SNOHOMISH COUNTY
PUD
PUBLIC UTILITY DISTRICT NO. 1

SNOHOMISH COUNTY PUD

2021 Water System Plan

Volume 1 of 16

December 2022

THIS PAGE INTENTIONALLY LEFT BLANK

2021 Water System Plan

Snohomish County PUD

December 2022

Digitally signed by Joseph Foote
Reason: I have reviewed this document
Date: 2023.01.03 11:26:14-08'00'

Murraysmith

1102 Broadway Plaza
Suite 401
Tacoma, WA 98402

THIS PAGE INTENTIONALLY LEFT BLANK

Acknowledgements

Appreciation is expressed to all who contributed to the completion of this report.

Snohomish County Public Utility District No. 1

Brant Wood

Karen Heneghan

Brett Gehrke

Max Selin

Kevin Presler

Karen Latimer

Paul Federspiel

Misty Stevens

Lillian Manley

Christina Arndt

Murraysmith | Consor

Joe Foote

Elisheva Walters

Stephanie Ard

Preston Love

Christoph Tanner

Jessica Wall

David Stangel

FCS Group

Brooke Tacia

Sergey Tarasov

Law Office of Thomas D. Mortimer

THIS PAGE INTENTIONALLY LEFT BLANK

Acronyms & Abbreviations

2-Line	Everett No. 2 Pipeline
3-Line	Everett No. 3 Pipeline
5-Line	Everett No. 5 Pipeline
A	
AC	Asbestos Cement
ACS	US Census Bureau’s American Community Survey
ADD	Average Day Demand
afy	Acre Feet Per Year
AGM	Assistant General Manager
ALOP	Appropriate Level of Planning
Amendment	ALOP WSP Amendment
AMI	Advanced Metering Infrastructure
Arlington	City of Arlington
AWIA	America’s Water Infrastructure Act
AWWA	American Water Works Association
B	
BAT	Backflow Assembly Tester
BMP	Best Management Practice
BPS	Booster Pump Station
C	
C	Copper
CAR	Critical Area Regulation
ccf	Hundred Cubic Feet
CCR	Consumer Confidence Report
CCS	Cross Connection Specialist
CE	Civil Engineer
CEO	Chief Executive Officer
CEU	Continuing Education Unit
CF	Commercial Forest
CF-FTA	Commercial Forest - Forest Transition Area
CFP	Capital Facilities Plan
cfs	Cubic Feet Per Second
CI	Cast Iron
CIP	Capital Improvement Program
CMP	Coliform Monitoring Plan
COOP	Continuity of Operations Plan
Coordination Act	1977 Public Water System Coordination Act

County	Snohomish County
CWSP	Coordinated Water System Plan
CWSSA	Critical Water Supply Service Area
D	
D/DBP	Disinfectants and Disinfection Byproducts
DBP	Disinfection Byproduct
DBPR	Disinfectants and Disinfection Byproducts Rule
DEA	Developer Extension Agreement
DI	Ductile Iron
District	Snohomish County PUD No. 1
DOH	Washington State Department of Health
DSC	Distribution System Charge
DSL	Distribution System Leakage
DWSRF	Drinking Water State Revolving Fund
E	
Ecology	Department of Ecology
ENR	Engineering News-Record
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPS	Extended Period Simulation
ERP	Emergency Response Plan
ERU	Equivalent Residential Unit
ES	East Stanwood
ESA	Existing Service Area
Everett	City of Everett
EWUC	Everett Water Utilities Committee
F	
F	Fahrenheit
FAZ	Forecast Analysis Zones
FERC	Federal Energy Regulatory Commission
Forum	Water Supply Forum
ft/day	Feet Per Day
G	
G	Galvanized Iron
GFC	General Facilities Charge
GIS	Geographic Information System
GMA	Growth Management Act
G.O.	General Obligation
Gold Bar	City of Gold Bar
gpd	Gallons Per Day
gpd/ft	Gallons Per Day per Foot
gpm ES &	Gallons Per Minute

GPP	General Policy Plan
GPTRAC	General Particle Tracking Module
Granite Falls	City of Granite Falls
GSA	Getchell-Snohomish Aquifer
Guidebook	Water Use Efficiency Guidebook
GWMP	Groundwater Management Plan
H	
HAA5	A group of 5 Haloacetic Acids
HDPE	High-density Polyethylene
HGL	Hydraulic Grade Line
HPC	Heterotrophic Plate Count
I	
ICS	Incident Command Structure
IGEA	Investment Grade Efficiency Audit
IOC	Inorganic Contaminate
IT	In Training
J	
JOA	Joint Operating Agreement
K	
kw	Kilowatt
L	
LA	Lakes Aquifer
LCR	Lead and Copper Rule
LSWTF	Lake Stevens Water Treatment Facility
LT2	Long-Term 2 Enhanced Surface Water Treatment Rule
LUD	Local Utility District
M	
M	Million
Marysville	City of Marysville
MCL	Maximum Contaminate Level
MCLG	Maximum Contaminate Level Goal
MDD	Maximum Day Demand
MG	Million Gallons
mg/L	Milligrams Per Liter
MGD	Million Gallons per Day
MMM	Multi-Media Mitigation
Model	Municipal Water Demand Forecast Model
Monroe	City of Monroe
MWL	Municipal Water Law
N	
ND	Not Detected

NEB	Net Ecological Benefit
ng/L	Nanograms Per Liter
NPDES	National Pollutant Discharge Elimination System
NSWUCC	North Snohomish County Water Utility Coordinating Committee
NWRO	Northwest Regional Office
O	
O&M	Operations and Maintenance
OFM	Washington Office of Financial Management
Outlook	Regional Water Supply Outlook
P	
pCi/L	Pico Curies Per Liter
PE	Polyethylene
PFAS	Polyfluoroalkyl Substances
PFBS	Perfluorobutanesulfonic Acid
PFHxS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PHD	Peak Hour Demand
Policy Manual	*Policies and Procedures Manual for Administration of Water Services*
ppb	Parts Per Billion
ppm	Parts Per Million
PRV	Pressure Reducing Valve
PSI	Pounds Per Square Inch
PSRC	Puget Sound Regional Council
PUD	Public Utility District
PVC	Polyvinyl Chloride
PWB	Public Works Board
PWTF	Public Works Trust Fund
Q	
Qa	Annual Quantity
Qal	Alluvium
Qi	Instantaneous Quantity
Qtb	Transitional Beds
Qu	Undifferentiated Sediments
Qva	Vashon Advance Outwash
Qvr	Vashon Recessional Outwash
Qvt	Vashon Till
R	
RCW	Revised Code of Washington
RRA	Risk and Resilience Assessment

RSA	Retail Service Area
RTCR	Revised Total Coliform Rule
S	
SAL	State Action Level
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
Sewer District	Lake Stevens Sewer District
SIRC	Stillaguamish River Implementation Review Committee
SkA	Skykomish Aquifer
SMA	Satellite Management Agency
Snohomish	City of Snohomish
SOC	Synthetic Organic Compound
SSM	Satellite System Management
ST	Steel
Stanwood	City of Stanwood
State	State of Washington
Sultan	City of Sultan
SWTR	Surface Water Treatment Rule
T	
tb	Bedrock
TDH	Total Dynamic Head
THM	Trihalomethanes
Three Lakes	Three Lakes Water Association
TOT	Time of Travel
TuA	Tulalip Aquifer
U	
UGA	Urban Growth Area
ULID/LID	Utility Local Improvement District
USRP	Utility Service Review Procedure
UV	Ultraviolet
V	
VFD	Variable Frequency Drive
VOC	Volatile Organic Compound
VSS	Very Small System Waiver
W	
WAC	Washington Administration Code
WARN	Washington State Intrastate Water and Wastewater Agency Response Network
Watershed Plan	Watershed Restoration and Enhancement Plan
WBWA	Warm Beach Water Association
WDM	Water Distribution Manager

WDS	Water Distribution Specialist
WFI	Water Facility Inventory
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Program
WIFIA	Water Infrastructure Funding Innovation Act
WRIA	Water Resource Inventory Area
WRSA	Water Right Self-Assessment
WSA	Water Service Area
WSP	Water System Plan
WTPO	Water Treatment Plant Operator
WUE	Water Use Efficiency
WWTF	Wastewater Treatment Facility
WWUC	Washington Water Utility Council

Table of Contents

Executive Summary

Chapter 1 Management, History, and General Description

Chapter 2 Service Areas and Policies

Chapter 4 Existing Facilities

Chapter 5 Planning Data and Demand Forecasting

Chapter 6 Water Use Efficiency

Chapter 7 Facility Analysis

Chapter 8 Source of Supply

Chapter 9 Operations and Maintenance

Chapter 10 Water Quality and Compliance Introduction

Chapter 11 Improvement Program

Chapter 12 Financial Plan

Tables

Figures

Appendices

Executive Summary

THIS PAGE INTENTIONALLY LEFT BLANK

Executive Summary

The Snohomish County PUD No. 1 (District) prepared this Water System Plan (WSP) to provide policies and guidance for the utility to maintain a high level of service for existing customers while meeting the needs of planned growth. The WSP meets Washington Department of Health (DOH) planning requirements and is a summary of the manner in which the District fulfills its mission, "safely providing quality products and services in a cost-effective and environmentally sound manner;" its business strategy, "ensuring adequate, high quality and reliable water supplies and distribution systems that meet the needs of existing and future customers, while continuously pursuing increased customer service levels and cost efficiencies;" and its obligation as a public water utility.

Major changes in the District's water system since the 2011 Plan include the following:

- Acquired the Warm Beach water system and consolidated it with the Kayak water system, including a new connection between the two systems
- Merged the Lake Roesiger water system into the Lake Stevens Integrated water system by constructing water main extensions that combined the Lake Roesiger and Lake Bosworth pressure zones including a new pressure reducing valve (PRV) station that allows that zone to feed into the Granite Falls pressure zone, improving system connectivity and looping
- Merged the Dubuque and Lake Stevens Integrated water systems by constructing a new water main that connected the systems and boosted system redundancy
- Abandoned/removed Williams Road master meter, Portage master meter, Pilchuck 10 wells, and East Hewitt Pump Station. Customers served by the Pilchuck wells were connected to the Lake Stevens Integrated water system
- Replaced 16.8 miles of aging water mains since 2010 to improve hydraulic capacity of the water system and prevent leaks and water main breaks

The following sections summarize the content of each chapter in this WSP.

ES-1 Management, History, and General Description

Authority: The District is a municipal corporation of the State of Washington with authority to provide water utility service to all portions of Snohomish County (County) and Camano Island not served by other municipal water utilities or districts. Public Utility Districts (PUDs) are organized to provide electric and/or water utility service to their customers on a non-profit, cost of service basis. By special voter approval, PUDs can also provide sewer utility service. Local, publicly owned utility systems are based on the initiative law passed in 1930 by a majority vote of the people of the entire state. The PUDs were originally formed to combat high electric rates charged by private utilities, provide electricity to rural areas where such service had been denied, and to provide utility water service to otherwise un-served areas. The District has been providing water utility service in the County since 1946.

Administration: The District's water systems are administered according to RCW (Revised Code of Washington) 54.16.030, municipal codes, and policies and procedures set forth in the Policies and Procedures Manual for Administration of Water Services adopted by the District's Board of Commissioners by Resolution No. 4848-J in April 1999 and last amended and approved on March 1, 2010, under Resolution No. 5484. It is under this authority that the District provides water service to its retail and wholesale water customers.

Overview of Systems: The District owns and operates nine separate public water systems located throughout the County. The District's largest system is its Lake Stevens Integrated water system which provides wholesale service to the City of Granite Falls (Granite Falls), the City of Arlington (Arlington) and the City of Snohomish. Other standalone systems include the May Creek, Warm Beach (including the recently merged Kayak system), Storm Lake Ridge, Sunday Lake, Skylite, Creswell, 212 Market & Deli, and Otis water systems.

Regional Coordination: The District actively participates as a member of the Everett Water Utilities Committee (EWUC), the North Snohomish County Water Utility Coordinating Committee (NSWUCC), and the Washington Water Utility Council (WWUC).

ES-2 Service Areas and Policies

Regulatory Requirements for Water Service Areas: The District's 2011 WSP is consistent with requirements of the Public Water System Coordination Act, Growth Management Act, and 2003 Municipal Water Law.

District Water Service Areas: The District's water service areas (WSAs) were refined to be consistent with requirements of the Municipal Water Law and the County's Comprehensive Plan. This WSP distinguishes between the District's existing service areas, retail service areas where expansion is anticipated within the next ten years, and a future service area.

Service Area Policies: The WSP clarifies the District's processes to provide water service in a "timely and reasonable" manner and outlines the format of the District's Water Policies and Procedures Manual.

ES-3 Adjacent Systems, Related Plans, and Agreements

Related Plans: The District works to coordinate water system planning issues with other regional planning documents such as the City of Everett's (Everett's) Comprehensive Water Plan, Snohomish County Comprehensive Plan, the Growth Management Act, and the North Snohomish County Coordinated Water System Plan (CWSP). Concurrence with county and local land-use plans and policies, surrounding purveyor's water system plans, wholesale customer plans (Arlington, Granite Falls, and Snohomish), and supplier plans (Everett), is critical in the evaluation of long-term adequacy of the water system.

Service Area Agreements: A list of relevant interlocal agreements that the District has entered into with cities and other water utilities is incorporated into **Chapter 3**. The agreements include the Sultan River Agreement, North Snohomish County Joint Operating Agreements, Everett Water Supply Contract, and the Arlington, Gold Bar, Granite Falls, Sudden View, and Twin Falls wholesale water agreements. Also included are various CWSP service boundary area agreements.

ES-4 Existing Facilities

The District's nine water systems include approximately 408 miles of pipelines, 15.5 million gallons (MG) of storage (16 active storage tanks), 12 booster pump stations, 6 water supply pump stations, 14 active wells, and 40 pressure zones. Each of these facilities is integral to the operation of the District's water systems. The District also owns and operates treatment systems for its Lake Stevens, Sunday Lake, Kayak, and Warm Beach wells.

ES-5 Planning Data and Demand Forecasting

Future Growth: Future growth projections were calculated by analyzing historical service connection growths as well as the Puget Sound Regional Council's (PSRC's) growth projections for each service area. Annual growth rates were chosen for each system using the District's knowledge of the areas as well as regional growth projections and planning documents.

Future water demand projections were calculated using both the historical water supply and demand trends information as well as the growth projections for each system. These demand projections are used in later chapters to assess system capacity and inform when and where improvements will be needed to meet the District's design criteria.

Retail Service Area Demand: The District's retail service area includes Lake Stevens Integrated (and the greater Arlington and Granite Falls areas), and two additional satellite systems served by water purchased from Everett: Storm Lake Ridge and Creswell. The service area also includes an additional six systems served with groundwater sources: May Creek, Warm Beach (which includes the Kayak system), Sunday Lake, Skylite, 212 Market & Deli (Moa/Holbeck), and Otis.

Based on projections found in PSRC's VISION 2040 Plan and historical data provided by the District's utility billing records, the population in the District's integrated service area (Lake Stevens Integrated) is predicted to increase between 1.15 and 1.51 percent annually over the next 20 years. The projected growth results in over 6,000 new equivalent residential units (ERUs) within the District's retail service area in the next 20 years.

Wholesale Demands: The District serves five routine wholesale customers: Arlington, Snohomish, and Granite Falls; and the Sudden View and Twin Falls water systems. Wholesale water sales have remained fairly constant during the past five years with wholesale purchases representing between 9 and 33 percent of the District's total water sales. Wholesale customers perform their own population and water demand projections.

ES-6 Conservation/Water Use Efficiency

The District has engaged in water conservation planning and promotion of educational programs for a number of years. As a wholesale customer of Everett, the District participates in a regional conservation program established by the Everett Water Utilities Customers' conservation subcommittee in 1999.

The District has proposed the following supply-side and demand-side goals to be consistent with the Water Use Efficiency Rule which was updated in January 2017:

Supply-side goal: The District shall maintain its distribution leakage below the Washington State 10 percent standard and shall strive to progressively achieve lower percentages of lost water, where possible.

Demand-side goal: The District shall actively participate in the EWUC regional Water Use Efficiency (WUE) Program to reduce overall regional water demand by approximately by 1.4 million gallons per day (MGD) between 2020 and 2029, or approximately a two percent reduction in the cumulative projected water demand in 2029 (equal to 0.2% savings annually).

ES-7 Facility Analysis

The District's water systems are designed and constructed to provide long-term, reliable service. The systems are generally robust, with adequate supply and service pressures under most conditions. Recommended improvements in this section are designed to meet or exceed the District's level of service standards for existing customers while meeting needs for planned growth.

This chapter evaluates the capacity of the District's pump stations, water distribution, transmission, and storage by water system. Where deficiencies are identified, specific improvements are recommended to address those deficiencies. The specific improvements are identified in **Chapter 11 – Improvement Program.**

Chapter 7 includes and evaluation of each water system's ERU capacity, or how many ERUs it can support based on its existing infrastructure. These analyses are summarized in **Table ES-1** along with the CIPs planned to mitigate any system capacity deficiencies.

Table ES-1 | System Capacity Summary

Water System	Existing ERU Capacity[1]	Limiting Supply Capacity Factor	Capacity Limiting Year	Corresponding CIP
Lake Stevens	28,237	Storage	2030	▪ North Lake Stevens Tank ▪ Burn Road Tank ▪ Lake Roesiger Tank
Storm Lake Ridge	420	Storage	After approval period	N/A
Creswell	2,570	Supply Source	After approval period	N/A
May Creek	926	Storage	After approval period	N/A
Skylite	200	Water Right - Annual Capacity	After approval period	N/A
Sunday Lake	335	Supply Source	After approval period	N/A
Warm Beach	827	Storage	2020	▪ Kayak Reservoir 2

Note:
1. Based on limiting capacity factor

Lake Stevens Integrated Water System: This system has sufficient overall supply to meet existing and projected demands. However, additional booster station capacity will be required for the Granite Falls 726 Pressure Zone before 2040. The Walker Hill Booster Station can meet demand requirements (including minimum fire flow), but station retrofits are proposed to improve reliability and zone pressures during fire flow. Additional storage capacity is required to meet DOH standards, so three new tanks are proposed for Lake Stevens Integrated system and one new tank is proposed for the Warm Beach system (see below). The analysis also considered the number of ERUs that can be supported by the system's supply sources and storage. Storage was the limiting factor for the existing system capacity and will support water demand growth through 2030.

Storm Lake Ridge Water System: The Storm Lake Ridge Water System has sufficient supply, booster pump capacity, and storage to support projected growth through 2040; however, the number of dead ends in the system makes the distribution system ill-suited to provide minimum required fire flows. Improvements to address these deficiencies are included in **Chapter 11.** The analysis also evaluated the system capacity from a per-ERU standpoint; this evaluation, consistent with the other analyses, showed that the system should have adequate capacity through 2040 (limited factor is storage).

Creswell Water System: This small system receives all supply from a tap connected to an Everett transmission main, and this source is sufficient to support projected demands through 2040. The District intends to connect the Creswell system to the Lake Stevens Integrated Water System in the future, the distribution system has not changed since the 2011 distribution analysis, so no analysis was performed on the Creswell distribution system. The proposed connection from the Creswell Water System to the Lake Stevens Integrated Water System through the Lake Roesiger 811 pressure zone was evaluated for headloss during the minimum required fire flow of 1,000 gallons per minute (gpm). This analysis showed relatively minimal headloss in the pipe and velocities below the District standard of 8 feet per second.

May Creek Water System: Both the overall system and per-ERU analyses showed that the existing May Creek Water System can support projected growth through 2040, with storage as the limiting capacity factor. However, if any expansion occurs at elevations over 300 feet, a booster station will be required to supply adequate pressures to those new customers.

Skylite Water System: This small system is served entirely by booster pumps drawing water from storage which is filled by a well. While the source supply, distribution system, and storage can support 2040 projected growth, the booster pumps are deficient by 30 gallons per minute (gpm) according to firm supply capacity criteria applied in this WSP. Since the time the District originally acquired this historically DOH-approved system, the District continues to make improvements to the system including a construction of a storage tank in the supply zone and construction of the booster station. No growth is planned for the Skylite system beyond the existing number of approved connections. The second booster pump is used infrequently and only for short periods of time (typically less than one hour) during high demand periods in the summer. Should one booster pump go out of service during warm weather, the District would send a notice to Skylite customers asking them to curb use until repairs can be made, and the remaining booster pump would be able to support MDD-level demands. Therefore, the District does not have any current plans to improve the booster station but will evaluate increasing the capacity of the booster station in conjunction with the next upgrade required as the system ages.. The per-ERU analysis showed that the existing system will be at capacity in 2040 (water rights is the limiting capacity factor, aside from the booster station deficiency).

Sunday Lake Water System: The supply analysis for the Sunday Lake Water System showed that the DOH recommendation that sources supply maximum day demand (MDD) with 20 hours or less of pumping will not be met in 2040 (though it is met for 2020 and 2030) based on projected growth, with a deficit of 164 gpm. Because this is a minor deficiency, the District will monitor the situation but does not have current plans for a project to address it. Booster pump stations, the distribution system, and the storage system are sufficient to meet projected demands through 2040. According to the per-ERU analysis, the existing system has sufficient capacity to support 2040 projected demands.

Warm Beach Water System: Water supply and booster capacity in the Warm Beach Water System are sufficient to meet projected demands through 2040. Warm Beach Well 2, however, operates below its water rights capacity, so a pump replacement for this well is included in the District's Capital Improvement Program (CIP). High elevation customers and long dead-end pipes in the system also make fire flow availability below the required minimum in some locations, a deficiency that will be addressed by the connection between the Warm Beach and former Kayak systems, select pipe improvement projects, and possibly some service line booster pumps. The Warm Beach storage facilities are not adequate for existing or future projected demands; **Chapter 11** includes a new tank to address this deficiency. Consistent with the overall system analysis, the per-ERU analysis showed that the existing system capacity is deficient by an estimated 210 ERUs.

ES-8 Source of Supply

Water Rights: The District purchases the majority of its supply from Everett. The principal source of water is Sultan Basin water, which has been filtered, treated, chlorinated, and fluoridated by Everett. Existing water rights on the Sultan River are sufficient to meet forecast demands for Everett and its wholesale customers beyond 2050.

The District also holds groundwater rights for its Lake Stevens Integrated, May Creek, Warm Beach, Skylite, Sunday Lake, 212 Market & Deli (Moa/Holbeck), and Otis water systems. Treatment provided for water systems supplied by wells varies, depending on the characteristics of the water supply. The District also has an emergency intertie with the City of Gold Bar. The District's existing water rights are sufficient to meet the foreseeable needs of the individual satellite systems and the District has no need to apply for new water rights.

Wellhead Protection: Individual wellhead protection plans have been developed for each of the District's active Group A water systems, and a Susceptibility Assessment Survey was conducted for each system. As required by the state's Wellhead Protection Program, the District has notified owners of property with potential contaminant sources of their presence. All federal, state, and local regulatory agencies with jurisdiction over the water systems have been advised regarding the delineated wellhead protection areas and potential contaminant sources. Contingency and emergency response plans have been developed for each system to ensure availability of safe drinking water in the event contamination occurs within or near a wellhead protection area.

ES-10 Operations and Maintenance Overview

The District utilizes established goals and procedures to maintain reliability, performance, and water quality under routine and emergency conditions. The goals and procedures are reviewed periodically to respond to new or revised regulations, updated best management practices and system modifications, and revisions in tools, equipment, and techniques. Guidelines and manuals are retained at the District's Water Operations Facility and at the sites of specific equipment or treatment facilities. In addition, operations and maintenance manuals required by DOH are on-site and updated as necessary to remain in compliance with all regulations.

Personnel Certification: The District is in compliance with all laws and regulations regarding staff certification and training. All water crew employees, including three foremen, possess DOH certifications. The levels of certification of all water field crews and the District's management is included in **Table 9-1**. All personnel are actively encouraged to achieve the highest levels of certification possible.

Routine Operations and Preventive Maintenance: The District's goal is to follow a routine schedule of operating, monitoring, and maintaining facilities within its water systems. The schedule considers the features, use and critical role of each component, the number of customers served, failure or breakdown history, availability of staff resources and industry standards for maintenance. In addition to visits by crew members, the supervisory control and data acquisition

(SCADA) system electronically monitors the status at key pump stations, master meters, and reservoirs.

Vulnerability Assessment and Emergency Procedures: The District has adopted both a Continuity of Operations Plan (COOP), which is inclusive of all of the District's departments and a departmental specific Emergency Response Plan (ERP). A Risk and Resilience Assessment (RRA) was completed in accordance with the 2018 America's Water Infrastructure Act (AWIA).

ES-11 Water Quality and Compliance

The District is responsible for monitoring and compliance with all Safe Drinking Water Act (SDWA) and Washington Administrative Code (WAC) regulations. Because the District purchases the bulk of its water from Everett, the District is not responsible for documenting compliance with regulations that apply to source water. Everett is responsible for maintaining and documenting compliance with all requirements covering source water monitoring, maximum contaminant levels for specific compounds, filtered water quality, and disinfection contact times. The District complies with regulations pertaining to finished water impacts associated with disinfection in the distribution system. Since the water received from Everett is subsequently re-chlorinated, the District conducts chlorine residual monitoring.

The District does treat well water from the Lake Stevens and Warm Beach wells. An optimization study was completed for the Lake Stevens Water Treatment Facility (LSWTF) in 2019. The recommendations that came out of the study included installing pH adjustment treatment to optimize the facility under the Lead and Copper Rule. The District is in the process of finalizing the design and permitting necessary to make the operational changes with the goal of completing the improvements in 2022.

The water quality requirements for the District vary depending on the source of water for the specific system. The District's water quality monitoring program meets all state and federal requirements.

Consumer Confidence Reports: The District provides an annual water quality report to its retail customers informing them of test results, including any violations of maximum contaminant levels. As a wholesale supplier, the District also provides its wholesale customers with the necessary water quality data and other related information needed to prepare their own consumer confidence reports each year.

Emerging Water Quality Regulations: Several new or revised SDWA regulations are on the horizon. District staff continues to anticipate and track development of these regulations.

ES-12 Improvement Plan

The District's water system was designed and constructed to provide long-term, reliable service. The system is generally robust, with sufficient capacity to provide adequate supply and service pressures under most conditions. Improvements are needed over the next 20 years to repair and rehabilitate existing facilities and to add new capacity to meet the needs of planned growth.

Major planned system improvements and the estimated costs (in year 2021 dollars) include:

- Storage: New storage tanks will be constructed in the Warm Beach (one tank) and Lake Stevens Integrated (three tanks) Water Systems. Seven existing tanks are schedule for re-coats. A condition assessment and seismic analysis will be conducted for 12 older storage tanks. (Estimate $22.2 million (M))

- Pump Stations: The Granite Falls Pump Station will be retrofitted to meet 2040 demands, and capacity will be added to the Walker Hill Pump Station to boost zone pressures during fire flow demands. Improvements and pump replacements are planned for the Walker Hill, Machias, and East Hewitt Pump Stations. (Estimate $2.9M)

- Distribution Mains: There are approximately 408 miles of pipeline in the Lake Stevens Integrated System. When analyzing the needs of the distribution system, pipe projects were grouped into three categories: CIP-Funded, Developer-Funded, and Miscellaneous Main Replacement. Funding for developer projects comes solely from those developers requiring water service from the District. The CIP and Miscellaneous Main Replacements are estimated to cost $70.2M over the next 20 years.

- Overall Water System: Recommended projects that will benefit the overall water system total $26.6M over the next 20 years and include SCADA hardware and software upgrades, meter replacement, corrosion control optimization, conversion to advanced metering infrastructure (AMI) metering, security improvements, and new/replacement vehicles and equipment.

ES-13 Financial Plan

The purpose of the financial plan is to demonstrate the financial viability of the water utility to meet the system needs outlined in the WSP. This analysis considers historical performance, the sufficiency of utility revenues to meet current and future operating and maintenance (O&M) needs, policy obligations, and the impact of executing the CIP. The following plan demonstrates the ability of the water utility to maintain sufficient funds to construct, operate, and manage the system on a continuing basis, in full compliance with federal, state, and local requirements through the end of the planning period.

In developing the 2020-2040 financial forecast, three cost components were reviewed:

- Operation and maintenance expenses,

- Taxes and debt service, and

- Capital improvement projects.

- The CIP developed for this WSP identifies $87.0M in escalated project costs over the 10-year planning horizon. The 20-year period totals $172.1M in escalated project costs. Costs were escalated by 2.79 percent annually to the year of planned spending. The capital financing strategy developed to fund the CIP identified in this WSP assumes the following funding resources:

- Accumulated cash reserves;

- Excess cash (over minimum balance targets) from the Water System Revenue Fund;

- General Facilities Charge revenues;

- Interest earned on fund balances and other miscellaneous capital resources; and

- Revenue bond financing.

- The 20-Year proposed Capital Funding Strategy is shown in **Table ES-2**.

Table ES-2 | 20-Year Capital Funding Strategy

Year	Capital Expenditures (escalated)	Revenue Bond Annual Funding	Cash Funding	Total Financial Resources
2021	$5.7	$0.0	$5.7	$5.7
2022	$13.3	$0.0	$13.3	$13.3
2023	$13.5	$13.5	$0.0	$13.5
2024	$15.9	$2.8	$13.2	$15.9
2025	$7.8	$7.8	$0.0	$7.8
2026	$6.3	$2.3	$4.0	$6.3
2027	$6.5	$6.5	$0.0	$6.5
2028	$6.2	$3.6	$2.5	$6.2
2029	$6.2	$3.0	$3.2	$6.2
2030	$5.7	$0.0	$5.7	$5.7
Subtotal	**$87.0**	**$39.5**	**$47.5**	**$87.0**
2031-2040	**$85.1**	**$30.7**	**$54.5**	**$85.1**
Total	**$172.1**	**$70.1**	**$102.0**	**$172.1**

- The financial forecast, or revenue requirement analysis, forecasts the amount of annual revenue that needs to be generated by user rates. The analysis incorporates operating revenues, O&M expenses, debt service payments, rate-funded capital needs, and any other identified revenues or expenses related to operations. The objective of the financial forecast is to evaluate the sufficiency of the current level of rates. In addition to annual operating costs, the revenue needs also include debt covenant requirements and specific fiscal policies and financial goals of the District.

- The financial forecast indicates that the utility is currently covering all financial obligations under existing rates, however as the District prepares to fund the $172.1 million in needed capital improvements identified in the WSP, rates will need to increase annually to support the capital funding plan. The financial plan proposes the following rate increases and debt issuances to satisfy the identified future obligations of the utility, allowing for 59 percent cash funding of future capital improvements:
  - 1.75 percent in 2022, followed by 2.15 percent from 2023 through 2030.
  - Three new revenue bonds proposed in the ten-year planning period:
    - $24M revenue bond in 2023, $10.14M revenue bond in 2027, and a $2.95M revenue bond in 2029.
    - Annual new debt service payments are forecast to increase from $713,000 with the first issuance to $3.2M by the third new debt issuance. Including this new debt, total debt service will increase from $2.0M in 2021 to $4.3M by 2030.
- The results of this analysis indicate that annual rate increases are needed to provide revenue sufficient to cover all financial obligations of the utility. Rate increases are proposed at 1.75 percent in 2022, followed by 2.15 percent from 2023 through 2030.
- It is important to remember that the analysis performed in this chapter assumes population growth rates based on the assumptions outlined in **Chapter 5, Planning Date and Demand Forecasting**. If the future growth rates change, the existing rate strategy may need to be updated and revised.
- It is recommended that the District continue with the current practice of regular annual rate reviews and to update the key underlying assumptions that compose the multi-year financial plan to ensure that adequate revenues are collected to meet the District's total financial obligations.

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 1

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 1

Management, History, and General Description

1.1 Authority and Management

Snohomish County PUD No. 1 (District) is a municipal corporation of the State of Washington (State) created by a county-wide vote in 1936. The District is authorized to provide electric and water service to all portions of Snohomish County (County) and Camano Island not served by other municipal water utilities or districts.

Public Utility Districts (PUDs) are organized to provide utility service to their customers on a non-profit, cost of service basis. The authority to create municipal corporations to own and operate utilities outside of city limits began with approval of State Initiative No. 1 in the 1930 general election. The PUDs were originally formed to combat high electric rates charged by private utilities, to provide electricity in rural areas where service had been denied, and to provide water service in otherwise unserved areas.

The legal responsibilities and powers of the District, including establishment of rates and charges for services rendered, are exercised through a three-member Board of Commissioners elected from separate commissioner districts for staggered six-year terms. The District's Water Utility is administered according to Revised Code of Washington (RCW) 54, municipal codes, applicable state codes, and the *Policies and Procedures Manual for Administration of Water Services* (Policy Manual) adopted by the Board of Commissioners and included in this plan as Appendix 1-1. Pursuant to RCW 90.03.015 and the beneficial use of its water rights, the District is recognized as municipal water supplier.

The District is also an approved Satellite Management Agency (SMA) authorized by the Washington Department of Health (DOH) to serve the County. State rules require any new water system to be owned and operated by a SMA if one is available and willing to provide service. The District's most recent Satellite Management Program was approved in 2011. During this Water System Plan (WSP) update the District has adjusted its Satellite Service Area and Satellite Management Program policies as more fully described in Chapter 2 and the District's Policy Manual.

The District's management and organizational structure is summarized in Figure 1-1 and Figure 1-2 at the end of this chapter. The Water Utility Assistant General Manager (AGM) is one of twelve positions reporting directly to the District's Chief Executive Officer (CEO)/General Manager. Figure

1-2 shows all current Water Utility staff. Further detail about the Water Utility's organizational structure can be found in **Chapter 9**.

Copies of DOH Water Facility Inventory (WFI) forms and DOH Operating Permits are provided in **Appendix 1-2** and **Appendix 1-3**. The WFIs summarize facility information and contain contact names, addresses, and phone numbers for DOH records. Operating Permits are a DOH compliance tool linked to annual performance evaluations of the water systems. A "Green" permit category means a water system is substantially in compliance with drinking water requirements.

1.2 History and Future

The District began water operations in 1946 with the acquisition of the Beverly Park Water System and construction of the Lake Stevens Water System. The District sold Beverly Park to the City of Everett (Everett) in 1960 when a large portion of that service area was annexed. The Lake Stevens Water System subsequently expanded through mergers with adjacent water systems and capital improvements. The District also became responsible for various satellite water systems over the years.

Today, the District owns and operates nine water systems throughout the County. These systems are listed in **Table 1-1** and illustrated in **Figure 1-3**. DOH approved consolidation of the Warm Beach and Kayak water systems in December 2020 and is in process of combining them under the name and WFI # of the Warm Beach system. **Table 1-1** shows the number of water services and population as they were reported to DOH in December 2019.

Table 1-1 | District Water Systems as of December 2019

Water System Name	WFI #	Reported Connections	Reported Population
Lake Stevens Integrated	80907 1	20,775	51,625
Systems that will merge with the Lake Stevens Integrated Water System			
Storm Lake Ridge	44431 6	242	605
Creswell	06325 V	23	57
Satellite systems that have been merged[1]			
Warm Beach	93000 F	630	1,578
Kayak	23111 5	384	962
Satellite systems that will remain detached			
May Creek	52105 0	492	1,215
Sunday Lake	85205 D	194	485
Skylite	80220 1	153	383
212 Market & Deli	04515 Q	2	25
Otis	06956 X	4	10

Note:
1. Water connections and population data is from 2019, before Warm Beach and Kayak were merged.

In the 1996 edition of its WSP, the District outlined a sub-area within its authorized service area described as the integrated water service area (WSA), where many water systems had consolidated over the years and where more water systems were expected to merge into an integrated water system. The District retained the name Lake Stevens for the integrated water system as it grew via further water main extensions and consolidations. Since completion of the 2011 edition of its WSP, the District completed water mains to connect Lake Stevens Integrated System to the Lake Roesiger and Pilchuck 10 Water Systems in 2011 and to the Dubuque and Cascade Acres Water Systems in 2014. Storm Lake Ridge and Creswell are the remaining District water systems to be merged with Lake Stevens Integrated System as growth occurs over the next 20 years. **Figure 11-1** shows the master plan to merge these systems. Merging the water systems will have no impact on the external boundary of the future service area, illustrated in **Figure 2-1** in the next chapter.

District water systems outside of the integrated service area are known as satellite water systems because they are too far away to connect to the Lake Stevens Integrated System within the next 20 years. Warm Beach became the District's most recent satellite water system when ownership transferred from the Warm Beach Water Association (WBWA) to the District in September 2018. As part of the process leading up to the Warm Beach ownership transfer, the District completed a feasibility study/project report in September 2016, which laid out the plan for improvements to Warm Beach and to connect it to the District's Kayak Water System. These improvements and the connection would increase operational safety and redundancy of the Warm Beach system. The combined system is referred to as the Warm Beach Water System. Though the merged system has been approved by DOH (see **Appendix 1-4**), the two systems are still showing as separate systems in the DOH database. For the purposes of this WSP, the two systems will be referred to as the Warm Beach Water System except for where they must be differentiated from each other (e.g., when analyzing historical data).

It is possible that additional water systems could ask to consolidate with the District in coming years, either by connection to an existing District water system or as stand-alone satellite water system.

1.3 Accomplishments Since the 2011 Water System Plan

As shown in **Table 1-2** and **Table 1-3**, the District's water utility has been engaged in multiple projects since the 2011 edition of this WSP. Because the 2011 WSP presented data through 2009, **Table 1-2** summarizes the length of pipe installed and **Table 1-3** describes the District's major water projects since 2010.

Table 1-2 | Length of Water Mains Constructed since 2010

Year In Service	Pipe Extensions			Pipe Replacement[1]		
	By Developers (feet)	By District[1] (feet)	Total New Pipe (miles)	By Developers (feet)	By District[1] (feet)	Total New Pipe (miles)
2010	18,604	6,850	4.8	187	11,300	2.2
2011	13,803	27,250	7.8	880	7,155	1.5
2012	5,832	1,465	1.4	0	4,550	0.9
2013	15,569	0	2.9	100	0	0.0
2014	17,151	15,840	6.2	179	15,609	3.0
2015	8,506	0	1.6	3,024	7,900	2.1
2016	6,659	0	1.3	655	7,380	1.5
2017	14,502	0	2.7	0	3,390	0.6
2018	22,146	0	4.2	300	11,225	2.2
2019	41,280	0	7.8	0	14,808	2.8
Total	**164,052**	**51,405**	**40.8**	**5,325**	**83,317**	**16.8**

Note:
1. Description of District-constructed water mains is in **Table 1-3**

Table 1-3 | District Projects since 2010

Project Name (File #)	Description	Year Completed
Projects to Support Population and Merge Systems in Lake Stevens Integrated Area		
Granite Falls Alternate Route (WE-729)	This project installed approximately 6,850' of new 12" ductile iron to enhance redundancy and reliability to the City of Granite Falls and the entire Granite Falls 726 Pressure Zone.	2010/11
Robe Menzel/ Menzel Lake Rd Extension (WE-761)	This project installed approximately 27,250' of new 12" ductile iron water main to connect the District's Lake Roesiger and Pilchuck 10 Water System Areas to Lake Stevens Integrated, providing redundancy in the District's 810 Bosworth area as well as looping the Granite Falls 726 Pressure Zone with the Lake Roesiger 810 Pressure Zone for improved water quality, fire flows, and system redundancy.	2011/12
Tom Marks Main Extension (WE-804)	Installed approximately 1,465' of 8" DI to loop Tom Marks Road.	2012
16th St NE Main Extension (WE-813)	This project installed approximately 1,614' of new 8" ductile iron to enhance system hydraulics and redundancy to the City of Lake Stevens.	2014
Dubuque Intertie Project (WE-805)	This project installed approximately 14,226' of new 12" ductile iron main to consolidate the District's Dubuque Water System into Lake Stevens Integrated, making water storage available to customers in the Dubuque area. The project also allowed the District to assume ownership and consolidate the Cascade Acres Water System into Lake Stevens Integrated.	2014

Project Name (File #)	Description	Year Completed
North Lake Stevens Reservoir – Site Acquisition	Acquired property for the future 3.9 MG North Lake Stevens Reservoir in Lake Stevens Integrated.	2015
Satellite Water System Projects		
Warm Beach Water System Acquisition	Completed Public Process, applied for and received DWSRF funding, and completed the acquisition of the Warm Beach Water System Area.	2018
Replacement of Aging Water Facilities		
2010 Water Main Replacements (WE-783)	Project replaced approximately 11,300’ of aging water mains in Lake Stevens Integrated, Warm Beach, and older Dutch Hill water systems with new 8” DI. The project was broken up into 7 specific schedules and included replacement of approximately 2,200’ of main on Vernon Road, 2,500’ of AC main on Callow Road, 1,950 of AC main on 99th Ave NE, 2,950’ of AC main on North Davies Road, 230’ of AC main on 112th Dr NE in Lake Stevens Integrated, along with 870’ of failing PVC main on 66th Ave NW in Warm Beach, and 560’ of AC main on 145th Dr SE in Dutch Hill.	2010/2011
South Lake Stevens Main Replacement (WE-790)	Project replaced approximately 7,155’ of old AC water main with new 12” ductile iron on South Lake Stevens Road in Lake Stevens Integrated along with a 16” HDPE cased crossing of SR9.	2011
2012 Water Main Replacements (WE-805A, B, C)	Project replaced approximately 4,550’ of old galvanized iron and AC water main on Hartford Ave, Lakeview Dr, and 99th Ave NE in Lake Stevens Integrated with new approximately 2,900' of 8” and 1,650' of 12” ductile iron.	2012
2013 Water Main Replacements (WE-816)	Project replaced approximately 8,505’ of old AC and galvanized water main on South Davies Road, 119th Dr SE &121st Ave SE, Cavalero Road & 24th St SE, and Cedar Road in Lake Stevens Integrated with predominantly new 8” ductile iron.	2014
Lakemont Water Main Replacement (WE-834)	Project replaced approximately 1,972’ of old AC water main on Lakemont Ave in Lake Stevens Integrated with new 8” and 12” ductile iron.	2014
Rhodora Heights Water Main Replacement (WE-826)	Project replaced approximately 3,211’ of old AC water main on Rhodora Heights Road in Lake Stevens Integrated with new 8” ductile iron.	2014
Vernon Road Main Replacement (WE-821)	Project replaced approximately 2,292’ of old AC water main on Vernon Road in Lake Stevens Integrated with new 8” ductile iron.	2015
Davies Road Main Replacement (WE-838)	Project replaced approximately 2,258’ of old AC water main on Davies Road in Lake Stevens Integrated with new 8” ductile iron.	2015

Project Name (File #)	Description	Year Completed
Vista LaGrande Main Replacement (WE-842)	Project replaced approximately 3,350’ of old AC water main in the Vista LaGrande neighborhood off 131st Ave SE in the Dubuque area of Lake Stevens Integrated with new 8” ductile iron.	2015
91st Ave SE Main Replacement (WE-854)	Project replaced approximately 3,768’ of old AC water main along 91st Ave SE in Lake Stevens Integrated with new 8” ductile iron.	2016
123rd Ave SE & 12th St SE Main Replacement (WE-839)	Project replaced approximately 3,612’ of old AC water main along 123rd Ave SE and 12th St SE in Lake Stevens Integrated with new 8” ductile iron.	2016
117th Ave NE Water Main Replacement (WE-869)	Project replaced approximately 1,390’ of old AC water main along 117th Ave NE in Lake Stevens Integrated with new 8” ductile iron.	2017
Vernon West Main Replacement (WE-841)	Project replaced approximately 2,000 of old AC water main along Vernon Road in Lake Stevens Integrated with new 8” ductile iron.	2017
Frontier Circle West Main Replacement (WE-867)	Project replaced approximately 7,700’ of old AC water main along Frontier Circle West and the Frontier Heights neighborhood in Lake Stevens Integrated with new 8” and 12” ductile iron.	2017/18
87th Ave NE Main Replacement (WE-888)	Project replaced approximately 3,525’ of old AC water main along 87th Ave NE in Lake Stevens Integrated with new 8” ductile iron.	2018
32nd St SE Main Replacement (WE-887)	Project replaced approximately 8,331 of old AC water main along 32nd St SE in Lake Stevens Integrated with new 8” ductile iron.	2019
101st Ave NE Main Replacement (WE-899)	Project replaced approximately 450’ of old AC water main along 101st Ave NE in Lake Stevens Integrated with new 4” ductile iron.	2019
114th Dr NE, 11th Dr NE Main Replacement (WE-901)	Project replaced approximately 2,501’ of old AC water main along 114th Dr NE and 11th Dr NE in Lake Stevens Integrated with new 8” ductile iron.	2019
116th Ave NE, 26th St NE Main Replacement (WE-902)	Project replaced approximately 3,526’ of old AC water main along 116th Ave NE in Lake Stevens Integrated with new 8” ductile iron.	2019

1.4 Overview of Existing Water Systems

The District currently provides water through nine water systems located throughout the County. Current water service spans an area extending from the City of Stanwood (Stanwood) to the City of Gold Bar (Gold Bar) and from the City of Lake Stevens to the City of Arlington (Arlington). Most of the systems are classified as “Group A Community” water systems because they serve 25 or more year-round residents. The 212 Market & Deli is a “Group A Transient Non-Community” system because it serves an average non-residential population of 25. Otis is a “Group B” water system because it serves less than 25 residents.

All the District’s water systems are continuously chlorinated except for water delivered to four customers on the Otis Water System. Water supply purchased from the Everett filter plant and produced from the Lake Stevens Integrated wells is also fluoridated. The Sunday Lake and Warm Beach Systems have filtration treatment to remove manganese, iron, and a trace of hydrogen sulfide, which occur naturally in the well water. Water from the well serving the Skylite Water System is aerated as it enters the storage tanks to raise the pH and reduce the degree of corrosiveness toward copper plumbing.

Following is a description of each water system. Detailed information on the water facilities is provided in **Chapter 4**.

Lake Stevens Integrated – The Lake Stevens Integrated Water System is the District’s largest water system supplying water to the City of Lake Stevens and City of Granite Falls (Granite Falls) areas. Most of the water for this system is obtained from Everett’s filter plant and is supplemented by treated water from the Lake Stevens Integrated System Wells. The purchased water from the Everett is supplied by six taps on the Everett No. 3 Pipeline (3-Line), three taps on the Everett No. 5 Pipeline (5-Line), and one tap on the line shared with the Marysville Joint Operating Agreement (JOA) Line, which is also connected to the 3-Line. In an emergency, several of these taps can be switched to Everett’s No. 2 pipeline (2-Line). The Lake Stevens Integrated System contains 25 pressure zones, serving a wide range of elevations from almost sea level to over 700 feet. Lake Stevens Integrated also has 14.2 million gallons (MG) of water storage in eight tanks located on five sites throughout the system.

Storm Lake Ridge – The Storm Lake Ridge Water System supplies water to the Storm Lake Ridge community and surrounding area approximately three miles east of Machias and five miles north of the City of Monroe (Monroe). The system is supplied by a tap on Everett’s 5-Line from which water is pumped into the distribution system and then to a concrete reservoir. There is a small “boosted” pressure zone served by pumps in the vicinity of the storage tank.

Creswell – The Creswell Water System (formerly known as Butterfield) is supplied from a tap on Everett’s 3-Line at the northwest corner of Dubuque Road and Creswell Road. There is also a connection from Everett’s 2-Line as a backup. Creswell does not have a storage tank but will eventually be merged into the District’s adjacent Lake Stevens Integrated System that does have storage.

Warm Beach – The Warm Beach Water System is the most recent addition to the District's water systems. Warm Beach is located near the Puget Sound, just north of the Tulalip Reservation and about three miles south of Stanwood. This system has three pressure zones with a bolted steel reservoir in the middle zone. The upper zone is served by a booster pump station (BPS) and the lower zone is served by two pressure reducing stations. Two active wells are treated to supply the system. One of these wells is treated, and treatment is planned for the second well.

Additionally, the Kayak Water System to the south has been merged with the adjacent Warm Beach Water System. The Kayak portion of Warm Beach has two active wells that pump through treatment to the distribution system. A concrete tank is located at the highest ground elevation on the east side of the system, and pressure reducing stations control water pressure to lower elevations on the west side of the system.

Kayak – See Warm Beach Water System

May Creek – The May Creek Water System, located east of Gold Bar, supplies water to the May Creek community and surrounding area. The system has two wells which supply water to the distribution system and two concrete reservoirs. Chlorine is added to the well water. An emergency intertie connects May Creek to the Gold Bar Water System.

Sunday Lake – The Sunday Lake community is supplied by a single well located west of the lake. The water is treated before it is sent to the distribution system and a concrete storage tank. A BPS serves a newer development northwest of the original Sunday Lake subdivision.

Skylite – The Skylite Water System is located south of Highway-2 between the City of Sultan (Sultan) and Gold Bar and south of the Skykomish River. The system is supplied by a single well equipped with two pumps. The well water is chlorinated and aerated as it fills an adjacent concrete tank. Water is then pumped from the tank into the distribution system.

212 Market & Deli – The 212 Market & Deli Water System (formerly known as Moa/Holbeck) supplies water to a gas station and convenience store near Exit 212, southwest of the intersection of I-5 and Highway 532. The system is supplied by a well which pumps chlorinated water to a small concrete storage tank. Water is then pumped from the tank to the store.

Otis – The Otis Water System is designed to serve five lots and currently supplies water to four homes north of 196th Street NE on Burn Road. A single well supplies water directly to the homes.

The District's Jackson Hydroelectric Plant also has a tap on the Everett 5-line for its drinking water supply. Because the District does not sell this water, Jackson is considered a commercial customer of Everett. The District also shares ownership of a separate transmission main from the Everett 5-line to Sultan in the vicinity of the power plant. The District currently has no customers on this transmission main and Sultan pays Everett directly for the water that it consumes.

FIGURE 1-1 | PUD LEADERSHIP TEAM

Tanya (Toni) Olson
President
District 1

Rebecca Wolfe
Vice President
District 2

Sidney (Sid) Logan
Secretary
District 3

John Haarlow
CEO/General Manager

Allison Jubb
Human Resources Director

Vacant Position
General Counsel

Brant Wood
AGM Water Utility

Kristi Sterling
Chief Information Officer

Guy Payne
AGM Distribution & Engineering

Jason Zyskowski
Facilities, AGM Gen, Pwr, Rates & Trans Mgmt

Scott Jones
Chief Financial Officer

Julee Cunningham
Comm, Marketing & Business Rdns Director

Kim Johnston
Gov & External Affairs Director

Melissa Collins
Communication & Exec Svcs Director

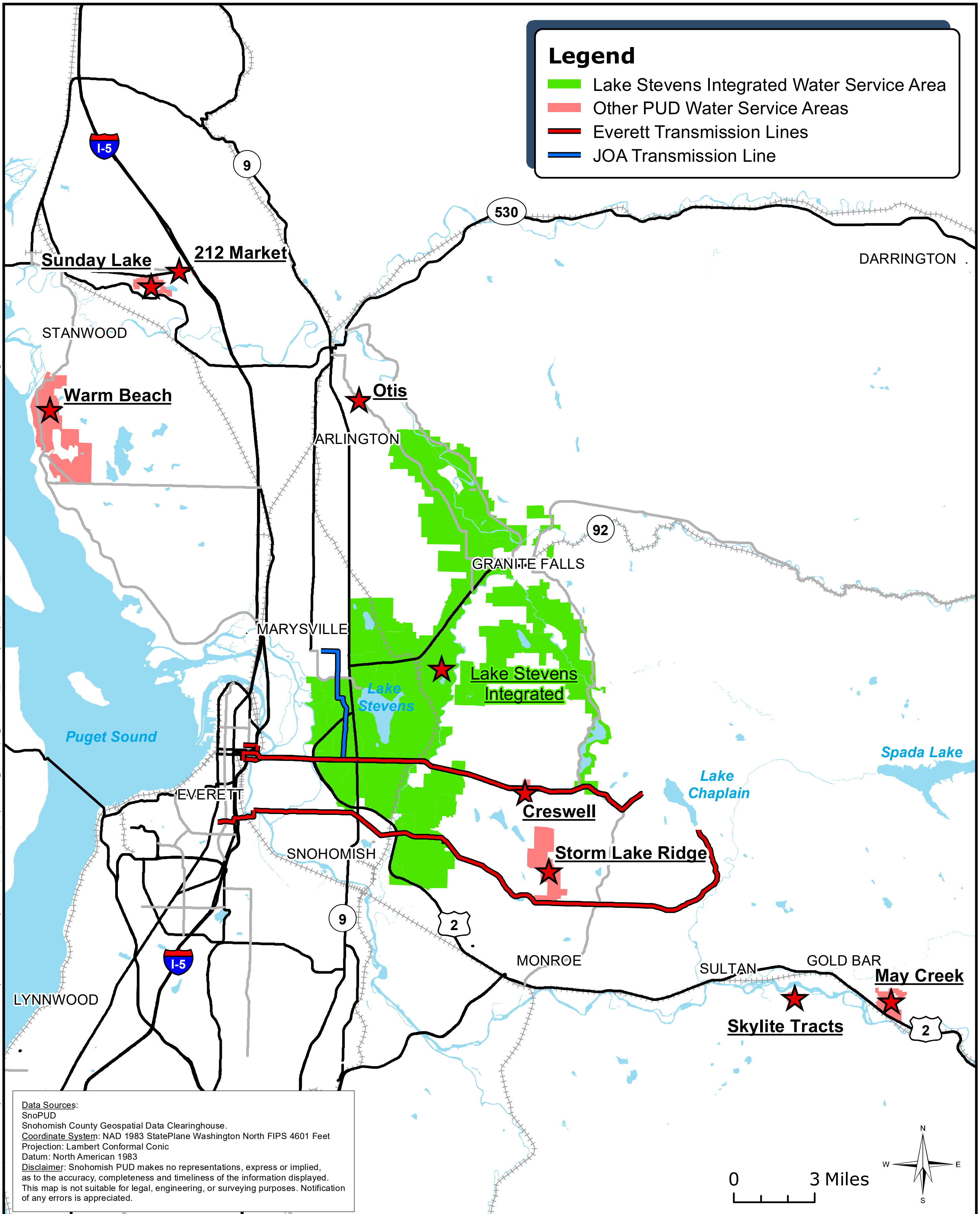
Pam Baley
AGM Customer & Energy Svcs

Rob Beidler
Sr Mgr Safety & Security

FIGURE 1-2 | WATER UTILITY

Brant Wood
AGM Water Utility

- **Christina Arndt** — Manger Water Business Services
  - **Tracy Boggs** — Utility Administrator
  - **Veronica Black** — Water Utility Associate
  - **Misty Stevens** — Sr. Water Service Liaison
  - **Lois Stone** — Water Service Liaison
  - **Amy Tonsgard** — Water Utility Administrator
- **Paul Federspiel** — Principal Engineer
- **Karen Heneghan** — Principal Engineer
- **Max Selin** — Principal Engineer
- **Kevin Presler** — Project Manager
- **Lillian Manley** — Engineering Tech II
- **Glenn Estabaya** — Storekeeper
- **Karen Latimer** — Water Superintendent
  - **Lee Ervin** — Crew Coordinator
  - **Lance Rhodes** — Water Distribution Specialist
  - **Sean O'Connor** — Water Distribution Specialist
  - **Vacant Position** — Water Distribution Specialist
  - **Zach McKinney** — Water Distribution Specialist
  - **Tom Heaphy** — Water Distribution Specialist
  - **Robert Patrick** — Water Electrician
  - **Alan Luna** — Water Foreman Maint & Op
  - **Thomas Blades** — Construction Foreman
  - **Tucker Nieman** — Water Distribution Specialist
  - **Monte Vitale** — Water Distribution Specialist
  - **Noah Rui** — Water Worker
  - **Ron Sheppard** — Water Distribution Specialist
  - **Andrew Jacques** — Water Distribution Specialist
  - **Kassidi Neal** — Water Helper



murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 1-3 Vicinity Map

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter **2**

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 2

Service Areas and Policies

This chapter summarizes regulatory requirements for the District's Water Systems. It also describes current and proposed service area boundaries and summarizes related policies.

2.1 Background

The District is authorized by RCW 54.04.030 to provide water service within and outside the corporate boundaries of Snohomish County. The District is also expressly recognized under the 2003 Municipal Water Law (MWL) as a municipal water supply system pursuant to RCW 90.03.015. Two state statutes set the requirements for water system service areas: (1) MWL, and (2) the 1977 Public Water System Coordination Act. The following sections describe how the provisions and criteria set by these statutes and implementing rules affect the District's Water Systems and policies.

2.1.1 Municipal Water Law: Rules and Related Policies

In 2003, the MWL was passed by the State Legislature. The MWL and related DOH rules changed how municipal water suppliers are to describe their water system service area(s) within their WSPs. To this end, DOH rules were adopted in 2008 and later amended in 2016 to require municipal water supply systems to identify within WSPs, their retail, future, and wholesale service areas as applicable. The following text describes the categories of service areas applicable to District operations.

- Retail Service Area (RSA): The specific area designated by the municipal water supplier where it has a duty to provide service to all new service connections as set forth in RCW 43.20.260.

- Future Service Area: The specific area a water system in a Critical Water Supply Service Area (CWSSA) plans to provide water service as determined by a written agreement between purveyors under Chapter 70.116 RCW and Chapter 246-293 Washington Administrative Code (WAC). No duty to serve is required for areas designated as future service areas (if they are unserved and fall outside of a designated RSA). Future service areas generally correspond to the service area a purveyor claims in a Coordinated Water System Plan (CWSP).

- Wholesale Service Area: A municipal water supplier may designate a wholesale WSA within a WSP or update. In this regard, a wholesale water system refers to *"a public water system that treats source water as necessary to produce finished water and then delivers some or* *all of that finished water to another public water system. Delivery may be through a direct connection or through the distribution system of one or more consecutive systems."* (40 CFR 141.2)

- **Existing Service Area**: Prior to 2017, WAC 246-290 included a definition for existing service area (ESA) as the area within which direct service or retail service connections are currently available. A direct service connection is a service hookup to a property where an extension of a distribution main would not be needed to provide service. Although there is no longer a requirement to show the ESA, the District is continuing this practice because it helps to show how the RSA extends beyond the areas with existing distribution mains.

<u>Retail Service Area: Duty to Serve</u>

Pursuant to RCW 43.20.260, a municipal water supply system has a duty to serve new connections falling within a designated RSA occurs if the following criteria can be met:

1. Sufficient capacity exists to serve water in a safe and reliable manner;
2. Service can be provided in a manner consistent with provisions of adopted land use plans and development regulations that reasonably relate to water service;
3. Sufficient water rights exist to provide the service;
4. Service can be provided in a timely and reasonable manner.

Regarding the "duty to serve" conditions 1, 2, and 3, this WSP update evaluates District water facilities, water sources, and water rights to ensure that planned improvements are at least sufficient to support projected growth in the retail portion of the WSAs over a 10-year planning period. Further, this WSP update is consistent with applicable county and city land use comprehensive plans and policies. This condition is also satisfied through ongoing coordination with local jurisdictions as they process permits in the District's service areas.

Condition 4 is addressed by conducting business in accordance with District procedures for providing timely and reasonable water service, as described later in this chapter.

The MWL did not define "timely and reasonable" for designated RSAs. The DOH has determined per rule guidance, however, that municipal water suppliers are responsible within their WSPs for identifying the "timely and reasonable" criteria and dispute resolution process for their RSAs. Such criteria and processes may be distinct from the CWSP criteria and process involving future service areas.

2.1.2 Coordinated Water System Planning in Snohomish County

The Coordination Act of 1977 applies where a county declares a CWSSA. By declaring a CWSSA, the local government determines that coordinated planning among water purveyors within the area is essential for orderly development.

The County Council declared North Snohomish County to be a CWSSA on October 19, 1988. As the next step, the North Snohomish Water Utility Coordinating Committee (NSWUCC) was formed to implement Coordination Act requirements. Membership consists of systems with 50 or more services in the CWSSA and representatives from the County, Snohomish Health District, DOH, and the Tulalip Tribes. The first NSWUCC action was to define the external boundary of the CWSSA, which is illustrated in the North Snohomish County CWSP figure, see **Appendix 2-1**. This boundary was ratified by the County Council on July 5, 1989 and remains unchanged to this day.

Members of the NSWUCC worked together to create the North Snohomish CWSP, which was completed in 1991 and most recently updated in 2010. The 2010 CWSP Update sets minimum standards that must be followed by all water systems in unincorporated parts of the CWSSA. It also designates service area boundaries for each system to prevent overlapping or redundant water service. For this effort, the proposed service areas of participating systems were combined on a base map, and efforts were made to resolve conflicting boundaries. Then, each system signed a Service Area Agreement and submitted individual WSPs to demonstrate responsibility for their designated area. The District's agreement can be found with Resolution 4590 in **Appendix 2-2**.

The NSWUCC also established a Utility Service Review Procedure (USRP) to identify water service for new developments located within future service areas, with a goal to minimize creation of new public water systems. As administrator of the USRP, the County refers each subdivision to the closest water utility in this order of precedence: (1) public water supplier in a designated future WSA, (2) adjacent water utilities that intend to expand, (3) the District, or (4) other approved SMAs. If water service is not "available" from these purveyors, the subdivision can proceed with individual wells, or a new water system can be created to serve the project under certain conditions.

As discussed earlier, the MWL had the effect of modifying the definition and responsibilities of municipal water system service areas within their planning areas, with particular regard to RSA designation and policies. The RSA policies may or may not directly correspond with all of the policies cited in a CWSP pertaining to future (claimed) service areas. More detail regarding the CWSP can be found in **Appendix 2-1**.

2.1.3 Satellite Management Agencies

The concept of SMAs was introduced with the Coordination Act. The SMAs can own or operate more than one water system on a regional or countywide basis, without the necessity for a physical connection between such systems. An SMA may prescribe a service area and conditions of service that correspond to SMA acceptance, operational, and financial criteria.

The Coordination Act was amended in 1991 to require counties to identify SMAs to serve in areas where no water purveyor is designated. When a new water system is proposed in an area not claimed by an existing system, local agencies must refer it to one or more qualified SMA, to explore the possibility of the SMA either owning or operating the new system.

In 1995, Senate Bill 5448 further tightened requirements by specifying that new public water systems must be owned by an SMA, rather than just requiring that the option be explored. If an SMA is not "available," the new system can be approved with a condition that it will be owned or managed by an SMA in the future if such management or ownership can be made with reasonable economy and efficiency. A 1995 guidance memo from DOH to local government jurisdictions emphasized that these provisions apply to any new water system, down to the smallest systems serving only two houses.

2.1.4 Growth Management Act

The Growth Management Act (GMA) was enacted to ensure a continuation of the State's high quality of life. The GMA originally passed in 1990 and has been amended several times since. The basic objective is to encourage local county and city governments to develop and implement 20-year Comprehensive Plans that incorporate their vision of the future within the framework of the broader needs of the State.

Under the GMA, municipalities must complete their own Comprehensive Plans while coordinating planning efforts with those of the county and surrounding municipalities. Likewise, water service provided by expanding public water systems must be consistent with land uses established in the Comprehensive Plans, as well as with WSAs established in CWSPs or other state approved planning processes.

The GMA requires water purveyors to provide evidence of adequate water service before the County will issue a permit for new development in unincorporated areas. Therefore, the District must anticipate the location of future development and plan for construction of water distribution systems sufficient to meet future demands.

The District serves water customers within the Urban Growth Areas (UGA) of four cities: The City of Lake Stevens, Granite Falls, Gold Bar, and the City of Snohomish. The District's WSAs have been developed to be consistent with the land use plans of the jurisdictions it serves.

2.2 District Water Service Areas Adjustments

As noted above, because the District is a municipal water supplier, it must identify its *retail service area* and future service area in accordance with the MWL. As noted earlier, the RSA is where the District has a "*duty to serve*", subject to referenced statutory criteria. Service areas in the North Snohomish County CWSP figure (see Appendix 2-1), described in the previous section, are *future service areas.* All of these terms were explained previously.

Figure 2-1 and Figure 2-2 show the District's proposed WSAs adjusted as appropriate to correspond to applicable MWL criteria, District operational criteria, and land use development trends. Section 2.2.1 describes adjustments to the District's future service area boundaries that are being submitted to adjacent water purveyors for review. Section 2.2.2 describes changes the District's Satellite Water System Management service area. Section 2.3 will describe all resulting service areas, including the RSAs within the future service areas where the MWL "duty to serve" criteria will apply.

The District has determined that no purveyors will be affected by the service area adjustments. A conformed and revised future service area map (**Figure 2-1**) will be provided to the NSWUCC and submitted to the County Planning Department.

2.2.1 Future Service Area Adjustments/Relinquishments

As part of this WSP update, the District intends to voluntarily diminish and relinquish parts of its CWSP-based future service area as depicted on **Figure 2-1**. The reason for such action is based on the following factors and developments. This section also clarifies boundaries with some water utilities that are immediately adjacent to the District's future service areas.

The District has determined that no purveyors will be affected by the service area adjustments. After review by the adjacent water purveyors, a conformed and revised future service area map (**Figure 2-1**) will be provided to the NSWUCC and submitted to the County Planning Department.

2.2.1.1 Removing the Lake Goodwin Future Service Area

Prior to 2011, the District was approached by a developer interested in extending water from Lake Stevens Integrated to a project on the north side of the Seven Lakes Water Association. Although it appears the Seven Lakes Water Association did not have capacity to serve the project, it did not formally decline to serve.

At the request of the developer, the District issued a letter of water availability stating that water could be provided from the Lake Stevens Integrated System, if facilities were extended at the developer's expense. The District then showed the project within the District's Lake Goodwin future service area which overlapped the service area claimed by Seven Lakes Water Association. The District did not oppose Seven Lakes Water Association serving the project but was prepared to assume the water service role if the Seven Lakes Water Association was unable to serve. By not agreeing to serve the project, that portion of the Seven Lake's service area was considered relinquished according to Coordination Act and CWSP procedures.

Subsequent to 2011, the preliminary plat for the development and the water availability certificate provided to the developer expired and all work on the project has terminated. There is no evidence that any new development is being planned at this time or in the foreseeable future. Because of this, the District intends to remove the Lake Goodwin area from its future service area. The District has determined that no purveyor, including the Seven Lakes Water Association, will be affected by this service area adjustment.

2.2.1.2 Pulling Back Northeast of City of Arlington Future Service Area

The District intends to relinquish part of its future service area that is east and northeast of Arlington. The new future service area boundary shall follow along the boundary of Arlington and the Sudden View WSAs on the west, then along the District's current RSA as was depicted in the 2011 WSP, and along the south side of Jim Creek to the east until intersecting with the District's current future service area boundary.

Reasons for relinquishing this portion of the District's future water service area include the following:

- Restrictions that were placed on pipeline sizing when the water main along Jordan Rd was constructed make it difficult to achieve the District's fire flow goals into the area
- The District has not received significant requests for water service in the area that would justify the facility investments that would be needed to properly serve the area

2.2.1.3 Pulling Back East of Storm Lake Ridge Service Area

The District intends to relinquish the future service area that is east of the Storm Lake Ridge Water System. The new future service area boundary shall follow along the western boundary of Commercial Forest – Forest Transition Area (CF-FTA). This corresponds to the eastern edge of the RSA, which, as defined later per the County's 2015 General Policy Plan, allows for development with the CF-FTA.

Land use in the area that is being removed is designated as Low Density Rural Residential with 1 dwelling unit per 20 acres and there is an island of CF-FTA designated land within that area. To loop a water main through that low-density rural area would involve passing through the Highland Water District service area. Considering these boundaries and the unlikely cost-effectiveness for water service extensions, the revised service area follows the western edge of the CF-FTA "island."

2.2.1.4 Service Area Adjustment with City of Marysville

In 2013-14, a portion of the District's service area west of Highway 9 and north of Soper Hill Rd was transferred to the City of Marysville. This change has already been made to the CWSP map in **Appendix 2-1**. The figures in the District's WSP are now also being updated to reflect this change.

2.2.1.5 Service Area Adjustment with City of Granite Falls

In 2020, Granite Falls signed a new wholesale water agreement with the District, which can be found in **Appendix 3-2**. The exhibit in the agreement reflects a couple adjustments to Granite Falls' future service area compared to the depiction in their 2013 WSP and on the CWSP map in **Appendix 2-1**. The District considers its future service area boundary to be adjusted with Granite Falls in accordance with the 2020 agreement.

Furthermore, Granite Falls' mapping shows the City has a pipe serving several lots outside their future service area to the southeast along Menzel Lake Road. The District is adding those lots to its wholesale water service area because they receive water that Granite Falls purchases from the District. It is understood that Granite Falls will show those customers within their existing service area, although they may choose to leave them outside of their future service area. If Granite Falls does not add those lots to their future service area, the PUD will leave them in its future service area even though District does not have any pipes near those lots and does not currently have plans to extend a pipe up Menzel Lake Road. The City of Granite Falls is preparing its WSP Update. It is expected that their future service area boundary will also be consistent with the description above, which is reflected in **Figure 2-1** and **Figure 2-2**.

2.2.1.6 Service Area Adjustment with City of Snohomish

The District provides water service to several properties in the northwest portion of Snohomish's UGA and city limits. These lots are labeled on a copy of the City of Snohomish's Land Use Designation Map in **Appendix 3-3F**.

In 2011, the District and the City of Snohomish cooperated to identify a common boundary for their future water service areas. The 2011 boundary revision was described in **Section 3.2.3** of the District's 2011 WSP and is reflected on the CWSP Map in **Appendix 2-1** and in the service area figures of the District's 2011 WSP and the City of Snohomish's WSP.

In 2012, the District water main serving the Snohomish School District bus barn was extended an additional 500 feet into the future service area claimed by the City of Snohomish along Sinclair Ave for an office building the City of Snohomish was unable to serve. One existing house fronting the water main also connected. When the development was proposed in 2008, the property had not yet been annexed into the city limits. According to the North Snohomish CWSP Utility Service Review Procedure (which applies outside of incorporated city limits), that part of the City of Snohomish water service area would have been considered relinquished because the City of Snohomish did not agree to provide timely and reasonable water service when it was requested. The area was subsequently annexed into the City of Snohomish.

The District is adding the two lots described above (at 3800 and 3811 Sinclair Ave) to its service area. Continued District service to these lots is authorized within city limits, according to RCW 54, which regulates Public Utility Districts. Other unserved lots adjacent to the District's water main on Sinclair Ave are now inside the Snohomish city limits and in their future service area. If the District receives a connection request from these properties, it should first contact Snohomish to determine if they decline to provide the water service and provide documentation of any further adjustment to the agreed water service area to the County.

Additionally, the District is slightly pulling back its future service area in the vicinity of 92nd St SE and Highway 2 (west of Bartelheimer dairy) because of an overlap with the City of Snohomish's water service area. The City of Snohomish's WSP shows they have existing pipes in that area, outside of their UGA and city limits. The District has no objection to the City of Snohomish continuing to serve that area.

2.2.1.7 Reducing the Sunday Lake Future Service Area

The 2011 WSP depicted the Sunday Lake future service area extending east all the way to I-5, west to Stanwood's service area boundary, north approximately 4,000 feet from the existing pipes and south to the top of the steep slope above Pioneer Highway. Considering that this might be overextending, the District has decided to pull back the Sunday Lake future service area to match the previously identified retail service area boundary, where the District is confident it can meet its duty to serve.

2.2.2 Satellite Management System Service Area

When first planned, the District's satellite system area was designated as the entire County, less those areas claimed or served by other purveyors as retail and/or future service areas. The District was most recently approved to serve as a SMA throughout the County as a result of its 2011 WSP update.

Within the CWSSA boundary, the CWSP gives the District first priority as the SMA. If the District decides a proposed water system is not feasible to serve, the County will refer the project to another approved SMA. The District's Satellite System Management (SSM) Policies may be found in Section 4 of the District Water Policy Manual.

As part of this WSP update, the District has elected to adjust and diminish the SMA service area reflected in its 2011 Satellite Management Plan from the entire area of unincorporated County to that area depicted in **Figure 2-1** that falls within the existing CWSSA boundary, plus Skylite.

The primary reason for the adjustments is based on the District's determination that it does not believe that it would be technically or financially feasible to provide SMA services to the entire originally delineated SMA service area.

In addition to the above SMA service area adjustment, the District has revised its Policies, Procedures, and Conditions as described in Chapter 4 of the SMA Policy Manual and **Section 2.4.3** of this Chapter.

2.3 Resulting District Water Service Areas

Following is a description of the resulting District service areas after the above adjustments are factored into the boundaries previously established in the District's 2011 WSP. This includes description of the existing service areas and RSAs within the future service areas. As noted earlier, the RSA is where the District has a "*duty to serve.*" Service areas in the North Snohomish County CWSP figure (see **Figure 2-1**) described in the previous section, are *future service areas.* All of these terms were explained previously.

2.3.1 Lake Stevens Integrated Water Service Area

The District's 2011 WSP updated the eastern boundary of its Lake Stevens Integrated WSA to match the edge of the CF-FTA in the County Comprehensive Plan, and further proposed adjustments were described in **Section 2.2.1**. The CF-FTA is a quarter-mile wide overlay along the perimeter of Commercial Forest (CF) land use areas. The County's 2015 General Policy Plan intended to allow partial development in the CF-FTA at one dwelling per 10 to 20 acres, but only if adjacent land use restricts normal forest practices. Otherwise, the minimum lot size is 80 acres. Excluding the CF-FTA at the eastern edge of the WSA simply indicates that the District does not foresee water facilities in that area, because it is unlikely that extending water mains to lots of this size would be cost effective. If the District receives a request for water service consistent with land use, the WSA boundary can be adjusted with the agreement of other water purveyors in the CWSSA if provision of water service is feasible. The proposed future WSA also includes adjustments along rivers and highways and minor modifications with adjacent utilities.

The District has planned water facilities for at least 20 years of population growth in the Lake Stevens Integrated Water System, including water mains that will connect the water systems to each other. In the rural areas, water extensions are typically for rural cluster subdivisions, which allow groupings of lots while preserving tracts of land for open space. Water extensions to rural clusters promote water resource conservation by use of metered water services compared to the alternative of larger lots with individual wells.

Figure 2-1 shows the RSA within the adjusted future WSA. The RSA covers where water main extensions could reasonably happen in the next ten years. To determine the retail area, a distance of about a half-mile from existing water mains was examined. This area was pulled back around water mains smaller than 8-inch diameter and in areas where geologic features make expansion more involved than simple water main extensions. The retail area was expanded beyond a half-mile where there are known requests for service and in the vicinity of planned water main extensions.

Additionally, the Lake Stevens Integrated WSA includes both Creswell and Storm Lake Ridge Water System within the RSA and future WSA boundaries. These two Water Systems are planned to be connected with Lake Stevens Integrated within the next twenty years.

2.3.2 Wholesale Service Areas

The District currently sells water to Granite Falls, Arlington, and City of Snohomish as well as the Sudden View and Twin Falls (Seymours) water systems on a wholesale basis. These wholesale service areas are outlined in Figure 2-1. Although Arlington only uses District-provided wholesale water in part of its system, the entire Arlington service area is described in the District's wholesale service area because the District's agreement with Arlington does not limit where the water can be used. Granite Falls, Twin Falls, and Sudden View use District wholesale water as their sole source of supply.

The Granite Falls wholesale service area has been adjusted was described in Section 2.2.1.5 for consistency with the Granite Falls' planned changes to their service area map.

Wholesale water sold to the City of Snohomish serves approximately 75 City of Snohomish customers along a transmission main that previously conveyed water from their decommissioned treatment plant. It also serves as a redundant supply for the City of Snohomish's 218-HGL pressure zone. The City of Snohomish's transmission line is approximately 14.7 miles long, starting near the south end of Menzel Lake Rd, passing through easements to Robe-Menzel Rd, then south along Robe-Menzel Rd to N Carpenter Rd, east and south on N Carpenter Rd to OK Mill Rd, east along OK Mill Rd to S Machias Rd, and then along S Machias Rd into the City of Snohomish. This linear wholesale service area is not shown on **Figure 2-1 and Figure 2-2** because it is involved to illustrate.

The District also sells water to several mobile home parks and to Lake Conner Park, a private camping club with about 200 sites. These systems are billed as commercial customers and are not classified as wholesale because they are not regulated public water systems.

2.3.3 Sunday Lake Water Service Area

Sunday Lake is currently approved for 278 Equivalent Residential Units (ERUs) and the District has made commitments for 194 connections. This leaves 84 available single-family hook-ups. The "existing service area" is an outline of lots currently served by the system. The "retail service area" represents an area that could consume the remaining approved water services if every lot connects to the system and subdivides to the maximum allowed potential under current zoning. The District has determined within recent years that full build-out of the Sunday Lake RSA may be affected by the fact that many existing lots are already developed with houses served by wells.

As described in **Section 2.2.1.7**, the District has decided to pull back the Sunday Lake future service area to match the RSA. If a request is received outside of the RSA that could make beneficial use of Sunday Lake's available water supply, and it looks like a development project will move forward, the District will prepare a WSP amendment to adjust the place of use/service area of the related Sunday Lake groundwater rights to correspond to the future service area consistent with RCW 90.03.386(2). In this way, the retail area will always represent the maximum area that can be supported by the system, while leaving options in the future service area as the true direction of development unfolds.

2.3.4 The 212 Market & Deli and Otis Water Service Areas

The 212 Market & Deli and Otis will remain non-expanding water systems. The 212 Market & Deli will only serve the gas station, market, and deli that it was originally designed to serve. Similarly, Otis will only serve the five residential lots that it was designed to serve.

Otis is located inside Arlington's future service area. It is possible that Otis could merge into Arlington's water system in the future if development extends a water main past the system along Burn Road.

2.3.5 Warm Beach/Kayak Water Systems Consolidation

In 2016, the District commenced work with the assistance of a DOH grant to study the feasibility of the District assuming ownership and operation of the Warm Beach Water Association (WBWA), including the cost of related improvements, and consolidating its operations as appropriate with the District's Kayak Water System in order to improve system reliability, redundancy, operational integrity, and emergency water access. As discussed below, this effort resulted in the 2020 operational consolidation of the Warm Beach and Kayak water systems.

Key among the actions deemed necessary by the District to ensure the proposed system consolidation could meet Warm Beach and District operational objectives, was the construction of two points of connection between the Warm Beach and Kayak Water Systems and securing an extension of Warm Beach groundwater permit G1-25686. The extension which runs to 2035 was approved by Ecology on July 9, 2019.

Consistent with the Drinking Water State Revolving Fund (DWSRF) loan criteria, the District provided project information to DOH regarding how the two systems would be operationally and financially consolidated through development of joint storage facilities, source of supply connections, and other related facilities. This information was then further refined and submitted as a limited appropriate level of planning (ALOP) WSP amendment to DOH and Ecology in March 2020.

On December 16, 2020, DOH approved the District's WSP ALOP to consolidate the Warm Beach and Kayak Water Systems as consistent with WAC 246-290-100. The ALOP approval included, as authorized by RCW 90.03.386(2), a place of use expansion of Kayak Groundwater rights (G1-24415C/ G1-25989C) enabling service to the Warm Beach community during exigent or maintenance circumstances. Consistent with terms of the ALOP, the water supply for customers located within the former Warm Beach and Kayak water service areas continues to be provided by their respective original wells/sources.

With approval of the ALOP WSP, the operational consolidation of the two water systems has occurred and the newly consolidated system is now referred to by the District as the Warm Beach Water System.

Please see **Figure 2-1** depicting the WBWA and Kayak (qualified) consolidated service area.

2.3.6 May Creek Water Service Area

Pursuant to its updated Water Service Area Agreement with Gold Bar, the District has made a one-time, voluntary boundary line adjustment to its May Creek retail service area that transfers two residential properties to Gold Bar's retail service area. Other than this minor change, the proposed future WSA for May Creek is identical to the North Snohomish County CWSP figure, see **Appendix 2-1**. The existing service area in **Figure 2-1** includes lots currently served by the system. The RSA extends beyond the existing service area to a ground elevation of 300 feet, which can be served by gravity from the storage tanks. A BPS would be needed to deliver water to any proposed subdivision to the east. Pursuant to its updated Water Service Area Agreement with the City of Gold Bar (Gold Bar), the District has made a one-time, voluntary boundary line adjustment to its May Creek retail service area that transfers two residential properties to Gold Bar's retail service area.

2.3.7 Skylite Water Service Area

Skylite is a non-expanding water system located outside of the CWSSA boundary, along the south side of the Skykomish River. There were originally 185 platted lots in this 1960s subdivision, some of which were later lost to river erosion. The early recreational use for the lots gradually transitioned into full-time occupancy. To assure that water hook-ups are available for remaining lots that the system was intended to serve, the District does not presently plan to hook up any lots outside of this defined service area. Consequently, the existing, retail, and future service areas are identical.

2.4 Service Area Policies

The District has attempted to define retail WSAs in a manner that assures it can fulfill its duty to serve. The District will strive to serve all applicants in its retail WSAs, provided all District policies related to service can be met, and the project is consistent with applicable statutes, rules, and guidance.

All proposed connections and extensions within the retail WSAs shall be allowed unless deemed unfeasible by the District at the time of request due to water supply and/or system capacity constraints.

It is important to recognize that the District's function is not to plan land uses within its boundaries, but to respond to land uses under applicable land use plans. The District's facilities are not to be used as tools for implementing changes in the character or timing of planned land uses.

2.4.1 Timely and Reasonable Water Service: Future and Retail Service Areas

A basic tenet of District policy is that growth pays for growth, or that existing water customers do not subsidize system expansions. District policies are designed to ensure that each new connection or facility extension will be paid for by the individuals that are benefitted.

The District has developed the following documentation of routine procedures for timely provision of service for its retail and future service areas to be consistent with the Coordination Act and District policies. Because time associated with design, permitting, and construction is outside the District's control, these are not counted in the timeline. The goals for District turnaround times are underlined. When added together, the combined District turnaround times are less than 120 days. There is no guarantee that all service requests can be processed in these timeframes. Large or complex projects, especially, might take more time. **Table 2-1** has been developed to illustrate how the District determines when it is "reasonable" to provide water service.

Table 2-1 | General District Criteria for Timely and Reasonable Water Service Decisions

Scenario	Distance from existing water main inside District RSA [1]			
	Water main Fronts Property	Within 1/4-mile [2]	1/4- to 1/2-mile [2]	Greater than 1/2-mile [2]
Standard Subdivision (5 or more lots)	Required to hook up [a]	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]
Short Subdivision (4 or fewer lots outside a UGA; 9 or less lots in a UGA)	Required to hook up [a]	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]
Rural Cluster Subdivision	Required to hook up [a]	Required to extend District facilities [c]	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]
Proposed Group A water system	Required to hook up [b]	Required to extend District facilities [b3]	Required to extend District facilities [b3]	Evaluate on case-by-case basis [b3]
Proposed Group B water system	Required to hook up [b]	Required to extend District facilities [b3]	Evaluate on case-by-case basis [b3]	Evaluate on case-by-case basis [b3]
Proposed "two-party" water system	Required to hook up [b]	Consider interim connection agreement [b]	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]
Individual service request for existing lot	District agrees to serve	Consider interim connection agreement	Water available if willing to extend at own expense per District standards [a3]	Water available if willing to extend at own expense per District standards [a3]
Proposed individual well on existing lot (not subdividing)	Not required to hook up [a]	Not required to hook up [a]	Not required to hook up [a]	Not required to hook up [a]

Notes
1. Measured along existing or proposed roads to the project site.
2. Applies if existing water main is 8-inch diameter or larger. For smaller existing water main, scenario will be evaluated on a case-by-case basis.
3. Individual wells are an allowed alternative for each residential lot, if lots are 1-acre or larger and can meet septic system setback requirements.
3a. North Snohomish County Coordinated Water System Plan (Per CWSP Section V.1, use of individual wells allowed only when public water does not meet the criteria of "available" in subsection V.7. Water for houses on existing lots is exempt from this procedural policy.)
3b. Coordination Act, RCW 70.116.060 (No new public water system shall be created in the CWSSA unless existing purveyors are unable to provide service in a timely and reasonable manner.)
3c. County Code (SCC 30.41C.070(3)(e) for rural clusters within ¼-mile of existing water mains)

Typically, an owner, representative, or potential purchaser of a property will call the District in the early stages of investigating options for water service. The District's goal is to initially respond to such requests within two working days. Some projects may necessitate meetings and further exchange of information. This WSP and related Policy Manual govern the determination of water improvements. Each project is evaluated in relation to the existing water system and the applicant is informed of any facilities that would need to be constructed and the related fees. The District does not consider such inquiries to be official requests for service until an agreement is signed to extend facilities or until all fees are paid to install an individual service.

The District will write water availability letters for applicants that pay the currently established fee for such letters or upon the request of applicants that have paid all fees for service installation. The requested service will be evaluated by District staff to determine system capacity, fire flow availability, meter size and/or other improvements necessary to provide adequate water pressure, fire flow, and water quality. In many cases, this has already been done during an initial inquiry, so availability letters can usually be issued within one week. After the letter is issued, it is up to the applicant to determine their schedule to proceed with installation (by paying the remaining fees or, for larger projects, designing and constructing facilities in accordance with District procedures). Water availability letters expire after five years but can usually be renewed if requested.

In addition to the District's water availability letters, the County may send a Preliminary Certificate of Water Availability for the District to complete and return within 30 days. This occurs when the County receives a land use application and determines that the District is the appropriate purveyor following the Utility Service Review Process. The District's goal is to complete and return these certificates within one week.

If the District declines to provide service in its retail area or if an applicant disagrees with offered terms of service, the potential customer can appeal through the dispute resolution procedure described in the District's Policy Manual. In addition, an appeal to the NSWUCC under the CWSP can occur if the District *requires* an applicant to hook up to District facilities and the applicant does not believe the District's terms are timely or reasonable.

For individual service connections, after all fees are paid, the service line and water meter can usually be installed within three weeks. Priorities for construction crews are, first, emergencies; second, critical maintenance and operation projects; and third, new service installation. Unexpected conditions or events can delay installation of new water services, but timeframes will not exceed the 120-day clock of the Coordination Act.

To extend water facilities or create a new satellite system, the applicant starts the process by submitting three copies of water construction drawings along with an Information Request form. The District drafts a Developer Extension Agreement (DEA) and sends it for signature with the first design review. The signed DEA and review fees should be returned with the applicant's first response, but at least before the District approves the project for construction. District engineers typically review the drawings in a timeframe consistent with the applicant's schedule. Applicants and design engineers are encouraged to communicate with District engineers as they prepare their drawings and to submit their plans well in advance of their anticipated construction start date. At minimum, applicants should be prepared for a 30-day turnaround for the initial review and a two-week turnaround for each subsequent review, until comments are satisfactorily addressed. Large or complex projects can experience longer review times. Design and review can occur concurrently with County review of the plat, so that the project can start construction when preliminary plat approval is received. After drawings are approved, remaining steps for construction include:

- Any off-site easements are drafted
- Right of way permit application is submitted to County, if applicable
- Contractor provides certificate of insurance and applies for a meter and cross-connection control assembly to use during construction
- A pre-construction meeting is held
- The District inspector monitors the project throughout construction
- Final disinfection, pressure, and bacteria tests are conducted until passed
- A District engineer signs the Certificate of Construction Completion form
- If requested, an agreement is drafted to defer general facility charges (GFCs) to future lot owners
- All remaining fees and charges are collected
- The applicant's engineer provides as-built water drawings
- The applicant provides a two-year maintenance bond for ten percent of installed cost
- Bill of Sale is executed to transfer ownership to the District
- The District reviews the draft "final plat" drawing to confirm that on-site water easements will show on the face of the recorded plat
- District sends a plat acceptance letter to the County

2.4.2 Receivership: Future and SMA Service Areas

The District's role as a potential receiver on behalf of the County shall be limited to those water systems falling within the Districts adjusted future service area as depicted in **Figure 2-1**. Pursuant to RCW 7.60.280, the District may refuse to act as receiver and/or resign such position at its discretion.

2.4.3 Policy and Procedures Manual

The District's Policy Manual is included as **Appendix 1-1**. This manual is also posted on the District's website. District staff keep copies of the manual at their desks for frequent reference when responding to water service inquiries. The copies are updated whenever there is a change to the manual. Copies of the extension policies, standards, and specifications sections of this manual are also kept readily available to distribute to applicants, design engineers, and construction contractors.

The District's service policies are established under RCW Title 54, governing public utility districts, and by the District's elected Board of Commissioners through the adoption of written resolutions at regularly scheduled public meetings. Copies of pertinent District resolutions can be found in **Appendix 2-2**. The general public is free to address the Commission on any issue regarding the District's responsibilities of providing potable water service.

This WSP, which contains statements of District policy, will be adopted by resolution following a public process to address any comments. The Policy Manual is a supplement to this WSP. Any amendments to this WSP or changes to the policies must also be reviewed and adopted by the Commission through the public process.

Following is a summary of the structure of the Policy Manual:

Policy Manual Section 1: Introduction

- Goal is to provide a helpful guide for customers, building trades, and representatives of the District.
- Also, the goal is to provide safe and reliable service at the most economical cost possible.
- Improvements and incremental extensions of the District's water systems must be consistent with the WSP, whether they are carried out by the District or a third party.

Policy Manual Section 2: General Terms, Conditions, and Policies for Water Service

Describes the District's routine procedures for water service, including:

- Guidelines to initiate or terminate water service
- Service equipment requirements and responsibilities, including cross-connection control
- Meter reading, billing, and collections procedures
- Dispute resolution
- Description of rates, fees, and charges
- District action for violations
- Guidelines to process applications for fire protection only
- Special arrangements for short-term water use

Policy Manual Section 3: Extension Policies

Describes the process for projects requiring an extension of water facilities, including:

- Procedures to apply for extension or improvement of a District water system
- Responsibility for preparation, review, and approval of design drawings
- Requirement to execute a Developer Extension Agreement
- Responsibilities for permits and easements
- Responsibility to submit as-built drawings and other conditions for final acceptance
- Description of fees and options to finance
- Design and construction procedures
- Provisions for interim connections

Policy Manual Section 4: Satellite System Management

Communicates the steps involved and service options to prospective clients of District's satellite system services, including:

- Direct Service, for a system that will be owned and operated by the District,

- Contract Services, including operation, maintenance, monitoring, billing, and other tasks for a system not owned by the District, or

- Support Assistance on a more limited scale, with charges determined in advance on a time and materials basis

Policy Manual Appendix A: Standards and Specifications for Design and Construction

- Can be used as a free-standing document to communicate with engineers and contractors

- Specifies design and performance standards for source, transmission, storage, and distribution, including material and construction specifications and detail drawings

- This part of the manual is updated regularly by the District's Water Resources Standard Committee to keep pace with changing technology and issues encountered in the course of design and construction

Policy Manual Appendix B: Rates, Charges, and Fees

- Contains a series of tables listing all of the District's current charges for water customers and projects

- Rates and Fees may be adjusted as necessary as approved and adopted by the Commission.

2.4.4 Other Key Service Area Policies

A DOH fact sheet lists elements that water systems should consider when developing service area policies. The following text describes how the District approaches these issues or where they can be found in the Policy Manual.

Possibility for cost recovery through latecomer agreements: See Section 3.3.9 of the Policy Manual.

Surcharges for areas outside a corporate boundary: The District does not distinguish its charges inside or outside of corporate boundaries. The District does have surcharges to recover costs of system improvements, as shown in Tables B-6, 7, and 8 of the Policy Manual.

Differences between service within or outside an Urban Growth Area: The District does not distinguish its service inside or outside of UGAs.

Cost for up-sizing facilities: See Section 3.3.11 of the Policy Manual for upsizing extension projects. Also, for an individual customer to increase the size of a service or to add a second meter, see Section 2.3.19 of the Policy Manual.

Wholesaling water: The District negotiates agreements to deliver wholesale water on a case-by-case basis. These agreements are described in **Chapter 3**.

Wheeling water: Water purchased from the Everett is re-sold through the wholesale water agreements described above.

Procedures for granting or requesting project time extensions: Water availability letters are good for five years but can usually be renewed. Other than this, applicants set their own schedule based on specific needs of their project.

Guiding principles for "first-come, first served" policies: When a system begins to approach its capacity-limit based on facilities or water rights, the District tracks service commitments to assure that it does not promise service that would exceed available capacity.

Annexation: The District's preference is to continue serving where it has existing water facilities, even if an area becomes annexed by a city. Public utility district laws protect District facilities from condemnation. The District will consider adjusting service area boundaries for areas not yet receiving District water service, as long as this does not adversely affect future water service or cost recovery for the District's overall water systems. District agreements with Granite Falls and the City of Marysville (Marysville) contain sections that discuss annexation issues. If a city insists that it wants to purchase District water facilities in an annexed area, the District will consider negotiations on a case-by-case basis. However, as a general rule, the District will not agree to give up service areas where it has existing or planned facilities.

2.4.5 Satellite System Management Program

The District clearly has a role as an SMA because it is authorized to provide water service within the County. The District's first policy to implement a Satellite Water System Management Program was adopted on August 5, 1980 under Resolution 2409.

In 1994, DOH finalized its guidance and sent letters to purveyors already recognized as SMAs, inviting them to prepare submittals and become approved. The District completed this task by providing required information in its 1995 WSP. With its 2002 WSP, the District created a free-standing Satellite Management Program to describe how it manages the program and meets state requirements. The document can be found in **Appendix 2-3**.

Section 4 of the Policy Manual describes options to potential satellite system applicants. The District offers three options (1) direct service, in which the District owns the water system; (2) contract services, in which the District performs routine operation and maintenance for systems that are not owned by the District; and (3) support assistance, consisting of one time or long-term support to systems requiring assistance on a more limited scale. If an extension of the District's system is feasible, then satellite system ownership or management is not an option.

In addition to the above SMA service area adjustment described earlier, the District has revised its SMA Program Policies, Procedures and Conditions in the following manner:

- Identified more specific/stringent satellite system qualification and assessment criteria, including the requirement of substantive cooperation and support of key state agencies (e.g., DOH/Ecology).
- Clarified District policies and position regarding acceptance/rejection of proposed extension of service to new satellite systems that may fall within the District's future service area but are currently provided retail service by other municipal water purveyors.
- Clarified review process for state agency financing options and regulatory support.
- Clarified approval process criteria and factors, particularly pertaining to water right regulatory issues, inter-agency coordination, and project support relating to water system consolidations.

More specific detail regarding the SMA program changes can be found in Section 4 of the SMA policy manual.

2.5 Service Area Physical and Environmental Characteristics

A general description of the physical environment in the water service areas is provided in the following sections. A working description of the service area is useful in identifying the constraints that may affect the implementation and development of the District's water systems.

2.5.1 Climate and Precipitation

The climate of west central Snohomish County is dominated by marine influences bringing moist air into the interior of the County from Puget Sound and the Pacific Coast. The Cascade Mountains force the moisture laden clouds upward with a resultant release of moisture. The mountains also act as a barrier against extreme continental influences which occur east of the Cascades. The prevailing winds are from the southwest in winter and the northwest in the summer. The winds have a modifying effect on the climate. As a result of these conditions, the climate in the District's area is characterized by high rainfall and low evaporation rates in winter, while summers are cool and relatively dry.

In general, the District's easternmost water systems, Skylite and May Creek closest to the Cascade Mountains, experience the highest average annual rainfall. The District's westernmost systems (Kayak, Sunday Lake, and 212 Market & Deli) have the least amount of rainfall, experiencing the rain shadow effect of the San Juan Islands. This trend of increasing rainfall from east to west across the County is illustrated by data in **Table 2-1**, obtained from the Western Regional Climate Center. Thunderstorms are rare and approximately 70 percent of the precipitation falls during October through March. The driest months are typically July, August, and September. Late fall and winter can produce potentially damaging flood flows in the rivers, while low flow conditions are common in the summer.

Temperatures in the region rarely exceed the 80s, in degrees Fahrenheit (F), and only occasionally fall below freezing. As can be seen in **Table 2-2**, average temperatures are relatively consistent throughout the region. The mean average annual temperatures in the County are about 60 degrees maximum and 40 degrees minimum.

Table 2-2 | Weather Station Statistics from East to West

Weather Station Location	Average Annual Rainfall (inches)	Avg Max Temperature (F)	Avg Min Temperature (F)
Mount Vernon	32.30	59.1	41.8
Everett Junior College	36.72	59.1	42.6
Arlington	46.34	not available	not available
Monroe	48.43	60.6	42.2
Startup	65.40	60.8	41.4
Darrington Ranger Station	79.48	59.3	38.9

2.5.2 Topography and Elevation

The District's water systems serve a wide range of elevations. For instance, Lake Stevens Integrated serves customers ranging from 65 to 742 feet in elevation. To maintain service pressures within the level of service standards, the District's systems are split into many pressure zones which are described in **Chapter 4**. The *Soil Survey of Snohomish County Area, Washington,* published in 1983, describes the area as follows:

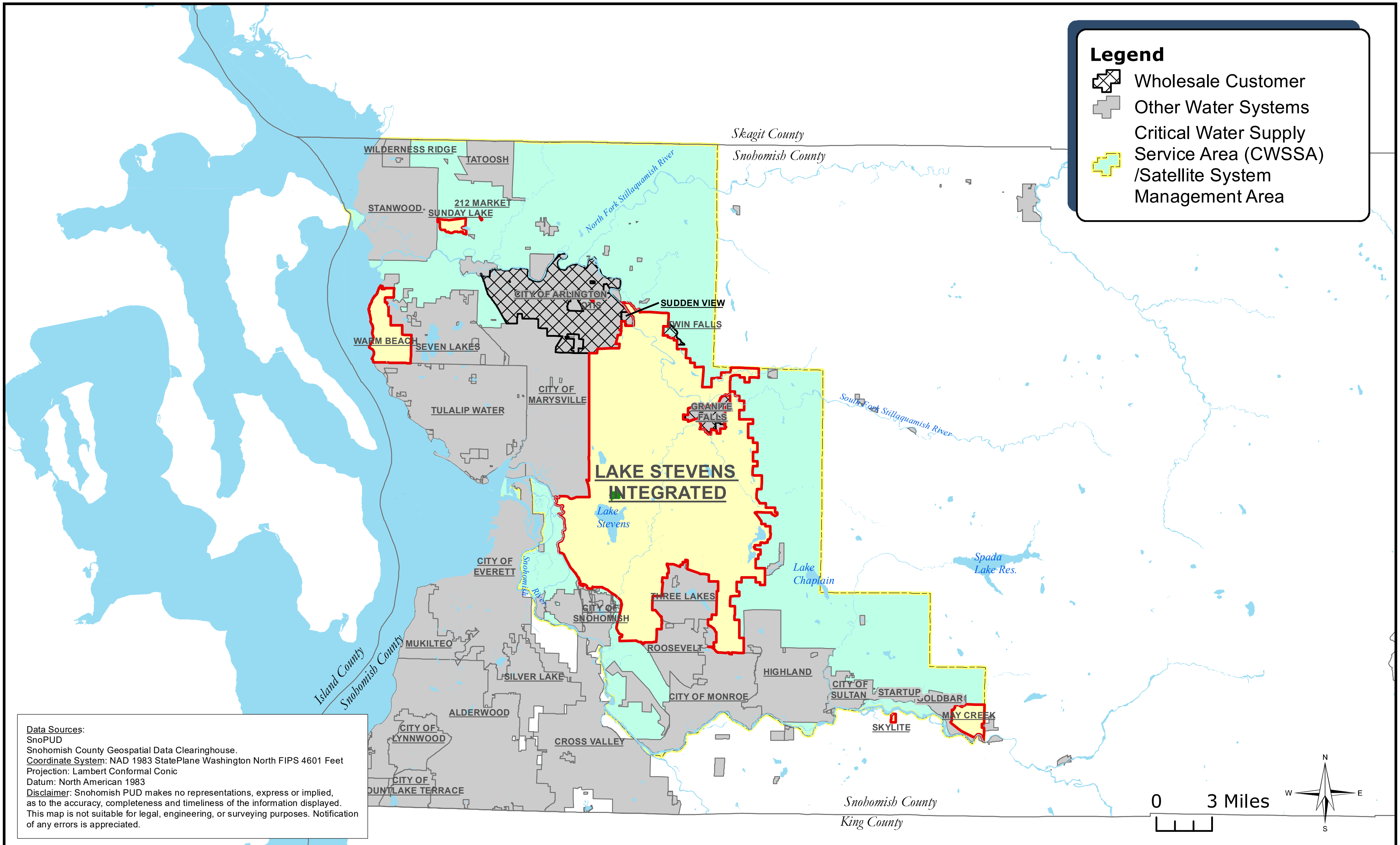
The physiography of the survey area is characterized by: (1) nearly level alluvial deposits along the major river valleys; (2) glacial till plains, outwash plains, and terraces in the middle part of the area; and (3) mountainous areas in the eastern part of the area. The basic drainage flow is from the mountains in the east to the Puget Sound in the west. The North Fork of the Stillaguamish River, along the northern edge of the survey area, begins at the town of Darrington and drains into the Puget Sound. The South Fork, which is in the center of the area, begins at Granite Falls and joins the North Fork at the town of Arlington. The Skykomish River begins at the town of Index in the southern part of the area, flows westerly through the towns of Sultan and Monroe, and joins the Snoqualmie River near the town of Snohomish to form the Snohomish River. The Snohomish River flows northwesterly through Everett to the Puget Sound.

2.5.3 Geology and Soils

Because the District's WSAs cover a large part of western Snohomish County, the full range of the region's geologic and soils conditions can be encountered in the construction of District water facilities. In the 1983 Snohomish County Soil Survey, soil scientists determined there are about 40 kinds of soil in the survey area, differing widely in texture, natural drainage, and other characteristics. Chapter 8, Source of Supply, describes of the geologic history and hydrogeology of the area and includes a detailed discussion of how these influence the District's groundwater sources.

2.5.4 Critical Areas

Critical areas include fish and wildlife habitat conservation areas, wetlands, geologic hazard areas, critical aquifer recharge areas and frequently flooded areas. Every seven years, local governments are required to review and, if necessary, revise their critical areas regulations to assure that they reflect "best available science" related to the protection and management of these areas. The County updated its Critical Area Regulation (CAR) in 2015. The CAR can be found in County Code Title 30, Chapter 30.62. Maps for a variety of critical areas categories can be downloaded from the County's website. These maps are useful to get a general sense of critical areas on a regional planning level. Detailed critical area mapping occurs during development review. The District also examines and considers critical areas when designing and constructing its water facilities.



murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD
2021 Water System Plan

Figure 2-1 Proposed District Water Service Area

December 2022

Project Number: 20-2733

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 3

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 3

Adjacent Systems, Related Plans and Agreements

This WSP was developed in coordination with other existing local WSPs, the CWSP, and with planning projections from county and city governments that partially or wholly encompass the District's service areas. The District intends to continue its cooperative relationship with local, state, tribal, and federal governments toward effective management of water resources in the county.

3.1 Adjacent Water Purveyors

Table 3-1 lists adjacent expanding water systems, including systems that have wholesale arrangements with the District. The locations of these systems can be seen in **Figure 2-1** and **Figure 2-2** in the previous chapter. Many additional non-expanding water systems exist inside the District's WSAs. These small existing systems (not shown in **Table 3-1**) are understood to remain independent during the planning period.

Table 3-1 | Adjacent Water Purveyors

Adjacent System Name	Residential Population[1]	# of Services[1]	Adjacent to	Receives Everett water?
Wholesale Water Provider				
Everett	103,000	28,605		
District Wholesale Customers				
City of Arlington	18,952	7,581	Lake Stevens Integrated	Partially
City of Granite Falls	3,647	1,437	Lake Stevens Integrated	Yes
City of Snohomish	10,200	4,827	Lake Stevens Integrated	Yes
Sudden View	60	24	Lake Stevens Integrated	Yes
Twin Falls	0	1	Lake Stevens Integrated	Yes
Other Adjacent Expanding Systems				
City of Marysville	67,820	27,362	Lake Stevens Integrated	Partially
Roosevelt Water Assoc	3,028	1,211	Lake Stevens Integrated & Storm Lake	Yes
Three Lakes Water Assoc	2,143	857	Lake Stevens Integrated & Storm Lake	Yes
City of Monroe	19,250	8,019	Storm Lake	Yes
Highland Water District	3,000	1,207	Storm Lake	Yes
Seven Lakes Water Assoc	5,557	2,298	Warm Beach	No

Adjacent System Name	Residential Population[1]	# of Services[1]	Adjacent to	Receives Everett water?
Tulalip Tribes	unknown	unknown	Warm Beach	Partially
Warm Beach Conference Grounds	540	181	Warm Beach	No
City of Stanwood	7,455	3,948	Sunday Lake	No
City of Sultan	4,650	1,985	Jackson	Partially
Startup Water District	643	269	Jackson/Sultan	No
City of Gold Bar	2,175	729	May Creek	No

Note:
1. From the DOH Water Facility Inventory records as of December 2019.

3.2 Related Planning Documents

Concurrence with land-use policies and with plans of other water purveyors is critical in evaluating the long-term adequacy of District water systems. The District maintains a library of WSPs from other water systems and works to stay abreast of city and county comprehensive plans. **Table 3-2** lists planning documents considered by the District when preparing this WSP.

Table 3-2 | Related Planning Documents

GMA Comprehensive Plans:	Year of Full Update[1]
Snohomish County	2015
City of Lake Stevens	2015
City of Granite Falls	2015
City of Marysville	2015
City of Gold Bar	2015
City of Snohomish	2016
Water System Plans:	**Year of Full Update**
City of Arlington	2015, amended 2017 and 2019
City of Everett	2014, 2020
City of Granite Falls	2013
City of Gold Bar	2015
Highland Water District	2016
City of Marysville	2016
City of Monroe	2015
Roosevelt Water Association	2014
Seven Lakes Water Association	Unknown
City of Snohomish	2020
Stanwood	2015
Startup Water District	2017
Sultan	2018
Three Lakes Water Association	2013, and 2019 limited update extension
Warm Beach Conference Grounds	2009 with 2014 & 2015 updates

Other Relevant Plans:	Year of Full Update
North Snohomish County CWSP	2016
Snohomish County Groundwater Management Plan (GWMP)	1999
Snohomish River Basin Salmon Conservation Plan	2005
Lake Stevens Sewer District, Wastewater Facilities Plan	2016
Regional Water Supply Outlook	2009

Note:
1. Comprehensive Plans are frequently amended in years between full updates.

3.2.1 Service Area Consistency

The MWL requires public water suppliers to describe how they have considered consistency with local plans and regulations. **Table 3-3** lists local planning elements that must be examined and where they can be found in this document.

Local governments in the District's service areas include the County, Granite Falls, Gold Bar, the City of Lake Stevens, and the City of Snohomish. The District mailed a copy of this WSP and a review checklist to each of these jurisdictions. A representative of the local government is asked to sign and return the checklist, certifying that the elements are consistent with adopted local plans and development regulations. The signed forms are in **Appendix 0-1**.

Table 3-3 | Consistency with Local Plans and Regulations

Local Government Consistency Element	Location in this Document
The WSA is consistent with the adopted land use and zoning within the service area.	**Section 2.3** and **3.2.2** **Figure 2-2** and **Appendix 3-3A**
The growth projection used to forecast water demand is consistent with the adopted city or county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	**Section 5.4** and **5.5**; **Table 5-7** and **Table 5-8**
For cities and towns that provide water service: All WSA policies of the city or town described in the plan conform to all relevant utility service extension ordinances.	Not Applicable
WSA policies for new service connections conform to the adopted local plans and adopted development regulations of all cities and counties with jurisdiction over the WSA.	**Section 2.4** **Appendix 1-1**

Local Government Consistency Element	Location in this Document
Other relevant elements related to water supply are addressed in the WSP, if applicable. This may include CWSPs, Regional Wastewater Plans, Reclaimed Water Plans, Groundwater Management Area Plans, and the Capital Facilities Element of local comprehensive plans.	North Snohomish CWSP: **Section 2.1.2**; **Appendix 2-1** County/City Comprehensive Plans: **Section 3.2.2** Other WSPs: **Section 3.2.2** Groundwater Management Plan: **Section 3.2.4** Wastewater/Reclaimed Water Plans: **Section 3.2.4** Watershed Basin Planning: **Section 8.1**

3.2.2 Land Use Plans and Zoning

County and city comprehensive plans and policies focus primarily on compliance with the GMA, which requires local jurisdictions to define UGA boundaries separating urban and rural areas. The GMA calls for phased development in urban areas to balance growth with transportation, infrastructure, employment, and economic development. The GMA also requires a rural element in county comprehensive plans to permit land uses compatible with rural character and to provide a variety of rural densities.

3.2.2.1 Snohomish County Comprehensive Plan

The County finalized its first GMA Comprehensive Plan in June 1995 and completed a 10-year update in 2005 and again in 2015, extending planning projections through 2035.

The General Policy Plan (GPP) within the County Comprehensive Plan establishes a framework of goals, objectives, and policies for more detailed planning and implementation that will occur in unincorporated UGAs and rural areas. The GPP has been amended several times since its first adoption with the current version becoming effective as of October 14, 2017. District planning for water service in these areas is restricted to densities shown on the Future Land Use Map in **Appendix 3-3A**, with allowances for rural cluster developments. (Rural clusters allow a greater number of smaller lots than underlying zoning in exchange for preserving open space.)

The Capital Facilities Plan (CFP) within the Comprehensive Plan establishes level of service standards, prioritizes needed facilities, and contains an inventory of County public facilities. The CFP also includes a Countywide Utility Inventory Report, which presents water system information and projected water facility needs compiled from the WSPs of major water systems in the county.

Table 3-4 summarizes the currently effective County 2035 population growth targets within rural areas (non-UGA) and within the UGAs that influence District water system growth. These growth projections are considered when developing water demand projections in **Chapter 5**.

Table 3-4 | City and County Population Growth Targets

Area	2011 Population	2016 Population	Target 2035 Population	Annual Growth Rates	
				2011-2016 (Actual)	2016-2035 (Target)
Arlington UGA	18,489	19,166	24,937	0.72%	1.62%
Gold Bar UGA	2,909	3,047	3,319	0.93%	0.45%
Granite Falls UGA	3,517	3,548	8,517	0.18%	4.72%
City of Lake Stevens UGA	33,218	36,615	46,380	1.97%	1.25%
Marysville UGA	60,869	65,164	87,798	1.37%	1.58%
Weighted average of annual growth rates for the above UGAs:[1]					
Non-UGA	123,349	121,287	140,125	0.82%	0.55%
Countywide	696,600	717,000	955,257	1.51%	1.12%

Note:

1. The weighted average of annual population growth rates for UGAs was determined by multiplying the growth rate in each UGA by the 2002 population within the UGA and then dividing by the sum of the 2002 UGA populations.

The County's 2035 growth targets are based on the Washington Office of Financial Management (OFM) medium countywide population forecast.

The County publishes routine Growth Monitoring Reports to compare actual demographic data with the growth projections. The 2011 and 2016 populations in **Table 3-4** were determined from the 2016 Growth Monitoring Report. Annual growth rates shown for 2016-2035 are the remaining annual growth required to reach the target populations by 2035.

Countywide, actual growth from 2011 through 2016 was slightly ahead of the growth needed to meet the revised 2035 targets. Rural growth was significantly slower than urban growth, which is consistent with goals of the GMA. Growth is likely to meet the 2035 targets even if it slows down over the next 15 years.

3.2.2.2 City Comprehensive Plans

The District provides retail water service in the entire City of Lake Stevens and wholesale water service to the entirety of Granite Falls. District water mains pass through Granite Falls to deliver water to rural areas north of the city. The District also serves retail water customers in a portion of Gold Bar, and the City of Snohomish. **Appendix 3-3** includes copies of land use maps for all of these cities. The District sells a limited amount of water to Arlington but has no facilities in Arlington's UGA. Therefore, a land use map for Arlington is not included with the appendix. **Table 3-5** lists the locations of each land use map.

Table 3-5 | City Land Use Maps

City/Entity	Appendix Reference
Snohomish County	3-3A
City of Lake Stevens	3-3B
Granite Falls	3-3C
Gold Bar	3-3D
City of Snohomish	3-3F

3.2.2.3 Anticipated Zoning and Land-Use Changes

The County and cities periodically review zoning and land use in response to proposals, which may be adopted as changes to their Comprehensive Plans. No further land use or zoning changes that would significantly affect the District's planning are currently anticipated.

3.2.3 Related Water System Plans

Because the District purchases water from Everett and Marysville, the District communicates projected water demands for inclusion in their planning processes. Similarly, because the District provides wholesale water to Granite Falls, Arlington and Snohomish, the District verifies that its water supply plan reflects the projected demands of these systems.

3.2.3.1 Everett 2020 Water System Plan

Everett is the predominant water supplier in the County. Everett's WSP estimated that, in 2018, 615,000 people out of 805,120 people in the County received Everett water either directly or indirectly. This works out to 76 percent of the County population receiving Everett water. The WSP counted 31 Group A and 66 Group B water systems purchasing Everett water directly, and 11 systems purchasing indirectly through other systems.

Everett examined the plans of its wholesale customers for historic water demands, peaking factors, and demand forecasts. Water demand forecasts were developed for each wholesale customer and for Everett's retail service area (RSA). These were summed to determine the total forecasted demand for Everett water. Everett concluded its surface and groundwater rights can meet average day water and maximum day demands beyond the 2040 planning period. A yield analysis concluded that climate change has potential to negatively impact Everett's safe yield, but surface water will be available to meet Everett's projected 2040 average day demand (ADD). Everett's WSP identifies alternative water sources that can be developed for longer-term water supply needs, including the Snohomish Regional Water Authority water right, additional reclaimed water, and unused groundwater rights.

Chapter 5 of Everett's WSP includes a water conservation plan developed by the Everett Water Utilities Committee (EWUC). The District is an active participant in this committee, and this conservation plan plays a crucial role in the District's Water Use Efficiency Program.

3.2.3.2 Marysville 2016 Water System Plan

Under a JOA with Marysville, the District and the Tulalip Tribes are entitled to a share of water delivered from a transmission main that conveys water from the Everett 3-line. Marysville's WSP observed that water purchased by the District from this shared transmission line ranged from 164 MG to 258 MG between 2007 and 2014. The amount of water purchased increased significantly in 2014 due to a change in the location JOA flow control valve, which allowed the District to increase pumping from this line. Marysville projected future District usage to grow proportionally with population increase with the city for the 20-year planning period, resulting in the District purchasing approximately 2.27 million gallons per day (MGD) (1,573 gallons per minute [gpm]) in 2036.

Marysville's WSP projects its retail customer demands with the following water use factors, determined as an average of the city's 2007-2014 records.

- 101 gallons per day (gpd) per capita in 2014, including distribution system leakage,
- Assumed future demand of 97 gpd per capita,
- 162 gpd per single-family household (average from 2010 to 2014),
- A maximum day to average day demand (MDD/ADD) ratio of 2.14

In 2013, consistent with a 2003 Agreement between the Marysville and the District and as amended in 2011, Marysville purchased and took ownership of District water facilities located inside its annexed city limits, as shown in **Appendix 3-3E**. The area transferred to the Marysville consisted of approximately 113,404 linear feet of water mains (4 inches - 12 inches), 168 fire hydrants, and 1,800 water services/customer connections.

3.2.3.3 Granite Falls 2013 Water System Plan and Update

Granite Falls was in process of updating its 2013 WSP while the District prepared its update. Granite Falls provided their key planning data shown in **Table 3-6** so that the District could achieve consistency in the planning efforts.

The District sells wholesale water to Granite Falls through three master meters and provides water storage for the city. Granite Falls paid for its share of transmission and storage for existing customers as part of the Granite Falls Regional Project. Source and storage for new city customers is assured as the city forwards a portion of its water connection fees to the District to pay for the additional transmission and storage impacts.

Granite Falls' wells are equipped with pumps but are disconnected from the system. Granite Falls occasionally uses its wells to supply non-potable bulk water to nearby quarries and for other non-potable purposes.

The Granite Falls WSP update will assume a water use factor of 143 gpd/ERU (compared to 155 gpd/ERU in their 2013 WSP). The MDD/ADD ratio for data in **Table 3-6** works out to 2.6, compared to 2.3 MDD/ADD in their 2013 WSP.

Table 3-6 | Granite Falls Projected Water Needs

Year	Projected year end population	Projected Avg Day Requirements (gpd)	Projected Max Day Requirements (gpd)	Projected Peak Hour Requirements (gpm)
2020	4,425	364,059	951,614	1,155
2021	4,720	380,549	994,719	1,207
2022	4,918	397,787	1,039,777	1,262
2023	4,992	415,806	1,086,875	1,319
2024	5,067	434,640	1,136,107	1,379
2025	5,143	454,328	1,187,569	1,441
2026	5,220	474,908	1,241,362	1,507
2027	5,298	496,419	1,297,591	1,575
2028	5,430	518,905	1,356,368	1,646
2029	5,783	542,410	1,417,807	1,721
2030	6,170	566,980	1,482,029	1,799
2035	8,343	707,563	1,849,501	2,245
2040	**9,814**	**883,005**	**2,308,089**	**2,801**

3.2.3.4 Arlington 2015 Water System Plan, Amended in 2019

Because Arlington is another expanding water system that purchases water from the District, it is important to consider their projected water needs. The District's contract to supply water to Arlington is limited to a maximum flow rate of 1,000 gpm. Because it appears Arlington will not need additional purchased supply, the District will focus on assuring it can continue to meet the 1,000-gpm contractual commitment at the master meter location.

According to Arlington's 2019 amendments to its 2015 WSP, the city plans to increase the capacity of its wells to match its water rights. When these improvements are constructed, the city expects to have sufficient water supply through 2064. The District's agreement with Arlington does not include storage.

Arlington's WSP points out that the District's Otis Water System is adjacent to a proposed subdivision and that the city might want to acquire the Otis system in the future. The Otis system is located just outside of the Arlington UGA boundary.

Water use factors in Arlington's WSP are:

- 90 gpd per capita (average between 2005-2014), including distribution system leakage,
- 187 gpd per single family residence (167-204 gpd per ERU in 2005-2014), and
- 1.75 MDD/ADD.

3.2.3.5 City of Snohomish 2020 Water System Plan

In 2020 the District and the City of Snohomish entered into a wholesale water supply agreement (see **Appendix 3-2**). The agreement allows the City of Snohomish to serve its existing transmission line customers, served previously by its Water Treatment Plan Facility which they decommissioned in 2017, through an existing 2-inch master meter. The agreement contains a provision that would allow the City of Snohomish to upsize this water meter or to install additional master meters at their expense if they need additional water supply capacity from the District in the future. Further description of this agreement is provided in **Section 3.3.8.**

See **Section 2.2.1.6** for a description of the District's proposed service area changes in relation to the City of Snohomish.

3.2.3.6 Water System Plans of Other Adjacent Purveyors

The WSPs of other adjacent purveyors have been reviewed. The District is not aware of anything in the remaining plans that would impact the District's WSP.

3.2.3.7 Previous Editions of District Water System Plans

The District has prepared many WSPs since beginning its water utility operations in 1946. The level of detail in the plans increased as regulatory requirements have been added. The last update was in 2011. **Table 1-3**, in **Chapter 1**, lists the projects completed since the 2011 WSP. For the most part, completed projects are consistent with the improvement plan in the 2011 WSP. Some funds and resources intended for replacing old water mains were used to accommodate unexpected county projects and the consolidation of the Warm Beach system, resulting in some delay to the District's pipe replacement program; however, the District still believes it is on track to have the majority of the oldest AC water main replaced by 2028 as shown in the capital facilities planning chapter.

3.2.4 Other Relevant Planning Documents

3.2.4.1 North Snohomish County Coordinated Water System Plan

The District is a member of NSWUCC. This group of water suppliers work together to create the North Snohomish CWSP, mostly recently updated in 2010. The 2010 CWSP Update sets minimum standards that must be followed by all water systems in unincorporated parts of the CWSSA. It also designates service area boundaries for each system to prevent overlapping or redundant water service.

More information on the CWSP can be found in **Chapter 2**.

3.2.4.2 Regional Water Supply Outlook

The Regional Water Supply Outlook (Outlook) is a regional assessment of municipal water supply and demand throughout King, Pierce, and Snohomish Counties. The Outlook was developed by the Water Supply Forum (Forum). The Forum is a voluntary organization comprised of representatives from water utilities and local governments. District participation occurs through its involvement in the EWUC, which is a Forum member. As part of this effort, water demand data was gathered from 118 water utilities in the region that serve greater than 500 customers. These utilities provide water to more than 94 percent of the area population.

The Forum issued full Outlook reports in 2001 and 2009 with an abbreviated Regional Water Supply Update in 2012.The Outlook describes how conservation efforts have significantly reduced water demands since 1990. The Executive Summary of the 2009 Outlook states that water use by single-family homes was 276 gpd in 1990 compared to 197 gpd in 2005. The Seattle, Tacoma, and Everett areas use less water today than 40 years ago, despite significant population growth. Primary reasons for this reduction are water metering and increasing water rates. Other reasons include a reduction in water use by the region's industries, plumbing code changes, utility conservation programs, efforts to reduce distribution system leakage, and lingering changes in habits from water short years.

Table 3-7 summarizes the weighted average water use factors for single-family, multi-family, and non-residential customer classes in each county and the region for 2004-2006, in addition to sub-area averages determined for Snohomish County. The weighted averages were computed based on usage reported by each utility weighted by the number of households in each utility's service area. Weighted averages for non-residential water use were determined by matching the non-residential usage from the water utility surveys with employment populations from Puget Sound Regional Council (PSRC) demographic data.

Table 3-7 | Regional Average Water Use in 2004-2006

	Single-family (gpd/unit)	Multi-family (gpd/unit)	Non-residential (gpd/employee)
King County weighted average	193	124	41
Pierce County weighted average	244	167	78
Snohomish County weighted average	220	131	57
Regional Weighted Average	210	142	65
Range of individual water system data	130-370	40-255	21-265
Snohomish County PUD No. 1 (Lake Stevens Integrated System)	215	70	38
Everett (Retail and Wholesale) weighted average	219	133	57
Rest of Snohomish County weighted average	226	109	60

Data reported for the District in this study is included in **Table 3-8** for comparison. The District's single-family water use factor of 215 gpd per unit in 2004-2006 corresponds closely with County and Everett regional weighted averages. The low water use factor indicated for the District's multi-family customers may be due to the study's methodology for counting multi-family units in the District's service area. For non-residential usage, the District's result is reasonably close to the weighted averages.

The Outlook also observes that MDD/ADD ratios in data reported by the water systems ranged from 1.4 to 3.0. The average ratio among the surveyed water providers was 2.2. Generally, larger water systems with more commercial and industrial users had lower peak day factors.

Work for the 2009 Outlook included preparation of a Municipal Water Demand Forecast Model (Model) to forecast water needs by decade from 2010 through 2060 and to extrapolate the regional water demand to 2110. The Model tested several scenarios including variations of demographic growth and climate change. Under all scenarios, the Outlook found that existing active water supplies in the region can meet projected demands through 2050, but localized water shortages may exist where infrastructure is unavailable or inadequate to move water where it is needed. In the baseline and the low demographic scenarios, existing drinking water supplies could meet demands until 2060 or beyond.

After 2050, there could be shortages in water supply if climate change materializes as forecasted and/or if population growth is greater than the baseline demographics. Climate change scenarios in the model predict that available surface water supply will decrease, and projected water demands will increase. The model predicts that stream flows will be greater in the winter/fall months and lower in the spring/summer months compared to historical conditions, and that this impact widens over time. The model also predicts that customer water demands could be as much as 12 percent greater by 2060 due to the dryer spring and summer months. These projections assume no changes to reservoir operation and management and no new water supplies or additional conservation. Area utilities have adapted to past water supply fluctuations and drought periods through reservoir management, system adaptations, long-term conservation programs, and short-term curtailments. Climate change may increase these challenges, and utilities must be prepared to address such uncertainty in addition to planning for long-term supply availability.

Looking to the future, the Outlook examines potential water supply projects that water utilities have been studying and planning, plus other possible new projects. The projects are categorized into surface water, groundwater, desalination, reclaimed water, and green options. Unit costs of the identified projects ranged from $50 to $43,000 per MG of water produced. The Outlook provides information on these potential water supplies, but does not recommend which, if any, should be developed. However, the Outlook does propose a multi-criteria evaluation method that can be used by decision-makers in the region to compare supply options using a consistent and transparent approach.

The 2012 report update noted plateaued water use due to conservation and the departure of the Kimberly-Clark paper mill from the region. The update included a new 50-year demand forecast which predicted 2060 demands at approximately 70 MGD, approximately 100 MGD lower than the 2007 forecast for 2060. The report showed a similar trend for major adjacent water supply purveyors such as Tacoma Water and Seattle Public Utilities. These conservation measures as well as better stewardship of regional supply sources means that "The central Puget Sound region has sufficient water for at least the next 50 years, given considerations of growth in the region and the potential impacts of climate change."

3.2.4.3 Watershed Basin Plans

District water facilities are located in two Ecology Water Resource Inventory Areas (WRIAs): the Stillaguamish Basin WRIA 5 and the Snohomish Basin WRIA 7. Planning efforts for these basins are described in **Section 8.1**.

3.2.4.4 Groundwater Management Plan

The County developed its draft Groundwater Management Plan (GWMP) in 1999. The GWMP provides a framework for protection of ground water resources within the County. The Surface Water Management Division of the County Public Works Department is the lead agency for implementing the GWMP.

The County developed a Ground Water Management Program as a direct result of the GWMP. The program objectives include:

- Providing the public with data on the groundwater resources of the County by compiling groundwater data and creating an on-line groundwater database.
- Preparing a subarea groundwater study to evaluate groundwater issues and recommend solutions at a local scale.
- Providing stewardship of groundwater in the County by recommending and implementing actions to protect groundwater quality for residential consumption and groundwater quantity for aquatic ecosystems.
- Providing management, policy, and technical expertise to help protect the quality and quantity of the groundwater resources in the County.
- Identifying development standards, policies, and regulations that would protect recharge to groundwater, prevent groundwater contamination, and maintain groundwater inputs to stream base flows.
- Coordinating and implementing groundwater management alternatives with purveyors, County departments, state, and federal agencies, and interested parties as set forth by the GWMP.

The County's groundwater database has been a useful reference for the District, as it combines information from multiple data sources.

The subarea study mentioned above is the draft Getchell Plateau Groundwater Investigation, published in June 2005. The Getchell Plateau was selected for the study because residents in the area are highly dependent on groundwater for potable water and because groundwater systems beneath the Getchell Plateau are representative of other County groundwater systems. The area covered by the investigation extends from the City of Snohomish to Arlington and from Marysville to Granite Falls, which pretty much covers the Lake Stevens Integrated WSA.

This investigation developed a picture of groundwater availability as both a source of potable water and as source of discharge to lakes, streams, and wetlands. The investigation also examined the potential impact of future urban and rural development on groundwater quality.

3.2.5 Review of Reclaimed Water in Other Planning Documents

The 2003 MWL and the amended Reclaimed Water Statute RCW 90.46 require water systems serving one thousand or more connections to evaluate opportunities for the use of reclaimed water. This section describes the District's review of local planning documents to: (1) identify where reclaimed water production facilities and reclaimed water distribution lines exist; and (2) identify where reclaimed water is used or proposed within the District's water service areas. Additional elements to evaluate reclaimed water opportunities are addressed in **Chapter 6**.

3.2.5.1 Reclaimed Water and Lake Stevens Sewer District Comprehensive Plan

The District has a close relationship with the Lake Stevens Sewer District (Sewer District), considering that Lake Stevens Integrated is the heart of the District's largest water system. The Sewer District's 2016 Wastewater Facilities Plan evaluated the potential for wastewater reclamation and reuse.

The Sewer District's wastewater treatment facility (WWTF), completed in 2012, does not have sufficient storage volume for either bypass or reclaimed water. The Sewer District's National Pollutant Discharge Elimination System (NPDES) Permit allows for discharge to Ebey Slough, and because of this, bypass and reclaimed water storage are not a requirement for the WWTF. Currently, the Sewer District can meet its NPDES discharge limits and not meet requirements for "Class A" Reclaimed Water.

Potential reuse options include offsets to existing water rights, irrigation or landscaping use, flushing of sanitary sewers and industrial use. For reclaimed water to be economically feasible, the cost of producing and distributing reclaimed water must be less than the cost of purchasing water. Currently, the Sewer District has determined that water reuse is only cost effective for sanitary sewer flushing.

3.2.5.2 Reclaimed Water Evaluation by Granite Falls

The Granite Falls 2013 WSP states the potential for reuse within the water system. Granite Falls currently reuses non-potable water at the wastewater treatment plant for equipment wash down. In order to use more reclaimed water, additional wastewater treatment process capacity would be required for reuse, in addition to new pipeline and pumping capacity. Granite Falls has also determined that there are limited opportunities for reuse within the city as a majority of the water use within the city is residential use. Therefore, expanding its reclaimed water program has been deemed infeasible at this time. Granite Falls will continue to perpetually re-evaluate reclaimed water opportunities.

3.2.5.3 Reclaimed Water Reuse by Everett

Reclaimed water use projects by Everett are beneficial to the District because of the shared Sultan Basin water supply. In 2005, Everett began providing reclaimed water for use as single-pass non-contact cooling water in Kimberly-Clark's paper mill bleach plant heat exchanger. When the plant closed in 2012, this was discontinued, resulting in no remaining significant reclaimed water customers.

Everett has reviewed the feasibility of providing reclaimed water to other customers. Everett has identified potential customers for reclaimed water including two city-owned golf courses and the private Everett Golf and Country Club. Everett's Legion Golf Course is within one mile from the Crosstown Line. However, in order for Everett's reclaimed water to be used by these customers, it would need to be treated to a tertiary effluent level, most likely to a Class A reclaimed water standard, and additional permitting would be required.

Everett does not have plans to provide reclaimed water to other customers in the next 10 years, due to the high infrastructure cost to treat and deliver the water and the fact that there is not a near-term need for additional water supply.

3.2.5.4 Reclaimed Water Evaluation by Marysville

Marysville also has a wastewater treatment plant. Marysville's 2016 WSP indicates that significant investments would be needed to install advanced treatment technology and a delivery system to customers that could put the water to use. Marysville does not currently have any plans to implement a reuse strategy but will periodically evaluate opportunities for reuse in the future.

3.3 Agreements with Other Water Systems

Table 3-8 lists relevant interlocal agreements that the District shares with cities and other water utilities. Numbers in the table correspond to the order of the agreements in Appendix 3-2. The following summaries are provided for information only.

Table 3-8 | Relevant Water Agreements

	Agreement	Dated	Effective Through
	Everett Water Supply Agreements		
1	Agreement for Multipurpose Development of the Sultan River	July 21, 1960	The duration of the Federal Energy Regulatory Commission (FERC) license, provided that the agreement will be renegotiated after 2031
2	Amended Agreement for Multipurpose Development of the Sultan River	November 17, 1981	The duration of the FERC license, provided that the agreement will be renegotiated after 2031
3	Supplemental Agreement Between the District and Everett	October 16, 2007	Addendum to the 1960 and 1981 agreements
4	Everett Water Rates Ordinance 3721-21	February 12, 2021	No end date.
	North Snohomish County Joint Operating Agreements (JOA)		
5	North Snohomish County Regional Water Supply JOA	January 10, 1991	No expiration date, but requires further agreements to be developed
6	Everett and JOA Participants Water Supply Contract	June 15, 2021	December 31, 2050
7	2003 Agreement between Marysville and the District for Water Supply	June 23, 2003	The life of the JOA Pipeline subject to review and modification every 10 years
	District Wholesale Water Agreements		
8	Gold Bar	November 4, 2013	December 31, 2026
9	Arlington	July 28, 1998	December 31, 2018 and thereafter unless terminated by mutual agreement or upon 5 year written notice of either party.
10	Sudden View	January 1, 2020	December 31, 2029
11	Twin Falls (aka Seymour's Water Company)	January 6, 2020	December 31, 2029
12	Granite Falls	November 4, 2020	December 31, 2040
13	City of Snohomish	November 20, 2020	December 31, 2040
	Water Service Area Agreements		
14	Gold Bar Settlement and Release Agreement	June 18, 2001	January 2020 (Update No. 16 below)
15	3.3.9 CWSP Service Area Agreement	January 29, 1997	No end date.
16	Water Service Area Agreement Between PUD May Creek Water System and the City of Gold Bar	December 13, 2021	No end date. Agreement shall remain in effect unless terminated by written mutual agreement or upon one (1) year written notice by either party
17	Three Lakes Service Area Agreement	2010	No end date. Amended in 2011.

	Agreement	Dated	Effective Through
18	Letter from Monroe regarding temporary water service	November 5, 2010	No end date.
19	Agreement with Roosevelt Water Association, Three Lakes Water Association, Inc, and Meadow Lake Water Association	August 2011	No end date.
20	Revised Agreement with WBWA, the District – Kayak, and Seven Lakes Water System	February 2016	No end date.
	Other Agreements		
21	Tulalip Settlement Agreement regarding May Creek Water Right	November 6, 1999	Binding
22	Sultan Water Supply Pipeline Construction, Operation, and Maintenance Agreement	April 25, 2000	
23	Water and Sewer Mutual Aid Agreement	August 15, 2006	Binding until a purveyor revokes its authorizing action and delivers a copy to the Everett Utilities Director
24	Mutual Aid Agreement for Intrastate Water Utilities	September 15, 2009	Termination in its entirety when there are less than two Members

3.3.1 Sultan River Agreement

The *1981 Amended Agreement for Multipurpose Development of the Sultan River* updates an earlier 1960 agreement between Everett and the District (with amendments/supplements in 1981, 2007, 2008, 2009, 2012, and 2017) to build and maintain hydroelectric and water supply facilities in the Sultan River Basin, now collectively known as the Henry M. Jackson Hydroelectric Project. As will be described in the next chapter, the construction of the Jackson Project increased storage available for Everett's primary water source in addition to creating the District's Jackson Hydroelectric Plant. The agreements divide the project costs into water costs, hydroelectric costs, and joint costs and describe how the District and Everett will jointly operate the Jackson Project.

The District initially funded and constructed the Culmback Dam Stage I facilities, which were completed in 1965. The agreement specified a payment plan for Everett to reimburse half of the Joint Costs and all of the water costs. For Stage II, the District covered 25 percent of the filter plant costs and the entire cost of raising the dam and associated facilities, because Everett did not need additional storage at the time. When Everett's water use reaches 140 MGD as a three-month average (1981 Amended Agreement), or when it exhausts the 11 billion gallons of storage in Culmback Dam Stage I and the 2.6 billion gallons in Lake Chaplain in three separate water years (2017 Am. Agmt), it will repay half the Stage II joint use facilities up to $10M over a 30-year period, with interest accruing from the time it reaches the usage limit.

The 1981 Amended Agreement, Article VII, states that water supply will continue to have precedence over power generation up to 225 MGD to the year 2020 but adds a restriction that water distribution is limited to a portion of the County specified by Exhibit A in the agreement. This does not change the fact that Everett's water rights allow the water to be used throughout the County, and long-term planning still supports this use. However, the self-imposed limit will apply until 2020 unless the District and Everett agree to another amendment.

In the article of the 1981 agreement on water rates and service, Everett agrees to sell water to the District for re-sale to potential customers, provided that Everett has first option to serve previously un-served areas of the County on the same terms that the District would serve. Everett also agrees to charge reasonable rates to all city water customers whether such customers are inside or outside of Everett. A copy of Everett's current water rate ordinance is included in **Appendix 3-2**.

That same 2007 supplemental agreement (refined in 2008, 2009, and 2012) documented that the District and Everett entered into a supplemental agreement that, conforming to a declaratory order by the FERC, Everett was not required to be a licensee for any future FERC license for the Jackson Hydroelectric Project following the expiration of the existing FERC license in 2011. Everett will continue to cooperate with the District with respect to the operation of the project consistent with the requirements of the 1960 and 1981 Agreements, as amended and supplemented. The 2017 Amended Agreement detailed the criteria for sharing of operations, maintenance, repair, and construction costs related to the Jackson Project, specifically for those Project elements that provided mutual value to both Everett and the District.

3.3.2 North Snohomish County Joint Operating Agreements

The District shares in the use of a 30-inch diameter pipeline (the Joint Operating Agreement Pipeline referred to herein as the JOA Pipeline) that delivers water from the Everett 3-Line to the Sunnyside vicinity of Marysville. Three agreements govern this arrangement, as described below.

3.3.2.1 North Snohomish County Regional Water Supply JOA

This agreement, executed on January 10, 1991, establishes initial arrangements between Marysville, the District, and the Tulalip Tribes (JOA Participants) so that construction of the JOA Pipeline could begin. The pipeline is owned by Marysville with each participant paying a proportionate share of the construction cost based on their percentage of a forecasted 2010 peak day demand. Before construction completion, the participants expected to develop more detailed procedures for managing, operating, maintaining, and financing for the pipeline and associated facilities. If water use by a participant exceeds its capacity rights, the remaining participants will lease back their unused rights until additional regional facilities are constructed, as also anticipated by the agreement.

3.3.2.2 Everett and JOA Participants Water Supply Contract

The original 1991 agreement between the City of Everett and JOA Participants was updated and approved by all parties in June of 2021. The agreement establishes the terms in which the City of

Everett agrees to supply water to the JOA Pipeline and Participants. The critical provisions of the agreement include the following:

- Everett agrees to deliver and sell up to 20 MGD to the JOA Participants from the existing tap owned by Marysville located at 87th Avenue SE and 20th Street SE
- An Operating plan shown as Exhibit B in the agreement was developed to accommodate the operational needs of the parties
- If peak flow ratios (peak flow/average flow) become an issue that adversely affects Everett's ability to deliver water under the conditions of the contract, a committee of the Participants will be convened and charged with modifying the Operating Plan in such a manner to reverse effects of peaking. If this effort is unsuccessful, Everett reserves the right to implement, and the Participants agree to pay, a demand charge as may be established by Everett ordinance
- Everett shall deliver high quality drinking water that meets all State and Federal standards at the point of delivery
- Rates and charges shall be established by ordinance of Everett from time to time
- Participants must obtain approval from Everett before selling the water to a future customer through a connection larger than 12 inches or more than 1 MGD and indicates that the decision would be based on water supply impacts to the Everett water system.
- Participants are restricted to providing water in the areas outside the service area shown in Exhibit A of the agreement.

3.3.2.3 Agreement with Marysville for Supply from the JOA Pipeline

This 2003 agreement details arrangements between the District and Marysville, including a charge to compensate Marysville for the operation and maintenance cost of making the water available at the District's point of connection. By the time of this agreement, the District's assigned capacity was determined to be 16.55 percent of the JOA Pipeline capacity, or 2,375 gpm over 24 hours, whichever is greater.

3.3.3 Gold Bar Agreements

The District has an emergency interconnect with Gold Bar. A copy of the current 2013 agreement is provided in **Appendix 3-2** for information.

Also, a 2001 agreement with Gold Bar modified the service area boundary between the city's water system and the District's May Creek Water System. Negotiations for this agreement occurred sporadically from 1992 until the signing of the agreement. The parties agreed to adjust boundaries so that portions of the area where the District did not already have water facilities were transferred to Gold Bar's future service area. The District continues to serve an area inside the city limits where District water facilities existed prior to annexation. Until 2020, the parties agree not to "contest" each other's water service area boundaries.

On December 13, 2021, the District and Gold Bar executed a new water service area agreement that maintains, with the exception of two residential properties already served by Gold Bar, the retail and future service area boundaries shown in the 2001 Settlement and Release Agreement and the parties respective boundaries shown in their current water system plans. A copy of the new 2021 service area agreement is provided in **Appendix 3-2** for information.

3.3.4 Arlington Wholesale Water Agreement

The District's 1998 agreement with Arlington was designed to provide water to the city through a wholesale master meter identified in the District's 1995 WSP. The District agreed to provide up to 1,000 gpm by 2002. Arlington agreed to consume the water in a manner to minimize its peaking factor, determined as a ratio of annual peak day to ADDs. This is accomplished by a flow control valve at the master meter and by Arlington's use of the connection as a base source of supply with demands in excess of the agreed amount being supplied by Arlington's other sources.

Wholesale water rates paid by Arlington are based on Everett's water rates plus the District's cost of pumping, conveyance, administration, and depreciation. The rate is adjusted annually, effective April 1st of each year, in accordance with cost components listed in Exhibit 2 of the agreement. The District aims to notify Arlington at least 45 days before each rate change becomes effective.

Arlington paid a GFC for 1,820 ERUs, determined by dividing 1,000 gpm by 0.55 gpm per ERU. The District committed to provide the water between 650 and 726 feet hydraulic grade line (HGL) at the master meter location. The agreement says the District's system will have sufficient capacity to supply the water in accordance with the agreement. Arlington provides its own water storage, as described in its WSP.

The District and the Arlington are beginning negotiations on a new wholesale water service agreement with the hope to complete the new agreement in 2022.

3.3.5 Sudden View Wholesale Water Agreement

In 1999, the District entered into a standard Developer Extension Agreement with Iliad, Inc. to extend a water main to resolve capacity issues in the Sudden View system. As construction neared completion, the District and Iliad entered into a Wholesale Water Agreement to define ongoing arrangements for delivery of the water. The agreement was renewed in 2010 and again in 2020. Key points in the current agreement are:

- The agreement is intended for 48 ERUs.
- If Iliad wants to connect more than 48 homes or to connect a non-residential customer, it must first contact the District for written agreement.

- The wholesale water rate is the District's Commercial Water Rate.
- Iliad must keep its well disconnected from the system.
- Iliad must annually test the cross-connection control assembly and submit the results to the District.
- Iliad will pay the District's GFC charge for each new connection to the system. To date, Iliad has paid for 22 of the 48 ERUs, and 26 ERUs remain available. If a connection is made without the GFC payment, Iliad will pay 12 percent annual interest on the amount due from the time the connection was made.
- Iliad must submit an annual report by January 15th each year, listing the current customers. If Iliad fails to submit the report, a 30 percent surcharge can be added to the water bill after January 15th until the report is submitted.
- If Iliad fails to produce the annual report on more than one occasion or fails to pay a GFC when due, the District can collect all remaining GFC payments for the 48 ERUs.
- Iliad is responsible for maintaining water quality beyond the master meter.
- The District aims to provide the water at a hydraulic grade line above 600 feet, in the absence of a fire flow or water main break event.
- The hydraulic capacity of the Sudden View system does not include fire flow, and the maximum instantaneous flow for 48 ERUs is expected to be 103.1 gpm.
- Iliad is responsible to install and maintain pressure reducing and pressure relief valves to protect the Sudden View distribution system and its water service customers.

3.3.6 Twin Falls Wholesale Water Agreement

Twin Falls is a small water system owned by the Seymour Water Company and designed to serve up to 14 homes, with its own BPS and equalizing storage. The District preferred to provide water through a master meter, rather than owning and maintaining these water facilities. The District's wholesale agreement with Twin Falls is less detailed than the agreement with Sudden View because all fees were paid up front. Key points of the Twin Falls agreement are:

- The agreement is intended for a maximum of 14 ERUs.
- To serve more than 14 homes or to connect any non-residential customer, Twin Falls must contact the District for written approval. Any capacity not achieved through the 1 ½-inch meter would require payment of additional GFCs and installation of a larger meter.
- The wholesale water rate is the District's Commercial Water Rate.

- Twin Falls must annually test the cross-connection control assembly at the master meter and submit the results to the District.

- The District aims to provide the water at a hydraulic grade line above 500 feet at the master meter, in the absence of a fire flow or water main break event.

- Twin Falls is advised of potential low chlorine concentrations and high disinfection byproduct concentrations due to its long distribution and service lines and because of possible low water usage patterns. Twin Falls is responsible for any distribution system disinfection and flushing to maintain potable water quality for its customers.

3.3.7 Granite Falls Wholesale Water Agreement

The District's 2020 agreement with Granite Falls replaces a previous 2009 agreement.

Key features of the agreement are:

- Three existing master meters define the point of delivery from the District's system to Granite Falls' Water System. The master meters are owned and maintained by the District. Additional master meters can be installed at Granite Falls' expense. There are currently plans in place to establish a new fourth master meter in the vicinity of Gun Club Road to replace the master meter that was abandoned on Portage Avenue in 2018 at the request of the City.

- The District aims to provide water between 716 and 726 HGL at the master meter locations during normal operation. The regional water supply project can support a maximum flow of 3,000 gpm through the combined master meters for two hours. Granite Falls owns and maintains control valves on the downstream of the master meters to regulate pressure.

- Granite Falls will retain its wells and water rights for non-potable use. If it decides to reconnect the wells to its distribution system, it will install backflow prevention measures at the master meters.

- "Direct Service Customers" will continue to be allowed within Granite Falls' Retail Water Service Area; however, subject to the revised 2020 Wholesale agreement the following new conditions will apply:

    - Granite Falls will be billed the District's current retail rate for each existing and new Direct Service Customer.

    - Connection to a District water main inside Granite Falls' Retail Water Service Area is not intended to be permanent and over time those services will be transferred to a permanent Granite Falls water main; therefore, the District will waive the Distribution System Charge (DSC) for any new Direct Service Customer connected to an existing District water main within the Granit Falls Retail Water Service Area, after the date of execution of this Agreement. The District's DSC; however, will still be charged to new Direct Service Customers outside of the Granite Falls RSA but inside its future service area.

  - All applicable customer service fees associated with a Direct Service Customer (e.g., shut-off, turn-on, and miscellaneous connection fees, etc.) shall be billed to Granit Falls as set forth in Appendix B of the District's Policies Manual.
  - The District will own, locate, and maintain service lines for Direct Service Customers from the District's main to the water meter. This gives the District more control over facilities connected to its pipes.
  - The District reads the meters for Direct Service Customers.
  - The District bills Granite Falls monthly for water passing through the master meters and Direct Service Customers.

- Wholesale rates may be adjusted by the District's Board of Commissioners from time to time as needed.
- When Granite Falls connects a new customer (either to its own distribution system or as a Direct Service Customer, it passes a portion of the hook-up fees to the District, equivalent to the GFC charge. The GFC covers water supply, transmission, and storage facilities that the District has agreed to provide to support each new city customer.
- For any new Direct Service Customer connected outside of the Granite Falls' RSA but within their future service area, Granite Falls passes both the GFC and DSC to the District, to cover the cost of the District's pipe fronting the property in addition to the source, transmission, and storage impacts.
- The ERU determination for calculating GFCs is based on tables in Appendix B of the District's Policy Manual.
- Granite Falls' Retail Water Service Area can expand within the UGA of its 2015 Comprehensive Plan. Any expansion beyond this boundary must be mutually agreed upon.
- The District can add customers in the UGA, but they must be transferred to city pipes as city limits expand. If a city main is not available when an area is annexed, then these remain District customers. When a city main becomes available, such customers will transfer to the city pipe, and the city will pay to abandon the old services.

3.3.8 City of Snohomish

In November 2020 the District entered into a new wholesale water agreement with the City of Snohomish. This new agreement replaced a Temporary/Emergency only use agreement from 2012 and a temporary, but full-time use, agreement that was entered into in 2017.

Key features of the agreement are:

- The City of Snohomish retains ownership and operation of its transmission line and approximately 75 customers served from that main

- General Facilities Charge: Under normal circumstances the GFC would be levied per ERU for a customer's hook-up to the City of Snohomish's water system, representing a proportionate share of the cost of providing the additional source, storage, and transmission components necessary to provide service to the new customers. Due to the unknown nature of the City of Snohomish's future service to its current Transmission Main Customers, the GFC was waived in lieu of a capacity leasing agreement whereas the City of Snohomish agrees to pay for access to capacity being made available by the District on a per one hundred cubic feet (ccf) basis.

- Master Meter: The City of Snohomish is being served by an existing 2-inch master meter that was in installed in 2012 to serve the City of Snohomish Temporary/Emergency supply in the event of a water quality issue at their now decommissioned water treatment plant. The Agreement allows additional master meters to be installed at the City of Snohomish's cost in the future, if the District agrees it is reasonably necessary to enhance the City of Snohomish's water system.

- The wholesale water rates to the City of Snohomish will be adjusted by the District's Board of Commissioners from time to time as needed.

3.3.9 CWSP Service Area Agreement

As described in **Chapter 2**, the District signed the *Agreement for Establishing Water Utility Service Area Boundaries* in 1997. The agreement verifies that the District accepts responsibilities assigned by the CWSP in its claimed water service areas.

3.3.10 Three Lakes Service Area Agreement

The District agreed to adjust its service area boundary with the Three Lakes Water Association in 2011. The process began with a request for water service that the District agreed would be better provided by the Three Lakes System. Representatives of Three Lakes and the District met to review the entire boundary in relation to the location of existing water mains before presenting the change to the County. The County required evidence of agreement between the water systems before making changes to the CWSP service area map.

3.3.11 Monroe Service Area Letter

The District has one residential customer inside Monroe's claimed service area. This property is located outside of Monroe's UGA. A letter from Monroe included in **Appendix 3-2** documents the situation. If a city water main becomes available at this location, the city can transfer the service and abandon the District's water service at its own expense.

3.3.12 Roosevelt Water Association, Three Lakes Water Association, and Meadow Lake Water Association

In August 2011, Roosevelt Water Association, Three Lakes, Meadow Lake Water Association, and the District signed an agreement to adjust their service boundaries to clarify service to unserviced lots between or overlapping areas of their original boundaries.

3.3.13 Warm Beach, Kayak, and Seven Lakes Water System

In February 2016, Warm Beach Water Association, Seven Lakes Water System, and the District (previously the Kayak portion of the district) signed an agreement to adjust their service boundaries to clarify service to unserviced lots between or overlapping areas of their original boundaries.

3.3.14 Tulalip Settlement Agreement for May Creek Water Rights

In 1996, the Tulalip Tribes appealed Ecology's approval of a change to the District's May Creek water rights. This 1999 settlement agreement outlines mitigation, in the form of a stream flow augmentation plan, which was satisfactory for the Tribes to drop their appeal.

When water pumped from the wells exceeds 398,880 gallons in a calendar day, the District will divert a "mitigation flow" back to May Creek using a formula and method described in the agreement. The District installed facilities and a control system to implement the agreement, which were inspected and approved by the Washington Department of Fish and Wildlife. As will be seen in **Chapter 5**, the District is far from reaching the usage limit that would result in these facilities being put to use.

3.3.15 Sultan Water Supply Pipeline Agreement

In 1998, Sultan and the District worked together to fund a Regional Water Supply Alternatives Study relating to Sultan's UGA and the District's satellite water service area. The study recommended a new pipeline to Everett's 5-line. The route for the pipeline passes through the District's Jackson Hydroelectric Project. The District took the lead for the design, construction, and long-term maintenance of the pipeline on District property due to potential risks and costs associated with crossing the Sultan River in the vicinity of the Jackson Project Powerhouse, the Lake Chaplain Return Line, and high-pressure penstock facilities. The District required that the pipeline be large enough to minimize the likelihood of future related river crossings or construction disturbances.

A 16-inch diameter pipeline (Phase 1) was determined to be sufficient to meet the above criteria from the 5-line connection to the point where the pipe leaves the powerhouse access road and enters Sultan's easement. A 12-inch diameter water main (Phase 2) was constructed from that point to Sultan's treatment plant and storage tanks. Sultan paid the District $200,000 to design and develop plans and specifications for both phases. The District obtained the permits and government approvals, while Sultan took responsibility for the environmental review process.

The District paid the first $200,000 of the pipeline construction costs and the first $100,000 toward construction of the steel truss bridge carrying the pipe across the river, and Sultan paid for the rest of the construction expenses. Upon construction completion, the District became the owner of Phase 1 and Sultan became the owner of Phase 2, except for the master meter owned by Everett.

The District agreed to be responsible for maintaining and repairing the pipeline from where it connects to the 5-line to the point where the powerhouse access road turns eastward to join 116th Street SE and to be responsible for any future relocation of the pipeline resulting from improvements to the powerhouse or penstock facility. The District also took responsibility for the steel truss bridge for its useful life.

Sultan owns 66.7 percent, and the District owns 33.3 percent of the pipeline capacity, which is estimated to be between 3.89 and 5.76 MGD. Sultan is entitled to use the District's capacity share until the District has need for it. At the end of its service life, the cost to replace any portion of the pipeline will be shared by the parties proportional to their share in the capacity ownership. The cost to replace the steel truss bridge at the end of its useful service life will be shared equally by the parties.

3.3.16 Mutual Aid Agreements

In 2006 an agreement was drafted between many water and sewer purveyors in the County. The agreement enables the purveyors to make requests through their "Designated Official" to other purveyors for personnel, materials, equipment, or other resources to deal with a disaster or emergency. Each utility executed the agreement in accordance with their applicable procedures. The District's Board of Commissioners authorized its General Manager to sign the agreement through Resolution 5275 in August 2001.

In September 2009, the District's Board of Commissioners authorized its General Manager to sign a mutual aid and assistance agreement with the Washington State Intrastate Water and Wastewater Agency Response Network (WARN) for personnel, materials, equipment, or other resources required in a disaster or emergency. The WARN is administered through regional committees and a state-wide committee. The agreement establishes how WARN is administered and details the procedures for requesting assistance, responding to requests, withdrawing from responding, cost reimbursement and the dispute process.

THIS PAGE INTENTIONALLY LEFT BLANK

murraysmith

Chapter **4**

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 4

Existing Facilities

This chapter inventories the District's major water facilities, including nine water systems with approximately 408 miles of pipelines, 15.5 MG of storage (16 active tanks), six water supply pump stations, 12 BPSs, 14 active wells, and 40 pressure zones. The physical condition, capacity, and age of these facilities are important in determining the adequacy of the water systems for meeting future water demands.

4.1 Primary Source of Supply

The District purchases the majority of its water from Everett, which uses the Sultan River as its primary water source. By 1942, Everett's facilities included a concrete diversion dam and Tunnel No. 1, directing water from the Sultan River into the 4.5-billion-gallon Chaplain Reservoir about 16 miles east of Everett. These facilities are shown in **Figure 4-1**.

Everett and the District joined forces to build the "Sultan Project" starting in the early 1960s, as water supply needs increased. The first stage was completed in 1965 by constructing the Culmback Dam about 6.5 river miles upstream of Everett's diversion dam, which created the Spada Reservoir. In 1984, the second stage of the Sultan Project raised the dam, increasing the Spada Reservoir capacity to 50 billion gallons. The second phase also included the construction of the Jackson Hydroelectric Plant, including a 14-foot diameter tunnel and 10-foot diameter pipeline from Spada Reservoir to the hydroelectric plant and a 72-inch diameter pipeline from the power plant to Chaplain Reservoir. These facilities are also shown in **Figure 4-1**.

Under typical operating conditions, Tunnel No. 1 is now used in reverse to return water to the Sultan River to maintain critical instream flows. The diversion tunnel can still be used in its original flow direction if supply from the hydropower plant is interrupted. Another use for the diversion tunnel is to provide an alternate supply to the filtration plant in the event of short-term water quality problems in Chaplain Reservoir.

District water systems receiving Everett water are Lake Stevens Integrated, Storm Lake Ridge, and Creswell. **Figure 4-2** shows the location of District taps on transmission lines from the filtration plant. Water is normally conveyed to the District's systems through Everett's 3- and 5-Lines and through a connection on the Marysville JOA-Line. The District has eight connections on the 3-Line (most with backup connections on the 2-Line) and four connections on the 5-Line.

A more detailed description of all water sources supplying the District's systems can be found in **Chapter 8**, including discussion of water rights, hydrology, fishery conditions, watershed plans, supply yield, water shortage response planning, and wellhead protection plans.

4.2 Pressure Zones

Figure 4-3A, Figure 4-3B, and Figure 4-3C are schematic hydraulic profiles of the District's Water Systems. Ground elevations within these systems range from about 20 to 730 feet. To provide water at adequate pressure, the Lake Stevens Integrated Water System is divided into 25 pressure zones; the Storm Lake Ridge Water System is divided into two pressure zones and the Creswell Water System consists of a single pressure zone. Lake Stevens Integrated hydraulic profile (**Figure 4-3A**) illustrates how the three water systems will be connected to form a single system in the future. The Warm Beach system (**Figure 4-3B**) consists of the six pressure zones, the Sunday Lake Water System of two pressure zones, and the Skylite and May Creek S\Water Systems of one pressure zone each (**Figure 4-3C**). The small 212 Market and Otis Water Systems also consist of one pressure zone each and are not included in the hydraulic profile figures.

The nominal HGLs and range of service elevations for each pressure zone is summarized in **Table 4-1**.

The pressure zones and their boundaries are based on topography, service elevations, natural and physical barriers, and the District's WSA boundaries. Topographic considerations are significant because the District seeks to maintain service pressures between 40 and 80 pounds per square inch (psi). Service pressures exceeding 80 psi are unavoidable in many low-lying areas to assure that minimum pressure requirements are met at the highest elevations. Where service pressure exceeds 120 psi, the District installs and maintains pressure reducing valves (PRVs) in each meter box to protect the meter and the customer's plumbing. When service pressure is between 80 and 120 psi, the District gives customers an option to pay for a District-maintained PRV or to install their own PRV in their plumbing system.

4.3 Facilities and Components

The District's water facilities are shown on **Figure 4-4A through 4-4G**. The figures also illustrate the boundaries of the pressure zones described in the previous section.

4.3.1 Storage Facilities

The District owns and operates 16 water reservoirs dispersed throughout its water systems as detailed in **Table 4-2** and shown in the figures at the end of this chapter. Recent changes to State and Federal seismic resiliency requirements may point to older tanks (in otherwise good condition) that could be vulnerable during an earthquake.

4.3.2 Pump Stations

The District owns and operates six main supply pump stations, five of which deliver purchased water to Lake Stevens Integrated and one that delivers purchased water to the Storm Lake Ridge Water System. In some areas of Lake Stevens Integrated, the purchased water is supplied directly by gravity from Everett's transmission lines. Purchased water entering the Creswell system is also delivered directly from the transmission lines without pumping.

The District also owns and operates 12 BPSs to maintain water pressure to higher elevation areas within its systems as detailed in **Table 4-3** and shown in the figures. Pump station capacities in **Table 4-3** are based on pump curves and recorded performance.

4.3.3 Pressure Reducing Valve Stations and Flow Control Valves

Table 4-4 details the District's many pressure reducing stations spread throughout its 4 pressure zones. Station numbers in this table can be seen in the hydraulic profile **Figure 4-3A and Figure 4-3B**. Higher numbered stations are generally newer installations. When a station is abandoned, the station number is retired.

The District also maintains a variety of control valves that are not listed in **Table 4-4**, such as pressure relief and surge anticipator valves in pump stations, altitude valves for tanks, flow control valves to maintain flows below set limits, and hydraulic control valves in treatment processes. The District tracks the maintenance of these valves via its Geographic Information System (GIS) mapping.

4.3.4 Pipelines

The District maintains a GIS to track location and data associated with its water facilities. A GIS query determined that the District's WSAs contain over 408 miles of pipe ranging from 3/4 inches to 30 inches in diameter. A summary of the length, diameter, and material is presented in **Table 4-5**. Nearly 56 percent of the District's water mains are 8 inches in diameter or larger. The majority of the District's water mains are DI with some of the older sections being cast iron (CI) or AC. As will be discussed in following chapters, the District has a goal to replace the majority of its old AC pipes by the end of 2028. The District's systems contain about 19 miles of AC pipe.

4.3.5 Wells

The District owns and operates wells for its Lake Stevens Integrated, May Creek, Skylite, Warm Beach, 212 Market & Deli, and Otis Water Systems as detailed in **Table 4-6**. At the time of the District's 2011 WSP Update, the Lake Stevens Integrated wells were only used for emergency backup but were placed into routine service in 2012 after treatment was installed to remove iron and manganese.

4.3.6 Interties

The District has one existing emergency intertie with Gold Bar as detailed in **Table 4-7** and shown in **Figure 4-5**. **Table 4-7** also lists master meters for adjacent water systems that purchase water from the District on an ongoing basis.

4.3.7 Treatment Facilities

4.3.7.1 Everett Filter Plant

Everett adds chlorine and fluoride at its filter plant, which is conveyed through the District's Lake Stevens Integrated, Storm Lake Ridge, and Creswell water systems. The District boosts the chlorine at its Granite Falls BPS to maintain a residual to the far ends of its Lake Stevens Integrated WSA.

4.3.7.2 Groundwater Treatment

The District also chlorinates its groundwater systems, with the exception of the Otis Water System. In all cases, chlorine is added as a preventive measure to control bacteria growth in the distribution systems. There are no known bacteria or virus concerns with the wells. Sodium hypochlorite is used as the form of chlorine in all District disinfection facilities.

4.3.7.3 Sunday Lake, Skylite, and Warm Beach Treatment

In addition, the District has a greensand filter system at its Sunday Lake Water System and two pyrolusite filter systems at its Warm Beach Water System to remove manganese, iron, and a trace of hydrogen sulfide. These are secondary contaminants that are only a concern for aesthetic reasons.

At the Skylite Water System, the District aerates the water as it enters storage tanks. This releases naturally occurring carbon dioxide, which in turn raises the pH to reduce corrosiveness of the water toward copper (C) plumbing.

4.3.7.4 Lake Stevens Well Treatment Facility (LSWTF):

In 2012 the District installed treatment to remove iron and manganese at its existing Lake Stevens Well site, after approximately 26 years of using the wells only as an emergency backup source. The treatment system consists of chlorine and potassium permanganate oxidation followed by filtration through Pyrolox (Manganese Dioxide) media to remove the iron and manganese found in the two wells on site. Fluoride is added to the finished water to ensure the treated water is consistent with water supplied by the District's Everett wholesale supply.

In 2018/19 the estimated population served by the District's Lake Stevens Integrated Water System exceeded 50,000 thus pushing the system into what is considered under the Lead and Copper Rule (LCR) as a large system. Based on the change of status, the District was required to perform an optimization study with respect to the LCR to identify the optimal corrosion control strategy for the system.

The District engaged the services of Confluence Engineering Group to complete the optimization study which examined the water quality data for the two sources of supply to the Lake Stevens system, the LSWTF and the Everett supply, existing water quality conditions in the distribution system, lead and copper data collected under the LCR, the results of water quality modeling, and potential, future Long-Term Revisions to the LCR. This analysis led to the conclusion that pH adjustment treatment is recommended at the LSWTF for it to be considered optimized under the LCR. Although lead levels have been stable, copper levels have increased since the LSWTF was placed into service and pH adjustment is anticipated to reduce copper levels in the Lake Stevens system.

Specific conclusions and recommendations are as follows:

- The LSWTF water should be treated to a target pH of 7.6 with an operational range of 7.6 to 7.8. The minimum pH in the distribution system should be 7.4.
- Sodium hydroxide is the recommended pH adjustment method for the LSWTF.
- Once corrosion control treatment has been installed, the District will collect follow-up samples for lead and copper and conduct monitoring within the distribution system to confirm that the recommended minimum pH of 7.4 is being maintained.

The LSWTF optimization study was completed in June of 2019 and approved by DOH on July 31, 2019.

Due to space constraints associated with the existing LSTWF filter building the District budgeted for and began the design and permitting process for an expansion of the existing treatment building to accommodate the safe storage of the sodium hydroxide necessary to allow the optimal corrosion control treatment as outlined in the above-mentioned approved study. The roughly 528 square foot expansion of the existing building would allow for all treatment chemicals to be located in a separate room and provide sufficient space to accommodate the newly required sodium hydroxide main supply and day tanks. Based on the proximity of the LSWTF to Catherine Creek the first step was to work with the City of Lake Stevens on the land use permitting, specifically a required Shoreline Substantial Development permit. Delays in design and permitting due to the Covid 19 worldwide pandemic significantly delayed the design and permitting of the building expansion; however, the Shoreline Substantial Development permit was approved by the City on February 11, 2021. The District is currently in the process of finishing the final civil, structural, and electrical plans in preparation to go out to bid for the construction of the new addition to the existing treatment facility with the intent of constructing the new treatment plant building expansion before the end of 2021. During construction of the new chemical room, the plant will for the most part remain in service and no changes to the treatment process will be proposed.

Once the new expansion is complete, the design plans for the new chemical feed system and chemical storage tanks will be finalized along with the associated design report and provided to DOH for review and approval. It is anticipated that the installation of the new chemical storage tanks, chemical feed system, and control system changes will be completed by District staff with the assistance of the District's supervisory control and Data Acquisition (SCADA) consultant and water quality consultant, Confluence Engineering, by summer of 2022, subject to DOH approval.

Table 4-1 | Pressure Zones

Pressure Zone	Zone HGL (ft)	Max service Elev (ft)	Min Static Pressure (psi)	Min Service Elev (ft)	Max Static Pressure (psi)
Lake Stevens Integrated Water System					
10th St SE	320	220	43	20	130
28th St SE	360	220	61	120	104
Blue Spruce/Rainbow Springs	400	280	52	160	104
Cavaleros	460	280	78	80	165
Cedar Lane/Indian Summer	320	190	56	170	65
Crest Lane	470	360	48	300	74
Dubuque – 157th Boosted (aka Machias Ridge East)	640	520	52	340	130
Dubuque – 44th Boosted	640	540	43	350	126
Dubuque Southwest	400	240	69	70	143
East Everett	300	203	42	80	95
Engebretson	470	320	65	185	123
Granite Falls	726	600	55	200	228
Hillcrest	580	460	52	260	139
Jordan	520	420	43	120	173
Jordan River Trails	325	210	50	140	80
Kla-ha-ya East	350	220	56	120	100
Kla-ha-ya North	270	140	56	80	82
Lake Cassidy	580	460	52	320	113
Lake Stevens Integrated	500	400	43	100	173
Lake Roesiger	811	730	35	420	169
Meeker Retreat	270	140	56	120	65
Soper Hill	450	300	65	80	160
Sunset Ridge	700	580	52	390	134
Sunnyside	300	205	41	20	121
Walker Hill	580	440	61	320	113
Storm Lake Ridge & Creswell Water Systems (to be connected with Lake Stevens Integrated)					
Storm Lake Ridge (SLR)	760	670	39	320	191
Storm Lake Ridge Boosted	850	720	56	660	82
Creswell	525	360	71	300	97
Satellite Water Systems (groundwater sources)					
Kayak-535[1] (in Warm Beach)	535	450	37	325	91
Kayak-450 (in Warm Beach)	450	320	56	160	126
Kayak-370 (in Warm Beach)	370	180	82	150	95
Warm Beach-450	450	320	56	200	108
Warm Beach-350	350	240	48	80	117
Warm Beach-232	232	120	49	10	96
Sunday Lake	430	340	39	223	90
Sunday Lake Boosted	500	370	56	270	100
May Creek	392	330	27	200	83
Skylite	280	160	52	140	61
212 Market & Deli	360	245	50	235	54
Otis	540	425	50	400	61

Note:
1. The Kayak tank overflow is 546 feet; however, due to losses in the system, the zone HGL is closer to 535 feet when the tank is full.

Table 4-2 | Storage Facilities

Facility	Type	Location	Year Built	Total Volume (MG)	Diameter (ft)	Overflow Elevation (ft)	Base Elevation (ft)
Lake Stevens Integrated Water System							
Walker Hill 1 & 2	Steel	Cedar Road, near Lake Stevens Integrated HS	1973& 1990	2.0 & 2.0	70	490	422
Hillcrest 1 & 2	Steel	96th Ave SE & 9th Pl, E of Hwy 9	1998& 2009	3.0 & 3.0	100	502	450
Granite Falls	Steel	Wayside Mine Rd, near Iron Mountain Quarry	1995	2.7	120	726	694
Bosworth	Steel	N of 56th St NE, NW of the lake	1996	1.0	46	811	728
Lake Roesiger 1 & 2	Concrete	Frank Monson Rd, NE of the lake	1992	0.2 & 0.2	30	811	771
Total Lake Stevens Integrated System Storage:				14.1			
Other Systems with Purchased Water							
Storm Lake Ridge	Concrete	72nd Pl SE, W of Mero Rd	2000	0.23	30	762	718
Groundwater Systems							
Kayak Tank	Concrete	North end of 66th Ave NW	2009	0.29	26	548	474
Warm Beach Tank	Bolted Steel	Well 4 Site	1995	0.2	32.7	350	319
Sunday Lake	Concrete	West end of 254th St NW	1995	0.2	26	430	380
Skylite	Concrete	357th Ave SE, near Mann Rd	1997	0.1	30	170	150
May Creek 1 & 2	Concrete	156th St SE, W of 423rd Ave SE	1984	0.175 & 0.175	26	392	347
212 Market & Deli	Concrete	Old Hwy 99 N at I5& Hwy 532	1995	0.002	6x5x9 vault		250
System with no storage that will merge into adjacent systems: Creswell							
System with no storage requirement: Otis							

Table 4-3 | Pump Stations

Facility/ Yr Constructed	Year Pump Installed	Supply HGL	Pressure Zone Served	Pump No.	Pump Mfr.	Pump Model No.	Rated Flow[1] (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)
Supply Pump Stations to Lake Stevens Integrated 500 Pressure Zone:										
E. Hewitt Supply/1968[2]	1992	3 Line-450	Lk Stvns-500	1	Fairbanks	6937T, 6" impeller	Previously 600	148	1,765	30
	1968	3 Line-450	Lk Stvns-500	2	Goulds	10 LHC, 8" impeller	Previously 1,450	100	1,765	50
Station capacity with both pumps running near rated flows:2021							Decommissioned			
Soperwood Supply/1997	1997	JOA-450	Lk Stvns-500	1	Cornell	5RB-60-4, 12.25" Imp	1,365	120	VFD	60
	1997	JOA-450	Lk Stvns-500	2	Cornell	5RB-60-4, 12.25" Imp	1,365	120	VFD	60
Station capacity with both pumps running near rated flows:							1,700[3]			
Machias Supply/2002	2002	3 Line-450	Lk Stvns-500	1	Byron Jackson	12MQH-2 Stage 8.1298" Impeller	1,375	110	1,963 max VFD	60
	2002	3 Line-450	Lk Stvns-500	2	Byron Jackson	same as pump1	1,375	110	1,750 max VFD	60
	2006	3 Line-450	Lk Stvns-500	3	Byron Jackson	same as pump1	1,375	110	1,764/ VFD.	60
Current output with two pumps running at 25-50 ft TDH and 3rd pump maintained as a spare:							3,000			
Glenwood Supply/2006	2006	3 Line-450	Lk Stvns-500	1	Goulds	14RJMC, 1 stage, 8.625" impeller	1,500	65	1,760/ VFD	40
	2006	3 Line-450	Lk Stvns-500	2	Goulds	same as pump1	1,500	65	1,760/ VFD	40
Recorded flow with both pumps running in July 2009 (speed is restricted to 85% max):							2,000			
Lake Steven Integrated 500 Pressure Zone Total Pumped Supply:							6,700			

Facility/ Yr Constructed	Year Pump Installed	Supply HGL	Pressure Zone Served	Pump No.	Pump Mfr.	Pump Model No.	Rated Flow[1] (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)
Supply Pump Stations to Lake Stevens Integrated 580 Hillcrest Pressure Zone:										
Hillcrest Booster/1982	1982	Lk Stvns-500	Hillcrest-580	1	Paco	71-2D121-730101A01-1	100	85	1,745	5
	1982	Lk Stvns-500	Hillcrest-580	2	Paco	71-2D121-730101A01-1	200	85	1,750	10
	1982	Lk Stvns-500	Hillcrest-580	3	Paco	71-2D121-730101A01-1	200	85	1,750	10
	1982	Lk Stvns-500	Hillcrest-580	4	Paco	71-30121-740101A01-1	333	85	1,760	15
	1982	Lk Stvns-500	Hillcrest-580	5	Paco	71-40125-740101A01-1	667	85	1,765	20
Hillcrest station capacity at rated flow and head:							1,500			
Glenwood Supply/2006	2006	3 Line-450	Hillcrest-580	3	Goulds	10RJLC, 5 stage, 6.1875” impeller	500	145	1,740/ VFD	30
	2006	3 Line-450	Hillcrest-580	4	Goulds	12CLC, 3 stage, 8.5625” impeller	1,000	155	1,750/ VFD	60
	2006	3 Line-450	Hillcrest-580	5	Goulds	same as pump 4	1,000	155	1,750/ VFD	60
Glenwood station capacity to Hillcrest-580 zone with largest pump reserved as a spare:							1,500			
Lake Steven Integrated 580 Hillcrest Pressure Zone Total Pumped Supply with largest pump reserved as a spare:							2,333			

Facility/ Yr Constructed	Year Pump Installed	Supply HGL	Pressure Zone Served	Pump No.	Pump Mfr.	Pump Model No.	Rated Flow[1] (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)
Supply Pump Stations to Lake Stevens Integrated 580 Walker Hill Pressure Zone:										
Walker Hill Booster/1992	1992	Lk Stvns-500	Walker Hill-580	1	Paco	16-20955130101-2689	95	80	1,745	5
	1992	Lk Stvns-500	Walker Hill-580	2	Paco	16-30955130101-2782	200	80	1,755	10
	1992	Lk Stvns-500	Walker Hill-580	3	Paco	16-30955130101-2782	200	80	1,755	10
	1992	Lk Stvns-500	Walker Hill-580	4	Paco	16-50957140101-2852	500	80	1,765	20
	1992	Lk Stvns-500	Walker Hill-580	5	Paco	16-50957140101-2852	500	80	1,765	20
	1992	Lk Stvns-500	Walker Hill-580	6	Paco	16-50957140101-2852	500	80	1,765	20
Lake Steven Integrated 580 Walker Hill Pressure Zone Total Pumped Supply with largest pump reserved as a spare:							**1,500**			
Supply Pump Stations to Lake Stevens Integrated 726 Granite Falls Pressure Zone:										
Granite Falls Booster/1995	2006	Lk Stvns-500	Granite Falls-726	1	Peerless	12MB-8 Stage, 8.47" Impeller	1,000	355	VFD	150
	2006	Lk Stvns-500	Granite Falls-726	2	Peerless	same as pump 1	1,000	355	VFD	150
	2002	Lk Stvns-500	Granite Falls-726	3	Peerless	same as pump 1	1,000	355	VFD	150
	2002	Lk Stvns-500	Granite Falls-726	4	Peerless	same as pump 1	1,000	355	VFD	150
Lake Stevens Integrated 726 Granite Falls Pressure Zone Total Pumped Supply (operation limited to 2 pumps at a time):							**2,000**			

Facility/ Yr Constructed	Year Pump Installed	Supply HGL	Pressure Zone Served	Pump No.	Pump Mfr.	Pump Model No.	Rated Flow[1] (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)
Supply Pump Stations to Lake Stevens Integrated 580 Lake Cassidy Pressure Zone:										
Lake Cassidy Booster/2006	2006	Lk Stvns-500	Lk Cassidy-610	1	Peerless	C610A	150	100	3,450 VFD	7.5
	2006	Lk Stvns-500	Lk Cassidy-610	2	Peerless	C820A	280	100	VFD	15
	2006	Lk Stvns-500	Lk Cassidy-610	3	Peerless	C820A	280	100	VFD	15
	2006	Lk Stvns-500	Lk Cassidy-610	4	Peerless	F41660M	1,200	200	1,780	100
	Offline	Lk Stvns-500	Lk Cassidy-610	5	Peerless	F41660M	1,200	200	1,780	100
580 Lake Cassidy Pressure Total Pumped Supply at 110 ft TDH (with Pump 5 as a spare):							2,000			
Supply Pump Stations to Lake Stevens Integrated 640 Dubuque Pressure Zone:										
157th Ave SE Booster/2000 (Machias Ridge East)	2000	Lk Stvns-500	157th Ave-640	1	Goulds	3756S	75	190	3,500	7.5
	2000	Lk Stvns-500	157th Ave-640	2	Goulds	3656	75	190	3,500	7.5
Station capacity to 157th Ave zone (can manually switch to spare pump):							75			
44th St SE Booster/2008 Dubuque Boosted)	2008	Lk Stvns-500	44th St-640	1	Paco	624165	175	100	3,500	7.5
	2008	Lk Stvns-500	44th St-640	2	Paco	624165	175	100	3,500	7.5
Station capacity at 120 ft TDH to maintain 40 psi at highest service (with one pump as spare):							125			
Supply Pump Stations to Lake Stevens Integrated 760 Storm Lake Ridge Pressure Zone:										
Storm Lake Supply/2000	2000	5 Line	Storm Lk-760	1	Cornell	2Y-40-2	250	260	3,525	40
	2000	5 Line	Storm Lk-760	2	Cornell	2Y-40-2	250	260	3,525	40
760 Storm Lake Ridge Total Pumped Supply with one pump as a spare:							250			

Facility/ Yr Constructed	Year Pump Installed	Supply HGL	Pressure Zone Served	Pump No.	Pump Mfr.	Pump Model No.	Rated Flow[1] (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)
Supply Pump Stations to Lake Stevens Integrated 850 Storm Lake Ridge Pressure Zone:										
Storm Lake Ridge Booster/2000	2000	Storm Lk-760	SL Boosted-850	1	Grundfos	ME3CRE4-40	22	143	850-3450 VFD	1.5
	2000	Storm Lk-760	SL Boosted-850	2	Grundfos	ME3CRE4-40	22	143	see above	1.5
	2000	Storm Lk-760	SL Boosted-850	3	Grundfos	ME3CRE4-40	22	143	see above	1.5
850 Storm Lake Ridge Total Pumped Supply with one pump as a spare:							44			
Supply Pump Stations to Lake Stevens Integrated 811 Lake Roesinger Pressure Zone:										
Bosworth Booster/1997	1997	Granite Falls	Bosworth-811	1	Peerless	1215AM-BF	250	120	SMC	15
	1997	Granite Falls	Bosworth-811	2	Peerless	1215AM-BF	250	120	soft start	15
Station capacity to Bosworth zone with one pump as a spare:							250			
Lake Roesiger Supply/1992	1992	3 Line-540	Roesiger-811	1	Aurora	92-10029-2 Size 2-1/2 x 3 x 10B	450	280	3,500	50
	1992	3 Line-540	Roesiger-811	2	Aurora	same as pump 1	450	280	3,500	50
Station capacity to Lake Roesiger zone with one pump as a spare:							450			
811 Lake Roesinger Pressure Zone Total Pumped Supply:							700			
Sunday Lake Booster Station										
Sunday Lake Booster/2006	2006	Sunday Lk-430	SL Boosted-	1	Grundfos	A91124379-P1055	90	153	3,525 VFD	7.5
	2006	Sunday Lk-430	SL Boosted-	2	Grundfos	A91124379	90	153	3,525 VFD	7.5
	2006	Sunday Lk-430	SL Boosted-	3	Grundfos	A38753006	450	155	3,525 VFD	25
	2006	Sunday Lk-430	SL Boosted-	4	Grundfos	A38753006	450	155	3,450 VFD	25
Station capacity to Sunday Lake boosted zone (with one pump as a spare):							630			
Skylite Booster Station										
Skylite Booster 2007	2007	Skylite Tank	Skylite	1	Grundfos	CR10-5	60	150	3,510 VFD	5
	2007	Skylite Tank	Skylite	2	Grundfos	CR10-5	60	150	3,510 VFD	5
Station capacity to Skylite:							120			

Facility/ Yr Constructed	Year Pump Installed	Supply HGL	Pressure Zone Served	Pump No.	Pump Mfr.	Pump Model No.	Rated Flow[1] (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)
Warm Beach Booster Station										
Well 4 Booster/1995	1995	Warm Beach Tank	Warm Beach 450 PZ	1	Paco	Smart Pump	65	140	3,500	7.5
	1995	Warm Beach Tank	Warm Beach 450 PZ	2	Paco	Smart Pump	65	140	3,500	7.5
Station Capacity to Warm Beach boost zone (one pump as a spare)							65			

Note:

1. Rated flow when a single pump is operating
2. East Hewitt PS was decommissioned in 2021 through a developer extension agreement between the City of Lake Stevens and the District based on the proximity of a new road being proposed by the City of Lake Stevens that required approximately 20' of fill in the area of the existing system. In return, the City of Lake Stevens provided the District a new fenced build site at the grade of the new road that includes suction and discharge piping as well as electrical and communication conduits necessary for the construction of a new pump station (shown in the CIP [see **Chapter 11**] as being planned for 2029).
3. Measured flow with two pumps on

THIS PAGE INTENTIONALLY LEFT BLANK

Table 4-4 | Pressure Reducing Valves

Station # / Location	Zone		Valve Size (in.)	Typical Upstream Pressure (psi)	Settings (psi unless otherwise noted)	Elevation (ft)	Calculated HGL (ft)	Zone HGL (ft)	Pressure Relief Valve		Reverse Flow	Notes
	From	To							Size (in)	Setting (psi)		
Lake Stevens Integrated Water System Pressure Reducing Stations												
1 / Jordan Rd & Jordan Trails Rd	Granite Falls	Jordan Road	2-½ 8	158	57 51	383	515 500	520	3	80	Yes	Small valves in Stations 1& 3 work together as lead. Station 1 large valve is 1st lag. Station 3 large valve is 2nd lag.
3 / Jordan Rd & 179th Dr NE	Granite Falls	Jordan Road	3 8	215	105 95	273	515 492		3	125	Yes	
2 / Rainbow Drive	Jordan Road	Blue Spruce	2-½ 8	106	57 47	279	411 388	400	3	60	Yes	
4 / Chappel Rd & 117th Pl NE	Jordan Road	Blue Spruce	2 8	115	62 55	245	388 372		3	65	Yes	Station 4 operates as lag to Station 2.
5 / Chappel Rd & 119th Pl NE	Jordan Road	Blue Spruce	2	-	65	245	395		none	n/a	No	Serves a dead-end pipe in the vicinity of other Blue Spruce stations.
6 / Chappel Rd & 177th Av NE	Jordan Road	Blue Spruce	2	160	61	245	386		none	n/a	No	Station 6 operates as lag to Station 7 in a small loop off of Chappel Rd.
7 / Chappel Rd & 178th Dr NE	Jordan Road	Blue Spruce	1	160	65	265	415		none	n/a	No	
27 / Jordan Rd, NW of 137th Dr NE	Jordan Road	Meeker Retreat	2	-	55	140	267	270	none	n/a	No	Small zone serving only 4 meters.
28 / Jordan River Trails	Jordan Road	Jordan River Trails	1-½ (2)3	140	35 30	247	328 316	325	none	n/a	No	Two 3" valves in series to avoid cavitation.
43 / Jordan Trails Rd & Crest Lane	Jordan Road	Crest Lane	2	78	58	340	474	470	none	n/a	No	Serves 8 meters west of Jordan River Trails.
9 / Engebretsen Rd, N of Jordan Road	Granite Falls	Engebretsen	2 8	163	68 63	315	472 461	470	3	85	No	
8 / Engebretsen Rd & 175th Av NE	Engebretsen	Cedar Lane/ Indian Summer	2 8	148	55 45	194	321 298	320	3	60	Yes	Station 42 is lag to the small valve in Station 8. The large valve in Station 8 opens last for fire flows or flushing.
42 / Engebretsen Rd & 172nd Dr NE	Engebretsen	Cedar Lane/ Indian Summer	2	148	55	190	317		none	n/a	No	
11 / Lake Bosworth Pump Station	Lake Roesiger	Granite Falls	6	110	95	455	674	726	none	n/a	Yes	Allows water back into the Granite Falls zone in case of emergency. Also controls discharge pressure at the outlet of the Bosworth pumps,

Station # / Location	Zone		Valve Size (in.)	Typical Upstream Pressure (psi)	Settings (psi unless otherwise noted)	Elevation (ft)	Calculated HGL (ft)	Zone HGL (ft)	Pressure Relief Valve		Reverse Flow	Notes
	From	To							Size (in)	Setting (psi)		
												which is currently set for 140 psi.
41 / Carpenter Rd & Menzel Lake Rd	Lake Roesiger	Granite Falls	2 8	120	83 77	532	724		3	unknown	Yes	Includes an upstream pressure sustaining feature set for 100 psi.
17 / 23rd St NE & 159th Av NE	Lake Roesiger	Sunset Ridge	1 2	117	70 65	540	702	700	none	n/a	No	Serves about 20 homes on 4" pipe, southwest of Lake Bosworth
10 / Granite Falls Pump Station	Granite Falls	Lake Stevens	8	-	65	270	420	500	4	225	Yes	Allows water back to the Lake Stevens zone in case of emergency. An 8-in valve is on the suction side of the pumps. A solenoid valve closes when pumps turn on, so that the valve does not open when the pumps draw down the suction side pressure.
24 / 36th St SE & 101st Av SE	Hillcrest	Lake Stevens	6	88	44	377	479		3	65	Yes	Supports fire flow to the Lake Stevens zone. Includes reverse flow in case of major pressure loss in the Hillcrest zone.
47 / 8421 19th St NE (Campus Park)	Lake Stevens	Soper Hill	2 8	86	53 46	305	427 411	450	3	65	Yes	This station assists with fire flow and provide backup to gravity flow from the Marysville JOA line to the Soper Hill area. Can also flow in reverse to back up the Lake Stevens zone.
15 / Sunnyside Blvd & 71st Av NE	Soper Hill	Sunnyside	2 8	151	104 97	60	300 284	300	3	110	Yes	Third and fifth valves to open to the Sunnyside Zone.

Station # / Location	Zone		Valve Size (in.)	Typical Upstream Pressure (psi)	Settings (psi unless otherwise noted)	Elevation (ft)	Calculated HGL (ft)	Zone HGL (ft)	Pressure Relief Valve		Reverse Flow	Notes
	From	To							Size (in)	Setting (psi)		
21 / S. Lk Stevens Rd & 87th Av SE	Lake Stevens	Cavaleros	8	123	90	223	431	460	3	115	Yes	Backup supply to Cavaleros zone, which is normally fed from Everett transmission.
45 / 8099 8th St SE	Lake Stevens	Cavaleros	6 2	88	64 64	294	442		3	unknown	Yes	
54 / 20th Sth SE & 79th Ave SE	Lake Stevens	Cavaleros	12	97	67	269	424		none	n/a	Yes	
18 / 10th St SE, West of 79th Av SE	Cavaleros	10th SE	2 8	118	60 55	177	316 304	320	3	70	Yes	
46 / 157th Ave SE & 15th Pl SE	Cavaleros	10th SE	2-½ 8	100	48 43	209	320 308		3	58	Yes	Serves the plat of Cavalero Ridge. Equipped with a pressure sustaining feature, to prevent pressure drop in the upstream 460 zone.
52 / Valtera, between Sunnyside & Lundeen	Lake Stevens	10th SE	2-½ 8	123	60 50	190	329 306		3	70	Yes	Serves the plat of Valtera. Also has a pressure sustaining feature.
20 / 28th St SE & Cavaleros Rd	Cavaleros	28th St SE	2	140	75	180	353	360	none	n/a	No	
53 / 17th St SE & 73rd Ave SE	Cavaleros	East Everett	2-½ 8	115	45 40	200	304 292	300	3	55	Yes	Serves the plat of East Everett Hills. Station has a pressure sustaining feature.
29 Kla-ha-ya (Tap)	5 Line	Dubuque	6		170/140	110	433		-	-	No	Everett-owned PRV
26 88th St SE & 125th Av SE	Lake Stevens	Dubuque Southwest	2 6	145	80 70	210	395 372	400	2	90	No	Small valves in Stations 26 and 33 work together as lead. Large valve in Station 33 opens next. Large valve in Station 26 opens last.
33 / 121st Ave SE & 8th St SE	Lake Stevens	Dubuque Southwest	1 2	125	80 75	213	398 386		-	-	No	
60 / Bartelheimer Dairy	Lake Stevens		2	120	70	75	237		-	-	No	This is a service PRV on the 2" pipe that only goes to the Dairy.
30 / Kla-ha-ya, 60th St NE	Lake Stevens	Kla-ha-ya E	1 2	145-175	100 95	120	351 339	350	-	-	No	Upstream pressure depends on Everett 5-line, which varies depending on season.

Station # / Location	Zone		Valve Size (in.)	Typical Upstream Pressure (psi)	Settings (psi unless otherwise noted)	Elevation (ft)	Calculated HGL (ft)	Zone HGL (ft)	Pressure Relief Valve		Reverse Flow	Notes
	From	To							Size (in)	Setting (psi)		
31 / 123rd Av SE, S of 58th Pl SE	Lake Stevens	Kla-ha-ya N	2 6	145-160	65 60	124	274 263	270	3	75	No	Upstream pressure depends on Everett 5-line, which varies depending on season.
Warm Beach System Pressure Reducing Stations												
48 / 7908 150th Pl NW	Kayak-535	Kayak-450	2 6	129	66 57	302	444 433	440	3	72	Yes	
49 / 17217 84th Ave NW (at 172nd St NW)	Kayak-535	Kayak-450	2 6	119	50 58	320	432 421		3	63	Yes	
50 / 15219 Kayak Pt Rd	Kayak-535	Kayak-450	2 6	120	40 33	321	413 397		3	50	Yes	
51 / 16322 91st Ave NW	Kayak-450	Kayak-370	3	75	20	290	336		3	50	Yes	
63 / 9620 188th St NW	Warm Beach - 350	Warm Beach – 232	1.5 4	95	28 33	130	206	232	1.5	50	No	
64 / 19212 96th Ave NW	Warm Beach - 350	Warm Beach – 232	1.5 4	97	30 35	125	206		1.5	50	No	

Table 4-5 | Length of System Pipe

Diameter (in)	AC	C	CI	DI	G	PE	PVC	ST	Total (ft)	Total (mi)
¾-inch			97						97	0.02
1-inch			264	5			1,104		1,373	0.26
1-¼-inch						54			54	0.01
1-½-inch			111			313	1,730		2,154	0.41
2-inch	236		304	2,201	487	13,709	42,154	69	59,160	11.20
2-½-inch				25			2,817		2,842	0.54
3-inch	107			451	5		8,238	6	8,807	1.67
4-inch	9,554	62		140,691		115	37,636		188,058	35.62
6-inch	75,362	3,587		78,095			31,384	85	188,513	35.70
8-inch	15,587	4,664		1,133,853		528	62,936	53	1,217,621	230.61
10-inch	733	1,451		3,735			195		6,114	1.16
12-inch	23	13,643		366,732		1,328	5,563		387,289	73.35
16-inch				70,600		2,186			72,786	13.79
18-inch				319					319	0.06
24-inch				17,774					17,774	3.37
30-inch				3,015					3,015	0.57
Total (ft)	101,602	23,407	776	1,817,496	492	18,233	193,757	213	2,155,976	
Total (mi)	19.2	4.4	0.1	344.2	0.1	3.5	36.7	0.04	408.3	408.3

AC = asbestos cement; C = copper; CI = cast iron DI = ductile iron; G = galvanized iron; PE = polyethylene; PVC = polyvinyl chloride; ST = steel; XX=Unknown

THIS PAGE INTENTIONALLY LEFT BLANK

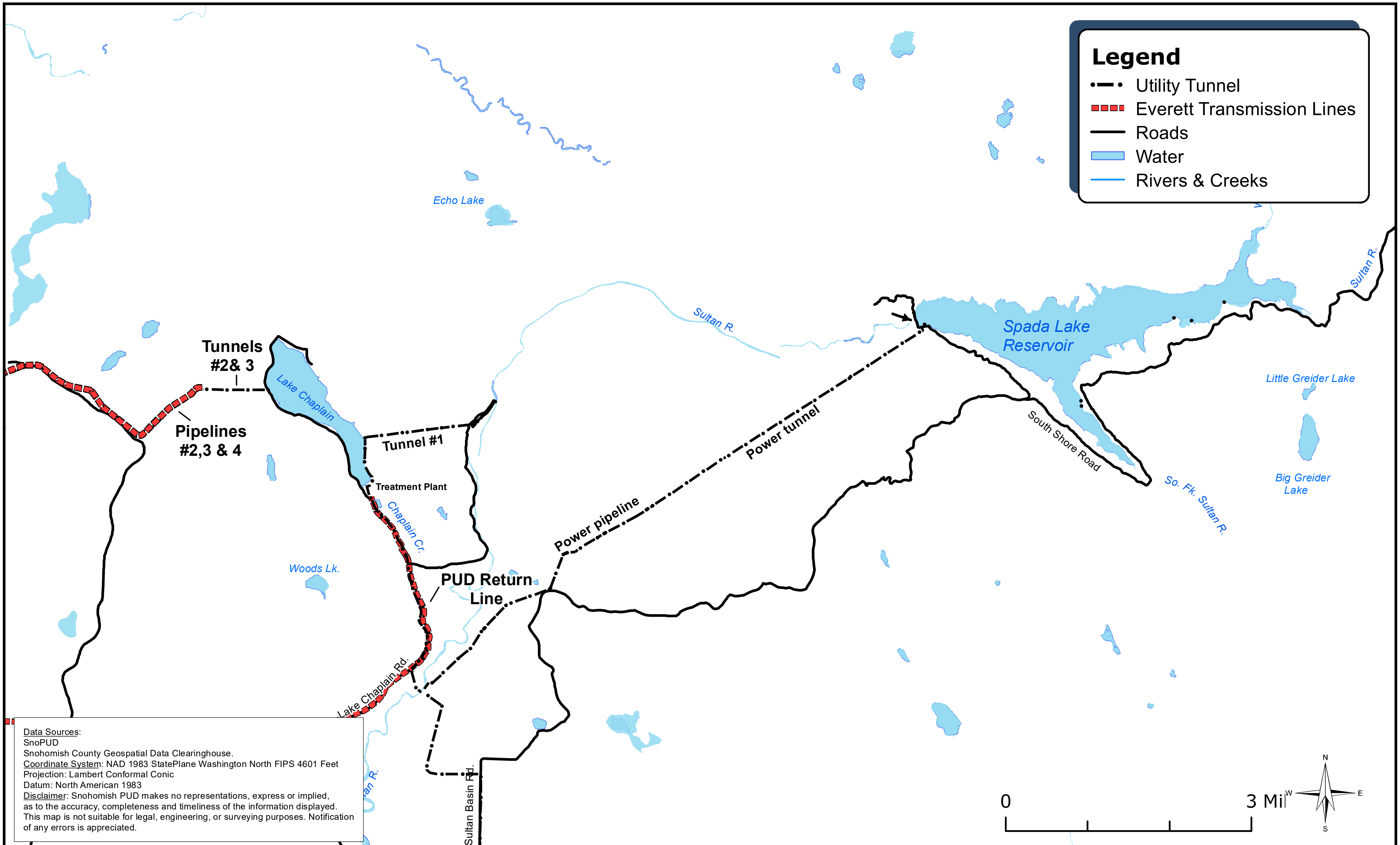
Table 4-6 | Inventory of Active Wells

Water System	DOH Source ID	Well Tag #	PUD Source Name	Year Drilled	Year Pump Installed	Diameter (in)	Ground Surface Elev (ft)	Top of Screen (ft)	Bottom of Screen (ft)	Completed Well Depth (ft)	Pump No.	Pump Mfr.	Type	Pump Model No.	Rated Flow (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)	Generator
Sunday Lake	S03	AGB638	Well 3	1994	1998	12	220	364	431	436	1	Goulds	Submersible	8 RALC 6 Stage, 5" Impeller	100	575	3500	20	Wired for trailer generator.
Skylite	S01	AAA901	Well 1	1962	1986	8	154	38	48	48	1	UNK	Submersible	UNK	60	150	3450	3	Generator on site.
Skylite	Secondary pump in Well 1			-	1982	-	-	-	-	-	2	UNK	Submersible	UNK	60	150	3450	5	
May Creek	S01	AGB579	Well 1	1983	1984	8	260	64	138	143	1	Layne & Bowler	Submersible	6 GH – 4 Stage	277	196	3500	20	Generator on site.
May Creek	S02	AGB629	Well 2	1994	2001	12	260	90	151	156	2	Goulds	Submersible	10 RJMC – 8 Stage 8-1/2" Impeller	500	268	1740	50	
Otis	S01	AGB580	Well	1994	1994		423	228	233	233	1	Flint & Walling	Submersible	Aermotor 31 Stage	33	368	3450	5	None
Lake Stevens Integrated	S05	AGB694	Well 1	1984		16	217	78	108	111	1	Byron Jackson	Submersible	12MQH	1200	405	1760	150	Wired for trailer generator.
Lake Stevens Integrated	S06	AGB695	Well 2	1984		16	217	78	98	101.5	2	Byron Jackson	Submersible	12MQH	1200	405	1760	150	
212 Market & Deli	S01	ABD001	Well	1994		6		93	108	118	1	UNK	Submersible	UNK	2.5	UNK	3500	UNK	None
Warm Beach	S01 (Kayak)	BBF570	Well 2	1979	2017	15 (reduces to 10)	321	341	361	381	1	Grundfos	Submersible	230S600-19, Product No 15BH0019, 19 stage	275	654	3450	60	Wired for trailer generator.
Warm Beach	S02 (Kayak)	BBF571	Well 3	1993	1994	12	333	370	400	402	2	American Turbine	Vertical Turbine	10-L-20 13 Stage	300	600	1765	60	
Warm Beach	S01 (Warm Beach)	ABR307	Well 2	1982	2014	6	175	171	180	180		Grundfos	Submersible	60S75-13	50	303	3450	7.5	None
Warm Beach	S04 (Warm Beach)	ABR309	Well 4	1990	2020	12	320	527	537	542		Franklin	Submersible	F8STS225-4 Impeller diam "4B"	200	390	3450	25	Propane Gen. (permanent)

THIS PAGE INTENTIONALLY LEFT BLANK

Table 4-7 | Interties to Adjacent Purveyors

Purveyor	Location	Meter Size (inch)	Purpose
Gold Bar	40720 May Creek Rd.	4” & (2) 2”	Emergency Interlocal Agreement
Granite Falls (Saratoga)	830 Saratoga St	6”	Wholesale
Granite Falls (100th St)	1401 100th St NE	8”	Wholesale
Granite Falls (Alder)	100 S. Alder Ave	6”	Wholesale
Arlington	11700 172nd St NE	6”	Wholesale
City of Snohomish	3124 Robe Menzel Road (approximate)	2”	Wholesale
Sudden View	17523 123rd Ave NE	2	Wholesale
Twin Falls	155th Ave NE, North of Jordan Rd	1.5	Wholesale



Data Sources:
SnoPUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

murraysmith

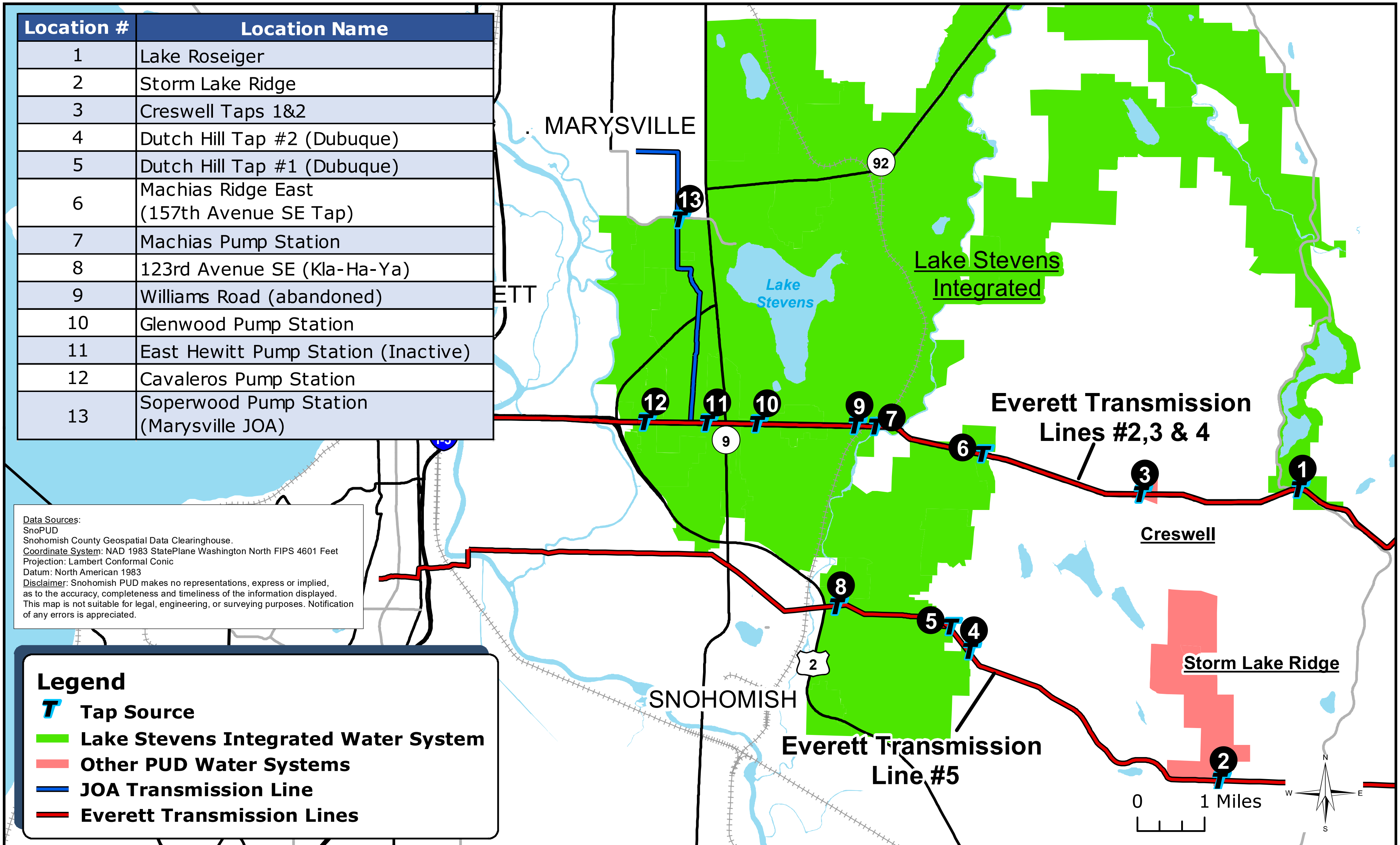
SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD
2021 Water System Plan

Figure 4-1
Major Source of Supply

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\Report Figures\Figure4-2_SourceofSupplyandPUDTaps.mxd 12/6/2022 11:33:19 AM joshua.ishimwe

Location #	Location Name
1	Lake Roseiger
2	Storm Lake Ridge
3	Creswell Taps 1&2
4	Dutch Hill Tap #2 (Dubuque)
5	Dutch Hill Tap #1 (Dubuque)
6	Machias Ridge East (157th Avenue SE Tap)
7	Machias Pump Station
8	123rd Avenue SE (Kla-Ha-Ya)
9	Williams Road (abandoned)
10	Glenwood Pump Station
11	East Hewitt Pump Station (Inactive)
12	Cavaleros Pump Station
13	Soperwood Pump Station (Marysville JOA)



Data Sources:
SnoPUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

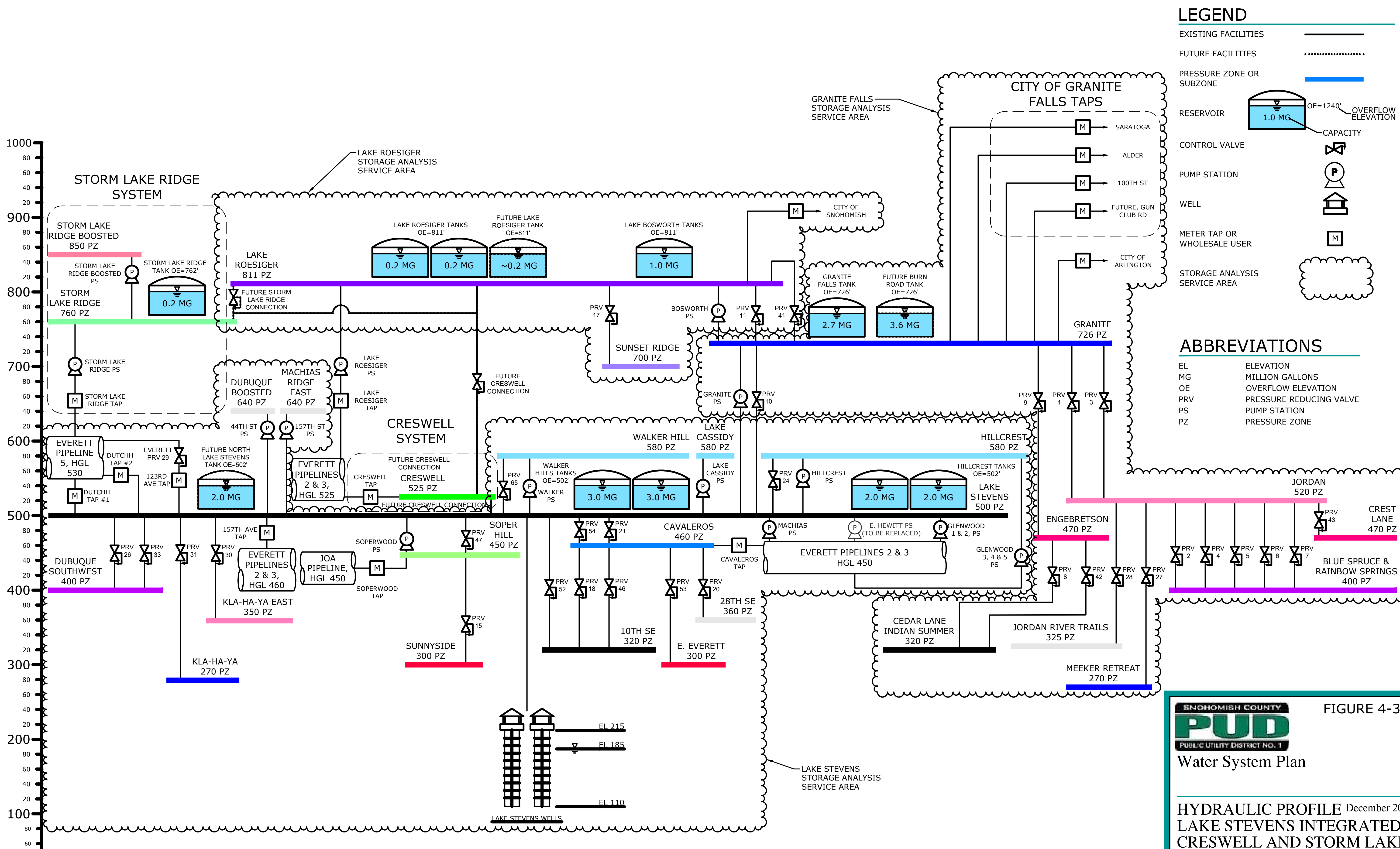
Snohomish County PUD
2021 Water System Plan

Figure 4-2
Source of Supply and PUD Taps

December 2022

20-2733

THIS PAGE INTENTIONALLY LEFT BLANK



SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Water System Plan

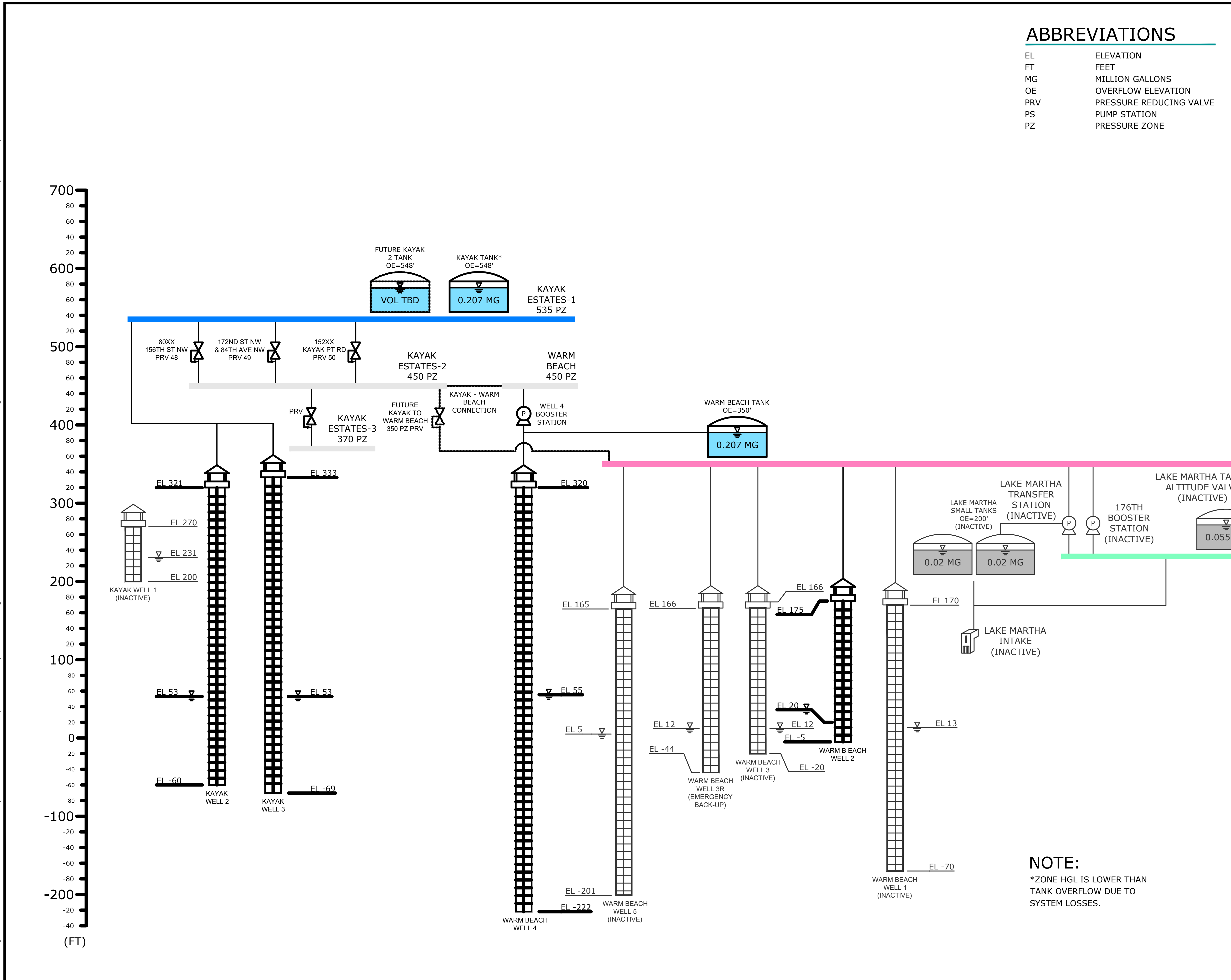
FIGURE 4-3A

HYDRAULIC PROFILE December 2022
LAKE STEVENS INTEGRATED, CRESWELL AND STORM LAKE RIDGE WATER SYSTEMS

murraysmith

20-2733

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\Figures\20-2733-WA-HYDRAULIC PROFILES-CT.dwg 4-3B 12/6/2022 11:14 AM JOSHUA.ISHIMWE 23.0s (LMS Tech)



SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

FIGURE 4-3B

Water System Plan

HYDRAULIC PROFILE WARM BEACH WATER SYSTEMS

December 2022

murraysmith

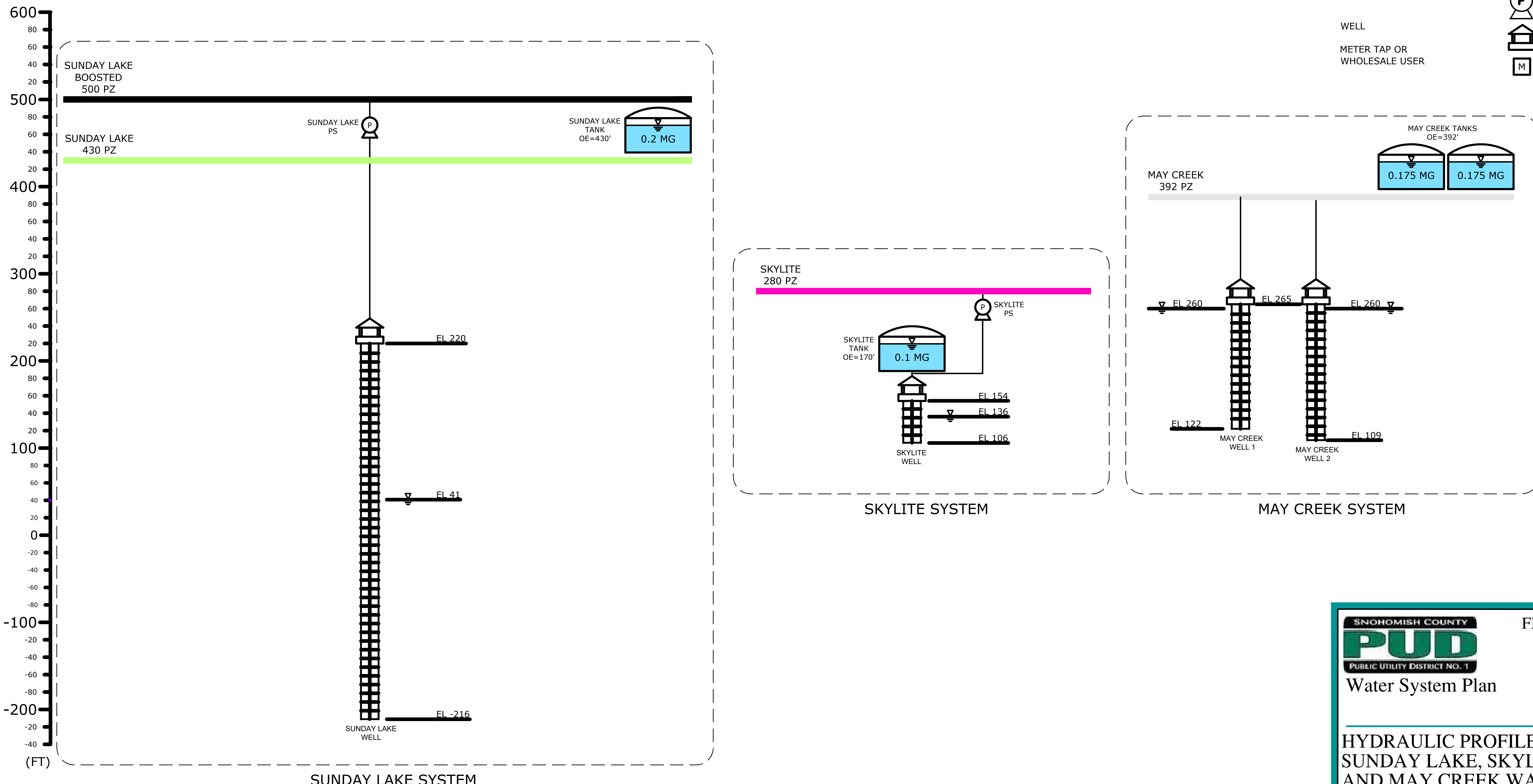
20-2733

ABBREVIATIONS

EL	ELEVATION
MG	MILLION GALLONS
OE	OVERFLOW ELEVATION
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
PZ	PRESSURE ZONE

LEGEND

- EXISTING FACILITIES
- FUTURE FACILITIES
- PRESSURE ZONE OR SUBZONE
- RESERVOIR (1.0 MG – CAPACITY; OE=1240' – OVERFLOW ELEVATION)
- CONTROL VALVE
- PUMP STATION
- WELL
- METER TAP OR WHOLESALE USER (M)



SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

FIGURE 4-3C

Water System Plan

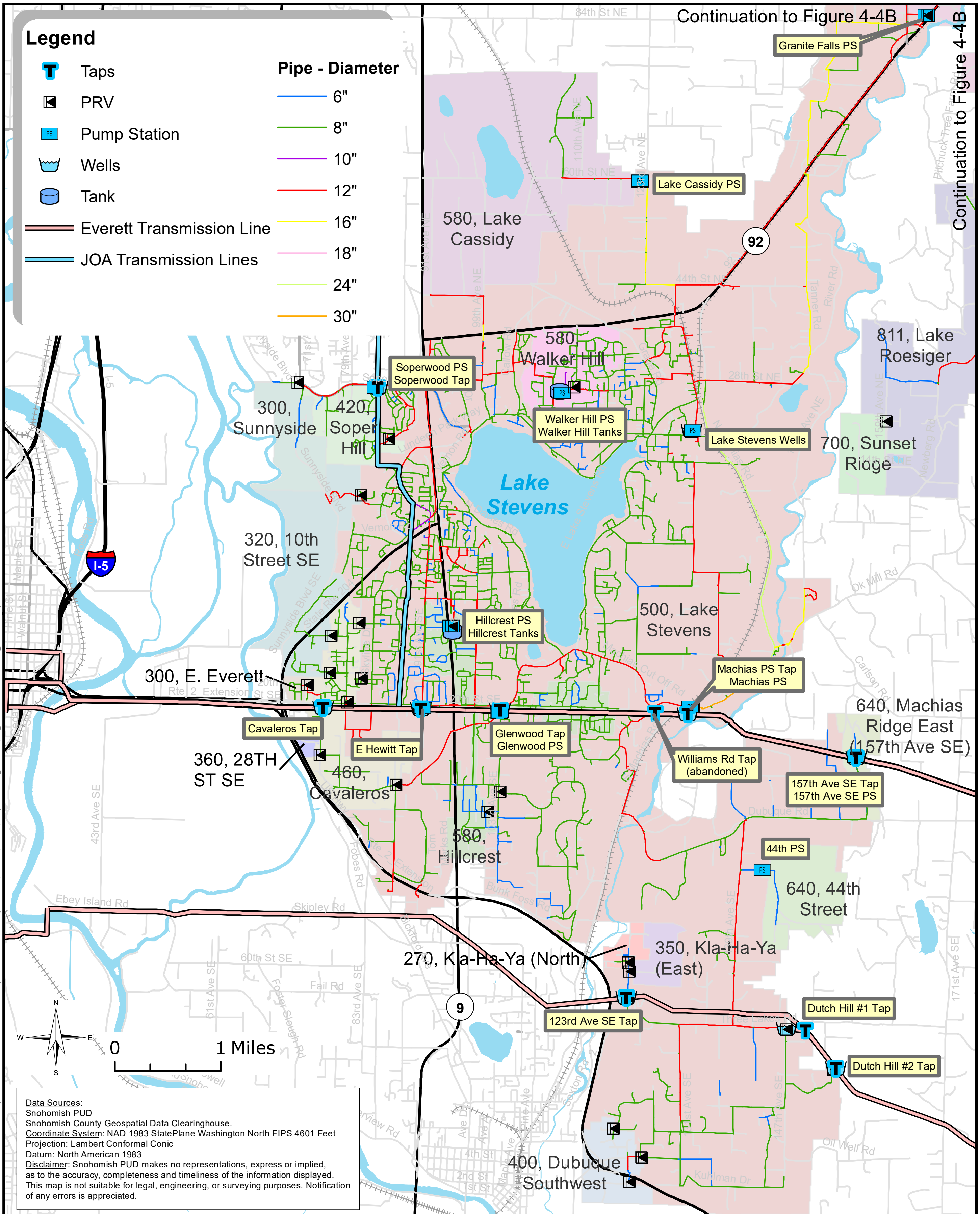
HYDRAULIC PROFILE SUNDAY LAKE, SKYLITE, AND MAY CREEK WATER SYSTEMS

December 2022

murraysmith

20-2733

THIS PAGE INTENTIONALLY LEFT BLANK

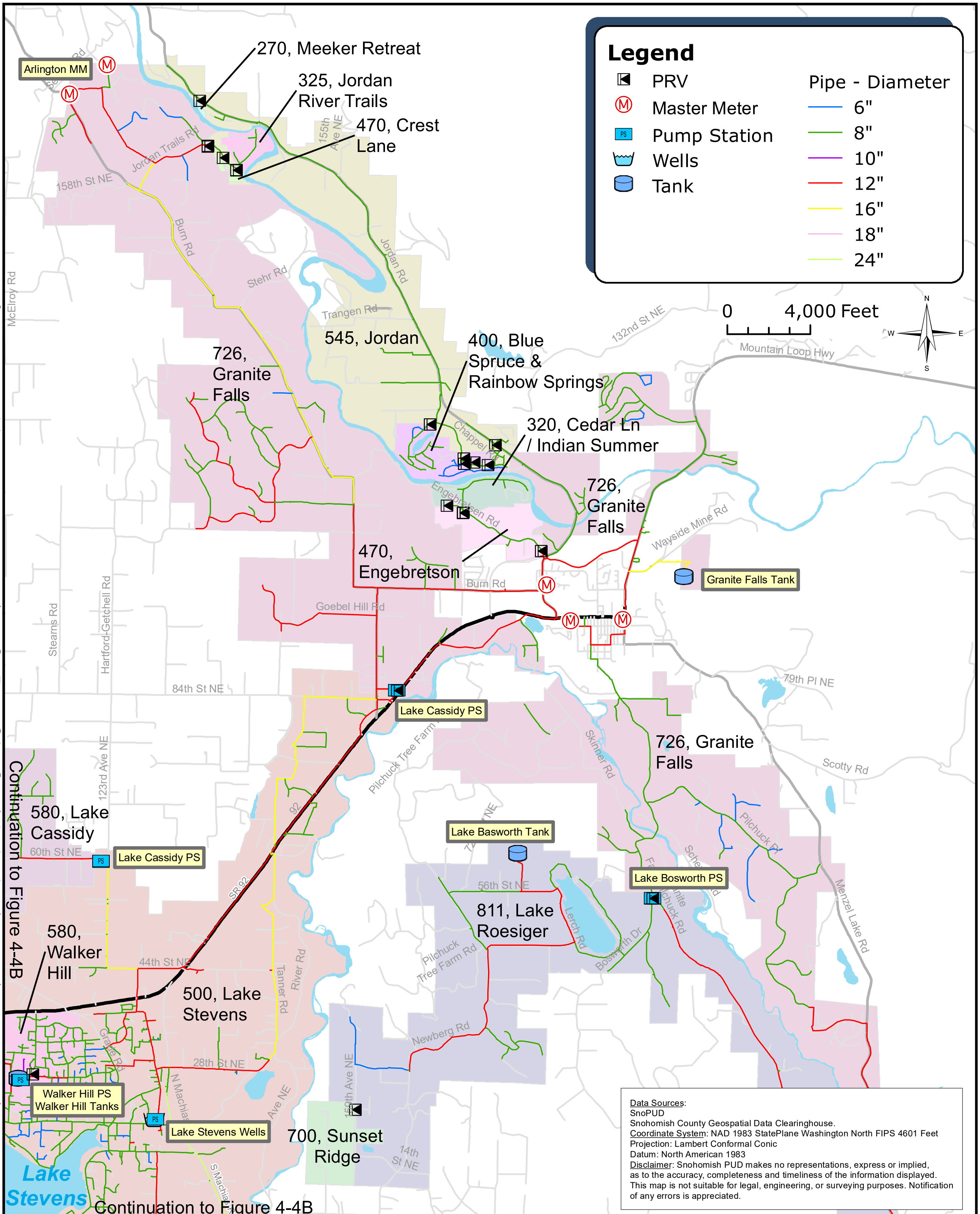


murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 4-4A: Lake Stevens Integrated Water System Southwest Sub Area



murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

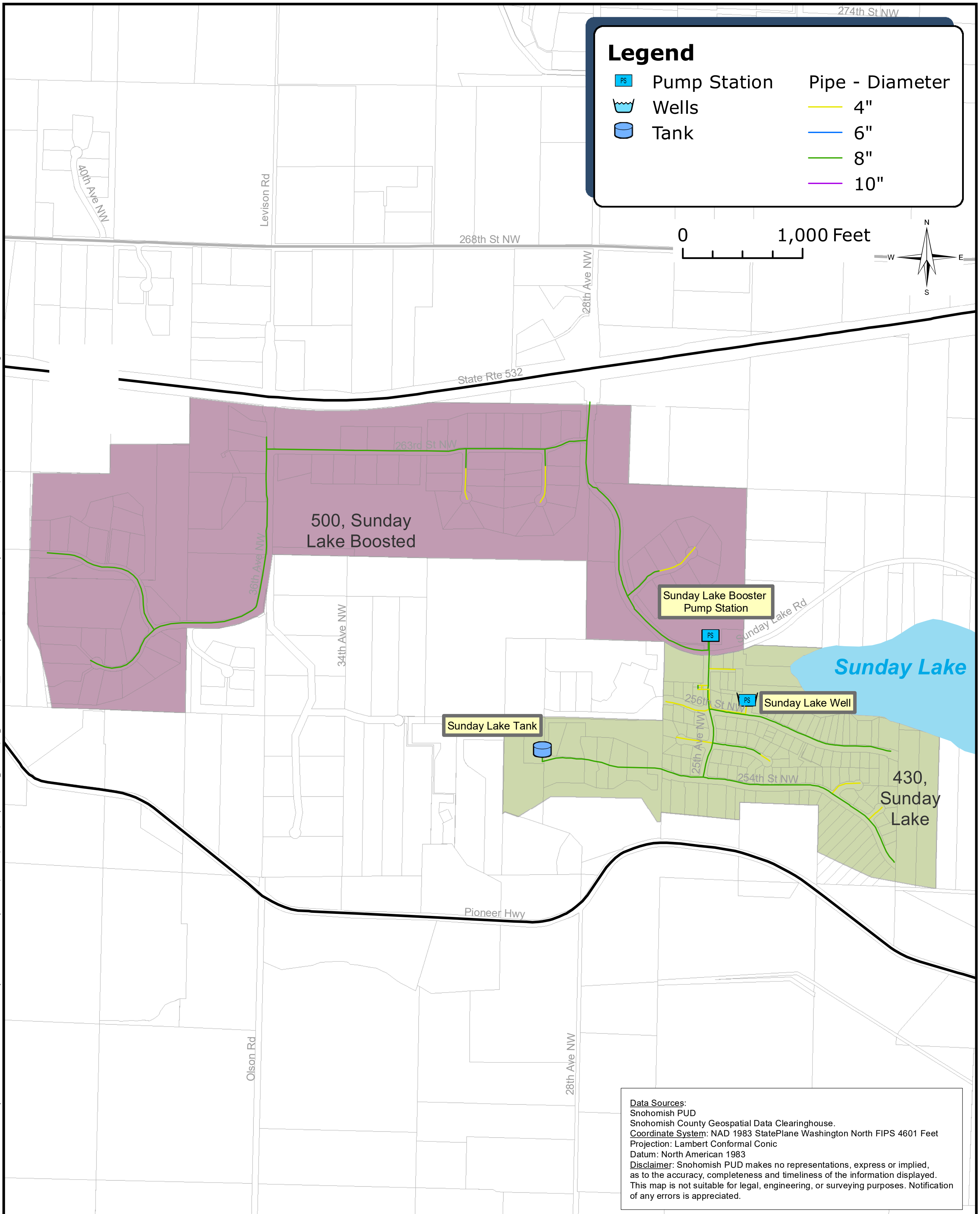
Snohomish County PUD 2021 Water System Plan

Figure 4-4B Integrated System Granite Falls Area

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\Report Figures\Figure4-4B_Integrated System Granite Falls Area.mxd 12/6/2022 11:46:28 AM joshua.ishimwe

December 2022

20-2733



Data Sources:
Snohomish PUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\Report Figures\Figure4-4C_Sunday Lake Water System.mxd 12/6/2022 11:50:26 AM joshua.ishimwe

murraysmith

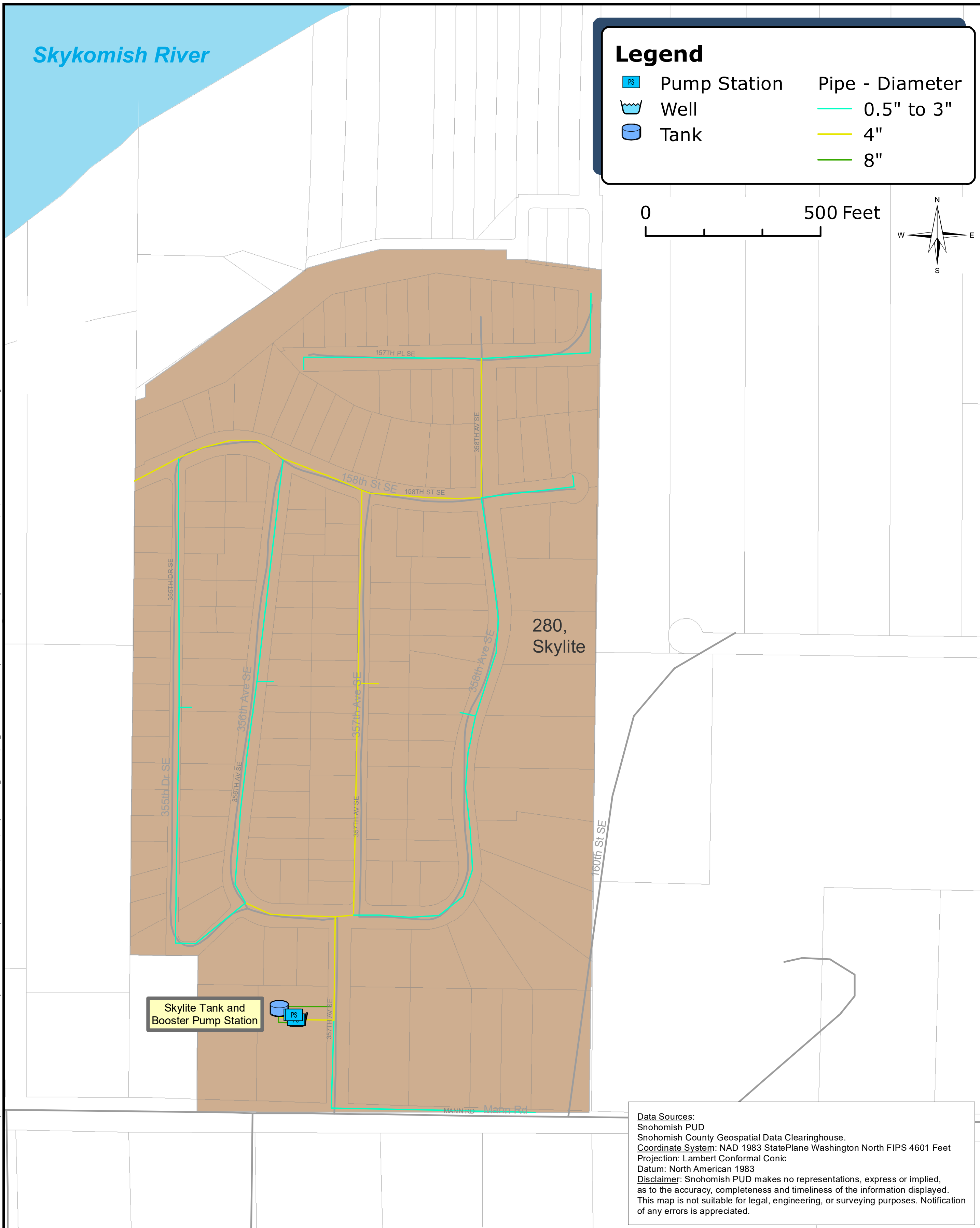
SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 4-4C Sunday Lake Water Service Area

December 2022

20-2733



Data Sources:
Snohomish PUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

murraysmith

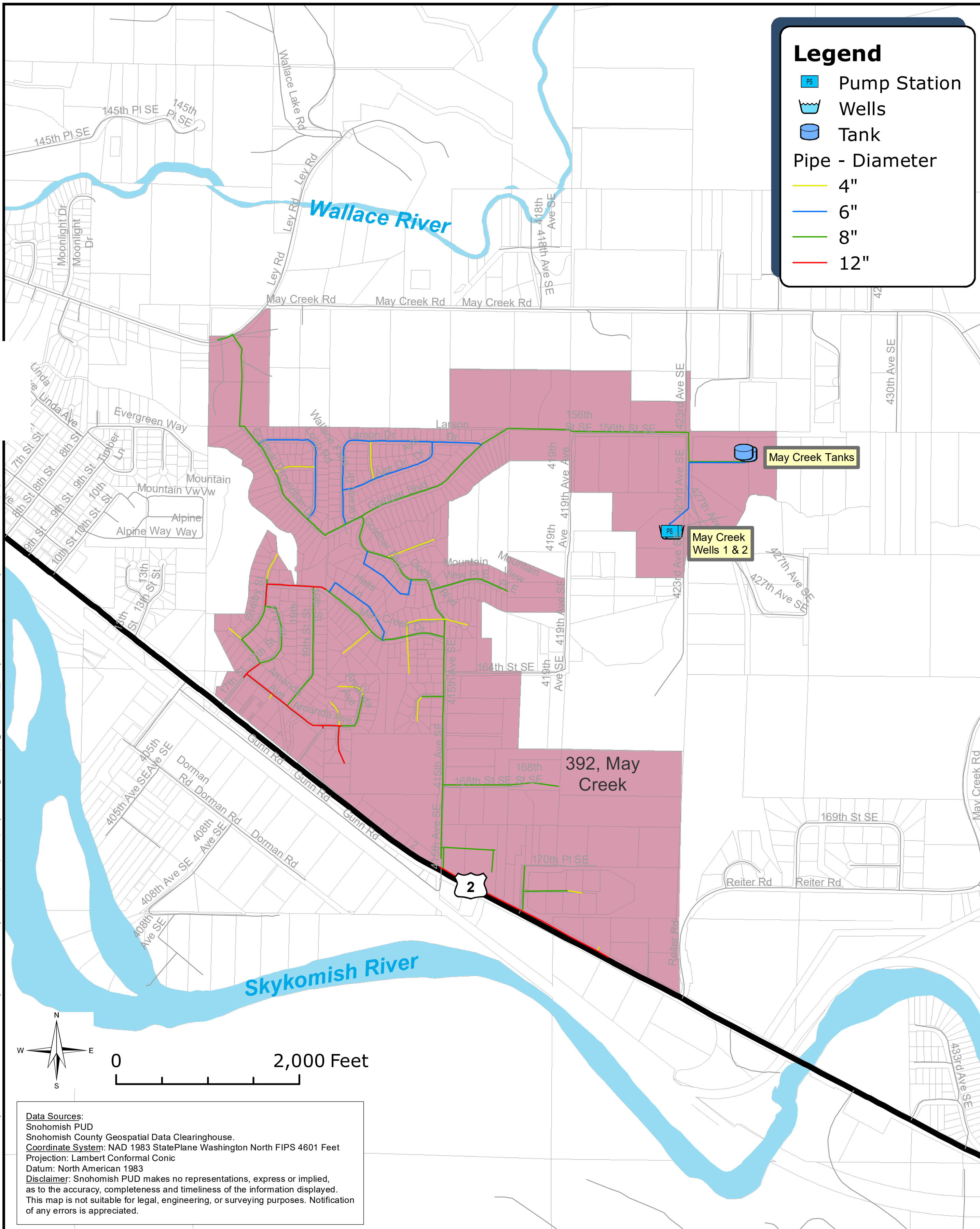
SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 4-4D Skylite Water System

December 2022

20-2733



murraysmith

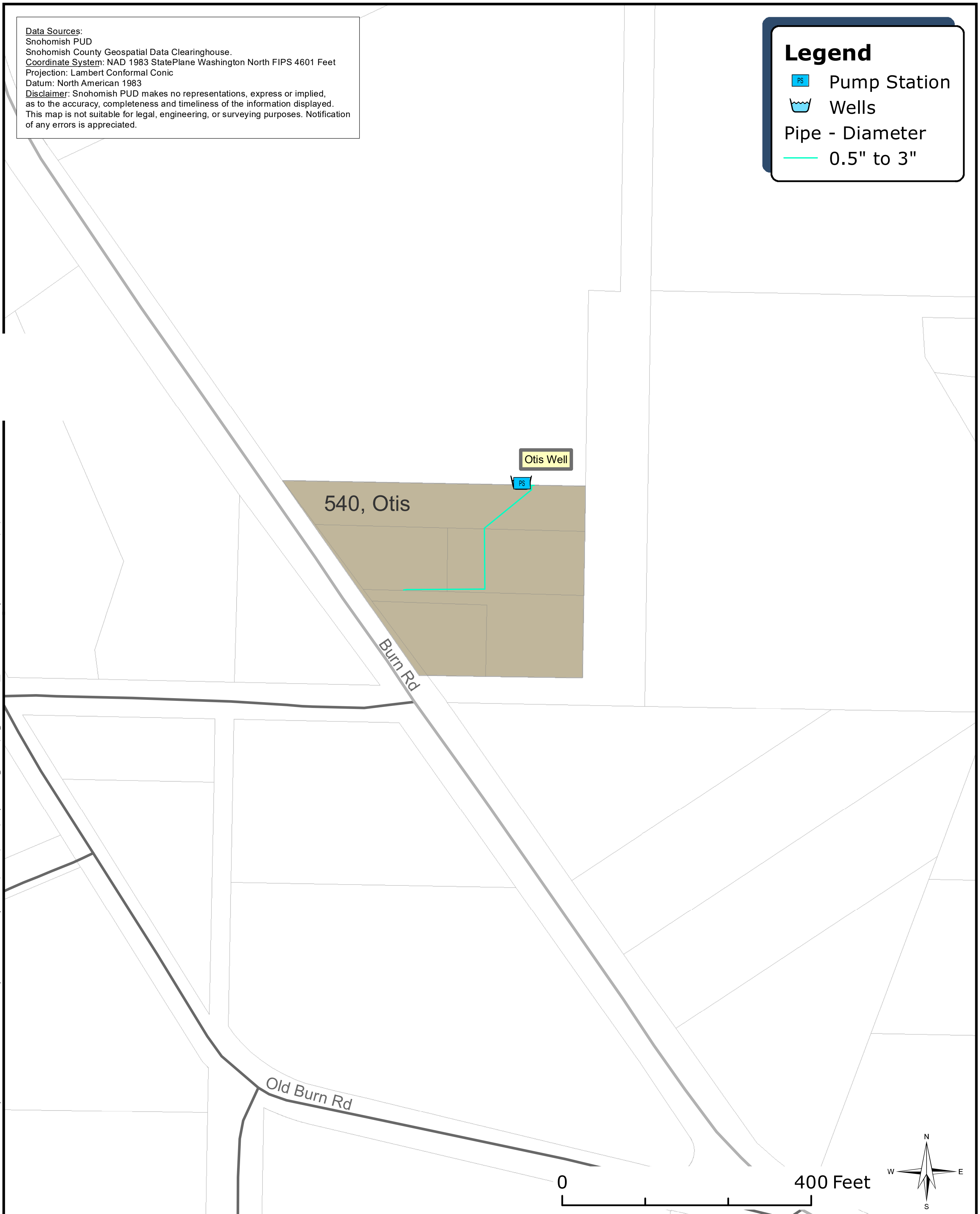
SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 4-4E May Creek Water System

December 2022

20-2733

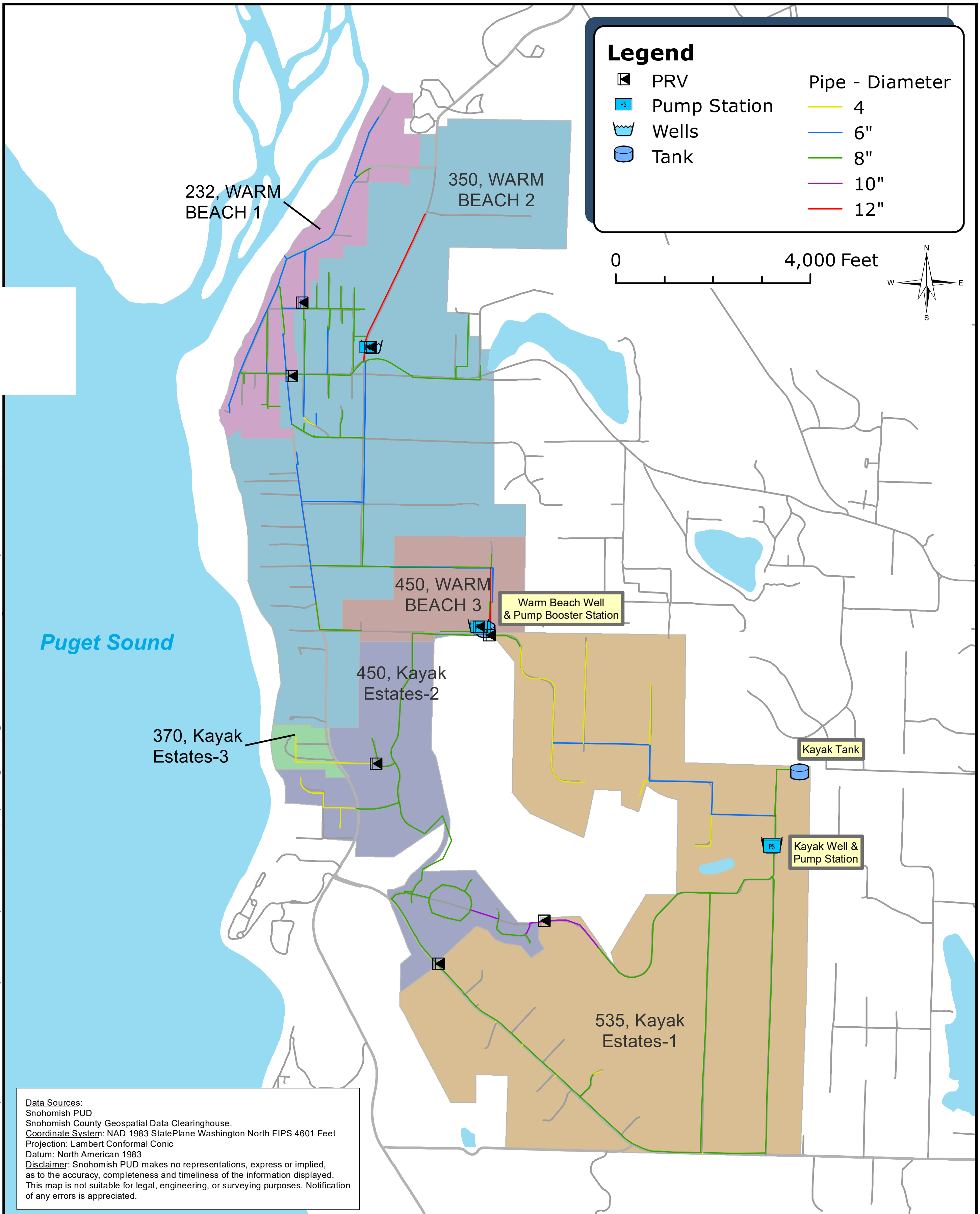


murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 4-4F Otis Water System



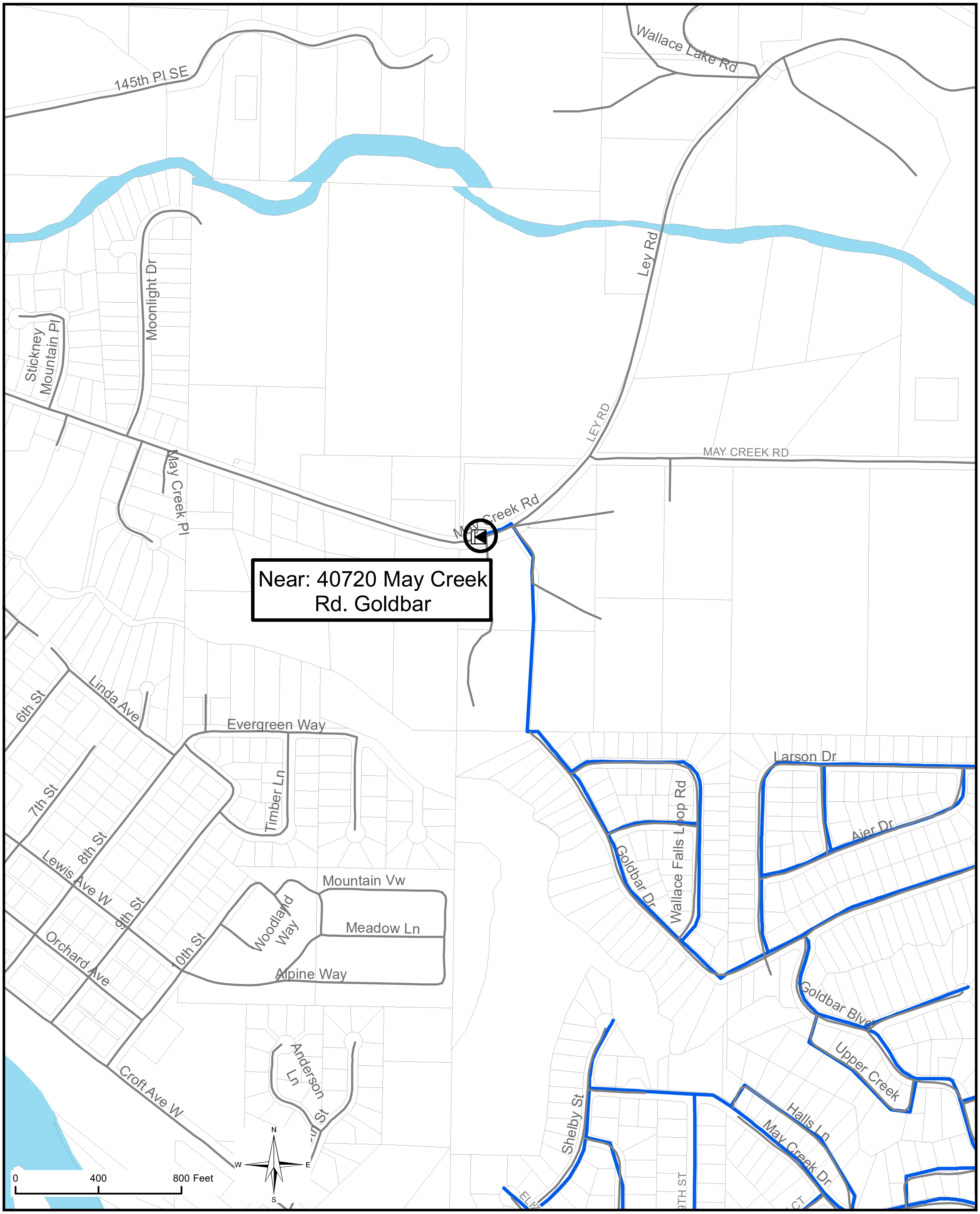
K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\Report Figures\Figure4-4G_Warm Beach Water System.mxd 12/6/2022 11:31

murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD 2021 Water System Plan

Figure 4-4G Warm Beach Water System



Snohomish County PUD 2021 Water System Plan

Figure 4-5: Existing Intertie with Gold Bar

December 2022

20-2733

murraysmith

Chapter 5

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 5

Planning Data and Demand Forecasting

5.1 Introduction

The planning efforts conducted by the District rely on a thorough analysis of its systems' water demands. This section summarizes the District's historical water consumption and supply trends in each water system between 2010 and 2019. Using this data, the demand per ERU, the ADD, and the MDD for each of the District's systems are calculated for each year. The analysis then looks at the historical trends of these values and determines "planning" values to use in forecasting the system's future water demand.

These planning values are used to forecast the future water supply and demands needs for the system for the next 10- and 20-year planning periods. The future water supply and demands determined by this analysis are used in later chapters to identify the required piping and facility capacity as one of the primary inputs to the capital improvement plan.

5.2 Definitions

When evaluating planned water use, it is important to clearly define the language used. Below is a summary of the terms used in this chapter and the throughout this plan.

Customers: The number of service connections served by the District.

Consumption: The true volume of water used by the water system's customers. The volume is measured at each customer's connection to the distribution system.

Demand: The quantity of water required from a water supply source over a period of time necessary to meet the needs of domestic, commercial, industrial, and public uses, and to provide enough water to supply firefighting, system losses, and miscellaneous water uses. Demands are normally discussed in terms of flow rate, such as MGD or gpm and are described in terms of a volume of water delivered during a certain time period. Flow rates pertinent to the analysis and design of water systems are:

- Average Day Demand (ADD): The total amount of water delivered to the system in a year divided by the number of days in the year.
- Maximum Day Demand (MDD): The maximum amount of water delivered to the system during a 24-hour time period of a given year.

- Peak Hour Demand (PHD): The maximum amount of water delivered to the system, excluding fire flow, during a one-hour time period of a given year. A systems peak hour demand usually occurs during the same day as the peak day demand.

Distribution System Leakage (DSL): The annual amount of water calculated from the difference between the measured amount of water supplied into the system and the measured amount of water taken out of the system for consumption and other authorized uses. Authorized uses include both metered and unmetered water uses. Water use that is unmetered must be estimated to be classified as an authorized use. Examples of common unmetered water uses include the use of hydrants for flushing, firefighting, and construction. The calculated DSL volume consists primarily of water loss through leaks in the water system, but may also include meter inaccuracies, meter reading errors, water theft, and reservoir overflows.

Equivalent Residential Units (ERUs): One ERU represents the amount of water used by one single family residence for a specific water system. The demand of other customer classes can be expressed in terms of ERU's by dividing the demand of each of the other customer classes by the demand represented by one ERU.

Non-revenue water usage: Consumption that is tracked or estimated, but not billed. The District tracks non-revenue water as water used for flushing, tank cleaning, construction, fire-fighting, and similar activities. Non-revenue water use typically makes up a small part of the total demand.

Supply: Water that is delivered to a water system by one or more supply facilities which may consist of supply stations, BPSs, and wells. Supply is further broken down into two categories, as further described below.

- Production: The amount of water supplied by District sources (e.g., Production wells).

- Purchased water: Supply purchased from another water system and supplied through third party mains. "

Unaccounted-for Water: Water that is measured as going into the distribution system but not metered as going out of the system. This term was previously used before the definition of DSL became standard.

5.3 Historical Water Usage

The systems managed by the District have changed since the last update of the WSP in 2011. The Lake Roesiger, Pilchuck 10, and Dubuque systems were merged into the Lake Stevens Integrated system in 2012, 2012, and 2014, respectively. The historical data for these systems have been combined with the Lake Stevens Integrated system.

The District acquired the Warm Beach system in September 2018 and historical data is available beginning in 2014. The Warm Beach system is currently in the process of being combined with the Kayak system, which will be jointly called Warm Beach. These two combined systems will be shown as one system in the future projections at the end of this chapter and the system analysis shown in **Chapter 7**. A combined Warm Beach table is provided for each historical usage table shown below. The values shown in these tables come from the historical water usage of both the Kayak and Warm Beach systems.

5.3.1 Water Supply Purchased and Produced

Table 5-1 summarizes the monthly supply for each water system from 2010 through 2019. The tables review both purchased and well supply. Of the District's nine existing systems, two purchase water (Creswell and Storm Lake Ridge), seven pump water from their wells (May Creek, Skylite, Kayak, Warm Beach, Sunday Lake, 212 Market & Deli, and Otis), and one system, Lake Stevens Integrated, uses both purchased and well water to supply its customers.

Table 5-1 | Historical Water Supply

Lake Stevens Integrated	Water Purchased & Pumped (1000-gal)									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
January	120,670	125,832	112,228	110,825	99,454	104,847	176,974	101,841	111,662	107,967
February	110,300	112,017	102,996	98,039	89,764	90,959	62,424	105,133	105,181	83,006
March	123,140	124,167	106,753	107,987	101,899	104,846	67,980	103,146	100,216	105,101
April	122,255	119,930	117,797	109,786	113,679	106,952	112,689	108,056	131,151	109,521
May	133,780	130,353	123,372	126,407	113,190	128,363	121,466	119,832	129,971	176,355
June	138,290	137,089	114,015	134,259	128,889	191,574	144,260	178,796	177,132	193,479
July	232,293	157,465	149,885	212,612	195,552	221,612	146,459	215,274	216,866	170,914
August	214,719	201,991	193,825	174,738	164,745	183,527	173,361	208,289	191,507	195,053
September	135,438	167,124	156,690	128,588	132,824	117,242	130,881	174,655	156,170	132,332
October	129,245	126,429	115,203	117,188	106,702	105,627	106,777	112,201	115,932	127,292
November	128,878	112,532	106,382	107,391	104,137	104,389	104,555	107,474	111,658	96,004
December	120,893	112,734	111,436	114,166	104,120	107,703	112,434	102,037	106,264	133,020
Annual Production (1000-gal/year)	1,709,361	1,627,662	1,510,583	1,541,986	1,454,953	1,567,641	1,460,261	1,636,734	1,653,710	1,630,043
ADD (1000-gal/day)	4,683	4,459	4,139	4,225	3,986	4,295	4,000	4,484	4,531	4,466
Storm Lake Ridge	Water Purchased (1000-gal)									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
January	749	859	832	1,034	1,059	915	910	1,068	994	1,003
February	688	815	790	889	877	868	907	860	983	1,038
March	770	830	797	937	903	878	939	939	950	949
April	786	895	917	1,008	1,101	1,006	1,135	1,004	1,230	1,183
May	968	896	1,142	1,121	1,126	1,482	1,372	1,281	1,190	1,552
June	1,040	952	975	1,456	1,490	2,780	1,690	1,720	2,620	1,918
July	2,927	1,313	1,458	2,851	2,432	3,340	1,785	3,252	2,620	2,352
August	2,445	2,028	2,579	2,085	2,035	2,364	2,331	3,193	2,023	2,302
September	1,025	1,775	1,827	1,177	1,290	1,128	1,131	1,889	2,023	1,419
October	928	984	1,208	1,032	1,032	1,054	1,039	1,021	1,078	1,245
November	925	791	855	951	921	955	983	1,045	1,043	935
December	839	993	967	941	948	969	1,034	993	1,051	1,195
Annual Production (1000-gal/year)	14,092	13,131	14,348	15,484	15,214	17,739	15,257	18,265	17,805	17,090
ADD (1000-gal/day)	39	36	39	42	42	49	42	50	49	47

Creswell	Water Purchased (1000-gal)									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019[1]
January	76.9	92.9	89.8	93.0	88.9	95.2	88.6	106.2	102.5	106.7
February	78.8	56.0	75.1	88.3	84.4	78.2	99.2	94.0	97.2	84.3
March	57.1	66.3	83.1	88.2	102.2	112.3	104.3	106.4	93.5	84.4
April	69.0	77.9	92.5	107.5	101.3	96.5	131.3	104.0	163.8	105.5
May	59.3	94.1	144.7	158.0	159.4	139.7	174.5	152.8	157.8	215.3
June	80.6	143.0	95.0	181.7	191.5	406.7	226.3	276.9	354.6	252.3
July	402.3	102.6	242.7	422.1	411.8	375.2	212.4	473.1	353.1	354.6
August	264.6	303.4	455.8	267.2	249.5	275.8	411.3	457.5	243.8	344.8
September	67.8	256.6	279.2	147.4	174.2	108.6	154.9	222.8	243.8	171.7
October	85.5	111.4	157.8	107.9	100.5	110.9	74.8	76.1	103.2	91.7
November	66.8	83.6	90.2	80.3	67.3	100.8	106.9	74.0	100.2	94.8
December	60.6	85.2	91.3	103.3	112.1	90.7	94.2	155.6	104.7	118.2
Annual Production (1000-gal/year)	1,369	1,473	1,897	1,845	1,843	1,991	1,879	2,299	2,118	2,024
ADD (1000-gal/day)	3.75	4.04	5.18	5.05	5.05	5.45	5.15	6.30	5.80	5.55
May Creek	Water Pumped (1000-gal)									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
January	1,932	2,382	2,224	1,937	2,515	1,762	1,915	2,346	2,604	2,419
February	1,832	2,117	1,922	1,740	1,967	1,804	2,059	1,942	2,305	2,386
March	2,295	2,128	2,518	1,755	2,486	2,010	2,083	2,073	2,623	2,356
April	1,958	2,000	2,229	3,111	2,348	2,050	2,107	2,261	2,813	1,995
May	2,016	2,313	2,451	5,483	1,943	2,072	2,401	2,961	3,175	3,197
June	2,637	2,436	2,116	6,324	2,440	3,371	2,452	2,682	3,118	2,775
July	2,927	2,413	3,082	5,684	3,065	3,640	2,159	4,133	3,705	3,022
August	3,078	3,013	3,546	2,668	2,448	2,878	3,096	4,770	3,597	3,206
September	2,237	2,472	2,709	2,188	2,384	1,909	2,290	3,536	2,379	2,656
October	2,044	2,221	1,531	3,173	1,992	1,728	1,917	2,625	2,359	2,527
November	2,381	2,055	2,204	1,781	2,082	1,979	2,364	2,646	2,169	2,315
December	2,088	2,080	1,964	2,899	1,747	1,936	2,671	2,381	2,023	2,572
Annual Production (1000-gal/year)	27,426	27,629	28,496	38,744	27,416	27,139	27,514	34,357	32,868	31,427
ADD (1000-gal/day)	75.1	75.7	77.9	106.1	75.1	74.4	75.4	94.1	90.0	86.1

Skylite	Water Pumped (1000-gal)									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
January	987	894	776	693	730	605	776	1,399	691	767
February	729	1,071	681	357	640	579	881	769	627	604
March	888	1,032	727	1,023	767	721	877	747	715	611
April	671	678	808	721	644	663	857	667	765	625
May	743	823	985	815	669	638	1,043	880	820	909
June	971	808	898	926	768	1,074	1,095	889	784	817
July	1,165	846	1,148	1,622	988	1,143	1,131	1,257	1,113	882
August	1,274	1,260	1,124	1,456	889	941	1,382	1,008	1,028	907
September	858	1,300	976	1,164	862	779	849	781	728	652
October	782	1,372	610	719	697	698	825	673	683	709
November	875	824	1,194	540	704	795	1,027	724	659	620
December	1,020	844	735	786	682	818	1,101	642	604	821
Annual Production (1000-gal/year)	10,964	11,752	10,661	10,821	9,042	9,453	11,844	10,437	9,218	8,924
ADD (1000-gal/day)	30	32	29	30	25	26	32	29	25	24
Otis	Water Pumped (1000-gal)									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
January	16.5	14.9	13.7	18.3	15.8	15.3	15.0	12.4	16.1	11.9
February	13.9	13.2	14.6	14.1	16.9	12.9	15.9	9.4	14.0	7.9
March	16.1	15.7	14.7	13.9	15.0	15.9	15.0	10.4	13.4	11.7
April	17.8	14.4	16.3	16.5	17.1	16.0	16.5	11.7	15.8	12.6
May	16.0	15.3	20.9	17.5	22.9	21.1	17.5	16.3	16.4	22.8
June	18.1	14.7	14.7	16.8	18.5	28.2	20.1	15.2	13.9	19.0
July	18.6	19.0	18.2	20.5	26.5	26.0	19.7	16.8	19.7	25.8
August	16.1	22.6	18.1	17.1	15.5	19.8	21.7	16.2	26.7	22.8
September	13.5	17.3	17.1	15.6	20.3	16.5	13.2	14.3	20.1	11.2
October	13.9	14.4	19.4	17.4	21.1	19.5	11.2	15.8	14.1	10.6
November	14.0	15.6	15.2	13.8	17.5	15.5	14.7	14.6	11.4	10.2
December	12.9	14.7	15.2	18.1	14.6	16.8	14.2	14.4	9.3	13.9
Annual Production (1000-gal/year)	187	192	198	200	221	224	195	167	191	180
ADD (1000-gal/day)	0.51	0.53	0.54	0.55	0.61	0.61	0.53	0.46	0.52	0.49

Sunday Lake	Water Pumped (1000-gal)									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
January	652	648	652	727	635	601	660	684	708	770
February	607	721	632	539	575	540	581	588	649	650
March	800	832	732	623	566	645	844	757	648	734
April	709	546	576	680	724	667	702	631	727	722
May	720	722	899	758	746	772	1,118	954	1,416	1,565
June	859	773	827	861	936	1,959	1,052	1,293	1,530	1,860
July	1,565	827	1,103	1,840	1,841	1,877	1,459	2,052	2,572	2,192
August	1,556	1,450	1,520	1,317	1,372	1,628	2,098	2,381	2,194	2,101
September	653	1,243	1,092	752	968	831	952	1,226	1,022	1,026
October	650	591	759	750	712	738	688	748	770	833
November	714	622	770	346	667	722	693	736	718	692
December	573	601	606	942	613	647	699	658	644	856
Annual Production (1000-gal/year)	10,058	9,578	10,169	10,135	10,355	11,628	11,546	12,708	13,599	14,001
ADD (1000-gal/day)	27.6	26.2	27.8	27.8	28.4	31.9	31.5	34.8	37.3	38.4
212 Market & Deli	**Water Pumped (1000-gal)**									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
January	12.3	8.4	7.7	7.6	13.9	13.6	9.4	18.5	14.1	4.9
February	11.3	8.9	6.6	11.9	13.6	15.3	8.2	10.7	10.7	3.9
March	9.9	9.3	6.9	15.0	11.5	17.5	10.3	9.2	4.9	4.1
April	6.9	5.4	7.4	15.7	13.0	16.6	8.8	4.9	6.1	4.9
May	7.2	8.3	10.2	17.8	10.4	15.6	10.4	5.0	6.3	5.6
June	8.7	10.7	9.9	14.9	9.5	17.4	8.2	5.6	4.4	4.8
July	9.7	16.0	14.5	16.5	12.5	11.8	8.8	3.1	5.7	5.5
August	9.1	24.2	9.6	15.0	10.7	12.4	9.3	5.3	5.6	4.4
September	13.0	18.2	9.2	13.1	11.1	17.8	11.8	4.9	5.0	4.1
October	14.2	14.0	10.4	7.9	11.5	9.2	11.8	8.2	5.0	3.7
November	12.7	12.7	10.3	20.9	11.2	14.0	15.8	16.5	5.3	3.2
December	9.7	9.1	5.1	12.8	11.2	9.6	16.4	15.9	4.9	3.4
Annual Production (1000-gal/year)	125	145	108	169	140	171	129	108	78	52
ADD (1000-gal/day)	0.34	0.40	0.29	0.46	0.38	0.47	0.35	0.30	0.21	0.14

Kayak	Water Pumped (1000-gal)									
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
January	2,034	2,407	2,432	2,340	1,978	2,295	2,097	2,131	2,291	1,975
February	1,801	1,724	1,851	1,615	1,875	1,777	2,079	1,713	1,780	2,096
March	1,969	2,485	1,996	1,953	1,730	2,304	2,307	2,125	1,797	1,919
April	1,902	1,932	2,306	2,201	2,069	2,198	2,032	1,791	2,025	1,928
May	2,423	2,274	2,462	2,304	2,216	2,747	2,910	2,704	3,497	3,542
June	2,184	2,585	2,363	2,827	2,933	5,345	2,820	3,516	3,372	3,969
July	4,534	2,642	3,861	5,262	5,332	5,291	3,813	5,149	5,895	5,213
August	4,365	4,366	6,908	3,867	3,870	4,667	5,174	5,756	4,770	4,403
September	2,089	3,400	2,966	2,154	2,819	2,508	2,422	3,061	2,502	2,281
October	760	1,921	2,169	2,389	2,010	2,214	1,829	2,084	2,126	1,885
November	3,425	2,111	2,314	1,618	2,120	2,179	2,062	1,937	1,944	1,660
December	1,966	1,843	1,878	2,287	1,909	1,960	2,053	1,714	1,720	2,116
Annual Production (1000-gal/year)	29,453	29,691	33,506	30,818	30,860	35,487	31,599	33,680	33,719	32,987
ADD (1000-gal/day)	81	81	92	84	85	97	86	92	92	90

Warm Beach	Water Pumped (1000-gal)									
					2014	**2015**	**2016**	**2017**	**2018**	**2019**
January					1,696	2,126	2,020	2,592	2,464	2,566
February					2,243	1,978	1,924	2,103	2,149	2,178
March					1,762	2,264	2,554	2,130	2,254	2,380
April					2,238	2,064	2,346	2,072	2,267	2,405
May					2,337	2,297	3,079	2,931	3,645	3,392
June					2,809	4,492	3,033	3,275	3,532	3,115
July					4,462	4,418	3,570	4,694	5,544	4,686
August					3,708	3,654	4,914	5,195	4,407	4,186
September					2,898	2,558	2,490	3,020	2,857	2,515
October					2,552	2,117	2,378	2,525	2,390	2,361
November					1,812	1,860	2,429	2,250	2,263	1,856
December					2,495	2,641	2,347	2,189	2,211	2,417
Annual Production (1000-gal/year)					31,012	32,469	33,082	34,975	35,982	34,056
ADD (1000-gal/day)					85.0	89.0	90.4	95.8	98.6	93.3

Combined Warm Beach	Water Purchased (1000-gal)								
					2014	2015	2016	2017	2018	2019
January					3,674	4,422	4,117	4,724	4,755	4,541
February					4,117	3,755	4,003	3,816	3,929	4,274
March					3,492	4,567	4,861	4,254	4,051	4,299
April					4,307	4,263	4,378	3,863	4,292	4,333
May					4,553	5,045	5,989	5,635	7,142	6,934
June					5,742	9,837	5,853	6,791	6,904	7,084
July					9,794	9,710	7,383	9,843	11,438	9,899
August					7,578	8,321	10,088	10,950	9,177	8,590
September					5,717	5,066	4,912	6,081	5,359	4,796
October					4,562	4,331	4,207	4,609	4,516	4,246
November					3,932	4,039	4,491	4,187	4,206	3,516
December					4,403	4,601	4,401	3,903	3,931	4,533
Annual Production (1000-gal/year)					61,872	67,956	64,682	68,655	69,700	67,043
ADD (1000-gal/day)					170	186	177	188	191	184

[1]In Creswell 2019 production, hydrant usage is subtracted because it was atypical.

5.3.2 Historical Water Consumption

The District divides its water consumption into four customer classifications: single family, multi-family, non-residential, and wholesale. These four user groups are described in more detail below:

- Single family connections include all residential dwellings designed to accommodate a single residential unit.
- Multi-family connections include all residential dwellings designed to accommodate two or more residential units served by a single meter.
- Non-residential customers include businesses, schools, day cares, churches, industries, public parks, some irrigation customers, camps, and mobile home parks, which are not considered single family or multi-family connections to be consistent with District records and historical reports.
- Wholesale customers are other water systems that purchase water from the District.
  - Arlington, Granite Falls, and the City of Snohomish purchase water from the Lake Stevens Integrated system.
  - During the historical review period (2010-2019), Gold Bar purchased wholesale water from the May Creek system through an emergency intertie. This intertie is expected to remain an emergency intertie only and Gold Bar is not anticipated to routinely purchase wholesale water in the future.
  - Two small water systems (Sudden View and Twin Falls) also purchase water from the Lake Stevens Integrated system. In 2010-2019, their use was billed under the non-residential rate category. Going forward, water use by these systems will be recorded as wholesale use.

The consumption analysis that follows will summarize the water use patterns of these four user groups. Table 5-2 shows the average annual consumption, average number of connections, and average daily consumption per connection for each customer group between 2010 and 2019. The table also evaluates customer water consumption in terms of ERUs.

Average demand per ERU varies between systems based on the average age and size of single-family lots. Newer homes typically have more water efficient fixtures and appliances and are therefore more water efficient. Large homes on large, rural lots typically use more water than small homes on intercity lots. The District's many satellite systems are composed of different types of customers, which accounts for the differences in demand per ERU between systems.

Table 5-2 | Historical Water Consumption

Lake Stevens Integrated System						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	155,539,654	1,163,437	3,187,498	18,134	176	18,134
2011	145,357,175	1,087,272	2,978,826	18,361	162	18,361
2012	150,774,380	1,127,792	3,089,842	18,721	165	18,721
2013	155,127,739	1,160,355	3,179,056	19,074	167	19,074
2014	143,855,627	1,076,040	2,948,055	17,198	171	17,198
2015	157,502,007	1,178,115	3,227,712	17,519	184	17,519
2016	144,074,885	1,077,680	2,952,548	18,047	164	18,047
2017	159,621,234	1,193,967	3,271,142	18,264	179	18,264
2018	156,864,959	1,173,350	3,214,657	18,565	173	18,565
2019	154,797,190	1,157,883	3,172,282	18,966	167	18,966
			2015-2019 average:		173	18,272
Multi-Family Customer Class						
2010	7,424,807	55,538	152,158	230	176	866
2011	7,769,519	58,116	159,222	300	162	981
2012	8,344,828	62,419	171,012	300	165	1,036
2013	8,452,269	63,223	173,214	300	167	1,039
2014	8,188,533	61,250	167,809	299	171	979
2015	8,843,577	66,150	181,233	299	184	984
2016	7,971,313	59,625	163,357	299	164	998
2017	7,619,273	56,992	156,143	299	179	872
2018	7,592,368	56,791	155,592	299	173	899
2019	7,293,544	54,556	149,468	298	167	894
Non-Residential Customer Class						
2010	16,137,141	120,706	330,701	414	176	1,881
2011	14,256,247	106,637	292,155	420	162	1,801
2012	13,610,556	101,807	278,923	423	165	1,690
2013	14,031,825	104,958	287,556	431	167	1,725
2014	15,215,842	113,814	311,821	431	171	1,819
2015	15,383,603	115,069	315,258	436	184	1,711
2016	14,493,570	108,412	297,019	442	164	1,815
2017	16,224,266	121,358	332,486	457	179	1,856
2018	17,035,243	127,424	349,106	468	173	2,016
2019	16,196,228	121,148	331,912	478	167	1,984
Wholesale Customer Class						
2010	34,896,007	261,022	715,129		176	4,068
2011	34,334,692	256,823	703,626		162	4,337
2012	19,132,973	143,115	392,095		165	2,376
2013	18,133,140	135,636	371,605		167	2,230
2014	20,399,329	152,587	418,047		171	2,439
2015	18,962,127	141,837	388,594		184	2,109
2016	16,801,908	125,678	344,324		164	2,105
2017	21,959,349	164,256	450,016		179	2,513
2018	24,002,681	179,540	491,891		173	2,841
2019	26,837,348	200,743	549,982		167	3,288

Lake Stevens Integrated System						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Billed Fill Stations						
2013	256,483	1,918	5,256		167	32
2014	135,754	1,015	2,782		171	16
2015	238,725	1,786	4,892		184	27
2016	361,626	2,705	7,411		164	45
2017	1,017,402	7,610	20,850		179	116
2018	1,977,528	14,792	40,526		173	234
2019	1,141,237	8,536	23,388		167	140
Total Demand						
2010	213,997,609	1,600,702	4,385,485	18,778	176	24,949
2011	201,717,633	1,508,848	4,133,830	19,081	162	25,480
2012	191,862,737	1,435,133	3,931,872	19,444	165	23,823
2013	196,001,456	1,466,091	4,016,687	19,805	167	24,100
2014	187,795,085	1,404,707	3,848,513	17,928	171	22,451
2015	200,930,039	1,502,957	4,117,690	18,254	184	22,350
2016	183,703,302	1,374,101	3,764,659	18,788	164	23,011
2017	206,441,524	1,544,183	4,230,637	19,020	179	23,621
2018	207,472,779	1,551,896	4,251,771	19,332	173	24,554
2019	206,265,547	1,542,866	4,227,031	19,742	167	25,272

Storm Lake Ridge						
Year	Annual Consumption		Average Daily Demand			ERUs**
	Cubic Feet per Year	1000-gal per Year	Gallons per Day*	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	1,816,409	13,587	63,489	190	334	190
2011	1,568,152	11,730	32,136	192	167	192
2012	1,812,173	13,555	37,137	205	181	205
2013	2,026,103	15,155	41,521	212	196	212
2014	1,990,715	14,891	40,796	214	191	214
2015	2,305,588	17,246	47,249	218	217	218
2016	1,929,887	14,436	39,549	224	177	224
2017	2,379,103	17,796	48,755	229	213	229
2018	2,328,249	17,415	47,713	230	207	230
2019	2,209,844	16,530	45,287	257	176	257
				2015-2019 average:	198	232

Creswell						
Year	Annual Consumption		Average Daily Demand			ERUs**
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	146,046	1,092	2,993	16	187	16
2011	172,396	1,290	3,533	20	177	20
2012	249,938	1,870	5,122	23	223	23
2013	242,427	1,813	4,968	23	216	23
2014	227,823	1,704	4,669	23	203	23
2015	270,605	2,024	5,546	23	241	23
2016	246,808	1,846	5,058	23	220	23
2017	303,471	2,270	6,219	23	270	23
2018	279,366	2,090	5,725	23	249	23
2019	265,008	1,982	5,431	23	236	23
			2015-2019 average:		243	23

May Creek						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	3,264,176	24,416	66,893	440	152	440
2011	3,168,194	23,698	64,926	442	147	442
2012	3,250,566	24,314	66,614	443	150	443
2013	3,088,671	23,103	63,297	446	142	446
2014	3,155,540	23,603	64,667	447	145	447
2015	3,431,172	25,665	70,316	450	156	450
2016	3,213,236	24,035	65,849	459	143	459
2017	3,873,570	28,974	79,382	475	167	475
2018	3,620,554	27,082	74,197	480	155	480
2019	3,564,591	26,663	73,050	491	149	491
			2015-2019 average:		154	471
Non-Residential Customer Class						
2010	97,535	730	1,999	5	152	13
2011	83,029	621	1,702	5	147	12
2012	65,278	488	1,338	5	150	9
2013	62,567	468	1,282	5	142	9
2014	232,094	1,736	4,756	5	145	33
2015	109,221	817	2,238	5	156	14
2016	126,353	945	2,589	6	143	18
2017	155,866	1,166	3,194	6	167	19
2018	151,484	1,133	3,104	6	155	20
2019	146,091	1,093	2,994	6	149	20
Wholesale Customer Class						
2010	18,268	137	374	1	152	1
2011	0	0	0	1	147	0
2012	59,470	445	1,219	1	150	3
2013	1,381,945	10,337	28,320	1	142	63
2014	0	0	0	1	145	0

May Creek						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Wholesale Customer Class						
2015	0	0	0	1	156	0
2016	0	0	0	1	143	0
2017	229,293	1,715	4,699	1	167	10
2018	0	0	0	1	155	0
2019	0	0	0	1	149	0
Total Demand						
2010	3,379,979	25,282	69,266	445	152	454
2011	3,251,223	24,319	66,628	447	147	454
2012	3,375,314	25,247	69,171	448	150	455
2013	4,533,183	33,908	92,899	451	142	519
2014	3,387,634	25,340	69,423	452	145	480
2015	3,540,393	26,482	72,554	455	156	464
2016	3,339,589	24,980	68,439	465	143	477
2017	4,258,729	31,855	87,275	481	167	504
2018	3,772,038	28,215	77,301	486	155	500
2019	3,710,682	27,756	76,044	497	149	511

Skylite						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	1,297,495	9,705	26,590	152	175	152
2011	1,451,935	10,860	29,755	152	196	152
2012	1,288,603	9,639	26,408	152	174	152
2013	1,174,025	8,782	24,059	152	158	152
2014	1,109,227	8,297	22,732	152	150	152
2015	1,073,988	8,033	22,009	152	145	152
2016	1,112,601	8,322	22,801	152	150	152
2017	1,148,130	8,588	23,529	152	155	152
2018	1,156,509	8,651	23,701	152	156	152
2019	1,112,692	8,323	22,803	153	149	153
				2015-2019 average:	151	152

212 Market & Deli						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Non-Residential Customer Class						
2010	18,147	136	372			
2011	19,526	146	400			
2012	15,146	113	310			
2013	20,907	156	428			
2014	19,276	144	395			
2015	24,297	182	498			
2016	17,370	130	356			
2017	14,174	106	290			
2018	11,333	85	232			
2019	7,065	53	145			

Sunday Lake						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	1,236,693	9,250	25,344	153	166	153
2011	1,188,017	8,886	24,346	155	157	155
2012	1,259,817	9,423	25,818	155	167	155
2013	1,244,386	9,308	25,501	156	163	156
2014	1,304,095	9,755	26,725	161	166	161
2015	1,475,330	11,035	30,234	170	178	170
2016	1,435,772	10,740	29,423	177	166	177
2017	1,613,999	12,073	33,076	187	177	187
2018	1,726,405	12,914	35,379	194	182	194
2019	1,753,817	13,119	35,941	194	185	194
				2015-2019 average:	178	184

Otis						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	29,171	218	598	4	149	4
2011	25,279	189	518	4	130	4
2012	23,289	174	477	4	119	4
2013	27,236	204	558	4	140	4
2014	33,778	253	692	4	173	4
2015	27,656	207	567	4	142	4
2016	26,365	197	540	4	135	4
2017	22,113	165	453	4	113	4
2018	26,587	199	545	4	136	4
2019	24,261	181	497	4	124	4
				2015-2019 average:	130	4

Warm Beach						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per meter	
Single-Family Customer Class						
2014	3,350,557	25,062	68,663	574	120	574
2015	3,829,142	28,642	78,471	589	133	589
2016	3,776,479	28,248	77,392	594	130	594
2017	3,946,129	29,517	80,869	603	134	603
2018	3,815,407	28,539	78,190	613	128	613
2019	4,038,491	30,208	82,761	604	137	604
				2015-2019 average:	132	601
Multi-Family Customer Class						
2019	78,408	586	1,607	8	201	12
Non-Residential Customer Class						
2019	47,185	353	967	8	121	7
Total Demand						
2014	3,350,557	25,062	68,663	574	120	574
2015	3,829,142	28,642	78,471	589	133	589
2016	3,776,479	28,248	77,392	594	130	594
2017	3,946,129	29,517	80,869	603	134	603
2018	3,815,407	28,539	78,190	613	128	613
2019	4,164,084	31,147	85,335	620	137	623
				2018-2019 average:	132	618

Kayak						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year*	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per ERU	
Single-Family Customer Class						
2010	3,766,890	28,176	77,195	364	212	364
2011	3,500,457	26,183	71,735	364	197	364
2012	3,530,178	26,406	72,344	365	198	365
2013	3,729,517	27,897	76,430	367	208	367
2014	3,679,933	27,526	75,413	367	205	367
2015	4,435,435	33,177	90,896	368	247	368
2016	3,756,769	28,101	76,988	373	206	373
2017	4,040,998	30,227	82,813	381	217	381
2018	4,048,313	30,281	82,963	385	215	385
2019	4,006,088	29,966	82,097	385	213	385
				2015-2019 average:	220	378

Combined Warm Beach						
Year	Annual Consumption		Average Daily Demand			ERUs
	Cubic Feet per Year*	1000-gal per Year	Gallons per Day	Number of Installed Meters	gpd per meter	
Single-Family Customer Class						
2014	7,030,490	52,588	144,077	941	153	941
2015	8,264,577	61,819	169,367	957	177	957
2016	7,533,248	56,349	154,380	967	160	967
2017	7,987,127	59,744	163,681	984	166	984
2018	7,863,720	58,821	161,152	998	161	998
2019	8,044,579	60,173	164,859	989	167	989
			2015-2019 average:		**166**	**979**
Multi-Family Customer Class						
2019	78,408	586	1,607	8	201	12
Non-Residential Customer Class						
2019	47,185	353	967	8	121	7
Total Demand						
2014	7,038,140	52,645	144,234	942	153	941
2015	8,301,050	62,092	170,115	958	177	957
2016	7,592,281	56,790	155,590	968	160	967
2017	8,070,552	60,368	165,391	985	166	984
2018	7,944,357	59,424	162,805	999	161	998
2019	8,176,368	61,159	167,560	1,006	167	1008
			2015-2019 average:		**167**	**983**

5.3.3 Trends in Customer Demands

Water purveyors serving more than 1,000 customers evaluate seasonal variations in water use by customer class. Of the District's existing systems, Lake Stevens Integrated is the only District system to meet this requirement. However, the combined Warm Beach system will have approximately 1,000 customers. Therefore, the seasonal variations in water demands for both the Lake Stevens Integrated and combined Warm Beach systems have been analyzed.

Figure 5-1 illustrates the relationship between the average monthly temperature in the County and the monthly Lake Stevens Integrated system demand in 2019. **Figure 5-2** compares these average monthly temperatures to the average combined Warm Beach system demands in 2019. In general, as temperature increases, so does water demand. Also, a significant number of homes in the Warm Beach system are used as second residences, which contributes to the usage patterns in that system and may adjust with changing demographics in the future.

Figure 5-1 | Temperature Effect on Lake Stevens Integrated Customer Water Demands

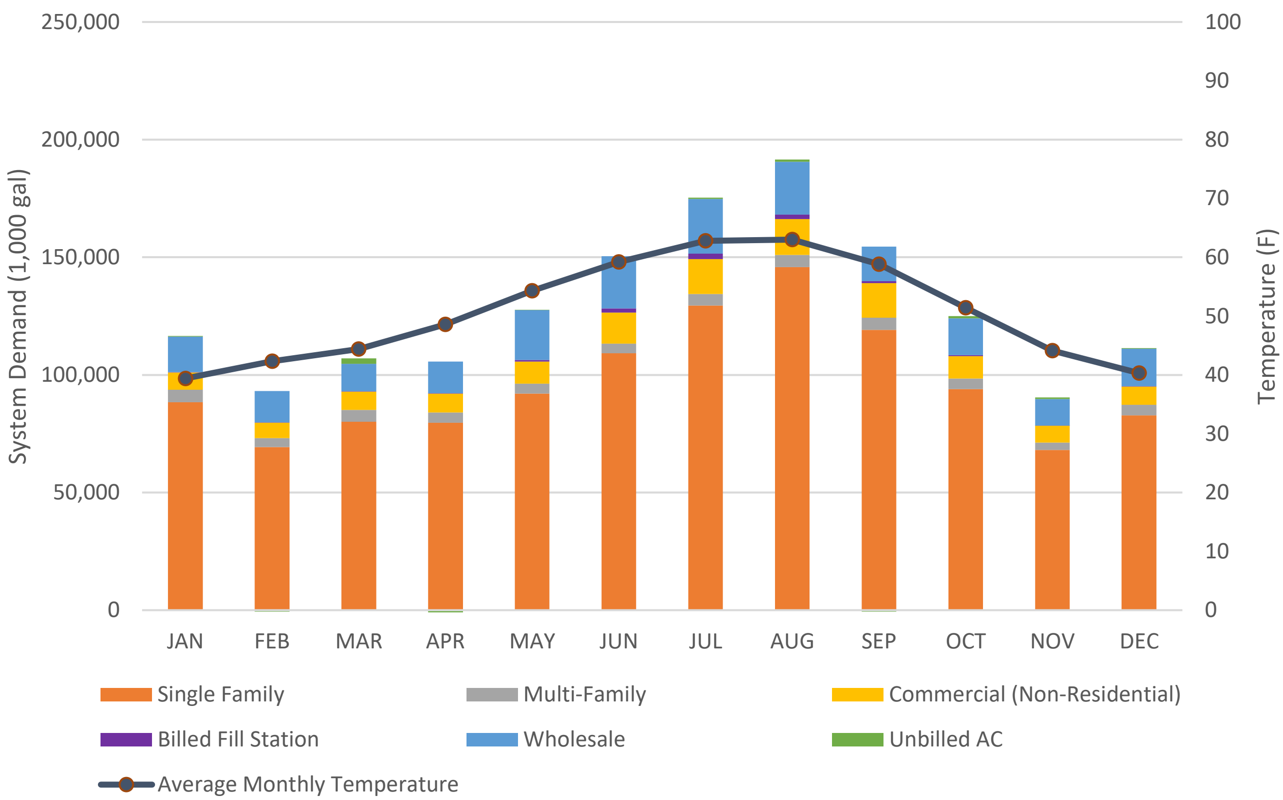
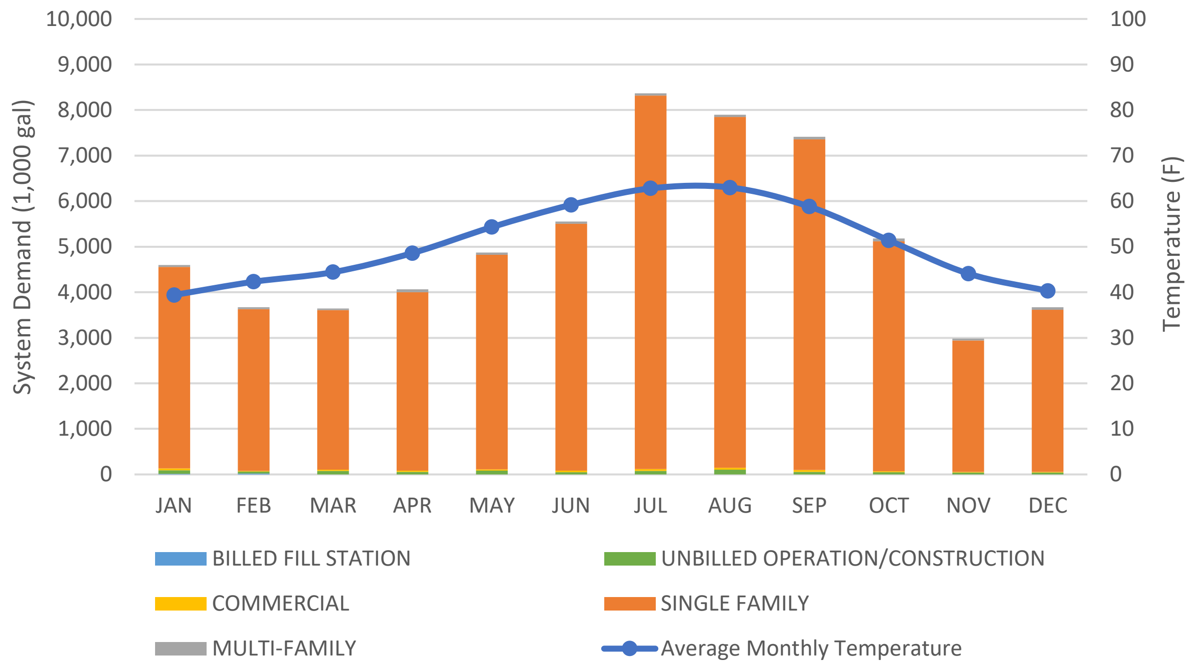


Figure 5-2 | Temperature's Effect on Combined Warm Beach Customer Water Demands



5.3.4 Non-Revenue Water Use and Distribution System Leakage

Non-revenue and DSL are additional demands on the system. Combined non-revenue, DSL, and customer consumption equal the total water supplied to a system.

Table 5-3 summarizes non-revenue water use (non-billed consumption) and DSL in the District's water systems. The numbers shown in **Table 5-3** differ from those reported annually to DOH. This difference is due to the timing of the reporting. Until 2018, the District reported annual water usage from March to February. The District changed from bi-monthly to monthly service meter reading starting in September 2015. After a few years examining the impact of this change on DSL calculations the District adjusted its reporting to show annual water usage from January to December. **Table 5-3** also shows annual water usage as from January to December.

Per WAC 246-290-820(1)(b)(i), DSL is required to be less than 10 percent on a 3-year rolling average. **Table 5-3** shows that two of the District's systems exceed this standard, May Creek and Warm Beach. The Skylite 3-year average DSL previously exceeded the standard but reduced below 10 percent in 2019. Such systems must develop an action plan to identify steps and timelines to reduce leakage below the standard. The District's action plan to meet this standard is described in **Chapter 6**. The District's two smallest systems, 212 Market & Deli and Otis, both show some years of negative DSL, which is due to the difference in timing between the source meter and service meter readings.

Table 5-3 | Historical Water Use Efficiency (1,000-gal)

Lake Stevens Integrated					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	1,567,641	1,502,957	4,554	60,130	3.8%
2016	1,460,261	1,374,101	3,880	82,281	5.6%
2017	1,636,734	1,544,183	3,649	88,903	5.4%
2018	1,653,710	1,551,896	4,405	97,409	5.9%
2019	1,630,043	1,542,866	3,455	83,722	5.1%
			3-year 2017-19 average:	**90,011**	**5.5%**

Sunday Lake					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	11,628	11,035	201	392	3.4%
2016	11,546	10,740	196	610	5.3%
2017	12,708	12,073	166	469	3.7%
2018	13,599	12,914	306	379	2.8%
2019	14,001	13,119	343	540	3.9%
			3-year 2017-19 average:	**463**	**3.5%**

Storm Lake Ridge					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	17,739	17,246	192	301	1.7%
2016	15,257	14,436	72	749	4.9%
2017	18,265	17,796	150	320	1.8%
2018	17,805	17,415	119	270	1.5%
2019	17,090	16,530	212	348	2.0%
			3-year 2017-19 average:	**313**	**1.8%**

Skylite					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	9,453	8,033	99	1,321	14.0%
2016	11,844	8,322	99	3,423	28.9%
2017	10,437	8,588	99	1,750	16.8%
2018	9,218	8,651	99	468	5.1%
2019	8,924	8,323	100	501	5.6%
			3-year 2017-19 average:	**906**	**9.1%**

Creswell					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	1,991	2,024	0	-33	-1.7%
2016	1,879	1,846	0	33	1.7%
2017	2,299	2,270	0	29	1.3%
2018	2,118	2,090	0	29	1.4%
2019	2,112	1,982	87	43	2.0%
			3-year 2017-19 average:	33	1.5%

May Creek					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	27,139	26,482	101	556	2.0%
2016	27,514	24,980	99	2,435	8.8%
2017	34,357	31,855	99	2,403	7.0%
2018	32,868	28,215	99	4,554	13.9%
2019	31,427	27,756	131	3,540	11.3%
			3-year 2017-19 average:	3,499	10.7%

Kayak					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	35,487	33,450	264	1,773	5.0%
2016	31,599	28,542	186	2,871	9.1%
2017	33,680	30,851	122	2,707	8.0%
2018	33,719	30,885	57	2,777	8.2%
2019	32,987	30,012	61	2,913	8.8%
			3-year 2017-19 average:	2,799	8.4%

Warm Beach					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	32,469	28,642	553	3,274	10.1%
2016	33,082	28,248	745	4,089	12.4%
2017	34,975	29,517	661	4,797	13.7%
2018	35,982	28,539	746	6,696	18.6%
2019	34,056	31,147	689	2,220	6.5%
			3-year 2017-19 average:	4,571	13.0%

212 Market & Deli					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	171	182	0	-11	-6.5%
2016	129	130	0	-1	-0.6%
2017	108	106	0	2	1.7%
2018	78	85	0	-7	-8.7%
2019	52	53	0	0	-0.7%
			3-year 2017-19 average:	-2	-2.6%

Otis					
Year	Annual Supply	Total Customer	Non-Revenue	Annual Leakage	
				1000-gal	%
2015	224	207	0	17	7.4%
2016	195	197	0	-3	-1.3%
2017	167	165	0	2	1.2%
2018	191	199	0	-8	-4.2%
2019	180	181	0	-1	-0.5%
			3-year 2017-19 average:	-2	-0.5%

5.3.5 Peaking Factors

Peaking factors are calculated based on historical maximum day water demand compared to average day water demand per year for each water system. The average historical peaking factors are used to estimate a MDD and a PHD for a water system.

The MDD is the largest amount of water consumed and used throughout the system during a 24-hour period of a given year. The MDD typically occurs on a hot summer day when outdoor water use for lawn watering and other purposes is occurring. Projected system MDD will be used to evaluate the capacity of water sources and pump stations to meet peak day demands over a 24-hour period. MDD will also be used in the hydraulic model when evaluating fire flow capacity.

The PHD is the amount of water used (excluding fire flow or other emergency use) during the largest use hour of the year. In accordance with WAC 246-290-230, new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 psi during PHD conditions. The PHD flow is used in the hydraulic model to assure that minimum pressure requirements will be met throughout the water systems at the peak hour of the peak day. It is also used to evaluate the capacity of BPSs and to assure that storage is sufficient to supplement water supplies during the peak hour. **Equation 3-1**, shown below, from the DOH Design Manual is used to calculate PHD for each system.

Equation 3-1 from the DOH Design Manual

$$PHD = (ERU_{MDD}/1440)\ [(C)(N) + F] + 18$$

Where PHD = Peak Hourly Demand (gallon per minute)
C = Coefficient Associated with Ranges of ERUs
N = Number of ERUs based on MDD
F = Factor Associated with Ranges of ERUs
ERU_{MDD} = Maximum Day Demand per ERU (gallons per day)

Peaking factors vary by water system area; each unique makeup of customer types, climate, property sizes, second/vacation homes, and conservation practices determine how water use changes throughout the day. For example, a water system serving a large number of customers with big lawns will see water use peak during the time of the day when people typically water their lawns, and during the summer. A water system with a large portion of commercial users will see less of a water use peak in the morning and evening since more customers are using water during the day and not just when they are home from work.

Table 5-4 compares the average day and maximum day demand for each year as well as provides the factors used to calculate the estimated peak hour demand for each year based on DOH's Equation 3-1. Using this information, the tables calculate an average peaking factor for each water system area using historical peaking data from 2015-2020.

Table 5-4 | Calculated Peaking Factors

Lake Stevens Integrated System									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	Max Day (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	22,350	184	4,294,906	10,620,540	2.47	1.60	225.00	11,403	1.55
2016	23,011	164	3,989,784	7,620,010	1.91	1.60	225.00	8,056	1.52
2017	23,621	179	4,484,203	9,014,720	2.01	1.60	225.00	9,524	1.52
2018	24,554	173	4,530,713	9,747,760	2.15	1.60	225.00	10,240	1.51
2019	25,272	167	4,465,872	8,463,970	1.90	1.60	225.00	8,969	1.53
Average		**173**			**2.09**				**1.53**

Storm Lake Ridge									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	Max Day (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	218	217	48,600	167,703	3.45	2.00	75.00	283	2.43
2016	224	177	41,686	115,203	2.76	2.00	75.00	195	2.44
2017	229	213	50,042	140,109	2.80	2.00	75.00	239	2.45
2018	230	207	48,780	160,406	3.29	2.00	75.00	271	2.44
2019	257	176	46,823	117,528	2.51	1.80	125.00	198	2.43
Average		**198**			**2.96**				**2.44**

Creswell									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	3-Day Max Average (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	23	241	5,454	18,333	3.36	3.00	0.00	57	4.46
2016	23	220	5,133	17,000	3.31	3.00	0.00	53	4.48
2017	23	270	6,300	20,000	3.17	3.00	0.00	59	4.26
2018	23	249	5,804	21,667	3.73	3.00	0.00	63	4.16
2019	23	236	5,546	17,667	3.19	3.00	0.00	54	4.40
Average		**243**			**3.35**				**4.35**

May Creek									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	Max Day (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	464	156	74,353	168,406	2.26	1.80	125.00	254	2.17
2016	477	143	75,174	138,594	1.84	1.80	125.00	199	2.06
2017	504	167	94,128	166,219	1.77	1.60	225.00	229	1.99
2018	500	155	90,048	172,594	1.92	1.60	225.00	229	1.91
2019	511	149	86,100	148,594	1.73	1.60	225.00	204	1.98
Average		**154**			**1.90**				**2.02**

Skylite									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	3-Day Max Average (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	152	145	25,898	48,000	1.85	2.00	75.00	89	2.66
2016[1]	152	150	32,360	59,000	1.82	2.00	75.00	90	2.20
2017	152	155	28,593	50,667	1.77	2.00	75.00	90	2.56
2018	152	156	25,255	48,333	1.91	2.00	75.00	97	2.88
2019	153	149	24,450	44,333	1.81	2.00	75.00	89	2.91
Average		**151**			**1.84**				**2.75**

Note:
1. 2016 was removed from the average due to exceedingly high DSL during this year.

Sunday Lake									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	3-Day Peak Average (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	170	178	31,859	98,588	3.09	2.00	75.00	177	2.58
2016	177	166	31,546	87,206	2.76	2.00	75.00	155	2.56
2017	187	177	34,815	95,588	2.75	2.00	75.00	169	2.55
2018	194	182	37,257	114,144	3.06	2.00	75.00	198	2.49
2019	194	185	38,360	103,526	2.70	2.00	75.00	179	2.49
Average		**178**			**2.87**				**2.53**

Warm Beach									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	Max Day (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2019	623	137	93,305	192,693	2.07	1.60	225.00	258	1.93
Average		**137**			**2.07**				**1.93**
Planning Value		**137**			**2.70**				**2.48**

Kayak									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	Max Day (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2015	368	247	88,957	281,951	3.17	1.80	125.00	446	2.28
2016	373	206	90,389	207,830	2.30	1.80	125.00	280	1.94
2017	381	217	95,822	222,646	2.32	1.80	125.00	302	1.96
2018	385	215	98,580	237,491	2.41	1.80	125.00	313	1.90
2019	385	213	93,305	220,627	2.36	1.80	125.00	304	1.99
Average		**220**			**2.51**				**2.01**

Combined Warm Beach									
Year	Number of ERUs (N)	ERUADD (gpd/ERU)	Average Day (gpd)	Max Day (gpd)	MDD Factor	C Factor	F Factor	Calculated PHD (gpm)	Calculated PHD/MDD
2019	1,008	166	186,611	413,320	2.21	1.60	225.00	644	2.25
Average		**166**			**2.21**				**2.25**
Planning Value		**166**			**2.61**				**2.96**

5.4 Future Population and Connections

Developing accurate projections for populations and connections in each system is critical to the veracity of the system analysis and capital improvement plans described later in this document. Therefore, the District has analyzed relevant planning documents for the systems as well as historical trends to create reliable projections.

5.4.1 Relevant Planning Documents

Relevant planning documents from various agencies were used in the future population and water demand estimations. These documents include the comprehensive plans of Snohomish County; comprehensive plans of Gold Bar, Granite Falls, Marysville, the City of Snohomish, and the City of Lake Stevens; water system plans from adjacent systems; the North Snohomish County CWSP; and PSRC VISION 2040 and draft VISION 2050 plans. A detailed summary of these related planning documents is provided in **Chapter 3**.

5.4.2 Historical Population and Connections

The historical water connection and population trends were analyzed for each system. Due to the lack of population data related directly to the water system retail service areas (RSAs), historical populations were estimated from the number of residential meters (single family and multi-family) and an assumed people per meter. For all single-family meters, the analysis assumed 2.68 people per household (this is an updated estimate from what has been used historically, which was 2.5), which is the average household size in the County according to the US Census Bureau's American Community Survey (ACS), dated July 1, 2019. For multi-family meters, the analysis used an estimated five households per meter in Lake Stevens Integrated and two households per meter in Kayak and Warm Beach, based on a *Water Multi Family Unit Count Report* provided by the District, included in **Appendix 5-1**. For non-residential meters, the analysis used the county-wide average of 7.5 employees per non-residential meter.

Water purveyors that purchase from the District on a wholesale basis are responsible to determine their own number of households, population, and growth projections. Population and water demand projections by the District's major wholesale water customers (Granite Falls, Arlington, and City of Snohomish) reference the information provided in their comprehensive and water system plans, described in **Chapter 3**.

Table 5-5 presents historic retail water connections for all single-family, multi-family, and non-residential customers served from 2010-2019. Otis and 212 Market & Deli water systems are not included in this table because there is no expected growth for these systems.

Table 5-5 | Historical Population and Connections

Lake Stevens Integrated										
Year	Single-Family		Multi-Family		Non-Residential		Total Retail		Population	
	Meters	GR	Meters	GR	Meters	GR	Meters	GR	People	GR
2010	18,144	-	230	-	414	-	18,788	-	53,809	-
2011	18,361	1.20%	299	30.00%	419	1.21%	19,079	1.55%	55,389	2.94%
2012	18,721	1.96%	300	0.33%	423	0.95%	19,444	1.91%	57,625	4.04%
2013	19,074	1.89%	300	0.00%	431	1.89%	19,805	1.86%	58,675	1.82%
2014	17,198	-9.84%	300	-0.33%	431	0.00%	17,928	-9.48%	56,562	-3.60%[1]
2015	17,519	1.87%	299	0.00%	436	1.16%	18,254	1.82%	57,498	1.65%
2016	18,047	3.01%	299	0.00%	442	1.38%	18,788	2.93%	59,003	2.62%
2017	18,264	1.20%	299	0.00%	457	3.39%	19,020	1.23%	59,809	1.37%
2018	18,565	1.65%	299	0.00%	468	2.41%	19,332	1.64%	60,781	1.62%
2019	18,966	2.16%	298	-0.33%	478	2.14%	19,742	2.12%	61,992	1.99%
5-Yr Annual Growth		**1.98%**		**-0.07%**		**2.09%**		**1.95%**		**1.85%**

Storm Lake Ridge						
Year	Single-Family		Total Retail		Population	
	Meters	GR	Meters	GR	People	GR
2010	190	-	190	-	509	-
2011	192	1.05%	192	1.05%	515	1.05%
2012	205	6.77%	205	6.77%	549	6.77%
2013	212	3.41%	212	3.41%	568	3.41%
2014	214	0.94%	214	0.94%	574	0.94%
2015	218	1.87%	218	1.87%	584	1.87%
2016	224	2.75%	224	2.75%	600	2.75%
2017	229	2.23%	229	2.23%	614	2.23%
2018	230	0.44%	230	0.44%	616	0.44%
2019	257	11.74%	257	11.74%	689	11.74%
5-Yr Annual Growth		**3.81%**		**3.81%**		**3.81%**

Creswell						
Year	Single-Family		Total Retail		Population	
	Meters	GR	Meters	GR	People	GR
2010	16	-	16	-	43	-
2011	20	25.00%	20	25.00%	54	25.00%
2012	23	15.00%	23	15.00%	62	15.00%
2013	23	0.00%	23	0.00%	62	0.00%
2014	23	0.00%	23	0.00%	62	0.00%
2015	23	0.00%	23	0.00%	62	0.00%
2016	23	0.00%	23	0.00%	62	0.00%
2017	23	0.00%	23	0.00%	62	0.00%
2018	23	0.00%	23	0.00%	62	0.00%
2019	23	0.00%	23	0.00%	62	0.00%
5-Yr Annual Growth		**0.0%**		**0.0%**		**0.0%**

May Creek								
Year	Single-Family		Non-Residential		Total Retail		Population	
	Meters	GR	Meters	GR	Meters	GR	People	GR
2010	440	-	5	-	445	-	1,194	-
2011	442	0.45%	5	0.00%	447	0.45%	1,200	0.45%
2012	443	0.23%	5	0.00%	448	0.22%	1,202	0.22%
2013	446	0.68%	5	0.00%	451	0.67%	1,210	0.67%
2014	447	0.22%	5	0.00%	452	0.22%	1,213	0.22%
2015	450	0.67%	5	0.00%	455	0.66%	1,221	0.66%
2016	459	2.00%	6	20.00%	465	2.20%	1,248	2.22%
2017	475	3.49%	6	0.00%	481	3.44%	1,291	3.44%
2018	480	1.05%	6	0.00%	486	1.04%	1,304	1.04%
2019	491	2.29%	6	0.00%	497	2.26%	1,339	2.26%
5-Yr Annual Growth		**1.90%**		**4.00%**		**1.92%**		**1.92%**

Kayak								
Year	Single-Family		Multi-Family		Total Retail		Population	
	Meters	GR	Meters	GR	Meters	GR	People	GR
2010	364	-	1	-	365	-	981	-
2011	364	0.00%	1	0.00%	365	0.00%	981	0.00%
2012	365	0.27%	1	0.00%	366	0.27%	984	0.27%
2013	367	0.55%	1	0.00%	368	0.55%	989	0.54%
2014	367	0.00%	1	0.00%	368	0.00%	989	0.00%
2015	368	0.27%	1	0.00%	369	0.27%	992	0.27%
2016	373	1.36%	1	0.00%	374	1.36%	1,005	1.35%
2017	381	2.14%	1	0.00%	382	2.14%	1,026	2.13%
2018	385	1.05%	1	0.00%	386	1.05%	1,037	1.04%
2019	385	0.00%	1	0.00%	386	0.00%	1,037	0.00%
5-Yr Annual Growth		**0.97%**		**0.00%**		**0.96%**		**0.96%**

Skylite						
Year	Single-Family		Total Retail		Population	
	Meters	GR	Meters	GR	People	GR
2010	152	-	152	-	407	-
2011	152	0.00%	152	0.00%	407	0.00%
2012	152	0.00%	152	0.00%	407	0.00%
2013	152	0.00%	152	0.00%	407	0.00%
2014	152	0.00%	152	0.00%	407	0.00%
2015	152	0.00%	152	0.00%	407	0.00%
2016	152	0.00%	152	0.00%	407	0.00%
2017	152	0.00%	152	0.00%	407	0.00%
2018	152	0.00%	152	0.00%	407	0.00%
2019	153	0.66%	153	0.66%	410	0.66%
5-Yr Annual Growth		**0.13%**		**0.13%**		**0.13%**

Warm Beach										
Year	Single-Family		Multi-Family		Non-Residential		Total Retail		Population	
	Meters	GR	Meters	GR	Meters	GR	Meters	GR	People	GR
2014	574	-	N/A	-	N/A	-	574	-	1538	-
2015	589	2.61%	N/A	N/A	N/A	N/A	589	2.61%	1579	2.61%
2016	594	0.85%	N/A	N/A	N/A	N/A	594	0.85%	1592	0.85%
2017	603	1.52%	N/A	N/A	N/A	N/A	603	1.52%	1616	1.52%
2018	613	1.66%	N/A	N/A	N/A	N/A	613	1.66%	1643	1.66%
2019	604	-1.47%	8	0.00%	8	0.00%	620	1.14%	1659	0.97%
5-Yr Annual Growth		**1.03%**		**0.00%**		**0.00%**		**1.56%**		**1.55%**

Combined Warm Beach										
Year	Single-Family		Multi-Family		Non-Residential		Total Retail		Population	
	Meters	GR	Meters	GR	Meters	GR	Meters	GR	People	GR
2014	941	-	1	-	N/A	-	942	-	2527	-
2015	957	1.70%	1	0.00%	N/A	N/A	958	1.70%	2570	1.70%
2016	967	1.04%	1	0.00%	N/A	N/A	968	1.04%	2597	1.05%
2017	984	1.76%	1	0.00%	N/A	N/A	985	1.76%	2642	1.73%
2018	998	1.42%	1	0.00%	N/A	N/A	999	1.42%	2680	1.44%
2019	989	-0.90%	9	0.00%[1]	8	N/A	1006	0.70%	2699	0.71%
5-Yr Annual Growth		**1.00%**		**N/A**		**N/A**		**1.35%**		**1.37%**

[1]Increased number of Combined Warm Beach multi-family meters results from combined systems, not actual growth in multi-family customers.

Sunday Lake						
Year	Single-Family		Total Retail		Population	
	Meters	GR	Meters	GR	People	GR
2010	153	-	153	-	410	-
2011	155	1.31%	155	1.31%	415	1.31%
2012	155	0.00%	155	0.00%	415	0.00%
2013	156	0.65%	156	0.65%	418	0.65%
2014	161	3.21%	161	3.21%	431	3.21%
2015	170	5.59%	170	5.59%	456	5.59%
2016	177	4.12%	177	4.12%	474	4.12%
2017	187	5.65%	187	5.65%	501	5.65%
2018	194	3.74%	194	3.74%	520	3.74%
2019	194	0.00%	194	0.00%	520	0.00%
5-Yr Annual Growth		**3.82%**		**3.82%**		**3.82%**

5.4.3 Future Population and Connection Projections

Using these planning documents and historical trends, population and connection projections were developed for each water system.

Historical trends were calculated as the average annual water system growth rate for each water system based on the number of connections added to each system per year. The analysis calculated the average annual growth rate based on the last five years of data (2015-2019) in an effort to use the most recent and relevant data for projecting forward.

Growth projections were also calculated using PSRC's VISION 2040 analysis for each water system's RSA (Dataset: Land Use Vision version 2 (LUV.2), updated April 2017). PSRC's VISION 2040 is broken down into forecast analysis zones (FAZ). Each FAZ represents a defined area that PSRC analyzes and creates an individual growth projection. The population projection for each system compared the area of FAZ to that of the retail water service area to calculate the percentage of the FAZ that was in the system's RSA. This percentage was then multiplied by the FAZ's projected population. The higher the percentage of FAZ in the RSA, the more accurate the PSRC projection. A map of the County FAZ boundaries is included in **Appendix 5-2.**

The comparison of the various growth rates is shown **Table 5-6**.

Table 5-6 | Comparative Population Projections by System

Water System	Historical Growth 2015-2019	PSRC's Est. Growth Rate 2015-2019
Lake Stevens Integrated	1.85%	1.90%
Storm Lake Ridge	3.81%	-0.39%
Creswell	0.04%	1.97%
May Creek	1.92%	2.76%
Skylite	0.13%	2.76%
Kayak	0.96%	1.18%
Warm Beach	1.55%	1.18%
Combined WB	1.37%	1.18%
Sunday Lake	3.82%	1.90%
Otis	0.00%	2.31%
212 Market & Deli	0.00%	-0.39%

Due to the many differences of the District's various systems, different projection methods were used for different systems. In general, where historical trends were used to project future growth, the percentages were rounded up to the nearest quarter of a percent. The methods used for each system is discussed in further detail below. Projected growth rates for each system are summarized in **Table 5-7**.

The Lake Stevens Integrated system is the District's largest system. Much of its service area is in and around Granite Falls and the City of Lake Stevens. Because of its size and location, the PSCR's

FAZ boundaries closely aligned with the Lake Stevens RSA. The PSRC's projections were also consistent with the growth seen between 2015 and 2019. Therefore, PSRC's VISION 2040 analysis was determined to be the most accurate and informed population projection for its RSA and are used for its future projections.

The Storm Lake Ridge and Creswell systems are adjacent to Lake Stevens Integrated system and are planned to be integrated into that system during this 20-year planning period. Therefore, these two systems are assumed to experience the same growth rate as the Lake Stevens Integrated system. The population projections for these systems would be less accurate using the FAZ method described above since they are much smaller than the area of their corresponding FAZ.

Sunday Lake experienced significant development within the last five years, resulting in a higher historical growth rate. At this point, most of the new developments have been connected to the system and the District is not aware of further anticipated subdivisions in the Sunday Lake area in the coming years. Therefore, the District has elected to use PSRC's growth projection for this system.

The remaining systems represented only a small percentage of their respective FAZs, and therefore, PSCR's projections did not accurately represent the growth expected within their RSA. The projected growth for May Creek, Skylite, Kayak and Warm Beach will match the historical growth, rounded up to the nearest 0.05 percent.

Otis and 212 Market & Deli are not expected to grow during the planning period.

Table 5-7 | Summary of Growth Rates by System

System	Historical Annual Growth Rate	Average Annual Growth Rate			
		2020-2025	2025-2030	2030-2035	2035-2040
Lake Stevens Integrated	1.85%	1.51%	1.31%	1.15%	1.16%
Storm Lake Ridge	3.81%	1.51%	1.31%	1.15%	1.16%
Creswell	0.04%	1.51%	1.31%	1.15%	1.16%
May Creek	1.92%	1.95%			
Skylite	0.13%	0.15%			
Kayak	0.96%	1.00%			
Warm Beach	1.55%	1.60%			
Combined Warm Beach	1.37%	1.37%			
Sunday Lake	3.82%	1.90%			

5.5 Future Water Demands

Table 5-8 summarizes how information presented earlier in this chapter is used to create the demand projections in **Table 5-9**. The capacity of the water systems will be evaluated in relation to these water demand projections as part of the System Capacity Analysis in **Chapter 7**. The District recognizes that some of the water systems will reach capacity within the planning period, at which point it is prepared to halt further connections to such systems as described in **Chapter 7**.

Table 5-8 | Planning Values for Water Demand Projections

System	ADD per ERU[1]	MDD:ADD Factor[2]	PHD:MDD Factor[3]	DSL[4]	Planned Growth[5]
Lake Stevens Integrated	173	2.09	1.53	5.5%	1.51% to 1.15%
Storm Lake Ridge	198	2.96	2.44	1.8%	1.51% to 1.15%
Creswell	243	3.34	4.34	1.5%	1.51% to 1.15%
May Creek	154	1.92	2.03	10.0%	1.95%
Skylite	151	1.84	2.75	9.1%	0.15%
Kayak	220	2.51	3.50	8.4%	1.00%
Warm Beach	137	2.70	2.48	10.0%	1.60%
Combined Warm Beach	166	2.61	2.96	9.4%	1.37%
Sunday Lake	178	2.87	2.53	3.5%	1.90%

Note:
1. Per the average ADD/ERU between 2015-2019, per **Table 5-2**. Except for Warm Beach, the 2019 value is used.
2. Customer MDD:ADD Factor as shown in **Table 5-4**.
3. PHD:MDD Factor as shown in **Table 5-54**.
4. 3-year rolling average DSL as shown in **Table 5-3**. DSL reduced to 10% for systems currently above the standard.
5. Planned growth for each system as shown in **Table 5-7**.

Table 5-9 summarizes projected water demands for each of the District's water systems in the 10-year and 20-year planning periods. The projections include the wholesale water demands in addition to retail water demands. The 212 Market & Deli and Otis water systems are not included in **Table 5-9** because these small systems will not expand beyond their existing facilities.

The expected water savings from conservation efforts and plumbing code improvements is described in **Chapter 6**.

Table 5-9 | Water Demand Projections

Lake Stevens Integrated													
	Base Year	Current Year	Ten-Year Planning Period								20-Yr Period		
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Retail ERU PROJECTIONS	22,013	22,345	22,681	23,023	23,370	23,722	24,032	24,346	24,664	24,986	25,312	25,602	28,713
Granite Falls ERU PROJECTIONS	1,989	2,099	2,194	2,293	2,397	2,506	2,619	2,738	2,862	2,991	3,127	3,268	5,090
Arlington ERU Projections	749	749	8,301	8,301	8,301	8,301	8,301	8,301	8,301	8,301	8,301	8,301	8,301
Snohomish ERU Projections	456	461	461	461	461	461	461	461	461	461	461	461	461
Total ERU Projections	**24,752**	**25,193**	**33,176**	**33,617**	**34,068**	**34,529**	**34,952**	**35,385**	**35,826**	**36,278**	**36,740**	**37,172**	**42,104**
Retail & Non-Rev. ADD (gpd)	3,915,890	3,876,204	3,934,616	3,993,912	4,054,107	4,115,213	4,168,937	4,223,365	4,278,507	4,334,373	4,390,971	4,441,333	4,980,900
Granite Falls (gpd)	345,094	364,059	380,549	397,787	415,806	434,640	454,328	474,908	496,419	518,905	542,410	566,980	883,005
Arlington (gpd)	130,000	130,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Snohomish (gpd)	79,114	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
System Leakage		240,364	316,534	320,743	325,045	329,442	333,480	337,605	341,821	346,130	350,536	354,657	401,715
Total ADD (gpd)	**4,470,098**	**4,690,628**	**6,151,699**	**6,232,443**	**6,314,958**	**6,399,295**	**6,476,744**	**6,555,878**	**6,636,747**	**6,719,408**	**6,803,917**	**6,882,970**	**7,785,620**
Retail MDD (gpd)	7,628,710	8,093,337	8,215,298	8,339,106	8,464,789	8,592,376	8,704,549	8,818,193	8,933,327	9,049,972	9,168,147	9,273,299	10,399,892
Granite Falls (gpd)	720,541	760,139	794,569	830,561	868,184	907,508	948,616	991,586	1,036,500	1,083,450	1,132,527	1,183,828	1,843,674
Arlington (gpd)	130,000	130,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Snohomish (gpd)	165,186	167,036	167,036	167,036	167,036	167,036	167,036	167,036	167,036	167,036	167,036	167,036	167,036
System Leakage		494,091	574,743	583,532	592,514	601,694	610,124	618,738	627,541	636,538	645,737	654,342	752,596
Total MDD (gpd)	**8,644,437**	**9,644,603**	**11,191,646**	**11,360,235**	**11,532,523**	**11,708,615**	**11,870,325**	**12,035,553**	**12,204,404**	**12,376,996**	**12,553,448**	**12,718,506**	**14,603,199**
Retail PHD (gpm)	8,028	8,575	8,704	8,835	8,969	9,104	9,223	9,343	9,465	9,589	9,714	9,825	11,019
Granite Falls (gpm)	763	805	842	880	920	962	1,005	1,051	1,098	1,148	1,200	1,254	1,953
Arlington (gpm)	90	90	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Snohomish (gpm)	175	177	177	177	177	177	177	177	177	177	177	177	177
System Leakage		521	580	589	599	609	618	627	636	646	655	664	768
Total PHD (gpm)	**9,057**	**10,168**	**11,303**	**11,482**	**11,664**	**11,851**	**12,022**	**12,197**	**12,376**	**12,559**	**12,746**	**12,921**	**14,918**
Annual (1,000 gallons)	1,631,586	1,712,079	2,245,370	2,274,842	2,304,960	2,335,743	2,364,012	2,392,895	2,422,413	2,452,584	2,483,430	2,512,284	2,841,751
Annual (acre-ft)	5,007	5,255	6,891	6,982	7,074	7,169	7,255	7,344	7,435	7,527	7,622	7,710	8,722

Storm Lake Ridge													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	260	264	268	272	276	280	284	288	291	295	299	303	340
ADD (gpd)	46,823	53,193	53,999	54,816	55,647	56,489	57,230	57,981	58,742	59,512	60,293	60,987	68,429
MDD (gpd)	117,528	157,585	159,972	162,395	164,854	167,351	169,546	171,770	174,023	176,306	178,618	180,676	202,722
PHD (gpm)	198	267	271	275	279	283	287	291	295	299	303	306	343
Annual (1,000 gallons)	17,090	19,415	19,710	20,008	20,311	20,619	20,889	21,163	21,441	21,722	22,007	22,260	24,977
Annual (acre-ft)	52	60	60	61	62	63	64	65	66	67	68	68	77

Creswell													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	23	23	24	24	24	25	25	25	26	26	26	27	30
ADD (gpd)	5,546	5,765	5,852	5,941	6,031	6,122	6,202	6,283	6,366	6,449	6,534	6,609	7,415
MDD (gpd)	17,667	19,256	19,547	19,842	20,142	20,446	20,714	20,986	21,261	21,540	21,823	22,074	24,768
PHD (gpm)	54	58	59	60	61	62	62	63	64	65	66	67	75
Annual (1,000 gallons)	2,024	2,104	2,136	2,168	2,201	2,234	2,264	2,293	2,323	2,354	2,385	2,412	2,707
Annual (acre-ft)	6	6	7	7	7	7	7	7	7	7	7	7	8

May Creek													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	513	523	533	544	554	565	576	587	599	610	622	634	770
ADD (gpd)	86,100	88,619	90,347	92,109	93,905	95,736	97,603	99,506	101,446	103,425	105,441	107,498	130,398
MDD (gpd)	148,594	170,148	173,466	176,849	180,297	183,813	187,397	191,052	194,777	198,575	202,448	206,395	250,364
PHD (gpm)	204	240	245	249	254	259	264	269	275	280	285	291	353
Annual (1,000 gallons)	31,427	32,346	32,977	33,620	34,275	34,944	35,625	36,320	37,028	37,750	38,486	39,237	47,595
Annual (acre-ft)	96	99	101	103	105	107	109	111	114	116	118	120	146

Skylite													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	155	155	155	156	156	156	156	157	157	157	157	158	160
ADD (gpd)	24,450	25,558	25,597	25,635	25,673	25,712	25,750	25,789	25,828	25,867	25,905	25,944	26,336
MDD (gpd)	44,333	46,979	47,049	47,120	47,191	47,261	47,332	47,403	47,474	47,546	47,617	47,688	48,408
PHD (gpm)	89	90	90	90	90	90	90	91	91	91	91	91	92
Annual (1,000 gallons)	8,924	9,329	9,343	9,357	9,371	9,385	9,399	9,413	9,427	9,441	9,455	9,470	9,613
Annual (acre-ft)	27	29	29	29	29	29	29	29	29	29	29	29	30

Sunday Lake													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	199	203	207	211	215	219	223	227	231	236	240	245	295
ADD (gpd)	38,360	37,299	38,008	38,730	39,466	40,216	40,980	41,759	42,552	43,360	44,184	45,024	54,348
MDD (gpd)	103,526	107,176	109,212	111,287	113,402	115,556	117,752	119,989	122,269	124,592	126,959	129,371	156,164
PHD (gpm)	179	189	192	196	200	203	207	211	215	219	223	228	275
Annual (1,000 gallons)	14,001	13,614	13,873	14,136	14,405	14,679	14,958	15,242	15,531	15,827	16,127	16,434	19,837
Annual (acre-ft)	43	42	43	43	44	45	46	47	48	49	49	50	61

Kayak													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	386	390	394	398	402	406	410	414	418	422	426	431	476
ADD (gpd)	90,374	92,954	93,884	94,823	95,771	96,729	97,696	98,673	99,660	100,656	101,663	102,680	113,422
MDD (gpd)	220,627	233,614	235,950	238,309	240,692	243,099	245,530	247,985	250,465	252,970	255,500	258,055	285,053
PHD (gpm)	528	567	573	579	585	590	596	602	608	614	621	627	692
Annual (1,000 gallons)	32,987	33,928	34,268	34,610	34,956	35,306	35,659	36,016	36,376	36,740	37,107	37,478	41,399
Annual (acre-ft)	101	104	105	106	107	108	109	111	112	113	114	115	127

Warm Beach													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	637	647	658	668	679	690	701	712	723	735	747	759	889
ADD (gpd)	93,305	97,548	99,108	100,694	102,305	103,942	105,605	107,295	109,012	110,756	112,528	114,328	133,996
MDD (gpd)	192,693	263,379	267,593	271,874	276,224	280,644	285,134	289,696	294,331	299,041	303,825	308,686	361,788
PHD (gpm)	258	454	461	468	476	483	491	499	507	515	523	532	623
Annual (1,000 gallons)	34,056	35,605	36,175	36,753	37,341	37,939	38,546	39,163	39,789	40,426	41,073	41,730	48,908
Annual (acre-ft)	105	109	111	113	115	116	118	120	122	124	126	128	150

Combined Warm Beach and Kayak													
	Base Year	Current Year	Ten-Year Planning Period										20-Yr Period
YEAR	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ERU PROJECTIONS	1,023	1,037	1,051	1,066	1,081	1,095	1,111	1,126	1,141	1,157	1,173	1,189	1,365
ADD (gpd)	183,679	190,502	192,992	195,517	198,076	200,671	203,301	205,968	208,671	211,412	214,191	217,008	247,418
MDD (gpd)	413,320	496,992	503,542	510,183	516,916	523,743	530,664	537,682	544,797	552,011	559,325	566,741	646,841
PHD (gpm)	786	1,021	1,034	1,047	1,060	1,074	1,087	1,101	1,115	1,129	1,144	1,158	1,315
Annual (1,000 gallons)	67,043	69,533	70,442	71,364	72,298	73,245	74,205	75,178	76,165	77,165	78,180	79,208	90,308
Annual (acre-ft)	206	213	216	219	222	225	228	231	234	237	240	243	277

THIS PAGE INTENTIONALLY LEFT BLANK

5.6 Summary

This chapter reviewed the historical water supply and demand trends for each of the District's water systems. The analysis first reviewed historical supply data for each system. It then looked at customer demands for each system as well as seasonal demand trends of the Lake Stevens Integrated system. Non-revenue usage and DSL percentages were analyzed, and peaking factors were calculated for each system.

Future growth projections were calculated by analyzing historical service connection growths as well as PSRC's growth projections for each service area. Annual growth rates were chosen for each system using the District's knowledge of the areas as well as regional growth projections and planning documents.

Future water demand projections were calculated using both the historical water supply and demand trends information as well as the growth projections for each system. These demand projections are used in later chapters to assess system capacity and inform when and where improvements will be needed to meet the District's design criteria.

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 6

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 6

Water Use Efficiency

6.1 Introduction

The District is committed to water conservation and efficiency efforts. As stewards of the Spada Reservoir and associated watershed feeding into the Sultan River, the District has an interest in preserving long-term water supply for power generation, drinking water, and fish needs. Water conservation and water use efficiencies may also reduce water demand per capita, and therefore, preserve groundwater resources for the District's satellite systems by extending water rights to serve people that would otherwise obtain water from permit exempt individual wells.

This chapter describes the goals for the 2020 Water Use Efficiency (WUE) Program. It also reviews the historical (2011) WUE Program and evaluate its success in meeting its goals.

6.2 Everett Water Utilities Committee

The District is a member of the EWUC and its conservation subcommittee. The subcommittee was formed in 1999 to coordinate water conservation efforts among systems that use water from Everett's filtration plant. Prior to forming this regional committee, the District's conservation program was coordinated through its Water Resources Department. The District continues to participate in the EWUC regional water efficiency program. The District supplements this program with additional water efficiency measures for its water service area.

6.3 Water Use Efficiency Program Requirements

The State's water conservation requirements are incorporated in the Water Use Efficiency Rule, which was finalized as WAC 246-290-800 in January 2007. The DOH published the first Water Use Efficiency Guidebook (Guidebook) in July 2007; the latest (third) edition of this guidance was released in January 2017. The District's WUE program is consistent with the Guidebook and the WUE Rule.

Based on this Guidebook, municipal water suppliers must develop and implement WUE programs to achieve their goals by implementing cost-effective measures. It lists eleven items that must be included in WUE programs. Table 6-1 shows where the required program elements can be found in this WSP.

Table 6-1 | Required WUE Program Elements

Water Use Efficiency Program Element	Chapter Sections
1a. Describe current water conservation program.	6.6
1b. For systems with 1,000 or more connections, estimate of water saved over the last six years.	6.6.2
2. Describe the WUE goals that support your WUE program and how the goals were established.	6.4
3. Evaluate WUE measures for cost-effectiveness.	6.5.3
4. Describe the WUE measures you will implement to meet your established goals for the next 10 years.	6.5.1 & 6.5.2
5. Describe how you will educate customers to use water efficiently.	6.5.2
6. Estimate projected water savings from the selected WUE measures.	6.5.3
7. Describe how you will evaluate the effectiveness of your WUE program.	6.5.5
8. Evaluate distribution system leakage.	6.6.1
9. Evaluate rate structures that encourage water demand efficiency.	6.5.2
10. Evaluate reclaimed water opportunities.	3.2.5 & 6.5.2
11. Describe your water supply characteristics.	6.5.1 & 8

6.4 Objectives and Goals

The WUE Rule requires water purveyors to define at least one measurable water conservation goal (the number of required measures is based on system size). Measurable goals provide a benchmark for evaluating the effectiveness of WUE programs.

As part of the EWUC, the District's previous WUE goals were to maintain DSL below 10 percent in all water systems and strive for progressively lower DSL where possible and to participate in the regional goal to reduce demand in the Everett water service area by 2.03 MGD by the end of 2019. The District was generally successful in meeting these goals. Its success is reviewed in detail in Section 6.6.

Moving forward, the District will maintain its supply-side goal of maintaining a DSL below 10 percent and update its demand-side to be consistent with the new EWUC regional goal. A public meeting was held as part of the District's regularly scheduled Commission meeting on October 19th, 2021, to present the proposed goals and to collect input from District customers. After reviewing and considering all comments, the District's Board of Commissioners will approve the adoption the following goals. A copy of the meeting agenda is included in **Appendix 6-1.** The goals will be officially adopted as part of the Resolution with 2022 water rates.

> <u>Supply-side goal:</u> The District shall maintain its distribution leakage below the State 10 percent standard and shall strive to progressively achieve lower percentages of lost water, where possible.

<u>Demand-side goal:</u> The District shall actively participate in the EWUC regional WUE Program to reduce overall regional water demand by approximately by 1.4 MGD between 2020 and 2029, or approximately a two percent reduction in the cumulative projected demand through 2029 (equal to 0.2% savings annually).

6.5 Water Use Efficiency Program for 2021 to 2030

The District's WUE program was developed for the next 10 years (2021 to 2030) based on current EWUC and District WUE measures. These measures were evaluated for cost effectiveness and water savings. The following sections describe the program and the analyses which informed development of the 2021-2030 WUE program.

6.5.1 Supply-Side Measures

The District sources of supply include surface water purchased from Everett and groundwater supplies from the District's own wells. Of the District's nine existing systems, two are solely supplied by Everett's surface water (Creswell and Storm Lake Ridge), seven systems are solely supplied by their own wells (May Creek, Skylite, Kayak, Warm Beach, Sunday Lake, 212 Market and Deli, and Otis), and one system uses both purchased and well water (Lake Stevens Integrated). A detailed description and analysis of the District's supply sources is provided in **Chapter 8**.

Supply-side measures implemented at the utility level focus on activities the District implements to understand and control its water loss. These measures include replacing source and service meters, accounting for various types of authorized water usage, along with leak detection and repair. These activities do not count toward the District's minimum number of measures. The supply-side measures that the District currently implements and will continue to use are described below.

Source Meters and Service Meters - The District has source meters for all water entering its systems and service meters for all water customers. Meter accuracy is maintained through inspection, maintenance, and replacement as described in **Chapter 9** (Operations and Maintenance) of this WSP. In addition, the District intends to replace the majority of its retail service meters by 2025 through its ongoing Automated Metering Infrastructure (AMI) meter replacement program.

All of the District's retail water services, source, and wholesale master meters are currently read monthly and with the implementation of the AMI program will provide the District with hourly reads at up to 6 hour intervals.

Accounting for Construction Water and Bulk Water Withdrawals - Water fill stations are installed strategically throughout the District's service territory to meter water truck use and to improve cross connection control. Filling of water trucks is monitored through a permit system. A refundable deposit is required to obtain a key to access the designated water fill stations. Permits are issued at flat rates for daily (2,500 gallons total), monthly (10,000 gallons total), or six-month

(10,000 gallons per month) periods. Water usage is recorded, and the records are collected by District staff monthly. Usage over the allotted amount is charged to the permit holder.

Contractors are required to rent a “hydrant watchdog” from the District for the duration of water main construction projects. The “hydrant watchdog” is attached to a blow-off or hydrant and consists of a meter and backflow device. The meter is read monthly by District staff and the contractor billed.

Reporting by Fire Districts - To improve the accounting of non-revenue water, the District continues to work with the local fire districts on reporting water used from hydrants for firefighting activities.

Accounting for Flushing and Tank Cleaning - District staff estimate water used when flushing water mains, cleaning water tanks, and similar activities. Water used for operational activities are tracked in a spreadsheet.

Leak Detection - The annual budget contains an amount for water leak detection services. In 2007, staff purchased sounding equipment to improve detection of leaks in the distribution system. Devices are placed in service meter boxes to “listen” for leaks overnight. The District intends to expand the use of the leak detection equipment.

Tracking Water Main Breaks - The District tracks unplanned water shutdowns resulting from water main breaks and other occurrences. Main breaks caused by aging infrastructure are added to the District’s GIS database. This information is used in conjunction with input from staff to identify and prioritize water main replacement projects.

Water Main Replacement Program - A major portion of the District's ongoing improvement program is dedicated to replacement of aging water mains. The District's goal has been to replace the majority of its old AC, steel, and galvanized iron pipe by 2028.

6.5.2 Demand-Side Measures

Demand-side conservation is achieved through efforts at the customer level. The WUE Rule specifies that at least nine demand-side measures must be evaluated for cost-effectiveness for systems the size of Lake Stevens Integrated and one for each of the District's other water systems. Evaluated measures must be selected from three categories: (1) indoor residential, (2) outdoor, and (3) industrial/commercial/institutional.

Table 6-2 summarizes demand-side measures that have been evaluated for the District’s water systems. The “regional program” consists of measures evaluated by the EWUC subcommittee, as described in Everett’s 2020 WSP. The “local program” consists of measures implemented by the District beyond the regional program.

The WUE Rule’s instructions for counting evaluated measures goes as follows:

- Count one measure for each customer class in which the measure was evaluated.
- Each implemented measure automatically counts as having been evaluated.
- Any measure required to be implemented (marked in **Table 6-2** as "RI") does not count toward number of measures evaluated.
- Any measure required to be evaluated (marked in **Table 6-2** as "RE") does not count unless it is implemented.

As shown in **Table 6-2**, the District easily satisfies the minimum required WUE measures. These demand-side measures that the District evaluated in the regional and local programs are described in further detail immediately following the table.

Table 6-2 | Demand-Side Measures

Measure Name	Implemented[1]			Counts as # of Measures Evaluated
	SF	MF	C	
Public Education Measures				
Customer Education (RI)	x	x	x	0
School Outreach			x	1
Regional Program Measures				
Indoor Retrofit Kits				
Toilets Leak Detection	x	x		2
Showerheads, 1.75 gpm	x	x		2
Bathroom Faucet Aerators 1.0 gpm	x	x		2
Kitchen Faucet Aerators 1.5 gpm	x	x		2
Outdoor Irrigation Kits	x			1
Combined Indoor and Outdoor Audit			x	1
Local Program Measures				
Bill Showing Consumption History	x	x	x	3
Leak Adjustment	x	x	x	3
Conservation Rate Structure (RE)				0
Reclaimed Water Opportunities (RE)				0
Total Implemented:				**17**

Note:
1. (SF) = Single-Family; (MF) = Multi-Family; (C) = Commercial

Customer Education (Single Family, Multi-Family, and Commercial) - The District contributes financially to promote the Everett regional conservation program. A primary effort uses billboards with conservation themes on Community Transit buses during the summer months. It is estimated these billboards are seen by over 75 percent of residents in the region each year. The EWUC also participates in tri-county (Snohomish, King, and Pierce) water conservation marketing campaigns to broadcast radio and/or television messages.

In addition, Everett develops a summer lawn watering calendar encouraging customers to water every third day (staggered, based on street address). This helps reduce peak day demand by reducing the amount of watering on a given day. The District mails this calendar to all of its water customers each year.

In addition to the regional program's customer education efforts, the District conducts its own educational program, including mailings, newsletters, brochures, bill inserts, a web page, contests, and local advertisement. In 2008, the District began including conservation performance in its annual Consumer Confidence Report.

School Outreach (Commercial) - The District participates in the regional school outreach program coordinated by Everett. Everett uses trained instructors for presentations to elementary, middle, and high school students.

In addition to the regional program's customer education efforts, the District also has its own outreach program to public, private, and home schools within its water service territory. The selection of available offerings can be viewed on the Education page of the District's website, www.snopud.com. These include classroom presentations, curricula, teacher workshops, tours, special programs, videos, books, and other support materials. Educators can subscribe to a mailing list to keep informed of special events, regular program offerings, and general information and updates about energy and water education. Current highlights include interactive storytelling for grades K-1 entitled "Exploring Water with Wanda Flipplefairy," promotion of regional classroom presentations, mini-grants of up to $500 in the District's water service territory for water education projects, materials and events, educator workshops, and a wide variety of free educational materials.

Indoor Retrofit Kits (Single and Multi-Family) - As part of the EWUC regional conservation program, the District distributes free indoor water conservation kits to single-family and multi-family retail customers. The indoor conservation kits are intended for homes built prior to 1993, when the National Plumbing Code of 1991 was adopted in the State.

Indoor kits are free to customers and currently include 1.75 gpm showerheads, 1.0 gpm bathroom faucet aerators, a brochure, and thread seal tape. Additionally, 1.5 gpm kitchen faucet aerators and toilet leak detection dye strips are offered separate from the packaged indoor kits. The showerheads, bathroom faucet aerators, and kitchen faucet aerators are more efficient than the maximum allowed under the plumbing code. As such, indoor kits are distributed to both existing and new customers.

Outdoor Irrigation Kits (Single Family) - As part of the EWUC regional conservation program, the District will continue to distribute its share of single-family outdoor conservation kits. Based on studies that show that most households overwater their landscape areas by 15 to 20 percent, these kits are designed to encourage consumers to reduce watering and other outdoor water use.

The outdoor kits include devices and information to improve the irrigation efficiency of residential customers that manually irrigate their landscaping. Most recently the "kits" consisted of an automatic shut-off watering timer, a garden hose shut-off nozzle, and garden hose repair ends: female/male for 5/8-inch and ¾-inch hoses. The contents may remain similar in future years, although some fine-tuning could occur.

Indoor and Outdoor Audits (Commercial) - In partnership with the EWUC regional conservation program, the District provides free indoor and outdoor audits to large volume commercial customers. The audit focuses on efficiencies that could be achieved through hardware improvements, operational changes, or irrigation efficiency improvements. The audits are performed by a contracted professional auditor.

Bill Showing Consumption History (Single Family, Multi-Family, and Commercial) - The District provides as much consumption history as possible on water and electric bills. The current billing software is limited to comparing average use per day and average temperature per day between same time previous year as compared to current year. Due to limitations in the billing program, it is unable to show customers their consumption history in a graph format. With the implementation of the District's AMI project customer's billing history and the amount of data they will be able to review will be dramatically increased.

Leak Adjustment (Single Family and Multi-Family) - District meter readers observe for signs of leaks when reading retail water meters. Computer variance reports also flag high and low meter readings. When a leak is suspected, a staff person visits the site and contacts the customer if a potential problem is confirmed. As an incentive to fix qualifying service line leaks, the District allows for a water bill adjustment of 50 percent for the excess amount of water used during the eligible time frame. Once the customer's meter has been replaced with a new AMI meter, the goal will be to notify the customer of a suspected leak within a couple of days compared to our current manually read process where a leak could go undetected for more than a month.

Evaluated Conservation Rate Structure - The WUE Rule requires purveyors to evaluate a rate structure that encourages conservation. The Guidebook classifies the District's current water rate structure as a "uniform rate," with the same charge per unit of water used. According to the Guidebook, this is better than a declining block rate or a flat rate but does not qualify as encouraging efficient water use.

The Guidebook instructs utilities with a uniform water rate to evaluate an inclining block rate or a seasonal rate structure. The District evaluated water rates in September 2018 and adopted its current water rates with Resolution Nos. 5829 and 5864.

A public meeting was held as part of the District's regularly scheduled Commission meeting on November 2nd, 2021, to present the proposed conservation goals and to collect input from District customers. As part of this meeting the Commissioners were asked if they would like staff to explore different conservation rate structures such as an inclining block structure and/or a seasonal rate. The Commission was interested in looking more closely at conservation rate structures in the future; however, understood that it would be difficult to implement any new rate structure in 2022 due to the ongoing work to prepare for the District's Automated Metering Infrastructure (AMI) project that is being implemented for both the Electric Utility and Water Utility. The Board also believed that the more detailed usage data that will be collected with the new system will be important in the development of any new conservation rate structure.

Evaluated Reclaimed Water Opportunities - Reclaimed water evaluations conducted by the Lake Stevens Sewer District, Granite Falls, Everett, and Marysville were summarized in **Chapter 3, Section 3.2.5** of this WSP. These evaluations thoroughly cover the potential for reclaimed water within and near the District's water service areas. Relevant pages from the referenced documents are provided in **Appendix 3-1**.

Lake Stevens Sewer District, Granite Falls, and Everett reuse water at their respective wastewater treatment plants. Each of these jurisdictions currently find reclaimed water cost prohibitive due to the cost of treatment and additional permitting, and do not have plans to use reclaimed water at this time.

6.5.3 Cost Effective Analysis

The EWUC planning effort used an avoided cost approach to evaluate the cost-effectiveness of potential conservation measures. It reviewed the costs associated with the water and wastewater systems that were avoided due to conservation. These avoided costs include operational costs such as chemical costs associated with water and wastewater treatment, energy costs associated with pump drinking water and wastewater, and capital costs associated with expanding the capacity of facilities to convey higher volumes of water or wastewater. The WUE measures where the implementation cost is less than the avoided cost was considered cost-effective. In total, the analysis founded that the total potential avoided cost of supply due to conservation is $0.41 per hundred cubic feet (ccf). A technical memorandum detailing the information gathered, the analysis methodology, and the results of the avoided cost of supply analysis can be found in Appendix K of the 2020 Everett Comprehensive Water Plan.

6.5.4 Conservation Impact on the Demand Forecast

Table 6-3 shows how the estimated savings in the District's water systems. The District's estimate assumes an additional 0.2 percent savings each year through 2029. This water savings includes both code changes (or houses being updated to meet current plumbing codes) and WUE program savings. **Table 6-3** shows this combination of projected savings, which are factored into the District's demand projections in **Chapter 5**.

Table 6-3 | District Projected Water Savings over the Next 10 Years

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Demand w/o conservation (ADD, 1000 gpd)[1]	5,003	6,454	6,526	6,611	6,697	6,776	6,855	6,936	7,033	7,131	7,223
Demand w/conservation (ADD, 1000 gpd)	4,993	6,441	6,513	6,598	6,684	6,762	6,842	6,922	7,019	7,117	7,208
Conservation Savings (ADD, 1000 gpd)	10.0	12.9	13.1	13.2	13.4	13.6	13.7	13.9	14.1	14.3	14.4
Demand Reduction - Individual Year	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%
Demand Reduction - Cumulative	0.2%	0.4%	0.6%	0.8%	1.0%	1.2%	1.4%	1.6%	1.8%	2.0%	2.2%

Note:
1. Cumulative demand for Lake Stevens Integrated, Storm Lake Ridge, Creswell, May Creek, Skylite, combined Warm Beach, and Sunday Lake.

6.5.5 Evaluating Program Effectiveness

As pointed out by the WUE Guidebook, WUE programs change for a variety of reasons. The Guidebook mentions factors that contribute to shifts in water use patterns, including drought, budget constraints, changes in demographics, and climate change. Water purveyors should monitor the progress of their WUE programs and be prepared to adjust them to stay on track.

Everett and the EWUC conservation committee made several minor adjustments to the 2014 regional program, such as what is included in the Indoor Kits and the Outdoor Kits.

The regional program has also faced financial hurdles. The budget must be authorized each year by the Everett City Council, even though the program is largely funded from rates paid by the wholesale water customers. On at least one occasion, the EWUC supported city staff to make arguments for restoring funds that had been cut.

The progress of the regional program is monitored by Everett Public Works department on an ongoing basis. The EWUC conservation subcommittee meets a couple times per year. Regular updates and discussion about the program also occur at the monthly EWUC meetings.

6.5.6 Funding the WUE Program

The regional conservation program is funded from a portion of the water rates paid to Everett by its wholesale water purveyors. The goal for the 2020-2029 regional water conservation program is to fund about $226,000 a year in regional water conservation activities. The program is also designed to meet, or exceed, the requirements of the MWL. Conservation efforts supplemented by the District are paid for by water rates.

6.6 Historical Water Use Efficiency Program

The District’s historical WUE was developed as part of the 2011 WSP update. After a public meeting on January 8, 2008, the District's Board of Commissioners adopted the following goals:

> Supply-side goal: The District shall maintain its distribution leakage below the State 10 percent standard and shall strive to progressively achieve lower percentages of lost water, where possible.
>
> Demand-side goal: The District shall actively participate in the EWUC regional conservation program to reduce the 2012 regional demand for water by 3 percent (1.97 MGD), while implementing additional WUE measures for the District's water systems.

The supply-side and demand-side measures are described in **Section 6.5.1** and **Section 6.5.2**, respectively of this chapter, though the details of some measure have changed. The following sections analyze the success of the 2011 WUE Program’s goals.

6.6.1 Measuring Success – Supply-Side Goal

The District has been calculating DSL since 1996. The WUE Rule requires that DSL be reported in annual performance reports. Since July 1, 2011, all water systems were required to meet the 10 percent DSL standard as a 3-year average. Systems that do not meet the requirement must develop an action plan to identify steps and timelines to reduce leakage below the standard.

Table 6-4 summarizes distribution system leakage since 2015. The numbers shown in the table may differ from those reported annually to DOH. This difference is due to the timing of the reporting. Until 2018, the District reported annual water usage from March to February. The District changed from bi-monthly to monthly service meter reading starting in September 2015. After a few years examining the impact of this change on DSL calculations the District adjusted its reporting to show annual water usage from January to December.

The negative DSL shown in the Otis and 212 Market & Deli systems are due to the difference in timing between when the water was pumped and when it is used in the system. Due to the size of these systems, one to two gallons equates to about one percent of annual water usage most years. Therefore, the timing of when a gallon of water was pumped versus when it is used plays a noticeable effect in the WUE reports.

Table 6-4 | Reported DSL in Annual WUE Performance Reports

Water System	2015	2016	2017	2018	2019	3-year Average
Lake Stevens Integrated	3.8%	5.6%	5.4%	5.9%	5.1%	5.5%
Warm Beach[1]	10.1%	12.4%	13.7%	5.7%	6.5%	9.7%
Storm Lake Ridge	1.7%	4.9%	1.8%	1.5%	2.0%	1.8%
Kayak	5.0%	9.1%	8.0%	8.2%	8.8%	8.4%
May Creek	2.0%	8.8%	7.0%	13.9%	11.3%	10.7%
Sunday Lake	3.4%	5.3%	3.7%	2.8%	3.9%	3.5%
Skylite	14.0%	28.9%	16.8%	5.1%	5.6%	9.1%
Otis	7.4%	-1.3%	1.2%	-4.2%	-0.5%	-1.2%
212 Market & Deli	-6.5%	-0.6%	1.7%	-8.7%	-0.7%	-2.6%
Creswell	-1.7%	1.7%	1.3%	1.4%	2.0%	1.5%

Note:
1. The 2018 DSL for Warm Beach is significantly different than what was reported due to the District finding additional customers that where not being counted when setting up accounts for billing.

The May Creek system does not meet the DSL standard. DSL in May Creek has increased since 2015; the District estimates a portion of this demand comes from unreported fire department usage. The District is working with the local fire department to improve reporting which should lower DSL in the future.

In the Warm Beach system, DSL significantly dropped since the District took over the system due to an increase in tracking all authorized water usage. In addition, the District plans on replacing the old AC pipe in the system to continue to reduce DSL.

The District is working to improve leak detection and repair turn around in the Skylite system, which is evidenced by the lower DSLs for 2018 and 2019; if this trend continues, the Skylite rolling average will decrease in 2020.

With the above action plan to address leakage in systems that exceed the standard, the District's goal is to assure that the three-year average DSL for all systems is below 10 percent by the time of the next WSP update, which will be due in about ten years.

6.6.2 Measuring Success – Demand-Side Goal

Everett's 2020 WSP estimates that the previous regional program reduced peak season demand by 1.08 MGD from 2014 to the end of 2019, which did not meet its lofty goal of reducing water usage regional by 2.03 MGD between 2014 and 2019. **Table 6-5** shows District water savings for the six-year period from 2014 through 2019 by conservation measure.

Table 6-5 | Estimated Regional Water Savings from 2014-2019 (MGD)

Measure	2014	2015	2016	2017	2018	2019	Total
Education	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Indoor Kits	0.02	0.05	0.04	0.04	0.06	0.04	0.25
Outdoor Kits	0.02	0.02	0.02	0.02	0.03	0.03	0.14
ICI Audits	-	-	0.04	0.05	0.00	-	0.09
Other	0.64	0.67	0.70	0.71	0.69	0.67	1.08
Totals	-	0.71	0.81	0.92	1.01	1.08	

Water systems that serve more than 1,000 customers are required to include an estimate of water saved over the last six years in their WSPs. **Table 6-6** summarizes water savings by District systems, except 212 Market & Deli and Otis. Warm Beach, which was added to the District in 2018, is only shown in 2019 since that is the only complete year that the system was owned and operated by the District.

Table 6-6 | Water Savings by System

System	2015 WUE Goal[1]		2015 Actual Usage[2]	
	gpd/ERU	Gallons	gpd/ERU	Gallons
Lake Stevens Integrated	182	1,975,211,669	184	1,502,956,692[1]
Storm Lake Ridge	262	18,808,424	217	17,245,798
Creswell	182	1,742,797	241	2,024,125
May Creek	173	34,155,334	156	26,482,140
Skylite	180	11,278,936	145	8,033,430
Sunday Lake	186	13,145,384	170	11,035,468
(Former) Kayak	240	36,719,750	247	33,449,8723

System	2016 WUE Goal[4]		2016 Actual Usage[2]	
	gpd/ERU	Gallons	gpd/ERU	Gallons
Lake Stevens Integrated	182	2,038,307,198	164	1,374,100,699
Storm Lake Ridge	261	19,049,509	177	14,435,555
Creswell	182	1,936,455	220	1,846,124[3]
May Creek	172	34,522,662	143	24,980,126
Skylite	180	11,297,204	150	8,322,255
Sunday Lake	187	13,801,591	177	10,739,575
(Former) Kayak	239	36,964,467	206	28,542,199

System	2017 WUE Goal[3]		2017 Actual Usage[2]	
	gpd/ERU	Gallons	gpd/ERU	Gallons
Lake Stevens Integrated	181	2,101,402,727	179	1,544,182,600
Storm Lake Ridge	260	19,290,595	213	17,795,690
Creswell	181	2,130,114	270	2,269,963
May Creek	172	34,889,990	167	31,855,293
Skylite	179	11,315,471	155	8,588,012
Sunday Lake	189	14,457,798	187	12,072,713
(Former) Kayak	238	37,209,184	217	30,850,684

System	2018 WUE Goal[3]		2018 Actual Usage[2]	
	gpd/ERU	Gallons	gpd/ERU	Gallons
Lake Stevens Integrated	181	2,164,498,255	173	1,551,896,387
Storm Lake Ridge	259	19,531,681	207	17,415,303
Creswell	181	2,323,773	249	2,089,658[3]
May Creek	171	35,257,318	155	28,214,844
Skylite	179	11,333,738	156	8,650,687
Sunday Lake	190	15,114,004	194	12,913,509[3]
(Former) Kayak	237	37,453,900	215	30,884,546

System	2019 WUE Goal[5]		2019 Actual Usage[2]	
	gpd/ERU	Gallons	gpd/ERU	Gallons
Lake Stevens Integrated	180	2,227,593,784	167	1,542,866,292
Storm Lake Ridge	258	19,772,766	176	16,529,633
Creswell	180	2,517,432	236	1,982,260[3]
May Creek	170	35,624,646	149	27,755,901
Skylite	178	11,352,006	149	8,322,936
Sunday Lake	191	15,770,211	194	13,118,551[3]
(Former) Kayak	236	37,698,617	213	30,011,884
Warm Beach			137	31,147,348

Note:
1. Actual population growth was less than projected, which is why actual usage went down.
2. Actual Usage values are from **Table 5-2.**
3. Growth was lower than projected; this explains why total usage is lower than projected while usage per ERU is higher than projected.
4. 2016, 2017, and 2018 WUE Goals are interpretated from 2015 and 2019 values stated in the 2011 WSP's Table 5-8.
5. 2015 and 2019 WUE Goals are from the 2011 WSP's Table 5-8.

The goals from 2015 and 2019 reference the conservation values stated in the 2011 WSP's Table 5-8. The goals from 2016 through 2018 are interpolated from the 2015 and 2019 values. The actual usage values are from this WSP's **Table 5-2**.

Creswell is the only system that consistently did not meet its water usage per ERU conservation goal. Creswell's water usage per ERU has significantly increased since the 2011 WSP. The 2011

WSP used a planning value of 188 gpd per ERU whereas the average ERU value between 2015 and 2019 was 243 gpd per ERU.

The remaining systems meet their WUE goals for most years. The summer of 2015 was a particularly hot and dry, which can be seen in the data as the ERU values for most systems increase during this year, and in addition to Creswell, both Lake Stevens Integrated and Kayak are slightly off their goal WUE ERU value for that year.

The 2011 WSP predicted that the ERU value for Sunday Lake would increase, whereas the ERU values for the other systems would decrease. This increase was expected because new customers built on larger lots and therefore used more water per ERU. This prediction turned out to be true, with the increase happening slightly faster than predicted. Therefore, Sunday Lake's actual ERU value is slightly higher than its WUE goal ERU value in 2018 and 2019.

Chapter 7

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 7

Facility Analysis

This chapter describes the evaluations performed on the District's water systems to identify deficiencies and associated improvements to meet the defined analysis criteria. This analysis evaluates Lake Stevens Integrated and the District's larger satellite systems following similar procedures. The resulting project recommendations are combined in **Chapter 11** to create a capital improvement program (CIP) designed to meet or exceed the District's level of service standards. The analysis excludes the Otis and 212 Market & Deli systems, which will not grow beyond their current infrastructure or provide additional customer connections.

The District's water facilities are evaluated in relation to the current (2020), 10-year (2030), and 20-year (2040) projected water demands that were developed in **Chapter 5**. The analyses use projected demands without additional water savings through conservation. Although the District will make its best effort to implement its water use efficiency program, this approach assures that the District adequately plans and funds improvements to support growth if conservation goals are not met. The District will periodically review actual water demands and growth patterns in comparison to estimates and will appropriately adjust the timeline of planned improvements as warranted.

7.1 System Analysis Criteria

Table 7-1 summarizes the criteria used for this system analysis, which is consistent with both DOH requirements and District standards. In this chapter, a "closed zone" refers to a pressure zone without storage and an "open zone" refers to a pressure zone with storage or with access to upstream storage through a PRV.

The Lake Stevens Integrated system supply and storage facilities were evaluated for their ability to provide 3,000 gpm fire flow to open pressure zones (zones with storage), though actual available fire flow throughout the distribution system is dependent on pipe sizes, looping, and elevations. In each storage analysis, fire suppression storage and standby storage are "nested"; the maximum component makes up the emergency storage volume for each system.

Table 7-1 | System Analysis Criteria

Attribute	Evaluation Type	Evaluation Criteria
Water Supply	Firm Supply Capacity	2+ supply sources available with a capability to replenish FSS within 72-hrs while supplying MDD, all available sources
	Reliable Capacity	System ADD with largest source out of service
	Well Sources - Firm Yield	Provide the MDD in a period of 20hrs or less of pumping **(DOH recommended, not required)**
	Surface Source - Firm Yield	Consistent with lowest flow or longest period of extended low precipitation on record.
	Emergency Power	At least two independent sources if adequate standby storage is not available
Storage Facilities	Total Storage Capacity	Sum of operational, equalization, emergency storage (nested fire suppression and standby), and dead.
	Operating[1]	The volume of water before sources turn on. (pump off elev. – pump on elev.) * gal/ft Min of 3 ft operating range
	Equalizing[2]	= (PHD-maximum supply capacity) *150 min Min pressure 30 psi
	Standby[3] (Emergency)	= 2 days of ADD Min recommended is 200 gallons per ERU Min pressure 20 psi
	Fire Suppression[4] (Emergency)	= (Maximum Fire Flow) x (duration) Min pressure 20 psi For Lake Stevens Integrated system: 3,000 gpm fire flow x 120 min
	Dead[5]	Volume that cannot provide minimum design pressure (20 psi) to all customers.
Pump Stations	Firm Capacity when pumping to storage	ADD with largest pump out of service
	Total Capacity when pumping to storage	MDD (recommend also looking at replenishing FSS in 72-hours)
	Firm Capacity when pump to system (no storage)	PHD with largest pump out of service
	Reliable Capacity when pump to system (no storage)	MDD + Fire Flow with largest pump out of service
Service Pressure	Minimum during MDD plus fire flow	20 psi
	Minimum during PHD	30 psi – design new projects to meet 40 psi
	Maximum	Recommend 80 psi. If over 80 psi, recommend customers get an individual PRV.

Attribute	Evaluation Type	Evaluation Criteria
Distribution Piping	Maximum Velocity during PHD	8 fps
	Maximum Velocity during Fire Flow[6]	10 ps – design new projects to meet 8 fps

Notes:

1. Operating storage is used to supply the water system under normal demand conditions. The operational storage in all the District's reservoirs is the volume of storage between the average water level of the reservoirs which signal a supply source to operate and the maximum water level (i.e., overflow elevation) of the reservoirs.
2. When the source pumping capacity cannot meet the periodic daily (or longer) peak demands placed on the water system, equalizing storage must be provided as a part of the total storage for the system, and must be available at 30 psi to all service connections.
3. Standby storage is the portion of the reservoir used to supply the water system under emergency conditions when supply facilities are out of service.
4. Fire flow storage is the portion of the reservoir with sufficient volume to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement.
5. Dead storage is the bottom portion of the reservoir that cannot be used because water is stored at an elevation that is too low to provide sufficient pressure (below 20 psi at the highest elevation served by the reservoir).
6. Velocity criteria are primarily for designing pipe improvements and these criteria alone will not typically result in recommendations for existing system improvements.

7.2 Hydraulic Model

The current version of the hydraulic model was completed by another consultant in 2019 using InfoWater, a GIS-based modeling program developed by Innovyze. The 2019 work included calibrating the District's existing steady-state model (Lake Stevens Integrated only) to be consistent with recent field flow tests. A memorandum titled "Hydraulic Model Update and Steady-State Calibration" by Sedaru Consulting summarizes the calibration effort and can be found in **Appendix 7-1**. The memorandum recommends a few additional flow tests in certain locations or an EPS calibration against SCADA to verify the model but concluded that "the District can confidently use the hydraulic model for planning purposes such as hydrant testing and potential pipe improvements". However, the memorandum also noted that any analysis performed near Tests 1 (southern area of Lake Roesiger 811 Pressure Zone) and 3 (northeastern area of Granite Falls 726 Pressure Zone should be preceded by further validation of the model. An EPS calibration was completed as defined below.

Murraysmith also calibrated the May Creek and Storm Lake Ridge portions of the hydraulic model for steady-state analysis. The District provided flow tests for two representative hydrants in the May Creek water system and four representative hydrants in the Storm Lake Ridge water system. The hydraulic model was run under the same operational conditions (e.g., tank levels, PRV settings where applicable) and the pressure results compared to the pressures measured in the field during the flow tests. The model matched the field results within +\- 1 psi for static pressures and within +/- 8 psi for changes in residual pressures. Industry guidance is that differences lower than 5 psi between the model and the field are considered a high level of confidence in the hydraulic model, so a difference of +/- psi indicates the District can have a reasonable level of confidence in the hydraulic model.

For the May Creek, Sunday Lake, Warm Beach, and Skylite water systems, Murraysmith validated the model by simulating typical operating conditions and reviewed pressures and flows for any suspicious or unrealistic results, such as extreme pressure losses, flows that did not match pump ratings, or service pressures outside typical service pressure ranges. Any concerns were reviewed with the District to check the model setup. For small systems where the hydraulics are not complex, this validation effort provided a confidence in the hydraulic model.

Murraysmith calibrated the Lake Stevens Integrated portion of the District's water model for extended period simulation (EPS) analysis. An EPS calibration assesses the model to ensure it matches the typical system behavior over time. To set up the calibration, two EPS scenarios in the water system model were configured (one for winter and one for summer) to match facility control schemes provided by the District. Murraysmith used real-time supervisory control and data acquisition (SCADA) records to define diurnal water use patterns over the course of the day. These diurnal patterns mimic the changes in water use from Lake Stevens Integrated customers over time. System behavior in the model was compared to the behavior shown in the SCADA records for a specific calibration period. Model boundary conditions such as pump status, pump curves, tank elevations, PRV settings, and tap HGLs were modified to match the SCADA for a typical summer and winter day. The calibration showed that the model's summer and winter control schemes generally matched field conditions, thus the model can be used for extended period analyses.

Water demands are distributed in the model by assigning a unit demand for each meter to the nearest pipe junction. A global demand factor is then applied to adjust system-wide demands to match the supply-based ADD determined in Chapter 5. Peaking factors as described in Chapter 5 were applied to adjust the demand levels to MDD for the fire flow analysis and to PHD for the pressure analysis.

Future demands were projected by both multiplying demands inside the existing RSA by a future multiplier for each pressure zone. These future multipliers were developed from PSRC's VISION 2040 growth projections for each FAZ. Lake Stevens Integrated is spread among six FAZs, each with unique growth projection.

Additional demand was added to areas of expected growth, per the District's knowledge of its system. These areas included the northern border of the Lake Stevens Integrated Zone, the northwestern and southeastern edges of the Granite Falls 726 Pressure Zone, and the northern and southwestern edges of the Lake Roesiger 811 Pressure Zone. These boundaries encompass future retail area that is expected to grow and become part of the District's retail area during the 20-year planning period.

7.3 Lake Stevens Integrated Facilities Analysis

The following section describes the Lake Stevens Integrated system's ability to meet various capacity and regulatory requirements. The analysis reviews the system's supply facilities, booster pump stations, distribution system, storage facilities, and total system capacity, as measured by the total number of ERUs a system can support. The Lake Stevens Integrated system was divided into three service areas for purposes of the analysis: the Lake Roesiger service area, the Granite Falls service area, and the Lake Stevens service area. Each of these service areas' supply and storage facilities were evaluated for their ability to provide 3,000 gpm fire flow to open zones, though actual available fire flow throughout the distribution system is dependent on pipe sizes, looping, and elevations.

The analysis is based on the demand distribution used in the hydraulic model, which is further discussed in **Section 7.2** of this chapter. The individual demands of Arlington, Granite Falls, and the City of Snohomish were considered in terms of the amount of water the District is contractually obligated to provide. As described in the wholesale agreements, the District provides storage for Granite Falls, but not for Arlington.

7.3.1 Water Supply Facility Evaluation for the Lake Stevens Integrated

This section evaluates Lake Stevens Integrated supply facilities. Supply facilities must provide a sufficient quantity of water at pressures that reliably meet the requirements of shown in **Table 7-1**. The required quantity depends on whether the pressure zone is an open zone (i.e., has storage) or a closed zone (i.e., does not have storage). These requirements are summarized in **Table 7-1**.

The Lake Stevens Integrated system is primarily supplied by purchased water from Everett with additional supply coming from its wells. **Figure 4-2** indicated the approximate location of taps for purchased water supply and **Figure 4-3** illustrated how water is delivered from these taps into the District's water systems. The majority of purchased water is supplied by pump stations. The remaining purchased supply is delivered directly from the transmission line taps. **Table 4-3** listed details about each pump in the supply stations, including their rated capacities.

Table 7-2 shows the Lake Stevens Integrated system's supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet existing and projected demands.

Table 7-2 | Lake Stevens Integrated System Supply Evaluation

Description	Plan Yr 2020[1]	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	83	83	83
Maximum Day Demand	6,598	8,993	10,436[2]
Average Day Demand	3,224	4,857	5,545[2]
Available Supply (gpm)			
Largest Source (QL)	4,125	4,125	4,125
Total Capacity (Qs)[3]	19,150	19,150	19,150
Reliable Supply Capacity (ADD with largest source out of service)			
Surplus / (Deficit) of Supply (gpm)	11,801	10,168	9,480
Firm Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	12,468	10,074	8,631

Note:
1. 2020 "plan year" is a projection based on 2019 data but accounts for 2020 Granite Falls demand
2. The Creswell system will be connected to the Lake Roesiger 811 Pressure Zone by 2040, so Creswell demand is included in the 2040 analysis.
3. Total Capacity includes only sources that pump or gravity-flow directly into the Lake Stevens Pressure Zone

7.3.2 Boosted Pressure Zones within the Lake Stevens Integrated System

Booster pumps are used when serving higher elevation pressure zones where higher hydraulic grades are required to maintain adequate service pressures. Similar principles applied when sizing the water supply also apply to sizing booster pumps. These principles summarized in **Table 7-1.** If a booster station serves a zone containing equalizing storage (an open zone), it must supply at least the MDD. If the booster station pumps into a closed zone, it must supply the PHD. In addition, if the station supports fire flow, it should provide the fire flow under MDD with the largest pump out of service. The capacities of existing pumps in the booster stations were summarized in **Table 4-3**. The booster stations for Lake Stevens Integrated are evaluated individually below.

7.3.2.1 Granite Falls 726 Pressure Zone

The Granite Falls pump station serves the Granite Falls 726 Pressure Zone and eight other pressure zones that receive water through the Bosworth Pump Station and PRV stations from the Granite Falls zone. The wholesale master meters for the cities of Granite Falls and Arlington are also located in this zone. The Granite Falls zone is an open zone and contains equalizing storage, so the pumps only need to supply the MDD of this area. The pump station contains chlorination equipment to boost the chlorine residual to the northern extremes of the system.

The concrete masonry, metal roofed, three-room building housing the Granite Falls pumps was constructed in 1995. The station has separate rooms for a pad mounted generator and for the chlorination facilities. In 2001, two new variable frequency drive (VFD) controlled pumps were installed (replacing one existing pump), and the electrical service was upgraded to increase the capacity. The other two pumps were replaced in 2006. The station now contains four identical pumps, each capable of supplying 1,000 gpm at 355 feet total dynamic head (TDH). The pumps alternate in pairs, so the station is considered to have a capacity of 2,000 gpm. District crews report that it is difficult to run three pumps in this station simultaneously due to high pressure on the discharge side of the pumps.

Table 7-3 shows the Granite Falls pump stations supply evaluation. It reviews the pump station's ability to both provide maximum day demand while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands through 2030, but additional pumping will be needed before 2040, which is part of the District's 20-year CIP. The table shows capacity for only two out of the four pumps in the station due to the excessive discharge pressure produced by three or more pumps. The CIP includes a retrofit to the station in 2040 that will optimize the existing pumps to lower TDH so that all four pumps can be used. The need for an additional pump to reach the required capacity will be evaluated during pre-design.

Table 7-3 | Granite Falls 726 Pressure Zone Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	83	83	83
Maximum Day Demand	1,026	2,084	3,237
Average Day Demand	501	1,109	1,689
Available Supply (gpm)			
Largest Pump (QL)	1,000	1,000	1,000
Total Pumping Capacity (Qs)[1]	2,000	2,000	2,000
Reliable Supply Capacity (ADD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	1,499	891	311
Total Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	891	(168)	(1,320)

Note:
1. Granite Falls pump station has four (4) 1,000 gpm; however, only 2 pumps can run at a time, or the max discharge pressure will be exceeded.

7.3.2.2 Lake Roesiger 811 Pressure Zone

The Lake Roesiger 811 Pressure Zone is served by the Lake Roesiger tap and BPS and the Bosworth pump station which was constructed in 1997. The Bosworth BPS is a fabricated steel, below-grade station that pumps water from the District's Granite Falls 726 Pressure Zone to the Lake Roesiger 811 Pressure Zone through two end suction pumps. Water levels in the Bosworth tank trigger pump operation. A PRV at the Bosworth pump station is hydraulically activated to direct flow back into the Granite Falls 726 Pressure Zone as needed.

As was indicated in **Table 4-3**, the Lake Roesiger supply pump station contains two pumps that deliver water from Everett's 3-Line. The station was completed in 1992 and is in good condition. Each pump is rated for 450 gpm at 280 feet TDH. The pumps normally alternate, with each pump supplying 410-440 gpm while pumping from the Everett 3-line through distribution to the tanks. Additionally, **Table 4-3** indicates the capacity of the Bosworth pump station is 250 gpm at 120 feet of head with one pump running. The pumps alternate in a lead/lag configuration, and both pumps can run together if needed resulting in a total capacity of about 350 gpm.

The Lake Roesiger 811 Pressure Zone contains three tanks and is an open zone. **Table 7-4** shows the Lake Roesiger 811 Pressure Zone supply evaluation. It reviews the Lake Roesiger and Bosworth pump stations' ability to provide the required demand for the Lake Roesiger 811 Pressure Zone and the Sunset Ridge 700 Pressure Zone. The pump stations have the capacities to provide MDD while replenishing fire suppression storage in 72 hours as well as the ability to meet ADD with the largest source out of service. As **Table 7-4** shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-4 | Lake Roesiger 811 Pressure Zone Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	83	83	83
Maximum Day Demand	215	372	529[1]
Average Day Demand	105	202	280[1]
Available Supply (gpm)			
Lk Roesiger PS - Largest Pump (QL)	465	465	465
Lk Roesiger PS - Total Pumping Capacity (Qs)	700	700	700
Bosworth PS - Largest Pump (QL)	250	250	250
Bosworth PS - Total Pumping Capacity (Qs)	350	350	350
Reliable Supply Capacity (ADD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	480	383	305
Total Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	752	594	438

Note:
1. The Creswell system will be connected to the Lake Roesiger 811 Pressure Zone by 2040, so Creswell demand is included in the 2040 analysis.

7.3.2.3 Hillcrest 580 Pressure Zone

The Hillcrest 580 Pressure Zone is served by a combination of eight pumps in two pump stations. As was shown in **Table 4-3** the Hillcrest and Glenwood Pump Stations have a capacity of 1,000 gpm and 2,500 gpm, respectively. No tanks float on this pressure zone and is therefore a "closed zone".

The Hillcrest Pump Station is located adjacent to the Hillcrest Tanks. The concrete masonry block building is equipped with a PACO booster pump system and was constructed in 1982. The control system was replaced in 2001 with the installation of the District's Water SCADA system. The station maintains normal and high demand flows by staging five VFD pumps through a start on-pressure, stop on-flow control sequence. Hillcrest is the District's second oldest pump station. However, the pumps and other station facilities are still in very good condition.

The District added new pumps in 2006 as part of the Glenwood Pump Station replacement project, based on the 2002 WSP which identified need for additional pumps to meet increasing demands in the Hillcrest 580 Pressure Zone. The three VFD Goulds pumps supply the Hillcrest 580 Pressure Zone directly from the Everett 3-line.

Table 7-5 shows the Hillcrest 580 Pressure Zone supply evaluation. It reviews the Hillcrest and Glenwood Pump Stations' ability to provide the required demand for the Hillcrest 580 Pressure Zone. The combined pump stations' capacities are adequate to provide MDD plus a 2,000-gpm fire flow as well as its ability to meet PHD, with the single largest pump out of service between the two facilities. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-5 | Hillcrest 580 Pressure Zone Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	1,500	1,500	1,500
Maximum Day Demand	242	374	478
Peak Hour Demand	367	547	701
Available Supply (gpm)			
Glenwood 3,4,5 - Largest Pump (QL)	1,000	1,000	1,000
Glenwood 3,4,5 - Total Pumping Capacity (Qs)	2,500	2,500	2,500
Hillcrest - Largest Pump (QL)	667	667	667
Hillcrest - Total Pumping Capacity (Qs)	1,000	1,000	1,000
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	2,133	1,953	1,799
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)[1]			
Surplus / (Deficit) of Supply (gpm)	758	626	522

Note:
1. Largest pump is considered to be the largest Glenwood Pump. All Hillcrest pumps are considered active.

7.3.2.4 Walker Hill 580 Pressure Zone

The Walker Hill Booster Station is located on the Walker Hill Tank site and serves the Walker Hill 580 Pressure Zone at the north end of Lake Stevens Integrated. The concrete masonry block building and booster pump system were constructed in 1990 to replace the old booster station located south of the tank site. A sixth pump was added in 1996 to increase fire flow capacity for the Lake Stevens School District, and a permanent pad mounted generator was installed in 1998. The pump control system was replaced in 2001 with the installation of the District's Water SCADA system. The booster station maintains normal and high demand flows by staging VFD six pumps through a start on-pressure, stop on-flow control sequence.

Table 7-6 shows the Walker Hill 580 Pressure Zone supply evaluation. The table assesses the pump stations' capacities to provide MDD plus a 2,000-gpm fire flow and to meet PHD, at the design capacity of the pumps with the largest pump out of service. The tabular analysis indicates that the Walker Hill station does not have the pumping capacity to support the 2,000-gpm fire flow requirement at the school with the largest pump out of service; under typical pressure and head conditions (approximately 580 feet of head). The hydraulic model was used to evaluate the capacity of the pump station to provide a 2,000-gpm requirement at the lower, 20 psi pressure requirement during a fire. The hydraulic model analysis shows that the pumps operating at a lower head, higher flow condition provides sufficient fire flow to the zone at a lower 20 psi condition. Furthermore, check valves connected from the Lake Stevens 500 zone can open to provide gravity support during an emergency. Both the high flow pump operation and the check valve support lower the hydraulic grade line in the zone but maintain enough head so that all customers have sufficient pressure during a fire at the school (over 20 psi). Therefore, the pump station is considered to have adequate capacity to supply the school's minimum required flow. A pump station upgrade is included in the CIP (**Chapter 11**) to improve overall service to the Walker Hill 580 Pressure Zone.

Table 7-6 | Walker Hill 580 Pressure Zone Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	2,000	2,000	2,000
Maximum Day Demand	211	295	346
Peak Hour Demand	320	431	507
Available Supply (gpm)			
Largest Pump (QL)	500	500	500
Total Pumping Capacity (Qs)	1,995	1,995	1,995
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	1,175	1,064	988
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	(716)	(800)	(851)

7.3.2.5 Lake Cassidy 580 Pressure Zone

Lake Cassidy Pump Station was placed into service in 2006 for the Preserve at Lake Cassidy. As was shown in **Table 4-3**, the Lake Cassidy station has a capacity of 2,000 gpm when one 1,200 gpm pump is held in reserve. Three of the five pumps are VFD and can modulate pressure to this closed zone.

Table 7-7 shows the Lake Cassidy 580 Pressure Zone supply evaluation. The table assesses the pump stations' capacities to provide MDD plus a 500-gpm fire flow and to meet PHD, both with the largest pump out of service. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-7 | Lake Cassidy 580 Pressure Zone Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	500	500	500
Maximum Day Demand	11	18	23
Peak Hour Demand	17	26	34
Available Supply (gpm)			
Largest Pump (QL)	1,200	1,200	1,200
Total Pumping Capacity (Qs)	2,000	2,000	2,000
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	783	774	766
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	289	282	277

7.3.2.6 Machias Ridge East 640 Pressure Zone

The 157th Avenue SE Booster Station serves about 30 homes in the Machias Ridge East 640 Pressure Zone (closed zone), which includes the Machias Ridge East and Panther Creek East developments. The VFD pump and controls are installed in a daylight-drained vault that was renovated in 2001 during the integration of the Machias Ridge East Water System. The District since added a backup pump and wired the station so it can be operated by a trailer mounted generator during power outages. The backup pump must be activated manually when needed.

Table 7-8 shows the 157th Street pump stations supply evaluation. It looks at the pump station's capacity to provide MDD and to meet PHD, both with the largest pump out of service. Fire flow requirements were not considered because there are no fire hydrants in this pressure zone. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-8 | Machias Ridge East 640 Pressure Zone Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	0	0	0
Maximum Day Demand	19	24	27
Peak Hour Demand	28	35	39
Available Supply (gpm)			
Largest Pump (QL)	75	75	75
Total Pumping Capacity (Qs)	75	75	75
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	47	40	36
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	56	51	48

Note:
The District has an auxiliary pump at this pump station with a capacity of 75 gpm. The two pumps can be manually switched on, if necessary.

7.3.2.7 Dubuque Boosted 640 Pressure Zone

The 44th Street SE Booster Station serves about 40 homes on 144th Avenue SE, 143rd Avenue SE, and Brookside Place in the Dubuque Boosted 640 Pressure Zone (closed zone). This station is also located in a vault, as was the case when the District acquired the Dutch Hill System in 1997. The District upgraded the electric service for the station in January 2002 and installed new pumps in 2008. The pumps alternate and produce 125 gpm when operating at 120 feet TDH to maintain 40 psi at the highest residence.

Table 7-9 shows the 44th Street pump stations supply evaluation. It looks at the pump station capacity to provide MDD and to meet PHD, both with the largest pump out of service. Fire flow requirements were not considered because there are no fire hydrants in this pressure zone. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-9 | Dubuque Boosted 640 Pressure Zone Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	0	0	0
Maximum Day Demand	23	30	33
Peak Hour Demand	35	44	48
Available Supply (gpm)			
Largest Pump (QL)	125	125	125
Total Pumping Capacity (Qs)	250	250	250
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	90	81	77
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	102	95	92

7.3.3 Distribution System Evaluation for the Lake Stevens Integrated System

The Lake Stevens Integrated distribution system must convey water from the sources of supply to customers and to/from the storage tanks. Murraysmith evaluated the Lake Stevens Integrated distribution systems using the District's hydraulic model. Following is a description of the criteria, results, and recommendations for Lake Stevens Integrated. Recommended improvements for other systems will be presented later in this chapter.

7.3.3.1 Evaluation Criteria

As shown in **Table 7-1,** the criteria used as the basis for evaluating the distribution of all the District's water systems include:

- Identifying areas with service pressures below 30 psi under existing and future PHD,
- Identifying areas where required fire flow cannot be met under existing or future MDD conditions while maintaining at least 20 psi throughout the water system, and
- Identifying pipe with velocities in excess of 8 feet per second during PHD.

Fire flow demands used for evaluating the distribution system are shown in **Table 7-10** below. As noted above, the supply and storage facilities in the Lake Stevens Integrated system were evaluated for their ability to provide 3,000 gpm fire flow in open zones; however, the fire flow requirements in the table below were used to evaluate the distribution system itself.

Table 7-10 | Fire Flow Requirements

Water System	Pressure Zone (PZ)/ Service Area (SA)	Fire Flow Evaluation Criteria
Lake Stevens Integrated	Lk Stevens SA	1,000 to 1,500 gpm for 2 hours max
	Granite Falls SA Granite Falls City	1,000 gpm for 2 hours 3,000 gpm for 2 hours
	Lk Roesiger SA	1,000 gpm for 2 hours
	Dubuque 640 PZ	No fire flow required
	Machias Ridge PZ	No fire flow required
	Walker Hill PZ	1,000 to 2,000 gpm for 2 hours
	Lk Cassidy PZ	500 gpm for 1 hour
	Hillcrest PZ	1,500 gpm for 2 hours
Storm Lake Ridge	760 PZ	500 to 1,000 gpm for 2 hours
	850 PZ	No fire flow required
Creswell	525 PZ	1,000 gpm for 2 hours
May Creek	392 PZ	500 gpm for 1 hour
Skylite	280 PZ	No fire flow required
Sunday Lake	430 PZ	500 gpm for 1 hour
	500 PZ	500 gpm for 1 hour
Warm Beach	Kayak 535 PZ	500 gpm for 2 hours
	Kayak 450 PZ	500 gpm for 2 hours
	WB 370 PZ	500 gpm for 2 hours
	WB 350 PZ	500 gpm for 2 hours
	WB 450 PZ	No fire flow required
	WB 232 PZ	500 gpm for 2 hours

Murraysmith evaluated the Lake Stevens Integrated system for the above criteria based on 2020, and 2040 water demands. Murraysmith modeled fire flow for each hydraulic model node close to a hydrant for these systems. The resulting available fire flow from each hydrant node was compared to the fire flow requirement to determine any deficient areas that cannot provide the minimum requirement.

7.3.3.2 Analysis Results

The areas with fire flow or PHD pressure deficiencies are shown in **Figure 7-1**. There are very few PHD pressures below the criteria of 30 psi and a number of areas where fire flows did not meet the minimum requirement (see **Table 7-10**) under existing conditions or future demands. Improvements were identified and added to the model to address any existing deficiencies prior to doing the analysis on the 2040 timeframe. A future analysis then reviewed the projected 2040 water system, including projected demands and previously identified system improvements. Additional improvements were identified to address any future deficiencies. All improvements to address the deficiencies, both existing and future, are discussed in **Chapter 11**. Analysis results for the District's other systems are presented later in this chapter.

7.3.4 Storage Evaluation for the Lake Stevens Integrated System

The District's storage facilities provide a key system component for: maintaining pressure, controlling pumps, providing water for demands above MDD and during emergencies such as fires. Following is a description of the condition, capacity, and recommended improvements for storage in the Lake Stevens Integrated system. Lake Stevens Integrated storage facilities range from 11 to 48 years old. All the tanks are well maintained and are in good condition. No tanks are proposed for replacement within the 20-year planning period. The basic storage tank characteristics were listed in **Table 4-2** and their approximate locations were shown in **Figure 4-4A, 4-4B, and 4-4C**.

- **Walker Hill Reservoirs 1 and 2 –** The Walker Hill Tanks are located at the north end of Lake Stevens Integrated and provide a combined capacity of 4 MG. These tanks supply the Lake Stevens 500 Pressure Zone by gravity and the Walker Hill 580 Pressure Zone through a BPS. The steel tanks are 70 feet in diameter and approximately 68 feet tall. Tank 1 was constructed in 1972 and Tank 2 was completed in 1990.

- **Hillcrest Reservoirs 1 and 2 –** The Hillcrest Reservoirs are located on the west side of Lake Stevens Integrated and provide the system with 6 MG of storage. The tanks supply the Lake Steven 500 Pressure Zone by gravity and the Hillcrest 580 Pressure Zone through a pump station. The steel tanks are 100 feet in diameter and 52 feet tall. Tank 1 was constructed in 1998 and Tank 2 was placed in service in 2009.

- **Granite Falls Reservoir –** The Granite Falls Reservoir is located northeast of Granite Falls near the Iron Mountain Quarry and provides the Granite Falls 726 Pressure Zone with 2.7 MG of storage. The steel tank is 120 feet in diameter and approximately 32 feet tall and was constructed in 1995.

- **Bosworth Reservoir –** The Bosworth Reservoir is located northwest of Lake Bosworth and provides the Bosworth 811 Pressure Zone with 1 MG of storage. The steel tank is 46 feet in diameter and approximately 83 feet tall and was constructed in 1996.

- **Lake Reservoirs 1 and 2** - The Lake Roesiger Tanks are located northeast of Lake Roesiger and provide the system with 0.4 MG of combined storage. The two concrete tanks, constructed in 1992, are each 30 feet in diameter and approximately 45 feet tall.

From a planning perspective, steel tank interiors and exteriors should be re-coated every 15 years. Quarterly physical inspections are performed by operations and maintenance staff to check the seal and structural integrity. The staff also make note of the condition of the coatings to determine the specific timing for cleaning or re-coating. Ongoing cleaning and touch up painting are funded in the operations and maintenance budget. Full tank re-coats and required structural modifications are funded in the capital budget and discussed in **Chapter 11**.

Table 7-11, Table 7-12, and **Table 7-13** show the Lake Stevens Integrated storage evaluation. It looks at the storage tank's capacity to meet the needs of the system by breaking down the storage volume by type. As mentioned in **Table 7-1**, the District nests standby and fire flow storage.

The storage analysis breaks the Lake Stevens Integrated system into three service areas to ensure that all areas of the system have sufficient storage. The service areas represent larger pressure zones that supply at least one additional pressure zone through a pressure valve or BPS. Any deficiencies in lower service areas can be supplemented by surpluses in higher service areas.

Table 7-11 shows the existing (2020) storage analysis. **Table 7-12** shows the projected 10-year (2030) storage analysis.

Table 7-13 shows the projected 20-year (2040) storage analysis. Additional information on the storage analysis calculations can be found in **Appendix 7-2**. The tables below show a storage deficiency by 2030. This deficiency will be addressed by two proposed tanks listed in CIP projects 200 and 201, both of which are discussed in more detail in **Section 7.3.4.1**, below. A new tank in the Lake Roesiger service area is proposed to address the 2040 deficiency.

Table 7-11 | 2020 Storage Analysis

Description	Lk Stevens Integrated Service Area	Granite Service Area	Lk Roesiger Service Area	Total System
Usable Storage (MG)				
Maximum Storage Capacity	9.69	2.62	1.37	13.69
Dead (Non-usable) Storage	1.06	0.04	0.57	1.68
Total Usable Storage	8.63	2.58	0.80	12.01
Required Storage (MG)				
Operational Storage	0.88	0.59	0.23	1.70
Equalizing Storage	0.00	0.00	0.00	0.00
Standby Storage (Emergency)	7.54	0.83	0.30	8.67
Fire Flow Storage (Emergency)	0.36	0.36	0.36	1.08
Total Required Storage	8.42	1.42	0.59	10.43
Surplus Storage	**0.21**	**1.16**	**0.21**	**1.58**

Table 7-12 | 2030 Storage Analysis

Description	Lk Stevens Integrated Service Area	Granite Service Area	Lk Roesiger Service Area	Total System
Usable Storage (MG)				
Maximum Storage Capacity	9.69	2.62	1.37	13.69
Dead (Non-usable) Storage	1.06	0.04	0.57	1.68
Total Usable Storage	8.63	2.58	0.80	12.01
Required Storage (MG)				
Operational Storage	0.88	0.59	0.23	1.70
Equalizing Storage	0.00	0.16	0.00	-.16
Standby Storage (Emergency)	10.21	0.31	0.58	11.11
Fire Flow Storage (Emergency)	0.36	0.36	0.36	1.08
Total Required Storage	11.09	1.11	0.81	13.02
Surplus Storage	-2.46	1.47	-0.01	-1.01

Table 7-13 | 2040 Storage Analysis

Description	Lk Stevens Integrated Service Area	Granite Service Area	Lk Roesiger Service Area	Total System
Usable Storage (MG)				
Maximum Storage Capacity	9.69	2.62	1.37	13.69
Dead (Non-usable) Storage	1.06	0.04	0.57	1.68
Total Usable Storage	8.63	2.58	0.80	12.01
Required Storage (MG)				
Operational Storage	0.88	0.59	0.23	1.70
Equalizing Storage	0.00	0.42	0.00	0.42
Standby Storage (Emergency)	10.3	1.98	0.79	13.07
Fire Flow Storage (Emergency)	0.36	0.36	0.36	1.08
Total Required Storage	11.18	3.00	1.02	15.20
Surplus Storage	-2.55	-0.42	-0.22	-3.19

7.3.4.1 System Capacity Analysis

The preceding sections confirm that the Lake Stevens Integrated water facilities are sufficient for current customers and below is a plan of how the District will support projected growth for the next 20 years. DOH additionally requires that the water system physical capacity be determined by evaluating the capacity of each existing system component in terms of the number of ERUs that can be supported.

The system-wide analysis in **Table 7-14** indicate that storage is the limiting factor for the Lake Stevens Integrated system. Based on the existing facilities, the system has sufficient capacity through 2030. The planned storage tanks described in **Section 7.3.4.2** will provide the system sufficient capacity to support the planned growth beyond the 20-year planning period. The calculations represent the combined facilities for the entire Lake Stevens Integrated water system. A description of the analysis follows the table.

Table 7-14 | Lake Stevens Integrated Existing System Capacity Analysis (Entire Water System)

Description	Plan Yr. 2020	10-Yr 2030	20-Yr 2040
Demands per ERU Basis			
Average Day Demand per ERU (gpd/ERU)[1]	183	183	183
Maximum Day Demand per ERU (gpd/ERU)	381	381	381
Peak Hour Demand per ERU (gpd/ERU)	584	584	584
Total Projected ERUs (ERUs)[2]	24,819	37,777	43,150
Arlington Wholesale ERUs[3]	1,775	8,301	8,301
Source Capacity			
Total System Supply Capacity (Total, gpd)[4]	21,420,000	21,420,000	21,420,000
Fire Suppression Storage Replenished in 72 hours (gpd)	120,000[5]	120,000[5]	120,000[5]
Maximum Day Demand per ERU (gpd/ERU)	381	381	381
Maximum Supply Capacity (ERUs)	55,839	55,839	55,839
Storage Capacity			
Maximum Usable Storage Capacity (MG)	12.01	12.01	12.01
Available Standby and Equalization Storage Capacity (MG)	10.31	10.31	10.31
Standby Storage Requirement per ERU (gal/ERU)	365	365	365
Equalizing Storage Requirement per ERU (gal/ERU)	0.00	0.00	0.00
Maximum Storage Capacity (ERUs)	28,237	28,237	28,237
Maximum System Capacity			
Based on Limiting Facility (ERUs)	28,237	28,237	28,237
Available System Capacity			
Maximum System Capacity (ERUs)	28,237	28,237	28,237
Remaining System Capacity (ERUs)[2]	5,303	-1,239	-6,612

Note:
1. A 5.5% DSL is included in system demand estimates
2. Includes retail and wholesale ERUs
3. Arlington Wholesale is not included in standby storage requirements, so Arlington ERUs are subtracted from the projected ERUs when storage is the limiting factor for capacity.
4. Assumes supply sources are only operated for 20 hrs per day
5. 360,000 gallons spread out over three days

The 183 gpd/ERU ADD value in **Table 7-14** comes from the Lake Stevens Integrated water demand projections in **Chapter 5**. The MDD of 381 gpd/ERU is based on the system MDD/ADD ratio of 2.09, which was also determined in **Chapter 5**.

The supply capacity represents the combined flow of the supply taps with Everett as well as the Lake Stevens Integrated Wells, with all sources operating an average of 20 hours per day. This analysis does not include the system's East Hewitt Supply Pump Station, which was abandoned in late 2020. This analysis shows that supply is not a limiting factor for the Lake Stevens Integrated system.

In relation to the supply capacity, it is also important to note that Everett determined that their water rights should be sufficient for regional growth through at least 2036. There is no contractual limit on the amount of water that the District can purchase from Everett.

This analysis reviews the available equalizing and standby storage (total storage minus dead storage and operational storage) for the Hillcrest, Walker Hill, Granite Falls, Bosworth, and Lake Roesiger Tanks. The storage requirement of 365 gpd/ERU is two times the ADD plus current equalizing storage requirements. The total number of ERUs that the system's storage capacity can accommodate has increased since the 2011 WSP. This increase is due to the small reduction in water usage per ERU in the Lake Stevens Integrated system. As water usage per ERU decreases, the number of ERUs a system can support increases.

The existing number of ERUs in **Table 7-14** includes the ERUs assigned for leakage and non-revenue water uses. Because the District does not supply storage for Arlington, the ERU equivalent for the Arlington supply is included in the source capacity evaluation but excluded from the storage evaluation.

7.3.4.2 Proposed Storage Improvements

Following is a description of the three proposed tanks that will add storage to the Lake Stevens Integrated system. More information about these proposed improvements is included in **Chapter 11.**

- **North Lake Stevens Tank:** This project replaces the Getchell Tank site mentioned in the 2011 WSP. The new site, which was purchased by the District in 2015, has a site elevation of approximately 460 feet instead of 405 feet. This change in elevation allows the tank(s) to be approximately 40 feet tall (overflow at 500 feet elevation), instead of 100 feet, and eliminates the need for dead storage. The tank diameter is assumed to be 129 feet in this analysis, for a total volume of 3.9 MG.

- **Burn Road Tank:** In 2004 the District purchased a site for future storage at the highest elevation along Burn Road, in the Granite Falls 726 Pressure Zone. The site elevation is approximately 600 feet, so tanks will be about 126 feet tall for an overflow at 726 feet elevation. For planning purposes, future tanks are assumed to be 70 feet in diameter, with a total volume of 3.6 MG per tank, of which about 2.3 MG would be available for equalizing and standby storage. Although the zone only has a small estimated deficiency by 2030, the timing for construction and sizing of this tank is primarily intended to give the District operational flexibility and redundancy to the one existing Granite Falls 726 storage tank, which is in need of a complete painting re-coat. The site is large enough to accommodate several tanks in the future. The Burn Road Tank will feature a mixing capability to manage its dead storage.

- **Lake Roesiger Tank:** This project will address the 2040 storage deficiency in the Lake Roesiger service area. The proposed tank will be sized similar to the existing 0.2 MG tanks and the project serves as a placeholder for replacing the tanks with a larger tank if they are nearing the end of their life in 2040.

7.4 Storm Lake Ridge Facilities Analysis

Storm Lake Ridge was originally designed to support up to 220 single family residences, but a re-evaluation of water use after the design showed it could support more users. It currently serves 257 homes. Even though the Storm Lake Ridge system has surpassed its original design capacity, it continues to have sufficient capacity to support its projected growth, as shown in the analyses below. This additional capacity is primarily due to a reduction in water usage per household. As noted in **Table 7-10**, the required fire flow for the Storm Lake Ridge water system is 1,000 gpm for 2 hours.

Fire flow was not a requirement at the time of the Storm Lake Ridge system design; therefore, some sections of this system, primarily the boosted pressure zone, do not have hydrants. However, the majority of the system does provide fire protection.

7.4.1 Water Supply Facility Evaluation for the Storm Lake Ridge System

This section evaluates Storm Lake Ridge's supply capacity based on the requirements summarized in **Table 7-1**. The Storm Lake Ridge system is supplied by purchased water from Everett that is pumped into the system. The Storm Lake Ridge supply station contains two pumps, each rated for 250 gpm at 260-foot of head.

Table 7-15 shows the Storm Lake Ridge supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands.

Table 7-15 | Storm Lake Ridge Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	28	28	28
Maximum Day Demand	109	125	141
Average Day Demand	37	42	48
Available Supply (gpm)			
Largest Pump (QL)	250	250	250
Total Pumping Capacity (Qs)	500	500	500
Reliable Supply Capacity (ADD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	213	208	202
Firm Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	363	347	331

7.4.2 Boosted Pressure Zone within the Storm Lake Ridge Water System

The Storm Lake Ridge Booster Station is located at the reservoir site. It was re-built in 2001 to serve approximately 20 homes off 72nd Place SE at a grade of 860 feet. The station is a wood-framed, metal-roofed structure that houses a packaged VFD booster pump system with a capacity of approximately 100 gpm, a master meter, and the electrical controls. There is no plan to serve additional homes beyond the approved capacity of this pump station. Fire flow is not provided to this zone.

The station is currently operating at a set point correlating to 850-foot HGL, or at net head of 132-foot (57 psi) at the station elevation of 718-foot. This provides a static pressure ranging between 55 and 70 psi at service meters in the zone.

As was indicated in **Table 4-3**, the station contains three Grundfos pumps, each rated for 22 gpm at 143-foot. Under the current operating conditions, this allows 10 feet of head loss within the pump station.

Table 7-16 shows the BPS's supply evaluation. It looks at the capacity to provide MDD as well as its ability to meet PHD, both with the largest pump out of service. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-16 | Boosted Pressure Zone within the Storm Lake Ridge Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	0	0	0
Maximum Day Demand	5	6	7
Peak Hour Demand	13	15	16
Available Supply (gpm)			
Largest Pump (QL)	22	22	22
Total Pumping Capacity (Qs)	66	66	66
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	31	29	28
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	39	38	37

7.4.3 Distribution System Evaluation for the Storm Lake Ridge System

The Storm Lake Ridge System does not provide fire service to the boosted zone, but for the main Storm Lake Ridge Zone there are existing fire flow deficiencies as shown in **Figure 7-1**. The deficiencies are the result of long, dead-end pipes that increase in elevation at their ends resulting in low pressures when conveying fire flows. Improvements to address the deficiencies are discussed in **Chapter 11**.

The District has not experienced problems with the pipes installed in 1987, and they are not planned for replacement. The very low leakage in recent years (see **Table 5-3**) is further evidence that this pipe is holding up. If leaks and breaks begin to occur in the future, the District can add this pipe to the replacement program.

7.4.4 Storage Evaluation for the Storm Lake Ridge Water System

The Storm Lake Ridge Tank is located near 72nd Place SE and provides the system with 0.23 MG of storage. The concrete tank, constructed in 2000, is 26 feet in diameter and approximately 40 feet tall. The tank was sized in conjunction with the source and distribution facilities to support 220 residences and to provide a minimum of 500 gpm of fire flow.

Table 7-17 shows the Storm Lake Ridge storage evaluation. The analysis shows the storage tank's capacity is adequate to meet the needs of the system by breaking down the storage volume by component. As mentioned previously, standby and fire flow storage are nested together into emergency storage. As the table shows, the system has sufficient storage to meet the projected demands through 2040.

Table 7-17 | Storm Lake Ridge Storage Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Usable Storage (MG)			
Maximum Storage Capacity	0.23	0.23	0.23
Dead (Non-usable) Storage	0.005	0.005	0.005
Total Usable Storage	0.23	0.23	0.23
Required Storage (MG)			
Operational Storage	0.06	0.06	0.06
Equalizing Storage	0.00	0.00	0.00
Standby Storage (Emergency)	0.11	0.12	0.14
Fire Flow Storage (Emergency)	0.12	0.12	0.12
Total Required Storage	0.18	0.18	0.20
Surplus Storage	**0.05**	**0.05**	**0.03**

7.4.5 Remaining Physical Capacity in Existing Storm Lake Ridge Facilities

Table 7-18 presents the maximum capacity of the Storm Lake Ridge supply and storage facilities. Storage is clearly the most limiting factor, even when only one supply pump is considered in the analysis. This analysis shows that the system can support additional capacity. Because the system has surpassed the DOH approved limit of 220 ERUs, the District will use this system capacity analysis to ask DOH to increase the approved capacity.

Table 7-18 | Storm Lake Existing System Capacity Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Demands (per ERU Basis)			
Average Day Demand per ERU (gpd/ERU)[1]	202	202	202
Maximum Day Demand per ERU (gpd/ERU)	597	597	597
Peak Hour Demand per ERU (gpd/ERU)	1,456	1,456	1,456
Total Projected ERUs (ERUs)	264	303	340
Source Capacity			
Total System Supply Capacity (Total, gpd)	720,000	720,000	720,000
Fire Suppression Storage Replenished in 72 hours (gpd)[2]	40,000	40,000	40,000
Maximum Day Demand per ERU (gpd/ERU)	597	597	597
Maximum Supply Capacity (ERUs)	1,139	1,139	1,139

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Storage Capacity			
Maximum Usable Storage Capacity (MG)	0.23	0.23	0.23
Available Standby and Equalization Storage Capacity (MG)	0.17	0.17	0.17
Standby Storage Requirement per ERU (gal/ERU)	403.07	403.07	403.07
Equalizing Storage Requirement per ERU (gal/ERU)	0.00	0.00	0.00
Maximum Storage Capacity (ERUs)	420	420	420
Maximum System Capacity			
Based on Limiting Facility (ERUs)	420	420	420
Available System Capacity			
Maximum System Capacity (ERUs)	420	420	420
Remaining System Capacity (ERUs)	156	117	80

Note:
1. A 1.8% DSL is included in system demand estimates
2. Fire storage volume is averaged over three days

7.5 Creswell Facilities Analysis

Creswell is a simple water system, with a single tap from the Everett 2/3 Lines and a 12-inch diameter water main forming the backbone of the system. As noted in **Table 7-10,** the fire flow requirement for the Creswell water system is 1,000 gpm for two hours.

7.5.1 Water Supply Facility Evaluation for the Creswell Water System

This section evaluates Creswell's supply capacity based on the requirements summarized in **Table 7-1**. The Creswell system is supplied by purchased water from Everett. The capacity of the 8-inch diameter tap on the Everett 3-Line is about 1,500 gpm.

Table 7-19 shows the system's supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands. As noted below, the Creswell system will be connected to the Lake Stevens Integrated system by 2040, so Creswell demand is included in the Lake Stevens Integrated Analyses also.

Table 7-19 | Creswell System Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	28	28	28
Maximum Day Demand	13	15	17
Peak Hour Demand	58	67	75
Available Supply (gpm)			
Butterfield Tap	1,500	1,500	1,500
Firm Supply Capacity (no storage) (PHD)			
Surplus / (Deficit) of Supply (gpm)	1,442	1,433	1,425
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	1,459	1,457	1,455

Therefore, the supply tap is capable of supporting the 1,000-gpm design fire flow plus MDD flow, as well as supporting the PHD. For reliability, this supply tap also has a backup connection on the Everett 2-Line.

7.5.2 Distribution System Evaluation for the Creswell Water System

There are no existing or future fire flow or pressure deficiencies in the Creswell system. The HGL of the Creswell Pressure Zone is approximately 525 feet, based on pressure at the Everett transmission line tap location.

The proposed future water main that will integrate the Creswell water system with the Lake Stevens Integrated System will connect to the 811 Lake Roesiger Pressure Zone and the Storm Lake Ridge 760 Pressure Zone through a PRV. At a maximum elevation of 590 feet and a minimum elevation of 260 feet, the pressures in the main are predicted to range between 74 and 216 psi at an HGL of 760 feet. Though the function of the main is primarily for water transmission, individual PRVs will be used at any service connections where pressure exceeds 80 psi, in accordance with the Uniform Plumbing Code. Pressure will be reduced at the connection to the Creswell system with a new PRV.

The hydraulic model was used to evaluate headloss in the transmission main during a fire in the Creswell system (1,000 gpm minimum required). The model predicted a total headloss of approximately 34 feet over the 12,500-foot transmission main, which allows for plenty of pressure at the upstream end of the proposed Creswell PRV. Pipe velocities during fire flow did not exceed the District standard of 8 feet per second.

7.5.3 Storage Evaluation for the Creswell Water System

Creswell is not currently connected to a system with available storage; however, the Improvement Plan as shown in **Chapter 11** shows the District's intent to connect the system to both the Storm Lake Ridge and LS Integrated system. The DOH defines standby storage as the volume of stored water available for use during a loss of source capacity, power, or similar short-term emergency. Standby storage would mainly be used when Everett's filter plant is out of commission. This is an extremely rare circumstance because of redundancies built into the filter plant. Loss of power is not a concern for the Creswell system because it is served by gravity flow and will be served by the Lake Stevens Integrated storage tanks once it is connected.

The DOH Design Manual recommends standby storage to cover two average days of water demand for systems supplied by a single water source. The WAC 246-290-420(5) allows a lower standard if acceptable by the customers. Customer expectations can be established by a majority vote of the water system's governing body.

Standby storage will become available when Creswell merges with the Storm Lake Ridge and Lake Stevens Integrated system as shown in Chapter 11.

By adopting this WSP through its standard public processes, the District's Commission will satisfy the requirements of WAC 246-290-420(5) to confirm that it is acceptable for customers to temporarily forego standby storage in the Creswell system until it merges with the other water systems.

7.5.4 Remaining Physical Capacity in Existing Creswell Facilities

Table 7-20 shows that the Creswell supply facilities should be sufficient for up to 1,865 ERUs. This is more than enough capacity to support growth until the Creswell system merges with the adjacent water systems.

Table 7-20 | Creswell Existing System Capacity Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Demands per ERU Basis			
Average Day Demand per ERU (gpd/ERU)[1]	247	247	247
Maximum Day Demand per ERU (gpd/ERU)	825	825	825
Peak Hour Demand per ERU (gpd/ERU)	3,580	3,580	3,580
Total Projected ERUs (ERUs)	23	27	30
Source Capacity			
Total System Supply Capacity (Total, gpd)	2,160,000	2,160,000	2,160,000
Fire Suppression Storage Replenished in 72 hours (gpd)[2]	40,000	40,000	40,000
Maximum Day Demand per ERU (gpd/ERU)	825	825	825
Maximum Supply Capacity (ERUs)	2,570	2,570	2,570
Storage Capacity	N/A		
Maximum System Capacity			
Based on Limiting Facility (ERUs)	2,570	2,570	2,570
Available System Capacity			
Maximum System Capacity (ERUs)	2,570	2,570	2,570
Remaining System Capacity (ERUs)	2,547	2,544	2,540

Note:
1. A 1.5% DSL is included in system demand estimates
2. Fire storage volume is averaged over three days

7.6 May Creek Facilities Analysis

May Creek was the first satellite water system designed and built by the District after establishing the Satellite Water System Program in 1980. It replaced a system originally constructed to serve the four divisions of May Creek Mountain View Tracts in the 1960s. May Creek is approved by DOH to serve an “unspecified” number of connections, which means the system can grow up to the number of connections justified by this WSP. As noted in **Table 7-10,** the minimum fire flow requirement for the May Creek water system is 500 gpm for 1 hour.

7.6.1 Water Supply Facility Evaluation for the May Creek System

This section evaluates May Creek’s supply capacity based on the requirements summarized in **Table 7-1**. May Creek is supplied by two wells. Well 1 well drilled in 1983 was intended to produce 300 gpm. Well 2 was drilled in 1994 to perfect the May Creek water right and is intended to produce 500 gpm. The wells are located at the same site and do not operate simultaneously.

In the May Creek system, the two wells supply the system by a control sequence so that the two wells alternate. Recorded flow indicates that Well 1 is delivering 277 gpm and Well 2 is delivering about 500 gpm when pumping through the 6-inch diameter fill pipe to the tanks.

Table 7-21 shows the system's supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands. An on-site propane powered generator is available to operate the wells during power outages.

Table 7-21 | May Creek System Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	7	7	7
Maximum Day Demand	118	143	174
Available Supply (gpm)			
Total Pumping Capacity (Qs)	500	500	500
Total Water Right(Qi)	500	500	500
20-hr Pumping Capacity	417	417	417
Firm Supply Capacity (Provide the MDD in a period of 20hrs or less of pumping.)			
Surplus / (Deficit) of Supply (gpm)	299	273	243
Reliable Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	375	350	319

7.6.2 Distribution System Evaluation for the May Creek System

The existing May Creek Water System is comprised of a single pressure zone with a hydraulic grade level of 392 feet, determined by the overflow level of the tanks. The highest ground elevation in the May Creek RSA is 300 feet, which corresponds to a static pressure of 40 psi. The boundary of the "retail service area" was outlined in **Figure 2-2**. The highest currently active water service is at approximately 270 feet elevation, with a static pressure of about 50 psi. The lowest elevation in the service area is about 205 feet, so the high end of the pressure range is about 80 psi. There are no existing or future fire flow or low-pressure deficiencies within the existing service area.

A BPS will be needed to expand the May Creek system above 300 feet into the eastern portion of the future service area. If customer growth occurs above this elevation, the developer will be responsible for the cost to design and build the booster station.

7.6.3 Storage Evaluation for the May Creek System

The May Creek tanks are located east of the plat of May Creek Tracts and provide the system with 0.35 MG of combined storage. The two concrete tanks, constructed in 1984, are 26 feet in diameter and approximately 45 feet tall with a base elevation at 347 feet.

Table 7-22 shows May Creek storage evaluation, which assesses the storage tank's capacity to meet the needs of the system by breaking down the storage volume by component. As mentioned previously, standby and fire flow storage are nested together into emergency storage. As the table shows, the system has sufficient storage to meet the projected demands through 2040.

Table 7-22 | May Creek Storage Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Usable Storage (MG)			
Maximum Storage Capacity	0.36	0.36	0.36
Dead (Non-usable) Storage	0.004	0.004	0.004
Total Usable Storage	0.35	0.35	0.35
Required Storage (MG)			
Operational Storage	0.04	0.04	0.04
Equalizing Storage	0.00	0.00	0.00
Standby Storage (Emergency)	0.18	0.21	0.26
Fire Flow Storage (Emergency)	0.03	0.03	0.03
Total Required Storage	0.22	0.25	0.30
Surplus Storage	**0.14**	**0.10**	**0.05**

7.6.4 Remaining Physical Capacity in Existing May Creek Facilities

Table 7-23 shows that the existing May Creek facilities may be sufficient to serve about two times the current number of customers. Storage is currently the most limiting factor. The remaining capacity in the existing facilities appears to be sufficient for build-out of the future May Creek service area in accordance with current zoning.

The capacity analysis for the May Creek system includes a reference to the District's 1999 agreement with the Tulalip tribe regarding groundwater withdrawal (see **Section 8.3**). Use of the entire May Creek water right for domestic consumption has been constrained as a condition of the Tribes' dismissal of its objection to a proposed change application. The agreement stipulates that a portion of the groundwater pumped shall be returned to May Creek (as mitigation for groundwater withdrawal impact) when the peak daily groundwater withdrawal rate exceeds 277 gpm within any calendar day (398,880 gpd). The current average daily withdrawal rate is 60 gpm, and the estimated MDD for 2040 is 174 gpm. The system has source capacity to meet anticipated growth and demand without mitigation requirements being triggered through 2040.

Table 7-23 | May Creek Existing System Capacity Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Demands per ERU Basis			
Average Day Demand per ERU (gpd/ERU)[1]	169	169	169
Maximum Day Demand per ERU (gpd/ERU)	325	325	325
Peak Hour Demand per ERU (gpd/ERU)	660	660	660
Total Projected ERUs (ERUs)	523	634	770
Water Right - Instantaneous Capacity			
Limiting Supply Rate (based on Qi) (gal/day)	720,000	720,000	720,000
Mitigation Trigger for MDD (gpd)	398,880	398,880	398,880
Maximum Day Demand per ERU (gpd/ERU)	325	325	325
Maximum Supply Capacity (ERU)	2,213	2,213	2,213
Maximum Supply Capacity without Mitigation (ERU)	1,226	1,226	1,226
Water Right - Annual Capacity			
Limiting Supply Rate (based on Qa) (gal/day)	285,231	285,231	285,231
Average Day Demand per ERU (gpd/ERU)	169	169	169
Maximum Supply Capacity (ERU)	1,683	1,683	1,683
Source Capacity			
Total System Supply Capacity (Total, gpd, 20hr pumping)	932,400	932,400	932,400
Fire Suppression Storage Replenished in 72 hours (gpd)[2]	10,000	10,000	10,000
Maximum Day Demand per ERU (gpd/ERU)	325	325	325
Maximum Supply Capacity (ERUs)	2,835	2,835	2,835
Storage Capacity			
Maximum Usable Storage Capacity (MG)	0.35	0.35	0.35
Available Standby and Equalization Storage Capacity (MG)	0.31	0.31	0.31
Standby Storage Requirement per ERU (gal/ERU)	339	339	339
Equalizing Storage Requirement per ERU (gal/ERU)	0.00	0.00	0.00
Maximum Storage Capacity (ERUs)	926	926	926
Maximum System Capacity			
Based on Limiting Facility (ERUs)	926	926	926
Available System Capacity			
Maximum System Capacity (ERUs)	926	926	926
Remaining System Capacity (ERUs)	403	291	156

Note:
1. A 10% DSL is included in system demand estimates
2. Fire storage volume is averaged over three days

7.7 Skylite Water System Facilities Analysis

The District accepted ownership of the Skylite system from an association of Skylite Tracts property owners in 1992 (see Resolution 3756). Skylite was constructed in the 1960s and approved for 167 connections, based on consideration that the lots would be primarily recreational in nature (e.g., vacation homes). The system consisted of a single well containing two pumps, a single 1,000-gallon pressure tank, and a distribution system comprised of approximately 9,700 feet of 4-inch and 2-inch diameter Class 160 PVC. Design shortcomings became apparent as recreational uses transitioned into residential occupancy.

The District's first improvements to the system included locating all valves and returning them to operational condition, replacing the service lines, and installing meters. The District developed a spare parts inventory to facilitate emergency repairs on the distribution system with minimal interruption. To further improve reliability, the District moved the pump house electrical service to direct service from Mann Road, because power lines on Mann Road were often energized when lines in the tract were out due to limb or tree damage. For the next step, the District purchased and installed a propane-powered emergency generator with an automatic transfer feature.

The District built a 106,000-gallon concrete storage tank in 1997 and completed a booster pump system in 1999 to deliver water from the tank into the system. One fire hydrant is available for the local fire department to fill tanker trucks directly from the tank. These improvements included sprayers to aerate the water as it enters the tank. Aeration strips naturally occurring carbon dioxide and raises the pH to reduce the corrosiveness of the water toward copper plumbing. The aeration treatment successfully brought Skylite into compliance with the Lead and Copper Rule. The District subsequently began continuous chlorination in 2002.

In 2007, the District further modernized the Skylite Pump House. The booster pumps were replaced by VFD pumps, which enabled the removal of the large pressure tanks. This freed up space to replace the 11-kilowatt (kw) generator with a 47-kw generator and to move the chlorine equipment into a dedicated chemical feed room. The 2007 improvements also integrated Skylite with the District's SCADA control system, which has been a significant operational advance.

As noted in **Table 7-10,** there is no minimum fire flow requirement for the Skylite system.

7.7.1 Water Supply Facility Evaluation for the Skylite System

This section evaluates Skylite's supply capacity based on the requirements summarized in **Table 7-1**. When the District received ownership of the Skylite system, the existing pumps in the well had been installed by the Skylite Tracts Association in 1982 and 1986. It was understood that each pump was intended to provide 60 gpm at 150-foot TDH. In 2011 the older of the two pumps failed and the District replaced it with a new, more efficient pump and motor. The replacement pump provides approximately 55 gpm and the remaining 1986 pump provides approximately 45 gpm. As part of an effort to purchase and have available replacement pumps, motors, and wire for each of its smaller standalone water systems, the District has ordered a new pump and motor capable of supplying 60 gpm consistent with the previous pumps. As part of the process of replacing the 1986 era pump and motor, the District intends to look at the feasibility of running both new pumps together to restore the earlier 120 gpm operation during peak day system demands and in the process assess the potential impact to well drawdown and overall well capacity. If this proves successful, the District may consider further up-sizing the pumps the next time they are replaced to achieve the 150 gpm Qi allowed by water rights. As, an alternative, the District could seek approval to drill a second adjacent well under the water rights so that each well could contain a single pump.

Skylite's wells pump directly into its storage tank, which is then pumped through the system's BPS to its customers. The well pump needs to provide sufficient supply to allow tanker trucks to fill directly from the tank for fire suppression.

Table 7-24 shows the system's supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands.

Table 7-24 | Skylite System Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	7	7	7
Maximum Day Demand	33	33	34
Available Supply (gpm)			
Total Pumping Capacity (Qs)	100	120	150
Total Water Right (Qi)	150	150	150
20-hr Pumping Capacity	83	100	125
Firm Supply Capacity (Provide the MDD in a period of 20hrs or less of pumping.)			
Surplus / (Deficit) of Supply (gpm)	50	67	91
Reliable Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	60	80	109

7.7.2 Boosted Pressure Zone within the Skylite System

Booster pumps deliver water from the storage tank to the entire Skylite distribution system. The VFD pumps are each rated for 60 gpm at 150-foot TDH (65 psi), like the intended capacity of the well pumps, which had satisfactory served the community for years before the tank was added to the system. The pumps are currently set to operate at 60 psi and normally alternate every 6 hours. Both pumps operate together when needed for peak hour demands. Because the single fire hydrant in the Skylite system is not connected to the distribution pipes, the booster pumps do not need to provide fire flow.

Table 7-25 shows the BPS's supply evaluation and assesses the pump stations' capacity to provide MDD as well as its ability to meet PHD, both with the largest pump out of service. As the table shows, the system's supply is 30 gpm below the supply required to meet demands through 2040. Since the time the District originally acquired this historically DOH-approved system, the District continues to make improvements to the system including construction of a storage tank in the supply zone and construction of the booster station. No growth is planned for the Skylite system beyond the existing number of approved connections. The second booster pump is used infrequently and only for short periods of time (typically less than one hour) during high demand periods in the summer. Should one booster pump go out of service during warm weather, the District would send a notice to Skylite customers asking them to curb use until repairs can be made, and the remaining booster pump would be able to support MDD-level demands. Therefore, the District does not have any current plans to improve the booster station but will evaluate increasing the capacity of the booster station in conjunction with the next upgrade required as the system ages.

Table 7-25 | Boosted Pressure Zone within the Skylite Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	0	0	0
Maximum Day Demand	33	33	34
Peak Hour Demand	90	91	92
Available Supply (gpm)			
Largest Pump (QL)	60	60	60
Total Pumping Capacity (Qs)	120	120	120
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply[1]	(30)	(31)	(32)
Reliable Capacity (no storage) (MDD[2] with largest pump out of service)			
Surplus / (Deficit) of Supply	27	27	26

Note:
1. Since the known deficiency meets the current DOH requirement to supply MDD + FF with the largest pump offline, the District will monitor the situation and retrofit the pumps to meet our revised design standard of supplying PHD *with the largest pump out of service* when the pumps require replacement.
2. No fire flow service provided for this water system.

7.7.3 Distribution System Evaluation for the Skylite System

Skylite does not provide fire flow service and does not have any low-pressure deficiencies.

7.7.4 Storage Evaluation for the Skylite System

The Skylite Reservoir provides the system with 0.1 MG of storage as well as aerating the well water to reduce the levels of carbon dioxide in the ground water as a corrosion control measure. The concrete tank is 30 feet in diameter and approximately 20 feet tall and was constructed in 1997.

Table 7-26 shows Skylite storage evaluation which assesses the storage tank's capacity to meet the needs of the system by breaking down the storage volume by type. As mentioned previously, standby and fire flow storage are nested together into emergency storage. For this system, fire flow is pulled directly from the tank to a tanker truck since the single fire hydrant in the Skylite system is not connected to the distribution pipes. As the table shows, the system has sufficient storage to meet the projected demands through 2040.

Table 7-26 | Skylite Storage Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Usable Storage (MG)			
Maximum Storage Capacity	0.106	0.106	0.106
Dead (Non-usable) Storage	0.003	0.003	0.003
Total Usable Storage	0.103	0.103	0.103
Required Storage (MG)			
Operational Storage	0.016	0.016	0.016
Equalizing Storage	0.000	0.000	0.000
Standby Storage (Emergency)	0.051	0.052	0.053
Fire Flow Storage (Emergency)	0.030	0.030	0.030
Total Required Storage	0.067	0.068	0.069
Surplus Storage	**0.036**	**0.035**	**0.035**

7.7.5 Remaining Physical Capacity in Existing Skylite Facilities

Table 7-27 evaluates the Skylite water rights and existing facilities to determine the maximum number of ERUs that can be served. As can be seen in the table, the system's limiting factor is its annual water right withdrawal rate, which suggests the Skylite system may have capacity for up to 200 ERUs. The District is not seeking an increase in the 167 approved connections, in case it becomes difficult to maintain customer demand below 165 gpd/ERU and because the system is not expected to reach 167 connections by 2040.

Table 7-27 | Skylite Existing System Capacity Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Demands per ERU Basis			
Average Day Demand per ERU (gpd/ERU)[1]	165	165	165
Maximum Day Demand per ERU (gpd/ERU)	303	303	303
Peak Hour Demand per ERU (gpd/ERU)	833	833	833
Total Projected ERUs (ERUs)	155	158	160
Water Right - Instantaneous Capacity			
Limiting Supply Rate (based on Qi) (gal/day)	216,000	216,000	216,000
Maximum Day Demand per ERU (gpd/ERU)	303	303	303
Maximum Supply Capacity (ERU)	713	713	713

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Water Right - Annual Capacity			
Limiting Supply Rate (based on Qa) (gal/day)	33,030	33,030	33,030
Average Day Demand per ERU (gpd/ERU)	165	165	165
Maximum Supply Capacity (ERU)	200	200	200
Source Capacity			
Total System Supply Capacity (Total, gpd, 20hr pumping)	120,000	1,000	180,000
Fire Suppression Storage Replenished in 72 hours (gpd)[2]	0	0	0
Maximum Day Demand per ERU (gpd/ERU)	303	303	303
Maximum Supply Capacity (ERUs)	397	475	594
Storage Capacity			
Maximum Usable Storage Capacity (MG)	0.10	0.10	0.10
Available Standby and Equalization Storage Capacity (MG)	0.09	0.09	0.09
Standby Storage Requirement per ERU (gal/ERU)	329.29	329.29	329.29
Equalizing Storage Requirement per ERU (gal/ERU)	0.00	0.00	0.00
Maximum Storage Capacity (ERUs)	265	265	265
Maximum System Capacity			
Based on Limiting Facility (ERUs)	200	200	200
Available System Capacity			
Maximum System Capacity (ERUs)	200	200	200
Remaining System Capacity (ERUs)	45	42	40

Note:
1. A 9.1% DSL is included in system demand estimates
2. Fire storage volume is averaged over three days

7.8 Sunday Lake Water System Facilities Analysis

7.8.1 Water Supply Facility Evaluation for the Sunday Lake System

This section evaluates Sunday Lake's supply capacity based on the requirements summarized in **Table 7-1**. Sunday Lake is served by a single well with a pump that can operate at 130 gpm to match the water rights limit.

Table 7-28 shows the system's supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands. As noted in **Table 7-10,** the minimum fire flow requirement for the Sunday Lake water system is 500 gpm for 1 hour.

Table 7-28 | Sunday Lake System Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	7	7	7
Maximum Day Demand	74	90	108
Available Supply (gpm)			
Total Pumping Capacity (Qs)	130	130	130
Total Water Right (Qi)	130	130	130
20-hr Pumping Capacity	108	108	108
Firm Supply Capacity (Provide the MDD in a period of 20hrs or less of pumping.)			
Surplus / (Deficit) of Supply (gpm)	34	18	(0)[1]
Reliable Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	49	33	15

Note:
1. Note that the ability to provide MDD with 20 hours or less of pumping is a recommendation, not a requirement. Since the shown deficiency is minor, the District will monitor the situation and is not currently planning a CIP project to address this finding.

7.8.2 Boosted Pressure Zone within the Sunday Lake System

The Sunday Lake Booster Station was constructed in 2006 and is set to operate at a desired pressure of 110 psi. Pumps 1 and 2 have a 90-gpm capacity and are for ADD, MDD, and PHD. Pumps 3 and 4 have a 450-gpm capacity and are for high demand periods, such as fire flow demands. All four pumps are VFD.

Table 7-29 shows the BPS's supply evaluation which assesses the pump station capacity to provide MDD plus a 500-gpm fire flow as well as its ability to meet PHD, both with the largest pump out of service. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-29 | Boosted Pressure Zone within the Sunday Lake Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	500	500	500
Maximum Day Demand	74	90	108
Peak Hour Demand	189	228	275
Available Supply (gpm)			
Largest Pump (QL)	450	450	450
Total Pumping Capacity (Qs)	1,080	1,080	1,080
Firm Supply Capacity (no storage) (PHD with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	441	402	355
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	56	40	22

7.8.3 Distribution System Evaluation for the Sunday Lake System

Sunday Lake has low pressure deficiencies at customer meters very near the tank. Some customer owned service line booster pumps are required to provide adequate pressures to these customers.

7.8.4 Storage Evaluation for the Sunday Lake System

The Sunday Lake Reservoir is located west of 254th Street NW and provides the system with 0.2 MG of storage. The concrete tank is 26 feet in diameter, approximately 50 feet tall and was constructed in 1995.

Table 7-30 shows Sunday Lake storage evaluation which assesses the storage tank's capacity to meet the needs of the system by breaking down the storage volume by type. As mentioned previously, standby and fire flow storage are nested together into emergency storage. As the table shows, the system has sufficient storage to meet the projected demands through 2040.

Table 7-30 | Sunday Lake Storage Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Usable Storage (MG)			
Maximum Storage Capacity	0.20	0.20	0.20
Dead (Non-usable) Storage	0.02	0.02	0.02
Total Usable Storage	0.17	0.17	0.17
Required Storage (MG)			
Operational Storage	0.01	0.01	0.01
Equalizing Storage	0.01	0.01	0.02
Standby Storage (Emergency)	0.07	0.09	0.11
Fire Flow Storage (Emergency)	0.03	0.03	0.03
Total Required Storage	0.09	0.11	0.14
Surplus Storage	**0.08**	**0.06**	**0.04**

7.8.5 Remaining Physical Capacity in Existing Sunday Lake Facilities

Table 7-31 evaluates the Sunday Lake water rights and existing facilities to determine the maximum number of ERUs that can be served. As can be seen in the table, the system's limiting factor is its supply capacity. The system has sufficient capacity for its projected growth.

Table 7-31 | Sunday Lake Existing System Capacity Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Demands per ERU Basis			
Average Day Demand per ERU (gpd/ERU)[1]	184	184	184
Maximum Day Demand per ERU (gpd/ERU)	529	529	529
Peak Hour Demand per ERU (gpd/ERU)	1,339	1,339	1,339
Total Projected ERUs (ERUs)	203	245	295
Water Right - Instantaneous Capacity			
Limiting Supply Rate (based on Qi) (gal/day)	187,200	187,200	187,200
Maximum Day Demand per ERU (gpd/ERU)	529	529	529
Maximum Supply Capacity (ERU)	354	354	354
Water Right - Annual Capacity			
Limiting Supply Rate (based on Qa) (gal/day)	89,721	89,721	89,721
Average Day Demand per ERU (gpd/ERU)	184	184	184
Maximum Supply Capacity (ERU)	488	488	488
Source Capacity			
Total System Supply Capacity (Total, gpd, 20hr pumping)	187,200	187,200	187,200
Fire Suppression Storage Replenished in 72 hours (gpd)	10,000	10,000	10,000
Maximum Day Demand per ERU (gpd/ERU)	529	529	529
Maximum Supply Capacity (ERUs)	335	335	335
Storage Capacity			
Maximum Usable Storage Capacity (MG)	0.174	0.174	0.174
Available Standby and Equalization Storage Capacity (MG)	0.166	0.166	0.166
Standby Storage Requirement per ERU (gal/ERU)	367.88	367.88	367.88
Equalizing Storage Requirement per ERU (gal/ERU)	43.34	59.84	73.51
Maximum Storage Capacity (ERUs)	404	389	377
Maximum System Capacity			
Based on Limiting Facility (ERUs)	335	335	335
Available System Capacity			
Maximum System Capacity (ERUs)	335	335	335
Remaining System Capacity (ERUs)	132	90	40

Note:
1. A 3.5% DSL is included in system demand estimates

7.9 Warm Beach System Facilities Analysis

The District is currently in the process of combining its Kayak and Warm Beach systems. The District became responsible for the Kayak system in October 2006 and the Warm Beach system in September 2018. As noted in **Table 7-10,** the minimum fire flow requirement for the Warm Beach water system is 500 gpm for 2 hours.

7.9.1 Water Supply Facility Evaluation for the Warm Beach System

The combined Warm Beach system has four active wells. The historical Kayak water system has two active wells. Kayak-Well 2 currently operates between 200 to 285 gpm and Kayak-Well 3 operates at 300 gpm. The wells currently alternate in operation. In 2009 the District constructed a treatment system for these two wells to remove manganese, iron, and hydrogen sulfide and provide free chlorine residual throughout the distribution system.

The historic Warm Beach water system also has two active wells. Warm Beach-Well 2 operates at 50 gpm and Warm Beach-Well 4 operates between 170-200 gpm. While Well 2 operates at its full water rights capacity, Well 4 currently operates under its 200 gpm water right capacity. The District replaced the pump, motor, 4" drop pipe, and wire at Well 4 under an emergency contract in August 2020 after the failure of the well's submersible motor. Although consideration was made to complete the replacement in a manner that would maximize its water rights, expediency and availability of equipment was prioritized over selection of the optimum pump and motor combination. The new pump, however, does pump the 200-gpm Qi initially at start-up and then drops to between 170-180 gpm during its normal run. The District has ordered a new pump and motor with slightly higher head to maintain as a spare that should be sufficient to consistently run the well at the targeted 200 gpm; however, installation of that new pump and motor is not emergent at this time and would be delayed until the Kayak and Warm Beach systems are fully connected with planned improvements as discussed in **Chapter 11** or as needed based on the ongoing performance of the newly installed pump and motor.

Table 7-32 shows the system's supply evaluation. It reviews the system's ability to both provide MDD while replenishing fire suppression storage in 72 hours as well as its ability to meet ADD with the largest source out of service. As the table shows, the system has sufficient supply to meet the projected demands.

Table 7-32 | Warm Beach System Supply Evaluation

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Fire Suppression Storage Replenished in 72 hours	14	14	14
Maximum Day Demand	345	394	449
Available Supply (gpm)			
Total Pumping Capacity (Qs)	550	550	550
Total Water Right (Qi)	620	620	620
20-hr Pumping Capacity	458	458	458
Firm Supply Capacity (Provide the MDD in a period of 20hrs or less of pumping.)			
Surplus / (Deficit) of Supply (gpm)	113	65	9
Reliable Capacity (MDD + replenish FSS in 72-hours)			
Surplus / (Deficit) of Supply (gpm)	191	143	87

7.9.2 Boosted Pressure Zone within the Warm Beach System

The Warm Beach Booster Station was constructed in 1995 and is set to operate at a desired head of 140 feet. It has two pumps, each with a 65-gpm capacity. Pressure is modulated by six 86-gallon bladder tanks.

Table 7-33 shows the BPS's supply evaluation, which assesses the pump station capacity to provide MDD as well as its ability to meet PHD, both with the largest pump out of service. As the table shows, the system has sufficient supply to meet the projected demands through 2040.

Table 7-33 | Boosted Pressure Zone within the Warm Beach Supply Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Required Supply (gpm)			
Max Fire Flow	0	0	0
Maximum Day Demand	10	11	13
Peak Hour Demand	29	33	37
Available Supply (gpm)			
Largest Pump (QL)	65	65	65
Total Pumping Capacity (Qs)	130	130	130
Firm Supply Capacity (no storage) (PHD)			
Surplus / (Deficit) of Supply (gpm)	36	32	28
Reliable Capacity (no storage) (MDD + Fire Flow with largest pump out of service)			
Surplus / (Deficit) of Supply (gpm)	55	54	52

7.9.3 Distribution System Evaluation for the Warm Beach System

As shown in **Figure 7-2,** there are a significant number of existing fire flow deficiencies in the Warm Beach system due to storage capacity deficiencies and high elevation customers, particularly at the end of dead-end pipes. Connecting the Warm Beach and Kayak Systems along with some pipe upsizing improves the fire flow availability. Some service line booster pumps or connecting customers to parallel higher-zone piping may be required. Specific improvements to address the deficiencies are discussed in **Chapter 11**.

7.9.4 Storage Evaluation for the Warm Beach System

The combined Warm Beach system has two storage tanks, the Kayak Tank and the Warm Beach Tank. The Kayak Tank provides the system with 0.3 MG of total storage, 0.2 MG of usable storage. The concrete tank is 26 feet in diameter, approximately 75 feet tall and was constructed in 2009. The Warm Beach Tank and provides the system with 0.2 MG of total and usable storage. The bolted steel tank is 33 feet in diameter, approximately 32 feet tall and was constructed in 1995.

Table 7-34 shows Warm Beach storage evaluation. It reviews the system's storage capacity against its storage needs by breaking down the storage volume by type. As mentioned previously, standby and fire flow storage are nested together into emergency storage. The table below show an existing storage deficiency. This is due primarily to the District taking a more conservative approach to standby storage for the combined Warm Beach system than has been historically used. The table shows separate analyses for the existing Warm Beach and Kayak tanks. Though the tanks will be connected via a control valve at the completion of the proposed system improvements, the higher Kayak zones do not have gravity access to the existing Warm Beach tank storage (storage can only be utilized by the higher zones through a pump station), so it is more conservative to evaluate them separately.

The historic Warm Beach system has defined standby storage as 200 gpd per ERU and historic Kayak system has defined standby storage as the larger of two average days of demand with the largest source offline or 200 gpd per ERU. Because of the remoteness of this system, the District has decided to plan for added standby storage as part of this WSP update and has defined standby storage as two average days of demand.

To address this deficiency the District has proposed a new tank (located in the higher Kayak area of the system, so that it can address the entire deficiency) as noted in Chapter 11.

Table 7-34 | Warm Beach Storage Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Existing Warm Beach Tank			
Usable Storage (MG)			
Maximum Storage Capacity	0.201	0.201	0.201
Dead (Non-usable) Storage	0.003	0.003	0.003
Total Usable Storage	0.198	0.198	0.198
Required Storage (MG)			
Operational Storage	0.03	0.03	0.03
Equalizing Storage	0.05	0.06	0.07
Standby Storage (Emergency)	0.20	0.22	0.25
Fire Flow Storage (Emergency)	0.06	0.06	0.06
Total Required Storage	0.27	0.30	0.35
Surplus Storage	-0.07	-0.11	-0.15
Existing Kayak Tank			
Usable Storage (MG)			
Maximum Storage Capacity	0.30	0.30	0.30
Dead (Non-usable) Storage	0.09	0.09	0.09
Total Usable Storage	0.21	0.21	0.21
Required Storage (MG)			
Operational Storage	0.03	0.03	0.03
Equalizing Storage	0.02	0.03	0.04
Standby Storage (Emergency)	0.19	0.21	0.24
Fire Flow Storage (Emergency)	0.06	0.06	0.06
Total Required Storage	0.23	0.27	0.31
Surplus Storage	-0.02	-0.06	-0.10

7.9.5 Remaining Physical Capacity in Existing Warm Beach Facilities

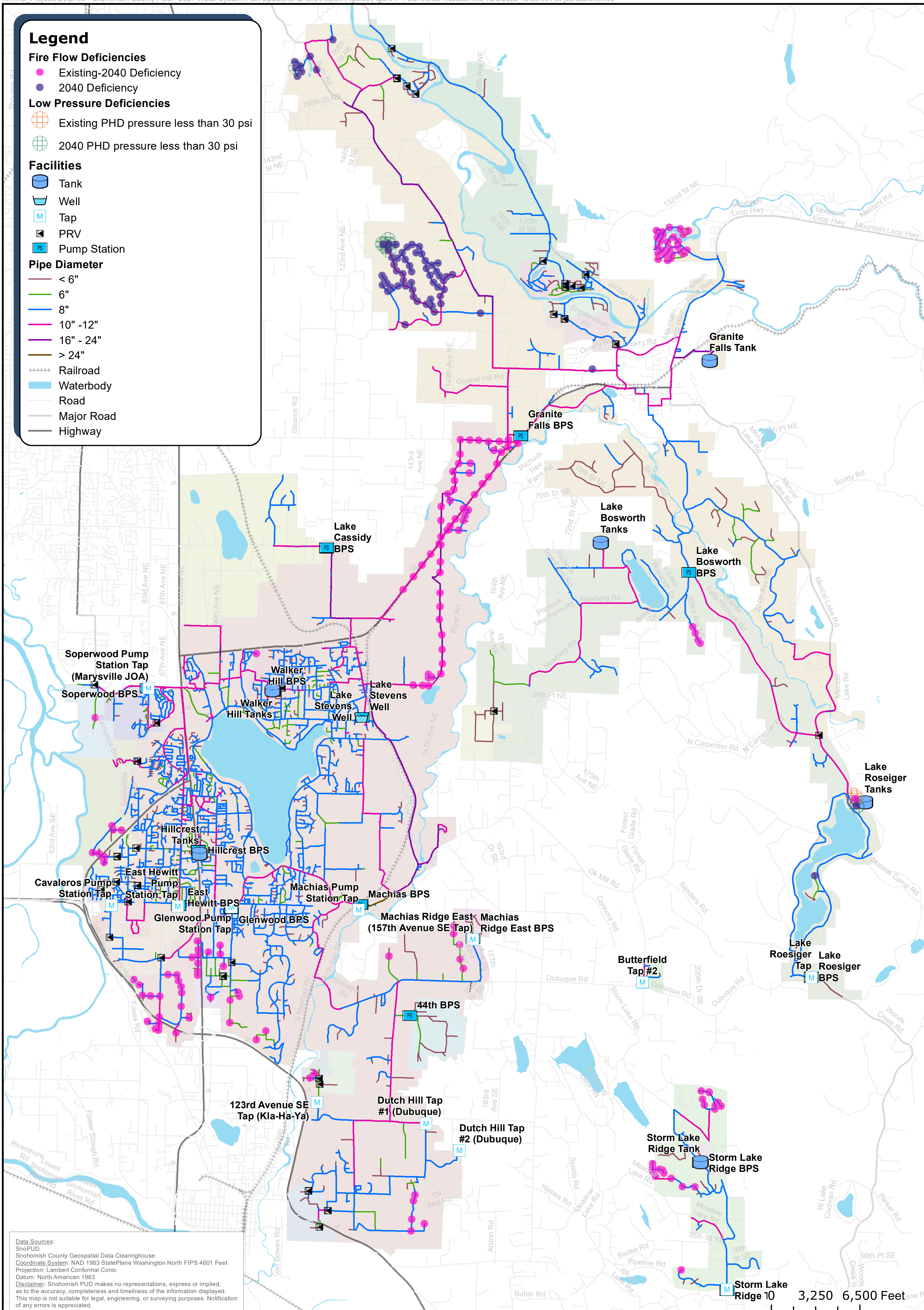
Table 7-35 evaluates the capacity of the existing Warm Beach water rights and existing facilities in terms of the maximum number of ERUs supported by each component. The result shows that the system has surpassed its capacity due to lack of storage. As discussed previously, this is due to the District taking a more conservative approach to standby storage for the combined Warm Beach system than has been historically used. To rectify this deficiency the District plans on constructing new storage for the system within the next five years.

Table 7-35 | Warm Beach System Capacity Analysis

Description	Plan Yr 2020	10-Yr 2030	20-Yr 2040
Demands per ERU Basis			
Average Day Demand per ERU (gpd/ERU)	184	184	184
Maximum Day Demand per ERU (gpd/ERU)	479	479	479
Peak Hour Demand per ERU (gpd/ERU)	1,417	1,417	1,417
Total Projected ERUs (ERUs)	1,037	1,189	1,365
Water Right - Instantaneous Capacity			
Limiting Supply Rate (based on Qi) (gal/day)	892,800	892,800	892,800
Maximum Day Demand per ERU (gpd/ERU)	479	479	479
Maximum Supply Capacity (ERU)	1,863	1,863	1,863
Water Right - Annual Capacity			
Limiting Supply Rate (based on Qa) (gal/day)	324,066	324,066	324,066
Average Day Demand per ERU (gpd/ERU)	184	184	184
Maximum Supply Capacity (ERU)	1,764	1,764	1,764
Source Capacity			
Total System Supply Capacity (Total, gpd, 20hr pumping)	792,000	792,000	792,000
Fire Suppression Storage Replenished in 72 hours (gpd)[1]	20,000	20,000	20,000
Maximum Day Demand per ERU (gpd/ERU)	479	479	479
Maximum Supply Capacity (ERUs)	1,611	1,611	1,611
Storage Capacity			
Maximum Usable Storage Capacity (MG)	0.41	0.41	0.41
Available Standby and Equalization Storage Capacity (MG)	0.35	0.35	0.35
Standby Storage Requirement per ERU (gal/ERU)	367	367	367
Equalizing Storage Requirement per ERU (gal/ERU)	58	68	76
Maximum Storage Capacity (ERUs)	827	808	793
Maximum System Capacity			
Based on Limiting Facility (ERUs)	827	808	793
Available System Capacity			
Maximum System Capacity (ERUs)	827	808	793
Remaining System Capacity (ERUs)	-210	-381	-572

Note:
1. Fire storage volume is averaged over three days

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\Report Figures\Figure 7-1 LSI Model Results.mxd 12/6/2022 10:25:09 AM joshua.ishimwe



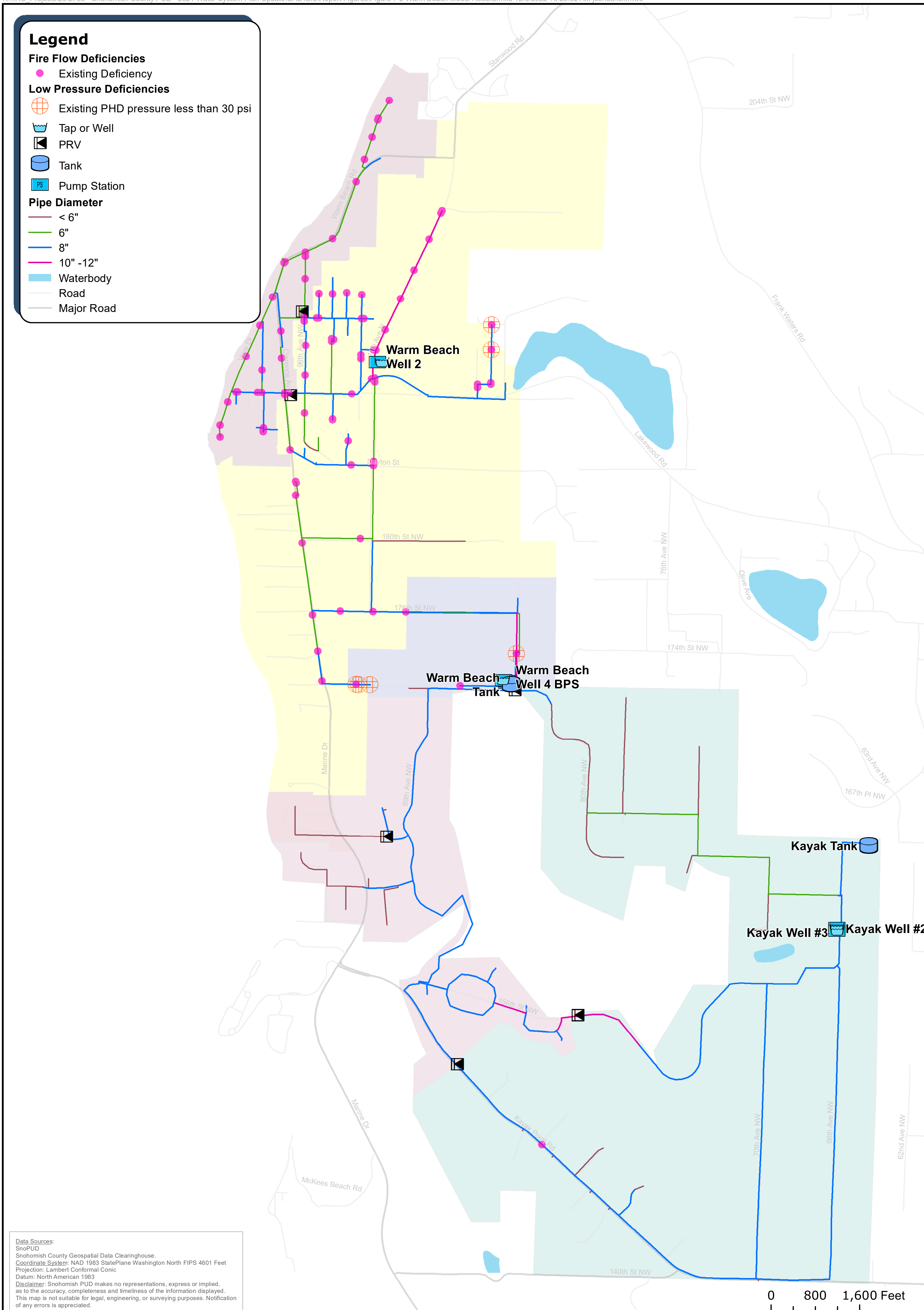
murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD
2021 Water System Plan

Figure 7-1
Lake Stevens Integrated and Storm Lake Ridge Fire Flow and PHD Deficiencies

December 2022 20-2733



murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD
2021 Water System Plan

Figure 7-2
Warm Beach
Fire Flow and
PHD Deficiencies

Chapter **8**

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 8

Source of Supply

The District sources of supply include surface water purchased from Everett and groundwater supplies from the District's own wells. This chapter discusses the condition and capacity of these supplies, the water rights and wellhead protection programs (WHPP) associated with the groundwater supplies, and any recommended improvements for the District's wells.

8.1 Surface Water

All the District's surface water is currently purchased from Everett. Everett's supply system and the District's wholesale supply connections are described in **Chapter 4**. The District's agreements with Everett are summarized in **Section 3.3** and can be found in **Appendix 3-2**.

8.1.1 Surface Water Rights

The District holds four water rights jointly with Everett that relate to the operation of the District's Jackson Hydroelectric Project. Those rights are presented in **Table 8-1**. Everett has other surface water diversion and storage rights associated with its municipal source of supply. Everett has four diversion rights on the Sultan River, one diversion right on Chaplain Creek, and one storage right for the Sultan River. Existing water rights on the Sultan River are sufficient to meet forecast demands for Everett and its wholesale customers until about 2036. More detailed information about each of Everett's water rights can be found in Everett's 2020 WSP.

Table 8-1 | Jointly Held Surface Water Rights

File No.	Cert No.	Name	Priority Date	Purpose	Qi (cfs)	QiA (gpm)	QaA (afy)
S1-07097C[1]	S1-00732C	District/ Everett	5/3/1946	Power Generation	556.0	249,549.5	250,200
R1-00733C	R1-00733C	District/ Everett	5/3/1946	Power/ Municipal			113,700.0
S1-23398C	S1-23398C	District/ Everett	6/15/1979	Power/ Municipal	1,500	673,246	506,000
R1-23397C	R1-23397C	District/ Everett	6/15/1979	Power Generation			153,260[2]
				Subtotal	2,056.0	922,795.5	1,023,160.0

Note:
1. 250,200 afy non-additive
2. 39,560 afy additive/113,700 afy non-additive

The District also holds a certificated surface water right (S1-07584C) to divert water from Lake Stevens, which was the original water supply to the District's Lake Stevens Integrated system plus two certificated surface water rights (S1-*02303 and S1-*22545) to divert water from Lake Martha, which was the original water supply to the Warm Bench system. These surface water rights, which qualify as water rights for municipal purposes under RCW 90.03.015, are listed with the District's groundwater rights in **Table 8-3**, at the end of this chapter. The District has an ongoing interest in retaining these municipal water rights to meet future demands within Lake Stevens Integrated and Warm Beach.

8.1.2 Surface Water Supply Yield

Everett performed a detailed yield analysis as part of its 2020 WSP. The analysis showed that Everett's surface and groundwater rights can meet maximum day demands until after 2040. The analysis also showed that climate change could have a negative impact on the safe yield available between now and 2075. Everett is considering operational changes to their system that would help mitigate this risk. The WSP notes that "these are long-term forecasts with great uncertainty, and the need for capital projects to improve supply reliability will be revisited in future plans". A more detailed discussion of Everett's yield analysis and alternative sources of supply may be found in Everett's 2020 WSP.

8.1.3 Surface Water Shortage Response Plan

Everett has a Water Shortage Response Plan in the event of unplanned or projected water shortages. The Spada Reservoir has a one-year supply of water to meet retail and wholesale demands and the Chaplain Reservoir has sufficient water for 60 days of normal water use. Under emergency conditions, the Chaplain Reservoir could be extended to 120 days of supply. Everett's complete Water Shortage Response Plan is provided in the appendices of its 2020 WSP.

In addition, the District has an Emergency Drought Response Plan (see **Appendix 8-1** of this WSP). The District's emergency plan identifies the range of demand and reduction actions that are available and defines the triggers by which decisions are made during a low-water event. The Emergency Drought Response Plan is designed to meet the needs of the District and its water customers, in addition to achieving three goals: 1) ensure an adequate supply of high-quality water is maintained throughout the event; 2) ensure adequate stream flows are maintained for fish and wildlife habitat; and 3) where feasible, maintain adequate storage in the Spada Reservoir for generation of hydroelectric power.

8.1.4 Watershed Plans

8.1.4.1 WRIA 5 - Stillaguamish Basin

Watershed planning has not been conducted in WRIA 5. However, in consultation with the State Department of Fish and Wildlife and the Tribes, Ecology developed recommendations for instream flows and closures. Ecology adopted the Instream Resources Protection and Water Resources Program Rule (Chapter 173-505 WAC) in August 2005. The rule established instream flows for 32 rivers or streams in the basin, reserved a limited amount of groundwater for future domestic use, reserved a limited amount of water for stock watering, established maximum limits for withdrawals from nine water sources, closed lakes and ponds to new diversions, (except for domestic use), and closed numerous rivers and streams to new uses unless the use qualifies under identified exceptions.

The rule was developed by Ecology in conjunction with the Stillaguamish River Implementation Review Committee (SIRC). The SIRC members consisted of representatives from the Stillaguamish Indian Tribe, regional salmon recovery groups, federal, and local governments.

8.1.4.2 WRIA 7 – Snohomish Basin

8.1.4.2.1 Watershed Restoration Act Plan (ESSB 6091)

In January 2018, the Legislature passed the Streamflow Restoration law to help restore streamflow levels. Its purpose is to support robust, healthy, and sustainable salmon populations while providing water for homes in rural Washington. The law calls for local watershed planning and project implementation that improve streamflows. Ecology funds implementation through its competitive grant program. Specifically, the law directs Ecology to convene Watershed Restoration and Enhancement Committees in eight watersheds surrounding Puget Sound.

Each of these committees will develop a watershed restoration and enhancement plan (watershed plan). The watershed plan must identify projects that: offset the potential impacts future permit-exempt domestic groundwater withdrawals will have on streamflows; and provide a net ecological benefit (NEB) to the WRIA. All members of the WRIA 7 Watershed Restoration and Enhancement Committee must approve the watershed plan prior to submitting its plan to Ecology for review. Ecology must complete its review by June 30, 2021. If it meets the requirements of the law and guidance, Ecology will adopt the plan.

8.1.4.2.2 Committee Membership

The Streamflow Restoration law instructed Ecology to chair the WRIA 7 Watershed Restoration and Enhancement Committee and invite entities in the watershed to participate, including tribal governments, county governments, city governments, Department of Fish and Wildlife, the largest non-municipal water purveyor, the largest irrigation district, and interest groups. Local governments on the Committee selected organizations to represent agricultural interests, the residential construction industry, and environmental interests through a nomination process. The WRIA 7 Committee also added "ex officio" members, who were not listed in the law but provide valuable information and perspective.

Members include: Tulalip Tribes, Snoqualmie Indian Tribe, King County, Snohomish County, Arlington, City of Carnation, City of Duvall, Everett, Gold Bar, Town of Index, City of Lake Stevens, Marysville, Monroe, City of North Bend, City of Snohomish, City of Snoqualmie, City of Seattle - ex officio member, Department of Fish and Wildlife, Ecology, Snohomish Public Utility District, Washington Water Trust, Snohomish Conservation District, Master Builder Association of King and

Snohomish Counties, Snoqualmie Valley, Watershed Improvement District Snoqualmie Watershed Forum - ex officio member, and Snohomish Basin Salmon Recovery Forum - ex officio member.

8.1.4.2.3 Approval Overview

The WRIA 7 Committee and technical consultants started developing the plan in October 2018. The WRIA 7 Committee hoped to finalize the plan for local review and WRIA 7 approval in early 2021; however, a consensus was not reached by June 30, 2021. State law requires that all members of the WRIA 7 Committee must approve the plan prior to adoption by Ecology. In the absence of consensus approval, the Department of Ecology is required to prepare and adopt a WRIA 7 plan. Starting in July 2021, the Department of Ecology began to prepare a plan for adoption as directed by RCW 90.94.030(3)(h). For more details on plan finalization, please see Ecology's streamflow restoration planning update.

8.1.4.2.4 Watershed Planning (RCW 90.82)

Watershed planning under RCW 90.82 has not been conducted in WRIA 7. A Phase 1 watershed grant application was prepared with the Tulalip Tribes and Everett as co-leads but was never perfected and grant funding was not awarded. The WRIA 7 is part of the Central Puget Sound Regional Unit.

8.1.5 General Hydrology / Fishery Conditions

Because of the size of the District's retail and future service areas, its water systems and sources can be found in both the Snohomish and Stillaguamish River Basins.

8.1.5.1 Snohomish River Basin (WRIA 7)

The Snohomish River Basin, located on the western slope of the Cascade Mountains, has a total area of about 1,900 square miles in Snohomish and King Counties. The basin is bounded on the north by the Skagit and Stillaguamish River basins, and on the south by the Sammamish and Cedar River basins. The Snohomish River is formed by the confluence of the Skykomish and Snoqualmie Rivers near Monroe. The Snohomish River flows for 21 miles in northwesterly direction and discharges into Possession Sound. In the lower third of the valley, the river discharges into several distributary channels, principally Ebey, Steamboat, and Union Sloughs. The Pilchuck River joins the Snohomish River just upstream of the City of Snohomish and is the only sizeable tributary below the confluence of the Snoqualmie and Skykomish Rivers.

The Snoqualmie and Skykomish Rivers each host one population of threatened Chinook salmon. The Snohomish Watershed is also home to threatened bull trout, in addition to Skykomish and Snoqualmie River Coho. Populations of chum, pink, and sockeye salmon, as well as steelhead, also inhabit the Snohomish River system. Urbanization has resulted in loss of off-channel habitat, such as oxbows. Efforts are underway in the Snohomish River basin to reconnect off-channel habitat, restore bank edges, and riparian forests in strategic locations in order to improve salmonid population health and production.

8.1.5.2 Stillaguamish River Basin (WRIA 5)

The Stillaguamish Basin drains an area of approximately 700 square miles and includes more than 3,112 miles of river, streams, and marine shore habitat. The river enters Puget Sound at Stanwood, 16 miles north of Everett in northern Snohomish County. The basin/watershed drains into both Port Susan and Skagit Bay. It is also part of the Whidbey Basin, which includes Skagit Bay, Saratoga Passage, Port Susan, and Deception Pass. The Stillaguamish Basin can be divided into three general regions: North Fork, South Fork, and Lower Mainstem. The two forks join at Arlington, 18 river miles from the mouth. Pilchuck, Deer, Boulder, and Canyon Creeks are the four largest tributaries to the Stillaguamish River system.

Chinook salmon inhabit the mainstem, North Fork, and South Fork of the Stillaguamish River, as well as several of the basin's larger tributaries (Pilchuck, Jim, Canyon, Squire, French, Deer, and Boulder Creeks). Two distinct coho salmon populations reside in the basin: the Stillaguamish and Deer Creek. The former is considered a mixture of native and non-native fish due to historic releases of hatchery coho salmon. In addition to Chinook and coho salmon populations, the Stillaguamish basin also hosts populations of Chum Salmon, Pink Salmon, Steelhead Trout, Sockeye Salmon, and Sea-Run Cutthroat Trout. Four local populations of bull trout reside in the Stillaguamish Basin: North Fork Stillaguamish, South Fork Stillaguamish River, Canyon Creek, and upper Deer Creek.

The Stillaguamish River has experienced deterioration in water quality from sources such as commercial and non-commercial farms, failing septic systems, land clearing, and road surface run-off. Multiple state, local, and federal agencies are working with the County to address water quality issues. In addition, the Stillaguamish Tribe has conducted significant monitoring efforts in the upper basin to document temperature, dissolved oxygen, turbidity, and other factors.

8.2 Groundwater

The District has 13 active wells that serve seven District-owned and operated retail/satellite water systems and Lake Stevens Integrated. The water rights associated with the District's wells are authorized to provide municipal and community domestic water supply; however, the latter (i.e., community domestic) rights now qualify as water rights for municipal water supply purposes pursuant to RCW 90.03.015(4) (provide water to 15 or more residential connections). The District relies on the certificated and permitted water rights issued for these wells to meet the customer supply requirements of its satellite/retail service areas, with the exception of Lake Stevens Integrated which also has access to Everett's wholesale water supply.

Overall, the District's wells are in good condition. Aquifer levels and daily production records are collected, recorded, and reviewed for indications of reduced well efficiency. Well rehabilitation will be considered in the event of unacceptable losses of well efficiency. Well replacement will be considered if well rehabilitation is not appropriate or fails to improve a well's efficiency.

The water rights and list of sources for each of the District's water systems are presented in **Table 8-3** at the end of this chapter. More detailed information about the currently active wells can be found in **Table 4-6** of **Chapter 4**. The District's Water Right Self-Assessment (WRSA) forms documenting production and capacity can be found in **Appendix 8-2**. An overview of the wellhead protection program, source aquifer systems, basin planning status, and the water rights associated with each of the District's wells follows.

8.2.1 Wellhead Protection Program

8.2.1.1 Wellhead Protection Program Requirements

The 1986 Amendment to the Federal Safe Drinking Water Act required that all states establish a WHPP. In the State, the program was officially adopted by DOH in July 1994. The WHPP requirement applies to all Group A public water systems that use wells or springs. The goal of the WHPP is to prevent contamination of groundwater sources used for drinking water. The strategy to attain this goal involved three main components:

- Delineation of wellhead protection areas (WHPAs)
- Inventory of potential contaminant sources
- Management of WHPAs to prevent contamination

The WAC 246-290 stipulates that every purveyor of public drinking water shall have a WHPP as part of its WSP or management program. The WHPP shall contain, at a minimum, seven elements for each individual well within a water system's boundaries. These elements are:

- A completed susceptibility assessment

- Delineated WHPAs for each well with 1-, 5-, 10-year time of travel (TOT) boundaries

- A listing of known and potential groundwater contamination sources that may pose a threat to the water-bearing zone

- Documentation of purveyor's notification to all owners/operators of known and potential sources of groundwater contamination within the WHPA

- Documentation of purveyor's notification to all regulatory agencies and local governments of the WHPA boundaries and the finding of the WHPA inventory

- A contingency plan for providing an adequate supply of potable water in the event that groundwater contamination occurs in the temporary or permanent loss of main source of supply

- Documentation of coordination with local emergency responders, including notification of WHPA boundaries, results of susceptibility assessments, inventories of findings, and contingency plans

The District's Wellhead Protection Plan can be found in **Appendix 8-3A**.

8.2.1.2 Wellhead Protection Program Description

The District owns and operates seven Group A and one Group B water systems which use well sources: May Creek, Skylite, Sunday Lake, 212 Market & Deli, Warm Beach, and Lake Stevens Integrated. The location of each system is shown on **Figure 1-3** in **Chapter 1**.

Individual WHPPs developed by the District for each of the active Group A systems are included in **Appendix 8-3A**. An aquifer study was conducted in October 1985 for the Lake Stevens Integrated Wells by Hart-Crowser and Associates, Inc. This study defines a high yield zone for the aquifer surrounding the Lake Stevens Integrated Wells. This high yield area was used to identify and define potential contaminant sources for the wells. A figure developed as part of the study showing the high yield zone is included in **Appendix 8-3A.**

A Susceptibility Assessment Survey Form is required of public drinking water purveyors for each Group A well it owns and operates as the initial step in the WHPA process. The assessment form provides information on well construction and production, local aquifer characteristics, and local potential contamination sources. The DOH responds to the surveys with a susceptibility rating that establishes the level of monitoring requirements for Volatile Organic Compounds (VOCs) and Synthetic Organic Compounds (SOCs). A variety of waivers can be applied for to reduce or eliminate monitoring and sampling requirements. Based on review of the Susceptibility Assessment Survey Form, DOH issued a Susceptibility Waiver rating for each system well. Wells with "Moderate" or "High" ratings are also rated for Pesticide Vulnerability. The DOH susceptibility and vulnerability ratings issued for each system is listed in **Table 8-2**.

Table 8-2 | Susceptibility Ratings for District Satellite Water Systems

System	Susceptibility Rating	Pesticide Vulnerability Rating	No. of Potential Contaminant Sources	WHPA Length (ft)	WHPA Width (ft)	Well Screen Depth (ft)	Surface Seal Present
Lake Stevens Integrated	None[1]	None	1	2,700[2]	3,150[2]	78	Yes
May Creek	Moderate	Low	5	5,800	1,000	90-151	Yes
Skylite	High	Moderate	1	1,000	700	38-48	No
Sunday Lake	Low	N/A[3]	1	1,450	700	364-431	Yes
Warm Beach	Low	N/A	2[4]	2,396	2,396	340-400	Yes
212 Market & Deli	Low	N/A	5	300	300	93-108	Yes

Note:
1. Susceptibility study to be conducted for the Lake Stevens Integrated System in 2023
2. Indicates dimensions of high yield zone in accordance with 1985 aquifer study by Crowser and Associates, Inc.
3. N/A = Not Applicable
4. Septic contaminant sources and residential access roads grouped as individual potential contaminant sources.

As indicated, the Sunday Lake, Warm Beach, and 212 Market & Deli wells have a low susceptibility to surface sources of contamination and have not been given pesticide vulnerability ratings. This is primarily due to their relatively deep completions, verifiable presence of a surface seal, and local hydrogeologic conditions that help protect the aquifer from surface sources of contamination.

The May Creek System is moderately susceptible to surface sources of contamination and has low pesticide vulnerability. May Creek Wells have moderate completion depths, verifiable surface seals, and moderately protective overlying sediments.

The Skylite Well is highly susceptible to surface sources of contamination and is moderately vulnerable to pesticide contamination. It is completed between depths of 38 and 48 feet and has no record of a surface seal. Overlying sediments appear to be fine-grained glacial till, which to some degree, protect the underlying aquifer from surface sources of contamination. Without a verifiable surface seal, this well cannot be considered for sampling waiver reduction.

The WHPAs were delineated for each active system using the Environmental Protection Agency (EPA) WHPA (Code 2.2) module General Particle Tracking Module (GPTRAC). The purpose of the delineation is to describe the size and shape of that portion of an aquifer contributing groundwater to a well or well field. Maps of the delineated WHPAs are included with the WHPPs in Appendix 8-3A. The length and width of the delineated WHPAs are listed in Table 8-2.

Since no susceptibility rating has been developed for the Lake Stevens WHPA, the District will hire a hydrogeologist to review and update the WHPA and develop a corresponding susceptibility rating in 2022.

An inventory of potential contaminant sources within the delineated WHPAs was conducted by searching the EPA's online geospatial database that identifies facilities subject to environmental regulation as well as Ecology's online Neighborhood Cleanup Sites Database that identifies locations with potentially toxic substances. The number of potential contaminant sources identified within each delineated WHPA is listed on Table 8-2. The locations of the identified sources are shown on the WHPA maps.

One potential contaminant source has been identified for the high yield zone of the aquifer for the Lake Stevens Integrated Wells. The contaminant source is the now closed Barmon Door company, listed by the EPA as a site potentially facing environmental regulation and shown in Figure 8-1.

Three potential contaminant sources have been identified within the May Creek WHPA based on results from the field survey. They are disinfection facilities at the pump station, septic systems of nearby residences, and power transmission lines within the 10-year TOT area. Figure 8-2 also shows two potential contaminant sources from Ecology's online database but these are outside May Creek's WHPA.

The only contaminant sources identified within the Skylite and Sunday Lake WHPA are septic systems of nearby residences as identified by a field survey. The WHPAs are shown on Figure 8-4 and Figure 8-5, respectively.

Five potential contaminant sources have been identified within the 212 Market & Deli WHPA. They include two gas station/convenience stores with buried fuel tanks, nearby transportation routes, a septic system, and a buried tank used to hold water for fire protection purposes. All were identified by the field survey.

The WHPP completed for the Warm Beach system identifies septic systems and residential access roads as potential contaminant sources. Lots in the area are mostly five acres in size. The WHPP found that the 6-year TOT area overlapped eight lots and that the 1-year TOT overlapped 14 lots. Since becoming responsible for the Kayak system, the District removed a diesel storage tank from the well site but added storage of sodium hypochlorite and potassium permanganate in a new treatment building. Triple containment is provided for these chemicals, consisting of double-walled storage tanks inside concrete containment basins. The Warm Beach WHPA is shown in **Figure 8-3**.

Although a greater number of potential contaminants exist within the 212 Market & Deli WHPA, the most vulnerable of the District's Group A satellite water systems is the Skylite system. This is due mainly to the well's shallow completion and lack of surface seal. However, this well is surrounded by a concrete pad and located inside a building, which provides some measure of protection.

As required by the State's WHPP, the District notified the owner of commercial property with potential contaminant sources of their presence within a WHPA. The contaminant source identified on **Figure 8-3** is "Barmon Door & Plywood Inc.," and is located at 2508 Hartford Drive. All federal, state, and local regulatory agencies with jurisdiction over the water systems have been advised regarding the delineated WHPAs and potential contaminant sources. Contingency and emergency response plans have been developed for each system to ensure availability of safe drinking water in the event contamination occurs within or near a WHPA.

8.2.1.3 Wellhead PFAS Testing/Monitoring

During 2019, the District conducted water quality testing at its well sites for the purpose of detecting potential per- and polyfluoroalkyl substance (PFAS) compounds in the source groundwater. During this sampling effort, the District detected no PFAS compounds at its well sites. The District will continue to engage in periodic testing as appropriate and is monitoring state and federal PFAS rules, statutes, and policies.

8.2.2 Snohomish County Hydrogeology

The geology within the County has been formed by processes related to glaciers and mountain building in western Washington. Many of the recent deposits are the result of continental glacial ice that advanced into the Puget Sound region several times during the Pleistocene Epoch (between 2 million and 10,000 years ago). The most recent period of glaciation, the Vashon Stade, began approximately 15,000 years ago.

Materials deposited during the Vashon glacial period are generally well-preserved and represent the principal hydrogeologic units associated with the District's groundwater sources in terms of their importance as the primary aquifer and confining layers for groundwater supply purposes. Although groundwater occurs in all of the hydrogeologic units, groundwater is more readily transmitted within aquifer units, which are saturated permeable geologic units capable of transmitting a usable quantity of water. Confining units restrict the movement of groundwater.

Seven principle hydrogeologic units were defined within the County CWSP. The hydrologic units were defined based on the lithology of the unconsolidated materials and the stratigraphic and hydrologic relations between adjacent units. In general, the aquifers are comprised of coarse-grained deposits, and the confining layers are comprised of fine-grained, well-compacted deposits. The unconsolidated geologic deposits (which include all the glacial and interglacial deposits) were classified into four aquifers and two confining beds and the underlying rock was classified as a confining layer that is present at the base of the groundwater system.

The two upper aquifers are the Alluvium (Qal) and the Vashon Recessional Outwash (Qvr). In many areas, these two units are hydrologically continuous and act as a single aquifer. The confining unit underlying the recessional outwash is the Vashon Till (Qvt). Underlying the till is the Vashon Advance Outwash (Qva), which is the principal aquifer in the County in terms of areal extent and groundwater usage. The Transitional Beds (Qtb) are the confining unit that underlies Qva. Below the transitional beds is a unit of Undifferentiated Sediments (Qu). The Qu are heterogeneous and are not well defined but are generally course-grained and have been lumped together as a single aquifer unit. At the base of the Qu is the bedrock (tb) which acts as a confining layer below the unconsolidated deposits. The tb consists of a variety of rocks including volcanic, conglomerate, sandstone, limestone, and other types.

8.2.2.1 Snohomish County Topography

The County contains several plateaus that are separated by river valleys. This topography is typical of the Puget Sound region, reflecting glacial and river activity of the past. The primary river valleys are oriented in an east-west direction and are occupied by the Snohomish River, the north and south forks of the Stillaguamish River, and the Skykomish River. Other significant lowland areas include the Pilchuck River valley and the Marysville trough, of which are primarily oriented in a north-south direction.

8.2.3 District Aquifer Sources

As noted above, seven principle hydrogeologic units have been identified within the County and more specifically described in the County CWSP. The following section discusses those units where District groundwater wells are located.

8.2.3.1 East Stanwood Aquifer

The East Stanwood (ES) Aquifer occurs in the advance outwash deposits and extends from northeast of Stanwood to northwest of Arlington on the plateau above the Stillaguamish River.

The aquifer ranges in thickness from fifty to several hundred feet thick. Transmissivity and hydraulic conductivity range from 25,000 to 100,000 gallons per day per foot (gpd/ft) and 50 to 200 feet per day (ft/day) respectively. Individual wells in the aquifer may yield up to 1,000 gpm near the southern margins and less than 50 gpm towards the north. The direct surface recharge potential to most of the ES Aquifer is low except along the southern margins where the advance outwash deposits are exposed at the surface. The overlying till or underlying aquifers are the primary sources of recharge. Existing development of the aquifer is estimated at 3 MGD. Potential future development capacity is estimated to be 3 MGD. Overall groundwater quality is considered good.

The potential vulnerability of the ES Aquifer to contamination from land uses is generally low, except along the southern margins where the aquifer is exposed at the surface. The land above the ES Aquifer has been zoned Rural, except in the urbanized western area near Stanwood and Cedarhome. The District operates one Group A water system with a well that taps the Stanwood aquifer: the Sunday Lake Water System; and one Group B system; the 212 Street Market & Deli Water System.

8.2.3.2 Skykomish Aquifer

The Skykomish Aquifer (SkA) occurs in the alluvial deposits and extends east-west from Monroe to Gold Bar in the Skykomish River valley. Individual wells in the aquifer may yield up to 2,000 gpm. The aquifer ranges from 10 to 100 feet in thickness. The estimated transmissivity and hydraulic conductivity range from 50,000 to 300,000 gpd/ft and 1,000 to 1,500 ft/day, respectively. The direct surface recharge potential to most of the SkA is high. Induced recharge from the Skykomish River and other surface water bodies is a significant source of recharge during high river stages. The aquifer discharges water to the river during the summer months. Overall groundwater quality is considered good.

Existing development of the aquifer is estimated to be 6 MGD and potential future development capacity is estimated to be 4 to 9 MGD. The District operates two Group A water systems with wells that tap the Skykomish Aquifer: May Creek and Skylite.

8.2.3.3 Tulalip Aquifer

The Tulalip aquifer (TuA) occurs in the advance outwash deposits and extends from the south of Stanwood to northwest of Marysville in the Tulalip Plateau west of the Marysville Trough. The TuA has been studied for designation as a sole source aquifer. It is estimated to be from fifty to several hundred feet in thickness. Transmissivity and hydraulic conductivity are estimated to range from 25,000 to 100,000 gpd/ft and 50 to 200 ft/day respectively. The direct surface recharge potential to most of the TuA is low except along the margins where the advance outwash deposits are exposed at the surface. The overlying till or underlying aquifers are the primary sources of recharge.

Existing development of the aquifer is estimated at 2 MGD. Potential future development capacity is estimated to be one to 4 MGD. Overall, the groundwater quality of the TuA is good. The District operates one Group A water system with wells that tap this aquifer: The Kayak Point Water System (acquired in 2006) and the Warm Beach System. See **Section 8.4** for further discussion on how these two systems are being consolidated into a single Warm Beach System.

8.2.3.4 Getchell-Snohomish Aquifer

The Getchell-Snohomish Aquifer (GSA) occurs in the advance outwash of deposits and extends from south of Arlington to the City of Snohomish on the Getchell-Snohomish Plateau to the east of the Marysville Trough. The Pilchuck River valley forms the eastern boundary, although there may be some indirect hydraulic connections with the Lakes aquifer below the Pilchuck River. The aquifer ranges from fifty to several hundred feet thick. Transmissivity and hydraulic conductivity range from 25,000 to 100,000 gpd/ft and 50 to 200 ft/day respectively. The aquifer may produce well yields up to 1,200 gpm. The direct surface recharge potential to most of the GSA is low except along the western and southern margins where the advance outwash deposits are exposed at the surface. Induced recharge from surface water bodies are not a significant source of recharge. Overlying till or underlying aquifers are the primary sources of recharge.

Existing development of the aquifer is estimated at 0.5 MGD. Potential future development capacity is estimated to be 0.5 to 4.5 MGD. Overall, groundwater quality of the GSA is considered to be good. The District operates one Group A water system with wells that tap this aquifer: Lake Stevens Integrated; and a Group B System - Otis.

8.2.3.5 Lakes Aquifer

The Lakes Aquifer (LA) occurs in the advance outwash deposits and extends from south of Granite Falls to Monroe, bordered by the Pilchuck River valley on the west, and extending southeast to Gold Bar above the Skykomish River valley. The aquifer becomes thinner and discontinuous to the east and has an indefinite eastern boundary where depth to bedrock is shallow. There may be some indirect hydraulic connection with the GSA below the Pilchuck River. The Newburg sole source aquifer has been designated for the northern portion of the aquifer. The aquifer is estimated to be fifty to several hundred feet in thickness. Transmissivity and hydraulic conductivity are estimated at 25,000 to 200,000 gpd/ft and 100 to 500 ft/day, respectively. Wells completed in the aquifer may yield up to 1,200 gpm.

The direct surface recharge potential to most of the aquifer is low except along the western and southern margins where the advance outwash deposits are exposed at the surface. Recharge from the overlying till or underlying aquifers is the primary source of recharge. Overall groundwater quality is considered to be good. Existing development of the aquifer is unknown but is estimated to be .025 MGD. Potential future development capacity is estimated to be 1 to 3 MGD. The District no longer operates any wells that tap this aquifer since the Pilchuck 10 Water System was merged with the Lake Stevens Integrated Water System. In November 2011, the Pilchuck 10 system was inactivated in DOH records after being connected to a water main extension from the Lake Stevens Integrated system. In November 2012, the District applied to Ecology to request a temporary donation of the Pilchuck 10 water right (G1-26382C) to the Washington State Trust Water Right

Program. Ecology accepted the 10-year donation on January 10, 2013. In September 2022, the District requested and received an extension of the donation through January 7, 2033. Documentation and explanation of this temporary donation can be found in Appendix 8-2.

8.3 Retail Water Service Area / Forecast Water Rights

The District's Retail Water Service Area, which is described in **Chapter 2**, includes six satellite systems served by groundwater and three systems in the Lake Stevens Integrated area that receive treated surface water purchased from Everett. The water rights of the sources serving the District's RSA are shown in **Table 8-3**.

Water Right Self-Assessment forms are provided in **Appendix 8-2**. The existing and projected consumption in these tables is based on the projected water demands from the tables at the end of **Chapter 5**.

District satellite/retail water systems Skylite and 212 Market & Deli are non-expanding systems, with no plans for growth beyond connections to existing pipes within the DOH-approved capacity. May Creek is an expanding water system with sufficient capacity to serve several hundred additional connections under its authorized water right. Use of the entire May Creek water right for domestic consumption is constrained somewhat by a settlement agreement entered into by the District and Tulalip Tribe in 1999 as a condition of the Tribes' dismissal of its objection to a proposed change application. The agreement stipulates that a portion of the groundwater pumped shall be returned to May Creek (as mitigation for groundwater withdrawal impact) when the peak daily groundwater withdrawal rate exceeds 277 gpm within any calendar day (398,880 gpd). The current average daily withdrawal rate is 60 gpm, and the estimated MDD is 174 gpm for 2040. The system has source capacity to meet anticipated growth and demand without mitigation requirements being triggered through 2040.

8.4 Groundwater System Expansions / Additions

On December 16, 2020, the District received approval by the DOH for an ALOP WSP amendment, which authorized the District to consolidate its recently acquired Warm Beach Water System with its existing Kayak Water System. The consolidation of the two systems, which includes joint storage, new interconnections, and other capital facility improvements, shall enable the District to achieve greater system reliability, efficiency, and redundancy in the provision of water supply to the Warm Beach and Kayak communities. The resulting consolidated water system, which is more fully described in the 2020 ALOP, is now referred to by the District as the Warm Beach Water System. A brief history of the Warm Beach Water System is provided below.

8.4.1 Warm Beach Water Association (WBWA)

The Warm Beach Water Association (WBWA) was initially formed in 1928 as a not-for-profit water system for the purpose of serving 68 homes located along Soundview Drive, which is located approximately five miles south of Stanwood. In 1948, the WBWA was serving 90 connections and re-organized as a for profit entity. In 1992, the water system was re-organized again into a non-profit mutual water system. This allowed WBWA to pursue state and federal loan assistance to construct necessary system improvements.

Since its initial formation, the WBWA evolved from a small residential water system holding a single surface water right to the waters of Lake Martha, into an expanding and substantial community-owned, mutual water system. By 2016, the water system served 590 service connections and an estimated population of 1,475 people. As of 2019, the WBWA water system, which was previously approved by DOH to serve 750 connections, is now approved for an unspecified number of connections. The system was serving 620 service connections as of 2019. With system improvements, the District projects that the historic WBWA portion of the service area could serve a build-out up to 1,000 single family homes within the limitations of its existing, inchoate water rights.

The WBWA was issued four groundwater rights (G1-00718C, G1-24266C, G1-24690C, and G1-25686P) with a total Q_i of 318 gpm, a total Q_a of 135 afy, and two surface water rights with a total Q_i of 0.3 cubic feet per second (cfs) or 135 gpm and total Q_a of 216 afy. The Q_a of the groundwater rights appear to be non-additive to WBWA's additive surface water annual quantity total of 216 afy. The Q_is held under the groundwater rights all appear to be additive/primary quantities. The WBWA's Warm Beach Wells 1 and 3 are currently inactive. Well 1 is located near Warm Beach Well 2. Pior to the water system ownership transfer, WBWA had started investigating the possibility of reconditioning Well 1 to return it to service. The anecdotal history of Well 1 is that it was pumping sand or that the formation collapsed around the casing. For Well 3, a replacement Well 3R has been drilled and put into service under the water right with ion exchange treatment. However, Well 3R was placed into emergency status due to the difficulty of disposing the brine byproduct of the treatment. The District may consider rehabilitating or redrilling Well 1 and/or investigating other treatment options for Well 3R. However, these are not high priorities for the capital improvement plan in this planning period. Both water rights are considered by the District as rights in good standing that are not available for current use due to well performance, operation, and cost issues. The PUD retains these water rights for future growth/emergency standby purposes consistent with Pol-2030/Safe Harbor provision.

WBWA used the full Lake Martha annual water right limit of 216 afy/year in its 2016 WSP to determine that water rights could support a projected build-out of up to 1,000 connections within its service area. Likewise, the District anticipates it will need to apply to transfer more of the Lake Martha surface water rights to groundwater as growth approaches the limit of the authorized groundwater withdrawals that are intended to serve the area.

Pursuant to RCW 90.03.015 (Municipal Water Law), the community domestic water rights held by the District for its Warm Beach system qualify as water rights for "municipal water supply purposes" and are considered water rights in "good standing" under the water code RCW 90.03.330(3). The WBWA's most recent WSP was approved by the DOH in 2016. During its review of the WSP, Ecology reviewed and confirmed the instantaneous and annual quantities of the WBWA rights referenced above.

In 2016, the District commenced work with the assistance of a DOH grant to study the feasibility of the District assuming ownership and operation of the WBWA (now the Warm Beach Water System), including the cost of related improvements and appropriate engineering actions by which the WBWA could be consolidated with the District's adjacent Kayak Water System to improve system reliability, redundancy, operational integrity, and emergency water access.

The above work resulted in the District securing an extension for Warm Beach groundwater permit G1-25686 (approved July 9, 2019) to 2035, and the preparation of a limited water system plan amendment (ALOP) that was submitted to DOH in March, 2020 and approved on December 16, 2020. The ALOP includes a discussion of how the District's Kayak Water System groundwater rights (G1-22415 and G1-25989C) may be applied to limited beneficial use (e.g., maintenance, repair, and emergency circumstances) within the WBWA service area in accordance with RCW 90.03.386(2).

8.4.2 Kayak Water System (now referred to as Warm Beach Water System)

On May 17, 2016, the District submitted a request that Ecology conform the groundwater right certificates for the Kayak Wells 2 and 3 (G1-24415C and G1-25989C) to "municipal water supply purposes" and issue superseding certificates reflecting such status in accordance with RCW 90.03.560. Ecology issued the superseding certificates on November 4, 2016.

As described in **Section 2.3** and above, pursuant to its review of the District's March 2020 ALOP WSP Amendment to consolidate the Warm Beach and Kayak water systems, the ALOP (and consolidation) were approved by DOH on December 16, 2020, which included a place of use expansion of two Kayak Water System groundwater rights (G1-24415 and G1-25989C) in accordance with RCW 90.03.386(2).

The ALOP includes a discussion of how the two Kayak system groundwater rights may be applied to limited beneficial use (e.g., maintenance, repair, and emergency circumstances) within the original Warm Beach Water System. Beyond such circumstance, water supply for customers located within the former Warm Beach and Kayak water service areas is provided by their respective original wells/supply sources.

In the District's 2011 WSP, a statement was made that the District intends to transfer the water right from Well 1 to Wells 2 & 3 in the future, which has the potential for increasing the allowable withdrawal rate to 370 gpm. The ALOP also states that the District anticipates that a water right transfer within the Kayak service area would be necessary to support full build-out in the Kayak area, but that the water rights for Wells 2 & 3 may be sufficient through 2040 if growth continues as projected. The PUD continues to evaluate the feasibility of drilling a replacement well for Kayak Well 1 subject to other capital project priorities and system demands. The water right remains in good standing and continues to be held by the PUD for standby/emergency supply and/or future growth purposes consistent with Pol-2030/Safe Harbor provision.

The combined retail service area/place-of-use expansion is also described in **Section 2.3**. The water right/place-of-use expansion requests cited in the ALOP were determined by the District and Snohomish County to not be inconsistent with the 2015 County Comprehensive Land Use Plan, the applicable zoning regulations, and designated population allocation.

8.5 Skylite Water System Water Rights

The District holds two groundwater rights for the Skylite Water System that were conveyed to the District in 1992 by the system's prior developer/system operator – Skylite Tracts Inc. Groundwater Certificate 7293 was issued in May 1971, to Mr. H. Peter Beaupain and authorizes 50 gpm (Qi) and 7.3 afy (Qa) for community domestic supply. Groundwater Certificate G1-22033 was issued to Skylite Tracts, Inc., in 1978 for 100 gpm (Qi) and 29.3 afy (Qa), also for community domestic supply. The report of exam associated with G1-22033 specifies that the total annual quantity (Qa) approved by that right and GWC 7293 shall not exceed 37 afy (Qa). The water rights are exercised concurrently subject to demand and peaking conditions.

Mr. R.O. Sawyer was the original developer of the Skylite Tracts property as a recreational/vacation area around 1962. Mr. Sawyer secured a water right permit (5962) in 1962 for 300 gpm (Qi) and 98 afy (Qa) to serve 109 lots. A well was developed for this purpose and pump tested at 150 gpm for four hours with six (6) feet of drawdown that recovered within 15 seconds. However, the permit (5962) was cancelled in 1965 due to Mr. Sawyer's failure to submit a Proof of Appropriation.

In 1969, Mr. Beaupain acquired the Skylite Tracts property/water system and filed a new additive application (10429) to serve 175 recreational lots within the development from the well drilled for Mr. Sawyer. Shortly thereafter, Mr. Beaupain, also in 1969, formed Skylite Tracts, Inc., for the water system. In 1970, Mr. Beaupain received a water right permit in 1970 (GWC 7293), and a certificate for the same water right in 1971 (50 gpm/7.3 afy).

In 1974, Skylite Tracts Inc., legal counsel Donald W. Waring, applied for a further additive water right (G1-22033) for the Skylite Tracts water system for 100 gpm. The proposed point of withdrawal was the existing well developed /authorized pursuant to GWC 7293. In 1976, a permit for G1-22033 was issued in the amount of 100 gpm/29.7 afy and a certificate for the same quantities was issued in 1978. As noted above, the certificate issued for G1-22033 specifies that the total annual quantity (Qa) approved by that right and GWC 7293 shall not exceed 37 afy (Qa).

In 1992, the District acquired the Skylite Water System and all water rights that served the system. As noted above, both GWC 7293 and GWC 22033 are produced from the same well source which employed two pumps capable of producing 150 gpm and 37 afy which are required to achieve peaking demands and full build-out.

District records reflect beneficial use of both water rights as evidenced by Qa, beneficial use of greater than 27 afy, including 36.8 afy in 2007. District leak detection and water use efficiency measures should enable the District to better meet water system peak demand and future build-out conditions.

Both water rights also qualify as municipal purpose water rights under RCW 90.03.015 and are in good standing pursuant to RCW 90.03.330.

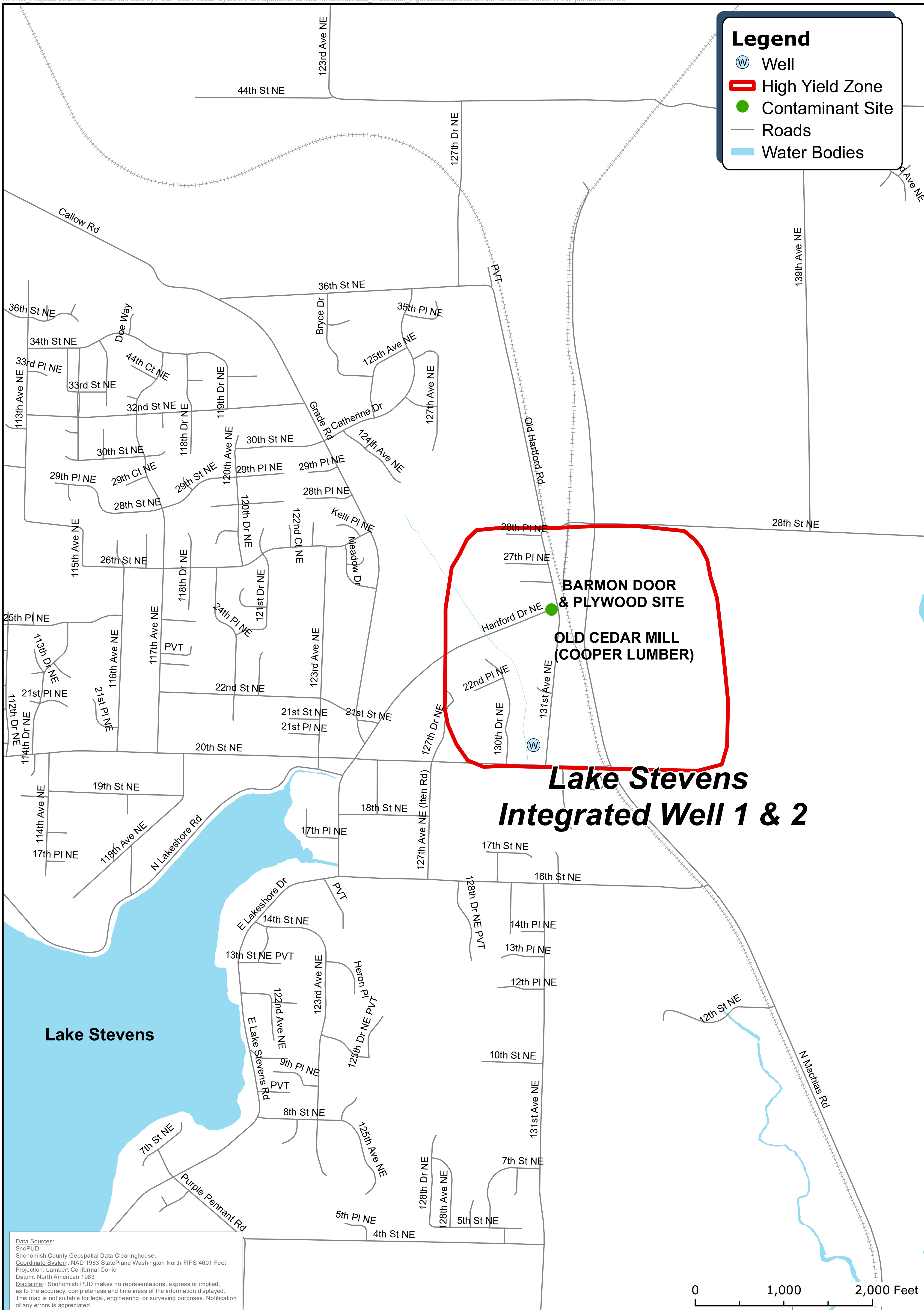
Table 8-3 | Existing and Forecast Groundwater Rights for Retail Service Area

Permit or Certificate No.	Priority Date	Source Name/ Well No.	Flow Rate (Q_i) (cfs) or (gpm)	Annual Quantity (Q_a) (acre-feet/yr)	Well Capacity (cfs) or (gpm)	Purpose of Use	Additive Or Non-Additive
May Creek G1-20625C	05/17/1973	Wells 1 & 2	200	319.5	500	Municipal	Additive
May Creek G1-*09360C Cert.#6488-A	04/04/1968	Wells 1 & 2	300	15	500	Municipal	Additive
Skylite G1-22033C	08/05/1974	Well 1	100	29.7	150	Community Domestic	Additive
Skylite Cert. 7293 (G1-*10429C)	09/29/1969	Well 1	50	7.33	150	Community Domestic	Additive
Sunday Lake G1-27418C	02/09/1994	Well 3	100	40.5	130	Municipal	Additive
Sunday Lake G1-*09636C Cert.#07295	08/06/1968	Well 3	30	60	130	Municipal	Additive
Otis	n/a	Well 1	33	Exempt (5.6)[1]	33	Domestic	Additive
212 Market & Deli	n/a	Well 1	4	Exempt (5.6)[1]	4	Domestic	Additive
Kayak G1-23278C	12/20/1978	Well 1	70	72	70	Community Domestic	Additive
Kayak G1-24415C	12/14/1983	Well 2	57	42	300	Community Domestic	Additive
Kayak G1-25989C	11/29/1990	Wells 2 & 3	300	156[2]	300	Community Domestic	Additive Non-Add
Lake Stevens Integrated S1-*07584C	12/28/1946	Lake Stevens	0.5 cfs 224 gpm	362	224	Domestic	Additive
Lake Stevens Integrated G1-*00782C Cert. #168-A Cert. SWC 4648	03/23/1948	Well 1	1,200	700	1,200	Municipal	Additive
Lake Stevens Integrated G1-*00783C Cert.#169-A	03/23/1948	Well 2	1,200	700	1,200	Municipal	Additive
Warm Beach G1-24266C	04/21/1983	Well 2	50	80	50	Community Domestic	Additive
Warm Beach G1-25686P	05/03/1990	Well 4	200	135	200	Community Domestic	Additive

Permit or Certificate No.	Priority Date	Source Name/ Well No.	Flow Rate (Q_i) (cfs) or (gpm)	Annual Quantity (Q_a) (acre-feet/yr)	Well Capacity (cfs) or (gpm)	Purpose of Use	Additive Or Non-Additive
Warm Beach G1-00718C	09/11/1970	Well 1	35	30	35	Community Domestic	Additive Non-Add
Warm Beach G1-24690C	08/12/1985	Well 3R	35	39.6	33	Community Domestic	Additive Non-Add
Warm Beach G1-26382C	11/14/1991	Well 1 + Dug Well	33	5.4	n/a	Multiple Domestic	Additive(Trust Water Donation
Warm Beach S1-*02303 / SWC 328	03/16/1928	Lake Martha	0.3 cfs 135 gpm	216	0.3 cfs	Community Domestic	Additive
Warm Beach S1-*22545 / SWC 11576	09/11/1970	Lake Martha	0.3 cfs	216	0.3 cfs	Community Domestic	Non-Additive
		Total	**4,147 gpm**	**3,009.1 afy**			

Note:

1. Exempt well quantities are not included in water right table Qi/Qa calculations
2. 57 gpm and 42 afy out of the 300 gpm and 156 afy quantities are covered by GWC G1-24415C.



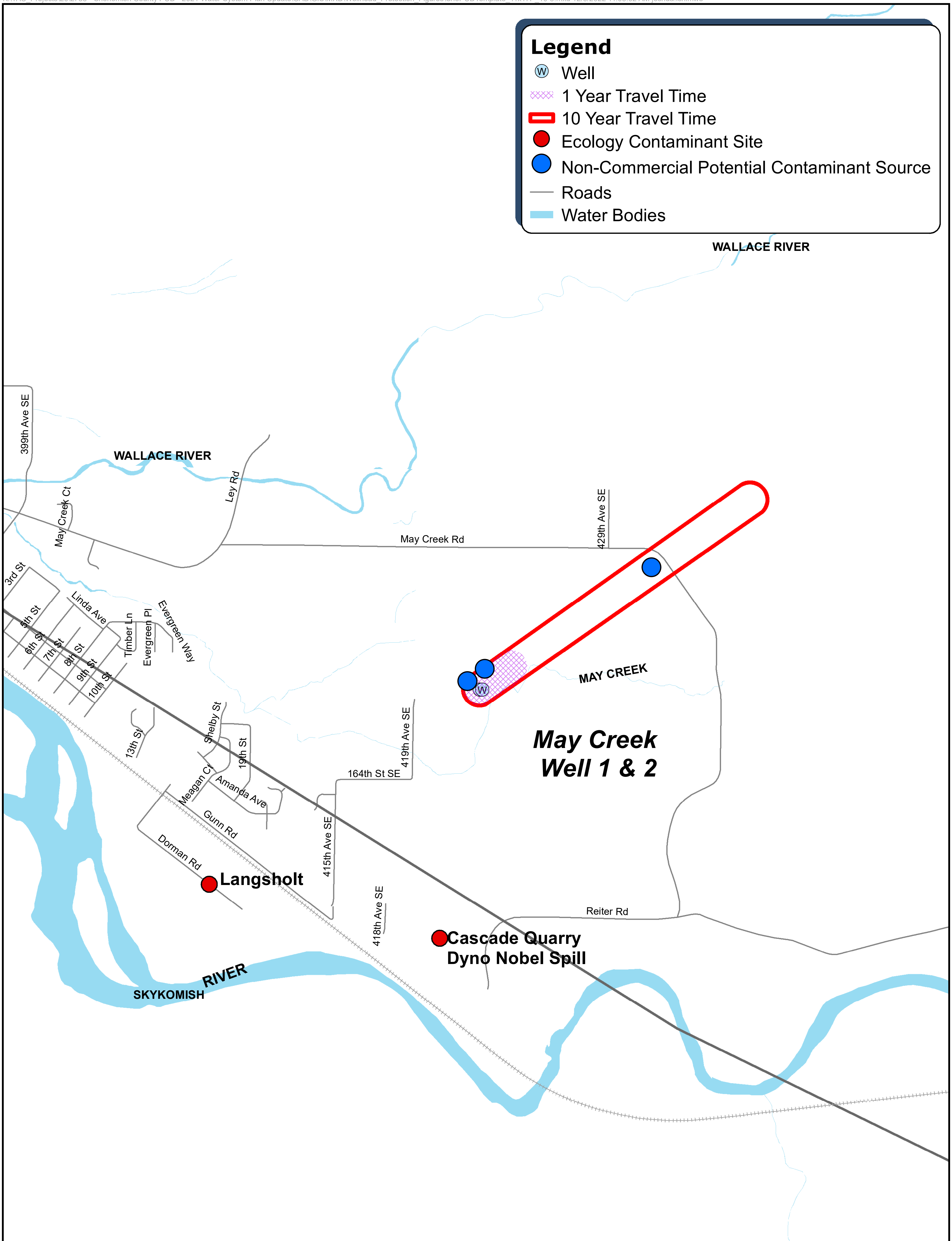
murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD
2021 Water System Plan

Wellhead Protection Area
Figure 8-1

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\MXD\Wellhead_Protection_Figures\SnoPUDTemplate_11x17P_10-5.mxd 12/6/2022 11:05:02 AM joshua.ishimwe



Data Sources:
SnoPUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

N W E S

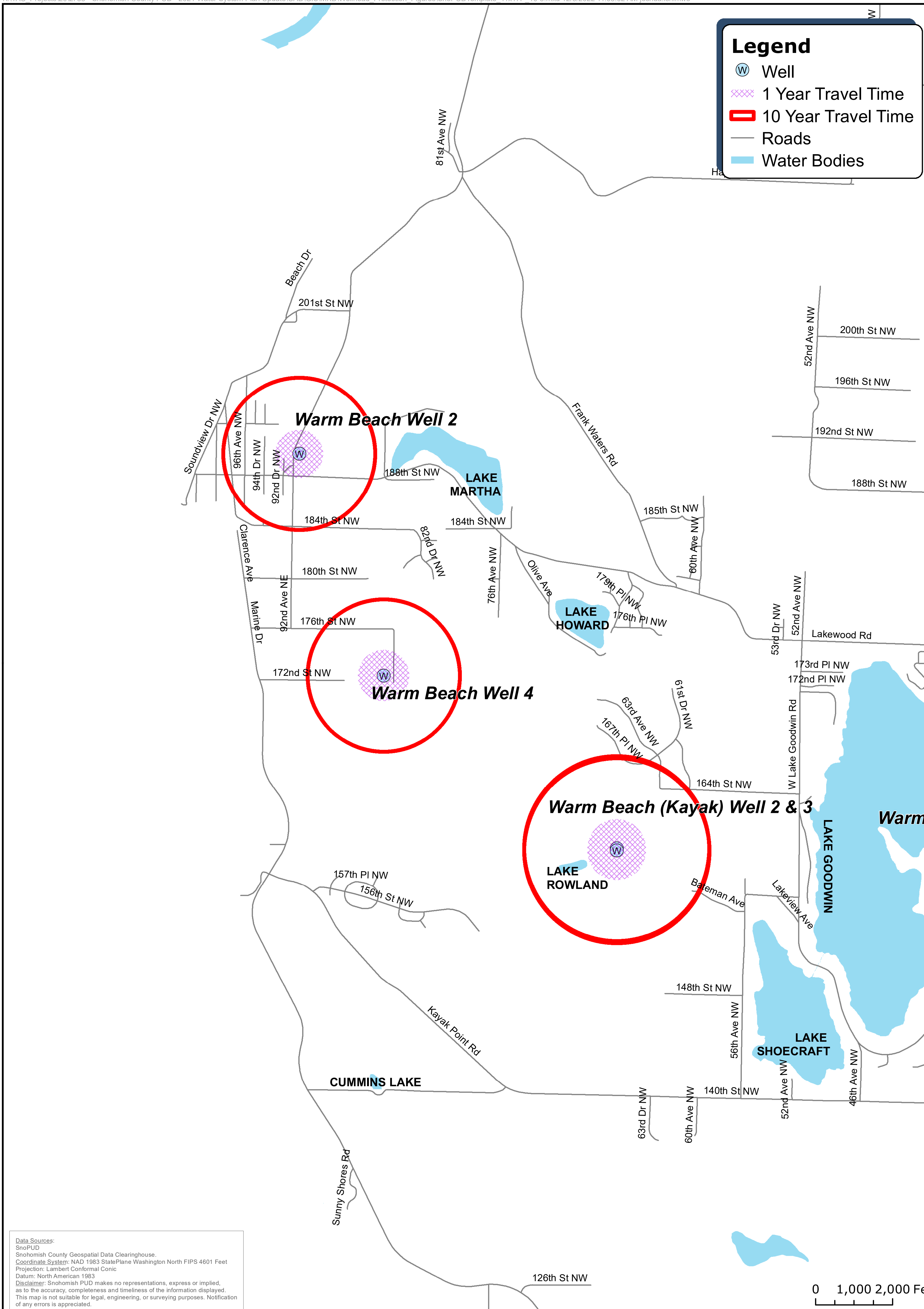
Snohomish County PUD
2021 Water System Plan

Wellhead Protection Area

Figure 8-2

December 2022

20-2733



Snohomish County PUD
2021 Water System Plan

Wellhead Protection Area

Figure 8-3

December 2022

20-2733

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\MXD\Wellhead_Protection_Figures\SnoPUDTemplate_11x17P_10-5.mxd 12/6/2022 11:05:02 AM joshua.ishimwe

Data Sources:
SnoPUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

murraysmith | SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

Snohomish County PUD
2021 Water System Plan

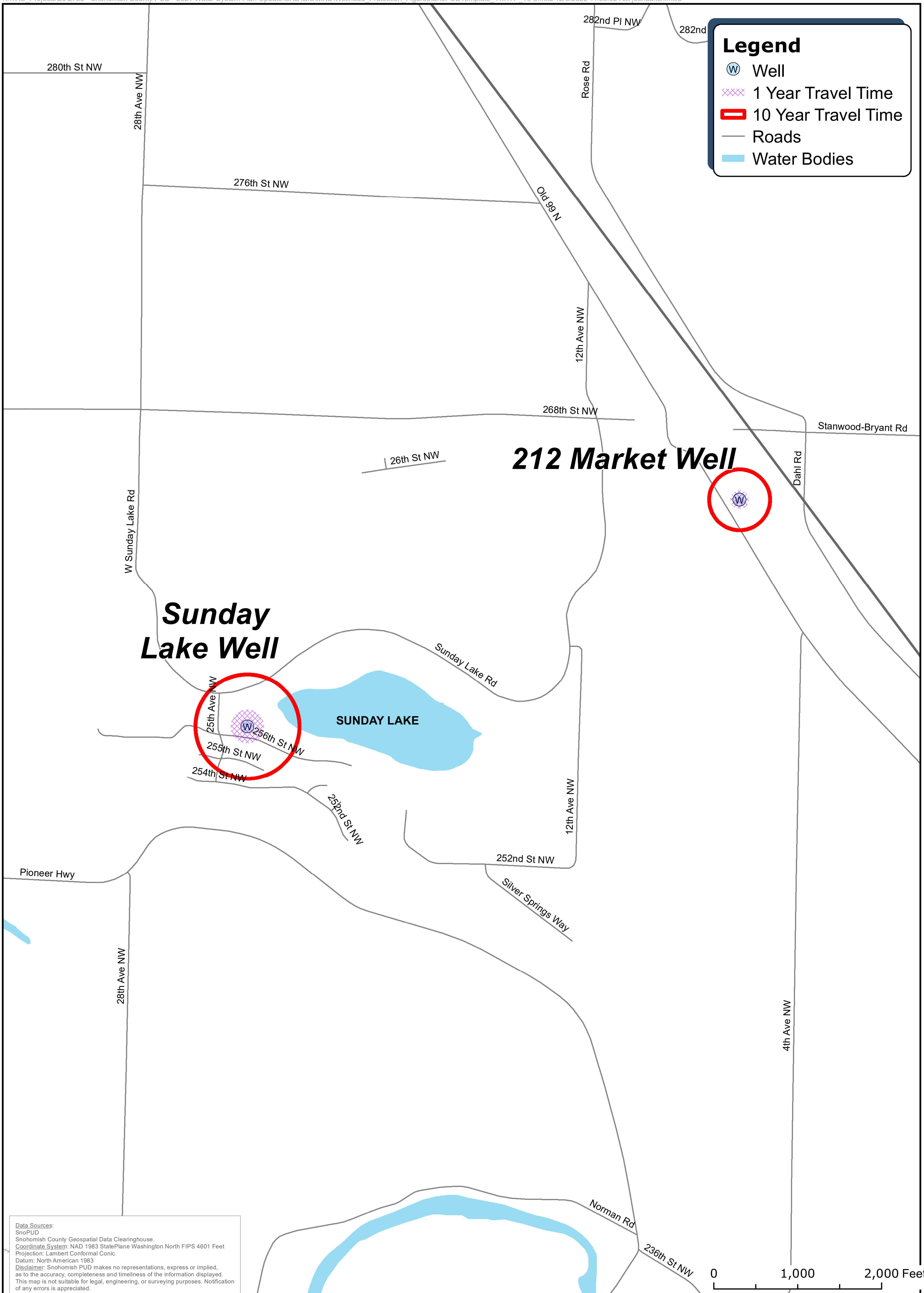
Wellhead Protection Area

Figure 8-4

December 2022

20-2733

K:\TAC_Projects\20\2733 - Snohomish County PUD - 2021 Water System Plan Update\CAD\GIS\MXD\Wellhead_Protection_Figures\SnoPUDTemplate_11x17P_10-5.mxd 12/6/2022 11:05:02 AM joshua.ishimwe



Data Sources:
SnoPUD
Snohomish County Geospatial Data Clearinghouse.
Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Snohomish PUD makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

murraysmith

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

N W E S

Snohomish County PUD
2021 Water System Plan

Wellhead Protection Area

Figure 8-5

December 2022

20-2733

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 9

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 9

Operations and Maintenance

9.1 Operations Program

This chapter summarizes District goals and procedures to maintain water system reliability, performance, and water quality under routine and emergency conditions.

The goals and procedures referenced herein are reviewed periodically to respond to new or revised regulations; updated best management practices (BMPs); system modifications; and revisions in tools, equipment, and techniques. This chapter and referenced documents do not contain troubleshooting guidelines or manuals for individual pieces of equipment or treatment facilities. Such guidelines and manuals are retained at the District's Water Operations Facility and at the site of the specific equipment or treatment facilities.

9.2 Organizational Structure and Responsibilities

The District organizational charts are shown in **Figure 1-1 and Figure 1-2.**

9.2.1 Assistant General Manager, Water Utility

The AGM of the Water Utility manages the operation, maintenance, engineering and related planning, design, and construction activities of the District's water systems. This position manages the implementation of the capital improvement plans for the Water Utility including design, construction, inspection, land surveys, material requirements, and right-of-way acquisitions. In addition, this position serves as or supervises the licensed Operator-in-Charge of the District's water systems. The current AGM has State certifications for Cross Connection Specialist (CCS), Water Treatment Plant Operator (WTPO)-1, Water Distribution Manager (WDM) -4, and is a registered professional Civil Engineer (CE) in the State.

9.2.2 Water Superintendent

The Water Superintendent manages daily activities related to the operation, maintenance, and related construction activities of the District's water systems to ensure compliance with all state and federal regulations. This position can optionally serve as or supervise the licensed Operator-in-Charge of the District's water systems in lieu of the AGM. The current Water Superintendent has State certifications for CCS, Water Distribution Specialist (WDS), and WDM-4, WTPO 2

This position also coordinates water quality testing, reporting, and record keeping ensuring compliance.

9.2.3 Water Crew Coordinator

The Water Crew Coordinator works under the direction of the Water Superintendent with the primary responsibility of providing direction, oversight, scheduling, permit coordination, and dispatch of the Water operations, maintenance, and construction activities performed by the operations staff for all of the District's water systems.

9.2.4 Water Foremen

The Water Foremen work under the direct supervision of the Water Superintendent on tasks, projects, and priorities scheduled and dispatched by the Water Crew Coordinator. The Water Foreman position is responsible for leading the water crew in the completion of all water system operations, maintenance, and construction activities for the District's Water systems. One of the Water Foremen is primarily responsible for the ongoing day-to-day operations and maintenance functions of the water systems and the other is primarily responsible for the larger construction related activities such as system repairs, installation of new water services, and maintenance projects that require a full crew and heavy equipment (vacuum excavator(s), dump truck(s), backhoe(s), etc.). The Water Foremen's current certifications are listed in Table 9-1.

9.2.5 Water Maintenance and Operations Crew

Currently, the Water Operations Crew includes one Water Construction Inspector, one Water Electrician, eight journeyman Water Distribution Specialists, one Water Worker, and one Water Helper. Table 9-1 lists the current people on the water crew, including foremen and supervisors, their years of experience, current employment classifications and state certifications held.

The Water Operations crew, including the Water Foremen, perform routine and emergency maintenance, operations, repair, and construction of the District's water systems, including collection of water quality samples and maintenance of all water treatment and pumping facilities. Crew members are available on a 24-hour/7-day basis to respond to emergencies (refer to Section 9.8.2.2 for a description of the District's emergency on-call system).

While most of the crew members are journeymen, the District also has both the entry level Water Helper position which only progresses on District need and the Water Worker position, which is a two-year apprentice program that requires passing the State WDS-1 exam to progress into the WDS classification. When a person reaches the WDS classification, further progression from WDS-1 to WDS-6 is available through accumulating sufficient experience. Promotional opportunities within the same Journey level structure include the Water Construction Inspector, Water Foremen, Water Electrician, and Water Crew Coordinator.

The organization charts in Chapter 1 identify the structure of the Water Utility Division. Responsibilities for water system operations and maintenance are listed in Table 9-1.

Table 9-1 | Years of Experience and Waterworks Certifications

Name	Title	Years of Experience	Certifications[1]
Thomas Blades	Water Foreman	8	CCS, WDM-3, WTPO-1
Lee Ervin	Water Crew Coordinator	15	CCS, WDM-3, WTPO 2
Tom Heaphy	Water Distribution Specialist	27	CCS, WDS, WTPO-IT, WDM-3
Karen Latimer	Water Superintendent	39	CCS, WDS, WTPO-3, WDM4
Alan Luna	Water Foreman	22	CCS, WDS, WDM-3, WTPO -1
Zach McKinney	Water Construction Inspector	24	CCS, WDS, WTPO-2, WDM-3, BAT[1]
Tucker Nieman	Water Distribution Specialist	7	CCS, WDM-1
Kassidi Neal	Water Helper	3	WDM-1
Noah Rui	Water Worker	5	WDM-1
Andrew Jacques	Water Distribution Specialist	5	CCS, WDS, WDM-1
Sean O'Connor	Water Distribution Specialist	8	CCS, WDM-2, WTPO-2
Robert Patrick	Water Electrician	22	EL-01
Lance Rhodes	Water Distribution Specialist	7	WDM-2, WTPO-IT
Ron Sheppard	Water Distribution Specialist	6	CCS, WDM-2, WTPO-2, BAT[1]
Monte Vitale	Water Distribution Specialist	9	WDM-1
Brant Wood	Assistant General Manager	31	CCS, WTPO-1, WDM-4, PE

Note:
BAT = Backflow Assembly Tester Certification

9.2.6 Engineering Staff

The District's engineering staff include three principal engineers and two engineering technicians that are managed by the AGM of the Water Utility. The engineering staff responsibilities include water system project planning, design, and management, including project funding applications, permitting acquisition, and engineering services during construction.

9.2.7 Administrative Support

Administrative support is provided by one Senior Water Service Liaison, one Water Service Liaison, one Water Utility Administrator, one Water Utility Associate, and one Water Utility Specialist. Administrative support is led by the Manager of Water Business Services. These positions coordinate schedules and maintain PC-based records of the department's activities. Job functions include maintaining daily operational records, documenting preventive maintenance work, generating work orders, responding to customer requests and complaints, payroll, accounts payable and receivable, and other administrative duties associated with maintenance and operation of the District's water systems. Several of the Administrative staff hold WDM-1 State certification.

9.3 Personnel Certification

The WAC 248-55 requires public water systems to have a responsible state-certified Operator-in-Charge. The AGM serves as or supervises the licensed Operator-in-Charge of the District's water systems. Certified personnel are required for positions that are in direct charge of public water systems or major segments of the system responsible for monitoring or improving water quality. Field personnel have one or more state certificates. A listing of personnel certifications can be found in Table 9-1.

All certified personnel must renew their certificates annually and demonstrate continued professional growth in the field by accumulating three related college credits, or Continuing Education Units (CEUs) every three years. The District's Operations budget includes sufficient funding to ensure that all certified personnel meet CEU requirements.

9.4 Routine Operations and Preventive Maintenance

The District's goal is to follow a routine schedule of operating, monitoring, and maintaining facilities within its water systems. The established schedule considers the features, use and critical role of each component, the number of customers served, failure or breakdown history, availability of staff resources and industry standards for maintenance.

If work schedules cannot be completed in a timely manner, the Water Superintendent evaluates established priorities, adjusts schedules, or revises staffing assignments to ensure that important work is completed. The District's computerized maintenance management system tracks completion of work orders and any outstanding work. Exceptions are reviewed by the AGM.

In addition to visits by crew members, the District's SCADA system electronically acquires data and monitors several status conditions at key pump stations, treatment facilities, master meters, and reservoirs. Key parameters at reservoirs include water level, rate of fill or draw, intrusion, high or low alarms, and status of electric power. At pump stations, key parameters include pump status, pressure, flows, intrusion, power failure, and chlorine residual where treatment is provided. At treatment facilities, key parameters include injection rates, chemical usage, pressure, flows, intrusion, power failure, and chlorine residual. When an alarm is received, a crew member is dispatched to evaluate and correct the problem. The District's SCADA system is discussed in more detail in Section 9.4.10.

Refer to Table 9-2 for a summarized maintenance frequency description for each type of District facility.

Table 9-2 | Facility Maintenance Schedule (Target Frequencies)

Facility	Tasks	Continuous (SCADA)	Weekly	Bi-Weekly	Monthly	Quarterly	Annual	Other
1.Wells	Security Visit			🌢				
	Production Records	🌢		🌢				
	Water Table	🌢			🌢 (Manual Check)			
2.Reservoirs	Security Visit			🌢				
	Climb, Ladder, Hatch, Vent				🌢			
	Interior Inspect (raft)							🌢 2 yrs
	Interior Cleaning							🌢 5 yrs
	Exterior Cleaning							🌢 3-5 yrs
	Coating Inspection (steel)							🌢 2 yrs
	Re-paint (steel)							🌢 15-20 yrs as needed
3.Transmission & Distribution	Flush Looped Mains							🌢 2 yrs
	Flush Dead Ends					🌢	🌢	🌢 As needed
	Operate Isolation Valves							🌢 2 yrs
	Hydrant Maintenance							🌢 2 yrs
	Main Line PRV Maintenance						🌢	
4.Pump Stations	Security Visit		🌢					
	Pumping Records	🌢	🌢	🌢	🌢			
	Lubrication					🌢	🌢	
	Vibration Test						🌢	
	Thermal Imaging						🌢	
5.Treatment	Security Visit		🌢					
	Disinfectant Residual	🌢						

9.4.1 Wells

The District operates wells at Sunday Lake, May Creek, Lake Stevens Integrated, 212 Market & Deli, Otis, Warm Beach, and Skylite. The goal is to visit wells twice weekly (see Table 9-2). Routine maintenance of wells includes monitoring production and regularly recording of depth to the water table. With the exception of Warm Beach Well 3, all wells are equipped with "submersible" pumps, which prevent any ongoing maintenance of the motor. All of the wells are metered. Pump flow rate well draw-down data, and ongoing measurements of voltage and amp draws can be compared to pump manufacturer's data and well history to provide an indication of the pump and motor condition.

9.4.2 Reservoirs

The District's goal is to visit each reservoir bi-weekly, including a "walk around" inspection for security and structural condition. The District's construction standard for reservoirs includes a chain-link security fence and a climbing ladder with a lockable shield to prevent unauthorized access. If unusual activity is noticed during a routine visit, the reservoir is climbed to check the condition of the access hatch and vent.

Monthly, the goal is to climb each reservoir to observe the condition of the ladder, access hatch, vents, exterior coating, intrusion alarm, and other monitoring equipment. All access hatches are locked and designed to prevent entry of contaminants. Screens on the vents are checked at this time. The hatch is opened annually to allow a visual inspection of the interior coating, and to observe any unusual conditions.

Bi-annually, it is the goal to insert a sanitized raft into each steel reservoir, so that a more thorough inspection of the interior coating can be completed. It is desirable that on a five-year interval, each reservoir be taken out of service so the interior can be pressure-washed, and the condition of the reservoir and its coating can be closely inspected. However, this has not always been feasible where redundant reservoirs or water sources are not available. In these circumstances, firms are available to clean a reservoir while full of water. This WSP includes reservoir improvements to address redundancy in critical pressure zones, which will allow existing steel reservoirs to be taken out of service for recoating. It is anticipated that steel reservoirs will be recoated as needed on about a 15-20-year schedule.

9.4.3 Transmission and Distribution Pipelines

The District operates over 408 miles of pipelines, ranging in size from 3/4-inch to 30 inches in diameter. Materials include CI, AC, DI, PVC, and a small amount of galvanized and wrapped steel.

As water travels through the distribution system, its quality can be adversely affected. There are several factors that contribute to this, including: 1) water age (measured by the time it takes the water to travel from the source to the end user); 2) type and age of pipe (and associated corrosion by-products); 3) diminished disinfection residual, which contributes to bacteria growth in pipelines; 4) formation of disinfection byproducts (DBPs); 5) cross-connections; and 6) methods used to repair main breaks.

Deterioration of water quality in the distribution system may be noticed and reported by customers as a “stale or musty” odor, an objectionable taste or color, or high turbidity (cloudiness). Water quality testing can also detect the formation of DBPs or bacterial contamination.

Common methods of dealing with these issues includes looping of piping to avoid “dead-end” mains, separating fill and outlet piping at reservoirs to circulate water, changing reservoir and pump “set points” seasonally, changing valving to occasionally “re-route” water, replacing corroded older mains, and routine main flushing where dead-ends or low-flow conditions cannot be avoided. In addition, a cross-connection control program and careful repair of broken mains are required.

The District’s routine main flushing program will focus on several parameters, including dead-end mains, areas with the longest travel times or “oldest water”, areas where routine monitoring shows low disinfectant residuals, and where water quality testing shows high results for Heterotrophic Plate Count (HPC) or DBPs. “Alert” and “Action” levels will be established for these parameters, to trigger remedial action to bring the factor into an acceptable range.

Flushing frequency is based on the water quality parameters; however, as a minimum the District’s goal is to flush every dead-end main annually and all mains bi-annually. For those areas needing more frequent flushing, use of automated blow-offs are under consideration.

The District employs methods for repairing main breaks that minimize the potential for contaminants entering the distribution system, such as maintaining positive pressure in the main whenever possible. Other techniques include use of a spray disinfectant, lowering the water table below the level of open pipes, flushing after the repair, and follow-up bacterial testing as needed. A draft form used to evaluate main breaks by field personnel is included in **Appendix 9-3.** The District follows DOH guidelines for responding to main breaks and pressure loss events; see the DOH Publication #331-583 included in the Emergency Response Plan (**Appendix 9-2**).

Another goal for distribution system maintenance and repair is a reduction in the percentage of “unaccounted-for” water, including leakage. This effort includes replacing older service meters, coordination with the May Creek fire department on metering fire flow usage, AC pipe replacement, scheduled leak detection efforts, and prompt repair turnaround. Monthly production reports are routinely compared with total water sales to evaluate the effectiveness of these efforts.

9.4.4 Supply Pump Stations and Booster Pump Stations

In addition to continuous SCADA monitoring, supply and BPSs are visited weekly, depending upon the system and critical nature of the pump station. Routine checks include security, logging of pump condition, hourly meter readings and suction/discharge pressures. In larger pump stations, the District intends to begin annual vibration monitoring to better review and document the condition of the pumps. In addition, it is the District's goal to scan the pumps and control equipment bi-annually with thermal imaging scopes to look for electrical "hot spots" that may indicate loose connections, shorts, contamination, or deterioration of electrical components.

9.4.5 Treatment Facilities

All purchased surface water is treated at the Everett filtration plant, which includes filtration, disinfection, fluoridation, and pH/alkalinity adjustment. As such, the District is not responsible for operation of major treatment facilities; however, water treatment (iron and manganese removal and disinfection) is provided at several locations and may increase as additional remote/satellite water systems are assumed by the District.

Currently, the May Creek, 212 Market & Deli, and Skylite Water Systems are treated with sodium hypochlorite to maintain a free chlorine residual throughout the systems and facilities for injecting sodium hypochlorite have been provided at the Granite Falls Pump Station to ensure that chlorine residuals are maintained in the extremities of Lake Stevens Integrated system. These treatment facilities are checked routinely and are equipped with continuous chlorine residual monitors. In addition, the Granite Falls Pump Station includes a "feedback loop," which adjusts the chlorine feed rate to maintain the desired amount. Records of chemical additions are retained, and copies are sent to the DOH monthly.

The Sunday Lake, Kayak and Warm Beach systems include treatment for removal of iron and manganese using sodium hypochlorite and potassium permanganate, followed by pressure filtration. These facilities are monitored continually by SCADA, and effectiveness of treatment is checked weekly at representative points in the distribution system. Monthly treatment reports are submitted to DOH.

9.4.6 Pressure Reducing Stations

The District has approximately 40 "main line" pressure reducing stations, and flow control valves between pressure zones. The District's design standards include the provision of strainers ahead of the PRVs, which reduces malfunctions in the valves. The PRVs are checked and maintained on a set schedule.

9.4.7 Fire Hydrants

The District owns over 2,300 hydrants and the number increases annually due to acquisition of satellite systems, new developer construction, District initiated projects, and/or replacements of older systems. When new hydrants are installed or as existing hydrants are acquired as part of a satellite system, each is tested and entered into the District's maintenance database.

Hydrants that are damaged, provide insufficient flow, or do not function properly are promptly repaired, upgraded, or removed from service. Non-operational hydrants are bagged, and the fire department is notified of the hydrant status and repair timeline. If the District is unable to provide timely upgrades to an acquired satellite system having hydrants with deficient flows, the District contacts the applicable fire department to advise of the diminished flow, or the District may choose to remove the hydrant or disable the ‘steamer port’ until hydraulic improvements are made to increase the available flow (all other feasible alternatives are evaluated before the District removes a hydrant from service).

While the District’s goal is to exercise all hydrants annually (which would require operation and maintenance of over 190 hydrants per month), actual performance has not met this goal. To improve this, the District’s goal is to encourage fire districts to systematically inspect the District’s hydrants within their protection areas and report any deficiencies. In order to minimize damage from water hammer and to improve data provided from fire districts, the District’s goal is to routinely meet with the training officer from each fire district to provide information regarding proper hydrant use and possible adverse effects (water hammer), resulting from improper hydrant operation.

9.4.8 Valves

The District’s systems include over 6,772 “main line” valves, and as growth and development occur, dozens of new valves are added annually. All existing and new valves are included in the District’s mapping system and database. A structured valve maintenance program has been established, dedicating budgetary and staff resources to valve maintenance. The District also coordinates with state, county, and city road departments so that as pavement overlay projects are scheduled, valves are raised or adjusted to prevent valves from being ‘paved over’ and potentially ‘lost.’

While the District’s goal has been to routinely operate each valve at least every two years, this has not always been feasible. In addition, the District’s main flushing program incorporates operation of valves.

9.4.9 Main Flushing

The main flushing program was discussed under **Section 9.4.3**.

9.4.10 SCADA Network

The District’s SCADA system controls and monitors all supply and BPSs, wells, treatment facilities, master meters and reservoir sites within the District’s water service area. Radio-based status changes are transmitted from each site to a base station located at the Lake Stevens Integrated Water Operations Facility. The SCADA system also forces a poll of each site every hour to ensure that the site has not lost communication ability. Status conditions include information on pumps, rate of flow, power, security, pressure, water levels and more. If conditions do not match identified parameters, an alarm is sent, which immediately “pages” operations personnel. The operations person on-duty is provided with a laptop computer that, via modem, allows the operator to view the nature of the alarm and respond accordingly.

9.4.11 Staffing

Currently, the District has 20,026 water services with an operations crew of 15 people, for a ratio of one person for every 1335 services. As the population and number of systems grow, crew size will be evaluated and adjusted to ensure that proper operation, maintenance, and customer service is provided.

9.5 Water Quality Sampling

The provision of safe drinking water to the District's customers is the issue that overrides all other tasks and functions. The water quality standards are established by the Federal EPA and are implemented and enforced by the DOH. The District is committed to working cooperatively with EPA and DOH to achieve compliance and ensure safe water for its customers. See **Chapter 10** for additional details about the District's water quality program.

9.6 Cross-Connection Control Program

Since cross-connections can result in contamination of drinking water, DOH has established the minimum requirements for a utility's cross-connection control program. See **Section 10.7** for additional details.

9.7 District Vehicles

The District's vehicle fleet includes a number of vehicles and construction equipment used in operating, maintaining, and repairing water systems. It is the District's goal to maintain sufficient staff, vehicles, and equipment to respond to two simultaneous emergencies, such as main breaks. If sufficient equipment is not available, the Water Utility can obtain additional equipment from the District's Electric Utility or rent equipment from a number of firms in the area. The District also maintains an on-call emergency contract with a local contractor to deal with emergencies that cannot be handled with District personnel or vehicles.

9.8 Vulnerability Assessment and Emergency Procedure

The District has adopted a departmental-specific Emergency Response Plan (ERP) (see **Appendix 9-2**). The Water Utility's ERP is a guide for personnel to identify the utility's most vulnerable facilities, property, customers, and/or services. Included in the ERP are operating procedures, DOH emergency response procedure publications, emergency alert rosters, equipment suppliers/technical representatives, adjacent facilities/utilities, and a contingency plan.

In the event of an emergency that exceeds the capabilities of the Water Operations and Maintenance (O&M) crews, staff from the District's Water Engineering and Administration groups provide additional support. Further, under the Continuity of Operations Plan (COOP), the resources of the entire District (including the Electric Utility), are available to respond to an emergency. The Water Utility maintains a close relationship with other District departments such as Transportation (additional vehicles and mechanics), Facilities (carpenters and electricians), Communications (radio and portable communications), Customer Service and Dispatch Departments (dispatch during evenings and weekends), and the Electric System's flagging crew. Key Water Utility staff receive training in both the Business Continuity Plan and the departmental specific ERP. Both the COOP and the Water Utility's ERP are on file at the Water Operations Facility.

9.8.1 AWIA Risk and Resilience Assessment

A Risk and Resilience Assessment (RRA) was completed in accordance with the 2018 America's Water Infrastructure Act (AWIA). The RRA considers the susceptibility of key water system components to damage, harm, or failure from a variety of potential sources and emergency conditions, including: 1) natural hazards (earthquakes, severe weather, floods, etc.); 2) dependency and proximity threats (loss of suppliers, loss of access roads, etc.); and 3) malevolent threats (vandalism, terrorism, etc.).

In addition, the RRA considers the magnitude of the potential impact on customers, availability of backup facilities and methods to detect the potential or actual failure. Finally, the RRA considers the probability of damage or harm, and plans should prioritize and address the most likely scenarios.

The major components of the District's water systems were evaluated in the RRA, including: 1) sources of supply wells; 2) pump stations (supply and booster); 3) distribution system including mains and valves; 4) water treatment components; 5) reservoirs; and 6) operations infrastructure (ops buildings, SCADA systems, enterprise systems, and IT/Security systems). The results and recommendations of the RRA are provided in **Appendix 9-1**. The District's ERP will be updated based on these recommendations, which includes alignment of the ERP with current AWIA regulations

9.8.2 Other Factors for Dealing with Emergencies

9.8.2.1 Security

Security must be in place to protect system integrity, deter or delay access, and alert personnel who will respond appropriately. All pumping and treatment facilities, control equipment and storage reservoirs are securely fenced and locked when they are unattended. The major facilities are equipped with intrusion sensors and intrusions are alarmed and monitored via SCADA. In addition, staff routinely visits facilities, and neighbors have been asked to report any unusual activity at the District's facilities. The RRA provided in **Appendix 9-1** includes recommendations for facility-specific security improvements that are intended to reduce the highest risks posed to the District.

9.8.2.2 Availability of Personnel

Trained staff is available to respond to emergencies 24 hours a day, 7 days a week. The District's 24-7 Dispatch Center contacts the Water Utility's on-call duty person, who then responds to after-hour emergencies. The Dispatch Center maintains lists of available specialized personnel; including engineering, warehousing, environmental, transportation and other support personnel if their assistance is needed in an emergency. If more people are needed, staff from the District's Electric Utility would be available to assist (spill response, safety, heavy equipment operators, flaggers, etc.).

9.8.2.3 Communications

District staff utilize landline and cellular telephones, mobile radios, e-mail, or mail services to stay in contact with each other. A Corporate Communications Department is available to notify customers and the news media of emergency conditions in the water system. Mobile radios and telephones are installed in all vehicles. A personnel roster with assigned radio call numbers, pagers, home, and cell phone numbers has been provided for all staff. The District's Dispatcher is equipped to communicate with all field personnel listed in the roster (see **Table 9-3**) by cellular phone, mobile radio, or landline.

Table 9-3 | Emergency Notification Numbers

Name	Emergency Phone	Business Phone	Mobile Phone
City and County Agencies – Emergency Contacts During Business Hours			
City of Lake Stevens – City Hall	N/A	425-622-9400	N/A
City of Lake Stevens - Police	911	425-622-9401	
Snohomish County Sheriff	911	425-407-3999 (non-emergencies) 425-388-3393 (Admin)	N/A
Snohomish County Emergency Management	N/A	425-388-5060	N/A
Snohomish County Public Works	N/A	425-388-3488	N/A
Snohomish County Health District	N/A	425-339-5200	N/A
Snohomish County Fire Districts:			
No. 4 – Snohomish	911	360-568-2141	N/A
No. 5 – Sultan	911	360-793-1179	N/A
No. 12 – Marysville Fire District RFA	911	360-363-8500	N/A
No. 14 – North County RFA	911	360-629-2184	N/A
No. 16 – Lake Roesiger	911	360-568-1954	N/A
No. 17 – Granite Falls	911	360-691-5553	N/A
No. 21 – Arlington Heights	911	360-435-3311	N/A

Name	Emergency Phone	Business Phone	Mobile Phone
No. 22 - Getchell	911	360-659-6400	N/A
No. 26 – Gold Bar	911	360-793-1335	N/A
Snohomish Regional Fire & Rescue – Monroe and Lake Stevens	911	360-794-7666	N/A
Lake Stevens Sewer District	N/A	425-334-8588	N/A
DOH NW Regional Office	877-481-4901	253-395-6750	N/A
City of Everett Water Filtration Plant	N/A	425-257-8200	N/A
City of Everett Public Works	425-257-8821	425-257-8800	N/A
City of Marysville Public Works	360-363-8100	360-363-8100	N/A
Emergency Notification Roster – District Staff During Business Hours			
Customer Service	Day Time Number	425-783-1000	N/A
Security Operations Center	After Hours Number	425-783-8787	N/A
Energy Control Center (Dispatch)	24 Hour Number	425-783-5040	N/A
Water Operations Facility	Day Time Number	425-397-3000	N/A
Brant Wood	AGM	425-397-3003	425-903-1025
Karen Latimer	Water Superintendent	425-397-3005	425-309-2882
Christina Arndt	Manager, Water Business Services	425-397-3001	425-261-9335
Paul Federspiel	Principal Engineer	425-397-3032	425-320-9359
Karen Heneghan	Principal Engineer	425-397-3037	425-309-4901
Max Selin	Principal Engineer	425-397-3033	425-231-1663
Lee Ervin	Crew Coordinator	425-397-3051	425-327-4499
Alan Luna	Water Foreman – Operations & Maintenance	425-397-3052	425-367-2017
Thomas Blades	Water Foreman - Construction	425-397-3074	425-297-0274
Zach McKinney	Construction Inspector	425-397-3050	425-239-0794
Tom Heaphy	WDS	425-397-3064	360-591-8315
Drew Jacques	WDS	425-397-3070	425-315-3150
Kassidi Neal	Water Helper	425-397-3063	425-238-5035
Tucker Nieman	WDS	425-397-3073	425-248-5950
Sean O'Connor	WDS	425-397-3065	425-308-7691
Robert Patrick	Water Electrician	425-397-3059	425-359-9347
Lance Rhodes	WDS	425-397-3072	425-238-8449
Noah Rui	Water Worker	397-3000	239-2651
Ron Sheppard	Water Worker	397-3000	367-2017
Monte Vitale	WDS	425-397-3068	425-446-9148
Kevin Presler	Project Manager	425-397-3030	425-309-2802
Lillian Manley	Engineering Tech II	425-397-3002	425-218-9874
Misty Stevens	Senior Water Liaison	425-397-3016	425-535-2883

Name	Emergency Phone	Business Phone	Mobile Phone
Lois Stone	Water Services Liaison	425-397-3015	425-535-0437
Amy Tongsgard	Water Utility Administrator	425-397-3013	425-328-5366
Tracy Boggs	Water Utility Administrator	425-397-3011	425-328-5139
Veronica Black	Water Utility Associate	425-397-3031	N/A
Michael Smith	SCADA Consultant	425-818-0160	206-354-1779
Caden Sowers	SCADA Consultant	N/A	360-441-9561

9.8.2.4 Interties

The District maintains an emergency intertie in its May Creek system with Gold Bar that is located at May Creek Road. This intertie is available for mutual aid in the event of a major emergency. While the intertie is normally closed, the District has supplied water through the intertie in the past.

9.8.2.5 Auxiliary Power

As discussed previously, auxiliary power is available to all of the District's critical facilities through the use of emergency generators:

- The Water Operations Facility is equipped with a standby generator, which is capable of providing power to the entire site. Telcom, computer, radio, and SCADA capabilities remain operational during power outage events. The site is equipped with an automatic transfer switch that transitions from normal line power to the standby generator during a power outage event.
- A stationary 100-kw diesel generator, stored at the Hillcrest BPS, normally acts as a direct standby power supply to the Hillcrest Pump Station. The site is equipped with an automatic transfer switch that transitions from normal line power to the standby generator during a power outage event.
- A stationary 100-kw diesel generator is stored at the Walker Hill Reservoir to serve the Walker Hill BPS. The site is equipped with an automatic transfer switch that transitions from normal line power to the standby generator during a power outage event.
- A trailer mounted 100-kw generator is stored at the Lake Roesiger Pump Station, and it would be available to serve other pump stations if needed. The site is equipped with an automatic transfer switch that transitions from normal line power to the standby generator during a power outage event.
- A 10-kw stationary propane-fueled generator supplies emergency power to the Skylite Water System. The site is equipped with an automatic transfer switch that transitions from normal line power to the generator standby during a power outage event.

- A 200-kw stationary diesel generator provides emergency power to the Granite Falls Pump Station. The site is equipped with an automatic transfer switch that transitions from normal line power to the generator standby during a power outage event.

- The Lake Stevens Integrated Well site has no emergency power backup but is equipped to accept connection to a mobile generator.

- The Warm Beach Well 4 has an existing standby generator that has insufficient capacity for both the well and booster pump. The District is planning to install a high-capacity generator to meet the entire facility electrical needs.

- The Warm Beach Well 2, Soperwood Supply Pump Station, Machias Pump Station, Glenwood BPS, Bosworth BPS, Storm Lake Ridge Supply Pump Station, Storm Lake Ridge BPS, and the May Creek and previously Kayak (now Warm Beach) well sites do not have emergency power backup on site but are equipped with a plug and transfer switch to rapidly accept power from a trailer-mounted generator.

- Two trailer-mounted 10-kw diesel generators are located at the Water Operations Facility and can be dispatched to various water sites as needed during power outage events.

- A trailer mounted 200-kw generator is stored at the Water Operations Facility which can be dispatched to various water sites as needed during power outage events. This generator is capable of supplying power to even the largest of the District's pump stations, wells, and treatment facilities.

9.8.2.6 Materials, Supplies, and Technical Representatives

The District maintains a large inventory of routine and emergency materials and supplies at the Water Operations Facility and at strategic remote locations.

9.8.3 Contingency Plan

9.8.3.1 Emergency Roster

Emergency rosters listing contact phone numbers for District staff and other local/state agency personnel during business hours are included as **Table 9-3**. The District maintains a listing of personal telephone numbers should there be an emergency after regular business hours. A copy of these, with telephone numbers, is kept on file by District management and Electric System Dispatch personnel. Qualified field personnel can volunteer every 6 months to be on a list of employees who are assigned standby responsibilities on a rotating basis for after-hour callouts. Additional personnel are called as necessary based on the severity of the emergency.

9.8.3.2 Department of Health Notification

The AGM or designee will immediately notify DOH, in the event a water shutdown is required for more than 24 hours, or where water quality is determined to be unacceptable, or in any instance where public health is threatened.

9.8.3.3 Priorities

Where there is damage to District facilities, the AGM or designee will assess damages and prioritize operational efforts, repairs and/or reconstruction.

The order of priority includes:

1. Preservation of public health and safety: During an emergency, a water system serves a dual role of providing water for public health (consumption, sanitation, and food preparation), and public safety (fire protection). The District would strive to satisfy both roles; however, the District's primary focus would be in support of public health.

2. Water quantity and quality: The District strives to provide a high-quality product at all times; however, during extreme conditions, "boil water" orders, or manual "dosing" of chlorine in reservoirs could be used if water was available but its quality was unreliable. The priority would be to use the safest possible source of water and keep users informed.

3. Service delivery: The District would first focus on providing service to major population centers, hospitals, nursing homes, emergency centers (shelters, control centers). Subsequently, efforts would shift focus to less populated residential areas and businesses.

9.8.3.4 Location of Activities and Responsibilities

Large incidents or disasters may trigger the activation of the District's Emergency Operations Center (EOC). The EOC will be located in the Commission Meeting Room at the Snohomish County PUD No. 1 Electric Headquarters building (2320 California Street, Everett WA 98201). Should the Electric Headquarters building be unavailable, the EOC will be located in the Central Conference Room at the District's Operations Center (1802 75th Street SW, Everett WA 98203).

The District's AGM, Water Utility will keep the General Manager and Board of Commissioners apprised of the current status of all emergency situations and as appropriate, may request the activation of the EOC.

In the event of a District-wide emergency (including the Electric Utility), the District's AGM will convene as part of the Crisis Management Team and will:

- Analyze the situation and requests for assistance.

- Establish priorities for District response.

- Provide short-term planning (i.e., employee direction, return to work, restoration of work, media campaign).
- Receive and evaluate reports and assessments from the EOC.
- Structure requests for outside assistance.
- Provide for the continuation of business and the resumption of business.

The AGM will report to the Water Operations Facility, or if required, the EOC and will:

- Receive and record damage and injury assessments.
- Coordinate the engineering response.
- Coordinate the District's activities with outside organizations and agencies.
- Coordinate requests for assistance from outside organizations and agencies.
- Coordinate the treatment and movement of the injured.
- Provide notification to and from families.
- Work with Corporate Communication to communicate with the media, the public, and with District employees.
- Direct damage mitigation, repair, and alternate site selection.
- Document the use of District resources during the emergency.
- Provide status summaries, as requested.
- Coordinate with the Crisis Management Team.

The Water Superintendent will report directly to the Water Operations Facility and will:

- Assess the disaster.
- Keep the Water staff informed.
- Direct emergency operations.
- Oversee repair operations.
- Work closely with the Water Crew Coordinator and Foremen for allocations of materials, equipment, and personnel.

The Water Crew Coordinator and Foremen will work closely with the Water Superintendent and will:

- Assess system damage.
- Make contact with end users regarding health and safety matters.
- Direct the water field crew in implementing and completing repairs and/or reconstruction.
- Document actions taken by the field crew.
- Work closely with the Warehouse Storekeeper for allocation of materials, equipment, and supplies.

The Water Field Crew will:

- Assist in assessing system damage and parts/supplies needed to effect repairs.
- Assess remaining, undamaged equipment and supplies.
- Execute repairs.
- Maintain contact with Water Foreman.

Warehouse Storekeeper will:

- Work closely with Water Foremen to ensure adequate materials, equipment, and supplies are allocated.
- Work closely with the District's Warehouse Department to ensure sufficient materials, equipment, and supplies are available.

The Water Engineering Group will:

- Assist in assessing system damage.
- Assist in assessing remaining, undamaged equipment and supplies.
- Maintain contact with the AGM and Water Superintendent.
- Assess water quality and possible remediation.
- Assist Water Superintendent in establishing priorities.

The Water Administrative Services Group will:

- Answer the telephone at the Water Operations Facility.

- Maintain contact with the field crew using mobile radios, telephone, cellular phone, and/or pagers.
- Assist in documenting actions.
- Be responsible for keeping the District's Customer Service Department informed.
- Assist in answering customer inquiries from the Electric Building.

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter **10**

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 10

Water Quality and Compliance

10.1 Water Quality

The provision of a safe and reliable supply of water to District customers is of highest priority. All functions including administrative services, engineering design, and operations/maintenance serve to maintain and/or enhance water quality; all other functions are secondary to that task.

To provide for this, high quality facilities are constructed, operation and maintenance programs are implemented, and programs such as cross-connection control are put into place to protect and enhance water quality. Those topics have been discussed in other chapters of this WSP.

The purpose of this chapter is to discuss the program that is in place to monitor water quality. Since water quality can be adversely affected in a number of ways, the monitoring program is the final test of how well the systems have been designed, operated, and maintained. Further, this chapter identifies anticipated emerging water quality regulations so the District can continue to be a leader in responding to water quality issues before they become requirements.

10.2 Water Quality Monitoring - Integrated System

Drinking water quality is regulated in the United States by the EPA. Under provisions of the Safe Drinking Water Act (SDWA), the EPA may delegate primary enforcement responsibility for water quality control to each state. The State has primacy, and the DOH is the agency responsible for implementing drinking water regulations at least as stringent as the federally designated regulations. State drinking water regulations can be more stringent than federal regulations, but they cannot be less stringent. The current and future water quality regulations and their potential impact to the District are discussed in this section.

10.3 Current Regulations

The State, which maintains primacy over drinking water regulations, has published the Washington Administrative Code (WAC). The state drinking water regulations are contained in Chapter 246-290 of the WAC. Section 246-290-300(2)(a) specifies the following:

> Source monitoring. Purveyors, with the exception of those that "wheel" water to their consumers (i.e., sell water that has passed through another purchasing purveyor's distribution system), shall conduct source monitoring under this chapter for the sources under their control. The level of monitoring shall satisfy the monitoring requirements associated with the total population served by the source.

WAC 246-290-300(2)(b) specifies the following:

> Distribution system monitoring. The purveyor of a system that receives and distributes water shall perform distribution-related monitoring requirements. Monitoring shall include, but not be limited to, the following:
>
> (i) Collect coliform samples;
>
> (ii) Collect disinfection by-product samples;
>
> (iii) Perform the distribution system residual disinfectant concentration monitoring as required under WAC 246-290-451, 246-290-664, or 246-290-694;
>
> (iv) Perform lead and copper monitoring under the Code of Federal Regulations (CFR) - 40 CFR 141.86, 141.87, and 141.88;
>
> (v) Perform the distribution system monitoring in accordance with 40 CFR 141.23(b) for asbestos if applicable.
>
> (vi) Other monitoring as required by the department.

As a wholesale customer of Everett, the Lake Stevens Integrated is required to comply with the specific drinking water regulations listed above. In general, the District must comply with regulations that apply to finished water impacts associated with chlorine in the distribution system. For the District's purchased water supply, Everett is responsible for maintaining and documenting compliance with all requirements covering source water monitoring, maximum contaminant levels (MCLs) for specific compounds, filtered water quality, and disinfection contact time.

Provided in this chapter is the District's compliance status for those regulations for which the District is responsible for demonstrating compliance within its Integrated System.

10.3.1 Revised Total Coliform Rule and Coliform Monitoring Plan

The District maintains two separate Coliform Monitoring Plans (CMPs), with the most recent updates in 2020. The first plan addresses the District's Surface Water Systems, the second covers District-owned Groundwater Systems. Both plans can be viewed in **Appendix 10-1A**. The District is required to take no fewer than the minimum number of samples specified in Table 2 of WAC 246-290-300, *Total Coliform Monitoring Frequency*. Sites in both the Lake Stevens Integrated and other District water system areas were selected to ensure that representative sections of the distribution system are used for bacterial sampling. These same sites are used for monitoring of disinfection residuals in the distribution system. A subset of these sites is also used to monitor Disinfection By Products (DBPs) and Heterotrophic Plate Counts (HPCs).

The Revised Total Coliform Rule (RTCR) requires purveyors to periodically review and evaluate the potential need to change sample locations in order to account for distribution system changes that may have occurred, and/or are expected to occur over time. This approach will ensure that as a system expands representative monitoring will be achieved on an ongoing basis.

10.3.2 Disinfectants and Disinfection Byproduct Rule and Disinfection Byproduct Monitoring Plan

10.3.2.1 Disinfectants and Disinfection Byproduct Plan Stage 1

The District has been monitoring DBPs, including Trihalomethanes (THMs) and Haloacidic Acid 5 (HAA5) in the distribution system for many years to maintain compliance with the existing DBP standards. Total THM sample results, collected from the Lake Stevens Integrated System, have ranged in concentrations from 9.6 to 54.0 parts per billion (ppb), with an average concentration of 40.3 ppb (2016 through 2020). The HAA5 samples collected during the same time-period ranged from 9.0 to 48.1 ppb with an average concentration of 36.0 ppb. Therefore, the District has consistently met the current MCL of 80 ppb for Total THMs and 60 ppb for HAA5's.

The District's Stage 1 Disinfectants and Disinfection Byproducts (D/DBP) monitoring plan originally used four sites in the Lake Stevens Integrated System for DBP sampling. The sites are all located downstream of where water is re-chlorinated at the Granite Falls BPS. The plan was originally written in 2002.The monitoring plan includes Lake Stevens Integrated and monitoring locations within other District-owned water systems with DBP monitoring requirements.

To select the Stage 1 sites within Lake Stevens Integrated, hydraulic modeling studies were conducted. "Time of travel" hydraulic modeling studies (up to 400 hours of residence time in the distribution system), indicated that the water age at all four sites is greater than 50 percent of the maximum residence time. The site with the maximum residence time is Site #25, 2020-155th Avenue NE, as shown in the coliform sampling plan. In addition to DBP monitoring, monthly chlorine residuals are collected at all 60 routine coliform monitoring sties, and an automatic, continuous chlorine residual analyzer is installed at the Granite Falls BPS.

In addition to Lake Stevens Integrated, the District is the owner of eight Group A Systems with varying DBP monitoring requirements. Provided in **Table 10-1** is a summary of Stage 1 D/DBP results listing the range detected in 2019 and the five-year average of results (2016 to 2019).

Table 10-1 | Other Group A Water Systems D/DBP Monitoring Results

Surface Water Systems:		2020 Results:	Five-year Average:
Lake Stevens Integrated, Arlington,	HAA5:	8 – 48.1 ppb	36.0 ppb
and Granite Falls	TTHM:	9.6 - 54 ppb	40.3 ppb
Creswell	HAA5:	34.0 – 36.0 ppb	35.4 ppb
	TTHM:	36.0 ppb	37.3 ppb
Storm Lake Ridge	HAA5:	-37.0 ppb	41.0 ppb
	TTHM:	-30.0 ppb	33.9 ppb
May Creek	HAA5:	0 - 0 ppb	1.2 ppb
	TTHM:	1.6 ppb	2.3ppb
Warm Beach	HAA5:	5.1 ppb	6.8 ppb
	TTHM:	7.0 ppb	6.5 ppb
Kayak	HAA5:	0.0 ppb	1.2 ppb
(part of Warm Beach water system area)	TTHM:	7.2 ppb	9.6 ppb
Sunday Lake	HAA5:	15.8 ppb	17.6 ppb
	TTHM:	31.0 ppb	31.4 ppb

Note: Disinfection of the Kayak part of Warm Beach water system area began in August of 2009.

10.3.2.2 Disinfectants and Disinfection Byproduct Rule Stage 2

The Stage 2 Disinfectants and Disinfection Byproducts Rule (DBPR) and the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2) were both published in the Federal Registry in January 2006. The Stage 2 DBPR applies to all public water supplies that treat with a primary or residual disinfectant other than ultraviolet (UV). The rule requires all systems evaluate their distribution systems, identifying locations with high levels of disinfection byproducts that will become the sampling sites. The rule also requires systems to meet the MCLs for the Total THM and HAA5 as an average at each of the new monitoring locations instead of as a system-wide average as was allowed with the Stage 1 DBP. Due to the diversity of water systems owned by the District, multiple paths were followed in meeting the requirements of the Stage 2 DBPR. The District conducted system specific studies and obtained Very Small System (VSS) Waivers, where applicable. A summary of District's Stage 2 requirements and monitoring schedules can be viewed in **Appendix 10-2**.

10.3.3 Surface Water Treatment Rule

Of the requirements stipulated by the Surface Water Treatment Rule (SWTR), only one requirement is applicable to the District. The majority of the burden of compliance with the SWTR lies with Everett, the water supplier.

Under the SWTR, the District is required to demonstrate detectable residual chlorine concentrations in at least 95 percent of the samples collected in a calendar month. With the adoption of the Group A WAC changes in January 2017, detectable residual disinfectant concentration has been defined and must be at least 0.2 mg/L. The District gathers information on measured free chlorine residuals at the coliform sampling points, which are located throughout each of the District's systems.

From the available data for surface water systems served by the District from 2016 to 2020, measured free chlorine residuals have ranged from 0.20 to 2.2 milligrams per liter (mg/L). Data for groundwater systems have measured 0.13 to 1.74 mg/L during the same time-period. Thus, the District has maintained compliance with the applicable requirement of the SWTR. Provided that no significant changes in water quality or chlorine dosing levels occur, the District will continue to comply with the requirement.

10.3.4 Lead and Copper

Everett organized and managed a group sampling effort to demonstrate compliance with the LCR. During a six-month period in 1992, a total of 26 water districts and cities participated in the Everett Consecutive System Sampling Plan. From the data for this period, the 90th percentile lead concentration was 0.013 mg/L and the 90th percentile copper concentration was 0.79 mg/L. Therefore, the results demonstrated compliance with both the lead and copper limits. The District continues to participate in the Everett Consecutive System Sampling Plan for Group A surface water systems until 2013, when it began the full time use of its Lake Stevens Wells Treatment Facility. Refer to **Table 10-2** for historical 90th percentile results.

The LCR dictates that sampling for the District's groundwater systems be conducted every third year. Sampling for the Kayak, May Creek, Skylite, and Sunday Lake systems have yielded results for lead in the range from Not Detected (ND) to 0.012 parts per million (ppm). Results for copper ranged from 0.009 to 0.404 ppm. All results were well below established MCLs.

Table 10-2 | Everett Regional Lead and Copper Monitoring Results

	90th Percentile (mg/L)	
Sample Period	Lead	Copper
1993	0.010	0.407
1996	0.008	0.371
1997	0.006	0.186
2000	0.003	0.130
2003	0.003	0.068
2006	0.003	0.072
2009	0.003	0.188
2012	0.002	0.109
2015	0.004	0.766
2018	0.002	0.936

10.4 Water Quality Monitoring – Other Group A Systems

The District samples and monitors water quality in accordance with the State Drinking Water Regulations for Group A Public Water Systems, Chapter 246-290 WAC. The water quality monitoring requirements for the District are presented in **Appendix 10-3**. The monitoring requirements vary depending on the source of water for the specific system (Everett source or groundwater).

As source water supplier for Lake Stevens Integrated water system, Everett is responsible for the monitoring of any source water quality parameters. The District's water quality monitoring requirements for surface water systems consist of asbestos, bacteriological monitoring, chlorine residual, lead and copper, DBPs, and other parameters as directed by the EPA or DOH. Groundwater monitoring consists of asbestos, bacteriological monitoring, chlorine residual, lead and copper, DBPs, VOCs, SOCs, Inorganic Contaminates (IOCs), radionuclides, and other parameters as directed by the EPA or DOH.

Based on the population served by each Group A system, the District is required to collect a minimum number of bacteriological samples monthly. These routine samples are collected throughout the District's service area and are representative of water quality throughout the distribution system. Both the surface and groundwater plans can be viewed in **Appendix 10-1A**. Historic records of bacteriological monitoring samples are recorded and maintained on file for five years.

The DBP compliance monitoring is conducted in accordance with DOH WAC 246-290-300(6) and has been completed successfully by the District over the past several years. It is not anticipated that compliance status will change in the future.

10.5 Consumer Confidence Reports and Public Notification Rule

Under the SDWA 1996 Amendments, community water systems are required to provide an annual Consumer Confidence Report (CCR) on the source of their drinking water and levels of any contaminants found. The annual report must be supplied to all customers prior to July 1 of each year and must include:

- Information on the source of drinking water,
- A brief definition of terms,
- If regulated contaminants are detected, the MCL goal (MCLG), the MCL, and the level detected,
- Information on health effects if an MCL is violated,
- Information on levels of unregulated contaminants if the EPA requires it, and
- Arsenic education language (which applies to the Sunday Lake system only).

As a wholesale supplier, the District must also provide its wholesale customers with the necessary water quality data and other related information needed to prepare their own CCRs by April 1st of each year.

The District's first CCR was distributed in 1999 and has been delivered to customers every year since. The District currently produces two separate CCRs. The first report addresses the Lake Stevens Integrated Water System. The second report is written for the satellite systems, including May Creek, Skylite, Sunday Lake, 212 Market & Deli, and Warm Beach. The 2019 CCR provided to customers is provided as Appendix 10-4.

While the CCR provides annual "state-of-the-water" reports, the Public Notification Rule directs utilities in notifying customers of non-acute and acute violations when they occur. In the event that District results for coliform or chlorine residual exceed a maximum contaminant level, the District is required to notify the Department of Health in accordance with WAC 246-290-480.

Public notification is designed to protect public health. As a public water supplier, the District is required by law to prepare and distribute public notification to consumers. Public notification is required by the District if any of the following conditions apply:

- The District violates a drinking water quality or monitoring requirement.
- The District is operating under a variance or exemption.
- The District has any situation that poses a public health risk, such as a disruption in service.
- The District receives an order from the Office of Drinking Water.
- The District fails to comply with an Office of Drinking Water order.
- The District receives a red operating permit.

Public notification timing and distribution requirements depend on the level of threat associated with the violation or event, such as:

Tier 1 (Immediate Notice, Within 24 Hours) Notice as soon as practical or within 24 hours via radio, TV, hand delivery, posting, or other method specified by the DOH, along with other methods if needed to reach persons served. The District must also initiate consultation with DOH within 24 hours. The DOH may establish additional requirements during consultation.

Tier 2 (Notice as Soon as Possible, Within 30 Days) Notice as soon as practical or within 30 days. Repeat notice every three months until violation is resolved. Notices shall be delivered via mail or direct delivery. The DOH may permit alternate methods. The District must use additional delivery methods reasonably calculated to reach other consumers not notified by the first method.

Tier 3 (Annual Notice) Notice within 12 months; repeated annually for unresolved violations. Notices for individual violations can be combined into an annual notice (including the CCR if public notification requirements can still be met). Notices shall be delivered via mail or direct delivery.

10.6 Emergency Response Program

Back-up facilities and safety procedures for the major elements of the water system were previously identified under **Chapter 9** (Operations and Maintenance) of this WSP. A comprehensive ERP and COOP have been prepared by the District. The following elements are being included in the ERP:

- Risk and resilience assessment of major facilities;
- Emergency operations procedures;
- Inventory of material, supplies and chemicals;
- Emergency contacts and phone numbers;
- Interagency agreements.

10.7 Cross-Connection Control Program

The District Board of Commissioners adopted Resolution 2535 which declares cross-connections that endanger water quality to be unlawful, and which requires the installation of backflow prevention devices. This resolution adopts the State regulations and the American Water Works Association (AWWA) guidelines regarding cross-connection control. A copy of the resolution is contained in **Appendix 10-5**.

10.8 Anticipated Water Quality Regulations

As drinking water regulations are continuously changing, it is important that District staff continue to anticipate and track the development of these regulations. A few regulations on the horizon are listed in the sections below.

10.8.1 Endocrine Disruptors

Endocrine disruptors are chemicals that interfere with the human (or animal) body's endocrine, or hormone system. The Safe Drinking Water Act requires drinking water to be monitored or screened for endocrine disruptors but there are no regulatory limits on them. The EPA also requires pesticide manufacturers to document the presence of endocrine disruptors in their products. In 2015, the EPA published guidelines under Guideline Series 890 on how to perform tests that "determine if a chemical substance may pose a risk to human health or the environment due to the disruption of the endocrine system". It is possible that regulations may evolve from EPA's research on this topic in the future.

10.8.2 Radon

The EPA proposed new regulations to reduce the public health risks from radon on November 2, 1999, in the Federal Register (64 FR 59246). The proposed standards will apply to community water systems that regularly serve 25 or more people and that use groundwater or mixed ground and surface water (e.g., systems serving homes, apartments, and trailer parks). They will not apply to systems that rely on surface water where radon levels in the water are very low. The proposal will provide states flexibility in how to limit exposure to radon by allowing them to focus their efforts on the greatest radon risks - those in indoor air - while also reducing the risks from radon in drinking water.

The unique multimedia framework for this proposed regulation is outlined in the SDWA as amended in 1996. The proposed regulation offers two paths to compliance:

- First Option

  The state can choose to develop enhanced state programs to address the health risks from radon in indoor air -- known as Multimedia Mitigation (MMM) programs -- while individual water systems reduce radon levels in drinking water to 4,000 picoCuries per liter (pCi/L), or lower. The EPA is encouraging states to adopt this option because it is the most cost-effective way to achieve the greatest radon risk reduction.

- Second Option

  If a state chooses not to develop an MMM program, individual water systems in that state would be required to either reduce radon in their system's drinking water to 300 pCi/L or develop individual local MMM programs and reduce levels in drinking water to 4000 pCi/L. Water systems already at or below 300 pCi/L standard would not be required to treat their water for radon.

10.8.3 Proposed Revisions to the Lead and Copper Rule

In October 2019, the EPA published proposed changes to the LCR. These proposed changes include identifying the most impacted areas, strengthening treatment requirements, replacing lead service lines, increasing drinking water sampling reliability and improving risk communication to customers.

10.8.4 Future PFOA and PFOS Regulations

The EPA issued health advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) in the spring of 2016. The PFOA, PFOS, and other PFASs are a family of chemicals used since the 1950s to manufacture stain-resistant, water-resistant, and non-stick products. Certain types of firefighting foam contain PFAS. These firefighting foams were historically used by the U.S. military, local fire departments, and airports.

Overtime, PFASs leached into groundwater and has contaminated drinking water. Exposure to PFAS over certain levels may result in adverse health effects. The current EPA health advisory level is at 70 parts per trillion.

The State Board of Health began rulemaking for PFAS in drinking water in late 2017. In November 2019, draft State Action Levels (SALs) were published. These draft SALs test for five PFAS as indicators to identify PFAS contamination in public drinking water supplies. Draft SALs are 10 nanograms per liter (ng/L) for PFOA, 15 ng/L for PFOS, 14 ng/L for perfluorononanoic acid (PFNA), 70 ng/L for perfluorohexanesulfonic acid (PFHxS), and 1,300 ng/L for perfluorobutanesulfonic acid (PFBS).

10.9 Laboratory Certification

The District uses state-certified laboratories for sample analyses.

10.10 Water Quality Sampling and Violation Response Procedures

Providing safe drinking water to the District's customers is the issue that overrides all other tasks and functions. The water quality standards (MCLs) are established by the federal EPA and are implemented and enforced by the DOH. The District is committed to working cooperatively with EPA and DOH to achieve compliance and ensure safe water for its customers.

10.10.1 Monitoring

The frequency, number, and type of water quality tests required of the District's different systems vary. The District's coliform monitoring and DBP monitoring plans are found in Appendix 10-1A and Appendix 10-2, respectively, while other water quality monitoring requirements can be viewed in Appendix 10-3. As population growth occurs and as additional requirements are imposed, the District adjusts the quantity and frequency of samples collected to conform to regulatory requirements.

Monitoring is an especially challenging task for the District due to its number of satellite systems and their diversity in size, age, sources, and location. The District is working hard to make their monitoring program cohesive and effective across its systems.

10.10.2 Reporting and Public Notification

The results of required water quality testing are provided to the District and DOH by the testing laboratories. Annually, the District's water customers are also informed of the test results through distribution of an annual CCR (see Appendix 10-4). The CCR lists results of the tests that have been performed, including any violations of MCLs.

10.10.3 Customer Inquiries and Record Keeping

The District is dedicated to providing good customer service and timely responses to customer inquiries. Inquiries are documented and tracked using a District-supported software system and the data is used to establish trends, focus maintenance and flushing efforts, and to obtain valuable feedback from customers. In addition, the District logs various inquiries relating to leaks, main breaks, pressure, and other service issues.

10.11 Treatment and Monitoring Violation Procedures

The District has established procedures in conformance with WAC 246-290-71001 (Public Notification) for cases when the system violates a primary water quality standard or fails to meet treatment, monitoring, and analytical testing requirements (see Appendix 10-6 for sample notifications).

Public notices must provide a clear explanation of the violation, adverse health effects, remedial action being taken, and steps the consumers should take to minimize risk. Notices are to be distributed by newspaper notice, by direct mail, or hand-delivery within specific time frames depending on the nature of the violation. If the violation is for acute coliform, nitrate, waterborne disease outbreak, or other acute violation determined by the DOH, there would be broadcast media announcements within 72 hours of the violation. The District closely coordinates all public notifications with DOH and the County Health Department.

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 11

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 11

Improvement Program

The intent of the District's CIP is to maintain and/or improve water service over the next 20 years while accommodating planned growth. Recommended improvements identified in previous chapters form the basis of the CIP as described in Table 11-1, Figure 11-1, and Figure 11-2. Funding alternatives and potential rate impacts are discussed in Chapter 12.

The CIP includes major improvements but does not include site-specific improvements within individual developments, which are typically designed and funded by the developers. This chapter includes background information about the CIP, such as prioritization and basis for estimated cost, as well as a summary of the most significant improvements.

11.1 Prioritization

The District refines the CIP annually. During each annual update, all proposed CIP projects are evaluated, prioritized, funded, and scheduled accordingly. The planned improvements fall into several categories:

- Improvements driven and funded by development. These are initially scheduled based on growth projections but are implemented when specific developments are platted and approved.
- Rehabilitation and replacement of aging facilities. These improvements are initially scheduled based on the useful life of pipes and facilities. Further refinement of the replacement schedule is based on condition information provided by operators and specific facilities assessments. Additionally, the annual operation and maintenance costs, including staff time is reviewed to determine if replacement schedules should be adjusted further.
- Operational improvements that provide for redundancy and reliability of enhanced level of service.

11.2 Budget Level Cost Estimates

Budget level cost estimates were prepared for each recommended improvement based on 2021 dollars (ENR index 11,628, 20-City Average, January 2021) and a planning-level cost accuracy Class 5 estimate (+100 percent, -50 percent). A detailed description of the cost estimating methodology used is provided in the Appendix 11-1.

These estimates are intended to be used for informing revenue requirements and prioritization of the proposed improvements. Because all costs are provided in 2021 dollars, future costs must be adjusted at the time of construction to account for inflation and changing market conditions.

The final cost of each project is at a Class 5 estimate level and will depend on actual labor and material costs, site conditions, productivity, competitive market conditions, final project scope, implementation schedule, and other variables. As a result, final construction costs will differ from the presented estimates. Because of these factors, project feasibility and funding must be reviewed carefully prior to making specific financial decisions. Before final budgets are developed, the cost of the planned projects should be estimated using project-specific data.

11.3 Summary of Major Improvements

This section presents the recommended major CIP projects for each type of infrastructure project (both major and minor projects summarized in **Figure 11-1 and Table 11-1**). Current and previously defined District CIP projects are identified in this section as well.

11.3.1 Overall Water System

Improvements that will benefit the overall water system include:

- **Control System (SCADA) Hardware and Software Upgrades.** The computer systems used to monitor and operate valves, pump stations, reservoirs, supply connections, and treatment facilities should be upgraded on a regular basis as the hardware and software becomes outdated, more likely to be inoperable, and can no longer be cost-effectively maintained.

- **Meter Replacement.** A key element of ongoing maintenance is regular replacement of older meters to minimize lost water through malfunctioning or erroneous readings. As meters age, they tend to under-register, resulting in lower than actual consumption being measured. Additionally, the District is assessing the implementation of advanced metering infrastructure (AMI). This project is current still being assessed by the District but anticipated to begin in 2022 if the District decides to move forward.

- **Vehicles and Equipment.** Vehicles and major equipment must be replaced on a regular basis to maintain a reliable fleet.

11.3.2 Reservoirs

In addition to maintaining existing storage tanks, the District will construct new storage to meet the needs of planned growth. A second storage tank will be constructed in the Warm Beach Water System at the Kayak Tank site. Two more storage tanks will be constructed in the Lake Stevens Integrated Water System serving the Lake Stevens 500 PZ and the Granite Falls 726 PZ. The Burn Road Tank located along Burn Road in the vicinity of 150th Street NE will serve the Granite Falls 726 PZ and the N Lake Stevens Tank located in the vicinity of 60th Street NE and 91st Avenue NE will serve the Lake Stevens 500 PZ. Additional Lake Roesiger 811 PZ storage capacity is planned for the 2040 CIP timeframe, and this effort may include replacement of the existing Lake Roesiger tanks. Additionally, a condition assessment and seismic analysis is included for existing storage tanks 200,000 gallons or larger and constructed in 2000 or earlier, which is a total of 12 water storage tanks.

11.3.3 Pump Stations

The District's pump stations are operated daily. Normal wear on mechanical and electrical equipment results in the need for periodic rehabilitation and replacement of facilities. In addition to keeping up with existing demands, future growth will require that station capacities be increased through upgrades or replacements. The following is a summary of the planning pump station improvements over the 20-year planning period. The Granite Falls BPS will be retrofitted to meet 2040 demands. Approximately 1,000 gpm of capacity will be added to the Walker Hill BPS to meet increased fire flow demands. The District is also currently planning for improvements at the Machias BPS with the installation of pumps 4 and 5. The District is also planning to construct a new BPS in 2029 to replace the East Hewitt BPS that was removed in 2020 to allow for development.

11.3.4 Distribution

There are approximately 408 miles of pipeline in the District's water systems ranging from ¾-inch to 30 inches in diameter and including steel, CI, AC, PVC, high-density polyethylene (HDPE), and DI.

Deficiencies with the piping will be addressed by either replacement through a specific CIP-funded project, through the District's miscellaneous pipeline replacement program, or through developer upsizing required to serve new developments.

The planned water mains in **Figure 11-1** and **Figure 11-2**Figure 11-1 are grouped into the following three types of projects:

CIP Funded Projects – The new pipelines shown in green on the figures will be constructed by the District.

- Existing Deficiencies
- 2030 Deficiencies
- 2040 Deficiencies

Developer Funded Projects – The new pipelines shown in red on the figures have been sized to handle the anticipated 2040 water demands; however, funding for these projects will come solely from developers requiring water service from the District in these designated areas. Developers desiring to extend water to projects in these areas will be required to install pipelines large enough to handle the anticipated needs of the future Integrated Service Area with no financial assistance from the District.

Miscellaneous Improvements, Relocations, and Pipeline Replacements – The District will replace existing pipes highlighted in orange. The District's CIP targets approximately 99,000 feet of galvanized iron/steel and AC pipe that is substandard and reaching its useful life. The District's goal is to replace all of these pipes by 2028. Project number 99 in **Table 11-1** is the annual funding dedicated to achieving this goal.

Each year, the District reviews the status of its pipes to identify those to be replaced. Priority pipes for replacement typically experience the greatest number of breaks or leaks. The frequency of breaks is evaluated through a combination of input from District crews and records maintained in GIS which is typically correlated to specific pipe groups of age and material. The District also prioritizes replacements that resolve issues such as fire flow or pressure deficiencies as an additional benefit. The District finds it is better to go through this prioritization each year than to identify specific pipes for replacement in the CIP, because priorities often shift over the course of the planning period.

The District also has unplanned projects that come up each year, such as relocations for transportation or drainage projects and opportunities to include water mains in bridge projects. Project number 98 in **Table 11-1** is an amount of money set aside every year to address the unplanned projects.

Table 11-1 - Snohomish County PUD - Capital Improvement Plan

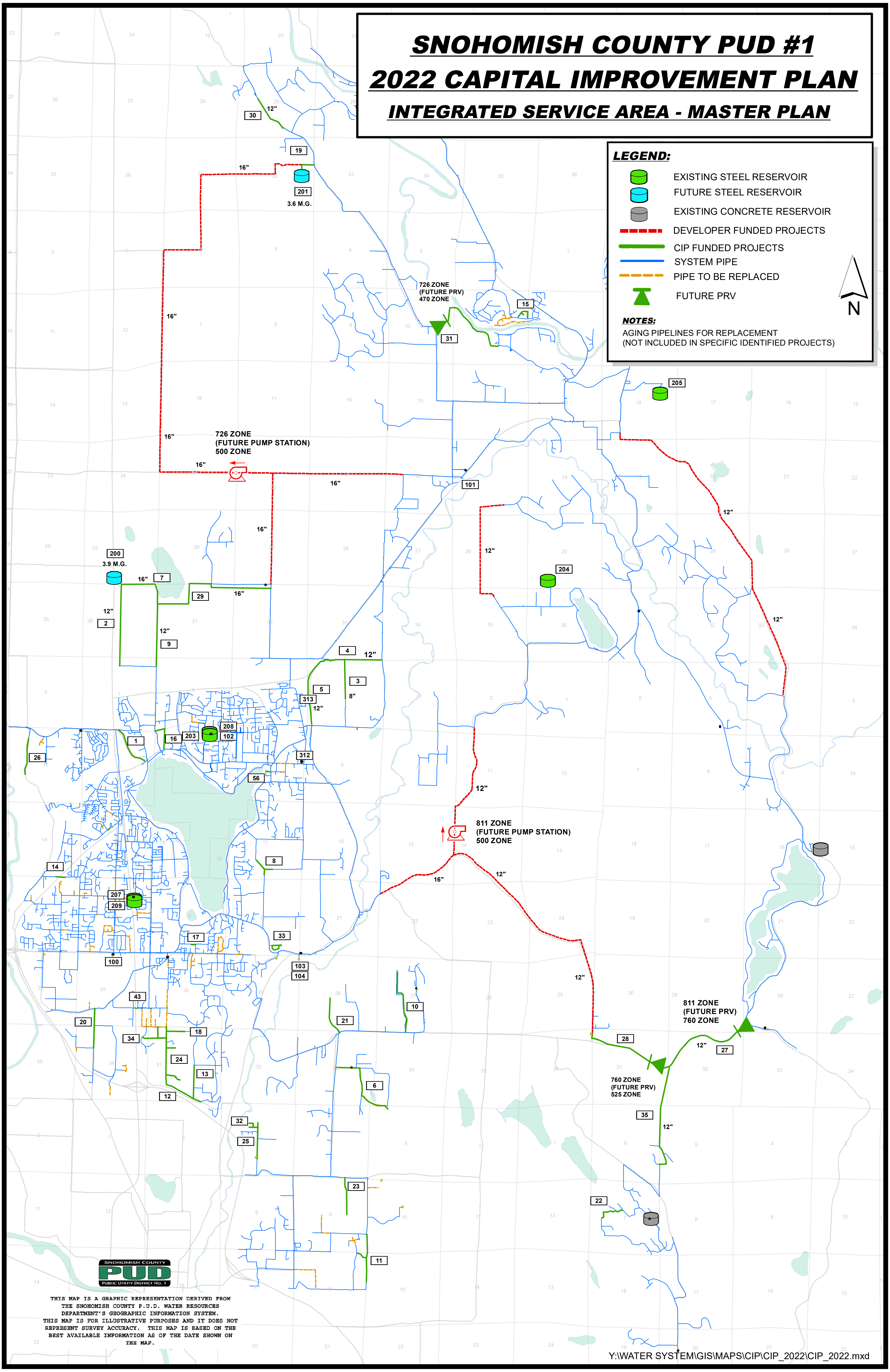
No.	Description	Est Project Cost ($1,000's)	%GFC	%RF	%Other	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Water Mains:																										
1	Soperhill Road	$821	0%	100%	0%			$821																		$821
2	91st Ave NE	$1,777	100%	0%	0%																			$1,777		$1,777
3	139th Ave NE	$764	100%	0%	0%		$764																			$764
4	44th St NE	$1,015	100%	0%	0%		$1,015																			$1,015
5	N Machias Road	$1,581	100%	0%	0%										$1,581											$1,581
6	44th St SE	$1,548	0%	100%	0%														$1,548							$1,548
7	60th St NE	$1,536	100%	0%	0%																			$1,536		$1,536
8	South Nyden Farms Road/2nd St SE / 123rd Ave SE Intersection	$606	0%	100%	0%				$606																	$606
9	99th Ave NE	$1,249	100%	0%	0%																		$1,249			$1,249
10	153rd Ave SE	$1,474	20%	80%	0%											$1,474										$1,474
11	147th Ave SE	$1,178	100%	0%	0%											$1,178										$1,178
12	Bunk Foss Road	$948	100%	0%	0%												$948									$948
13	109th Ave SE	$662	100%	0%	0%												$662									$662
14	SR 204 Crossing at 4th St SE	$539	100%	0%	0%												$539									$539
15	Blue Spruce - 177th Ave/178th Dr NE Loop	$375	0%	100%	0%											$375										$375
16	101st Ave NE / 28th St NE	$582	0%	100%	0%				$582																	$582
17	18th St SE	$53	0%	100%	0%					$53																$53
18	37th St SE	$351	0%	100%	0%					$351																$351
19	150th St NE	$459	100%	0%	0%			$459																		$459
20	87th Avenue SE	$863	100%	0%	0%													$863								$863
21	139th Ave SE	$741	0%	100%	0%									$741												$741
22	72nd Pl SE	$1,121	100%	0%	0%										$1,121											$1,121
23	142nd Drive SE	$703	0%	100%	0%					$703																$703
24	103rd Ave SE	$1,218	0%	100%	0%			$1,218																		$1,218
25	123rd Ave SE	$794	0%	100%	0%		$794																			$794
26	Sunnyside Blvd	$688	0%	100%	0%					$688																$688
27	Dubuque Road 760 Zone Transmission	$2,314	100%	0%	0%															$2,314						$2,314
28	Dubuque Road 525 Zone Transmission	$2,025	100%	0%	0%																$2,025					$2,025
29	Lake Cassidy Transmission Main	$3,406	100%	0%	0%																		$3,406			$3,406
30	Burn Road	$783	100%	0%	0%									$783												$783
31	West Engebretson Road (Includes Mainline PRV)	$2,253	100%	0%	0%																				$2,253	$2,253
32	57th Pl SE	$318	0%	100%	0%		$318																			$318
33	18th St SE / 19th Pl SE	$479	0%	100%	0%			$479																		$479
34	38th Pl SE / 101st Ave SE	$674	0%	100%	0%			$674																		$674
35	Storm Lake Transmission Main - 211th Ave SE Main Extension	$2,310	100%	0%	0%																	$2,310				$2,310
43	32nd St SE SR9 Crossing	$244	100%	0%	0%	$244																				$244
52	Replacement	$903	0%	0%	100%	$903																				$903
53	Warm Beach - Marine Dr Main Replacement	$1,345	0%	0%	100%	$1,345																				$1,345
54	Replacement	$1,542	0%	0%	100%	$154	$1,388																			$1,542
55 A	Warm Beach - 172nd St NW Main Extension	$917	0%	0%	100%	$917																				$917
55 B	Warm Beach - Kayak Intertie	$213	0%	0%	100%	$213																				$213
56	18th St NE (Festival St) Main Extension	$104	100%	0%	0%	$104																				$104
57	Warm Beach Misc Improvements (Add 10 Fire Hydrants)	$94	0%	0%	100%		$94																			$94
98	Forced Right of Way Relocations / Replacements	$2,000	0%	100%	0%	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$2,000
99	Misc Main Replacement Program (2026-2040)	$24,640	0%	100%	0%						$4,213	$4,213	$4,208	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$24,640
	Subtotal - Water Mains:					***$3,980***	***$4,473***	***$3,750***	***$1,288***	***$1,895***	***$4,313***	***$4,313***	***$4,308***	***$2,624***	***$3,802***	***$4,127***	***$3,249***	***$1,963***	***$2,649***	***$3,414***	***$3,125***	***$3,411***	***$5,756***	***$4,413***	***$3,353***	***$70,207***

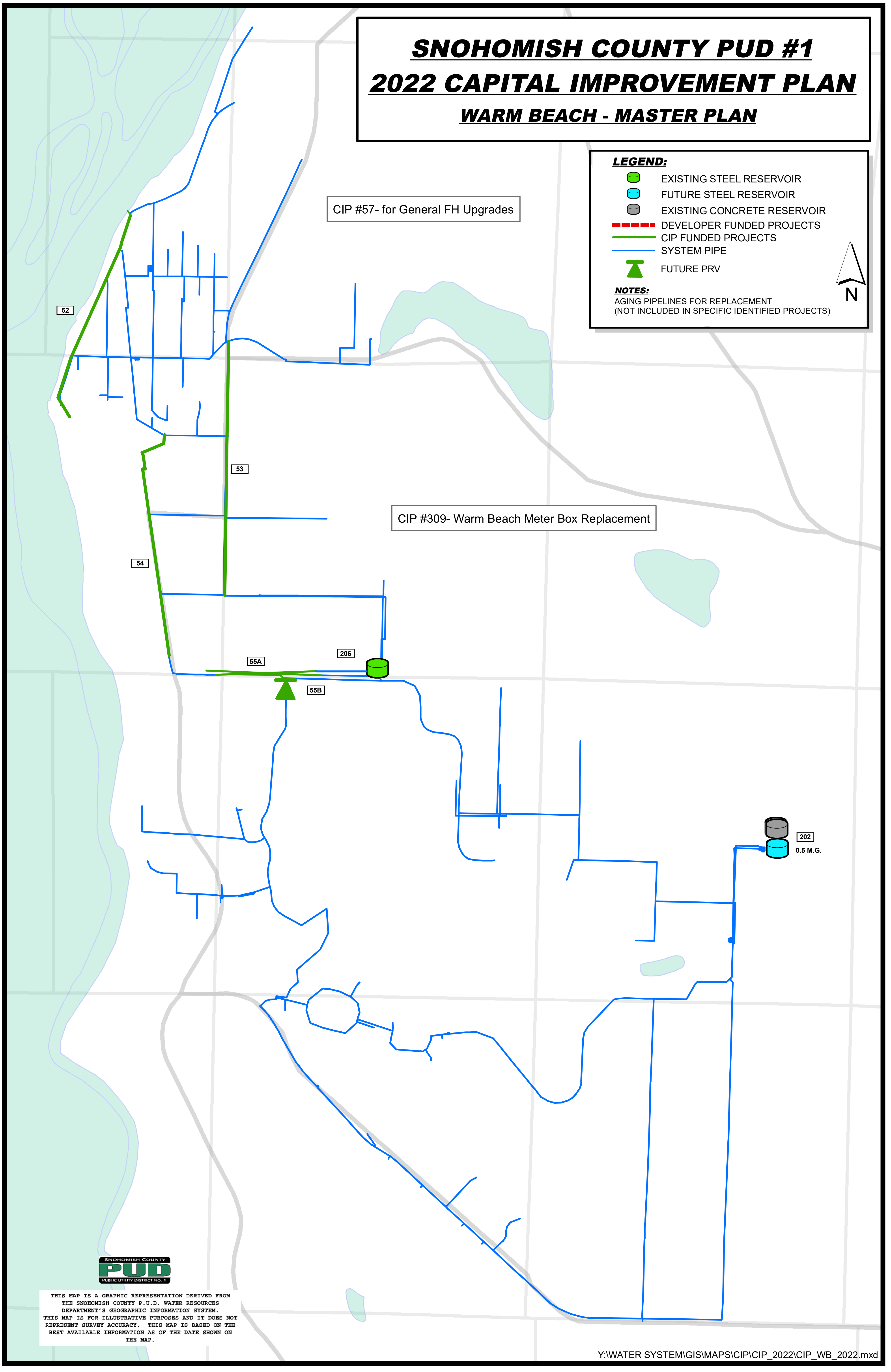
Table 11-1 - Snohomish County PUD - Capital Improvement Plan																										
No.	Description	Est Project Cost ($1,000's)	%GFC	%RF	%Other	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Pump Stations																										
100	East Hewitt Improvements (3500 gpm total capacity req)	$1,535	100%	0%	0%									$1,535												$1,535
101	Granite Falls BPS - Pump Retrofit	$461	100%	0%	0%																				$461	$461
102	Walker Hill PS Improvements (add 1000 gpm capacity)	$307	100%	0%	0%				$307																	$307
103	Machias Pump Station Pump #4	$154	100%	0%	0%									$154												$154
104	Machias Pump Station Pump #5	$154	100%	0%	0%														$154							$154
107	Small System Well pump, motor, and wire spare parts	$284	0%	100%	0%	$284																				$284
	Subtotal - Pump Stations:					***$284***	***$0***	***$0***	***$307***	***$0***	***$0***	***$0***	***$0***	***$1,689***	***$0***	***$0***	***$0***	***$0***	***$154***	***$0***	***$0***	***$0***	***$0***	***$0***	***$461***	***$2,894***
Reservoirs:																										
200	North LS Tank (500 Zone - 3.9MG)	$5,987	100%	0%	0%																		$299	$5,687		$5,987
201	Burn Road 726 Reservoir (3.6 MG)	$5,680	100%	0%	0%			$284	$5,396																	$5,680
202	Kayak Reservoir 2 (0.5 MG)	$2,149	100%	0%	0%		$43	$2,106																		$2,149
203	Walker Hill Reservoir 1 Improvements and Re-coat	$1,483	0%	100%	0%	$1,483																				$1,483
204	Bosworth Reservoir Re-coat	$732	0%	100%	0%			$732																		$732
205	Iron Mountain Reservoir Re-coat	$1,300	0%	100%	0%					$1,300																$1,300
206	Warm Beach Reservoir Re-coat	$452	0%	100%	0%							$452														$452
207	Hillcrest Reservoir 2 Re-coat	$1,258	0%	100%	0%															$1,258						$1,258
208	Walker Hill Reservoir 2 Re-coat	$1,071	0%	100%	0%																$1,071					$1,071
209	Hillcrest Reservoir 1 Re-coat	$1,258	0%	100%																					$1,258	$1,258
210	Lake Roesiger 811 Reservoir (0.2MG)	$860	100%	0%	0%																				$860	$860
	Subtotal - Reservoirs:					***$1,483***	***$43***	***$3,122***	***$5,396***	***$1,300***	***$0***	***$452***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$1,258***	***$1,071***	***$0***	***$299***	***$5,687***	***$2,118***	***$22,229***

Table 11-1 - Snohomish County PUD - Capital Improvement Plan

No.	Description	Est Project Cost ($1,000's)	%GFC	%RF	%Other	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
General:																										
300	Misc Meter Replacement (2021-2040)	$1,306	0%	100%	0%	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$65	$1,306
301	Vehicles & Equipment (WTR92)	$7,788	0%	100%	0%	$84	$468	$864	$396	$576	$468	$252	$132	$96	$84	$84	$1,302	$948	$342	$576	$468	$336	$132	$180	$0	$7,788
302	Power Operated Equipment (WTR96)	$540	0%	100%	0%	$6	$30	$30	$48	$0	$0	$0	$138	$18	$6	$0	$30	$30	$168	$0	$0	$0	$18	$18	$0	$540
303	New Capitalized Office Furniture and Equipment (WTR 91)	$133	0%	100%	0%	$22	$0	$0	$0	$30	$0	$0	$0	$0	$30	$0	$22	$0	$0	$30	$0	$0	$0	$0	$0	$133
304	Misc. Tools and Equipment (WTR 98)	$60	0%	100%	0%	$0	$0	$12	$0	$12	$0	$0	$0	$0	$12	$0	$0	$12	$0	$12	$0	$0	$0	$0	$0	$60
305	New Services - (2021-2040)	$6,398	0%	100%	0%	$269	$274	$279	$284	$289	$294	$299	$305	$310	$315	$321	$327	$333	$339	$345	$351	$357	$363	$370	$376	$6,398
308	Water SCADA System PLC Upgrade	$1,842	0%	100%	0%		$461	$461	$461	$461																$1,842
309	Warm Beach Water Meter Replacement	$435	0%	0%	100%		$435																			$435
310	Warm Beach Water Treatment and SCADA Upgrades	$1,714	0%	0%	100%	$320	$1,394																			$1,714
312	Lake Stevens Treatment Corrosion Control Optimization	$556	0%	100%	0%	$100	$456																			$556
313	Joint PUD Lake Stevens Decant Facility	$2,456	0%	100%	0%				$246	$2,210																$2,456
315	Water AMI Conversion	$12,431	0%	100%	0%		$2,822	$3,829	$5,780																	$12,431
316	Security Improvements (Per RRA Recommendations)	$160	0%	100%	0%						$160															$160
	Subtotal - General:					***$866***	***$6,404***	***$5,539***	***$7,280***	***$3,643***	***$988***	***$617***	***$640***	***$489***	***$513***	***$470***	***$1,746***	***$1,388***	***$914***	***$1,028***	***$884***	***$758***	***$578***	***$633***	***$441***	***$35,819***
	GFC Total:					***$348***	***$1,822***	***$2,849***	***$5,703***	***$0***	***$0***	***$0***	***$0***	***$2,471***	***$2,702***	***$1,473***	***$2,148***	***$863***	***$154***	***$2,314***	***$2,025***	***$2,310***	***$4,955***	***$9,000***	***$3,573***	***$44,708***
	RF Total:					***$2,413***	***$5,787***	***$9,563***	***$8,568***	***$6,837***	***$5,301***	***$5,382***	***$4,948***	***$2,331***	***$1,613***	***$3,125***	***$2,846***	***$2,488***	***$3,563***	***$3,387***	***$3,055***	***$1,859***	***$1,679***	***$1,733***	***$2,800***	***$79,279***
	Other Total:					***$3,852***	***$3,311***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$7,163***
	Total:	***$131,149***				***$6,613***	***$10,920***	***$12,412***	***$14,271***	***$6,837***	***$5,301***	***$5,382***	***$4,948***	***$4,802***	***$4,315***	***$4,598***	***$4,994***	***$3,351***	***$3,716***	***$5,700***	***$5,080***	***$4,169***	***$6,634***	***$10,733***	***$6,373***	***$131,149***

THIS PAGE INTENTIONALLY LEFT BLANK


SNOHOMISH COUNTY PUD #1
2022 CAPITAL IMPROVEMENT PLAN
INTEGRATED SERVICE AREA - MASTER PLAN
LEGEND:
EXISTING STEEL RESERVOIR
FUTURE STEEL RESERVOIR
EXISTING CONCRETE RESERVOIR
DEVELOPER FUNDED PROJECTS
CIP FUNDED PROJECTS
SYSTEM PIPE
PIPE TO BE REPLACED
FUTURE PRV
N
NOTES:
AGING PIPELINES FOR REPLACEMENT
(NOT INCLUDED IN SPECIFIC IDENTIFIED PROJECTS)
3.6 M.G.
3.9 M.G.
726 ZONE
(FUTURE PRV)
470 ZONE
726 ZONE
(FUTURE PUMP STATION)
500 ZONE
811 ZONE
(FUTURE PUMP STATION)
500 ZONE
811 ZONE
(FUTURE PRV)
760 ZONE
760 ZONE
(FUTURE PRV)
525 ZONE
SNOHOMISH COUNTY
PUD
PUBLIC UTILITY DISTRICT NO. 1
THIS MAP IS A GRAPHIC REPRESENTATION DERIVED FROM
THE SNOHOMISH COUNTY P.U.D. WATER RESOURCES
DEPARTMENT'S GEOGRAPHIC INFORMATION SYSTEM.
THIS MAP IS FOR ILLUSTRATIVE PURPOSES AND IT DOES NOT
REPRESENT SURVEY ACCURACY. THIS MAP IS BASED ON THE
BEST AVAILABLE INFORMATION AS OF THE DATE SHOWN ON
THE MAP.
Y:\WATER SYSTEM\GIS\MAPS\CIP\CIP_2022\CIP_2022.mxd



SNOHOMISH COUNTY PUD #1
2022 CAPITAL IMPROVEMENT PLAN
WARM BEACH - MASTER PLAN
LEGEND:
EXISTING STEEL RESERVOIR
FUTURE STEEL RESERVOIR
EXISTING CONCRETE RESERVOIR
DEVELOPER FUNDED PROJECTS
CIP FUNDED PROJECTS
SYSTEM PIPE
FUTURE PRV
NOTES:
AGING PIPELINES FOR REPLACEMENT
(NOT INCLUDED IN SPECIFIC IDENTIFIED PROJECTS)
N
CIP #57- for General FH Upgrades
CIP #309- Warm Beach Meter Box Replacement
52
53
54
55A
55B
206
202
0.5 M.G.
THIS MAP IS A GRAPHIC REPRESENTATION DERIVED FROM THE SNOHOMISH COUNTY P.U.D. WATER RESOURCES DEPARTMENT'S GEOGRAPHIC INFORMATION SYSTEM.
THIS MAP IS FOR ILLUSTRATIVE PURPOSES AND IT DOES NOT REPRESENT SURVEY ACCURACY. THIS MAP IS BASED ON THE BEST AVAILABLE INFORMATION AS OF THE DATE SHOWN ON THE MAP.
Y:\WATER SYSTEM\GIS\MAPS\CIP\CIP_2022\CIP_WB_2022.mxd

Chapter 12

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 12

Financial Plan

12.1 Introduction

This chapter was prepared by FCS GROUP to determine the total cost of providing water service to the customers of the District. The purpose of the financial plan is to demonstrate the financial viability of the water utility to meet the system needs outlined in the WSP update. This analysis considers historical performance, the sufficiency of utility revenues to meet current and future O&M needs, policy obligations, and the impact of executing the CIP. The following plan demonstrates the ability of the water utility to maintain sufficient funds to construct, operate, and manage the system on a continuing basis, in full compliance with federal, state, and local requirements through the end of the planning period.

12.2 Past Financial Performance

This section includes a historical summary of financial performance as reported by the District on fund resources and uses arising from cash transactions which is a useful indicator of the District's financial position.

12.2.1 Comparative Financial Statements

The District legally owns and operates a water utility. **Table 12-1** shows a summary of the utility fund resources and uses arising from cash transactions for the previous 6 years (2015 through 2020). Noteworthy findings and trends are discussed following the table to demonstrate the historical performance and condition of the District's water fund.

Table 12-1 | Summary of Historical Fund Resources and Uses Arising From Cash Transactions

Description (millions)	2015	2016	2017	2018	2019	2020
Operating Revenues:						
Sale of water	\$11.5	\$11.7	\$12.8	\$13.1	\$13.4	\$13.7
Other operating revenues	0.3	0.3	0.3	0.4	0.4	0.4
Total Operating Revenues	**\$11.8**	**\$12.0**	**\$13.1**	**\$13.5**	**\$13.8**	**\$14.1**

Description (millions)	2015	2016	2017	2018	2019	2020
Operating Expenses:						
Purchased water	$2.0	$2.1	$2.6	$2.4	$2.6	$2.9
Operations and maintenance	4.2	4.8	5.2	5.1	5.2	5.8
Depreciation	2.9	2.8	2.9	2.9	3.0	3.2
Taxes	0.6	0.6	0.6	0.7	0.7	0.6
Total Operating Expenses	**$9.8**	**$10.3**	**$11.3**	**$11.2**	**$11.6**	**$12.6**
Net Operating Income	**$2.0**	**$1.7**	**$1.8**	**$2.4**	**$2.2**	**$1.5**
Interest Charges	**$0.8**	**$0.7**	**$0.7**	**$0.6**	**$0.7**	**$0.3**
Other Income and Expense:						
Interest income	$0.2	$0.2	$0.2	$0.4	$0.6	$0.4
Net increase (decrease) in investments	0.01	0.01	(0.03)	0.05	0.06	(0.01)
Other income and expense, net	1.1	0.9	0.9	0	0.03	(0.02)
Total Other Income and Expense:	**$1.2**	**$1.1**	**$1.2**	**$0.5**	**$0.7**	**$0.3**
Capital Contributions:						
Cash contributions	$1.6	$2.8	$2.1	$3.4	$4.3	$4.3
Non-cash contributions	0.8	0.7	1.6	2.3	4.2	$2.1
Total Capital Contributions	**$2.4**	**$3.5**	**$3.7**	**$5.7**	**$8.4**	**$6.4**
Net Income	**$4.9**	**$5.7**	**$6.0**	**$7.9**	**$10.6**	**$7.9**
Non-cash contributions	($0.8)	($0.7)	($1.6)	($2.3)	($4.2)	($2.1)
Interest charges	0.8	0.7	0.7	0.6	0.7	0.3
Depreciation	2.9	2.8	2.9	2.9	3.0	3.2
Settlement amortization	(0.9)	(0.9)	(0.9)	0	0	0
Pension and OPEB liability adjustments	0.07	0.0	(0.2)	(0.3)	(0.4)	(0.4)
Net increase (decrease) in investments	0.01	(0.01)	0.03	(0.5)	(0.6)	0.1
Balance Available for Debt Coverage	**$6.8**	**$7.6**	**$6.9**	**$8.8**	**$9.8**	**$8.9**
Parity Debt Service Costs:						
Interest	$0.9	$0.8	$0.8	$0.7	$0.6	$0.4
Principal	1.7	1.7	1.7	1.7	1.6	1.2
Total Parity Debt Service Costs	**2.6**	**2.5**	**2.5**	**2.4**	**2.2**	**1.6**
Less: Assessment payments received	(0.1)	(0.1)	(0.1)	(0.1)	(0.03)	(0.02)
Debt Service Paid from Revenues	**$2.5**	**$2.4**	**$2.4**	**$2.3**	**$2.2**	**$1.6**
Parity Debt Service Coverage	**2.7x**	**3.1x**	**2.9x**	**3.8x**	**4.4x**	**5.5x**

12.2.1.1 Findings and Trends

- The District's sale of water charges increased from $11.5 million (M) in 2015 to $13.7M in 2020. The average annual increase is 3.6 percent per year, with a total increase of 19.1 percent from 2015 to 2020. 2017 saw the largest water sales increase of the six-year timeframe at 9.4 percent over 2016. Total operating expenses range from $9.8M in 2015 to $12.6M in 2020, showing increases every year, with the exception of 2018, where expenses decreased slightly under 1 percent. With an average increase of 5.2 percent, expenses have grown faster than revenues over the past 6 years and have increased 28.6 percent overall. While purchased water costs have contributed 32 percent of the total expense increase, the largest contributor to increases in expenses were operating and maintenance costs, accounting for 57 percent of the overall expense increase since 2015.

- The O&M Coverage Ratio (total operating revenues divided by total operating expenses) was 120 percent in 2015 and fluctuated between increases and decreases over the next six years, reaching a high of 121 percent in 2018 before ending at its lowest point of 112 percent in 2020. Despite the decrease between 2015 and 2020, a ratio of 100 percent or greater shows that revenue will successfully cover expenses, and the District has remained above this ratio for the past 6 years.

- Net Operating Income as a percent of Operating Revenue was 17 percent in 2015, fluctuating up and down and reaching a peak of 17.8 percent in 2018 before falling to the six-year low of 10.6 percent in 2020. Similar to the O&M Coverage Ratio, these trends help to show how successfully operating revenue actually covered operating expenses, with higher positive numbers being the best and negative numbers showing need for improvement.

- The Debt Service Coverage Ratio is to ensure the District is positioned to achieve favorable terms in the municipal bond market when issuing bonds for capital funding needs. The District's governance policy requires a minimum bond debt service coverage factor of 1.75. This ratio is calculated by dividing cash operating income (revenues less expenses before depreciation) by annual revenue bond expenses. The District's water utility had four outstanding revenue bonds over the last six years. The Debt Service Coverage Ratio for all outstanding debt ends 2015 at 2.70 and shows an upward trend thereafter, ending 2020 at 5.50. The year 2020 saw the largest increase in the debt coverage ratio as the District fully redeemed the 2006 revenue bonds and refunded one of the remaining revenue bonds. The ability of this ratio to remain at levels significantly higher than the District's policy minimum of 1.75 indicates a stable capacity for new debt and will likely result in favorable terms when entering the bond market.

12.3 Current Financial Structure

This section summarizes the current financial structure used as the baseline for the capital financing strategy and financial forecast developed for this WSP.

12.3.1 Financial Plan

The water utility is responsible for funding all of its costs. The primary source of funding is derived from ongoing monthly charges for service, with additional revenues coming from new service connections, property rentals, surcharge revenue, local utility district payments and other miscellaneous revenue. The District controls the level of user charges and, subject to the Board of Commissioners, can adjust user charges as needed to meet financial objectives.

The financial plan can only provide a qualified assurance of financial feasibility if it considers the total system costs of providing water services, both operating and capital. To meet these objectives, the following elements have been completed.

1. **Capital Funding Plan**. The District's 20-year CIP, as detailed more fully in **Chapter 11**, identifies the total obligations of the planning period. The plan defines a strategy for funding the CIP, including an analysis of available resources from rate revenues, existing reserves, General Facilities Charges, debt financing, and any special resources that may be readily available (e.g., grants, developer contributions, etc.). The capital funding plan impacts the financial plan through the use of debt financing (resulting in annual debt service) and the assumed rate revenue available for capital funding.

2. **Financial Forecast.** Identifies future annual non-capital costs associated with the operation, maintenance, and administration of the water system. Included in the financial plan is a reserve analysis that forecasts cash flow and fund balance activity, along with testing for satisfaction of actual or recommended minimum fund balance policies. The financial plan ultimately evaluates the sufficiency of utility revenues in meeting all obligations, including cash uses such as operating expenses, debt service, capital outlays, and reserve contributions, as well as any coverage requirements associated with long-term debt. The plan also identifies the future adjustments required to fully fund all utility obligations in the planning period.

12.3.1.1 Capital Funding Plan

The CIP developed for this WSP identifies $87.0M in escalated project costs over the 10-year planning horizon. The 20-year period totals $172.1M in escalated project costs. Costs were escalated by 2.79 percent annually to the year of planned spending.

A summary of the 10-year and 20-year CIP is shown in **Table 12-2.** As shown, each year has varied capital cost obligations depending on construction schedules and infrastructure planning needs. Approximately 50 percent of the escalated capital costs are included in the 10-year planning period. **Table 12-3** provides more detail for the 10-year CIP.

Table 12-2 | 10- and 20-Year CIP

Year	Capital Expenditures (escalated)
2021	$5.7
2022	$13.3
2023	$13.5
2024	$15.9
2025	$7.8
2026	$6.3
2027	$6.5
2028	$6.2
2029	$6.2
2030	$5.7
10-Year Total	**$87.0**
2031-2040	**$85.1**
20-Year Total	**$172.1**

Table 12-3 | 10 Year CIP (Escalated $)

Project	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Distribution	$3.3	$4.2	$4.1	$1.4	$2.2	$5.1	$5.2	$5.4	$2.4	$2.9	$36.2
Transmission	$0.0	$1.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$1.0	$2.1	$5.0
Pumping	$0.0	$0.2	$0.0	$0.3	$0.0	$0.0	$0.0	$0.0	$2.2	$0.0	$2.8
Storage	$1.3	$0.0	$3.4	$6.0	$1.5	$0.0	$0.5	$0.0	$0.0	$0.0	$12.8
Meters & Services	$0.3	$3.8	$4.5	$6.8	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5	$18.2
General	$0.6	$3.1	$1.5	$1.3	$3.8	$0.7	$0.3	$0.3	$0.1	$0.2	$11.9
Total	**$5.7**	**$13.3**	**$13.5**	**$15.9**	**$7.8**	**$6.3**	**$6.5**	**$6.2**	**$6.2**	**$5.7**	**$87.0**

12.3.1.2 Capital Financing Strategy

An ideal capital financing strategy would include the use of grants and low-cost loans when debt issuance is required. However, these resources are very limited and competitive in nature and do not provide a reliable source of funding for planning purposes. It is recommended that the District pursue these funding avenues but assume bond financing to meet the needs for which the District's available cash resources are insufficient. Revenue bonds have been used as the debt funding instrument in this analysis. The capital financing strategy developed to fund the CIP identified in this WSP assumes the following funding resources:

- Accumulated cash reserves;
- Excess cash (over minimum balance targets) from the Water System Revenue Fund;
- General Facilities Charge revenues;
- Interest earned on fund balances and other miscellaneous capital resources; and
- Revenue bond financing.

Based on information provided by the District, the water utility began 2021 with $24.6M in total funds.

The cash resources described above are anticipated to fund 55 percent of the 10-year CIP and 59 percent of the 20-year CIP. The remaining funding will come from new debt obligations of $70.1M over the twenty-year forecast period. **Table 12-4** presents the corresponding 20-year capital financing strategy.

Table 12-4 | 20-Year Capital Funding Strategy

Year	Capital Expenditures (escalated)	Revenue Bond Annual Funding	Cash Funding	Total Financial Resources
2021	$5.7	$0.0	$5.7	$5.7
2022	$13.3	$0.0	$13.3	$13.3
2023	$13.5	$13.5	$0.0	$13.5
2024	$15.9	$2.8	$13.2	$15.9
2025	$7.8	$7.8	$0.0	$7.8
2026	$6.3	$2.3	$4.0	$6.3
2027	$6.5	$6.5	$0.0	$6.5
2028	$6.2	$3.6	$2.5	$6.2
2029	$6.2	$3.0	$3.2	$6.2
2030	$5.7	$0.0	$5.7	$5.7
Subtotal	**$87.0**	**$39.5**	**$47.5**	**$87.0**
2031-2040	**$85.1**	**$30.7**	**$54.5**	**$85.1**
Total	**$172.1**	**$70.1**	**$102.0**	**$172.1**

12.4 Available Funding Assistance and Financing Resources

Feasible long-term capital funding strategies must be defined to ensure that adequate resources are available to fund the CIP identified in this WSP. In addition to the District's resources, such as accumulated cash reserves, capital revenues, and rate revenues designated for capital purposes, capital needs can be met from outside sources, such as grants, low-interest loans, and bond financing. The following is a summary of the District's internal and external resources.

12.4.1 District Resources

Resources appropriate for funding capital needs include accumulated cash reserves in excess of minimum balance targets, rate revenues designated for capital spending purposes, and capital-related charges such as General Facilities Charge and Distribution System Charge revenues. The first two resources will be discussed in the **Fiscal Policies** section of the Financial Forecast. Capital-related charges are discussed below.

12.4.1.1 General Facilities Charge

The District's General Facilities Charge (GFC) is a one-time charge imposed on new customers as a condition of connecting to the water system that is intended to finance new source, storage, and transmission related capital improvements. The purpose of the GFC is two-fold: 1) to promote equity between new and existing customers; and 2) to provide a source of revenue to fund capacity related capital projects. The GFC funds can only be used to fund specific capacity related capital projects or to pay debt service incurred to finance those projects. In 2021, the District charged all new customers a GFC of $3,645 per ERU.

12.4.1.2 Distribution System Charges

While the GFC is the manner in which new customers pay their share of capacity related plant investment costs, local facilities funding is used to pay the costs of local facilities that connect each property to the system's infrastructure. Local facilities funding is often overlooked in rate forecasting because it is funded upfront by either connecting customers and developers, or through an assessment to properties, but never from rates.

A number of mechanisms can be considered toward funding local facilities. One of the following scenarios typically occurs: (a) the utility charges a connection fee based on the cost of the local facilities (under the same authority as the GFCs); (b) a developer funds an extension of the system to its development and turns those facilities over to the utility (contributed capital); or (c) a local assessment is set up called a Utility Local Improvement District (ULID/LID) or a Local Utility District (LUD), which collects tax revenue from benefited properties.

The Distribution System Charge (DSC) is a District-imposed charge to recover the cost related to service extension to local properties. Often called a front-footage charge and imposed on the basis of footage of the main "fronting" a particular property, it is usually implemented as a reimbursement mechanism to the District or third-party developer incurred for the cost of a local facility that directly serves a property. It is a form of connection charge and thus can accumulate up to 10 years of interest. It typically applies in instances when no developer-installed facilities are needed through developer extension due to the prior existence of available mains already serving the developing property. In 2021, the District applied a DSC of $4,210 per parcel for a single-family resident. Multi-family and commercial customers are charged a DSC of $38.00 per front foot.

The developer extension is a requirement that a developer install on-site and sometimes off-site improvements as a condition of extending service. These are in addition to the GFC required and must be built to District standards. Part of the agreement between the District and the developer planning to extend service might include a latecomer agreement, resulting in a latecomer charge to new connections for the developer extension.

12.4.2 Outside Resources

This section outlines various grant, loan, and bond opportunities available to the District through federal and state agencies to fund the CIP identified in the WSP.

12.4.2.1 Grants and Low-Cost Loans

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However, these assistance programs have been mostly eliminated, substantially reduced in scope and amount, or replaced by loan programs. Remaining miscellaneous grant programs are generally lightly funded and heavily subscribed. Nonetheless, even the benefit of low-interest loans makes the effort of applying worthwhile. Grants and low-cost loans for the State utilities are available from the Department of Commerce and DOH, including two assistance programs for which the District may be eligible. In addition, federal assistance is available through the Water Infrastructure Funding Innovation Act (WIFIA).

Public Works Board (PWB) – Cities, counties, special purpose districts, public utility districts, and quasi-municipal governments are eligible to receive loans from the PWB. Eligible projects include repair, replacement, and construction of infrastructure for domestic water, sanitary wastewater, stormwater, solid waste, road, and bridge projects that improve public health and safety, respond to environmental issues, promote economic development, or upgrade system performance.

The PWB loans are available at interest rates ranging from 0.23 percent to 0.94 percent depending on the repayment term, with reduced interest rates available for all projects located in communities that have been declared a natural disaster. The standard loan offer is 0.94 percent interest repaid over a 20-year term. All loan terms are subject to negotiation and Board approval. Currently, no local match is required, and the maximum loan amount is $10M per jurisdiction per biennium.

The PWB loan process typically begins annually in the summer.

Information regarding the application process, as well as rates and terms, are posted on the PWB website in early spring. Further detail is available at http://www.pwb.wa.gov.

Drinking Water State Revolving Fund (DWSRF) Loan Program – DWSRF funding historically targets protection of public health, compliance with drinking water regulations and assistance for small and disadvantaged communities and is administered by the DOH. Terms are up to 20 years to pay back, and in some cases, provide partial loan forgiveness. Interest rates are 1.25 to 1.75 percent and no local match is required.

Applicants need an approved water system plan, or plan amendment, containing the DWSRF project prior to submitting an application. All public water systems that receive a DWSRF loan must undergo an environmental review, a cultural review, and an Investment Grade Efficiency Audit (IGEA). The IGEA is an effort to apply energy efficiency to water systems and may be financed as part of the DWSRF loan.

The DWSRF takes applications annually in the fall. Further detail is available at http://www.doh.wa.gov.

Water Infrastructure Funding Innovation Act (WIFIA) – The WIFIA was established in 2014 as a federal credit program administered by the EPA for eligible water and wastewater infrastructure projects. Loans can be used on development phase activities, including preliminary engineering, design, revenue forecasting and other pre-construction activities, as well as construction activities, acquisition of real property and environmental mitigation.

Terms for repayment extend for up to 35 years with interest rates lower than market and the added benefit of repayment deferrals up to five years after substantial completion of the project. Additional information regarding funding availability and the application process can be found at https://www.epa.gov/wifia.

12.4.2.2 Bond Financing

General Obligation Bonds – General obligation (G.O.) bonds are bonds secured by the full faith and credit of the issuing agency, committing all available tax and revenue resources to debt repayment. With this high level of commitment, G.O. bonds have relatively low interest rates and few financial restrictions.

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

Revenue Bonds – Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility. With this limited commitment, revenue bonds typically bear higher interest rates than G.O. bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (added bond debt service coverage). The District agrees to satisfy these requirements by resolution as a condition of bond sale.

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

12.5 Financial Forecast

The financial forecast, or revenue requirement analysis, forecasts the amount of annual revenue that needs to be generated by user rates. The analysis incorporates operating revenues, O&M expenses, debt service payments, rate-funded capital needs, and any other identified revenues or expenses related to operations. The objective of the financial forecast is to evaluate the sufficiency of the current level of rates. In addition to annual operating costs, the revenue needs also include debt covenant requirements and specific fiscal policies and financial goals of the District.

The analysis determines the amount of revenue needed in a given year to meet that year's expected financial obligations. For this analysis, two revenue sufficiency tests have been developed to reflect the financial goals and constraints of the District: cash needs must be met; and debt coverage requirements must be realized. In order to operate successfully with respect to these goals, both tests of revenue sufficiency must be met.

Cash Test – The cash flow test identifies all known cash requirements for the District in each year of the planning period. Typically, these include O&M expenses, debt service payments, rate-funded system reinvestment funding or directly funded capital outlays, and any additions to specified reserve balances. The total annual cash needs of the District are then compared to projected cash revenues using the current rate structure. Any projected revenue shortfalls are identified, and the rate increases necessary to make up the shortfalls are established.

Coverage Test – The coverage test is based on a commitment made by the District when issuing revenue bonds and some other forms of long-term debt. For the purposes of this analysis, revenue bond debt is assumed for any needed debt issuance. As a security condition of issuance, the District would be required per covenant to agree that the revenue bond debt would have a higher priority for payment (a senior lien) compared to most other expenditures; the only outlays with a higher lien are O&M expenses. Debt service coverage is expressed as a multiplier of the annual revenue bond debt service payment. For example, a 1.00 coverage factor would imply that no additional cushion is required. A 1.75 coverage factor means revenue must be sufficient to pay O&M expenses, annual revenue bond debt service payments, and an additional 75 percent of annual revenue bond debt service payments. The excess cash flow derived from the added coverage, if any, can be used for any purpose, including funding capital projects. Targeting a higher coverage factor can help the District achieve a better credit rating and provide lower interest rates for future debt issues.

In determining the annual revenue requirement, both the cash and coverage sufficiency test must be met, and the test with the greatest deficiency drives the level of needed rate increase in any given year.

12.5.1 Current Financial Structure

The District maintains a fund structure and implements financial policies that target management of a financially viable and fiscally responsible water system.

12.5.1.1 Financial Policies

A brief summary of the key financial policies employed by the District, as well as those recommended and incorporated in the financial program, are discussed below.

Water System Revenue Fund – The Water System Revenue Fund is an operating reserve. Operating reserves are designed to provide a liquidity cushion to ensure that adequate cash working capital will be maintained to deal with significant cash balance fluctuations, such as seasonal fluctuations in billings and receipts, unanticipated cash expenses, or lower than expected revenue collections.

Like other types of reserves, operating reserves also serve another purpose: they help smooth rate increases over time. Target funding levels for an operating reserve are generally expressed as a certain number of days of O&M expenses, with the minimum requirement varying with the expected revenue volatility. Industry practice for utility operating reserves ranges from 30 days to 120 days of O&M expenses, with the lower end more appropriate for utilities with stable revenue streams and the higher end more appropriate for utilities with significant seasonal or consumption-based fluctuations. The District's financial reserve policy requires a minimum balance in the Water System Revenue Fund equal to 90 days of O&M expenses for working capital.

General Facility Charge Reserve – The District retains funds from their GFC revenue in a separate fund. The District's financial reserve policy guides the spending of the accumulated funds each year. Funds in this reserve are spent on capital projects related to providing water supply, storage, or transmission related projects. There is not a target level to be maintained within the fund, except the practical limit that the balance should never fall below zero.

System Reinvestment – System reinvestment funding promotes system integrity through reinvestment in the system. Target system reinvestment funding levels are commonly linked to annual depreciation expense as a measure of the decline in asset value associated with routine use of the system. Particularly for utilities that do not already have an explicit system reinvestment policy in place, implementing a funding level based on full depreciation expense could significantly impact rates. A common alternative benchmark is annual depreciation expense net of debt principal payments on outstanding debt. This approach recognizes that customers are still paying for certain assets through the debt component of their rate and intends to avoid simultaneously charging customers for an asset and its future replacement. The specific benchmark used to set system reinvestment funding targets is a matter of policy that must balance various objectives, including managing rate impacts, keeping long-term costs down, and promoting "generational equity" (i.e., not excessively burdening current customers with paying for facilities that will serve a larger group of customers in the future).

The District's approach to system reinvestment is to direct the remaining revenues after the O&M and debt service expenses have been satisfied to first fund the Water System Revenue Fund target and then capital needs. As a result, rate revenues do contribute to the funding of capital projects, but the level of funding can be inconsistent from year to year. Capital funding from rates is available to fund replacement/reinvestment CIP and varies from $421,000 to $2.3M depending on the year. Those funds not used to pay for CIP in any given year, remain in the capital fund for future replacement/reinvestment needs. The District may want to consider a dedicated system reinvestment transfer to the capital fund in the future as a long-term funding strategy to smooth the rate impacts of cash-funding the repair and replacement projects identified in the twenty-year CIP.

Debt Management – It is prudent to consider policies related to debt management as part of a broader utility financial policy structure. Debt management policies should be evaluated and formalized, including the level of acceptable outstanding debt, debt repayment, bond coverage, and total debt coverage targets. For any existing and future revenue bond assumptions, coverage is tested at the District's governance policy target of 1.75.

12.5.1.2 Financial Forecast

The financial forecast is established from the 2021 budget documents along with other key factors and assumptions to develop a complete portrayal of the District's annual financial obligations for the water utility. The following is a list of the key revenue and expense factors and assumptions used to develop the financial forecast.

- **Revenue** – The District has three general revenue sources: 1) water rate revenues 2) wholesale rate revenues and 3) miscellaneous (non-rate) revenue. In the event of a forecasted annual shortfall, water rate revenues can be increased to meet the annual revenue requirement. For the purpose of this financial forecast, water rate revenues are based on the 2021 budget values and increase with customer growth. Wholesale rate revenues are forecasted to increase with overall system growth. No wholesale rate increases are assumed in this forecast. Wholesale rates are currently being evaluated as part of a separate rate study effort and will be presented to the District for consideration at a later date. Non-rate revenues are forecast to increase with customer growth, demand growth, general cost inflation or not escalate depending on the nature of the revenue.

- **Growth** – Rate revenue is escalated based on the demand growth rates for the Lake Stevens Integrated System as detailed in **Chapter 5, Planning Date and Demand Forecasting**. The annual growth rate is projected to be 1.51 percent from 2021 through 2025, 1.31 percent from 2026 through 2030, 1.15 percent from 2031 through 2035, and 1.16 percent from 2036 through 2040.

- **General Facilities Charge Revenue** – The existing GFCs are applied to the projected new connections to forecast revenue. Based on the growth assumptions described above, the GFC will generate an average of $1.5M annually from 2021-2040. This equates to an average of 417 new connections per year. The GFC revenue is directed towards annual capital needs.

- **Expenses** – The O&M expense projections are based on the 2021 budget and forecasted to increase with general cost inflation of 2.30 percent, labor cost inflation of 3.00 percent, benefit cost inflation of 2.24 percent, Everett purchased water cost inflation averaging 2.40 percent, and union step increases of 1.20 percent.

- **Existing Debt** – The District currently has two outstanding revenue bonds, the 2011 Series revenue bond and the 2019 Series refunding revenue bond. Full repayment is planned for 2022 on the 2011 Series bond while the 2019 series bond will be fully repaid in 2031. In addition to revenue bonds the District has five Public Works Trust Fund (PWTF) loans and one DWSRF. Repayment on the low-interest loans ranges from 2022 to 2040. Annual debt service payments begin 2021 at $2.0M, falling to an average of $1.1M from 2023-2031 and finally dropping to an average of $194,000 annually through the end of the planning period.

- **Future Debt** – The capital funding strategy developed for this WSP forecasts the need for six debt issuances within the planning period: $16.24M in new debt proceeds in 2023, followed by $10.14M in 2025, $10.14M in 2027, $2.95M in 2029, $4.8M in 2031, $9.2M in 2033, $3.45M in 2036, and $13.2M in 2039. Annual new debt service payments are forecast to increase from $713,000 with the first issuance to a maximum of $5.7M with the eighth issuance in 2039. The analysis performed assumes revenue bond financing.

- **Revenue Bond Assumptions** – Future debt is assumed to be revenue bonds each with a 20-year term, a 4.00 percent interest rate and a 1.50 percent issuance cost. The 2023 revenue bond assumes one (1) year of interest only payment.

- **Interfund Loan** – The District plans to transfer $1.7M from the GFC Reserve to the Water System Revenue Fund in 2022. The Water System Revenue Fund will reimburse the GFC Reserve the full amount borrowed in 2023 including 0.5 percent of interest.

- **Fund Balances** – Any Water System Revenue Fund balance above the minimum requirement is assumed to be available to fund capital projects. The 2021 Water System Revenue Fund balance is expected to end the year above 90 days of O&M expenses at $6.8M, or $2.5M above target.

Although the financial plan is completed for the 20-year time horizon of this WSP, the rate strategy focuses on the shorter-term planning period of 2021 through 2030. As is the current practice, it is recommended that the District revisit the proposed rates each year to ensure that the rate projections developed remain adequate. Any significant changes should be incorporated into the financial plan and future rates should be adjusted as needed.

Table 12-5 summarizes the annual revenue requirements based on the forecast of revenues, expenditures, fund balances, and fiscal policies.

Table 12-5 | 10-Year Financial Forecast

Revenue Requirement	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Revenues (millions)										
Rate Revenues (existing rates)	$13.8	$12.4	$12.6	$13.0	$13.4	$13.6	$13.8	$13.9	$14.1	$14.3
Wholesale Rate Revenues	$0.7	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.6
Non-Rate Revenues	$0.9	$1.4	$1.4	$1.5	$1.6	$1.7	$1.7	$1.8	$1.8	$1.8
Total Revenues	**$15.4**	**$14.3**	**$14.6**	**$15.0**	**$15.5**	**$15.8**	**$16.0**	**$16.2**	**$16.4**	**$16.6**

Revenue Requirement	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Expenses (millions)										
Cash Operating Expenses	$10.6	$11.4	$11.1	$11.0	$12.0	$12.4	$12.8	$13.4	$13.8	$14.6
Existing Debt Service	$2.0	$2.2	$1.2	$1.2	$1.2	$1.2	$1.2	$1.1	$1.1	$1.0
New Debt Service			$0.7	$1.4	$2.2	$2.2	$3.0	$3.0	$3.2	$3.2
Total Expenses	**$12.6**	**$13.6**	**$13.0**	**$13.6**	**$15.4**	**$15.7**	**$17.0**	**$17.6**	**$18.2**	**$18.9**
Total Surplus (Deficiency)	**$2.8**	**$0.7**	**$1.5**	**$1.5**	**($0.2)**	**($0.1)**	**($1.0)**	**($1.3)**	**($1.8)**	**($2.3)**
Proposed Rate Strategy	**0.00%**	**1.75%**	**2.15%**	**2.15%**	**2.15%**	**2.15%**	**2.25%**	**2.25%**	**2.25%**	**2.25%**
Cash Flow after Rate Increase	**$2.8**	**$0.8**	**$2.0**	**$2.2**	**$1.2**	**$1.5**	**$0.8**	**$0.8**	**$0.7**	**$0.6**

The financial forecast indicates that the utility is currently covering all financial obligations under existing rates, however as the District prepares to fund the $172.1M in needed capital improvements identified in the WSP, rates will need to increase annually to support the capital funding plan. The financial plan proposes the following rate increases and debt issuances to satisfy the identified future obligations of the utility, allowing for 59percent cash funding of future capital improvements:

- 1.75 percent in 2022, followed by 2.50 percent from 2023 through 2026, 2.25 percent from 2027 through 2031 and 3.15 percent from 2032 through 2040.
- Four new revenue bonds proposed in the ten-year planning period:
  - $24M revenue bond in 2023, $10.14M revenue bond in 2025, $10.14M revenue bond in 2027, and a $2.95M revenue bond in 2029.
  - Annual new debt service payments are forecast to increase from $713,000 with the first issuance to $3.2M by the third new debt issuance. Including this new debt, total debt service will increase from $2.0M in 2021 to $4.3M by 2030.

12.5.1.3 District Funds and Reserves

Table 12-6 shows a summary of the projected Water System Revenue Fund and GFC fund ending balances through 2030 based on the rate forecasts presented above. The Water System Revenue Fund is maintained at a minimum of 90 days of O&M expenses.

Table 12-6 | Ending Cash Balance Summary

Ending Fund Balances	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Water System Revenue Fund	$6.80	$3.40	$10.00	$3.30	$7.30	$3.10	$8.10	$3.30	$4.50	$3.60
General Facility Charge Fund	$16.70	$14.60	$14.90	$10.50	$12.50	$14.30	$16.30	$18.30	$17.20	$15.80
Total	**$23.50**	**$18.00**	**$25.00**	**$13.80**	**$19.80**	**$17.50**	**$24.30**	**$21.60**	**$21.80**	**$19.40**

12.6 Current and Projected Rates

12.6.1 Current Rates

The existing water rates are composed of a fixed monthly charge per account and a variable consumption charge per ccf for all water usage. Charges are different for each customer class. **Table 12-7** shows the existing rate schedule. The District also offers discounted rates for single family customers of between 25 and 50 percent of total bills dependent on a customer's income level.

Table 12-7 | Existing Schedule of Rates

Existing Rates	
Single Family	**Monthly Rates**
Fixed (per acct)	$22.98
Variable (per ccf)	$3.52
Multi Family	
Fixed (per acct)	$23.09
Variable (per ccf)	$3.34
Commercial	
Fixed (per acct)	$50.17
Variable (per ccf)	$3.24

12.6.2 Projected Rates

The financial forecast discussed above indicates that the utility is currently covering all financial obligations under existing rates, however as the District prepares to fund the needed capital improvements identified in the WSP, rates will need to increase annually to support the capital funding plan. Rates are forecast to increase 1.75 percent in 2022, followed by 2.15 percent from 2023 through 2026, 2.25 percent from 2027 through 2031, and 3.15 percent from 2032 through 2040. **Table 12-8** shows the projected rates with increases applied uniformly to all rate components for all customer classes.

Table 12-8 | Projected Schedule of Rates

Class	Existing Rates 2021	Proposed Rates 2022	2023	2024	2025	2026	2027	2028	2029	2030
Single Family										
Fixed (per acct)	$22.98	$23.38	$23.88	$24.39	$24.91	$25.45	$26.02	$26.61	$27.21	$27.82
Variable (per ccf)	$3.52	$3.58	$3.66	$3.74	$3.82	$3.90	$3.99	$4.08	$4.17	$4.26
Multi Family										
Fixed (per acct)	$23.09	$23.49	$24.00	$24.52	$25.05	$25.59	$26.17	$26.76	$27.36	$27.98
Variable (per ccf)	$3.34	$3.40	$3.47	$3.54	$3.62	$3.70	$3.78	$3.87	$3.96	$4.05
Commercial										
Fixed (per acct)	$50.17	$51.05	$52.15	$53.27	$54.42	$55.59	$56.84	$58.12	$59.43	$60.77
Variable (per ccf)	$3.24	$3.30	$3.37	$3.44	$3.51	$3.59	$3.67	$3.75	$3.83	$3.92

In 2003 the Washington State Legislature passed the Municipal Water Supply Efficiency Requirements Act. The Water Use Efficiency rules went into effect on January 22, 2007, and typically apply to WSPs that each jurisdiction is required to develop every six to ten years. The RCW outlines the rules of this act, under RCW 70.119.180. In section 4(B), the RCW states that jurisdictions must perform an "evaluation of the feasibility of adopting and implementing water delivery rate structures that encourage water conservation." A utility does not need to actually adopt such a rate structure, but is required to consider it, which is what the following analysis represents. Based on these guidelines a single-family tiered rate structure and a non-residential seasonal structure were developed as outlined in **Table 12-9**. The single-family tiered structure assesses fees per unit of consumption for use that falls into three tiers. Usage that falls below the class average will be charged the lowest amount per unit while rates will increase for customers that use more than the class average monthly. The non-residential seasonal structure will charge higher fees per unit of consumption during the summer months when supply is constrained.

One water conservation rate structure option for the District to consider in the future is separate rates for each of the District's water systems. Individual rate structures for each system may provide more targeted conservation incentives based on the unique water use characteristics of each system.

Table 12-9 | Conservation Based Rate Structure

Conservation Rate Structure	
Single Family	Monthly Rates
Fixed (per acct)	$22.98
Tiered Variable Rates	
Tier 1 (0-7 ccf)	$3.25
Tier 2 (8-14 ccf)	$3.90
Tier 3 (+ 15 ccf)	$4.78
Multi Family	
Fixed (per acct)	$23.09
Seasonal Variable Rates	
Winter (per ccf)	$3.25
Summer (per ccf)	$3.47
Commercial	
Fixed (per acct)	$50.17
Seasonal Variable Rates	
Winter (per ccf)	$3.15
Summer (per ccf)	$3.36

12.7 Affordability

The DOH and the Department of Commerce Public Works Board use an affordability index to prioritize low-cost loan awards depending on whether rates exceed 2.50 percent of the median household income for the service area. The average median household income for Snohomish County was $86,691 between 2015 and 2019 according to the U.S. Census Bureau. The 2019 value is escalated based on the assumed 2.30 percent general cost inflation to show the median household income in future years. **Table 12-10** presents the District's rates projected to 2030, tested against the 2.50 percent monthly affordability threshold.

Table 12-10 | Affordability Test

Year	Inflation	Median Household Income	2.50% Monthly Threshold	Projected Monthly Bill[1]	% of HH Income
2019		$86,691			
2020	2.30%	$88,685			
2021	2.30%	$90,725	$189.01	$47.62	0.63%
2022	2.30%	$92,811	$193.36	$48.45	0.63%
2023	2.30%	$94,946	$197.80	$49.50	0.63%
2024	2.30%	$97,130	$202.35	$50.56	0.62%
2025	2.30%	$99,364	$207.01	$51.65	0.62%
2026	2.30%	$101,649	$211.77	$52.76	0.62%
2027	2.30%	$103,987	$216.64	$53.94	0.62%
2028	2.30%	$106,379	$221.62	$55.16	0.62%
2029	2.30%	$108,825	$226.72	$56.40	0.62%
2030	2.30%	$111,328	$231.93	$57.67	0.62%

Note:
1. Assumes single family account with 7 ccf of usage monthly

The affordability test indicates that the District's rates are forecasted to remain below the 2.50 percent affordability threshold through 2030.

12.8 Conclusion

The results of this analysis indicate that annual rate increases are needed to provide revenue sufficient to cover all financial obligations of the utility. Rate increases are proposed at 1.75 percent in 2022, followed by 2.15 percent from 2023 through 2026, 2.25 percent from 2027 through 2031 and 3.15 percent from 2032 through 2040.

It is important to remember that the analysis performed in this chapter assumes population growth rates based on the assumptions outlined in **Chapter 5, Planning Date and Demand Forecasting**. If the future growth rates change, the existing rate strategy may need to be updated and revised.

It is recommended that the District continue with the current practice of regular annual rate reviews and to update the key underlying assumptions that compose the multi-year financial plan to ensure that adequate revenues are collected to meet the District's total financial obligations.

THIS PAGE INTENTIONALLY LEFT BLANK

1102 BROADWAY PLAZA, SUITE #401
TACOMA, WA 98402
www.murraysmith.us