Water Department offices and service vehicles.

Hydraulic Capacity Analysis:

A computer network simulating the existing primary elements of the distribution system has been prepared and updated to determine the adequacy of the distribution system under normal demand and fire flow conditions.

As an aid in identification of present and future demands and recommended improvements, the District's water system has been modeled on a computer utilizing the WaterGEMS program (Bentley). By modeling the system on the computer, analysis of the system for a variety of situations may be performed, efficiently and at a minimum of cost and effort. Computerization of the system allows identification of problem areas and possible solutions can be quickly examined.

The computational algorithm in WaterGEMS is the computer program developed by the Civil Engineering Software Center at the University of Kentucky. The program has the capability to simulate such elements as pumps, pipes, and PRVs which have connection points, referred to as nodes, on each side of the

element. Water demand is assigned to the nodes throughout the system. It is possible, through the adjustment of demand at the nodes, to investigate the ability of the system to provide MDD, MDD with fire flow or PHD at each node.

In order to perform simulations, it was necessary to establish a number of water system parameters. To determine the flow in pipes, the Hazen-Williams equation for turbulent flow as a function of length, diameter, pipe roughness and head loss was used. The value of 130 was used as the pipe friction factor, except for transmission mains completed within the past 10 years. A value of 140 was used for those new, larger mains.

It is essential to the proper functioning of a water system to have the line pressures and velocities within acceptable operational limits. Computer simulations were performed using pressure limits of 30 to 100 psi and a maximum velocity limit of eight fps. In the simulation output, the lines with velocities outside the limits, and the nodes which had pressures outside the boundaries were evaluated. In this way, identification of potential problem areas was accomplished.

Calibration of Hydraulic Model:

The water system hydraulic model was updated and calibrated in the 1990s. The model was transferred from the KYPIPE2 software program to the graphical interface software program. Following the transfer, the existing system was analyzed with WATERCAD to confirm the accuracy of the transfer. The transfer was successful. The next step was an update of the model. Additional pipes and nodes were added and input data such as diameter, length and junction elevation were reviewed and revised as appropriate. The distribution of demand around the system was revised based on an analysis of the geographical distribution of water used in July/August, 1994. Calibration was the final step in updating the model. A series of six fire flow tests were conducted around the system in June, 1995. Static and residual pressures were recorded at various locations around the District for each fire flow test. The system was modeled for each actual fire flow and predicted residual pressures were reviewed against field data. Adjustment in node elevations and pipe friction coefficients were made in the system data to result in model data which corresponds with field data. The calibrated model predicts pressures within two to three psi of the field data. The model was reviewed and updated for the 2003 and subsequent WSPs. As part of this WSP update, the model was updated to include recent projects and the demand distribution was updated from the work in 1994 and 2009. The model was upgraded from WATERCAD to WaterGEMS software.

Discussion:

The water distribution system was analyzed for its ability to meet PHD, MDD and MDD with fire flow (FF) for the years 2018 (i.e., current system), 2020, 2022, 2024, 2026, 2028, 2033 and 2038. The order of analysis was MDD, PHD, then MDD with FF, for each year. As deficiencies were found for each year and/or scenario, potential improvements were evaluated, modeled and added to the system. As pipes were added or replaced in the model, those “improvements” were retained in the model for analysis with subsequent scenarios. The presumption is that improvements identified for completion by 2020 will be in place by 2022, and so on.

The City of Blaine’s *2019 Comprehensive Water System Plan* was developed concurrently with the District’s. The MDD and PHD analysis for a given year was completed iteratively in the District and City hydraulic model, to assure that the demand and delivery conditions were consistent between each model. The hydraulic models for each system were developed concurrently, to confirm the pressure available in the Blaine system for a given BBWSD demand scenario was appropriately represented in the BBWSD supply scenario. For purposes of hydraulic modeling and capital improvement plan development, projects proposed in the City’s plan were also assumed to be in place per the City’s schedule for determination of available flow and pressure from the City points of supply to the District.

In most cases, the deficiencies were localized enough so probable solutions were obvious. In a few cases, particularly for MDD and water supply to the system, analysis of multiple scenarios was necessary to develop a suitable solution, or choose the minimum length or diameter of improvement project to address the deficiency.

As described above, the District and City system is configured in a way that constrains the capacity of the Blaine Road (supply) BPS. Presently all the District supply is routed south through a single pipe. Flow is split before the pipe crosses Dakota Creek, then the supply is combined at the suction side of the Blaine Rd BPS. To adequately supply the year forecast MDD, the supply system should be improved so it alone can provide all the MDD.

All analysis was completed for the demands presented in Table 2.12 (i.e. assuming no projected additional savings impact on demand).

Summary:

Table 3.8 presents a summary of the analysis of the distribution system, deficiencies and recommended improvements. Table 8.1 presents the description of each recommended improvement.

Table 3.8
SUMMARY OF DISTRIBUTION SYSTEM ANALYSIS

Year	Scenario/Deficiency/Improvements		
	MDD	PHD	MDD w/FF¹
2018	Adequate supply, appropriate pressure and velocity ^{2, 3, 4, 5} .	Adequate supply, appropriate pressure and velocity ^{2, 3, 4, 5} .	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie & BR BPS ⁵ .
2020	Adequate supply, appropriate pressure and velocity ^{2, 3, 4, 5} . Update Blaine Intertie pipe from 2.5" to 8" with 8" meter and PRV - 225 lf.	Adequate supply, appropriate pressure and velocity ^{2, 3, 5} .	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie & BR BPS ⁵ .
2022	Supply adequate, appropriate pressure and velocity ^{2, 3, 5} . Add 1,400 lf 4" main from Zone 2 to Birch Bay Village, add PRVs and close valves to isolate area of Village above elevation 65'.	Adequate supply, appropriate pressure and velocity ^{2, 3, 5} .	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie & BR BPS ⁵ .
2024	Adequate supply, appropriate pressure and velocity ^{2, 3, 5} . Complete 7,300 lf 8" pipe to connect Zone 5 to Zone 2 and add new Birch Point BPS at 200 Zone intertie for storage solution per Table 3.9.	Adequate supply, appropriate pressure and velocity ^{2, 3, 5} .	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie & BR BPS ⁵ .

2026	Adequate supply, appropriate pressure and velocity ^{2, 3, 5} . For PHD total supply through BR BPS results in velocity in station piping > 10 fps. Additional source options described in Table 3.9 - selected PW-2 equip and connect, with source HGL=210'. Also add Portal Way BPS. (Alternate source option - add well along Loomis Trail Rd, 12" main extension, HGL = 220', 700 gpm capacity.)	Adequate supply, appropriate pressure and velocity ^{2, 3, 5} . Velocity in BR BPS > 10 fps - resolved with CIP for MDD condition.	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie ⁵ .
2028	Supply adequate, appropriate pressure and velocity ^{2, 3} .	Adequate supply, appropriate pressure and velocity ^{2, 3} .	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie ⁵
2033	Adequate supply, appropriate pressure and velocity ^{2, 3} .	Adequate supply, appropriate pressure and velocity ^{2, 3} .	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie ⁵
2038	Supply adequate, appropriate pressure and velocity ^{2, 3} .	Adequate supply, appropriate pressure and velocity ^{2, 3} . Low pressure at State Park Supply - demand likely overstated with global escalation factor	No FF deficiencies, velocity > 10 fps in 300 Zone Intertie ⁵

General note - when an improvement is identified for a specific scenario, it is presumed to be complete for the subsequent scenarios in that and following years.

- 1 Fire flow adequacy was reviewed with respect to criteria in Table 3.2, for existing mains six inches and larger.
- 2 Supply deemed adequate if flow rate drawn from storage facilities less than 50 gpm total for MDD, and less for PHD than for MDD (i.e. not relying on additional supply from Blaine to meet PHD).
- 3 Pressure and velocity appropriate if within range of 30 to 80 psi and less than 8 fps within system. Pressure at some locations reaches 93 psi due to proximity to supply booster pump station but such are known long-term conditions.
- 4 Pressure in upper elevation area of Birch Bay Village is typically between 31 and 35 psi, or lower where called out.
- 5 Velocity about 17 to 18 fps in 4" PRV and intertie piping (<16") and > 8 but < 10 fps in BR BPS station manifold piping (till Portal Way BPS added). No improvement identified for this condition during emergency supply situation.

3.4 Summary of System Deficiencies

The following summarizes the system deficiencies identified as a result of the system analysis with respect to the forecast demand.

Table 3.8 includes the distribution system analysis deficiencies. Table 3.9 presents a summary of supply, storage and distribution system deficiencies, with respect to the forecast demand by the year anticipated, based on the discussion and analysis above. Table 3.9 also includes alternatives considered and recommended to address each present or anticipated system deficiency. All deficiencies are reported with respect to the system's ability to meet the demand forecast as presented in Chapter 2. As noted in Chapter 2, actual growth is lagging the County growth forecast by at least three years. The recommended timing of projects identified in this Chapter considering this growth lag is discussed in Chapter 8.

Water Supply:

The District has executed a long term (40 to 60 years) water supply contract with the City of Blaine. The contract has been amended four times to clarify terms and conditions and to provide for additional supply to the District (see Appendix C). The contract provides for up to 3.73 million gallons per day. The demand forecast indicates the contract capacity will not be exceeded by 2038. Improvements to the Blaine Road BPS and transmission/distribution system will be necessary to take delivery of the full supply contract amount (see discussion of transmission/distribution system deficiencies below). System improvements are recommended by 2026 to increase capacity to meet forecast demands.

Storage:

The District, as a whole, is nearly fully utilizing its available winter storage volume and has adequate summer volume through the year 2024. The analysis of each pressure zone group indicates that all three groups are at or approaching full utilization of existing storage capacity. Additional capacity is recommended in each zone group, or in Zone 1 and available by pump, with standby power, to Zones 2 and 3.

As presented in Table 3.4, there are physical deficiencies at each of the existing reservoirs. The conditions that should be addressed are as follows:

- Kickerville: seismic restraint upgrades
- Birch Point: seismic restraint upgrades (or replace with larger reservoir)
- Semiahmoo: seismic evaluation is recommended.

Transmission/Distribution:

As presented in Table 3.8, a number of deficiencies were identified under the various year/demand scenarios. The main condition that requires attention for water demand is to increase rate of supply to/from the Blaine Road BPS and Portal Way intertie to provide capacity for future increased demand.

3.5 Selection and Justification of Proposal Improvement Projects

Table 3.9 includes alternatives considered and recommended to address each present or anticipated system deficiency. System capacity is presented by system element in Table 3.10 and as ERUs and MDD in Table 3.11. Proposed improvement projects are summarized as follows and details are presented in Chapter 8.

Water Supply

Current efforts to ensure adequate water supply commensurate with growth in demand are focusing on conservation and additional groundwater supply. However, to meet the demand forecast as presented in Chapter 2, additional supply capacity is necessary. Several projects are recommended to improve the rate of supply into the District system.

For planning purposes, additional supply is recommended by working to support Blaine's efforts to equip and connect PW-2, likely with an arsenic treatment system. The District has been evaluating the area south/southeast of the City well field for additional water resources. In lieu of equipping and treating PW-2 a more cost-effective well location may be found and considered for development and connection. Future increases in supply can be achieved by additional supply to the Blaine system from Blaine and addition of a booster pump station at the Portal Way connection. Per the water supply contract, the District will financially support supply improvements completed by Blaine. Implementation of the identified projects sooner than required by the demand forecast should be considered where there is opportunity to increase the reliability of water supply in both the Blaine and District system. The proposed projects are summarized more specifically as follows:

- Equip and connect PW-2 to Blaine, or new source of similar benefit in this area, or south/southeast, by City and/or District
- Add BPS at Portal Way connection

Storage

The following projects are recommended to address the storage deficiencies identified above:

In general, confirmation of recommended seismic upgrades and completion of that work at the Kickerville Reservoir is the recommended priority for storage, to protect the largest existing storage facility. Additional capacity is recommended in

a new facility at Point Whitehorn, to address a vulnerable supply condition to Zone 3 and to address the combined near-term deficiency in Zones 1 and 3. Additional capacity is recommended at Zone 2. Consideration should be given to working with Blaine to share and enhance their 330 Zone surplus capacity in the near-term, and work with the City to address forecast deficiencies in Zones 1 and 2 (District) and 330 Zone (City) with a replacement Birch Point reservoir, and BPS serving the higher zones. A separate joint study is recommended to confirm each party's needs and interests, for their mutual benefit.

The recommended storage volume for Point Whitehorn is 169,000 gallons, as recommended in Table 3.6 (footnote).

An evaluation of options for storage and reliable supply for the Point Whitehorn water service area was completed for the 2009 WSP, considering several alternative piping and/or storage upgrade scenarios. That evaluation identified the optimal solution, based on capital cost and aesthetic factors, to be completion of a ground-level, "off-line" storage tank on District property adjacent to the District's wastewater treatment plant. The tank would fill through a level-control valve from Zone 1. The Point Whitehorn BPS would be modified (including new pumps) to draw from the tank and discharge to a closed system with HWL = 260 feet (see Figure 8.2). One system valve would be closed and a PRV would be added at another location for emergency supply back to the local customers in Zone 1. The recommended tank is 31' diameter, 34' tall (30' of water, about 169,000 gallons).

The area of Birch Point in the District's water service area ranges from sea level to about 235 feet elevation. Most customers are served by the existing Semiahmoo Reservoir which is supplied from Blaine or from the Zone 1 via the temporary Birch Point BPS west of Birch Bay Village. A portion of the area on either side of Selder Road is served by the temporary Bayvue BPS with emergency supply via the 300 Zone intertie with Blaine's system.

The 2009 WSP was supported by a detailed analysis of how to support growth in the largely undeveloped area in and above Zone 2. The area has since been removed from the City or County UGA and is now zoned rural, and thus has much lower density and anticipated water demand. The prior plan recommended a network of distribution mains, new BPS and higher-level reservoir, and several PRVs to revise the pressure zones in the area. The reduced density does not warrant and will not financially support such extensive additions to the water system. Therefore, this plan focuses on optimizing use of existing facilities, in context of the anticipated need for replacement and expansion of the Zone 1 Birch Point Reservoir. The details are summarized in Tables 3.9 and 8.1. Coordination with Blaine will be necessary for implementation, but mutual benefits over the planning period are anticipated.

Transmission/Distribution:

Projects are necessary to increase the rate of supply from the Blaine system to the District system, to meet increasing demand and to avoid the reliance on storage to meet MDD. Iterative analysis using the hydraulic model (see Section 3.3.4) resulted in recommendation of a series of transmission main improvement projects to address this deficiency. The supply improvements are summarized above. Otherwise the distribution system is generally adequate. Specific recommendations include new pipelines as follows:

- 8" pipeline to replace 2-1/2" pipeline from Blaine intertie at Semiahmoo Drive, to support recommended near-term reliance on surplus Blaine storage
- 8" pipeline to connect Zone 5 and Zone 2, for zone consolidation, connection of 300 Zone intertie to Zone 2 and to support the recommended shared storage for Zones 1 and 2 and the City in the Birch Point area
- New BPS to replace two existing small stations serving Zones 2 and 5, potentially integrated with BPS to serve the City in the recommended shared storage approach
- Upgraded Point Whitehorn BPS to support addition of ground-level, supply side storage for Zone 3
- Connection from Zone 2 to area of Birch Bay Village presently in relatively low-pressure area of Zone 1

The capital improvement program also should include removal of some parallel undersized piping and an allowance for annual miscellaneous system upgrades, typically for non-standard size and material pipe. Other mains are recommended to support local development, redundant flow paths and looping of the system, as undeveloped areas are developed or redeveloped. These are generally depicted on Figure 8.1 but additional or larger mains may be required by the District as determined in future studies or to meet particular development needs, including phased work in the system.

Table 3.9
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year¹	Deficiency	Alternatives	Evaluation/Recommendation
2018	Kickerville Reservoir vulnerable to damage from seismic load	To address reduced capacity due to limited freeboard, replace facility or manage system with increased OS volume. To address sidewall stability and anchoring deficiencies, complete structural upgrades or replace facility.	Reservoir is about 40 years old and in otherwise good condition. Prior analysis determined that the cost of stability and anchoring upgrades was reasonable compared to cost of replacement. Updated evaluation is recommended as soon as feasible to mitigate risk of loss of use of main storage facility.
2018	Birch Point Reservoir vulnerable to damage from seismic load	To address reduced capacity due to limited freeboard, replace facility or manage system with increased OS volume. To address sidewall stability and anchoring deficiencies, complete structural upgrades or replace facility.	Reservoir is about 45 years old but in otherwise good condition. Prior analysis determined that the cost of stability and anchoring upgrades was not reasonable compared to cost of replacement. As noted below, additional capacity is recommended for Zone 1. A replacement facility is recommended.
2018	Semiahmoo Reservoir seismic load vulnerability analysis	The prior seismic vulnerability analysis did not address this reservoir because it was planned to be replaced with higher and larger storage facility, to serve then-anticipated urban level development in Zone 2. Area is now rural and retaining the reservoir is recommended, with supporting supply upgrades.	Complete seismic load vulnerability analysis concurrent with updated Kickerville analysis. Include allowance for seismic upgrades in CIP.

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year ¹	Deficiency	Alternatives	Evaluation/Recommendation
2018	Inadequate Zone 2 storage volume through planning period	1a - construct replacement larger standpipe (0.1 MG useable) or new ground level reservoir or standpipe near Blaine Semiahmoo Reservoir (330 Zone).	Provides independent solution, with evaluation of final HGL recommended. Raising HGL to match Blaine 330 Zone would require revised District zones and additional PRVs.
		1b - coordinate with Blaine for shared additional storage capacity - Blaine requires additional capacity by 2026 for City 330 Zone.	Create an additional intertie and jointly fund/complete a shared standpipe adjacent to existing Blaine 330 Zone standpipe, with revised Zone 2 HGL. Raising HGL to match Blaine 330 Zone would require revised District pressure zones and additional PRVs.
		1c - utilize near-term Blaine surplus storage volume through upgraded Semiahmoo Intertie (8" piping, PRV and meter). Blaine's surplus exceeds the District's winter deficiency through 2023 (if Blaine nests FSS and SB volumes).	Complete intertie improvements (225 lf 8" main, PRV and meter) Complete agreement with Blaine to rely on up to 40,000 gallons of City surplus storage volume through year 2023. <i>This is the first phase of the recommended solution as it defers Birch Point area storage projects for both systems and plans for cost-efficient ground-level additional capacity for both systems, with Birch Point Reservoir anticipated replacement, to be sized for needs beyond 20 years for both systems.</i>

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year ¹	Deficiency	Alternatives	Evaluation/Recommendation
2018	Inadequate Zone 2 storage volume through planning period	1d - Add storage capacity for Zone 2 in replacement Birch Point Reservoir, through new BPS with generator. Additional BPS could be integrated with project for City to provide additional source of supply to City 330 Zone Standpipe to reduce City's required SB volume and further defer City's need for additional storage.	For long-term mutual benefit, complete a joint-benefit BPS with standby power to provide secondary supply from District Zone 1 to City 330 Zone, and permanent supply from Zone 1 to Zone 2, 4 pumps, with standby power. Provide additional storage volume in replacement Birch Point Reservoir for Blaine's future needs and Zone 2 needs. District use of BPS would be most beneficial with a pipe connection from Zone 5 to Zone 2 (7,300 lf 8"). City BPS would allow more time to defer the Zone 5 to 2 connection and District BPS. <i>This is the second phase of the recommended solution.</i>
2018	No facilities to serve above elevation 180'+/- at Birch Point	2a - if Semiahmoo Reservoir replaced with higher District or shared standpipe, provide direct service and modify zones with additional PRVs.	Not consistent with recommended Zone 2 improvements. Supply BPS would require larger pumps and generator.
		2b - plan future closed zone for small rural service area above elevation 180', with developer-funded zone BPS or private booster pumps.	Defers specific planning until rural area development plans are presented and avoids significant improvements for small number of connections. <i>This is the recommended plan.</i>

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year ¹	Deficiency	Alternatives	Evaluation/Recommendation
2018	Zone 3 Supply Reliability - single source and no storage - no supply if main break of AC supply/discharge piping	3a - provide secondary or replacement supply pipe (6,200 lf, 8") to and from Point Whitehorn BPS to replace 41 year old AC pipe in critical areas.	Prior analysis of routes from Jackson Rd. to Point Whitehorn Rd. for sewer system suggests that pipeline replacement along Birch Bay Drive would be very expensive or not feasible due to environmental and archaeological constraints, or at significant cost to parallel existing alignment or follow Grandview Rd.
		3b - add storage facility for Zone 3.	Prior analysis evaluated several options. Recommended approach is ground level storage, off-line, on supply side of Point Whitehorn BPS, with replacement discharge pipe to PW Road (1,000 lf, 8"). <i>This is the recommended solution as it is lower cost, addresses a near-term risk and supports solution to Zone 1 storage deficiency. Further study should consider water residence time in new facility, and potential to reduce SB volume, with provisions for supply main repair in less than 24 hours. Reduced volume would be added to Zone 1 volume increase.</i>

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year ¹	Deficiency	Alternatives	Evaluation/Recommendation
2021	Inadequate supply for forecast MDD - need to increase flow with limited supply pressure available, or increase flow and supply pressure (System modeling suggests need is by 2026, source analysis suggests need is by 2021, plan for 2020 to increase reliability and reduce storage deficiency)	4a - complete a new BPS at Portal Way, equip PW-2 for discharge of up to 500 gpm to HGL=125', 4,230 lf 12" & 980 lf 8" pipeline to Portal Way/Hall Rd. (West Rd. route), and transfer flow from Hall Rd. main direct to system ² .	Not feasible or cost effective - bypasses Blaine local distribution system and supply would be at too low pressure to serve existing customers.
		4b - complete a new BPS at Portal Way and transfer flow from Hall Rd. main direct to system ² .	Provides adequate flow but insufficient supply pressure with existing Blaine piping - not adequate alone.
		4c - Blaine equip PW-2 for discharge of up to 500 gpm to HGL=210', add Portal Way BPS due to HGL differences, transfer flow from Hall Rd main direct to system ² .	Provides 480 gpm additional supply to BB. <i>This is the modeled solution for the CIP but other feasible solutions will provide similar hydraulic benefit. Further analysis is recommended.</i>
		4d - complete supply pipeline upgrade of 8,700 lf 12" pipeline from Sweet Rd./Harvey Rd, across Dakota Creek to Fishermen's Bend Lane and West Rd., to Portal Way/Hall Rd.	Provides adequate supply but increases velocity through existing BR BPS too much.

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year ¹	Deficiency	Alternatives	Evaluation/Recommendation
2021	Inadequate supply for forecast MDD - need to increase flow with limited supply pressure available, or increase flow and supply pressure (System modeling suggests need is by 2026, source analysis suggests need is by 2021, plan for 2020 to increase reliability and reduce storage deficiency)	4f - BBWSD coordinate with BBJWA to utilize existing 6" BBJWA main along Portal Way south to Kickerville Rd. alignment, with 1,350 LF 8" (min) connection to District on Loomis Trail Rd. Relocate BBJWA BPS. (Transfer some customers to District? Adequate pressure?)	Provides adequate supply to District but Blaine supply pressure too low. Only 50 gpm provided to District in existing 6" main - likely less depending on BBJWA supply locations. Insufficient and low-yield solution.
		4g - same as Alt. 4f but with additional supply and pressure from PW-2 equipped for discharge of up to 500 gpm to HGL=210' as per Alt. 4c.	Provides adequate supply, but hydraulically prevents Blaine from supplying BBJWA. No mixing opportunity so either arsenic must be proven to be less than MCL or treatment provided. Only 56 gpm provided to District in existing 6" main - likely less depending on BBJWA supply locations. Sufficient but low-yield solution.
		4h - Increase capacity downstream of Blaine Rd. BPS with 4,000 lf 18" new main along Dearborn.	Provides very limited benefit as all flow through BPS and existing limited Blaine supply pressure.
		4i - add third pump to Blaine Rd. BPS.	supply pressure too low without other improvements.
		4j - complete connection from Alderson to Bay Rd along Blaine Rd to church extension - 12".	minimal additional supply capacity provided, but consider for reliability for supply to Kickerville Reservoir.

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year¹	Deficiency	Alternatives	Evaluation/Recommendation
2021	Inadequate supply for forecast MDD - need to increase flow with limited supply pressure available, or increase flow and supply pressure (System modeling suggests need is by 2026, source analysis suggests need is by 2021, plan for 2020 to increase reliability and reduce storage deficiency)	4k - complete or upgrade pipes between Harbor View and Shintaffer Rds, complete connection on Shintaffer north of Lincoln.	minimal additional supply capacity provided but consider for local looping and redundancy.
		4l - add new well east near I-5 along Loomis Trail Rd and supply to end of 16" transmission main on Loomis Trail Road - presum 8,000 lf 12" and 700 gpm capacity well.	This is a potential solution but expensive due to presumed distance. A closer well is preferred.
2022	Historically low (<35 psi) and decreasing pressure in upper elevation areas of Birch Bay Village	Southwest portion of Birch Bay Village is above elevation 100' and too high for Zone 1 service. Connect area to Zone 2 to increase HGL.	Connect area to Zone 2 with 1,400 lf 4" pipe and PRV from corner of Birch Point Road to Skagit Place. Close existing valves to northeast along roads between Skagit Way and Makah Rd. Add two or more PRVs for supply from Zone 2 to Zone 1, for redundant supply and fire flow capacity to Birch Bay Village area. Existing easement limits main to 4" - work with property owner to allow 8".

Table 3.9 (Cont.)
SUMMARY OF ALTERNATIVES FOR DEFICIENCY SOLUTIONS

Year¹	Deficiency	Alternatives	Evaluation/Recommendation
2024	Inadequate combined Zone 1 and Zone 3 storage volume (winter and summer) through planning period. Need is impacted by Zone 1 supply needs and upgrades.	Construct additional Zone 1 volume, with focus on Birch Point (see below) and increased supply (see below) to reduce SB storage volume required. Construct Zone 3 Reservoir - see above.	Net addition of 300 gpm supply capacity in year 2020 will reduce year 2038 SB volume by about 0.58 MG (still deficient in 2032 and thereafter). Net addition of 380 gpm supply capacity in year 2028 will reduce year 2038 SB volume by an additional 0.27 MG (still deficient in 2035 and thereafter without increased capacity). Net addition of 280 gpm supply capacity in year 2038 will have no additional impact on storage deficiency (still deficient in 2038 by 0.26 MG winter). In round numbers: replace BP capacity with 0.5 MG (ex.) + 0.26 MG (2038 deficiency with addn. supply + 0.1 MG (Zone 2) + 0.5 MG Blaine 330 Zone + 15% contingency = about 1.65 MG. Increase additional storage if new reservoir not constructed in Zone 3.

General note - when an improvement is identified for a specific scenario, it is sized only as necessary to meet that scenario/demand. If that solution is the ultimate recommended solution, it will be initially sized for the 20-year need, with phased capacity increase options as appropriate.

1 Indicates year deficiency identified - see CIP for schedule for recommended solution.

2 Presently the Blaine Rd. BPS is supplied by mains on Blaine Rd and Portal Way/Hall Rd. The Hall Rd. connection is valved to allow flow to bypass the existing BPS inlet, to serve the system directly if adequate supply pressure.

Table 3.10
WATER SYSTEM CAPACITY – BY COMPONENT 2019

Water System Component - Existing 2019	ERU Capacity¹	Gallons/GPD² Capacity
Source (MDD capacity)	15,542	3,730,000 gpd
Treatment	no treatment provided	no treatment provided
Equalizing Storage	7,979	263,869 gallons ³
Standby Storage	7,947	1,907,219 gallons ⁴
Transmission	>7,947 ⁵	adequate
Water Rights (Qa and Qi)	n/a ⁶	n/a ⁶
Water System Service Capacity (ERUs)⁷	7,947	

1 - ERU based on 120 gpd/ERU for ADD, 240 gpd/ERU for MDD

2 - GPD = gallons per day

3 - Based on required Equalizing Storage plus 50% of surplus storage volume above 30 psi.

4 - Based on available storage at 20-30 psi, plus 50% of surplus storage volume above 30 psi. District standard is two days of ADD, which is essentially equivalent to two days of MDD.

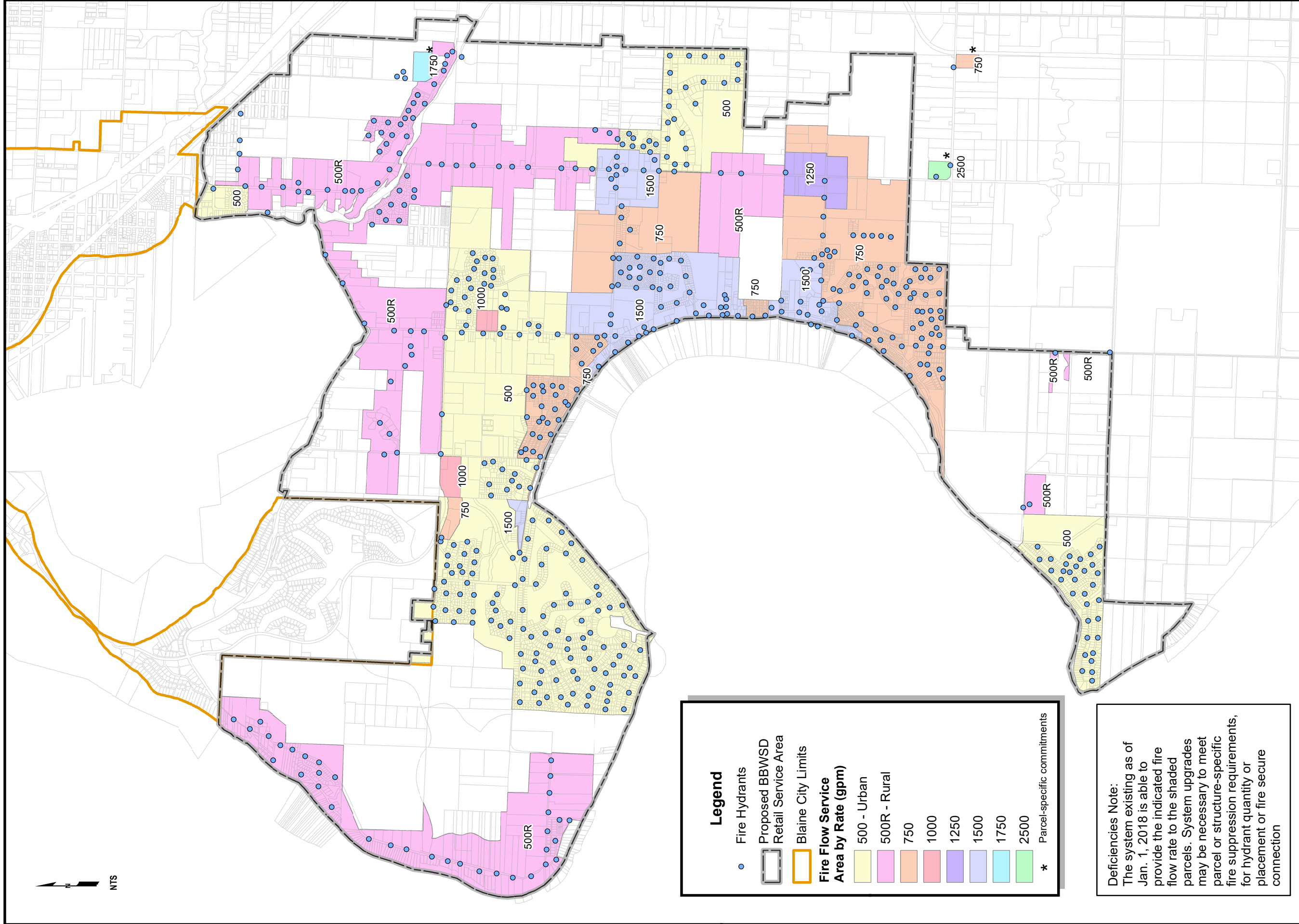
5 - Transmission and pumping capacity is adequate through year 2026 with forecast ERU count of 8,105.

6 - For purposes of this capacity analysis, only the Blaine intertie contract is noted for source. District water rights are not relied upon for this calculation.

7 - Based on the limiting water system component for existing facilities.

Table 3.11
WATER SYSTEM CAPACITY – BY ERUs and MDD

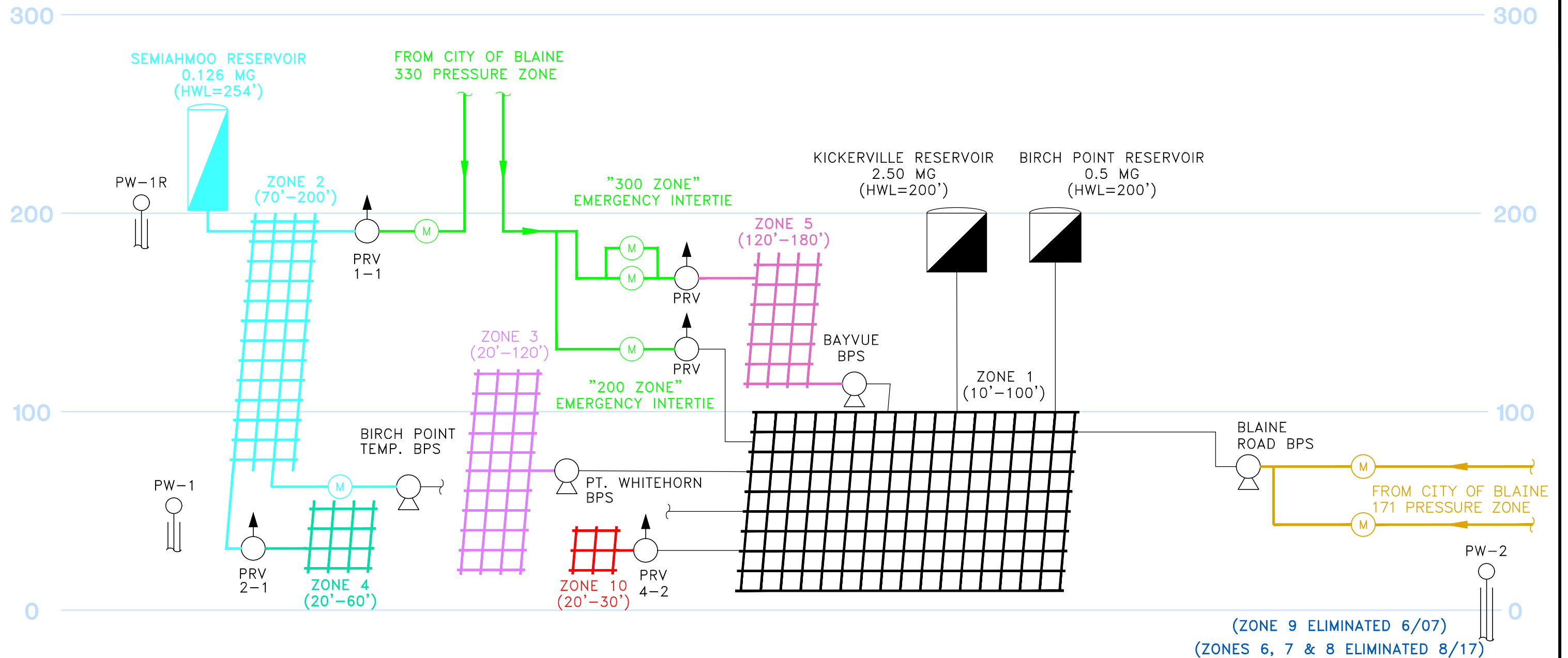
	2019	2028	2038
MDD - ERUs	6,983	8,460	10,300
MDD - mgd	1.91	2.45	3.15



Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

FIGURE 3.2
FIRE FLOW SERVICE
AND DEFICIENCIES

USER: Scott Stenerbinder PLOTTING DATE: 04/06/2017 FILE LOCATION: K:\19-BBWS\2019\191503 Comp Water Plan Update\191503 CAD Figures\191502 WSP - FIG 3-3.dwg



LEGEND

RESERVOIR		WELL		ELEVATION (FT)	300
METER		BOOSTER PUMP STATION (BPS)			
PRV		DISTRIBUTION SYSTEM (WITH SERVICE AREA ELEVATION RANGE)			

CHAPTER 4 WATER USE EFFICIENCY, WATER RIGHT ANALYSIS, SYSTEM RELIABILITY AND INTERTIES

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CHAPTER 4

WATER USE EFFICIENCY PROGRAM, WATER RIGHT ANALYSIS, SYSTEM RELIABILITY AND INTERTIES

4.1 Water Use Efficiency Program Development and Implementation

A water use efficiency (conservation) program should include components of long-term conservation measures and peak use management. Short-term emergency response plans, which are associated with drought and other emergency conditions of water shortage, are not considered elements of conservation.

Washington State adopted the Municipal Water Law (2E2SHB 1338) in 2003. This law amends and clarifies sections of the RCW pertaining to public water systems, including requirements for specific water conservation efforts. WAC 246-290 was amended effective January 22, 2007 to include the rules developed by DOH to implement the Municipal Water Law. The rules require development of a water use efficiency (WUE) program, including WUE planning requirements, WUE goal setting and performance reporting, and distribution system leakage (DSL) monitoring and correction as required. More specific direction is presented in DOH Publication #331-375, *Water Use Efficiency Guidebook*. The District's initial WUE Program was adopted on January 10, 2008 and was updated and adopted on July 10, 2014 (see Appendix I).

The District has been pro-active with water conservation measures and enhancements since it began operation. Water services and water supply facilities have had meters since the early 1970s. The District implemented more specific water conservation efforts in 1991, including public education, early adoption of low-flush toilet requirements, toilet tank retrofit kit analysis and distribution, "conservation" water rate structure, policy prohibiting potable water service for new golf courses, and low-flow showerhead distribution. The District has significantly increased its focus on conservation and implemented a broader water conservation program since 1998. In the 1991 *Comprehensive Water System Plan*, the District identified a water conservation program following the *Interim Guidelines for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs*, July 1990. Five conservation measures were identified as part of that plan.

4.1.1 Current Water Use Efficiency Program

More recently, the District adopted its 2008 WUE program, which consisted of eight water conservation measures, and updated that plan in 2014. The 2014 plan focused on maintaining the ADD/ERU at or below historical levels and maintaining DSL at or below 10%. Table 4.1 presents a summary of estimated

savings over the past six years. The District saved approximately 83.4 million gallons of water over the past six years by implementing this program.

Table 4.1
ESTIMATED WATER SAVINGS: 2012-2017

Forecast ADD	126 gpd/ERU					
WUE Goal 2012-2013	126 gpd/ERU					
WUE Goal 2014-2017	116 gpd/ERU					
DSL Goal 2012-2017	10% or less					
	2012	2013	2014	2015	2016	2017
ERUs	1,406	1,409	1,416	1,212	1,123	1,247
ADD/ERU (gpd)	105	103	108	114	111	106
ADD/ERU Reduction (gpd)	20.9	23.1	18.3	11.6	15.2	20.5
Annual ADD/ERU Savings (MG)	10.7	11.9	9.47	5.15	6.23	9.33
DSL (%)	4.90	7.80	8.98	7.36	10.2	9.38
Annual Production Less DSL (MG)	264	261	267	287	279	283
DSL Reduction (%)	5.10	2.20	1.02	2.64	(0.22)	0.62
DSL Savings (MG)	13.5	5.76	2.71	7.56	(0.61)	1.77
Total Estimated Savings (MG)	24.2	17.6	12.2	12.7	5.61	11.1
Total Estimated Savings, All Years (MG)	83.4					

The District adopted the 2014-2019 WUE Program on July 10, 2014 (see Appendix I). That WUE Program has been updated for implementation upon adoption of this Plan, for the period 2019-2028. Table 4.2 provides a summary of all conservation measures that are part of the WUE Program. The conservation measures encompass both supply-side and demand-side activities and are the eight measures established in the prior programs. Additional information about each program area is discussed below.

Table 4.2
2019-2028 CONSERVATION MEASURES

Measure	Sectors		
	SF	MF	ICI
1. Meters (Source and Service)	X	X	X
2. System Leak and Repair	X	X	X
3. Conservation Pricing in Rate Structure	X	X	X
4. School Education Program	X	X	
5. Public Outreach	X	X	X
6. Commission Policies	X	X	X
7. Joint Programs & Regional Collaboration	X	X	X
8. Evaluate Reclaimed Water			X

SF is single family; MF is multi-family;
ICI is industrial, commercial, institutional

1. Meters (Source and Service)

The District has been fully metered since 1970. Multiple unit accounts such as RV Parks, mobile home parks, apartments, condos, timeshare condos, and platted associations built after May 1994 are required to be individually metered. The District also has three source and two emergency intertie connections that are all metered.

In 2018 the District began a five-year program to implement an automated meter read (AMR) meter upgrade program. The meter heads will be replaced with units appropriate for data collection and radio transmission and meter assemblies that are more than 15 years old will be replaced.

2. System Leak Detection and Repair

The District employs numerous measures to minimize leaks on both the supply-side (District) and demand-side (customer). Leak detection measures include telemetry/monitoring, meter testing/calibration, hydrant meter rental, non-revenue water tracking, leak adjustment policy and water main repair and replacement program.

3. Conservation Pricing

The District implements a three-tiered inverted block rate structure and includes only 400 cubic feet in the base rate to encourage water customers to conserve at home.

4. School Education Programs

The District coordinates with the City of Blaine on a school outreach program for the Blaine School District (which serves both the City and District water service areas). Students are educated on water conservation issues and water saving ideas.

5. Public Outreach

The District disseminates its conservation messaging to its customers through multiple outreach efforts. The District distributes a newsletter periodically through customer billing statements and on the District website. During the summer peak season, the District runs advertisements in the local community newspaper “The Northern Light” to inform customers about the voluntary watering schedule, water usage status and other water conservation tips. The District participates in community events to promote its conservation efforts to the public.

6. Commission Policies

The District uses commission policies to limit and minimize the amount of potable water used for irrigation of commercial and residential properties.

7. Joint Programs/Collaboration

Since 1998, the City of Blaine and the District have worked collaboratively on water conservation activities and programs. The District is also a participating member of the Whatcom Water Alliance, a regional conservation group comprised of local water utilities in Whatcom County. The goals of the Alliance are to promote water conservation through coordinated public information efforts and other related activities. Conservation activities supported by the Alliance include the voluntary watering schedule, rain water harvesting, EPA WaterSense and Water’s Worth It Campaign messaging.

8. Evaluation of Reclaimed Water

The District continues to evaluate the potential use of reclaimed water for irrigation and industrial uses.

4.1.2 Goals

The principal drivers of the conservation program at the District are staying within allotted water rights and deferring expansion of existing facilities to control costs. The conservation program provides a cost-effective alternate approach to keeping up with demand, extending current supplies and maintaining reliability. The goal of the 2019-2028 conservation program is to manage demand in a manner consistent with this Plan's "with additional conservation" demand forecast (see Table 4.2 and Chapter 2).

To keep up with demand sustainably, the District has two goals:

- Maintain 116 gpd per single family residence through 2019, and less than 120 gpd through 2028
- Meet Distribution System Leakage Standard of 10% or less.

These goals were established by the District following a public hearing, by approval of the District Commissioners as discussed in Chapter 10.

The WUE Program will aim to reach conservation demand figures based on the updated demand forecast (see Chapter 2). Estimated total system savings for 2019 through 2028 with conservation efforts totals 0.525 mgd from MDD and 0.275 mgd from ADD (see Table 4.3).

Table 4.3

MEASURABLE OUTCOMES FOR SYSTEM WITH WATER USE EFFICIENCY PROGRAM

	Maximum Day Demand (MDD)			Average Day Demand (ADD)		
Year	Without Conservation (mgd)	With Conservation (mgd)	Savings (mgd)	Without Conservation (mgd)	With Conservation (mgd)	Savings (mgd)
2019	1.911	1.883	0.028	0.911	0.897	0.013
2020	1.964	1.931	0.033	0.962	0.944	0.018
2021	2.019	1.981	0.038	0.989	0.968	0.021
2022	2.075	2.032	0.043	1.016	0.993	0.023
2023	2.133	2.084	0.049	1.044	1.018	0.026
2024	2.192	2.137	0.054	1.073	1.044	0.029
2025	2.253	2.192	0.060	1.103	1.071	0.032
2026	2.315	2.249	0.066	1.134	1.099	0.035
2027	2.379	2.307	0.073	1.165	1.127	0.038
2028	2.445	2.366	0.079	1.197	1.156	0.041
	Total Savings		0.525	Total Savings		0.275

4.1.3 Measure Evaluation

The District's conservation program for 2019-2028 consists of eight measures which are listed in Table 4.4. The program reflects the continuation and/or enhancement of existing measures in the historical program. The District plans for the conservation program to remain flexible over the ten-year period; therefore, details may be modified to meet the conservation goal and maintain cost-effectiveness of the program.

Table 4.4
2019-2028 CONSERVATION PROGRAM

Measure	Implementation Schedule									
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
1. Meters (Source and Service)	X	X	X	X	X	X	X	X	X	X
2. System Leak Detection & Repair	X	X	X	X	X	X	X	X	X	X
3. Conservation Pricing in Rate Structure	X	X	X	X	X	X	X	X	X	X
4. School Education Programs	X	X	X	X	X	X	X	X	X	X
5. Public Outreach	X	X	X	X	X	X	X	X	X	X
6. Commission Policies	X	X	X	X	X	X	X	X	X	X
7. Joint Programs & Regional Collaboration	X	X	X	X	X	X	X	X	X	X
8. Evaluate Reclaimed Water	Periodically, as opportunities arise.									

1. Meters (Source and Service)

The District will continue to support the maintenance of source meters and service meters and install new service meters as required for years 1-10 of

the conservation program. Evaluation will consist of a meter testing program to determine the accuracy and efficiency of the existing meters. As part of the AMR implementation program, meters older than 15 years will be replaced.

2. System Leak and Repair

The District will continue to implement system leak detection and repair for years 1-10 of the conservation program. Evaluation will consist of reviewing the DSL percentage and volume each year to gauge compliance with the DSL requirement of 10% or less on a rolling three-year average.

3. Conservation Pricing in Rate Structure

The District will continue to support their existing three tier inverted block conservation pricing structure. Conservation pricing will be implemented for years 1-10 of the conservation program. Evaluation will consist of reviewing the impact of pricing during peak summer months.

4. School Education Program

The District will continue to coordinate with the City of Blaine for the school outreach program for the Blaine School District. This measure will be implemented for years 1-10 of the program and be evaluated by tracking the number of programs conducted and the number of students reached by the programs annually.

5. Public Outreach

The District will continue implementing and enhancing its various public outreach activities. This measure will be implemented for years 1-10 of the program. Evaluation will consist of tracking the number of programs conducted and the number of program participants reached by District outreach programs annually.

6. Commission Policies

The District will continue to enforce its two commission policies to limit and minimize the amount of potable water used for irrigation of commercial and residential properties for years 1-10 of the conservation program. Evaluation will consist of consideration of additional customer or development practices that warrant regulation for long-term water resource management.

7. Joint Programs & Regional Collaboration

The District will continue to work collaboratively with the City of Blaine on water conservation activities/programs. Collaboration will take place in years 1-10 of the conservation program. Collaboration efforts will be evaluated annually for involvement, cost-effectiveness, and comprehensiveness.

8. Evaluate Reclaimed Water

The District will continue to evaluate potential uses of reclaimed water for irrigation and industrial uses. Evaluation of potential reclaimed water uses will be completed periodically as potential new opportunities for cost-effective implementation of a reclaimed water program arise.

4.1.4 Measure Implementation

All WUE measures described in Section 4.1.3 above are planned for implementation by the District, as described above.

4.1.5 Customer Education

Customer education with respect to water use efficiency is accomplished through multiple WUE measures (see Sections 4.1.1 and 4.1.4) conservation pricing, public outreach, school education programs and public messaging.

4.1.6 Projected Water Savings

The 2019-2028 WUE Program will aim to reach conservation demand figures based on the updated demand forecast. Estimated total system savings for the years of 2019 through 2028 with conservation efforts totals 0.587 mgd from MDD and 0.305 mgd from ADD (refer to Section 4.1.2).

4.1.7 Effectiveness Evaluation

The performance of the water conservation program will be evaluated annually after each peak summer season and following each calendar year. Evaluation procedures will vary for each program component based on its conservation tactic (i.e. hardware versus behavioral), but reviewed to assess its effectiveness in achieving the program's conservation goal. Amount of water saved and savings in terms of water and sewer facilities will also be considered in the review process. If program measures are not supporting achievement of the established conservation goal, appropriate modifications will be made to uphold the program's goal and cost-effectiveness.

The AMR program to be implemented over the next five years will allow an increasing ability to gather more time-specific water use data, for customer and District information.

The WUE rule requires municipal water suppliers to submit a WUE performance report to the DOH by July 1st of each year for the previous year [WAC 246-290-840(1)(a)]. The information submitted to DOH must be made available to the public. The District distributes its performance report to the public in conjunction

with its annual Consumer Confidence Report (CCR). The District's annual reports for 2011 thru 2017 are included in Appendix I.

4.1.8 Distribution System Leakage

Under the WUE rules, all municipal water suppliers must maintain their DSL at or below 10 percent of their production, based on a rolling three-year average. Leakage must be reported as a percentage and as a volume. If municipal water suppliers are not meeting the distribution leak standard they must develop and implement a water loss control action plan. That action plan would outline steps and timelines needed to enhance efforts to reduce system leakage.

The District has taken numerous measures to minimize leaks on both the supply-side (District) and demand-side (customer), as listed below and previously described in Section 4.1.1, Item 2.

- telemetry/monitoring
- leak adjustment policy
- meter testing/calibration
- hydrant meter rental
- non-revenue water tracking
- water main repair and replacement program

See Section 2.2.4 for additional discussion of DSL.

4.1.9 Water Rate Structure

The District will continue to support their existing three-tiered inverted block conservation pricing structure. Conservation pricing will be implemented for years 1-10 of the conservation program. Evaluation will consist of periodically reviewing the impact of the inverted block structure and pricing.

4.1.10 Reclaimed Water Opportunities

The District has evaluated the potential use of reclaimed water for irrigation and industrial uses. In 1999, the concept was briefly addressed in the District's *Engineering Report for Wastewater Treatment Plant Improvements* and in 2006 the District completed a preliminary study looking at the cost to treat and deliver reclaimed water to golf courses within the District boundary and West Blaine. The BP Cherry Point Industrial Area was identified as having the most cost-effective market for reclaimed water service by the District because of the year-round demand and short distance from the District wastewater treatment plant (WWTP).

The City of Blaine produces Class A reclaimed water at their Water Reclamation Facility. As a measure to reduce the need to obtain additional potable water

supply, the City constructed a reclaimed water conveyance pipeline to the Semiahmoo Golf Course. As a result, the City and District are able to use the potable water previously used to irrigate the golf course (approximately 64 af/yr).

The District recently completed a study exploring the feasibility of supplying water from its service area to areas to the southeast and east of the District and Blaine. The study is titled *North Whatcom County Regional Water Supply Feasibility Study – Phase 1*, February 2018 (Feasibility Study). The Feasibility Study included a general evaluation of sources for and uses of reclaimed water in North Whatcom County. The District is identified as a potential source. Potential users include the BP Refinery, Chemco and other industrial water users southeast of the District.

4.1.11 Water Supply Characteristics

The District purchases and receives groundwater from the City of Blaine for all of its water supply needs. A majority of the water supply to the District is conveyed through a booster pumping station on Blaine Road, which is owned and operated by the District. This supply is from two interties. A small amount of water is also fed to the District through the line and meter on Semiahmoo Drive at Birch Point. Two interties have also been established between the two systems at the intersection of Semiahmoo Parkway and Horizons Drive. A small portion of these connections are for supply, but each mainly serve as emergency and/or fire flow connections. Water supply is limited to 3.73 mgd by the contract between the City of Blaine and Birch Bay Water and Sewer District.

In 2006, the District agreed to work with the City of Blaine to develop new groundwater resources to help meet current and future needs. As a result of the joint project, two new wells have been drilled to supplement existing City wells that were producing less water than their full water right capacity would allow. The City and District are seeking additional groundwater rights. The City has 15 ground water right applications pending review and approval, covering a large area east and southeast of the City. Four applications were submitted in 2007 and the remainder were submitted in 2011.

The District has secured a 500 gpm water right for its existing well PW-2. The District has transferred ownership of the physical elements of PW-2 to the City (now designated as PW-2D), and granted an easement to the City over the property on which the well is located. The District retains the water right, for management with other City wells for supply to both systems. The District has a water right for PW-1 for 100 gpm Qi, but the well yield is less than 20 gpm. The District has completed drilling a replacement well (PW-1R). However, the yield for this well is also substantially less than 100 gpm. The costs to equip PW-1R for supply are prohibitive at the present time, with the low yield.

Concurrent with initiating the Feasibility Study, the District completed three test wells southeast of Blaine and generally due east of PW-2 (#2D in that report) to further efforts to locate and quantify potential additional water resources. Evaluation of test pumping results for the westerly two wells (EW-3 and EW-2) suggests they could support a sustainable yield of over 500 and over 600 gpm, respectively. EW-3 is located adjacent to Haynie Road about 1.5 miles east of PW-2. Both are located in the area covered by Blaine's pending ground water right applications. Based on the findings of the exploration wells, additional exploration wells are recommended southwest and southeast of the Blaine well field.

4.2 Existing Source of Supply Analysis

The Department of Ecology requires water purveyors to demonstrate consideration of opportunities to optimize or obtain the use of existing sources already developed. An evaluation of other innovative methods to meet water needs should also be included. The source of supply should include analysis of the feasibility and cost effectiveness of implementing the alternatives in lieu of new source development. These alternatives are discussed below.

4.2.1 Enhanced Conservation Measures

As discussed in Section 4.1, the District has implemented eight water use efficiency measures with the goal of reducing ADD system-wide.

4.2.2 Water Right Changes

Birch Bay Water and Sewer District purchases groundwater from the City of Blaine, with delivery as described in Section 4.1.11 above. Water supply is presently limited to 3.73 mgd by the contract. Blaine holds the water rights for this supply and the parties have executed two contract amendments that provide for additional water supply associated with Blaine's groundwater wells and other coordinated efforts for additional water supply. The District has received approval of a water right permit for its well PW-2, and has conveyed the well's installed facilities to the City, for joint water supply purposes.

The District has a water right for PW-1 for 100 gpm Qi, but the well yield is less than 20 gpm. The District has completed drilling a replacement well (PW-1R). However, the yield for this well is also substantially less than 100 gpm. The costs to equip PW-1R for supply are prohibitive at the present time, with the low yield.

4.2.3 Interties

Blaine is the only water purveyor in the immediate area with significant source of supply and the systems are connected at five locations: Blaine Road, Portal

Way, Semiahmoo Drive and Semiahmoo Parkway (two). Additional connections between the City and District system may be made to enhance delivery to the District or for the purposes of emergency supply (one direction or the other or both).

Birch Bay State Park operates a Group A system for service within the Park boundary. The Park water system is served by the District by a single meter on Birch Bay Drive. DOH reports the Park Group A water system as inactive as of 2001.

The District has one intertie with another water user which is only used for emergency supply situations. Further discussions are included in Section 4.5.1.

4.2.4 Artificial Recharge

Artificial recharge is the injection or infiltration of available surface water, typically from winter flow or other available water into an aquifer and its subsequent withdrawal. This potential supply method may be evaluated in more detail in future years.

4.2.5 Use of Reclaimed Water, Reuse and other Non-Potable Sources

There are two classes of reclaimed water, as defined by the State: Class A and Class A+. Class A+ is the highest class and would be suitable for potable use. Class A has a wide range of potential uses. Class A reclaimed water is oxidized, coagulated, filtered and disinfected wastewater.

The level of treatment provided by the District's existing wastewater treatment plant meets the basic requirements for oxidation of all four classes of reclaimed water (BOD₅ and TSS of 30 mg/l). Additional treatment process units would be necessary for coagulation and flocculation in order to meet the requirements for Class A reclaimed water. These units would include chemical addition and mixing equipment, flocculation basins, and filters with backwash and solids handling equipment. Enhancements of the disinfection system may be necessary to achieve the appropriate level of disinfection for each class of reclaimed water. Depending on the proposed use of the reclaimed water, a chlorine residual may be required.

Potential existing and future candidate uses of reclaimed water, and the corresponding reclaimed water distribution system, are shown on Figure 4.1. These uses include golf course and landscape irrigation, construction (dust control and compaction), industrial process water, ship ballast, sewer flushing water and groundwater recharge. (Groundwater recharge areas are not shown, as potential areas of use have yet to be determined.) Additional low volume uses may be identified once the primary infrastructure is in place (e.g. fire sprinkler systems and residential landscape irrigation).

Use of the District's WWTP effluent as reclaimed water has been evaluated at times over the past few years. The two most likely candidates for reclaimed water use are golf course irrigation and industrial process water. The District adopted a policy in 1991 (revised in 1997) to not supply water for the purpose of irrigating new golf courses. The existing and proposed golf courses are in the north part of the District and it may be less expensive to serve these developments with reclaimed water from the City of Blaine. The City and local developers have been considering reclaimed water use for these golf courses. The other likely use would be industrial process water in the Cherry Point Industrial Area. It may prove cost effective to develop and use a reclaimed water system from the Birch Bay WWTP rather than bring significant volumes of water from the Nooksack River, the current water source for the industrial area. This concept was briefly evaluated in the Feasibility Study referenced above. Groundwater recharge may also prove to be feasible in the future as peak day and seasonal demands for potable water exceed the existing developed potable water sources.

Detailed planning efforts have not been completed by the District because the initial estimates of the cost of treatment and especially the cost of the reclaimed water distribution system have exceeded the estimated benefit from the use of reclaimed water. The availability of water in Birch Bay (and to some extent in Blaine, the current source for the District's water) is not a concern for most of the year due to cooler temperatures and the seasonal population fluctuations. The demands for irrigation water coincide with the peak demands for potable water but the duration of the demand period is only a few weeks to a few months. The cost to develop a reclaimed water system for only a few months of use each year appears to be prohibitive. If a year-round industrial demand is identified, development of the reclaimed water system may prove to be cost-effective.

4.2.6 Treatment

The type and level of treatment will need to be determined at such times as additional sources are identified.

4.3 Water Right Evaluation

The District's main source of water is derived from water rights, permits and claims issued to the City of Blaine for multiple wells installed to depths of approximately 100' to 700' below ground within aquifers in the vicinity of Blaine city limits. Pursuant to a wholesale water supply contract with Blaine, the City is obligated to deliver water derived from these rights, permits and claims to the District through interties. The District has reviewed Blaine's water rights and has determined that those rights allow the City to deliver water to the District as specified in the wholesale water supply contract. At this time, there are five connections in operation: the 10" connection near the point where Blaine Road

crosses Dakota Creek, the 10" connection on Portal Way immediately south of West Road, the 2-1/2" connection on Semiahmoo Drive (Birch Point) and two 4" connections northeast of Bayvue Road and Selder Road intersection on Semiahmoo Parkway for emergency and peak day supplemental supply. Master meters owned and operated by the City are installed on all interties in order to quantify the water delivered to the District. The District may in the future specify alternate or additional points of connection with the City's water system for delivery of wholesale water. The wholesale water supply contract, which runs through 2042, presently provides for delivery of water at a maximum daily rate of 3.73 mgd, with the total annual quantity limited to 2,628 acre-feet per year (af/yr).

The District understands the City of Blaine is developing additional information systems to monitor the aquifers that produce water under the supply contract. Collection of additional information is encouraged and supported by the District, in order to continuously improve the effective management of this critical resource and improve the understanding the long-term yield. In the event that long-term yield is anticipated to not meet the combined needs of the City and District, the supply contract provides that reductions in yield would be prorated between the District and the City. At no time, however, would a shared reduction in use require a District usage below 1.584 mgd.

To augment current system reliability and provide future supplies, the District is pursuing several additional supply and resource management options.

- The City of Blaine has secured three new water right permits (see Appendix E).
- The District has also secured a new water right permit for 500 gpm and 806 af/yr for a well (PW-2) located in the northeast corner of an approximately 2.2 acre parcel of property located immediately east of Interstate 5, approximately 1,600 feet south of Dakota Creek (see Appendix E). The water right permit is for public/municipal supply purposes and the place of use is the area served by Birch Bay Water and Sewer District. A test well was drilled to a depth of approximately 530 feet below ground at this site. On April 30, 2001, GeoEngineers issued a report on the results of water quantity and quality tests performed on PW-2 during 2000. The report concluded that PW-2 had a safe yield of 525 gpm with excellent water quality. The District has transferred the well's installed facilities to the City for joint water supply purposes.
- The District has a water right (Appendix E) for 100 gpm and 112 af/yr for Production Well 1 (PW-1), installed at a depth of approximately 70' below ground in an aquifer in the northwest portion of the Birch Point Upland. The Report of Examination for this water right indicates that the purpose was public water supply. No place of use was specified. However, the right was issued to former Whatcom County Water District No. 6 and the water produced was applied to beneficial use in the Birch Point area served by Water District No. 6. This well, when originally drilled by Water

District No. 6 in 1967, was reported to be capable of producing approximately 100 gpm with a limited amount of water level drawdown. During the 1980s, the well was observed to experience decreased production and elevated chloride levels, as a result of which production was suspended. In 2000, the District drilled a replacement well (PW-1R) near the District's Semiahmoo reservoir located approximately 1,000 feet east of PW-1. PW-1R was drilled to a depth of 260' and was determined to be capable of producing 15 gpm for at least 10 days of continuous pumping.

- The City has applied for additional ground water rights and has a total of 15 applications pending review. The applications were filed in 2007 and 2011 and cover a broad area generally north of Dakota Creek from Blaine Road east to Delta Line Road.
- The District has completed three exploration wells and determined that two of the wells can likely support a sustainable yield of over 500 gpm each. Those wells were completed concurrently with phase 1 of the Feasibility Study referenced above. The installation and testing of the three exploration wells were funded by a grant provided by DOE (Agreement No. WRPIFA-1517-BiBBWSD-0048). The scope of work, which included testing the wells (both quantity and quality) was approved by DOE prior to drilling the wells.

Table 4.5 presents a summary of the District's water rights and supply contract, with recent and forecast use by source.

As discussed in Section 1.6, the District has declared a retail water service area to meet the objectives of RCW 43.20.260. In addition to providing service within the retail service area, the District has and will continue to provide potable water service to an area outside the retail service area, by agreement. The District provided wholesale potable water supply to the PUD from 1990 until 2010, which in turn sold the water to BP. Following satisfaction of certain contractual conditions, the District began direct potable supply to BP, by agreement, through existing pipes and meter, without involvement of the PUD late in 2010. Thus, the service area of the District, as that term is defined in RCW 90.03.383, is larger than the retail service area described above. The District service area as defined by RCW 90.03.383 is indicated on Figure 4.2.

Service within the Retail Service Area is discussed in Section 1.6 of Chapter 1. Per RCW 43.20.260 pertaining to municipal water supply, the District has a duty to serve new connections within their retail service area if four thresholds are met. Sufficient water rights are one condition necessary for service. As documented above, the District has adequate water rights, by water supply contract, to provide service to its retail service area through and beyond the 20-year planning period. In addition, the District is continuing its efforts to assure a reliable supply of adequate capacity for its service area and beyond the current planning period.

4.4 Water System Reliability Analysis

Water system reliability analysis is necessary and prudent to understand the issues that threaten the District's ability to provide an adequate quantity of high quality water to its customers at all times.

4.4.1 Summary of System Reliability Efforts

- **Source Reliability**

The District presently purchases all of its water from the City of Blaine. The supply contract presently limits the District to 3.73 mgd of supply, and the contract expires in 2042, with remaining option for two additional 10-year extensions. The District and City continue to study the City's water supply system and production wells. These efforts have identified several options for increasing source capacity over the next few years, including improvements to and improved management and monitoring of the existing production wells, drilling replacement wells and drilling new wells. As noted above, the District completed the drilling and testing of its new well, PW-2, located in the Dakota Creek watershed northeast of the District and I-5. The District has also secured a water right permit for well PW-2 and has transferred this facility to the City for joint water supply purposes. The District has been exploring ways to fully utilize its existing water rights at PW-1 (supply for former Water District No. 6), including having already drilled a replacement well. Neither the original nor replacement well has sufficient yield to be cost-effectively placed in service at this time. Completion and connection of PW-2, potentially with permitting, completion and connection of EW-3, should be considered for increased supply reliability for the near term and for increased capacity for the long-term.

- **Water Rights Adequacy**

Water rights are discussed in Section 4.3 above.

- **Facility Reliability**

Refer to Chapter 3, system analysis for further discussion.

4.4.2 Water Shortage Response Planning

The District's water use emergency response plan is summarized in Section 6.5 of this Plan. A water shortage response plan has been adopted by the District (see Appendix J).

4.4.3 Monitoring Water Levels

The City of Blaine is responsible for monitoring water levels in its production wells. The District owns and operates a telemetry system to allow continuous monitoring, with alarm capability, of the status of the main water supply booster

station and water levels in the two large District reservoirs. The District periodically measures the pressure at the PW-2 wellhead (artesian well).

4.5 Interties

4.5.1 Existing Interties

Birch Bay Water and Sewer District currently has an intertie with Bell Bay Jackson Water Association in addition to their five connections with the City of Blaine's system.

The City of Blaine interties on Blaine Road and Portal Way provide water for all of the District's water service area, with the exception of that portion of the District served by the Blaine intertie on Semiahmoo Drive (Birch Point). The Semiahmoo Drive intertie provides for that minor portion of the District's water service area along Semiahmoo Drive and the area along Birch Point Road west of Birch Bay Village.

There are two interties on Semiahmoo Parkway with the City of Blaine's system. One intertie is designated as the 300 Zone Intertie and its purpose is for emergency supply from the Blaine water system to one of the District's pressure zones in anticipation of a future District booster pump station replacement project (essentially for fire flow and other short-term supply emergencies in the District's 300 Pressure Zone, including failure of the single pump serving this area). The other intertie is designated as the 200 Zone Intertie and its purpose is for reciprocal supply between the two systems. The primary purpose of the 200 Zone Intertie is for emergency supply between the systems. The 200 Zone Intertie may be used for short-term peaking supply until other system improvements are completed. The 200 Zone Intertie made the temporary Bayvue Intertie (DOH approval in 2004) a permanent part of the water system, and included installation of valves and piping to allow pumping (using portable or future installed equipment) of water from the District's 200 Pressure Zone to the City's 330 Pressure Zone. As currently configured, water could not readily flow from the District back to Blaine at either intertie.

Water supply is presently limited by the contract between the City of Blaine and Birch Bay Water and Sewer District to 3.73 mgd.

The Bell Jackson Water Association lies east and south of Birch Bay (see Figure 1.3). It supplies approximately 100 services and purchases its water from the City of Blaine. The Bell Bay Jackson pressure gradient is within 20 feet of the District's. The intertie is for emergency use only.

4.5.2 New Intertie Proposals

Modification of the existing Blaine system intertie on Semiahmoo Drive is anticipated in support of a project recommended in Chapters 3 and 8. Replacement of a section of 2-1/2" piping with 8" and an 8" PRV and meter station are recommended to increase reliability and supply for Pressure Zone 2.

No new interties are proposed at this time. If PW-2 and/or EW-3 (or similarly configured additional source) are developed jointly with Blaine, a water system plan modification will be necessary to specifically address such a new intertie. Future conditions may warrant District consideration of a regular service or additional intertie with Bell Bay Jackson Water Association or an intertie with the Grandview Beach Water Association. The Grandview Beach connection would likely be to meet that system's needs. The Bell Bay Jackson intertie may be to meet that system's needs and/or serve the District's long-range needs.

4.5.3 Intertie Agreements

A copy of the contract and emergency intertie memorandum of understanding with the City of Blaine is included in Appendix C. Also included in that appendix is the agreement with Bell Bay Jackson Water Association.

Table 4.5 - Water Right Self-Assessment

Mouse-over any link for more information. Click on any link for more detailed instructions.

Water Right Permit, Certificate, or Claim # *If water right is interruptible, identify limitation in yellow section below	WFI Source # If a source has multiple water rights, list each water right on separate line	Existing Water Rights Qi= Instantaneous Flow Rate Allowed (GPM or CFS) Qa= Annual Volume Allowed (Acre-Feet/Year) This includes wholesale water sold				Current Source Production – Most Recent Calendar Year Qi = Max Instantaneous Flow Rate Withdrawn (GPM or CFS) Qa = Annual Volume Withdrawn (Acre-Feet/Year) This includes wholesale water sold				10-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold				20-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold			
		Primary Qi Maximum Rate Allowed	Non-Additive Qi Maximum Rate Allowed	Primary Qa Maximum Volume Allowed	Non-Additive Qa Maximum Volume Allowed	Total Qi Maximum Instantaneous Flow Rate Withdrawn	Current Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume Withdrawn	Current Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 10 Years	10-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 10 Years	10-Year Forecasted Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 20 Years	20-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 20 Years	20-Year Forecasted Excess or (Deficiency) Qa
1 Cert. 6762A G1-*08287C		100 GPM		112 AF/YR		0 GPM	100 GPM	0 AF/YR	112 AF/YR	0 GPM	100 GPM	0 AF/YR	112 AF/YR	0 GPM	100 GPM	0 AF/YR	112 AF/YR
2 G1-28046P		500 GPM		806 AF/YR		0 GPM	500 GPM	0 AF/YR	806 AF/YR	0 GPM	500 GPM	0 AF/YR	806 AF/YR	0 GPM	500 GPM	0 AF/YR	806 AF/YR
3																	
4																	
5																	
6																	
	TOTALS =	600 GPM		918 AF/YR		0 GPM	600 GPM	0 AF/YR	918 AF/YR	0 GPM	600 GPM	0 AF/YR	918 AF/YR	0 GPM	600 GPM	0 AF/YR	918 AF/YR

Column Identifiers for Calculations: A B C =A-C D =B-D E = A-E F =B-F G =A-G H =B-H

PENDING WATER RIGHT APPLICATIONS: Identify any water right applications that have been submitted to Ecology.

Application Number	New or Change Application?	Date Submitted	Quantities Requested			
			Primary Qi	Non-Additive Qi	Primary Qa	Non-Additive Qa

INTERTIES: Systems receiving wholesale water complete this section. Wholesaling systems must include water sold through intertie in the current and forecasted source production columns above.

Name of Wholesaling System Providing Water	Quantities Allowed In Contract		Expiration Date of Contract	Currently Purchased (2017) Current quantity purchased through intertie				10-Year Forecasted Purchase (2028) Forecasted quantity purchased through intertie				20-Year Forecasted Purchase (2038) Forecasted quantity purchased through intertie			
	Maximum Qi	Maximum Qa		Maximum Qi	Current Excess or (Deficiency) Qi	Maximum Qa	Current Excess or (Deficiency) Qa	Maximum Qi	Future Excess or (Deficiency) Qi	Maximum Qa	Future Excess or (Deficiency) Qa	Maximum Qi	Future Excess or (Deficiency) Qi	Maximum Qa	Future Excess or (Deficiency) Qa
	Instantaneous Flow Rate	Annual Volume		Instantaneous Flow Rate		Annual Volume		10-Year Forecast		10-Year Forecast		20-Year Forecast		20-Year Forecast	
1 Blaine, City of (07300U)	2,590 GPM	2,628 AF/YR	April 1, 2042	1,362 GPM	1,228 GPM	992 AF/YR	1,636 AF/YR	1,698 GPM	892 GPM	1,305 AF/YR	1,323 AF/YR	2,189 GPM	401 GPM	1,682 AF/YR	946 AF/YR
2															
3															
TOTALS =	2,590 GPM	2,628 AF/YR		1,362 GPM	1,228 GPM	992 AF/YR	1,636 AF/YR	1,698 GPM	892 GPM	1,305 AF/YR	1,323 AF/YR	2,189 GPM	401 GPM	1,682 AF/YR	946 AF/YR

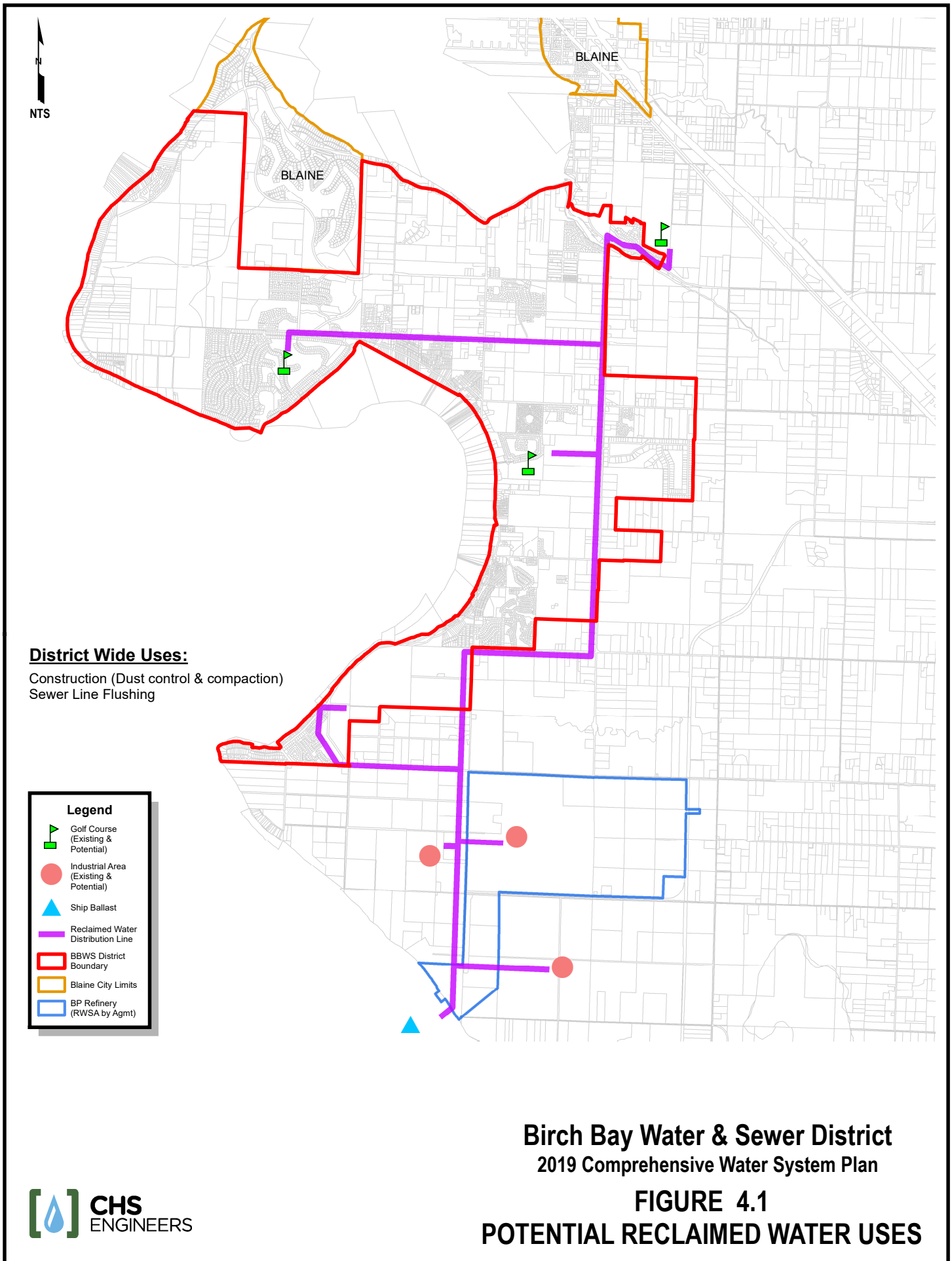
Column Identifiers for Calculations: A B C =A-C D =B-D E =A-E F =B-F G =A-G H =B-H

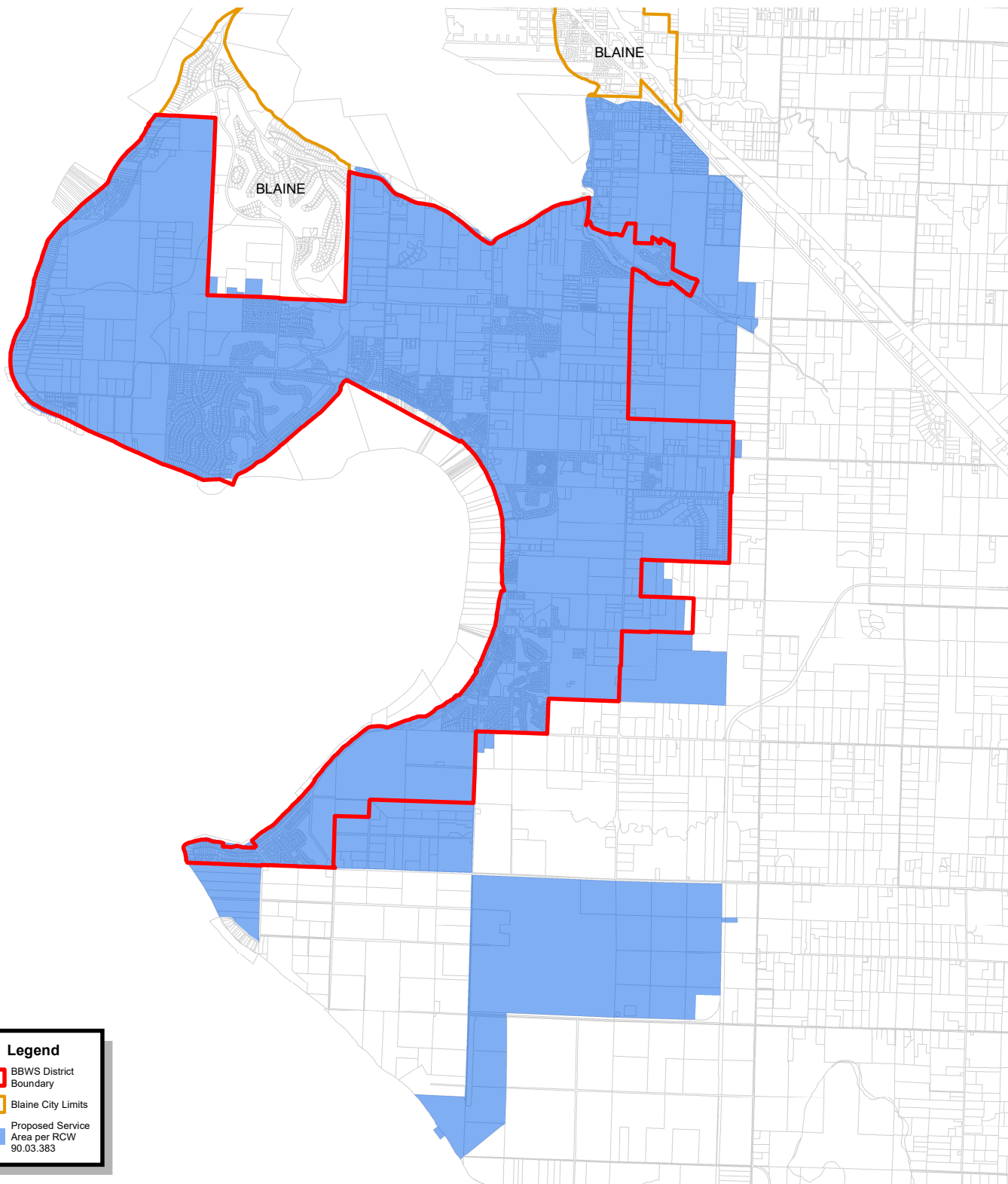
INTERRUPTIBLE WATER RIGHTS: Identify limitations on any water rights listed above that are interruptible.

Water Right #	Conditions of Interruption	Time Period of Interruption
1		
2		
3		

ADDITIONAL COMMENTS:

1 - Blaine Supply Contract is renewable by mutual agreement for up to two additional 10-year terms. The agreement has been amended to execute the first 10-year extension, resulting in a supply contract period from April 2002 until April 2042.
2 – The District water right under Permit G1-28046P (a.k.a. PW2D) is managed by the City of Blaine by agreement for the mutual benefit of Blaine and its wholesale customers.





Legend

-  BBWS District Boundary
-  Blaine City Limits
-  Proposed Service Area per RCW 90.03.383

Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

FIGURE 4.2
SERVICE AREA PER RCW 90.03.383

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CHAPTER 5

SOURCE WATER PROTECTION

5.1 Wellhead Protection Program

Presently, all potable water used in the District is purchased from the City of Blaine. The City of Blaine has established a wellhead protection program to reduce the likelihood of contamination of the drinking water supply from their wells. Included in the plan is a susceptibility assessment, a delineation of the wellhead protection area boundary, an inventory of potential contaminant sources in the wellhead protection area, and a management strategy to prevent potential contaminant sources from becoming actual contaminants.

The District has two wells: PW-1 and PW-1R. PW-1 is the well at Birch Point which was the source of supply for former Whatcom County Water District No. 6. A replacement well has been drilled and tested (PW-1R) further inland and at a higher ground elevation than PW-1. It also has a low yield and has therefore not yet been equipped for service.

The District completed an additional well, PW-2, which was drilled and tested in 2000. It is located northeast of the District in the Dakota Creek watershed, east of I-5. It had a promising yield (300 to 500 gpm) and the District has secured the water right permit. The District has transferred the well's installed facilities to the City of Blaine for joint water supply purposes. The District retains the water right for PW-2.

At such time as the District rehabilitates, replaces or otherwise improves the yield from PW-1 to the point of being a cost-effective source of annual or seasonal (peaking) supply, and at such time as the City or District proposes to utilize PW-2, wellhead protection programs will be completed as part of the source approval submittal process.

5.2 Watershed Control Program

All of the District's drinking water sources are from groundwater. Therefore, a watershed control program is not needed.

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CHAPTER 6

OPERATION AND MAINTENANCE PROGRAM

6.1 Water System Management and Personnel

The District is governed by a Board of Commissioners consisting of three local residents elected at large by the population within the District boundaries. The District General Manager has overall responsibility for the water system. The District General Manager is responsible for implementation of the Capital Improvement Program (CIP) and public/press contacts. The District General Manager, along with the Operations Manager and District Finance Director are responsible for formatting budgets and making recommendations to the Board of Commissioners. It is ultimately the Board's responsibility to adopt or modify the budget and implement the CIP. The District Operations Manager is responsible for the management, maintenance, operation, and control of the water system. The organization chart of the District is shown in Figure 6.1.

The District Operations Manager must have a Water Distribution Manager 2 certification or higher (WAC 246-292-050). The day-to-day operation of the water system is carried out under the direct supervision of the District Operations Manager. This position shall be held by a person who shall be qualified by experience, education and training to assure maintenance and continuous responsible operation of the water system. Certification as Water Distribution Manager 2 or greater under the provisions of WAC 246-292-060 shall constitute satisfactory evidence of competency. This position is specifically responsible for preventative maintenance, field engineering, water quality monitoring, troubleshooting, emergency response, and cross-connection control. The District Operations Manager is responsible for the overall operation of the water system, according to State and Federal law, the policy of the District Board of Commissioners and the direction of the District's General Manager. The District Operations Manager coordinates operation of the system with DOH. The water system operators support the District Operations Manager in his duties and responsibilities.

Any complaints that are received by District staff are forwarded to the District Operations Manager or Foreman who in turn delegates the response to the appropriate water operator. The District's Finance Director or their delegate addresses questions regarding water service billing.

6.2 Operator Certification

Birch Bay employs four persons for water system operation. The Operations Manager is certified by the State as a Water Distribution Manager 2. The Water System Foreman is certified as a Water Distribution Manager 2, Water

Distribution Specialist and Cross Connection Control Specialist. The Foreman is responsible for daily activities for operation and maintenance of the water system. Two other operators are also the meter readers for the District, and each are certified by the State as a Water Distribution Specialist or Water Distribution Manager. These operators perform meter reading one to two days per week and the Foreman and all operators complete fieldwork and system checks for operation, maintenance and repair.

The District's Field Inspector is certified as a Water Distribution Manager and Cross Connection Control Specialist. The Field inspector has day-to-day oversight of the District's Cross connection control program, including surveys, data entry, hazard and water service reviews. The Field Inspector also provides support for the water crew as needed.

The District requires that all field operators obtain a Water Distribution Manager certification and a program has been established to assist its employees in advancement to these levels. The District pays for tuition, examination fees, and renewal fees for its employees. The water department members complete three continuing education units of training or education each certification cycle and are trained in first aid and flagging as per the current applicable "card-carrying" certification renewal requirements.

The District's sewer department personnel support the water department when additional personnel are necessary. One sewer crew member is certified as a Cross Connection Control Specialist and one sewer crew is certified as a Water Distribution Manager 2. Each supports the water department as needed.

6.3 System Operation and Control

6.3.1 Water System Components and Operation

Birch Bay Water and Sewer District consists of a fully metered distribution system, one supply booster pump station, three ground level reservoirs and three small booster pump stations (BPS). The District serves most of the Birch Bay area (see Chapter 1).

The water system operates automatically, with the option for manual override. Water levels in the reservoirs are monitored via telemetry system. The telemetry or SCADA system is operated at the District Operations Headquarters. Also, the Manager and Foreman have the ability to monitor and, to some degree, control operation of the system from a remote personal computer. The automatic program calls for the pump operation at the Blaine Road BPS, with lead and lag pump operation. Once the reservoirs refill, the pumps are automatically turned off. The two primary reservoirs (Kickerville and Birch Point) are equipped with altitude valves to prevent overfilling.

The water supply to the Birch Point portion of the District is either from a separate connection to the Blaine water system or by pump from the main District system. The supply is on-demand through a meter and pressure-reducing valve (PRV) and level sensors in the reservoir. The PRV is set to prevent overfilling of the Semiahmoo Reservoir. The Birch Point BPS consists of an automatically controlled pump using telemetry system equipment at the BPS, Birch Point supply meter and Semiahmoo Reservoir. The Birch Point BPS operates in response to the water level in the District's Semiahmoo Reservoir. The current Birch Point BPS is considered to be a temporary installation until such time as a full-scale permanent station is installed for water supply to the pressure zones in the Birch Point area. Fire flow is provided from the Semiahmoo Reservoir.

Supply to the Point Whitehorn area is through the Point Whitehorn BPS, with its own control system operating pumps in response to demand in the Point Whitehorn service area. Similarly, a portion of the plat of Birch Bay View is served by the automatically controlled Bayvue BPS. The Bayvue BPS maintains a constant discharge pressure for its service area. These two booster pump stations service two separate pressure zones. Other pressure zones in the District are served on-demand through PRVs. Fire flow to the area served by the Bayvue BPS is thru a bypass check valve, with gravity supply from the Birch Point Reservoir. Fire flow to the Point Whitehorn BPS service area is from the larger pumps in the station, with supply from the main distribution system. This station is supported by the WWTP standby power generator.

Additional supply is available from either of the two emergency interties with the Blaine system on Semiahmoo Parkway. The 200 Zone intertie can provide manually or automatically controlled supply to the District Pressure Zone 1 (HWL = 200') and pressure is controlled by a pressure reducing valve. The 300 Zone intertie automatically provides supply to support regular potable demands as well as fire flow if demand exceeds the capacity of the nearby Bayvue BPS. Pressure is controlled by a pressure reducing valve.

Normal operation of the water system includes the following tasks:

- Continuous monitoring of system operation via telemetry and remote alarm annunciation (via SMS and email), collecting flow and level data for daily records, and investigating unusual operating conditions. The primary indicators of unusual system performance include decreasing or low reservoir levels, unusual demand patterns and low-pressure indication or complaint, and high flows.
- Monitor booster pump stations and reservoirs – weekly visits are made to each pump station and reservoir. During the visit, operational parameters, SCADA indications and notifications, and material conditions are reviewed, as designated on District checklists.
- Complete distribution system maintenance per work orders generated by water department Manager or Foreman, for routine operation and

maintenance, in response to customer complaint, for new service installation, or for system repair or upgrade with integrated job completion reporting for the records.

- Service meter reading – The District is divided into areas called “books”. There are approximately 16 books within the District, two or more of which are read each week. The meter reading occurs over an eight-week cycle such that all the service meters read for bi-monthly billing. The District is currently installing an automated meter reading (AMR) system. This system utilizes drive-by radio-read technology and will allow the District to read meters once/week and more frequently as necessary, particularly as usage and the probability of increased leaks or breaks (such as during freezing weather) increases. The new AMR system is expected to in full operation, including all services within the District, by the year 2023.
- Water quality testing - Chlorine residual is tested each day at the District’s wastewater treatment plant lab sample tap and with each coliform sample. Coliform testing is completed bi-weekly at several locations around the District, with the number of samples depending on the time of year (seasonal population). In addition, chlorine residual is tested at least weekly at the three reservoirs and the points of supply from Blaine. Other water quality samples, such as asbestos, lead and copper, and disinfection byproducts tests, are taken as necessary and as dictated by the WQMS (Water Quality Monitoring Schedule).
- Respond to customer calls regarding water quality, quantity, pressure or leak notification
- Daily and weekly tabulation of water supply and demand volumes from the master supply meters and reservoir levels.
- Preparation of monthly report to Board of Commissioners, including daily and weekly demand and water purchased versus water sold data and comparison.
- Assist Office Staff in “lock-off” of delinquent accounts, as necessary.
- Clean and inspect reservoirs every three to six years. Diving companies are typically utilized to clean and inspect the reservoirs to save water and minimize the amount of time that the reservoirs are out of service. The frequency of cleaning is based on previous inspections and regular, visual observations.
- Respond to alarms from telemetry and remote SCADA alarming system (on-call 24 hours).
- Annually send reminder letters to customers with cross-connection control devices and follow-up with customers who have failed or overdue tests.
- Participate in annual training program for safety (e.g. confined space work, trench excavation, flagging and first aid).
- Conservation program activities.

6.3.2 Preventative Maintenance and Equipment/Supplies

Maintenance manuals for all equipment are kept together in the Water Operations Headquarters and additional copies are available at each BPS. These manuals are available to all persons involved with the servicing of the equipment.

Service requirements recommended by the manufacturer shall be followed as a minimum. Depending on usage and age of equipment, more frequent service may be warranted. A service log is kept on all equipment or is entered in an on-line MS Access database.

The general preventative maintenance activities are as follows:

A. Water Sources and Booster Pump Stations

1. Daily: Check volume delivered, pump run time (hours); note pump status, suction and discharge pressures. Where these values are not recorded and monitored by the SCADA system, log and record as necessary.
2. Weekly: Log and record current draw (three phases), check oil levels as appropriate, motor noise, temperature, and vibration.
3. Monthly – Check/verify all SCADA site alarms (Intrusion, High/low levels, etc.)
4. Quarterly: Change pump lubricating grease if necessary.
5. Biannually: Change motor lubricating grease.
6. .
7. As needed: Paint structures and piping; maintain electrical and hydraulic controls.
8. Changes in water service when off-line: work on only one pump at a time, or ensure adequate supply in storage before interrupting service

B. Water Storage

1. Daily – Check status of reservoir security monitoring system.
2. Weekly: Check security (fencing, gate, vault locks, intrusion sensor), check operation of altitude valve, check local level indication to SCADA level indication to verify sensor accuracy and proper operation.
3. Monthly – Check/verify all SCADA site alarms (Intrusion, High/low levels, etc..).
4. Biannually: Check interior condition, paint, vent, hatch, etc.
5. Biannually: Clean reservoir interior/exterior; repaint interior and/or exterior as needed (estimated 15 to 20-year frequency).
6. Changes in Water Service when off-line: complete inspection during period of low demand, only one reservoir at a time

C. Water Distribution System

1. Water Mains:
As needed: Flush dead end lines.
2. Valves:
Annually: uncover where buried; clean out valve boxes, etc.; repair as necessary.
3. Hydrants:
Four-year cycle: check drain rate; lubricate as necessary; measure pressure.
4. Pressure Reducing Valves
Annually: Cycle all valves; check screens and pressure settings; rebuild as necessary.

D. Tools and Equipment

1. Rolling Stock (trucks, backhoe, excavator, vacuum truck or trailer)
Weekly: Check all fluid levels and brakes.
As Needed: Replace fluids and filters in accordance with manufacturers' recommendations (or more frequently depending on type of use).
2. Tools:
Clean after each use; lubricate and maintain as necessary, generally Friday afternoons.

E. Cross-Connection Control Devices

1. Annually: Inspect and test.
2. As Needed: Inspect and test as required if failures indicate need; rebuild, overhaul and/or replace if defective.

The water department has a generally complete array of equipment for operating and maintaining the water system, including:

- Tracked “mini” excavator
- 4-wheel drive backhoe
- Dump truck and flatbed trailer
- Road/shoring plates and trench boxes
- Towable vacuum-excavator trailer
- Service vehicles including one fully equipped truck with portable power tools, hand tools, repair materials, sump pump, portable generator and other equipment necessary for small main and service line repairs
- Inventory of water system materials, water main repair materials, spare valves, hydrants, blow-off valves, gasket, repair bands, backfill material, cold-mix asphalt and other materials used in system repairs
- Inventory of water service materials and testing equipment, including meters, setters, corporation stops, meter boxes, repair parts, “Touch-Read” sensor/meter assemblies, etc.
- Chlorine for water pipe disinfection and supplemental residual dosing if necessary.

- Dechlorination equipment for water main draining and flushing operations
- Filing system with records and service contacts and information for ordering additional inventory or service as necessary by outside service providers.

6.4 Comprehensive Monitoring Plan

As discussed in Chapter 3, the District is required to monitor the quality of water provided to its customers. As a system purchasing disinfected groundwater from another purveyor, the District is presently required to monitor its distribution system for the following parameters:

- Distribution system residual disinfectant
- Coliform bacteria
- Lead and copper
- Asbestos

Chlorine residual is monitored daily at one or more of 24 sampling station sites located throughout the District and every day at the Water Operations Headquarters (see Figure 1.3). The Water Operations Headquarters is located on the far side of the District from the point of supply to the District system. Water samples are collected bi-weekly and analyzed for coliform bacteria. The number of samples collected each month depends on the time of year (seasonal population). The collection rotates through 16 of the 24 sampling station sites. In January for example, samples may be collected from sampling stations (SS) #1, #2, #3 and #4 early in the month, then at #5 through #8 later in the month. The samples in February would begin at SS #9, and so on. Additional water quality samples are also collected if necessary due to customer request, and following positive detection of coliform. A copy of the District's Coliform Monitoring Plan can be found in Appendix F.

The latest definition of a minimum detectable chlorine residual is 0.2 mg/l, when chlorine residuals are required. However, the WAC includes a provision for allowable lower residual levels when purveyors can show that the test equipment in use can accurately detect and monitor residuals less than 0.2 mg/l. It is noted that while the District does not add chlorine to the system and is not required to meet reduction or removal requirements, they currently utilize Hach pocket digital colorimeters, lab spectrophotometer, and on-line analytical test equipment to monitor and test chlorine residuals for sampling, new or replaced piping installation sampling, and on a continuous basis throughout the distribution system. These instruments have a manufacturer's accuracy specification of 0.02 to 2.0 mg/l. As a result of the use of these instruments, a safe and secure supply source, and no chlorine demand, the District works closely with its source water supplier to maintain free chlorine residual levels between 0.02 and 0.1 mg/l. The District prefers to maintain lower free chlorine residuals in an effort to balance the risk of contamination and provide an indication in regard to distribution system

health status versus the corrosivity of chlorine and the health risks and concerns associated with disinfection byproducts.

Bacteriological samples shall be analyzed in accordance with methods approved by DOH and only in the State Public Health Laboratory or laboratories holding a current certificate of approval from DOH. Samples taken following water main construction or repair cannot be substituted for compliance with minimum sampling frequency or used to determine compliance with maximum contaminant level.

The following is an outline of the coliform sampling program:

A. Sample Collecting

Bacteriological samples shall be collected at regular intervals throughout the District. The samples shall be collected, transported and analyzed in accordance with procedures contained in "Standard Methods for Examination of Water and Wastewater". The bacteriological Maximum Contaminant Levels (MCLs), a primary drinking water standard, for coliform bacteria are as follows:

1. A Level 1 Assessment shall be required if one of the following occurs:
 - a. For a water system that collects less than 40 routine samples per month (such as the District); coliform detected in two or more routine or repeat samples.
 - b. For a water system that collects 40 or more routine samples per month, coliform detected in more than five percent of all routine and repeat samples.
 - c. The water system fails to collect 3 repeat samples for every total coliform-present routine sample.
2. An MCL (Level 2 Assessment) violation can occur four ways:
 - a. A total coliform-present repeat sample follows an *E. coli*-present routine sample.
 - b. An *E. coli*-present repeat sample follows a total coliform-present routine sample.
 - c. The lab fails to test a total coliform-present repeat sample for *E. coli*.
 - d. A system fails to take three repeat samples following an *E. coli*-present routine sample.

Upon detection of coliform bacteria in any sample, the District must analyze the sample for fecal coliform and *E. coli*, collect repeat samples within 24 hours, and notify DOH at 253-395-6750 in a timely manner of notice from the lab of positive detection and determine and correct the cause of the coliform presence.

For the Level 1 violation the District must notify DOH as soon as practical or within 30 days (Tier 2 violation) and a Level 1 system assessment performed by an owner, manager, or other knowledgeable person and correction of the defect must be completed in that same 30-day time period. If a second Level 1 violation occurs within a rolling 12-month period, a complex system evaluation performed by a person with state-required qualifications will need to be performed within 30 days of the second violation. For an MCL violation, the District must inform DOH as soon as possible but no later than 24 hours after learning of the violation (Tier 1 violation) in order to determine if additional public notice is required. Public notification is required in the event of Tier 1 violation within 24 hours in a form and manner reasonably calculated to reach all persons served. The requirements for notification to customers are very specific and comprehensive and are detailed in the WAC 246-290, Sections 71001 through 71007.

A Level 1 violation triggers a Level 1 Treatment Technique Assessment, and an MCL violation triggers a Level 2 Treatment Technique Assessment, as described in the Coliform Monitoring Plan. Each Assessment must be completed within 30 days.

B. Repeat and Follow-up Sampling

The total coliform rule requires water samples analyzed for coliform bacteria to be reported as “presence” or “absence”. Repeat and Follow-Up Sampling is the response to detection of a coliform “presence” in any drinking water sample. When any drinking water sample analysis results in a coliform presence report, a "set" of repeat samples must be collected within 24 hours of being notified by the lab of the presence determination.

1. A total of three (3) repeat samples, considered a "set", are required within 24 hours of being notified of the presence laboratory analysis.
 - a. Collect the first repeat sample from the same location the previous coliform presence sample was taken.
 - b. Collect the second repeat sample at a site five (5) service connections in either direction down the distribution pipeline from the previously mentioned coliform presence location.
 - c. Collect the third repeat sample from a site within five (5) service connections down the distribution pipeline the other direction (starting from the previously mentioned coliform presence location).
2. The month following a coliform presence sample the District must collect a minimum of five (5) Follow-Up Samples from the distribution system. These Follow-Up Samples include the routine samples normally collected. For reporting and compliance calculations, these samples are considered routine samples.

If any Repeat or Follow-Up Sample is analyzed with coliform presence then all of the above must be performed for that sample site.

No Repeat or Follow-Up Sampling is required for samples determined as coliform absence. Also, if a coliform MCL violation has been determined, no additional sets of repeat samples are required for any Repeat Sample with a coliform presence during that month. However, samples may be required by DOH in the investigation of contamination.

The District has been monitoring for lead and copper and has entered the reduced monitoring phase of the program. Sampling and analysis for lead and copper is required every three years. Asbestos monitoring was completed in 2015. The detected level of asbestos was below the MCL.

Additional monitoring may be required in response to new regulations promulgated by EPA and DOH and additional monitoring will be necessary if the District utilizes a new source of supply (e.g. PW-2, PW-1, PW-1R or surface water source).

6.5 Emergency Response Program

The District has an emergency response plan (ERP), which identifies the District's procedures for emergency situations. The current plan identifies the notification procedures in the event of an emergency. In response to the events of 9/11/01, the Federal government has enacted the Public Health Security and Bio-Terrorism Preparedness and Response Act (HR 3448) requiring preparation of vulnerability assessments and preparation or update of ERPs, for public water systems serving populations greater than 3,300 people. The District has prepared a separate vulnerability analysis and emergency response plan.

The following discussion summarizes elements of the District's ERP.

6.5.1 Water System Personnel Emergency Call-up List

The District maintains a detailed list of contacts for all District personnel and commissioners. That list is updated periodically and distributed to all staff. Key contacts are summarized in Table 6.1.

6.5.2 Notification Procedures

The ERP outlines the steps that should be taken in case of different types of an emergency situation in the water system (e.g., health risk, hazardous situation, natural disaster, security breach, vandalism, terrorism, etc.). In summary:

The responding operator or staff member shall notify their supervisor immediately. The Operations Manager or supervisor shall notify the General Manager or his designee, who in turn will notify Blaine Water Department if they are affected. The General Manager shall invoke the ERP if appropriate. The ERP includes descriptions of the incident command structure, checklists for response to various emergency situations, staff and resource contact information, and summary information for critical elements of the water system.

6.5.3 Vulnerability Analysis

In all cases described below, the Operations Manager must be informed of the emergency. If he is not available, the General Manager shall be notified.

A. Blaine Road Booster Pump Station (Supply from Blaine)

1. In the event of a short term local power outage in the Birch Bay area only, the District's reservoirs should provide service for a minimum of 24 hours. Portable standby power equipment may be rented for use during local power outages expected to last longer than the volume of water in standby storage.

Table 6.1
EMERGENCY CONTACTS

Contact	Telephone No.
Emergency	911
Birch Bay Water and Sewer District	360-371-7100
	(answering service after hours)
Charlie Hagin, Water Department Foreman	360-393-1895 (on call cell)
Blaine Water Department	360-332-8820
Department of Health (Kent)	253-395-6750
	or 877-481-4901
T.V. Stations (Seattle area)	
KIRO	800-777-5476
KOMO	800-477-5666
KING	206-448-4521
Radio Station (KARI)	360-371-5500
Radio Station (KGMI)	360-734-9790
Whatcom County Emergency Mgmt.	360-676-6681
	or 360-714-3507
North Whatcom Fire & Rescue Services – Business	360-371-2533
Whatcom County Fire District No. 7 – Business	360-384-0303

2. In the event of an area-wide power outage including Blaine, the main valves should be closed as redundant protection for the check valves to prevent backflow to Blaine (i.e. pressure may decrease in Blaine's system as their storage is drawn down, potentially allowing reverse flow through station).
3. In the event of destruction of the supply pumping station the station should be isolated and bypassed and provisions should be made for pumping water with portable pumps into the District's water system.

B. Main Supply Line from Blaine

1. In the event of a break in the supply main from Blaine to the supply pumping station, the supply pumping station should be deactivated by

turning off the pump controls through the telemetry system. The Blaine Water Department shall be informed of the break. The main shall then be repaired as quickly as possible.

2. In the event of a break in the supply main between Birch Bay Water and Sewer District and the supply pumping station, valves on each side of the break shall be closed. If water supply is necessary Blaine can deliver water to the District's 200 zone and 300 zone through the interties on Semiahmoo Parkway.

C. Storage Reservoirs

1. In the event of the discovery of a foreign object or substance in the reservoir the inlet-outlet valve shall be closed. Check telemetry system operation.
2. In the event of excessive leakage from a reservoir the inlet-outlet valve shall be closed. Check telemetry system operation.
3. In the event of excessive discharge from the overflow the inlet-outlet valve shall be closed. The supply pumping station should be deactivated by turning off the pump controls through the telemetry system.

D. Booster Pumping Stations

1. In the event of pump or motor failure, isolate the assembly by closing valves and switching off and tagging out the electrical breaker. If a pump bypass valve is present, open it, if conditions warrant. Observe operation of check valves.

E. Fire Hydrants

1. In the event of a hydrant failure, isolate it by closing the valve between it and the water main. Mark the hydrant for easy identification.
2. Notify North Whatcom Fire & Rescue Services north of Bay Road.
3. Notify Fire District No. 7 south of Bay Road.

F. Water Main Break

1. In the event of a break in a water main isolate the break by closing valves on each side of the failure.
2. Notify North Whatcom Fire & Rescue Services north of Bay Road.
3. Notify Fire District No. 7 south of Bay Road.

6.5.4 Contingency Operational Plan

The District's water system is operated automatically via telemetry and radio communication. If operation of either system is interrupted, the District staff can operate the water system manually. The staff members can control the pumps manually in response to changes in reservoir levels, and adjustment can be made several times throughout the day as necessary. If there is an interruption in the main supply or transmission line from the City of Blaine, the District staff will attempt to isolate the break and service interruption to a minimum number of

customers. Depending on the time of year and the severity of the break, the District can rely on storage reservoirs until the main is repaired. The District maintains an inventory of equipment and supplies it might need in emergency situations. With only one water source and one primary point of delivery to the District, it will be imperative for the District to restore service immediately. There are currently no other options for water to be delivered to the District customers. The potential exists for the intertie with Bell Bay Jackson Water Association to be used “in reverse” to deliver water to the District but the available quantity of water through their system is likely minimal compared to the District’s need, so this has not been given serious consideration.

The District has adopted a water shortage response plan that outlines action that can be taken depending on the severity of a water shortage situation (see Appendix J).

6.6 Safety Procedures

The District maintains a copy of the material and safety data (MSDS) sheets for all water department materials in the District Water Manager’s office. The District field staff is trained for traffic control/flagging and in the proper operation of District equipment, including vehicles, excavation and shoring equipment, power and hand tools. The same staff members are trained for safe procedures when working with dry and liquid chlorine for disinfection, PVC solvent and adhesive, paints, thinners, shop cleaning, cutting asbestos cement pipe, working around electrical equipment, etc. All District staff members are trained in CPR and first aid.

6.7 Cross-Connection Control Program

The District established an updated cross-connection control program by Resolution No. 648 (2005). This resolution was incorporated in the District’s Code as Chapter 7.08.

Resolution No. 648 implemented a continuous program of cross-connection investigation, surveillance and control in accordance with the rules and regulations of DOH. Currently, the program consists of having the District Water Manager, Cross-Connection Control Specialists and operators keep surveillance on the District service area and investigate any connection which could potentially cause a cross-connection. Testing of new and existing backflow prevention devices is the responsibility of the property owner. This is accomplished by having the owner contact a local certified tester and arrange for him to test the device and submit a report to the District. Annual inspections occur after the District mails a letter directing them to arrange for a certified tester to test the backflow prevention device and submit a report. The District’s Cross-Connection Control Specialists (CCS) coordinate the District’s cross-connection control program.

6.8 Customer Complaint Response Program

The District tracks customer inquiries/complaints as follows:

- Upon receipt of call/inquiry, a work order is generated for attention by a water operator. A separate record of the complaint and response is noted as part of the District's cross connection control program reports.
- An operator investigates and, if appropriate, addresses the issue (most often related to pressure or need for flushing in service or distribution mains)
- Response is then documented on the work order and as noted above.

6.9 Recordkeeping and Reporting

DOH has enacted regulations that address reporting, record keeping, and public notification. They can be found in WAC 246-290-480 and –485. These regulations stipulate that results of water quality testing, operational reports, and other documents related to compliance with the regulations are provided to the system's customers and the appropriate regulatory agency. The following presents an overview of these regulations, and specific requirements can be found in DOH rules and regulations.

1. Water Reporting: Analyses for water quality samples are performed by either the State Public Health Laboratory or a laboratory that holds a current Certificate of Approval by DOH. Copies of the current test results are automatically forwarded to DOH.

In general, the District shall report to the DOH within 48 hours any failure to comply with water quality regulation, or sooner as in the case of detection of Fecal coliform or E. coli. Water use data is reported to DOH monthly.

2. The following records are kept in the Water Supervisor's or Operations' Manager's Office:
 - Meter, valve, hydrant files – computer file
 - Vehicle and Equipment – paper file
 - Fire flow test records – paper file
3. The following records are kept in the District administrative office – on computers with backup files in fire vault or cabinet
 - Water use records – supply and delivered
 - Work orders – paper file
 - Customer accounts – billing and usage information
 - Service Meter notation – billing system

4. Record keeping: DOH requires the District to retain critical records dealing with water quality issues. An overview of requirements and retention time follows:
- Bacteriological and turbidity test results: 5 years.
 - Chemical test results: as long as the system is in operation.
 - Other records of operation and analysis or as may be required by DOH: 3 years.
 - Sample results are also maintained and are accessible at all times online via the WA State DOH Sentry System

The Federal Safe Drinking Water Act Consumer Confidence Rule (finalized August 1998) requires that water utilities provide an annual water quality report to their customers. The District has completed all required annual reports in accordance with this regulation. The most recent District and City of Blaine Consumer Confidence Reports are included in Appendix H.

6.10 O&M Improvements

The following revised or additional water system operation and maintenance measures are recommended:

General

The District should negotiate a reciprocal emergency intertie agreement with the City of Blaine – to extend the 2007 Memorandum of Understanding regarding the 200 and 300 Zone interties.

Steel Water Storage Tanks

Tanks shall only be drained for inspection, maintenance or repair if standby storage (SB) is available elsewhere in the system (i.e., the SB storage volume presently required is greater than the capacity of Birch Point Reservoir, therefore Kickerville should not be drained except in an emergency). For painting or other work requiring draining of the tank, alternative supply or storage scenarios should be in place. For example, although SB storage is based on the annual ADD, work on reservoirs could be scheduled for spring or fall period when the monthly ADD is lower than the annual ADD. The short-term SB storage requirement is therefore lower. Temporary reliance on Blaine's storage capacity and/or temporary supply reliability measures could be used to insure adequate standby supply is available when large volumes of reservoir capacity are temporarily unavailable.

Each tank should be comprehensively inspected every three years, or more often if conditions warrant. Based on the most recent internal inspections, the District plans to complete internal cleaning and inspection every six years.

Internal tank inspections may be made by draining the tank (see note above) or by a commercial diver. If inspected by a diver, the tank must first be isolated from the water system and all connection valves shall be locked out. All equipment, clothing, and personnel entering the tank must be cleaned thoroughly, and it must be certified that the equipment and clothing has been used only for potable water inspections. Two certified divers should be on site, and an additional diver should be available outside the tank in case of emergency. Before anyone or any equipment is allowed to enter the tank, the residual chlorine should be checked to determine that it is adequate. Air should be supplied to the divers from external air-supplying equipment.

During extended periods of freezing temperatures, tanks and supply sources should be operated to force water circulation through tank to prevent freezing in pipes or tank.

Fire Hydrants

All hydrants should be inspected at least once every four years, including confirmation of satisfactory operation and sealing.

Dry barrel hydrants in high groundwater areas or with plugged drains should be inspected and pumped out after each use.

Valves

All valves should be exercised at least once every five years and critical valves (e.g., at booster pump stations, tanks and along transmission mains or to dead-end distribution mains) should be inspected annually.

The condition of valve boxes and covers should be evaluated, and valve stem extensions should be in place where the District's standard valve operators are too short.

Flushing

Flushing water out of isolated or un-looped segments of the water distribution system can help improve water quality. Additionally, flushing can improve conditions (water quality, debris, taste and odor, etc.) in any part of the water system following unusual hydraulic or physical situations. For example, water main construction work may allow granular material into the system or high flows due to fire hydrant use or peak demands may redistribute debris or water that has been in the system for a long time. Such events may lead to water quality issues and/or customer complaints.

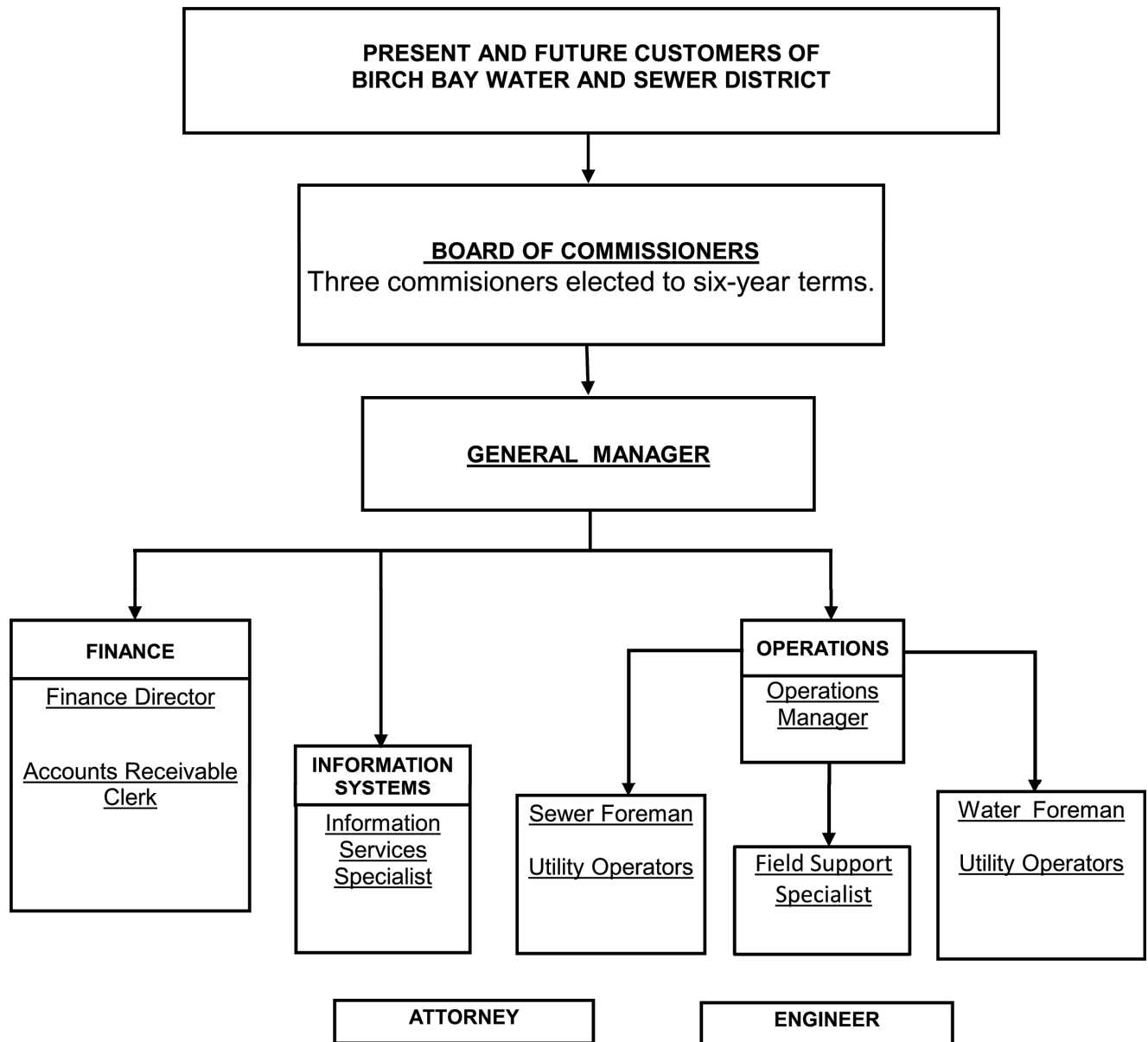
Most of the customer complaints in recent years are associated with taste and odor issues. The District has implemented a program of regular flushing of the

system, with focus on un-looped water mains. Such mains should be flushed annually, or more frequently in response to observed water quality conditions during flushing. Priority should be given to those un-looped lines serving the fewest customers. The District considers many factors in implementation of its flushing program and efforts. Typically flushing is done to move water in one direction only, away from the source, from higher pressure to lower pressure areas. Efforts are planned to move water to an isolated and manageable discharge point while not directing turbid water to other areas of the system, particularly those already flushed, or the reservoirs. The District manages maintenance of blow-off assemblies proactively so they are ready for use when flushing is planned or determined to be necessary.

Leak Detection

The District already meters each source, customer and District facility served by the system. Some over-sized meters have been and will be replaced to confirm that appropriately sized meters are used. Remaining potential sources of unaccounted-for water include fire protection and hydrant testing, construction, flushing and water main leaks. We recommend the District increase efforts to measure, locate and reduce the volume of unaccounted-for water in its system, including consideration of the following measures:

- Select and begin use of an automated meter reading system's leak detection & notification software, and, water audit software (examples are available from AWWA and are discussed in AWWA Manual M36).
- Implement and/or enforce requirements for metered use of all construction, flushing and testing water.
- Field evaluate (visual or with proprietary commercial methods) all mains of substandard material during dry weather/low groundwater season.
- Calibrate or test all supply and customer meters larger than 2 inches as necessary.



Birch Bay Water and Sewer District
2019 Comprehensive Water System Plan

FIGURE 6.1
ORGANIZATION CHART

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CHAPTER 7

DISTRIBUTION FACILITIES DESIGN AND CONSTRUCTION STANDARDS

The objective of this chapter is to describe water system distribution facilities design and construction standards to enable the water purveyor to utilize an alternative approval process. Obtaining advance approval of design and construction standards allows the District to use the alternative review process. The alternative review process provides for the District to approve individual project reports and construction documents for distribution main and other distribution related facilities without written approval from the Department of Health. The District is still responsible for complying with all applicable sections of the regulations, including project report and construction document requirements listed under WAC 246-290-110 and 120.

Distribution related projects eligible under the alternative review process include distribution reservoirs/storage tanks, booster pump facilities, transmission mains, distribution mains, pipe linings and tank coatings. The water system standards must be at least as stringent as those discussed in Chapter 246-290 WAC.

For the District, due to the variable and site/project specific nature of storage facilities and booster pump stations, the District is not seeking approval of an alternative review process for such facilities. The District will prepare project-specific reports and plans per Chapter 246-290 WAC.

7.1 Project Review Procedures

The utility service review procedures apply to all proposed land use actions requiring approval by the County, including formal subdivisions, land use permits and approvals, and the issuance of building permits as well as development proposals requesting water service. At the time an application is submitted for permits or approvals for land use actions, the Whatcom County Health Department will initiate the review process and coordinate the review before the issuance of any approvals. See the *Whatcom County Coordinated Water System Plan Update*, 2016, for further information.

7.2 Policies and Requirements for Outside Parties

Policies for development are set forth in Chapter 1, Section 1.8, Service Area Policies and Section 1.10, Conditions of Service.

7.3 Design Standards

Birch Bay Water and Sewer District has had in the past and will continue to have developer extensions on private property for residential and commercial development.

The Board of Commissioners of Birch Bay Water and Sewer District has established certain standards for extension of water mains within the District. The standard forms and requirements can be found in the *Birch Bay Water and Sewer District Developer Project Manual*. The developer manual is updated periodically, with the last revision on May, 2019.

The *Developer Project Manual* is included in its entirety in this plan by reference and is available for review or purchase at the District office.

The Design Criteria for water main extensions is reprinted from the *Developer Project Manual* below:

1. GENERAL

All extensions to the water system must conform to the standards of the District and the requirements of the County and State Departments of Health. In general, the Developer is required to construct the water lines through his property in order to allow for future extension, expansion and continuation of the District's distribution system and/or for conformance with the Comprehensive Water System Plan. The following items are necessary to meet the conditions.

The District and its consultants do not insure the correctness of the information supplied to the Developer from the District's records. The Developer shall verify by survey any information provided by the District prior to using the information in design or construction.

A. Plans and Specifications

The installation of water extensions shall be made in accordance with these Conditions and Standards. The scale shall be: horizontal 1" = 50' or other scale as appropriate for the specific project, subject to the approval of the District Engineer; vertical 1" = 5' on 22" x 34" mylar. The minimum text height shall be 0.12 inch. The plans shall be sealed by a Professional Engineer licensed in Washington. Enclosed is a sample plan showing a typical water design. Drafting of plans for the District shall conform to this example. The water extension shall be shown on a sheet separate from the sewer, storm drainage and roadway plans. The plans

shall indicate the distance from the point of connection to the nearest existing isolation valve. If the project is part of a phased development, a plan of the entire development shall be included, with the current phase clearly indicated.

The construction plans shall be reviewed or prepared by the District's Engineer. The developer shall submit two (2) sets of plans for review by the District. When the plans have been determined to meet the District standards, then a final set of reproducible plans shall be submitted to the District. These reproducible plans shall receive the District's "Plan Review" approval stamp. The District shall submit the plans to the regulatory agencies for approval if necessary. After approvals have been received, a set of plans stamped "Issued for Construction" shall be made available to the Developer.

When the Contractor completes the water line work, the water plans shall be revised to conform with construction records, and then sent to the District. Photomylars or archival quality plots on mylar are required for the District record drawings.

B. Right-of-Way and Monuments

All rights-of-way in which the water extension is to be made shall be improved prior to preparation of construction plans and installation of the water mains. Water mains in public right-of-way shall be a minimum of five feet from the edge of right-of-way. Permanent easements shall be not less than twenty feet (20') in width. Public rights-of-way shall be cleared, grubbed and graded in accordance with the requirements of Whatcom County. Monuments disturbed or destroyed shall be replaced at the Developer's expense.

2. DESIGN STANDARDS

- A.** The water system extension shall be routed as necessary to meet the following criteria:
- i. Provide water line to serve all the frontage of all lots or structures in the proposed development.
 - ii. Connect between the water system in the proposed development and the District's existing water distribution system at the location and in the manner (e.g., "wet tap" on main, connection at existing plugged or capped end, "cut-in" tee and valves) indicated by the District.

- iii. Extend water line through the property for potential future connection in accordance with the District's Comprehensive Water System Plan or as required by the District.
- iv. "Loop" the water system within the proposed development and/or with multiple connections to the existing water distribution system in accordance with the District's Comprehensive Water System Plan or as required by the District or as required to provide the required flow to the most remote fire hydrant in the proposed water extension.
- v. Locate the water system in the public right-of-way to the maximum extent feasible.
- vi. Locate valves at two of three branches of tee connection, at changes in pipe diameter and at intervals of no more than 800 feet along the water main in the distribution system and 1,320 feet in transmission mains. Valve spacing shall not exceed 500 feet in commercial, industrial and multi-family districts. Additional valves may be required at each connection, at the District's discretion, to facilitate flushing or other operation and maintenance needs.

B. Water line size shall be determined as necessary to meet all of the following criteria, subject to approval by the District:

- i. In accordance with size indicated in District Comprehensive Water System Plan.
- ii. As necessary to maintain minimum pressure in system of 20 psi under minimum fire flow and maximum day demand operating condition, and as necessary to maintain minimum pressure in system of 30 psi under maximum day and peak hour demand operating conditions, always with maximum velocity of eight feet per second and maximum pressure of 80 psi.
- iii. Minimum diameter of 8 inches if providing fire flow to a fire hydrant assembly.
- iv. Maximum of 50 feet of 6-inch diameter of lateral to a fire hydrant from the distribution main.
- v. Minimum of 4-inch diameter for distribution main without fire flow and hydrants and serving more than 10 single-family residences, subject to pressure and velocity limits in ii above.
- vi. Minimum of 2-inch diameter for distribution main without fire flow and hydrants and serving less than 10 single-family residences, subject to pressure and velocity limits in ii above.
- vii. 4-inch diameter and larger mains shall be cement-lined ductile iron, pressure class 350, polyethylene encased, per Specification Section 02610.
- viii. 2-inch diameter water mains shall be 200-psi high-density polyethylene, per Specification Section 02610.

- C. Water system extensions shall be sized for the following minimum fire flows according to Whatcom County Zoning Designation, or greater as required by the local fire district or Whatcom County Fire Marshal, or as indicated in the District's Comprehensive Water Plan:

<u>Zoning</u>	<u>Fire Flow and Duration</u>
R5A, R10A	Not required for new development
URM6	750 gpm for 60 minutes
UR4	500 gpm for 60 minutes
RC, NC, GC	Along Birch Bay Drive, 1,500 gpm for 120 minutes. In the GC area at the intersection of Blaine and Alderson Roads, 1,250 gpm for 120 minutes. Otherwise, 1,000 gpm for 120 minutes as required by the County Fire Marshal.

- D. Gate valves shall conform to AWWA C-509 or C-515 Resilient Seat and shall be furnished with a concrete valve marker. Valve marker shall be painted and stenciled to District requirements. Valves 12" and larger shall be butterfly valves. See Specification 02640.
- E. Valve boxes in shoulder of road shall be buried with valve markers located as required.
- F. The minimum cover on water mains shall be three feet unless otherwise approved by the District's Engineer, or as required by Road Agency.
- G. Water side services shall be 200 PSI P.E. pipe ASTM D2239 (3/4" single and 1" double) with brass fittings (see parts list on detail). The service line shall be installed to within 12 inches of property line of each lot and shall be 18 inches below grade to top of meter stop.
- H. Meter boxes shall be furnished and installed by the Developer.
- I. Casings under roadway for far side services may be required.
- J. Fire hydrants shall conform to AWWA C-502 and shall be M&H Style 929 Reliant, Clow Medallion, Waterous Pacer WB-67, or Mueller Super Centurion 250 with a 5¼ inch main valve opening equipped with a Storz adapter No. S-37 and two (2) 2-1/2" Hose Connections (all N.S.T.) Refer to Section 02645 for complete hydrant specifications. Fire hydrants shall be spaced at distances appropriate for the type of development with a maximum distance

of 250 feet from the hydrant to the furthest structure. Areas with flow requirement greater than 2,000 gpm will require closer hydrant spacing, per local code and fire official requirements. All fire flow rates, number, location and spacing of fire hydrants shall be as required by the local fire official. Where the rate of fire flow required for a specific building is greater than 1,000 gpm, more than one point of supply from the system is required, with a maximum of 1,000 gpm per fire hydrant. Fire hydrants shall be painted with two coats of paint to meet District requirements and installed without guard posts. Hydrant main sizes shall be 8" diameter on dead end mains. Six-inch (6") laterals to hydrants shall be a maximum of fifty feet (50') in length. When lateral exceeds 50 feet, gate valves shall be installed on the lateral at the mainline tee and within 10 feet of the hydrant. See Standard Details and Specification 02645.

- K. A two (2) inch or four (4) inch blow off assembly as required by the detail shall be installed at all dead-end water mains (temporary or permanent). Air and Air Vacuum relief valves shall be installed at high points of water transmission and distribution mains, except where waived by the District.
- L. Water lines shall generally be located on the north or east side of the public right-of-way, in accordance with the Whatcom County Development Standards.
- M. Water line marker posts shall be installed at changes of direction, at terminations and every 300 feet along water lines on easements.
- N. Galvanized pipe shall not be used underground.
- O. Valves on dedicated fire sprinkler or other fire protection service lines shall be installed with post-indicator assemblies. Maximum height for the post indicator shall be 36 inches above the adjacent grade.
- P. A double detector check assembly is required between the potable water system and private fire sprinkler and/or standpipe connections. The use of fire retardants, anti-freeze or other hazardous additives in the fire sprinkler system is prohibited.
- Q. Booster pump stations and water storage facilities shall be sized in accordance with the District's Comprehensive Water System Plan. In general, booster pump stations (BPS) shall be designed under the following criteria, and in accordance with a project-specific report and plan approval process, with review by DOH:

- i. Located above grade in permanent building, with paved access, on site with appropriate drainage facilities and protected from flooding.
- ii. Building shall be of low-maintenance durable construction in conformance with local codes and regulations. Building materials shall be split-face CMU walls with metal roofing, or as otherwise agreed by the District.
- iii. BPS shall have potable water pumps with non-overloading motors, minimum of two for domestic demand, and three or more if fire flow is to be provided by the BPS. Pumps and pumping system shall have capacity to meet the pressure, maximum day demand, and, as applicable, fire flow demand requirements for the station's service area.
- iv. BPS shall include isolation valves, check valves, pressure regulating valves, and flow meter.
- v. BPS shall be automatically controlled as appropriate for its location and purpose in the water system, with telemetry to District Headquarters.
- vi. BPS shall have on site standby power facilities unless otherwise waived by the District.
- vii. BPS shall be designed in accordance with the requirements of the DOH Water System Design Manual, latest edition.

R. Water system extensions shall also comply with the DOH Water System Design Manual and Whatcom County Coordinated Water System Plan (WCCWSP), latest editions. If there is a conflict between the requirements of this document, the Design Manual and the WCCWSP, the stricter requirements shall govern.

3. EASEMENTS

Legal descriptions for easements to be dedicated to the District for all portions of the water system which lie outside of public street rights-of-way shall be signed and stamped by a professional land surveyor and transmitted to the District. Easements shall be a minimum of twenty feet in width, or as required by the District. An easement may coincide with another utility easement, except that all sanitary sewer lines must be ten feet or more from water lines and other utilities must be a minimum of five feet from the waterlines. Water lines shall be located no closer than ten feet from the easement edge. At the discretion of the District, there shall be a separate easement provided for each lot that a waterline crosses. These easements are required by the District regardless of easements recorded with property deeds or plats.

Easements must be approved by the District prior to water service connection.

4. CONSTRUCTION AND INSPECTION

A. Installation and Inspection

No work on the water system shall be performed without a District Inspector being present. The District may refuse acceptance of any portion of the work installed without the Inspector having reviewed the work. The District must be notified a minimum of two full work days in advance of a firm starting date and time to arrange for and schedule the Inspector. Work must proceed in a continuous manner. If there are breaks in construction, there must be two working days' notice before beginning work again.

The approved construction plans and specifications shall be followed. No deviations will be allowed without request for change and approval received from the District. The District reserves the right to order changes in the event of conditions or circumstances discovered during construction; such changes could result from the ability or care shown by the Contractor, natural and man-made conditions, or any other reason.

The Contractor shall exercise extreme care in checking and cleaning all pipes and fittings of dirt, debris, and/or any foreign matter during installation. All material shall be kept clean. Plugs shall be used to seal system installed when it is to be left for any period of time, including lunch breaks, coffee breaks, and overnight. Pipe and fittings will be cleaned before installation if contaminated by dust, smoke, exhaust or any other material. Material contaminated by petroleum products or questionable chemical will be rejected. No trench water is to be allowed to enter installed system.

All taps of existing District mains must be performed while the District Inspector is present.

Final tie-in to the existing District system will not be permitted until after acceptance of the entire installation by the District. Acceptance will not be made until all submittals required are completed and after acceptable system installation is complete.

The entire water system shall be hydrostatically pressure tested as in accordance with Specification Section 02660, Waterlines, of this manual. The Contractor shall provide all testing equipment. The final testing shall be performed in the presence of the District's Inspector.

Before being placed into service, all new water mains and repaired portions of or extensions to existing mains shall be disinfected in accordance with Specification Section 02660, Waterlines, of this manual.

B. As-Built Drawings

When the Contractor completes the water system work, the water plans shall be revised to conform with construction records, and then sent to the District. Photomylars or archival plots on mylar are required for the District's record drawings. Prior to submitting revised plans, valve and blow off location and horizontal alignment shall be verified by a professional land surveyor. The location and type of all installed fittings shall be shown relative to monuments, lot corners, etc. Where butterfly valves are used, the location of the operating nut relative to the pipe centerline shall be shown.

7.4 Construction Standards

Construction materials and methods for distribution and transmission main improvement projects shall comply with the standards set forth in the *Developer Project Manual*.

Reservoirs and coating projects proposed for use in contact with potable water must have ANSI/NSF certification per WAC 246-290-220. These materials must be applied in accordance to the manufacturer's recommendations for that particular material.

Booster pump facilities must be designed to ensure the quality of pumped water be maintained and they do not cause water quality problems to occur elsewhere in the water system. Pressures in the distribution mains must comply with the requirements of WAC 246-290-230 and 246-290-420.

For storage facilities and booster pump station projects, the District will prepare project-specific reports and plans per Chapter 246-290 WAC, and design such facilities per DOH standards and the DOH-approved project report.

7.5 Construction Certification and Follow-up Procedures

The BBWSD inspects all new construction during and after construction to ensure that projects are constructed in accordance with the construction standards. This inspection includes being present during pressure test procedures to ensure that all have been properly performed. Any changes or additions to the facilities used for water supply must be properly disinfected prior to using them for service, in accordance with WAS 246-290-451(1). As-builts of

the final system are to be submitted to the District for each project. Service will not be provided until all requirements are satisfied.

The District will complete a “Construction Report”, which is required for public water system projects in accordance with WAC 246-290-040 following completion of construction of District and developer-initiated projects.

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CHAPTER 8

IMPROVEMENT PROGRAM

The purpose of this chapter is to develop an improvement program by incorporating the system needs previously identified in other chapters. The capital improvement program has been developed in accordance with the requirements identified in WAC 246-290-100.

The development of a comprehensive plan for the orderly expansion of Birch Bay Water and Sewer District's water system is set forth in this chapter. The population and water demand forecast existing system analysis discussed in previous chapters and the design criteria were used to formulate the plan and requirements.

The existing piping system was reviewed to determine the necessity of replacing older water mains because of material condition, size and the inability of the lines to deliver anticipated future flows. The District's service area was reviewed with respect to areas of expected future growth for the purpose of determining the need for future water main extensions.

8.1 Prioritizing Improvements

The following three step process used to identify how the CIP was developed: identify potential system improvements, evaluate the alternatives and finally select alternatives for the capital improvement plan.

8.1.1 Identification of System Improvements and Assessment of Alternatives

Each aspect of the system was analyzed, and a preliminary list of potential improvements was developed to address those deficiencies. Alternative projects to address present or future deficiencies were developed to meet DOH and District standards, serve the designated land use of the water service area, improve reliability of the system, and minimize capital and operating costs. Projects are located along existing or planned transportation and utility corridors, to minimized construction impact on the environment and minimize operation costs.

Table 3.9 presents the deficiencies, alternatives and recommended solutions.

Water Supply

The MDD forecast for year 2038 (without additional projected savings) is 3.15 mgd. In 2010, the District amended its contract with the City of Blaine to provide up to 3.73 mgd its MDD.

Presently Blaine is responsible for the treatment required for groundwater sources. Changing regulations may require the District and/or Blaine to implement additional treatment measures, and water treatment may be necessary for additional sources yet to be developed by the District. Once the regulations are implemented, additional study will be necessary to determine how best to meet the treatment requirements. Planning for equipping and connecting well PW-2 will require analysis and consideration of treatment for arsenic.

Storage

The District has sufficient storage, system-wide, through 2028 using “summer” operating levels. However, additional storage capacity is recommended as soon as feasible, particularly for the Birch Point and Point Whitehorn pressure zones, for reliability of service.

Seismic upgrade of the Kickerville Reservoir is recommended as soon as feasible to protect this significant asset. The Birch Point Reservoir should be replaced with a larger reservoir and a new reservoir should be added at Point Whitehorn.

Additional capacity for Zone 1 and Zone 3 should be integrated in the replacement Birch Point Reservoir. Upgrade of the Semiahmoo Drive intertie can facilitate the District’s reliance on existing Blaine storage capacity in their 330 Zone standpipe for the near-term. The District can support the City by working together to supply water from the District to the City through the existing 200 Zone intertie, with a new pump and standby power system. The District can support its future needs by considering a joint use pump station, to replace its two small pump stations serving Zone 2 and a pipeline connection from Zone 5 to Zone 2. Such an arrangement warrants more analysis to confirm that approach is agreeable to and in the mutual best interests of the City and District. Therefore a more detailed analysis is recommended.

Adding a reservoir at Point Whitehorn will require some distribution system replacement with addition of a PRV station. Modification of the Point Whitehorn BPS pump equipment will also be necessary.

The condition and appurtenances for each of the existing reservoirs was evaluated (see Section 3.4) and improvements were identified for each reservoir, as summarized in Chapter 3 and below. The recommended capacity for new facilities is described in Chapter 3 and in the Table 8.1.

Transmission/Distribution

As described in Section 3.3.4, the transmission/distribution system was analyzed with a computer model. The analysis included confirming the system will provide appropriate flow and pressure under PHD, MDD and MDD with fire flow

conditions, for current level of development and anticipated growth at two-year intervals for the next ten years then five-year intervals through 2038. Improvements identified to address deficiencies were assumed to be completed prior to the next analysis period. Nearly all the deficiencies identified were related to MDD delivery into the system, without relying on too much storage, with some local low-pressure areas requiring attention.

Supply is presently nearly all routed through one pipe segment in Blaine and through the existing Blaine Road BPS. The long supply line from Blaine is too small to provide adequate pressure upstream of the Blaine Road BPS throughout the planning period. Therefore, alternatives analysis focused on increased flow and/or pressure to the existing 18" main starting at the intersection of Portal Way and Hall Roads. That main presently supplies the Blaine Road BPS but operation of a few valves can direct supply directly to the system, provided adequate supply pressure and flow is available. The recommended option, for planning purposes, is for Blaine to equip PW-2, including arsenic treatment facilities, for enhanced capacity at the Portal Way Blaine intertie. The well will need to discharge to an HGL of about 210 feet to provide adequate pressure. Local modifications will be necessary to assure continued service to BBJWA by Blaine. Concurrently, a new BPS at the Portal Way intertie is necessary to deliver water to the District's Zone 1.

Equipping and connecting PW2 does address a supply need, primarily for BBWSD. However, eventually Blaine and BBWSD will need an additional source of supply, based on the analysis of both water systems. Therefore, as an alternative to connecting PW2 and building a new BPS at Portal Way, this Plan considers the option of a new District well, in the general vicinity of Loomis Trail Road at I-5. Such a well, presumed to have 700 gpm capacity, could provide supply to the system via a new transmission main and connection to the existing 16" transmission main on Loomis Trail Road. This alternative would allow Blaine to utilize PW2 primarily for their additional supply needs.

Pipeline projects are recommended within the system to support the recommended storage projects, pressure zone consolidation and improvements and for supply reliability. A few undersized parallel mains are recommended for removal. Additional distribution system improvements will be necessary with development to meet the requirements for looping and to provide appropriate flow and pressure within new plats.

Water Main Replacement

Portions of the District's system were installed prior to 1970 but most of the system is less than 40 years old. Beginning in the early 1990s the District began to replace its oldest and substandard mains through a series of projects. For development of this WSP update, 36 additional main replacement were identified for consideration, based on age of pipe, leak history, sub-standard size or

materials and fire flow capacity. Some pipes follow the alignment of proposed transmission main upgrades or future anticipated areas of new development. Following review of the potential projects, two projects were identified for inclusion in the capital improvement program (parallel main removal). An annual budget of \$50,000 is recommended for general water main upgrade or replacement projects. Depending on needs to be identified annually, these budgeted funds may be carried forward a year or two to address more significant needs.

Automatic Meter Reading

The District has begun a project to convert their entire metering system to an automatic meter read (AMR) system. The goal of this project is to improve accuracy and efficiency in the meter reading and billing process, improve customer service with more usage information available and increase data available for operations and system analysis, including future water system planning.

8.1.2 Selection of Alternatives

The selection of projects for supply, storage and transmission/distribution improvements are discussed in Section 3.5 and Table 3.9 and summarized in Section 8.2 and accompanying tables and figures. The sequence and schedule for the projects necessary for the next ten years was developed using the following general priority outline, balanced with review of the current and projected financial resources of the District (see Chapter 9):

- a) current deficiencies with potential impact on water quality
- b) current deficiencies limiting supply of MDD to the system
- c) current deficiencies or vulnerabilities impacting reliable storage for the system
- d) current deficiencies in fire flow to large areas of the District existing service area
- e) current deficiencies with potential impact on minimum service pressure to large areas of the District or system reliability
- f) forecast deficiencies limiting supply of MDD to the system.

8.2 Capital Improvement Plan and Schedule

Scheduled Improvements

Projects have been selected to address current deficiencies and to accommodate the forecast growth in the system through the forecast period (2038). Additional projects are indicated herein that provide for orderly expansion and improvement of the system in accordance with the standards discussed in Chapter 3. Table 8.1 and Figure 8.1 present the list of projects

necessary for extension of service throughout the water service area (except for local extensions) and those projects necessary to address current deficiencies and to accommodate growth for the planning period. Table 8.1 presents all projects recommended for completion over the 20-year planning period, through 2038. Tables 8.2 and 8.3 present more details for projects recommended for completion through 2028, including identification of financing source, schedule and reference to where the corresponding deficiency is identified in this WSP.

Projects were preliminarily scheduled as appropriate to address the timing of anticipated deficiencies as a function of the demand forecast and underlying population growth as discussed in Chapter 2. However, as noted in Chapter 2, actual growth from 2014-2018 indicates that growth of District customers and service population is lagging behind the forecast by about three years. Therefore, projects that have been identified to address anticipated capacity deficiencies have been scheduled in the Capital Improvement Plan for three years later.

The actual schedule for growth related projects (supply and storage capacity in particular) can and should be adjusted to suit actual increase in demand (i.e. deferred based on recent growth trends). As source capacity is added, future storage needs in Zone 1 should be re-evaluated per the current source capacity.

Route Selection

A detailed engineering route selection has not been made to determine a precise location for transmission/distribution mains. Therefore, the location shown on Figure 8.1 plan should be considered to be schematic in nature, especially in undeveloped portions of the District. The final location, configuration and length (and therefore cost) for each main will be the result of the final design made at the time project implementation. Location also will depend on availability of easements and right-of-way at time of construction.

Figure 8.1 does not indicate all the local distribution mains that will be necessary for development of residential and commercial projects. Such mains shall be designed to meet the standards presented in Chapter 3, and under specific conditions as may be determined by the District Board of Commissioners at the time of application for developer extension projects.

Project Cost Estimates

Cost estimates involve an engineering judgment based on experience, but construction costs can vary over a wide range because of the many factors which cannot be predicted such as labor availability, competitive conditions, final location of the project (i.e. on easement or in roadway), management, environmental considerations and other issues affecting design and construction costs at the time the work is actually performed. Generally, actual costs cannot

be known until bids are received, and even these may be subject to adjustment because of changed conditions encountered during construction. The District, in its decision making, must always keep in mind that the costs presented in this chapter are estimates.

Construction costs are estimated from prices obtained from various sources, including manufacturers and suppliers of materials and equipment and bid prices for projects in other communities in the area. In considering these estimates, it is important to realize that changes during final design will alter the total cost to some degree, and future changes in the cost of material, labor and equipment will also have a direct impact. Prior to the initiation of the projects shown in this capital improvement program, the project costs should be reviewed and updated to reflect current conditions.

The cost estimates presented are based on 2019 prices and represent estimated total project costs. For reference the Engineering News Record Construction Cost Index for Seattle is 12,026 (February, 2019). Project costs are developed from estimated construction cost plus allied costs. Allied costs are estimated as 60% of the estimated construction cost and represent costs for permitting, surveying, engineering design and observation, inspection, administration, legal and other project related costs, including 20% contingency and 8.5% sales tax.

Operation and maintenance costs are not reflected in the project cost estimates. However, these costs are important and require consideration during the design phase of a proposed facility or project.

8.3 Other Recommendations

As described in Chapter 6, there is one recommendation regarding operation and maintenance improvements, summarized as follows: Develop an emergency supply agreement with the City of Blaine, to confirm, expand and extend the terms of the 2007 Memorandum of Understanding regarding use and operation of the 200 Zone and 300 Zone interties. This update can be incorporated with agreements regarding shared use of storage and mutual supply between the City and District, including permanent or standby pumped supply from the District to the City at the 200 Zone intertie.

Water Storage Tanks

Tanks shall only be drained for inspection, maintenance or repair if standby storage (SB) is available elsewhere in the system (e.g., the SB storage volume required for 2019 is greater than the capacity of Birch Point Reservoir, therefore Kickerville should not be drained except in an emergency). For painting or other work requiring draining of the tank, alternative supply or storage scenarios should be in place. For example, although SB storage is based on the annual ADD, work on reservoirs could be scheduled for spring or fall period when

the monthly ADD is lower than the annual ADD. The short-term SB storage requirement is therefore lower. Temporary reliance on Blaine's storage capacity and/or temporary supply reliability measures could be used to insure adequate standby supply is available when large volumes of reservoir capacity are temporarily unavailable.

Each tank should be comprehensively inspected every six years or more often if conditions warrant.

Internal tank inspections may be made by draining the tank (see note above) or by a commercial diver. If inspected by a diver, the tank must first be isolated from the water system and all connection valves shall be locked out. All equipment, clothing, and personnel entering the tank must be cleaned thoroughly, and it must be certified that the equipment and clothing has been used only for potable water inspections. Two certified divers should be on site, and an additional diver should be available outside the tank in case of emergency. Before anyone or any equipment is allowed to enter the tank, the residual chlorine should be checked to determine that it is adequate. Air should be supplied to the divers from external air-supplying equipment.

During extended periods of freezing temperatures, tanks and supply sources should be operated to force water circulation through tank to prevent freezing in pipes or tank.

Fire Hydrants

All hydrants should be inspected at least once every four years, including confirmation of satisfactory operation and sealing.

Dry barrel hydrants in high groundwater areas or with plugged drains should be inspected and pumped out after each use.

Valves

All valves should be exercised at least once every five years and critical valves (e.g., at booster pump stations, tanks and along transmission mains or to dead-end distribution mains) should be inspected annually.

The condition of valve boxes and covers should be evaluated and valve stem extensions should be in place where the District's standard valve operators are too short.

Flushing

Flushing water out of isolated or un-looped segments of the water distribution system can help improve water quality. Additionally flushing can improve

conditions (water quality, debris, taste and odor, etc) in any part of the water system following unusual hydraulic or physical situations. For example, water main construction work may allow granular material into the system or high flows due to fire hydrant use or peak demands may redistribute debris or water that has been in the system for a long time. Such events may lead to water quality issues and/or customer complaints.

The District's design and construction standards require installation of temporary or permanent blow-off hydrant assemblies at the end of dead-end or un-looped water mains, if there is no fire hydrant at that location.

Most of the customer complaints in recent years are associated with taste and odor issues. We recommend the District implement a program of regular flushing of un-looped water mains. Such mains should be flushing annually to begin with. The frequency should then be adjusted in response to the benefit of the program. Priority should be given to those un-looped lines serving the fewest residential customers.

Leak Detection

An average annual water loss of eight percent will represent over 86,000 gallons per day of unaccounted water by 2028. DOH has developed the Water Use Efficiency Rule – Distribution Leakage Standard. The standard requires municipal water suppliers to maintain leakage at or below ten percent of production, based on a rolling three-year average. Leakage must be reported in planning documents and annually in performance reports.

The District already meters each source, customer and District facility served by the system. Some over-sized meters have been replaced to confirm that appropriately sized meters are used. Remaining potential sources of unaccounted-for water include fire protection and hydrant testing, construction, flushing and water main leaks.

We recommend the District increase efforts to measure, locate and reduce the volume of unaccounted-for water in its systems, including consideration of the following measures:

- Select and begin use of water audit software (examples are available from AWWA and are discussed in AWWA Manual M36).
- Implement and/or enforce requirements for metered use of all construction, flushing and testing water.
- Field evaluate (visual or with proprietary commercial methods) all mains of substandard material during dry weather/low groundwater season.

- Calibrate or test all supply and customer meters larger than 2 inches as necessary.

Additionally the District should update its water general facilities charge to reflect the projects proposed for completion within the next ten years, per Table 8.2.

Table 8.1
CAPITAL PROJECTS

ID	Capital Improvement	Project Description	Estimated Project Cost (2019)	Recommended Year of Completion	Capacity or Reliability
<i>I. SUPPLY</i>					
SU-1	Supply/ Storage Pre-design Study	Complete evaluation with Blaine to confirm mutually cost-beneficial and effective additional supply strategy, in context of shared storage needs at Birch Point. Consider feasible alternatives listed in Table 3.8. (District share at 50% indicated)	\$ 18,000	2019	Capacity
Blaine	Addn. Supply	Complete additional supply project for increased flow/pressure at Portal Way Intertie based on outcome of SU-1. For planning purposes, equip PW-2 for service to HGL=210' and connect to existing system, disconnect temporary Hall Road connection to BR BPS inlet for separate discharge direct to system (treatment assumed)	Blaine Project*	2023	Capacity & Reliability
SU-2	New BPS - Portal Way	Add 1,400 gpm BPS (no generator) at Portal Way Intertie.	\$ 962,000	2023	Capacity & Reliability
SU-3	New Birch Point BPS	Jointly with City of Blaine, add 250 gpm BPS with standby power at 200 Zone intertie for increased supply to Pressure Zone 3, and additional supply from District to City 330 Zone to reduce storage deficiencies in both systems (District share at 50% indicated)	\$ 440,000	2024	Capacity
SU-4	Source/Water Rights	Annual Allowance for Water Rights and Source of Supply Efforts	\$ 400,000	2019-2038	Capacity
		Subtotal for Supply Projects*	\$ 1,820,000		

ID	Capital Improvement	Project Description	Estimated Project Cost (2019)	Recommended Year of Completion	Capacity or Reliability
II. STORAGE					
ST-1	Updated Seismic Load Vulnerability Analysis	Complete updated analysis of Kickerville Reservoir and complete analysis for Semiahmoo Reservoir	\$ 125,000	2019	Reliability
ST-2	Kickerville Reservoir Upgrades	Kickerville Reservoir seismic upgrades - tensioning straps and exterior paint lower 10 feet	\$ 260,000	2019-2020	Reliability
ST-3	Semiahmoo Reservoir Upgrades	Allowance for seismic upgrades	\$ 162,000	2019-2020	Reliability
ST-4	Point Whitehorn Reservoir	Add Zone 3 reservoir at Point Whitehorn, (offline, at WWTP, 169,000 gallon concrete reservoir, with T-8)	\$ 375,000	2025	Capacity and Reliability
ST-5	Replace Birch Point Reservoir	Replace existing 0.5 MG reservoir with 1.65 MG ground level reservoir, on existing District property at existing site. Includes capacity for Zone 2 and for Blaine 330 Zone future need + 15% contingency. (Does not include Blaine cost sharing at 32%)	\$ 2,123,000	2028	Capacity and Reliability
ST-6	Tank Repainting	Kickerville Reservoir Exterior and Interior Repainting	\$ 652,000	2029	Reliability
		Subtotal for Storage Projects	\$ 3,697,000		

ID	Capital Improvement	Project Description	Estimated Project Cost (2019)	Recommended Year of Completion	Capacity or Reliability
III. TRANSMISSION/DISTRIBUTION					
T-1a	Relocate Meters/ Abandon Main	Relocate water meters to existing parallel main and abandon existing pipe on Birch Bay Dr. (Pt Whitehorn Rd. to Jill)	\$ 132,000	2019	Reliability
T-1b	Relocate Meters/ Abandon Main	Relocate water meters to existing parallel main and abandon existing pipe on Birch Bay Dr. (Cedar to Alderson)	\$ 46,000	2020	Reliability
T-1c	Abandon Dist. Main	Cap existing and abandon existing main from Loft Lane to Gemini Street	\$ 10,000	2020	Reliability
T-2	Shintaffer Rd Main Extension	Extend 8" DI main (1,200 lf) to connect existing 10" and 12" mains for north end loop	\$ 249,000	2020	Reliability
T-3	Main Replacement	Water Main Replacement/Upgrade Program, annual budget for 10 years	\$ 478,000	2019-2028	Reliability
T-4	Semiahmoo Intertie	Upgrade 225 lf 2.5" to 8" and replace meter and PRV with 8" facility.	\$ 185,000	2020	Capacity and Reliability
T-5	BBV Zone Change	Connect Zone 2 to portion of Birch Bay Village area southwest of Skeena Way, close valves, add 2 PRVs to shift area above elevation 65' to Zone 2 (4" DI 1,400 lf and cut-in valves)	\$ 325,000	2022	Reliability
T-6	PW BPS Pipe Replace	Replace 1,000 lf 8" AC pipe with DI pipe from PW BPS discharge connection to Point Whitehorn Rd. (Recommended prior to ST-4 and T-8)	\$ 289,000	2023	Reliability
T-7	Connect Zones 5 & 2	Integrate Zone 5 with Zone 2 with connection along Birch Point Road - 8" DI (7,300 lf)	\$ 2,110,000	2024	Reliability
T-8	Zone 3 and 3a	Upgrade BPS for lower supply HGL to increased Zone 3 HGL 260'), add PRV to create Zone 3a (with ST-4)	\$ 176,000	2025	Capacity and Reliability
T-9	WWTP Meter Relocation	Relocate WWTP supply meter to Point Whitehorn BPS area (PRV needed, abandon access road water main)	\$ 57,000	2028	Reliability
T-10	Semiahmoo Booster Pump Station	Booster Pump Station for closed future high pressure zone (above 180' elevation) with 4" supply line (no fire flow capacity)	\$ 723,000	2027, with DE	Capacity
T-11	Blaine Road	Transmission main for redundancy - Alderson to DE 11-A (Church 14" extension north of Bay Rd) - 3,300 lf 12" DI	\$ 1,208,000	2027, with DE	Reliability
		Subtotal for Transmission/Distribution Projects	\$ 5,988,000		

ID	Capital Improvement	Project Description	Estimated Project Cost (2019)	Recommended Year of Completion	Capacity or Reliability
IV. OTHER					
O-1	AMR	Complete AMR Program (not including District labor costs for installation)	\$ 1,500,000	2019-2022	Reliability
O-2	WSP	Comprehensive Water System Plan Update	\$ 150,000	2028	Capacity and Reliability
O-3	FMP	Update Financial Management Policy	\$ 7,500	2019	Reliability
O-4	Contract	Blaine Water Supply Contract Renewal	\$ 50,000	2021	Capacity
O-5	Facility	Facility Gates Upgrade/Building Upgrades	\$ 29,000	2019	Reliability
O-6	Records	Digital Records Project	\$ 9,000	2019	Reliability
O-7	Phone	Upgrade Phone System	\$ 15,000	2019	Reliability
O-8	Vehicles	Upgrade Vehicles	\$ 319,000	2019-2028	Reliability
		Subtotal for Other Projects	\$ 2,079,500		
		Grand Total	\$ 13,584,500		

(Not including sources of supply upgrades by Blaine or shared storage projects)

* Project is an improvement to the City of Blaine system, but the District will share in the project cost over time per the water supply contract - listed here for scheduling, coordination and financial planning purposes.

Table 8.2
10-YEAR CAPITAL IMPROVEMENT PLAN

ID	Capital Improvement	Project Description	Page Where Need Identified	Funding Source*	Estimated Project Cost (2019)	Recommended Year of Completion
SU-1	Supply/ Storage Pre-design Study	Complete evaluation with Blaine to confirm mutually cost-beneficial and effective additional supply strategy. in context of shared storage needs at Birch Point. Consider feasible alternatives listed in Table 3.8. (District share at 50% indicated)	3-27, Table 3.9	GFC	\$ 18,000	2019
SU-4	Source/Water Rights	Annual Allowance for Water Rights and Source of Supply Efforts	District Budget	GFC & Rates	\$ 200,000	2019-2028
ST-1	Updated Seismic Load Vulnerability Analysis	Complete updated analysis of Kickerville Reservoir and complete analysis for Semiahmoo Reservoir	3-21	Rates	\$ 125,000	2019
T-1a	Relocate Meters/ Abandon Main	Relocate water meters to existing parallel main and abandon existing pipe on Birch Bay Dr. (Pt Whitehorn Rd. to Jill)	8-3	Rates	\$ 132,000	2019
T-1b	Relocate Meters/ Abandon Main	Relocate water meters to existing parallel main and abandon existing pipe on Birch Bay Dr. (Cedar to Alderson)	8-3	Rates	\$ 46,000	2020
T-1c	Abandon Dist. Main	Cap existing and abandon existing main from Loft Lane to Gemini Street	8-3	Rates	\$ 10,000	2020
T-2	Shintaffer Rd Main Extension	Extend 8" DI main (1,200 lf) to connect existing 10" and 12" mains for north end loop	8-3	Rates	\$ 249,000	2020
T-3	Main Replacement	Water Main Replacement/Upgrade Program, annual budget for 10 years	8-3	Rates	\$ 478,000	2019-2028
O-1	AMR	Complete AMR Program (not including District labor costs for installation)	8-4	Rates	\$ 1,500,000	2019-2022
O-3	FMP	Update Financial Management Policy	District Budget	Rates	\$ 7,500	2019
O-5	Facility	Facility Gates Upgrade/Building Upgrades	District Budget	Rates	\$ 29,000	2019
O-6	Records	Digital Records Project	District Budget	Rates	\$ 9,000	2019

ID	Capital Improvement	Project Description	Page Where Need Identified	Funding Source*	Estimated Project Cost (2019)	Recommended Year of Completion
O-7	Phone	Upgrade Phone System	District Budget	Rates	\$ 15,000	2019
ST-2	Kickerville Reservoir Upgrades	Kickerville Reservoir seismic upgrades - tensioning straps and exterior paint lower 10 feet	3-21	Rates	\$ 260,000	2019-2020
ST-3	Semiahmoo Reservoir Upgrades	Allowance for seismic upgrades	3-29	Rates	\$ 162,000	2019-2020
T-4	Semiahmoo Intertie	Upgrade 225 lf 2.5" to 8" and replace meter and PRV with 8" facility.	3-39, Table 3.9	GFC	\$ 185,000	2020
O-4	Contract	Blaine Water Supply Contract Renewal	District Budget	Rates	\$ 50,000	2021
O-8	Vehicles	Upgrade Vehicles	District Budget	Rates	\$ 319,000	2019-2028
T-5	BBV Zone Change	Connect Zone 2 to portion of Birch Bay Village area southwest of Skeena Way, close valves, add 2 PRVs to shift area above elevation 65' to Zone 2 (4" DI 1,400 lf and cut-in valves)	3-39, Table 3.9	GFC	\$ 325,000	2022
Blaine	Addn. Supply	Complete additional supply project for increased flow/pressure at Portal Way Intertie based on outcome of SU-1. For planning purposes, equip PW-2 for service to HGL=210' and connect to existing system, disconnect temporary Hall Road connection to BR BPS inlet for separate discharge direct to system (treatment assumed)	3-37, Table 3.8 & 3.9	GFC	Blaine Project*	2023
SU-2	New BPS - Portal Way	Add 1,400 gpm BPS (no generator) at Portal Way Intertie.	3-37, Table 3.9	GFC	\$ 962,000	2023
T-6	PW BPS Pipe Replace	Replace 1,000 lf 8" AC pipe with DI pipe from PW BPS discharge connection to Point Whitehorn Rd. (Recommended prior to ST-4 and T-8)	Table 3.9	GFC	\$ 289,000	2023
SU-3	New Birch Point BPS	Jointly with City of Blaine, add 250 gpm BPS with standby power at 200 Zone intertie for increased supply to Pressure Zone 3, and additional supply from District to City 330 Zone to reduce storage deficiencies in both systems (District share at 50% indicated)	Table 3.9	GFC	\$ 440,000	2024

ID	Capital Improvement	Project Description	Page Where Need Identified	Funding Source*	Estimated Project Cost (2019)	Recommended Year of Completion
T-7	Connect Zones 5 & 2	Integrate Zone 5 with Zone 2 with connection along Birch Point Road - 8" DI (7,300 lf)	3-39, Table 3.9	GFC & LFC	\$ 2,110,000	2024
ST-4	Point Whitehorn Reservoir	Add Zone 3 reservoir at Point Whitehorn, (offline, at WWTP, 169,000 gallon concrete reservoir, with T-8)	3-28, Table 3.9	GFC	\$ 375,000	2025
T-8	Zone 3 and 3a	Upgrade BPS for lower supply HGL to increased Zone 3 HGL 260', add PRV to create Zone 3a (with ST-4)	3-39	Rates	\$ 176,000	2025
ST-5	Replace Birch Point Reservoir	Replace existing 0.5 MG reservoir with 1.65 MG ground level reservoir, on existing District property at existing site. Includes capacity for Zone 2 and for Blaine 330 Zone future need + 15% contingency. (Does not include Blaine cost sharing at 32%)	3-38, Table 3.9	GFC & Rates	\$ 2,123,000	2028
T-9	WWTP Meter Relocation	Relocate WWTP supply meter to Point Whitehorn BPS area (PRV needed, abandon access road water main)	8-3	Rates	\$ 57,000	2028
O-2	WSP	Comprehensive Water System Plan Update	n/a	Rates	\$ 150,000	2028
T-10	Semiahomoo Booster Pump Station	Booster Pump Station for closed future high pressure zone (above 180' elevation) with 4" supply line (no fire flow capacity)	Table 3.9	GFC & Rates	\$ 723,000	2027, with DE
T-11	Blaine Road	Transmission main for redundancy - Alderson to DE 11-A (Church 14" extension north of Bay Rd) - 3,300 lf 12" DI	8-3	GFC & Rates	\$ 1,208,000	2027, with DE
Grand Total					\$ 12,732,500	

*Funding Sources:

GFC Funded from District General Facilities Charges revenue

LFC Constructed by developer extension, or by district with subsequent cost recovery thru Local Facilities Charge revenue

Rates System improvements projects funded by water service charges

TABLE 8.3
10-YEAR CAPITAL IMPROVEMENT PLAN (2019-2028)

ID	Capital Improvement	Funding Source*	Estimated Project Cost - Thousands (2019 \$)									
			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
SU-1	Supply/Storage Pre-design Study	A	18									
SU-4	Source/Water Rights	A,C	20	20	20	20	20	20	20	20	20	20
ST-1	Updated Seismic Load Vulnerability Analysis	C	125									
T-1a	Relocate Meters/ Abandon Main	C	132									
T-1b	Relocate Meters/ Abandon Main	C		46								
T-1c	Abandon Dist. Main	C		10								
T-2	Shintaffer Rd Main Extension	C		249								
T-3	Main Replacement	C	28	50	50	50	50	50	50	50	50	50
O-1	AMR	C	500	400	400	200						
O-3	FMP	C	7.5									
O-5	Facility	C	29									
O-6	Records	C	9									
O-7	Phone	C	15									
ST-2	Kickerville Reservoir Upgrades	C	210	50								

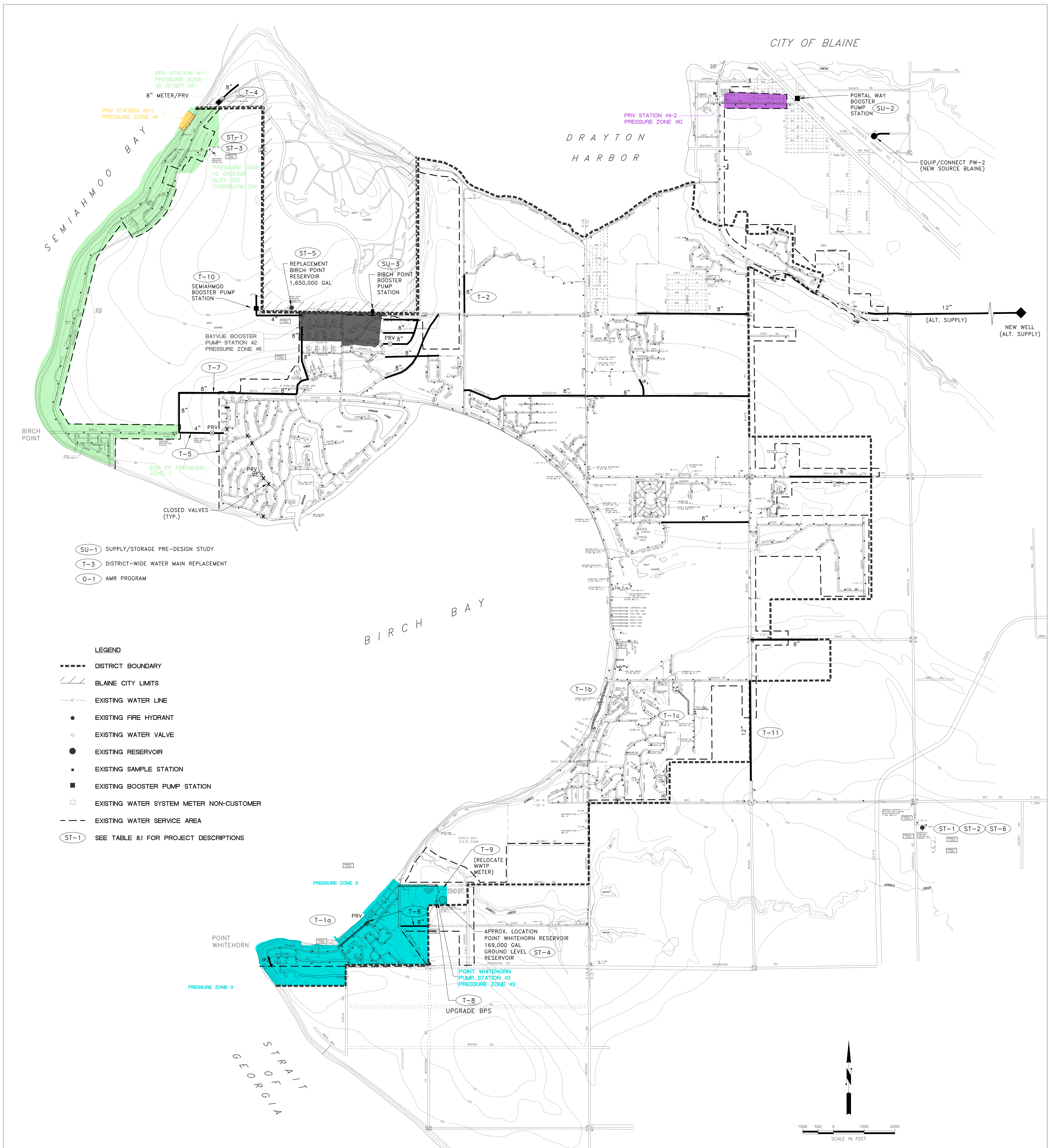
ID	Capital Improvement	Funding Source*	Estimated Project Cost - Thousands (2019 \$)									
			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
ST-3	Semiahmoo Reservoir Upgrades	C	115	47								
T-4	Semiahmoo Intertie	A		185								
O-4	Contract	C			50							
O-8	Vehicles	C	119		55	65	50				15	15
T-5	BBV Zone Change	A				325						
Blaine	Addn. Supply	A					TBD					
SU-2	New BPS - Portal Way	A					962					
T-6	PW BPS Pipe Replace	A					289					
SU-3	New Birch Point BPS	A						440				
T-7	Connect Zones 5 & 2	A, B						2,110				
ST-4	Point Whitehorn Reservoir	A							375			
T-8	Zone 3 and 3a	C									176	
ST-5	Replace Birch Point Reservoir	A,C										2,123
T-9	WWTP Meter Relocation	C										57
O-2	WSP	C										150
T-10	Semiahmoo Booster Pump Station	A, C									723	
T-11	Blaine Road	A, C									1,208	
Annual Totals			1,328	1,057	575	660	1,371	2,620	445	70	2,192	2,415

*Funding Sources:

A - GFC Funded from District General Facilities Charges revenue

B - LFC Constructed by developer extension, or by District with subsequent cost recovery thru Local Facilities Charge revenue

C - Rates System improvements projects funded by water service charges

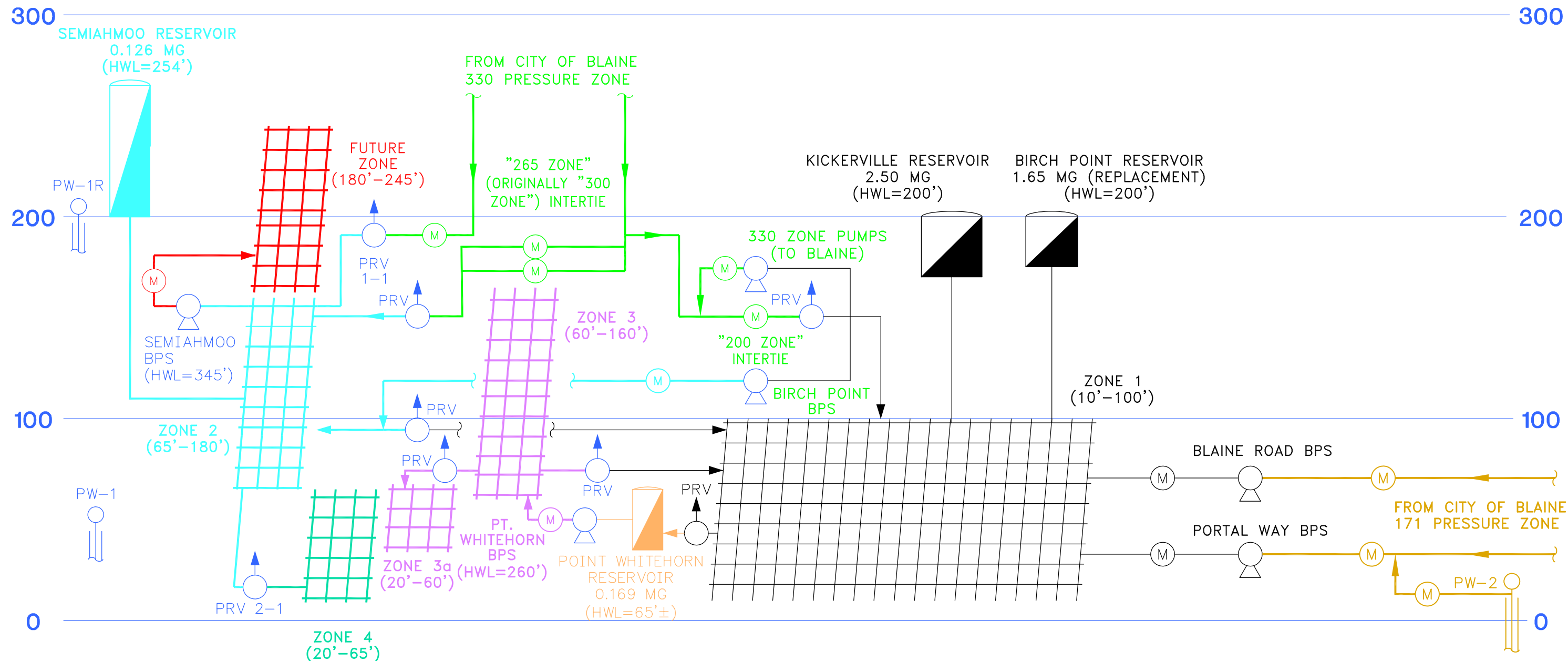


Birch Bay Water & Sewer District
2019 Comprehensive Water System Plan

FIGURE 8.1

CAPITAL IMPROVEMENT PLAN

USER: Scott, Schematic Plotting DATE: 4/2/2019 FILE LOCATION: K:\19-BBWS\2015\191503 Comp Water Plan Update\191503 CAD Figures\191502 WSP - FIG 8-2.dwg



LEGEND

RESERVOIR		WELL		ELEVATION (FT) 300	
METER		BOOSTER PUMP STATION (BPS)			
PRV		DISTRIBUTION SYSTEM (WITH SERVICE AREA ELEVATION RANGE)			

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CHAPTER 9

FINANCIAL PROGRAM

Birch Bay Water and Sewer District is a special purpose district, incorporated in the State of Washington under laws governing municipal entities. The water utility is operated as part of the District's single enterprise fund. The District assumed the duties of its own treasury function from the County in 1988. It has a long history of being responsible for managing its own financing, investment and accounting functions. Established fiscal management policies provide the baseline against which current water utility financial operations can be measured.

9.1 Past and Present Financial Status

The Finance Department for the District works closely with the Operations Department to monitor and evaluate the water utility's fiscal performance. Table 9.1 presents a summary of operating performance for the period 2012-2018.

The District has historically maintained and currently maintains a strong financial base. All previous bond debt has been retired.

9.2 Available Revenue Sources

There are many ways that the capital improvements outlined in this report can be financed. Each of these methods of financing is discussed in the following subsections. By using a Revenue Requirements Model, the District can maintain rates and charges at an adequate level to insure a sufficiency of funds to make payments to bondholders, provide for debt service coverage as specified in bond covenants, properly maintain and operate the system and provide funds for construction of the water system plan through a combination of cash contributions and debt financing.

Developer Financing

Developers of presently unimproved property will finance many of the new facilities constructed in the District. All of the improvements required for service to property within new plats or commercial and industrial developments will be designed and constructed in accordance with the District's *Developer Project Manual*. In some cases, latecomer's agreements may be executed for any water main serving property other than the property owned by the developer that is financing the project.

Table 9.1
HISTORICAL FINANCIAL PERFORMANCE

Description	Actual (\$)						
	2012	2013	2014	2015	2016	2017	2018
Operating Revenues and Expenditures							
Total Revenues	1,572,051	1,730,808	1,819,658	2,134,636	2,130,571	2,665,257	2,511,638
Total Expenditures	1,294,812	1,452,042	1,431,505	1,541,520	1,482,747	1,457,672	1,615,995
Net Income (Loss)	277,239	278,766	388,153	593,116	647,824	1,207,585	895,643
Other Increases							
Connection Charges	46,919	103,129	59,402	128,255	160,713	141,650	150,204
Other Financing Sources	19,639	16,565	6,150	64,055	529,176	637,268	14,777
Total Other Increases	66,558	119,694	65,552	192,310	689,889	778,918	164,981
Other Decreases							
Debt Service	576,168	146,507	146,507	140,706	132,204	212,681	223,730
Capital Outlay	117,227	109,668	158,654	249,926	1,563,017	1,313,162	302,917
Total Other Decreases	693,395	256,175	305,161	390,632	1,695,221	1,525,843	526,647
All Revenues and Expenditures							
Net Income (Loss)	(349,598)	142,285	148,544	394,794	(357,508)	460,660	533,977

Combination Financing by the District and Developers

It may be necessary in some cases to require the owner to construct a larger diameter line than is required by the current development in order to provide for the comprehensive development of the District. The District may enter into a latecomer's agreement or reimburse the developer for the extra cost of increasing the size of the line over that required to service the property under development. Oversizing should be considered when it is necessary to construct any pipe over 8 inches in diameter in single-family residential areas to comply with the water system plan. Construction of any pipe in multiple family, commercial or industrial areas that is larger than the size required to serve that development is considered oversizing.

Long Term Debt

The District adopted a Debt Policy in 2016 which earned an award of excellence by the State of Washington Municipal Treasurers Association. The Policy ensures that all debt is issued both prudently and cost effectively.

- Revenue Bonds

Transmission lines and improvements to the supply and storage that are of a general benefit to a major portion of the District may be financed by revenue bonds. Improvements that will benefit primarily a single developer should be financed by the developer developing the property. The District may use whatever funds are available for the payment of the debt service on the revenue bonds. A major source of these funds is from the sale of water to the District customers. However, all funds, such as general facility fees, connection charges, latecomer charges and miscellaneous income may be used for debt service.

- Special Assessment Bonds

Water distribution improvements that will cause extraordinary increases in the value of the properties receiving service may be financed through the establishment of a utility local improvement district (ULID). The financing is accomplished through the sale of revenue bonds. These bonds are retired with income from the assessments and/or other funds of the District.

- Private Placement Bank Loan

Similar to revenue bonds, this type of loan could be used for District capital improvement projects that are of a general benefit to a major portion of the District. Through a competitive process, a bank secured private placement loan could save the District expenses related to bonds.

- State & Federal Loan Funds

The State of Washington and federal authorities have previously provided loan funds through the Drinking Water State Revolving Fund loan and the

Public Works Board. The District should continuously monitor the activities of the state or federal agencies to determine the requirements of these programs or of any new loan programs that may be developed in the future.

Short Term Debt

The District may use Short Term Debt to meet the immediate financing needs of a project for which long-term financing has been secured but not yet received. Private bank placement short term debt may be an example that the Commissioners could approve.

Grant Funds

The State of Washington has previously provided funds under the various grant programs for the analysis for construction of major improvements to or rehabilitation of water systems. The District should continuously monitor the grant activities of the State to determine the requirements for future grant opportunities.

Figure 9.1 presents a schematic of revenue and expenses for the District.

9.3 Allocation of Revenue Sources

Following adoption of this plan, the District will update its general facilities charge (GFC) calculation to support the updated capital improvement plan. As described in Section 9.2, projects will be supported by revenue from GFCs, developer projects and contributions, and from water service charges. Preparation of the GFC calculation, including evaluation of alternative methods of calculation, will consider the extent to which the various revenue sources will support each project, generally based on the purpose of the project (e.g. serve growth, renew existing facilities, etc.).

9.4 Program Justification

Birch Bay Water & Sewer District has developed a Revenue Requirements Model that projects revenue required for 10 years in the future by factoring every aspect of District financial activity. The Model includes all uses and sources of funds and makes assumptions regarding growth, cost of living increases, debt issuance costs, and GFC rate increase. The model then projects the operating revenue needed to meet the administration, operation and maintenance, capital improvement and debt service needs. If a rate increase is called for, the Model will project a smooth level increase to meet the revenue requirements. Each year, the District devotes a substantial amount of staff and Commissioner effort to updating the Model with new projects and activities in order to confidently

make growth and revenue forecasts that will adequately support the revenue requirements of the District.

The District has utilized the Model to evaluate the impact of the 10-year capital improvement plan as presented in Table 8.2 on District water system rates and charges. Table 9.2 presents a preliminary summary of the forecast budget for the period 2019-2028, including identification of additional financing needs.

9.5 Assessment of Rates

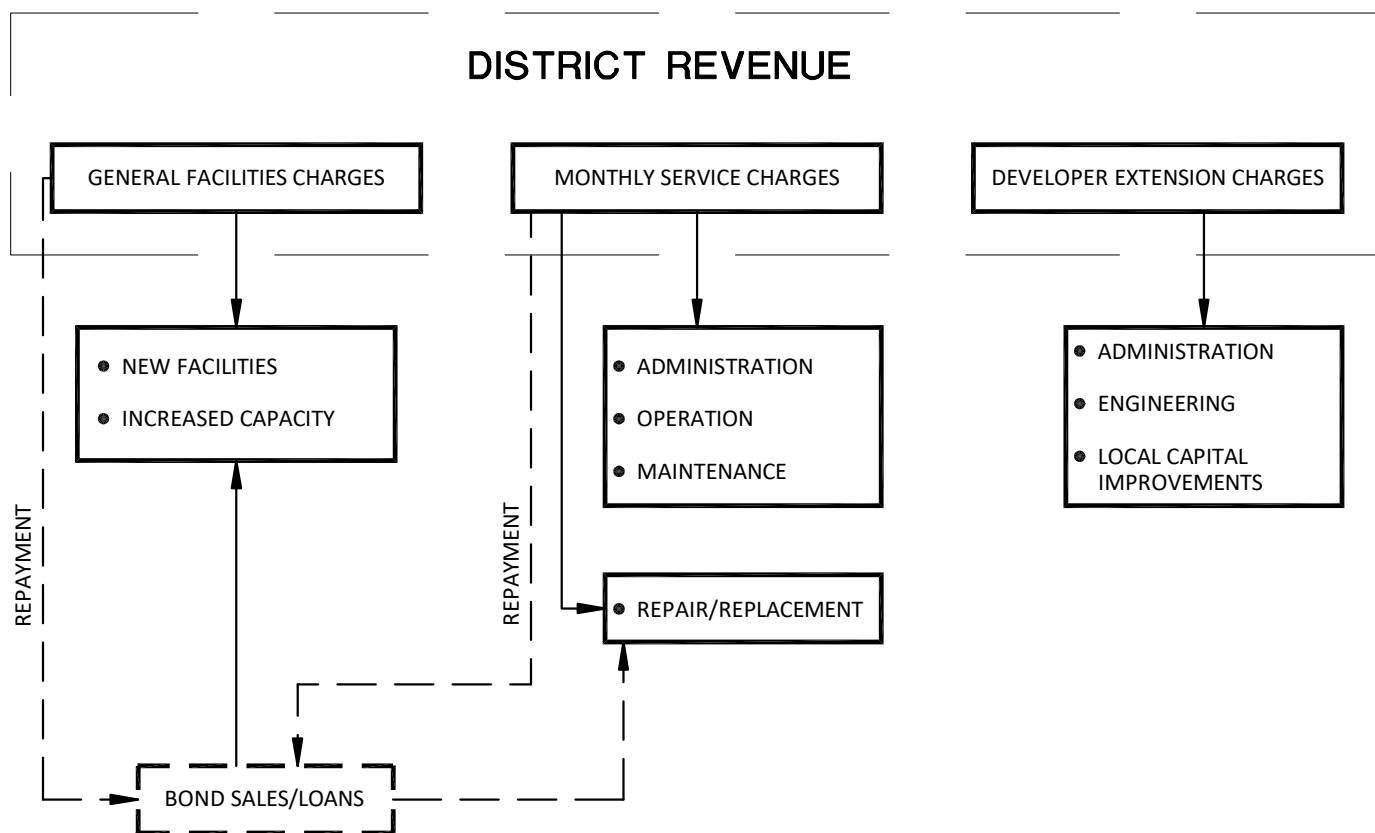
The District promotes water conservation by devoting substantial financial and staff resources in an aggressive year-round program of public education programs and advertising. Also, a three-tiered block rate structure encourages prudent water use by implementing an increase on water usage over four hundred cubic feet (ccf) per billing period, and an increase on usage over 20 ccf per billing period. A monthly billing and handling charge is applied to each water account for \$4.30 and covers the cost of staff billing and receipting of payments. Ongoing operating and maintenance expenses are recovered through a monthly basic charge for each account of \$11.60, and water purchase and delivery expense is recovered by charging \$3.30 per ccf up to 20 ccf and \$6.20/ccf over 21 ccf. This rate structure was implemented prior to development of the District's WUE Program (see Chapters 2, 4 and Appendix I) but was continued as part of the WUE Program as a continuing water use efficiency measure.

As stated in 9.4 above, rates are reviewed annually through the Revenue Requirements Model to insure adequate funds are available to meet every operation and maintenance, capital improvement and debt service requirement. Current projections indicate that a modest water rate increase may be needed to cover projected revenue needs. Also, the District periodically considers an outside consultant is engaged to perform a formal rate study.

Table 9.2

FORECAST FINANCIAL PERFORMANCE

Description	Forecast (\$)									
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Operating Revenues and Expenditures										
Total Revenues	2,444,370	2,515,293	2,656,060	2,804,966	2,962,480	2,929,099	3,305,351	3,491,792	3,689,012	3,897,632
Total Expenditures	1,739,284	1,791,463	1,845,206	1,900,563	1,957,579	2,016,307	2,076,796	2,139,100	2,203,273	2,269,371
Net Income (Loss)	705,086	723,830	810,854	904,403	1,004,901	912,792	1,228,555	1,352,692	1,485,739	1,628,261
Other Increases										
Connection Charges	139,958	141,330	448,627	474,562	501,997	531,017	561,715	594,188	628,538	664,874
Other Financing Sources	658,778	400,000	400,000	200,000	-					
Total Other Increases	798,736	541,330	848,627	674,562	501,997	531,017	561,715	594,188	628,538	664,874
Other Decreases										
Debt Service	222,324	306,781	312,437	312,541	312,572	309,745	183,339	180,545	177,751	174,957
Capital Outlay	1,477,500	1,120,420	626,750	739,200	1,576,650	1,846,700	538,450	86,800	2,783,840	3,139,500
Total Other Decreases	1,699,824	1,427,201	939,187	1,051,741	1,889,222	2,156,445	721,789	267,345	2,961,591	3,314,457
All Revenues and Expenditures										
Net Income (Loss)	(196,002)	(162,041)	720,294	527,224	(382,324)	(712,636)	1,068,481	1,679,535	(847,314)	(1,021,322)



Birch Bay Water and Sewer District
2019 Comprehensive Water System Plan

FIGURE 9.1
SCHEMATIC OF FINANCES

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CHAPTER 10

MISCELLANEOUS DOCUMENTS

The purpose of this chapter is to provide documentation on WSP compliance with the requirements of the State Environmental Policy Act, present other supportive documents, and to identify key agreements related to the WSP.

10.1 Supportive Documents

10.1.1 State Environmental Policy Act

A State Environmental Policy Act (SEPA) checklist must be prepared for review prior to adoption and approval of this WSP. The District, as lead agency, reviewed the checklist prepared for this plan and issued a determination of non-significance (DNS) on June 26, 2019. One comment letter was received in response to the DNS. The Lummi Tribe indicated that the District continue to follow its Cultural Resources Monitoring Plan. A copy of both the checklist and the DNS is included in Appendix B. A public hearing was advertised for and conducted on July 11, 2019. Two interested parties attended to hear the summary presentation, but no input was provided. The Board indicated public input was welcome until such time as the Plan was considered for adoption at a future meeting.

10.1.2 Adoption and Agency Review and Approvals

The District adopted the plan by resolution on July 9, 2020 (see Appendix A). The District concurrently approved the 2019-2028 WUE Program and the *Developer Project Manual*. Copies of this WSP were submitted to Whatcom County (Council, Engineering, Planning and Health Departments), the State Department of Health (DOH) and the City of Blaine for review and approval. The WSP was also submitted to the PUD No. 1 of Whatcom County, Bell-Bay Jackson Water Association and Grandview Beach Water Association for their information and review.

10.1.3 Related Documents

As previously referenced in this WSP, there are several District documents that support development and implementation of this WSP. Current copies of these documents are on file at the District office. They are summarized as follows:

- **Water Shortage Response Plan:** The District has prepared a Water Shortage Response Plan (WSRP). It is referenced in Chapter 4 and included in Appendix J. The WSRP describes actions to be taken in the event of

drought or supply shortages (stages of increasingly aggressive water use curtailment actions) and action to be taken in the event of an emergency that limits the supply of water to some or all District customers.

- **Coliform/Residual Monitoring Plan:** As described in Chapter 6, the District's monitoring plan addresses the location, quantity and frequency of water samples for Coliform bacteria and chlorine residual. A copy of the current plan is included in Appendix F, but it is updated periodically as conditions warrant.
- **Developer Extension Procedures:** The District-adopted procedures for developers on property owners to complete extensions of the water system are presented in the District's *Developer Project Manual* (DPM). The DPM is a separate document included herein by reference. The current version was adopted May, 2019, but updates are prepared and adopted as conditions warrant. The DPM is also referenced in the District Code. See Chapter 7 for additional discussion of the DPM.
- **Construction, Disinfection and Testing Standards:** The District's technical specifications for water system construction, disinfection and testing are included in the DPM discussed above. See Chapter 7 for additional discussion.
- **District Code:** The District's resolutions have been codified in a separate volume included herein by reference. A copy of Title 7, Water Supply System, is included in Appendix G.
- **District Policy Manual:** The District's policies for water system operation are recorded in a separate manual, included herein by reference.

10.2 Agreements

Intertie/Wheeling Agreements: The District does not have any wheeling or wholesale customers or agreements.

The District has intertie agreements with the City of Blaine and Bell Bay Jackson Water Association. Copies are included in Appendix C.

Source Agreements: A copy of the water supply agreement, as amended, with the City of Blaine is included in Appendix C.

Mutual Aid Agreements: Birch Bay Water and Sewer District is a participant in the statewide Washington Association of Sewer and Water District's Mutual Aid Agreement. This mutual aid program establishes a network and procedures for cooperation and assistance between participating members in the event of a disaster or emergency. Specific procedures for requesting or providing mutual

assistance are outlined in the Mutual Aid Agreement package on file at the District office.

Other: The District has provided potable water service to one customer by agreement and amendments, since 1990. Refer to the discussion at the end of Section 1.6 for complete details. In May 2008 the District and BP West Coast Products, LLC (BP) entered into an Agreement to Supply Potable Water to the BP Cherry Point Refinery. This agreement is known as the “Superseding Agreement” as referenced in prior agreements for water supply to the refinery by and between the District, the PUD and BP. The vesting date of this Agreement was thirty days following the latest date of notice of satisfaction of two conditions precedent. Notice of satisfaction of the first condition (additional District water supply) was issued on August 17, 2010. Notice of satisfaction of the second condition (completion of BRB review) was issued on September 27, 2010. See Appendix C for the Agreement.

10.3 References

BERK, *Whatcom County Population and Employment Projections and Urban Growth Area Allocations, Phase I Technical Report*, Revised November 1, 2013

Birch Bay Water and Sewer District records

CHS Engineers, LLC, *Birch Bay Water and Sewer District Developer Project Manual*; May, 2019

CHS Engineers, LLC, *North Whatcom County Regional Water Supply Feasibility Study – Phase 1*, February 2018

CHS Engineers, LLC, *Birch Bay Water and Sewer District Comprehensive Sewer System Plan*, May, 2009

CHS Engineers, LLC, *Birch Bay Water and Sewer District Comprehensive Water System Plan*, March, 2009

CHS Engineers, LLC, *Birch Bay Water and Sewer District Comprehensive Water System Plan, Amendment No. 1*, September, 2010

RH2 Engineering, Inc., *Whatcom County Coordinated Water System Plan Update*, September 2016

Washington State Department of Ecology Web Portal – well locations

Whatcom County Council, Resolution 2014-013 (Population and Employment Allocations), March, 2014

Whatcom County Planning Department; *Whatcom County Comprehensive Plan*; 2016

Whatcom County Planning Department, *Birch Bay Community Plan*, September, 2004

Whatcom County Planning and Development Services, *Whatcom County 2016 Comprehensive Plan and Development Regulations Update and Urban Growth Areas Review, Environmental Impact Statement*, Draft, March, 2015 and Final, November, 2015

Whatcom County Planning and Development Services, *Urban Growth Area Review, Birch Bay UGA Proposal*, June, 2015

Whatcom County GIS Web Portal (zoning, land use, UGA boundaries, wetlands, wellhead protection areas)