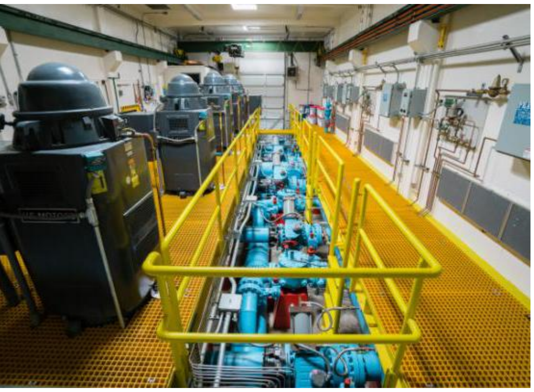
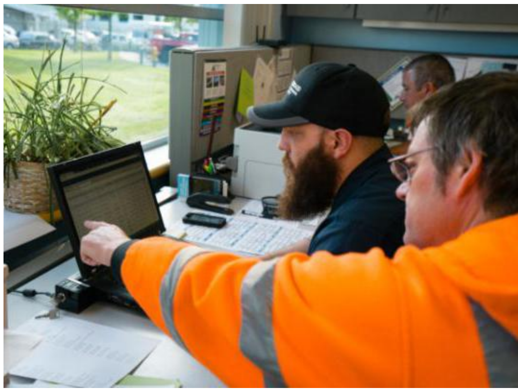
2017
Comprehensive Plan
WATER





ALDERWOOD
WATER & WASTEWATER
DISTRICT

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ALDERWOOD
WATER & WASTEWATER
DISTRICT

Comprehensive Water Plan

September 2017

Board of Commissioners

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Acknowledgements

Thanks to the Board of Commissioners, for their reviews and insight comments.

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Our thanks to the District staff in all departments who participated in the Mock CIP Event, Living Plan Introductory Meeting Mapping Exercise and Living Plan Listening Tour. Their contribution of ideas, observations and efforts helped make this Plan a useful tool for the future.

Consumer Meeting

An informational meeting for the District's Consumers was held as part of a Board of Commissioners work session on February 4, 2018. This meeting meets State requirement 246-290-100 (8), Washington Administrative Code.

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Abbreviations

ACV	Altitude Control Valve
AFF	Available fire flow
ADD	Average Day Demand
Add'l	Additional
AMD	Average Month Demand
ACS	American Community Survey
AMI	Advanced Metering Infrastructure
AMP	Asset Management Program
Approx	Approximate, Approximately
APWA	American Public Works Association
AVAR	Air Vacuum/ Air Release Valve
AWWA	American Water Works Association
BAT	Backflow Assembly Tester
BLR	Buildable Lands Report
CAD	Computer Aided Drawing
CCC	Cross-Connection Control
CCF	Hundred Cubic Feet
CCI	Construction Cost Index
CCR	Consumer Confidence Rule
CCS	Cross-Connection Control Specialist
CCTV	Close Captioned Television
CDC	US Dept of Health & Human Services, Centers for Disease Control & Prevention
CDD	Cooling Degree Days
CEU's	Continuing Education Units
CFR	United States Code of Federal Regulations
CI	Cast iron
CIP	Capital Improvement Plan
CIPC	Cast-in-Place Concrete (Conventional Reinforced)
CL2	Chlorine Analyzer
CMMS	Computerized Maintenance Management System
CMP	Coliform Monitoring Plan
CON	Concrete Cylinder

CVWD	Cross Valley Water District
CWP	Comprehensive Water Plan
CWS	Clearview Water Supply
CWSA	Clearview Water Supply Agency
DBPs	Disinfection Byproducts
Dept	Department
DHS	Department of Homeland Security
Dia	Diameter
DI	Ductile iron
D/DBP	Disinfection/Disinfection Byproduct Monitoring
DOE	Washington State Department of Ecology
DOH	Washington State Department of Health
DRP	Drought Response Plan
DSL	Distribution System Leakage
DWSRF	Drinking Water State Revolving Fund (Table 14.3)
EL	Elevation (feet, NAVD88, unless otherwise noted)
EPA/USPA	(United States) Environmental Protection Agency
ER&R	Equipment Repair & Replacement
ERU	Equivalent Residential Unit; ADD for a single-family household
EWSA	Everett Water Service Area
EWUC	Everett Water Utility Council
FEMA	Federal Emergency Management Agency
FAZ	Forecast Analysis Zone
FSIS	Facility Site Database (Washington State Dept. of Ecology)
Ft	Feet
Ft/s	Feet per second
FTE	Full-Time Employee
Gal	Gallon
GFC's	General Facilities Charge
GIS	Geographic Information System
GMA	Growth Management Act
gpcd	Gallon per Capita per Day
gpd	Gallon per Day

gpm	Gallon per Minute
GST	Galvanized Steel
HAAs/HAA5s	Haloacetic Acids
HDPE	High Density polyethylene
HET	High Efficiency Toilet
HGL	Hydraulic grade line, in Feet
HOA	Homeowners Association
HPC	Heterotrophic Plate Count
HVAC	Heating, Venting, Air Conditioning
hp	Horsepower
HWG	Hazardous Waste Generator
HWP	Hazardous Waste Planner
ICI	Industrial/Commercial/Industrial (Table 3.4)
IOC	Inorganic Compounds
IR	Indoor Residential (Table 3.4)
IT	Information Technology
KCWTD	King County Wastewater Treatment Division
L&I	Labor & Industries
LID	Local Improvement District
LOS	Level of Service
LUST	Leaking Underground Storage Tank, Undergoing cleanup
M&O	Maintenance & Operations
Max	Maximum
MCL	Maximum Contaminant Level or Maximum Allowable Level (Table 7.3)
MCLG	Maximum Contaminant Level Goal
MDD	Maximum Day Demand or Maximum Demand Day
MF	Multi-Family
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
Min	Minimum
MMD	Maximum Month Demand
MWD	Maximum Week Demand (daily demand over 7-day period with max demand)

MTS	Manual Transfer Switch
NIMS	National Incident Management System
NIS	Not in Service
NR	Non-Revenue Flows
NWIMT	Northwest Washington Incident Management Team
OSHA	Occupational Health and Safety Administration
O&M	Operations & Maintenance
O	Outdoor (Table 3.4)
PF	Peaking Factor
PH	Potential of Hydrogen
PHD	Peak Hour Demand
PNR	Public Notification Rule
PNWS-AWWA	Pacific Northwest Section – American Water Works Association
Pop	Population
ppm	Parts per Million (1 ppm = 1 mg/L in water at 4° C or 39° F)
PRV	Pressure Reducing Valve
PSC	Pre-Stressed Concrete
psi	Pounds per Square Inch
PS	Pump Station
PSRC	Puget Sound Regional Council
PUD	Public Utility District
PVC	Polyvinyl Chloride
PWS	Public Water System
PWTF	Public Works Trust Fund
R&R	Renewal and Replacement
RCW	Revised Code of Washington
Req'd	Required
Res	Reservoir
Retail	Direct water sales to customers within service area (does not include non-revenue demands or water wheeled to adjacent utilities)
RJDI	Restrained Joint Ductile Iron
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisition telemetry system

SDWA	Safe Drinking Water Act
SEPA	Washington State Environmental Policy Act
SF	Single-Family
SLWSD	Silver Lake Water & Sewer District
SOP	Standard Operating Procedure
SR	State Route
SSPH	Slip-in Pre Mix Heater for Asphalt
SWDA	Safe Water Drinking Act
SWUGA	Southwest Urban Growth Area
SWTRs	Water Treatment Rule (1989) and revisions (1998, 2002, 2006)
TBD	To Be Determined
TCR	Total Coliform Rule
TDH	Total Dynamic Head, in Feet
THMs	Trihalomethanes
TL	Transmission Line
TNC	System Transient Non-Community System
TAZ	Traffic Analysis Zone
TTHM	Total Trihalomethanes
UCM/UCMR	Unregulated Contaminant Monitoring Rule
UDF	Unidirectional Flushing
ug/L	Micrograms per Liter
ULID	Utility Local Improvement District
UNK	Unknown
UPC	Uniform Plumbing Code
UST	Underground Storage Tank
VCS	Voluntary Cleanup Site
VFD	Variable Frequency Drive
VOC	Volatile Organic Compound
VPN	Virtual Private Network
XC2	The Districts Computerized Backflow Prevention Device Tracking System
w/	with
WAC	Washington Administrative Code
WASWD	Washington Association of Sewer and Water Districts

WA WARN	Washington Water/Wastewater Agency Response Network
WCP	Water Comprehensive Plan
WDD	Typical Winter Day Demand
WDM	Water Distribution Manager (Levels 1-4 based on experience per WAC 246-292)
WDS	Water Distribution Specialist
WFI	Water Facilities Inventory
Wheel/Wheeled	Water that passes through one utility to another per agreement
WPA/WHPA	Wellhead Protection Area also Works Progress Administration
WPP/ WHPP	Wellhead Protection Plan
WQA	Water Quality Act
WSDM	WA Department of Health Water System Design Manual
WSP	Water System Plan
WSRB	Washington Surveying & Rating Bureau
WTPO	Water Treatment Plant Operator (Levels 1-4 per WAC 246-292)
WUE	Water Use Efficiency
WWTF	Wastewater Treatment Facility
‘	Feet
“	Inches

Introduction

The Importance of Water

Water is the essence of life. Here in the Pacific Northwest it is seemingly all around us such that people take it for granted, but it is a primary requirement for all life, for public health and for a functioning community. Establishing a reliable source of water has always been the first requirement in developing a town or city; understanding the importance of clean, sanitary water was the key to extending human life spans by an average of close to twenty years.

Today water needs are in the midst of major public issues as much as or more than they have ever been. A drought during the summer of 2015 pointed out the limitations of Puget Sound's major water supplies and the longstanding drought in the Southwest has forced major changes in agricultural, industrial and residential practices in California and elsewhere. Population growth and changing climate patterns will increasingly stress water supplies throughout the West and are necessitating a reevaluation of storage capacities close to home.

In addition, the lead contamination issues in Flint Michigan drove home the need for continuing investment in infrastructure monitoring, maintenance and replacement. In an era of fierce competition for public moneys, it made clear once again that neglecting basic treatment, pipes and reservoirs may save a few dollars now but will be very expensive in money and lives, sometime down the road.

For the Alderwood Water & Wastewater District, all this is happening in a fast-growing community with increasing ethnic and economic diversity. Almost perfectly situated to the north of booming economic centers in Seattle and on the Eastside, the District is seeing large new apartment and condominium developments, many inhabited by young people who commute to tech jobs to the south. A drive along Highway 99 clearly illustrates our growing Korean and Hispanic populations, along with dozens of other ethnicities. A challenge for District staff is to work with customers speaking various languages and assuring that our service rates remain affordable to the community as a whole.

The District and region also operate under a cloud – the concern that a major earthquake will someday strike. This is an active seismic zone and some geologists believe that, if not already overdue for a major quake, the region will get one in the next few hundred years. District staff need to work with regional partners to prepare for such an event, to try to minimize the damage when it happens and speed recovery. Safe potable water will be vital in such a catastrophe, and restoring the region's water systems will be crucial to getting the community back on its feet.

A Living Plan

State Law (RCW 57.16 and WAC 246-290-100) requires that water districts prepare comprehensive plans to assure that their systems will meet the future needs of their communities. However, the Plan you are reading seeks to do much more than contemplated by Legislators and Regulators. It recognizes the multiple challenges facing us and attempts to be a vital, dynamic tool for staff and Commissioners in allocating our resources. Staff throughout the District were directly involved in developing and writing the Plan and we expect that they will refer to it in deciding how to develop programs, select projects and spend our ratepayers' resources.

Doing so will require that:

- Staff develop a project prioritization process that includes the Plan.
- Staff regularly update various parts of the Plan: population, customer numbers, usage numbers and forecasts, water main maps, finances, etc.
- Staff in all departments develop, update and use the Plan as "One District".
- Field observations must be incorporated into facility assessments.
- Work plans and budgets are designed around a long-term perspective, with constant focus on reliable service and affordability over decades rather than just this year.

The expected results will be smarter decisions and more efficient use of ratepayer dollars. The process seeks to do the following:

- Promote preventative maintenance to assure reliable service and stretch out the life of facilities.
- Upsize pipes and other facilities only to serve actual need.
- Replace facilities before they break.
- Utilize modern equipment and information technology to be more efficient and increase the life of District assets.
- Harden key facilities against damage from natural and manmade disasters and prepare staff to respond to emergencies.
- Serve the needs of our wholesale customers.
- Anticipate surges and ebbs of capital projects and staff accordingly.
- Hire strong staff and train them to take on increasing levels of responsibility.

Contents

Here is a brief summary of what you will find in the Plan:

Section 10: Emergency Planning

Explanation of the District's preparations for responding to various emergencies so as to restore service to the community.

Section 11: Personnel

Overview of steps the District is taking to hire and train highly capable staff so as to better serve our customers.

Section 12: Information Technology (IT)

Summary of steps the District plans to take to better integrate and utilize IT tools.

Section 13: Capital Improvement Plan (CIP)

Documentation of the District's long-range plan for improving and replacing its physical infrastructure.

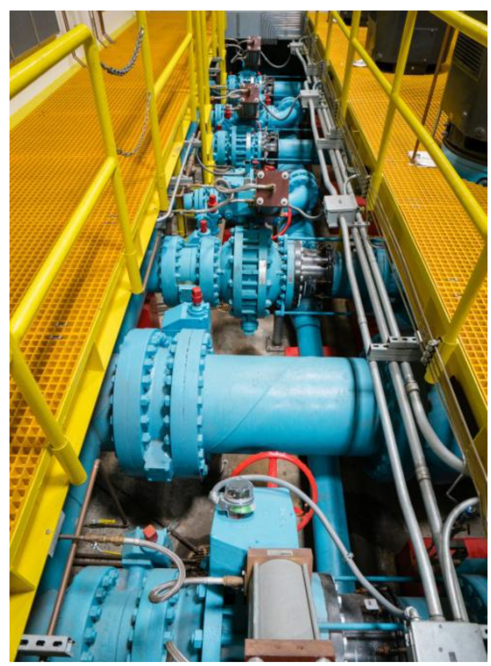
Section 14: Finance Plan

Evaluation of how the District will pay for necessary operations and the CIP, while remaining financially strong and maintaining affordable rates for our customers.

Conclusion

Developing this Plan has taken considerable effort, nearly all of it by internal staff. We expect that future updates will be relatively quick, as staff is expected to routinely keep the Plan up-to-date.

This is not a Plan to be printed once and left on a shelf to age and become obsolete – it is instead a "Living Plan", as relevant in five years' time as it is today.



1. System Description

1. System Description

The characteristics of a water service area define the conditions for meeting customer water demands. The economy, land use patterns, geography, climate, population trends and governing agencies influence the type and location of water usage within a service area. This chapter provides a description of Alderwood Water & Wastewater District's (AWWD) management, history, source of water supply, relationship with adjacent purveyors, system and District facilities and the Clearview Water Supply (CWS) agency. Descriptions and functions of the major system components and how they integrate with one another are also included.

Last Updated: September, 2016

Ownership and Management – WAC 246-290-100(4)(a)(i)

The District is a branch of local government, created by a vote of the people in 1931 and operated under the Revised Code of Washington Title 57. The District is governed by a five-member Board of Commissioners with daily operations overseen by a General Manager. The organizational structure includes both water and wastewater positions.

Table 1.1: Basic Water System Information

System Name	Alderwood Water & Wastewater District
System Type	Group A Community Water System
System ID Number	01300E
Artesian Well ID Number[1]	01319B
Owner Name	Alderwood Water & Wastewater District
Owner Type	Public Sector – Special District
Owner Address	3626 156th Street SW, Lynnwood, WA 98087
Location	Snohomish County, WA
Retail Service Connections [2]	50,600
Residential Population Served [2, 3]	175,800
Employment Population Served [2, 3]	38,600
Wholesale Service Connections [2]	31,130

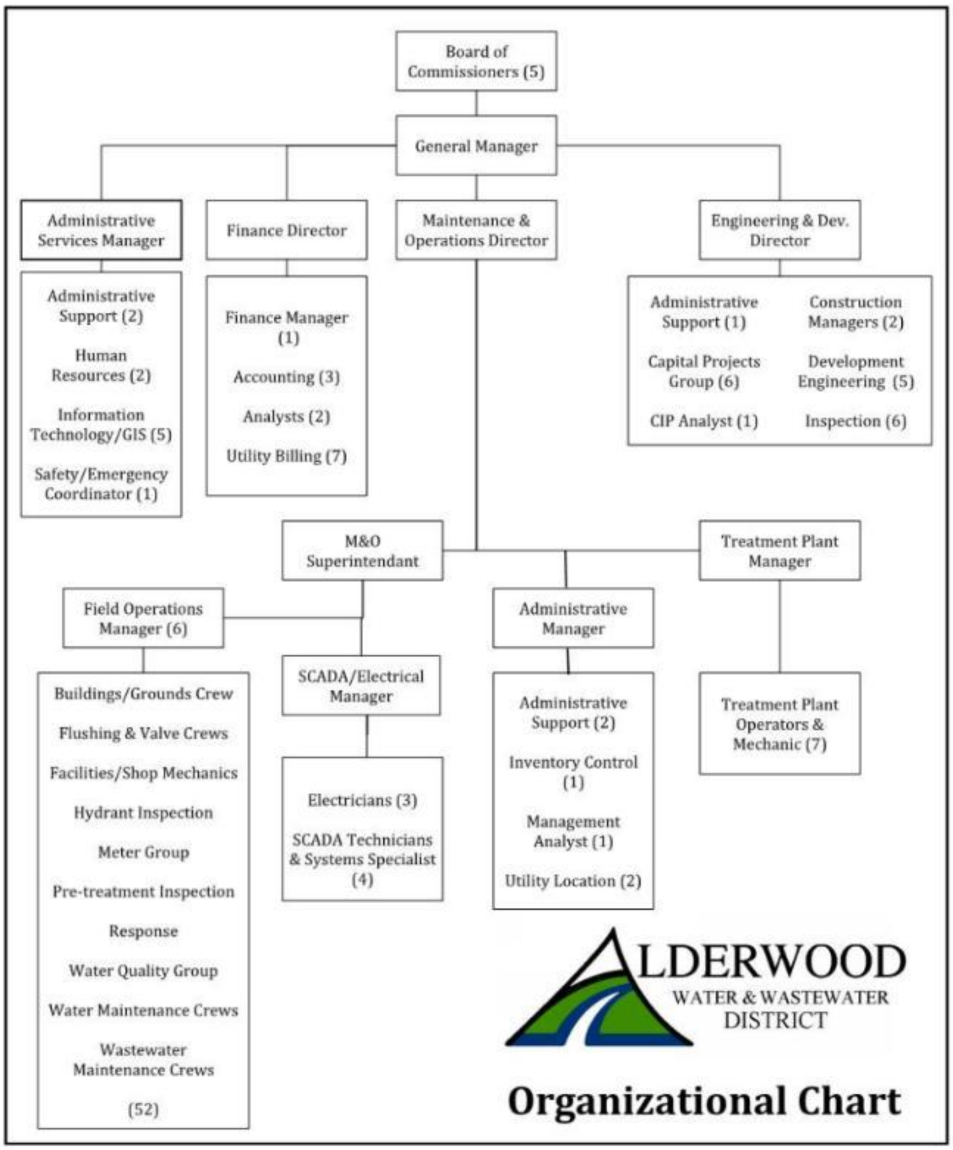
1. Located at 164th Street SW, the artesian well is a non-transient, non-community system.
2. Data as of September 2015.
3. Estimated retail population using Snohomish County *2012 Buildable Lands Report*, Census, American Community Survey, District and wholesale customer data.

Last Updated: August, 2017

The organization is comprised of four departments, as shown in *Figure 1.1: Organizational Chart*. The four departments are described as follows:

- Administrative Services, responsible for providing administrative support to the functions of the District;
- Finance, responsible for budgeting, billing and financial planning;
- Maintenance & Operations, responsible for preventative maintenance, repair and operation of the water and wastewater infrastructure; and
- Engineering & Development Services, responsible for review of proposed construction, inspection of capital and private projects, long-range planning, hydraulic modeling and the design, bidding and oversight of capital projects.

Figure 1.1: Organizational Chart



Last Updated: August, 2017

History of the Water System

Formed in 1931, the Alderwood Water & Wastewater District was established in the midst of the Great Depression and rapidly rising unemployment. Originally developed as a series of small five- and ten-acre farms, the area was sparsely populated. Due to the economic reality of the time, which caused farm income to decline, the completion of Highway 99 enabled people to commute to non-farming jobs in Seattle and Everett. Many of the farms were eventually converted from egg production or subdivided and sold, leading to the rapid suburbanization of the area.

The District is now responsible for procuring and distributing water to residential, commercial, industrial and wholesale customers within the District's 44-square mile water service area. Customers are served directly in both incorporated (within a city) and unincorporated (within the county outside city limits) areas and also on a wholesale basis to several cities and Districts in southwest Snohomish County.

Timeline of Events Affecting Alderwood

1927 Crews working north from the King County line and south from Everett meet at 164th Street SW, completing construction of State Route 99 (Highway 99).

1929 Great Depression begins. As the price for eggs dropped tenfold, owners of 5- and 10-acre poultry farms in the Alderwood area made it through the hardship by diversifying into other crops, dairy, furs, or commuting via the Interurban rail line to jobs in Seattle and Everett.

1931 The Alderwood Water District (AWD) is formed to meet the needs of the growing Alderwood Manor community and begins with three commissioners. At this time, Washington is coming out of a period of prolonged drought and increasing electrical demands are affecting the water supply.

196th Street SW is paved from Alderwood Manor (located in the area of the current Alderwood Mall) to Highway 99.

1933 A water supply contract is signed with the City of Everett that will provide 1.15 million gallons per day (mgd) from the Sultan River to Alderwood Water District via a 12-inch water main transmission line.

1934 Local Improvement District (LID) No. 1 is established in order to install approximately 40 miles of wood pipeline. Water storage facilities consisted of two 100,000-gallon tanks and one 25,000-gallon below-ground reservoir.

1936 Paine Field is constructed as a Works Progress Administration (WPA) project in partnership with Snohomish County.

1938 Rainfall throughout western Washington is at less than half of normal, affecting the District's source of supply from Everett.

1939 The Interurban rail line is closed due to competition from Highway 99.

1940s King County's population increases dramatically and low home loan interest drove significant growth and new subdivisions along Highway 99.

1940 As of this year the District serves 800 customer connections in approximately 38 square miles after annexation of new areas and several small existing water systems.

1941-45 The United States joins in fighting World War II. Post-war economic expansion and affordable mortgage rates for veterans lead to a housing boom in the suburban areas surrounding Seattle.

1946 The size of the District has grown to approximately 42 square miles, serving 1,600 service connections with 190 miles of water main.

The beginning of the Cold War and the conflict in Korea lead to concerns about the security of the water supply and the impact of radioactive material on water quality.

1948 The District constructs a 2-million-gallon reservoir and two 150,000-gallon elevated storage tanks to improve water pressure.

1950s Significant growth occurs along Highway 99 between Lynnwood and Everett. The temperatures in the decade overall are warm and many south Snohomish County purveyors experience shortages severe enough to require mandatory water restrictions.

1951 Water demand increases to the point where additional supply is needed, so the District enters an agreement with the City of Everett for an additional 3 mgd from five wells. Supply from Everett is also increased to 2 mgd and a second 12-inch transmission line is installed. The District has grown to 4,900 service customer connections.

1952 Extremely dry weather all year with below-normal precipitation in every month but June, severely affecting water supply in the Puget Sound region.

1953 The District constructs an administrative office building and garage at 197th Street SW and 37th Avenue W.

1954 A 12-inch steel water supply transmission main to Mountlake Terrace is completed from Well No. 2 to a 500,000-gallon storage facility completed the year before.

1956 Severe water shortages during summer evenings lead AWD to first urge conservation efforts and ultimately to turn off water supply to customers not complying with the restrictions.

1957 The District constructs a 3-million-gallon steel reservoir and transmission main to the Well No. 7 site. The reservoir and transmission main are currently owned and operated by the City of Lynnwood.

1957-9 Test wells are drilled in various parts of the District in search of additional water supply. Five of the nine test wells produce sufficient water to warrant construction of production wells. With the added wells, there are a total of 10 producing wells with a capacity of 8.15 mgd from the wells alone.

1959 Peak day demand exceeds 8.5-million gallons, serving approximately 12,000 customer service connections. The District grows at a rate of 1,000 customer connections per year and serves approximately 42,000 people with 250 miles of pipe.

The City of Mountlake Terrace becomes wholesale customer.

1960 Construction on Interstate 5 began, as authorized by the Federal Aid Highway Act of 1956.

1961 Based on studies completed in 1960, the District determines that the wells alone will not supply enough water for future demand. The District negotiated with Everett for additional supply from the City of Everett.

Nike Tank No. 1, a 2.4-million-gallon reservoir, is completed in the southwest portion of the District.

At this point, there are 270 miles of water main and 14,000 service connections serving approximately 50,000 customers.

1963 The District completes construction of Reservoir No. 1, the world's then-largest pre-stressed concrete reservoir, able to store 28-million gallons. One transmission line from Everett and Pump Station No. 1 are also completed, which brings the District's storage capacity up to 38 mgd and its pumping capacity up to 23 mgd.

1964 A 2-million-gallon storage tank (High Tank No. 1) is constructed to provide additional storage for Paine Field.

Lynnwood hires a consulting firm to study the feasibility of taking over a portion of the District's water system, comprising approximately 52 miles of water main and associated assets.

Peak day demand exceeds 11.0-million gallons, serving approximately 17,700 service connections (over 600 gallons per day per connection).

1965 The federal government passes the *Water Quality Act* (WQA), which requires all states to establish minimum water quality standards.

Everett and Snohomish County PUD complete Culmback Dam upstream of Lake Chaplain, named after former Everett Mayor George Culmback.

The 724 Booster Pump Station is completed to provide service to the 724 Zone from High Tank No. 1.

Interstate 5 opens in the District's service area.

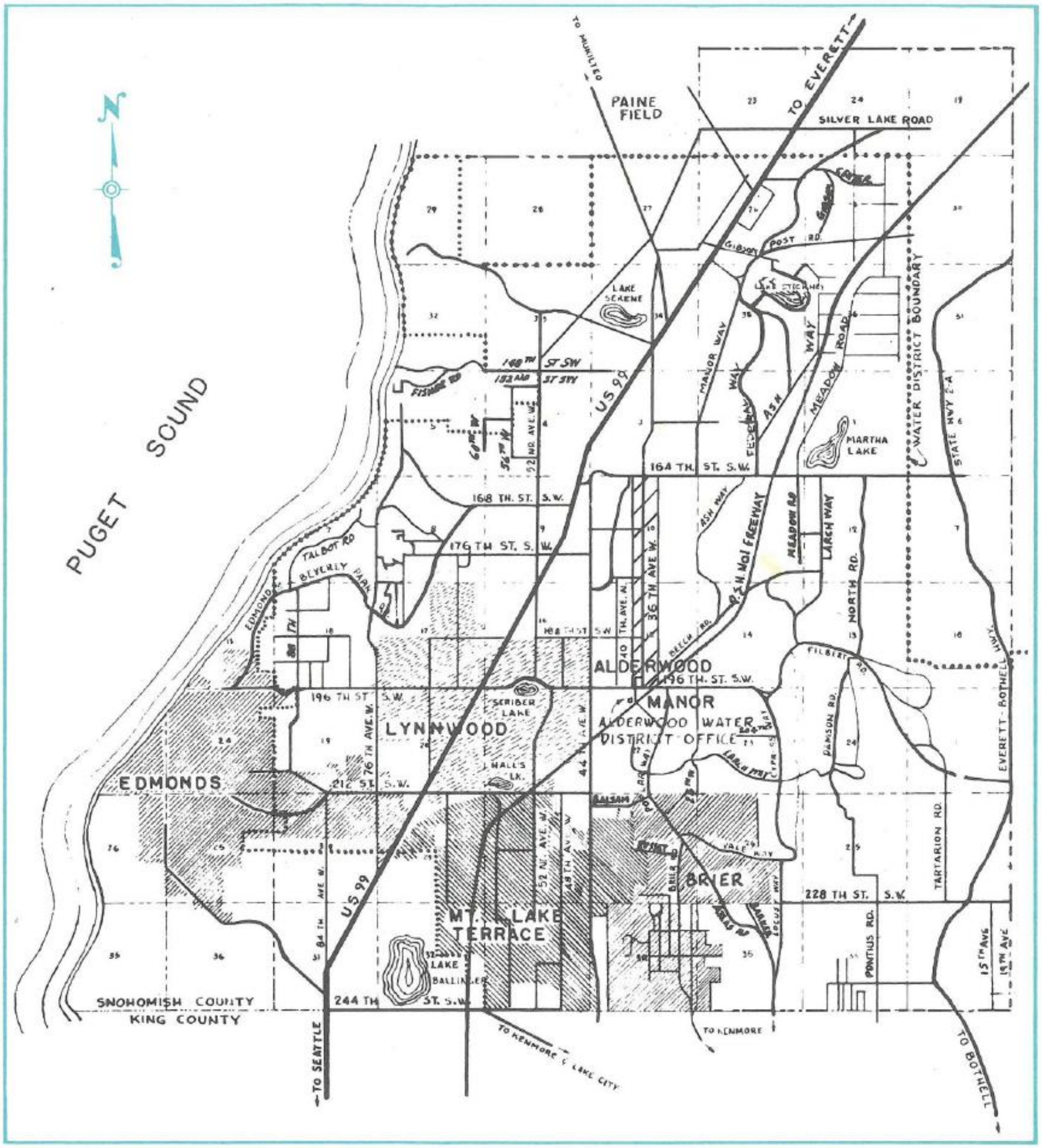


Figure 1.2: Map of the District, 1966

1966 The District adopts a Comprehensive Sewer Plan and applies for federal funds to assist with construction. The estimated cost of adding sewer within the District is $32 million in 1966 dollars.

Edmonds and Lynnwood each take over a portion of the water system and become wholesale customers.

1966-7 Boeing constructs its first Paine Field manufacturing plant.

1967 AWD completes a 24-inch transmission main to supply Edmonds.

1968 AWD is named the largest water district in the nation by the *Seattle Times*.

A 28-million-gallon reservoir (Reservoir No. 2) is constructed at the 156th Street SW site and is claimed to be the largest covered steel reservoir in the world at that time.

Construction on Interstate 405 begins.

1970-7 A period of moderate to severe drought affects water supply in western Washington.

1972 The *Clean Water Act* is passed by the Senate after a veto by President Nixon, which defines water quality goals for public water supplies and supplements existing water quality standards.

1973 A second transmission line is completed from Pump Station No. 1 in Everett.

1975 The District completes construction of its administration offices on 156th Street SW, still in use today.

Public access to the Sultan Basin watershed serving the Everett system is restricted to protect water quality.

1977 A second reservoir (Reservoir No. 3) is constructed at the 156th Street SW site with a capacity of 20-million gallons.

1979 Alderwood Mall opens and becomes one of the largest employers in south Snohomish County.

1982 Snohomish County PUD begins construction on the Jackson Hydroelectric Plant at Culmback Dam, creating a three-way balance for water supply, power generation and fish preservation.

1983 Everett raises Culmback Dam, allowing the reservoir to hold 50 billion gallons of water and completes construction on its 100 mgd water filtration plant after the Department of Social and Health Services orders the City to filter its water beginning in the 1970s due to water in the Spada Lake system being contaminated by disease-causing organisms and asbestos dislodged by logging activities in the Sultan watershed.

1984 Canyon Park Tank is constructed in the southeast portion of the District, with a capacity of 3-million gallons and is placed into service in October.

1987 Congress amends the WQA, which allows the Environmental Protection Agency to establish and enforce pollutant limits in water. The District served approximately 41,600 connections and had a peak day demand of 37.8-million gallons.

1989 Due to record consumption in the summers of 1986-88, the Board of Commissioners imposes mandatory irrigation restrictions on all retail and wholesale customers.

1990 By the end of this year, the District serves 26,800 retail water accounts and 18,400 wholesale customers in Edmonds, Lynnwood and Mountlake Terrace. New accounts are added at a rate of approximately 900 per year.

1991 Pump Station No. 2 in Everett is completed and brings the District's total pumping capacity to 50 mgd. While the stations are able to operate automatically, they are generally run in manual mode.

1992 The US Navy opens its Naval Station in Everett after five years of construction.

1994-95 The Board of Commissioners establishes recommended sprinkler guidance for all retail and wholesale customers to support conservation efforts.

Both the Administration and Maintenance & Operations buildings undergo significant remodeling and new construction.

1995 The District combines all of its development and engineering standards into a single adopted document.

1996 Negotiations begin on the Clearview water supply project, a joint effort between the District, Cross Valley Water District and Silver Lake Water & Sewer District. Combining efforts allows the districts to reduce costs and limit environmental impacts.

1997 Though not required by State law, the District adopts its first formal biennial budget for 1998-99.

1998 The number of District Commissioners is increased from three to five.

1999 The District completes a project to expand the 724 Pressure Zone in order to improve low pressures in the north portion of the District.

2000 Alderwood Water District changes its name to Alderwood Water & Wastewater District (AWWD).

2001 The chlorine gas disinfection facilities are removed from the Reservoir Nos. 1, 2 and 3, Nike Tank Nos. 1 and 2 and the Canyon Park sites and are replaced with sodium hypochlorite on-site generation facilities. Chlorine gas is no longer used for disinfection.

2002 Reservoir No. 1 is covered, preventing outside contaminants from entering the water supply filtered by Everett. Nike Tank No. 2 (3.7-million gallons) is added to the southwest portion of the District.

AWWD begins a project to implement a digital asset management system.

2003 High Tank No. 2 (3.1-million gallons) is completed at the 35th Avenue W site.

Approximately 440 acres of land is added to the 724 Pressure Zone from the 635 Pressure Zone in order to help meet the minimum pressure requirements established by the State. The project adds 65 on-site Pressure Reducing Valves (PRVs), 2.8 miles of 6- to 18-inch water mains and includes a 24-inch boring under SR 525.

2005 The Clearview project is completed, including an 11.9-million-gallon reservoir, pump station and transmission line. This project will serve growth in southwest Snohomish County over the next 40 years.

A new 50-year water supply contract is signed with the City of Everett for 106 mgd.

2008 A Supervisory Control and Data Acquisition (SCADA) telemetry system is updated throughout the District to major assets, allowing for remote review of asset performance in real time.

2009 A record-breaking heat wave in western Washington brings temperatures in the 100s during a prolonged drought. The District's maximum pumping day demand hits an all-time high of 51.5-million gallons.

2010 The District joins the Washington Water/Wastewater Agency Response Network (WA WARN) in order to coordinate response efforts during an emergency and established a cross-connection control program.

2011 The District begins a project to replace all of its meters with radio-read meters.

Mukilteo Water & Wastewater District becomes a wholesale customer.

2013 The District completes upgrades to approximately 2.6 miles of distribution main in Highway 99, from approximately 128th Street SW to Lincoln Way.

Water rates are converted from a winter/summer rate structure (where the rate per unit increases in the summer) to an increasing block-rate structure (where the rate-per-unit increases as consumption increases) to promote year-round conservation.

2014 Silver Lake Water & Sewer District becomes a wholesale customer.

2015 The District adds our 50,000th retail customer connection.

Last Updated: September, 2016

Service Area

The District's retail water service boundary covers approximately 44 square miles spanning from Puget Sound east beyond the Bothell-Everett Highway (State Route 527) and north from the Snohomish/King County line to just south of Paine Field. The service area encompasses the city of Brier, portions of Mill Creek, that portion of Bothell north of the Snohomish County line, Mukilteo south of Paine Field, portions of Lynnwood and unincorporated areas of Snohomish County.

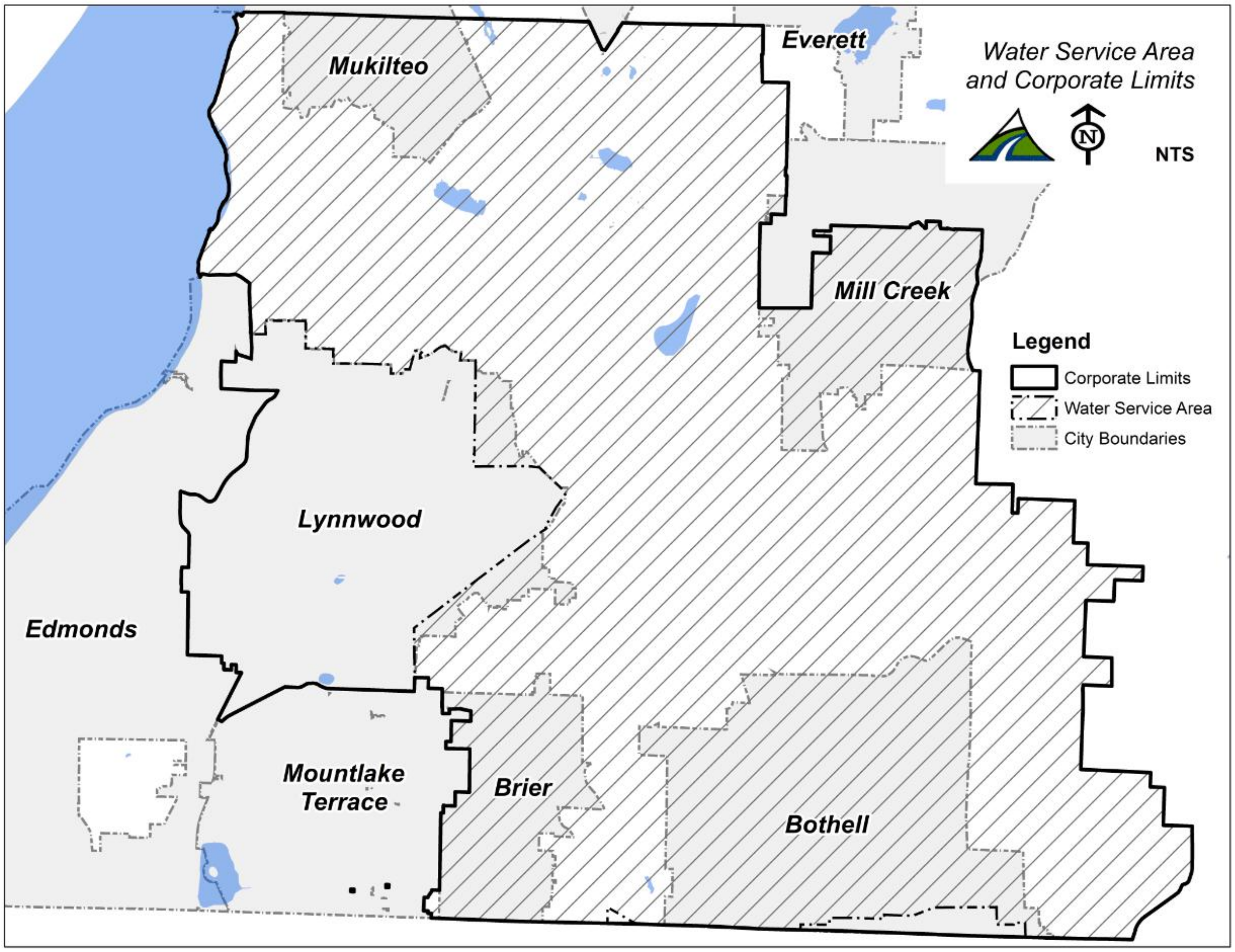


Figure 1.3: Water Service Area and Corporate Area

The District sells wholesale water to the cities of Edmonds, Lynnwood and Mountlake Terrace (which are wholly or partially within the District's 51-square mile corporate boundary); and to the Clearview Water Supply Agency, the Mukilteo Water & Wastewater District and the Silver Lake Water & Sewer District (which are outside the District's corporate boundary).

Since adoption of the District's 2009 Water Comprehensive Plan, there have been small interior annexations to eliminate service area islands and withdrawal of corporate area within the Cities of Everett, Edmonds and Mountlake Terrace. The withdrawal areas are served directly by those cities. At this time the District does not anticipate significant expansion of its boundaries and works collaboratively with adjacent purveyors to determine the best provider for unserved and unclaimed perimeter areas.

The District also provides wastewater collection services. The retail wastewater service areas are not the same as the retail water service area, primarily because extension of sewer service beyond the Urban Growth Area (UGA) established by Snohomish County is not permitted. The City of Brier is a second area where this occurs, as the City provides sewer service, but not water service, to its customers. The current Wastewater Comprehensive Plan (WWCP) describes the wastewater system and service area, as well as identifies needs, actions and capital projects for the wastewater system.

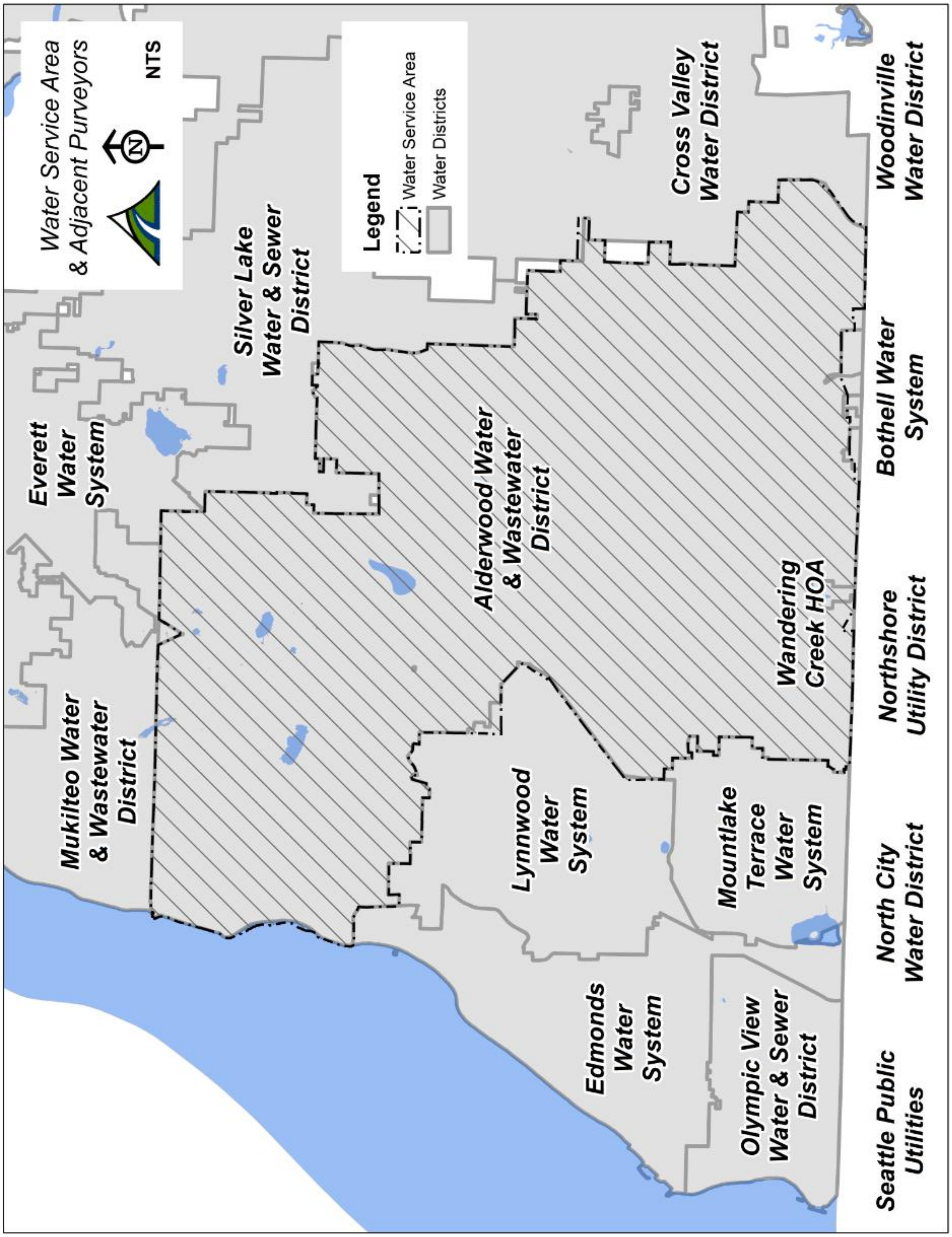
Last Updated: September, 2016

Wholesale Customers and Adjacent Purveyors

The District is bordered by ten adjacent water purveyors. All of the systems in Snohomish County, except the portions of the City of Bothell and the Northshore Utility District within Snohomish County, obtain filtered water from the City of Everett supply, either directly or indirectly. Cross Valley Water District also maintains a groundwater supply. Cities and Districts in King County immediately south of the county line purchase water from Seattle Public Utilities. All of the adjacent water purveyors are publicly owned, with the exception of Wandering Creek Homeowner's Association (HOA). Wandering Creek operates as a private system using water provided by the District. For additional information about agreements with wholesale customers, please see *Chapter 2 – Related Plans, Agreements and Policies*.

Last Updated: September, 2016

Figure 1.4: Adjacent Water Purveyors

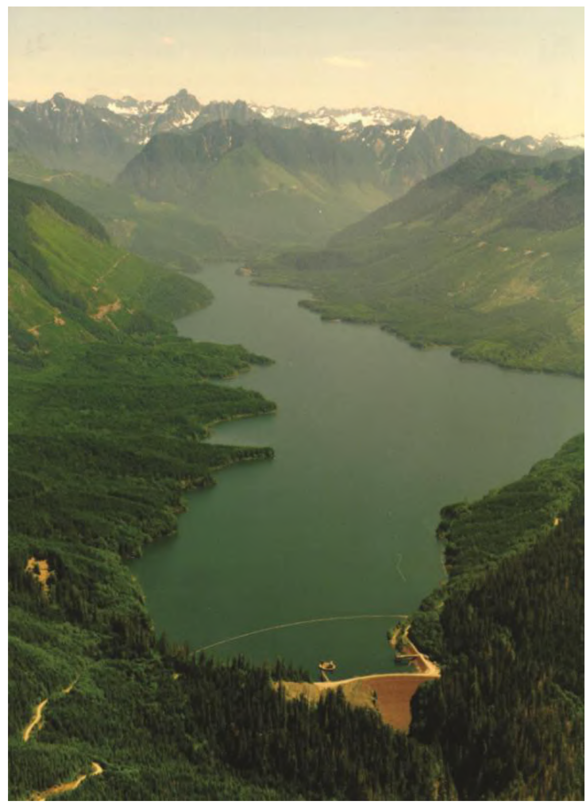


Source of Supply – WAC 246-290-100(4)(f)(ii)(b)

The District currently purchases all of the water the District sells to retail and wholesale customers directly and indirectly from the City of Everett, which provides the water supply for the majority of southwest Snohomish County. Everett's raw water supply is drawn from the Spada Reservoir, located at the headwaters of the Sultan River approximately 25 miles east of Everett. Raw water is delivered from Spada to the Chaplain Reservoir after passing through Snohomish PUD No. 1's Jackson hydroelectric facility, which provides approximately 5% of PUD's power supply. The water is then filtered, chlorinated and fluoridated at Everett's water filtration plant for delivery to its customers and to wholesale customers such as the District.

Once the water is treated, it is pumped through Everett's transmission system, which consists of four large diameter pipelines, known as Transmission Line No. 2, 3, 4 and 5. For the District, water is conveyed primarily through Transmission Line No. 5 (TL5) to Everett's Reservoir 3, which supplies the District's Pump Station Nos. 1 and 2. The Clearview Water Supply Agency (CWSA) is also supplied by TL5 in Snohomish.

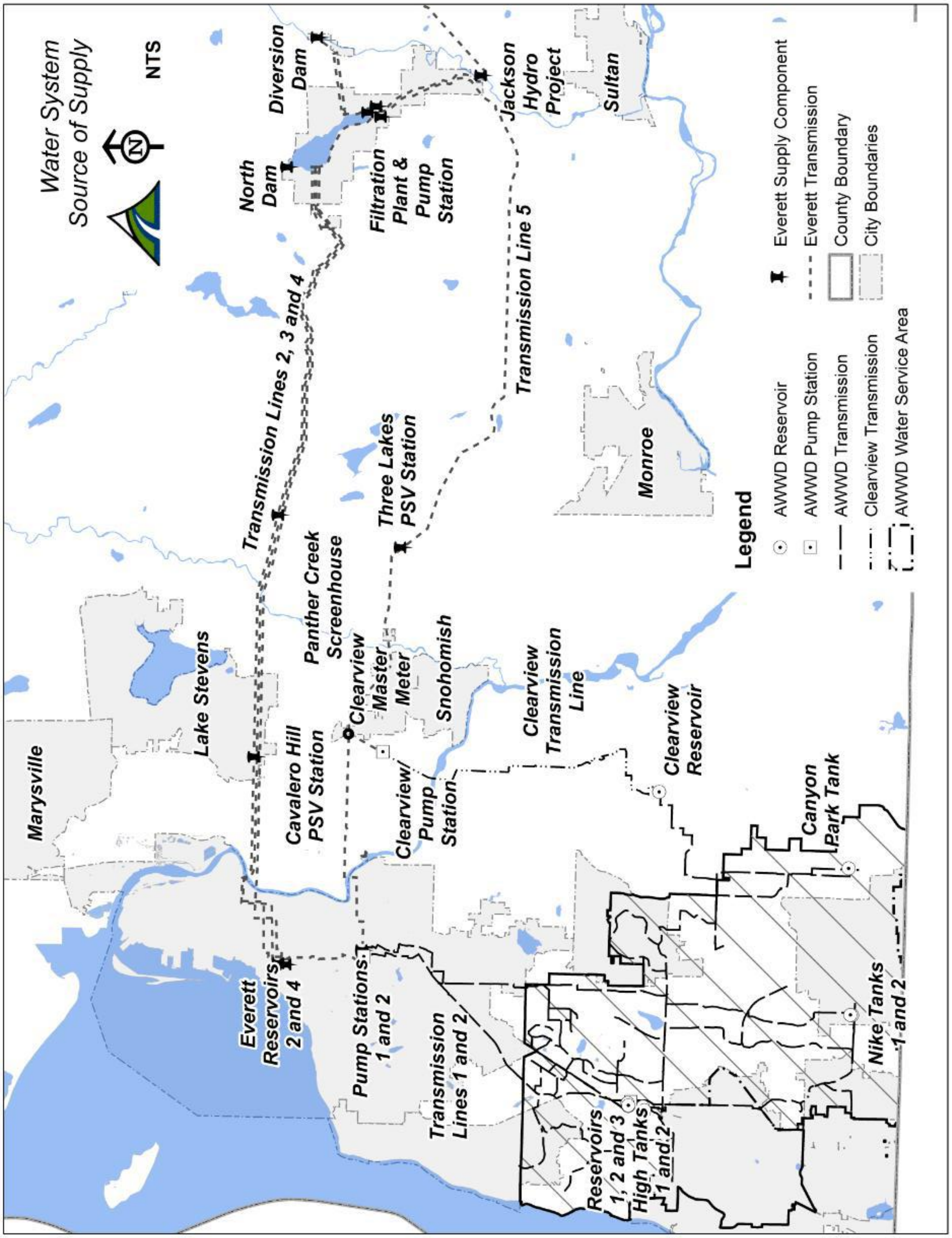
In 2005, the CWSA transmission main, pump station and storage facility were completed and provide the District with an additional supply connection from the City of Everett supply system. The CWSA pipeline conveys water south to Silver Lake Water & Sewer District, Cross Valley Water District and the District.



In order to meet the District's water demands, including the District's retail and wholesale customers and CWSA, the District purchases over half of the water produced and treated by Everett. Everett is responsible for monitoring and testing the water supply for compliance with federal and state regulations. The District is responsible for performing water quality testing within the District's retail service area.

Figure 1.5: Water Supply Facilities

Last Updated: September, 2016



Typical System Components

There are many parts and pieces that go into making a water system function smoothly, starting at the source, through treatment, storage and delivery. This section provides descriptions of the various components within the District's system, including their purposes and functions and why they are important.

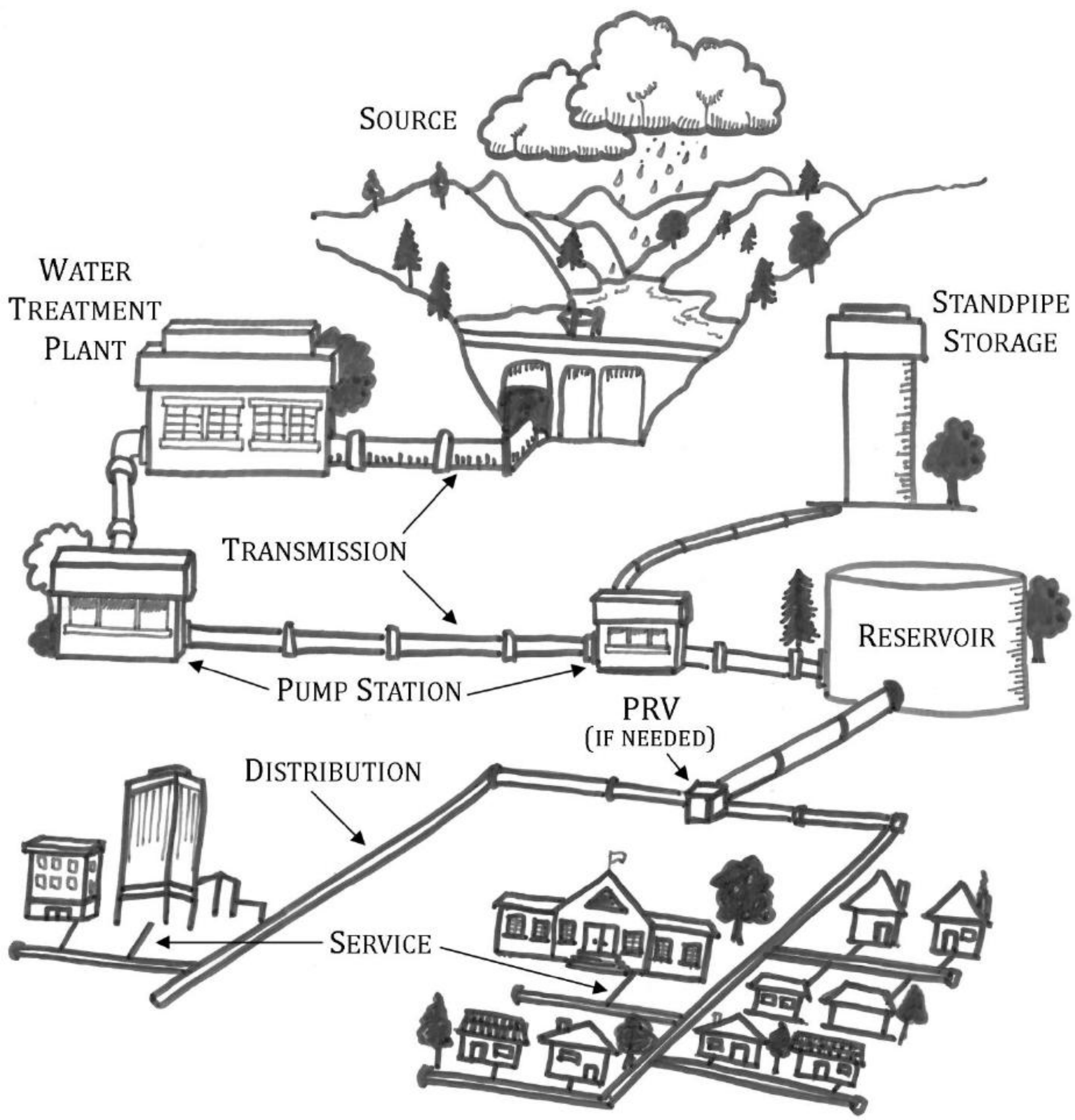


Figure 1.6: Typical Water System Components

Last Updated: September, 2016

Artesian Well

A *flowing artesian well* is a type of groundwater well that does not require mechanical pumping. The well is tapped into an “artesian aquifer,” where porous, permeable rock (such as sand or gravel) is surrounded by an impermeable geologic layer that water cannot pass through (such as clay). The water in the permeable layers is under pressure and flows to the surface.

Last Updated: September, 2016

Disinfection Facility

Disinfection facilities treat water by the use of an approved process for killing or inactivating microbiological organisms, such as by adding small amounts of chlorine. Microbiological organisms include both pathogenic (disease-causing) and indicator organisms. Indicator organisms are used to measure contamination of water samples. The presence of coliform bacteria, for example, is a common indicator of fecal contamination.

Last Updated: September, 2016

Interties

An *intertie* is defined under Washington State law as “an interconnection between public water systems permitting the exchange or delivery of water between those systems” (WAC 246-290-010(140)). *Emergency* interties are only used when an unplanned event causes damage to or disrupts the normal source of supply, while *regular* or *non-emergency* interties are connections used for routine daily water supply.

Last Updated: September, 2016

Pressure Reducing Valve and Station

A *Pressure Reducing Valve* (PRV) is used to reduce water pressure either within a water system (off-site) or where water is delivered to the customer (on-site). *Off-site* PRVs are housed in *pressure reducing valve stations* situated along a water distribution main. These PRVs are used to significantly reduce pressure in areas where there is a large elevation change or to normalize pressure between pressure zones. *On-site* PRVs are used by households or businesses, either at the water meter or within the building, in order to reduce pressure to the level for which the plumbing system was designed.

Last Updated: September, 2016

Pressure Zone

Pressure zones are geographic areas defined by an elevation, such as a reservoir's overflow level or the hydraulic grade line (HGL, the level water would rise to if a water main was tapped), of a water distribution system. Each area is divided to ensure that minimum water pressures are provided to as many customers as possible within that distribution area. The water pressure at any given point within a pressure zone depends on the elevation of that point in relation to the HGL. Topographic considerations are significant because the water purveyors seek to maintain normal service pressures between 30 and approximately 120 pounds per square inch (psi). In some areas with higher operating pressures (typically above 80 psi), the District and/or individual customers have installed pressure reducing valves (PRVs) to reduce pressures to an acceptable level.

The four pressure zones and their boundaries within the District have been established based on area topography and service elevations, natural and physical barriers and the District's water service area boundary.

Last Updated: September, 2016

Pump Station

A *pump station*, sometimes called a *booster pump station*, mechanically pumps water from one location or pressure zone in a water system to another, generally along a transmission main or at a reservoir. The District uses its High Tank booster pump station to fill High Tanks No.1 and No. 2 and pump stations 1 and 2 to pump water from the Everett System. The Clearview pump station which is operated by the District under the Clearview Interlocal Joint Operating Agreement pumps water from the Everett system to the Clearview Reservoir via the Clearview transmission piping.

Last Updated: September, 2016

Transmission, Distribution and Service Lines

Transmission main lines are the largest pipes within a water system and are used to transport water from a treatment facility or pump station to storage facilities, to wholesale customers and to smaller distribution mains. The District's transmission mains are broken into three categories, wholesale, regional and retail. The wholesale and regional transmission mains are defined in the District's wholesale agreements with its wholesale customers. Retail are those mains not listed in the district wholesale agreements that are 16-inch and larger mains. Transmission mains range from 12 to 36-inches in size at Alderwood, though they can be much larger in other water systems. Transmission lines typically do not have any service connections, which differentiates them from distribution main lines.

Distribution main lines transport water throughout the water system and range from 4- to 12-inches in size at the District. Distribution lines transport water to customers for use and also provide fire protection via sprinkler systems and fire hydrants. *Service lines* are individual pipes which connect the distribution mains to customer meters and in most cases, range from three quarter to 2 inches.

Last Updated: September, 2016

Storage Facilities

In order to have enough water to reliably supply customer needs, water purveyors must have a method for collecting and storing water. Water storage may be provided in a number of different natural or manmade facilities, including the three primary methods described below:

Elevated Tank (Water Tower)

Elevated water tanks are constructed above ground with the water supported by a structure. Elevated tanks increase water pressure within the distribution system, provide higher water quality than standpipes and are especially useful in areas that are relatively flat. However, cost considerations limit the size that elevated tanks can be usefully employed. The District no longer has elevated tanks.

Reservoir

R*eservoirs* are constructed at ground level and have a greater diameter than height. Reservoirs tend to be the most economical type of storage and, depending on construction type, can last over 100 years. Some water purveyors also use natural or artificial lakes as reservoirs.

Standpipe

Standpipes are also constructed at ground level, but have a greater height than diameter. Standpipes are used to store water at a higher elevation in order to increase water pressure within the distribution system. They serve the same function as elevated tanks and usually provide more standby and emergency storage due to their shape.

Last Updated: September, 2016

System Overview

The District's water system currently has four pressure zones served by two water supply pump stations, one booster pump station, eight storage facilities and over 660 miles of pipe. The District also operates two wells: Well No. 5 is an artesian well that provides a local community amenity and Well No. 7 provides water for District equipment use. Neither Well No. 5 nor Well No. 7 is connected to the District's distribution system.

In addition, the District is part of the Clearview Water Supply Agency (CWSA), which owns a separate connection to Everett's Transmission Line 5, a transmission line, a reservoir and a pump station. The District operates the Clearview pump station and its metered connection to CWSA under an agreement with CWSA. The other facilities are operated by the other CWSA partners. The physical condition, capacity and age of these facilities are all important in determining the adequacy of the water system for meeting future water demands.

The following sections describe major system components in association with the pressure zone or portion of the water system they serve. The relationship between the pressure zones is shown in *Table 1.2* and a map of the pressure zones with their respective transmission lines is shown in Figure 1.7.

A visual overview of the system and the hydraulic relationship among pressure zones, reservoirs, pump stations and PRVs is shown in

Figure 1.8.

Pressure zones are named for the maximum height of water in their reservoir. For example, the water in the reservoirs supplying the District's largest pressure zone is 635 feet above sea level.

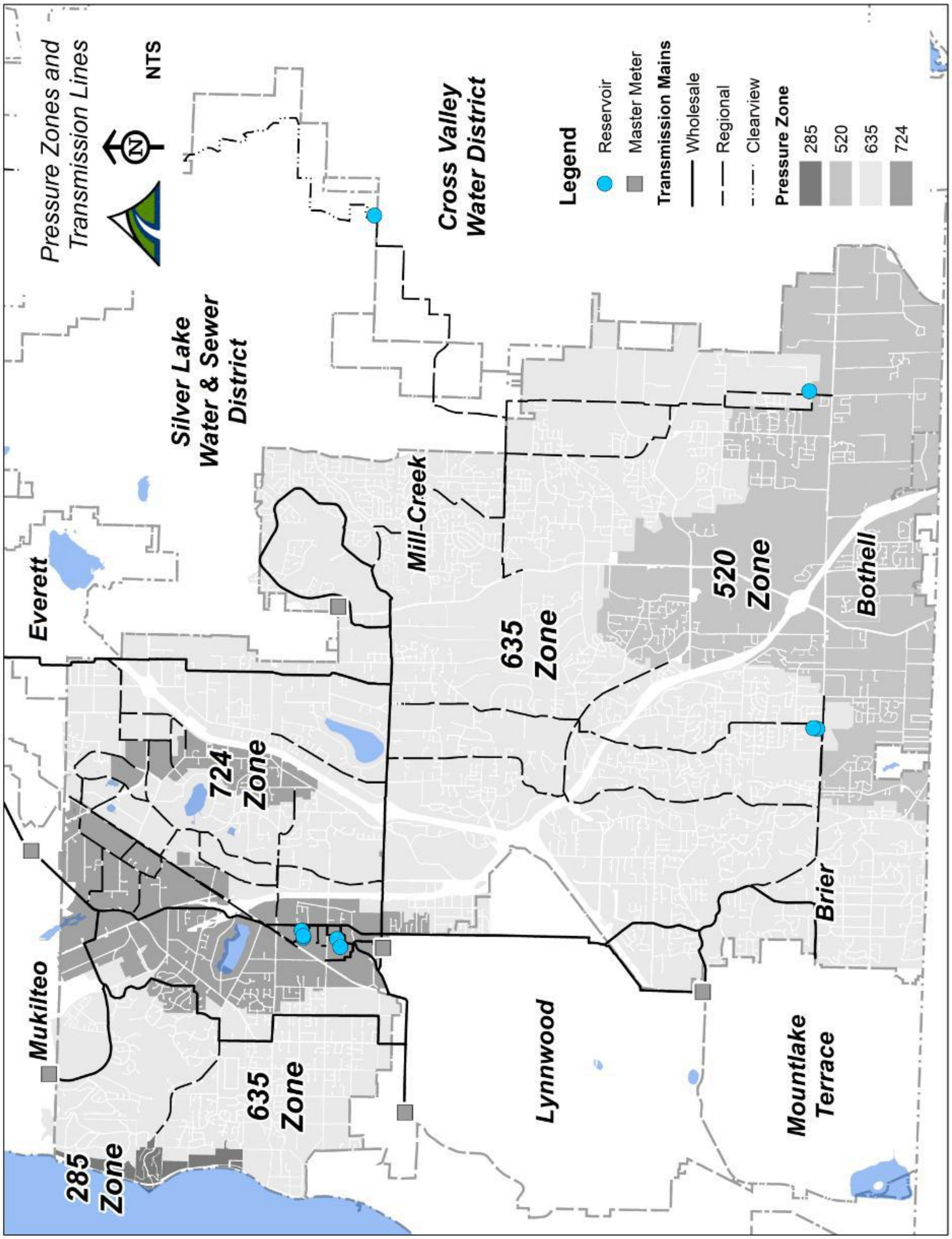
Table 1.2: Pressure Zones and Service Elevations

Pressure Zone	Source	Min. Service Elevation (ft) [1]	Max. Service Elevation (ft) [1]	Min. Static Service Pressure (psi)	Max. Static Service Pressure (psi)
285	635 via PRV	32	174	48	110
520	635 via PRV	40	435	37	208
635	Everett	135	583	23	217
724	635 via Booster Pump Station	415	640	37	134

1. Location of customer service meter in feet above sea level.

Last Updated: September, 2016

Figure 1.7: Existing Pressure Zones and Transmission System



Last Updated: September, 2016

Figure 1.8: Hydraulic Profile of the Water System

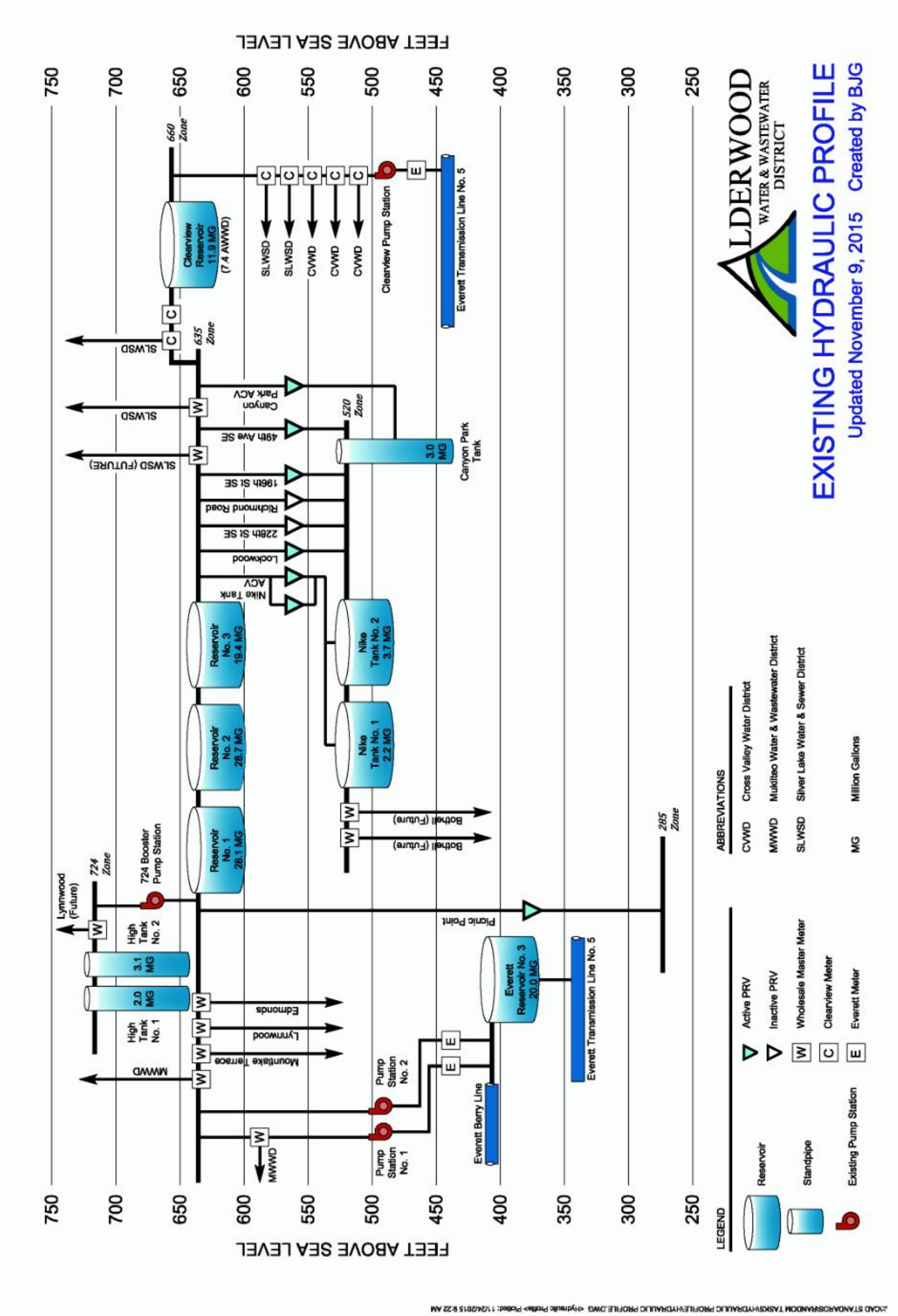
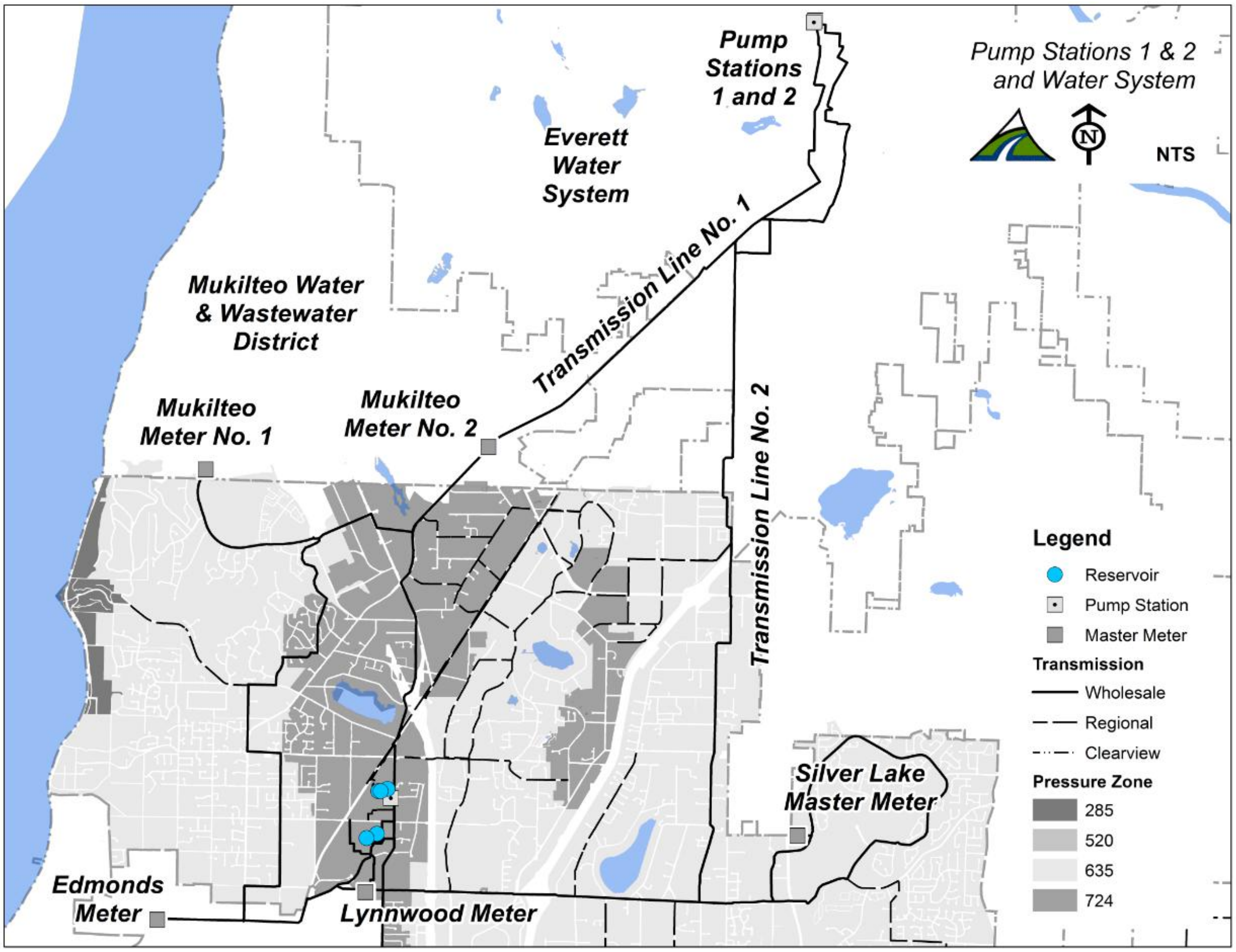


Figure 1.9: Pump Stations Nos 1 and 2 in relation to the Water System



Last Updated: September, 2016

Pump Stations Nos. 1 and 2

After the District signed its first water supply contract with Everett in 1960, the District needed to construct facilities to pump water south. Pump Station No. 1 was completed in the early 1960s in conjunction with the District's Transmission Line No. 1 and is adjacent to Everett's southernmost reservoir, Reservoir No. 3. Shortly after Pump Station No. 1 was completed, Everett replaced the 28-inch wood stave Transmission Line No. 1 with the 51-inch steel Transmission Line No. 5 and added the Evergreen Pump Station, which today shares power with Pump Station No. 1.

Pump Station No. 2 was completed in 1991. The second pump station was constructed in a separate building in order to improve reliability and add redundancy to the system. The two pump stations can be operated separately, but functionally operate as a single pumping source. Pump Station No. 2 has a dedicated electrical feed that is separate from Pump Station No. 1.

Pump Station No. 1

Year Constructed:	1964	*Job No.:*	A21-A
Location:	Evergreen Way, Everett	*Capacity:*	28.9 mgd

Pump Types:
- Two 800-hp variable speed
- Three 500-hp fixed speed

Supplied By: Everett: Reservoir No. 3, from the Berry Transmission Line or Transmission Line 5

Discharges To: AWWD: Transmission Line Nos. 1 and 2

Major Features:
- Concrete construction with electric unit heaters.
- Pump room has a bridge crane and roll-up door for equipment access.
- Electrical room contains all electrical and auxiliary equipment.
- During average demand periods, pump starts and stops are controlled by the water level in the District's Reservoir Nos. 1, 2 and 3.
- Check valves are on each pump in addition to surge protection for the station.
- Two dedicated primary electrical feeds from PUD.
- Equipped with a Manual Transfer Switch (MTS).

Major Upgrades:

Year	Job No.	Description of Work
1980	A98-78	Pump 5 installed.
1986	TBD	Pumps 1 and 2 replaced with variable-speed pumps, Pumps 3 and 4 rebuilt.
2008	A294-00	Supervisory control system upgraded.
2009	A471-08	Starters for Pumps 1 and 2 replaced.
2011	W0501A	All five pumps replaced; upgrades to lighting, electrical and HVAC systems.

Last Updated: September, 2016

Pump Station No. 2

Year Constructed:	1991	*Job No.:*	A142-86

Location: Evergreen Way, Everett

Total Pumping Capacity: 25 mgd in conjunction with Pump Station No. 1, 44 mgd if operating alone

Pump Types:

- Four 800-hp fixed speed

Supplied By: Everett: Reservoir No. 3, from the Berry Transmission Line or Transmission Line 5

Discharges To: Transmission Line Nos. 1 and 2

Major Features:

- Concrete/masonry construction.
- Structure has a bridge crane for equipment access.
- All electrical and auxiliary equipment is housed indoors.
- During average demand periods, pump starts and stops are controlled by the water level in the District's Reservoir Nos. 1, 2 and 3.
- Check valves are on each pump in addition to surge protection for the station.
- Two dedicated primary electrical feeds from PUD.

Major Upgrades:

Year	Job No.	Description of Work
2008	A294-00	Supervisory control system upgraded.
2014	W1107B	Upgrades to motors, lighting, electrical, HVAC, instrumentation and control systems. New roof with improved fall protection. Discharge pipe restraint couplings replaced.

Last Updated: September, 2016

Transmission and Distribution Lines

The District's water system includes over 660 miles of transmission and distribution pipe ranging from 4-inches to 36-inches in diameter. The District has replaced all wood stave and asbestos cement pipe in our system with ductile iron pipe, or used PVC pipe in areas of crossing under or near high-voltage power lines. Other materials, such as cast iron and HDPE, are used for transmission and distribution lines within the District.

This plan defines transmission mains in one of two categories: wholesale or regional. Wholesale transmission water mains are those water mains which transfer water from the source of supply to the District's wholesale customers through the District's system, as listed in the wholesale contracts (see Appendix D - Supply Agreements). Regional transmission water mains are those water mains which transfer water to and between the District's pressure zones, in addition to those specifically listed in the wholesale contracts. Transmission mains tend to be 16-inches in diameter and larger. Generally, no service connections are allowed to a transmission main. Transmission line materials are concrete cylinder, cast or ductile iron pipes. The supply transmission lines are on separate routes to provide redundancy, allowing for one to be shut down for maintenance or repair and to ensure adequate water is available during peak demand periods.

Table 1.3: Transmission and Distribution Main Lines by Size and Type

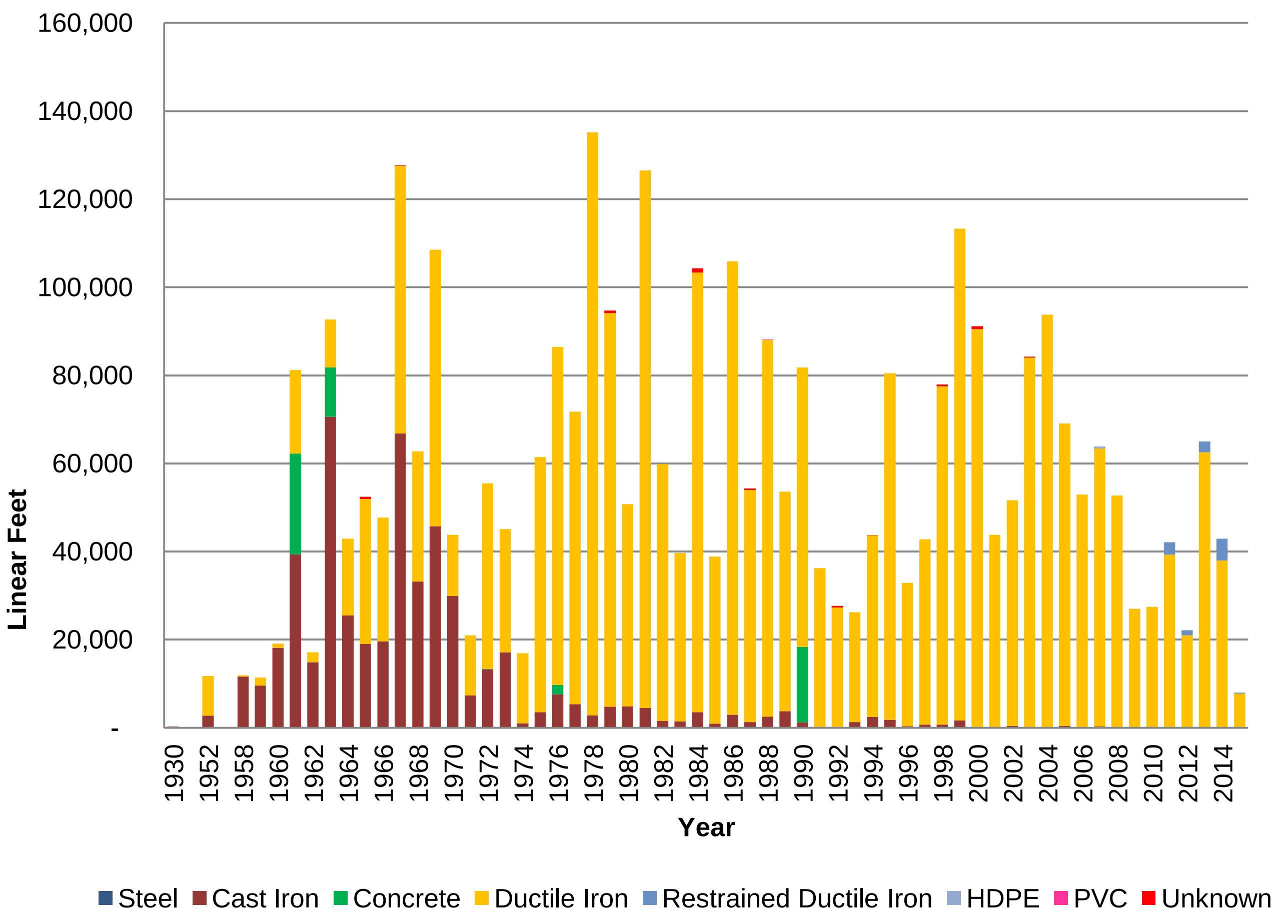
Diameter (inches)	CI	CON	DI	RJDI	ST	HD	PVC	Ukn	Total	Proportion
4	32,748	351	8,225						*41,324*	*1.2%*
6	316,699	289	650,636	868	73				*968,565*	*27.8%*
8	114,167		1,672,998	8808	116		55		*1,796,144*	*51.5%*
10	307		4,493			304			*5,104*	*0.0%*
12	25,808	1688	283,917	875					*312,288*	*9.0%*
14						209			*209*	*0.0%*
16	18,004		130,052	623	330				*149,009*	*4.3%*
18			7,857						*7,857*	*0.0%*
20			6,468						*6,468*	*0.0%*
24	161	103	46,629	309	95				*47,297*	*1.4%*
30	618	23,375	33,336						*57,329*	*1.6%*
36		27,359	59,347						*86,706*	*2.5%*
Other/Uknown								10735	10,735	*0.0%*
Total (ft)	*508,512*	*53,165*	*2,903,958*	*11483*	*614*	*513*	*55*	*10,735*	*3,489,035*	*Total (ft)*
Total (mi)	*96.3*	*10.1*	*550.0*	*2.2*	*0.1*	*0.1*	*0.0*	*2.0*	*660.8*	*Total (mi)*
Proportion	*14.6%*	*1.5%*	*83.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*		*Proportion*

1. CI = Cast Iron
2. CON = Concrete Cylinder
3. DI = Ductile Iron
4. RJDI = Restrained Joint Ductile Iron
5. HD = High Density Polyethylene
6. PVC = Polyvinyl Chloride
7. Ukn = Unknown

Last Updated: July, 2017

The District water system is largely comprised of water distribution mains. The distribution mains consist of 4" (1.2%), 6" (27.8%) 8” (51.5%), 10” (<1.0%) and 12” (9.0%) diameter mains to make up 98.7% of the total lineal footage of the Districts water pipe inventory.

Chart 1.1: Water Distribution Mains by Material and Year Installed



Last Updated: September, 2016

Listed below are the major transmission mains that bring water from Everett or Clearview Water Supply Agency to the District's retail service area:

Transmission Line No. 1

Year Constructed:	1962	*Job No.:*	A-21A
Approximate Route:	Cascadian Way south to 148th Street SE	*Length:*	7.5 miles
Diameter and Type:	30- and 36-inch concrete cylinder pipe		
Supplied By:	AWWD: Pump Station Nos. 1 and 2		
Discharges To:	AWWD: Reservoir Nos. 1, 2 and 3; 635 Pressure Zone		

Major Upgrades:

Year	*Job No.*	*Description of Work*
2003	A234-96	Relocated portion of transmission main for SR 527 widening.

Last Updated: September, 2016

Transmission Line No. 2

Year Constructed:	1973	*Job No.:*	A-59
Approximate Route:	Cascadian Way south to 164th Street SE	*Length:*	8 miles
Diameter and Type:	30- and 36-inch concrete cylinder pipe		
Supplied By:	AWWD: Pump Station Nos. 1 and 2		
Discharges To:	AWWD: Reservoir Nos. 1, 2 and 3; 635 Pressure Zone		

Major Upgrades:

Year	*Job No.*	*Description of Work*
None		

Last Updated: September, 2016

Transmission Line No. 3 (Clearview Transmission Line)

Year Constructed:	2003 (Segment 1), 2004 (Segment 2)	*Job No.:*	A271-98A
Approximate Route:	180th Street SE at SR 527 to CWSA Master Meter, 160th St SE at 68th Ave SE	*Length:*	11 miles
Diameter and Type:	36- and 30-inch ductile iron equipped with impressed current cathodic protection and test stations		
Supplied By:	CWSA: Master Meter		
Discharges To:	AWWD: 635 Pressure Zone		

Major Upgrades:

Year	*Job No.*	*Description of Work*
None		

Last Updated: September, 2016

635 Pressure Zone Facilities

The 635 Zone is supplied by Everett's Reservoir No. 3 via Pump Station Nos. 1 and 2. This zone is also supplied by the Clearview Water Supply agency connection. The District's Reservoir Nos. 1, 2 and 3 are located within this pressure zone at the highest point in the District. This pressure zone serves the 520 and 285 Zones by gravity, as well as the five wholesale customers: the cities of Lynnwood, Edmonds and Mountlake Terrace, the Mukilteo Water & Wastewater District and the Silver Lake Water & Sewer District. The 635 Zone also serves the 724 Zone via the 724 Booster Pump Station.

The 635 Zone has two distinct areas separated by the 724 Pressure Zone. The two areas operate at the same nominal hydraulic grade. The 635 Zone reservoirs provide water to both portions of the 635 Zone, which are connected with transmission mains.

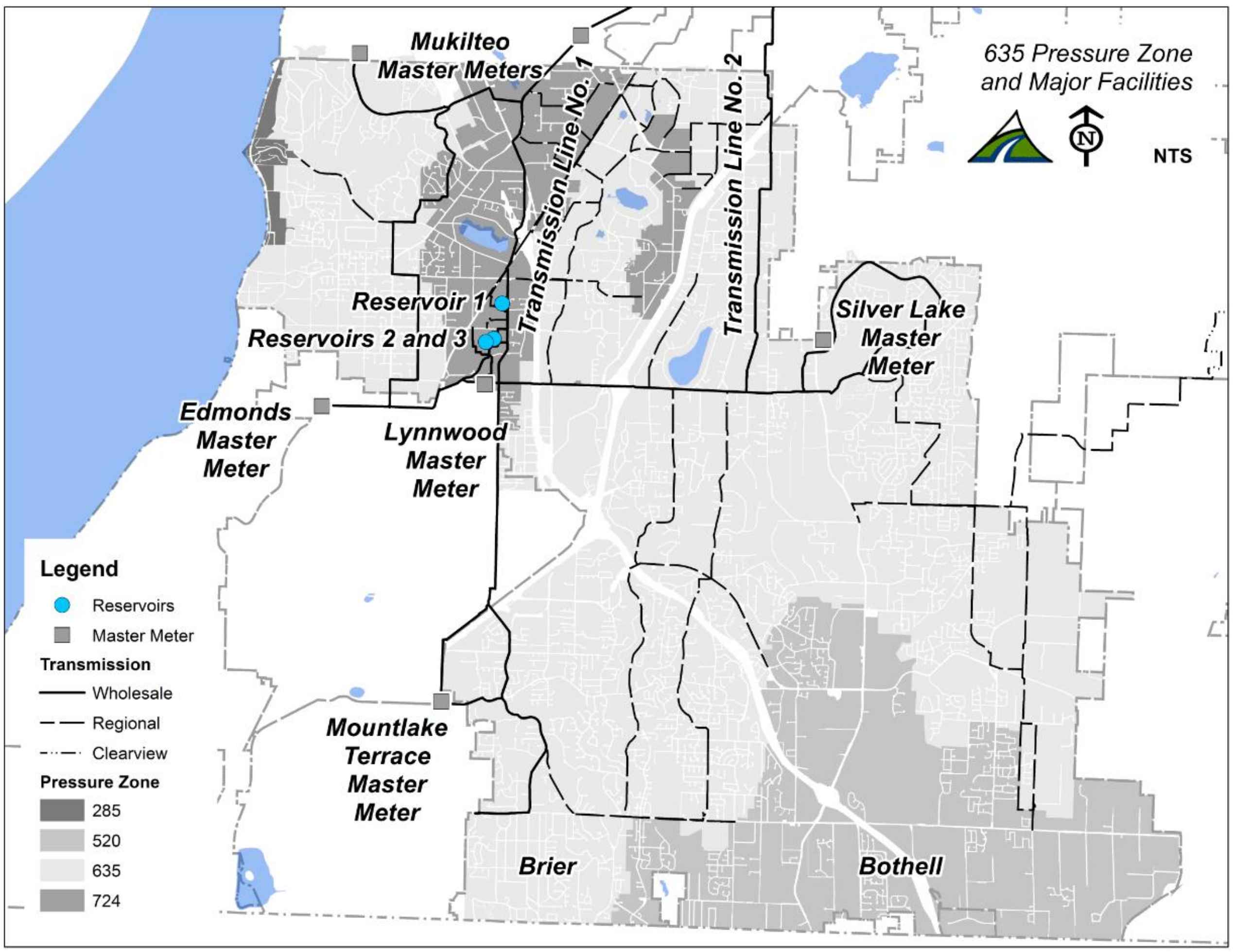
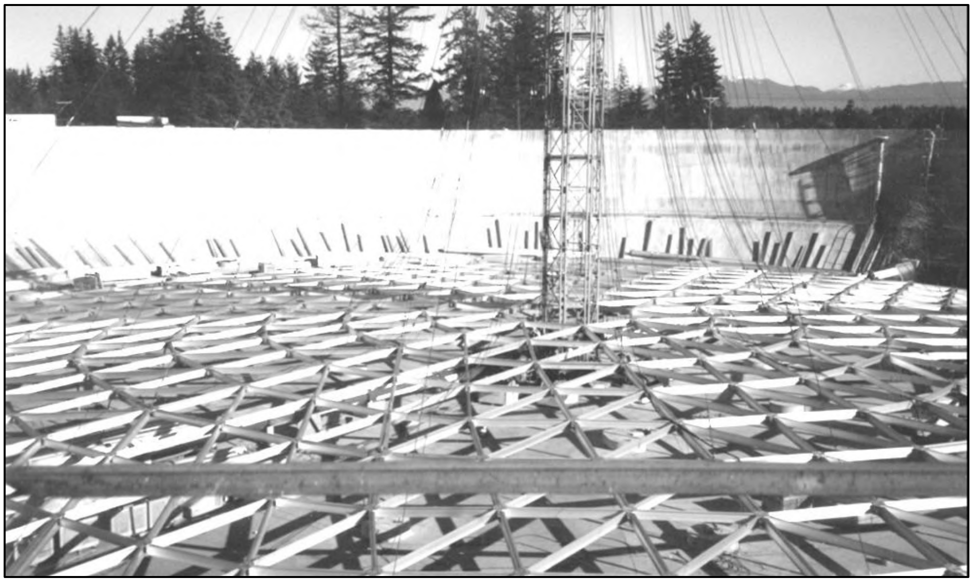


Figure 1.9: 635 Pressure Zone Facilities in Relation to the Water System

Last Updated: September, 2016

Reservoir No. 1



Crane Used to Hoist Roof Lattice Structure into Place, 2001

Year Constructed:	1963	*Job No.:*	A-21A
Location:	35th Ave W, Lynnwood	*Capacity:*	28.0 mg

Supplied By: Pump Station Nos. 1 and 2 (635 Pressure Zone), Clearview Reservoir

Discharges To: Directly to 635 Pressure Zone
Indirectly to 285 and 520 Pressure Zones and 724 Booster Pump Station

Major Features:

- Concrete construction, 376-foot diameter, 37-foot height.
- Epoxy-lined interior.
- Can be taken out of service without disruption of water supply.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2000	A269-98A	Reinforced foundation to meet seismic requirements. Repaired cracks and construction joints. Interior cleaned and coating replaced with epoxy.
2001	A269-98B	Reservoir roof installed with gutters.
2008	A294-00	Supervisory control system upgraded.
2014	W1408	Interior cleaned.
Pending	W1403	Add check valve to overflow discharge pipe.

Last Updated: December 2017

Reservoir No. 1 Disinfection Facility

Year Constructed:	2000	*Job No.:*	A269-98
Location:	35th Avenue W, Lynnwood		
Type:	Sodium hypochlorite, at least 20-pounds per day		
Serves:	AWWD: Reservoir No. 1, High Tank Nos. 1 and 2		

Major Features:

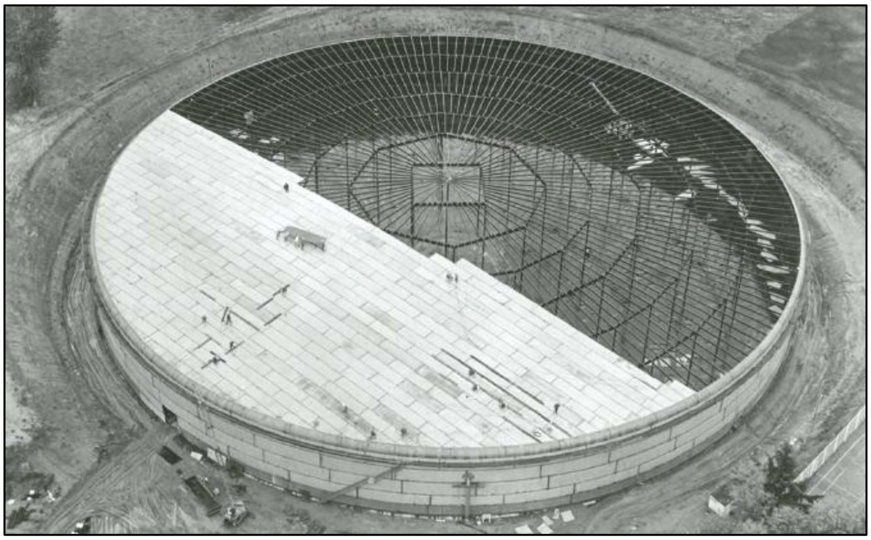
- Concrete masonry building.
- On-site chlorine generation system.
- Operates at a constant rate set by the operator based on chlorine residual and flow rate out of the reservoir.
- Backup on-site generator located at 724 Booster Pump Station.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system upgraded.
2016	W1402	Replaced chlorine generation system and electrical components, upgraded supervisory control system.

Last Updated: September, 2016

Reservoir No. 2



Installing Steel Roof Panels, circa 1967

Year Constructed:	1968	*Job No.:*	A-25A
Location:	156th Street SW, Lynnwood	*Capacity:*	28.7 mg

Supplied By: AWWD: Pump Station Nos. 1 and 2 (635 Pressure Zone)

Discharges To: AWWD: 635, 285 and 520 Pressure Zones

Major Features:

- Welded steel construction, 370-foot diameter, 26-foot height.
- Equipped with an impressed current catholic protection system
- Can be taken out of service without disruption of water supply.

Major Upgrades:

Year	*Job No.*	*Description of Work*
1976	A83-75	Impressed current cathodic protection added.
1992	A199-92	Leak evaluation and repair.
2002	A306-01	Seismic valving and seismic retrofit to footings.
2007	A382-05B	Valve vault modified and upgraded.
2008	A294-00	Supervisory control system upgraded.
2008	W0503	Interior cleaned and coating replaced with epoxy. Exterior cleaned and recoated. Access and security improvements.
2014	W1401	Exterior cleaned.
2015	W1403	Added air gap to overflow discharge pipe.
Pending	W1401	Exterior recoating

Last Updated: December, 2017

Reservoir No. 3

Paving the Driveway to Reservoir 3, circa 1977

Year Constructed:	1977	*Job No.:*	A-61, A85-76
Location:	156th Street SW, Lynnwood	*Capacity:*	19.4 mg
Supplied By:	AWWD: Pump Station Nos. 1 and 2 (635 Pressure Zone)		
Discharges To:	AWWD: 635, 285 and 520 Pressure Zones		

Major Features:

- Welded steel construction, 370-foot diameter, 24-foot height.
- Equipped with an impressed current cathodic protection system.
- Can be taken out of service without disruption of water supply.

Major Upgrades:

Year	Job No.	Description of Work
1992	A198-92	Exterior cleaned and recoated.
2002	A306-01	Seismic valving and seismic retrofit to footings.
2007	A382-05	Exterior cleaned and recoated. Access and security improvements.
2007	A382-05B	Valve vault modified and upgraded.
2008	A294-00	Supervisory control system upgraded.
2009	W0503	Interior cleaned and coating replaced with epoxy.
2014	W1401	Exterior cleaned.
2015	W1401	Exterior recoated.
2015	W1403	Added air gap to overflow discharge pipe.

Last Updated: December, 2017

Reservoir Nos. 2 and 3 Disinfection Facility

Year Constructed:	2001	*Job No.:*	A269-98
Location:	156th Street SW, Lynnwood		
Type:	Sodium hypochlorite, up to 50 pounds per day		
Serves:	AWWD: Reservoir Nos. 2 and 3		

Major Features:

- Concrete masonry building.
- On-site chlorine generation system.
- Operates at a constant rate set by the operator based on chlorine residual and flow rate out of the reservoir.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system upgraded.
2015	W1402	Upgrade equipment to allow flow paced operation
Pending		Replacement of chlorine generation system and electrical components. Upgrade SCADA

Last Updated: December, 2017

285 Pressure Zone Facilities

The 285 Zone is supplied by the District's 635 Zone via the Picnic Point PRV.

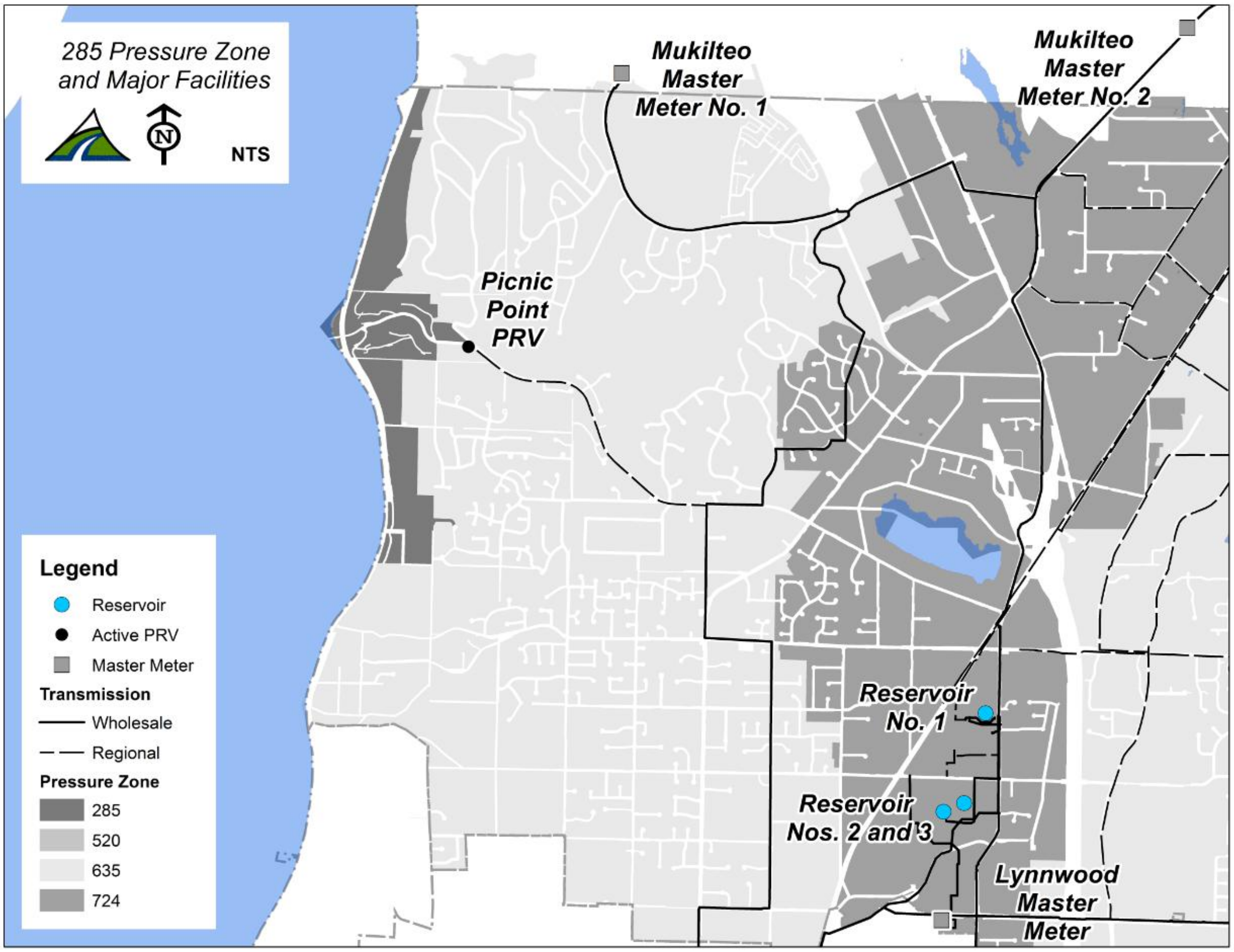


Figure 1.10: 285 Pressure Zone Facilities in Relation to the Water System

Last Updated: September, 2016

Picnic Point Pressure Reducing Station

Year Constructed:	1981	*Job No.:*	A-75
Location:	Picnic Point Road, Edmonds		
Status:	Active		
Supplied By:	635 Pressure Zone	*Discharges To:*	285 Pressure Zone

Major Features:

- Concrete vault.
- One 6-inch PRV for average and high demand periods.
- Two 2-inch PRVs in sequence as a bypass.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system added.
2013	WO51928	Supervisory control system moved to (sewer) Lift Station No. 18 to prevent flooding of equipment.

Last Updated: September, 2016

520 Pressure Zone Facilities

The 520 Zone is supplied by the District's 635 Pressure Zone via PRVs, with backup storage provided by Reservoir Nos. 1, 2 and 3 and Clearview Reservoir. There are three additional storage facilities in this pressure zone: Nike Tank Nos. 1 and 2 and the Canyon Park Tank.

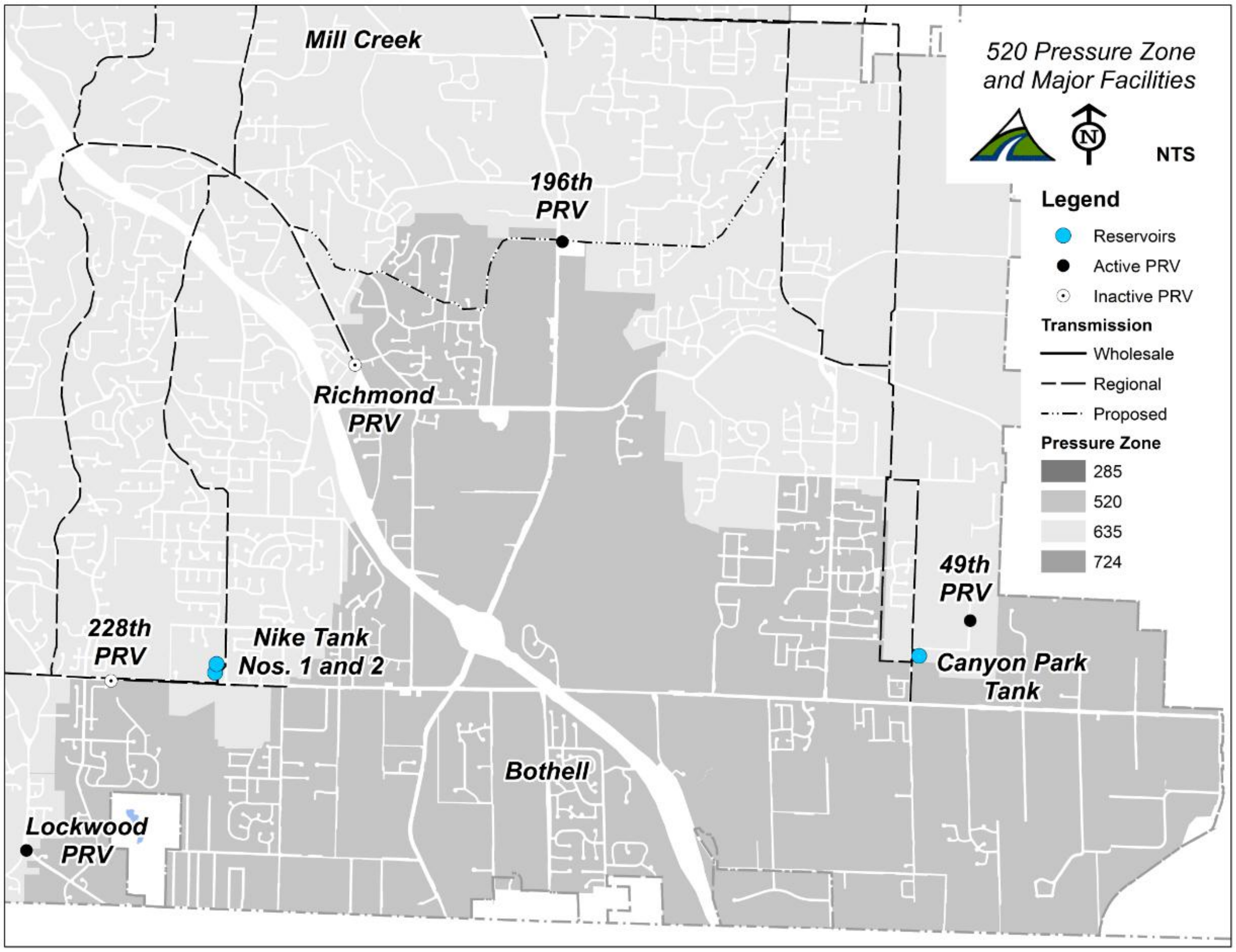


Figure 1.11: 520 Pressure Zone Facilities in Relation to the Water System

Last Updated: September, 2016

Canyon Park Tank (Standpipe)

Canyon Park Tank During Recoating, 2005

Year Constructed:	1983	*Job No.:*	A103-79
Location:	45th Avenue SE, Bothell	*Capacity:*	3.0 mg
Supplied By:	635 Pressure Zone PRVs		
Discharges To:	520 Pressure Zone		

Major Features:

- Welded steel construction, 80-foot diameter, 80-foot height.
- Epoxy-lined interior.
- Equipped with an impressed current cathodic protection system.
- Equipped with 8-inch modulating control valve to control the rate of flow, water level and water pressure into the tank.
- Can be taken out of service without disruption of water supply if Nike Tank Nos. 1 and 2 are in service.

Major Upgrades:

Year	Job No.	Description of Work
2002	A279-98B	Seismic retrofit to footings.
2005	W0503	Interior cleaned and coating replaced with epoxy. Exterior cleaned and recoated. Access and security improvements.
2008	A294-00	Supervisory control system upgraded.
2013	A103-79	Lighting and security upgrades.
2015	W1102B	Replaced altitude control valve; move valve, electrical and supervisory control system components to new prefabricated building.

Last Updated: December, 2017

Canyon Park Disinfection Facility

Year Constructed:	2001	*Job No.:*	A279-98A
Location:	45th Avenue SE, Bothell		
Type:	Sodium hypochlorite, up to 6-pounds per day		
Serves:	AWWD: Canyon Park Tank		

Major Features:

- Concrete building with brick facade.
- On-site chlorine generation system.
- Operates at a constant rate based on flow out of the tanks.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system upgraded.
2015	W1102B	Altitude control valve replaced in above-grade pre-fabricated building.

Last Updated: September, 2016

Nike Tank No. 1 (Reservoir)

Nike Tank No. 1, 2014

Year Constructed:	1961	*Job No.:*	A-18
Location:	228th St SE, Bothell	*Capacity:*	2.2 mg
Supplied By:	AWWD: Reservoirs 1, 2 and 3 (635 Pressure Zone)		
Discharges To:	AWWD: 520 Pressure Zone		

Major Features:

- Welded steel construction, 114-foot diameter, 31-foot height.
- Epoxy-lined interior.
- Equipped with 10-inch altitude control valve to control the rate of flow, water level and water pressure into the tank.
- Can be taken out of service without disruption of water supply if Canyon Park Tank and Nike Tank No. 2 are in service.

Major Upgrades:

Year	*Job No.*	*Description of Work*
1996	A237-96	Added impressed current cathodic protection system.
2005	A341-03	Interior and exterior cleaned and recoated. Security improvements, including safety cage for ladder access.
2008	A294-00	Supervisory control system upgraded.
2013	A103-79	Lighting and security upgrades.
2014	WQ71242	Exterior cleaned.

Last Updated: September, 2016

Nike Tank No. 2 (Reservoir)

Nike Tank No. 2, 2014

Year Constructed:	2003	*Job No.:*	A279-98B
Location:	228th St SE, Bothell	*Capacity:*	3.7 mg

Supplied By: AWWD: Reservoirs 1, 2 and 3 (635 Pressure Zone)

Discharges To: AWWD: 520 Pressure Zone

Major Features:

- Welded steel construction, 150-foot diameter, 28-foot height.
- Equipped with an impressed current cathodic protection system.
- Equipped with 10-inch altitude control valve to control the rate of flow, water level and water pressure into the tank.
- Can be taken out of service without disruption of water supply if Canyon Park Tank and Nike Tank No. 1 are in service.

Major Upgrades:

Year	Job No.	Description of Work
2005	A385-05	Security ladder modified.
2008	A294-00	Supervisory control system upgraded.
2013	A103-79	Lighting and security upgrades.
2014	WQ71241	Exterior cleaned.
2015	W1403	Added air gap to overflow pipe.

Last Updated: September, 2016

Nike Disinfection Facility

Year Constructed: 2003 *Job No.:* A279-98B

Location: 228th Street SE, Bothell

Type: Sodium hypochlorite, up to 6-pounds per day

Serves: AWWD: Nike Tank Nos. 1 and 2

Major Features:

- Prefabricated metal building.
- On-site chlorine generation system.
- Operates at a constant rate based on flow out of the tanks.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system upgraded.

Last Updated: September, 2016

49th Avenue SE Pressure Reducing Station

Year Constructed: 2008 *Status:* Active *Job No.:* A403-05

Location: 49th Avenue SE and 224th Street SE

Supplied By: 635 Pressure Zone *Discharges To:* 520 Pressure Zone

Major Features:

- Concrete vault.
- One 3-inch PRV for low demand periods.
- One 8-inch PRV for average and high demand periods.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None

Last Updated: September, 2016

196th Street SE Pressure Reducing Station

Year Constructed: 1995 *Status:* Active *Job No.:* A192-92

Location: 196th Street SE and Bothell-Everett Highway

Supplied By: 635 Pressure Zone *Discharges To:* 520 Pressure Zone

Major Features:

- Concrete vault.
- One 3-inch PRV for low demand periods.
- One 8-inch PRV for average and high demand periods.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system upgraded.

Last Updated: September, 2016

228th St SW Pressure Reducing Station

Year Constructed:	1988	*Status:*	Inactive	*Job No.:*	X955
Location:	228th Street SW and 14th Avenue W				
Supplied By:	635 Pressure Zone	*Discharges To:*	520 Pressure Zone		

Major Features:

- Concrete vault.
- One 6-inch PRV for average and high demand.
- Does not have a parallel PRV for low demand.
- Taken out of service to prevent Canyon Park Tank from draining.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None

Last Updated: September, 2016

Richmond Pressure Reducing Station (Filbert / Nellis)

Year Constructed:	1968	*Status:*	Inactive	*Job No.:*	A-34
Location:	Filbert Road and Richmond Road				
Supplied By:	635 Pressure Zone	*Discharges To:*	520 Pressure Zone		

Major Features:

- Concrete vault.
- One 8-inch PRV for average and high demand; no parallel PRV.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None

Last Updated: September, 2016

Lockwood Pressure Reducing Station

Year Constructed:	2013	*Status:*	Active	*Job No.:*	W1102
Location:	Lockwood Road and Locust Way				
Supplied By:	635 Pressure Zone	*Discharges To:*	520 Pressure Zone		

Major Features:

- Prefabricated steel vault.
- One 6-inch PRV for fire flow demand.
- One 1-inch PRV for water quality.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2014	WQ61281	1-inch PRV added to protect the analyzer.

Last Updated: September, 2016

724 Pressure Zone Facilities

The 724 Zone is supplied from the 635 Zone via the 724 Zone Booster Pump Station. Water from the 724 Booster Pump Station is conveyed to High Tank No. 1 and High Tank No. 2, located at the highest point in the District, which then supply the 724 Zone. The 724 Zone can also be supplied directly from the 724 Booster Pump Station if both tanks are out of service. The 724 Zone was expanded in 2003-2004 to improve service pressures for a high elevation area near Lake Stickney.

The 724 Zone has two distinct, separate areas that operate at the same hydraulic grade. The 724 Booster Pump Station pumps water from the 635 Zone to the High Tanks, which serves our customers in the 724 Zone. The two portions of the 724 Zone are connected by transmission mains.

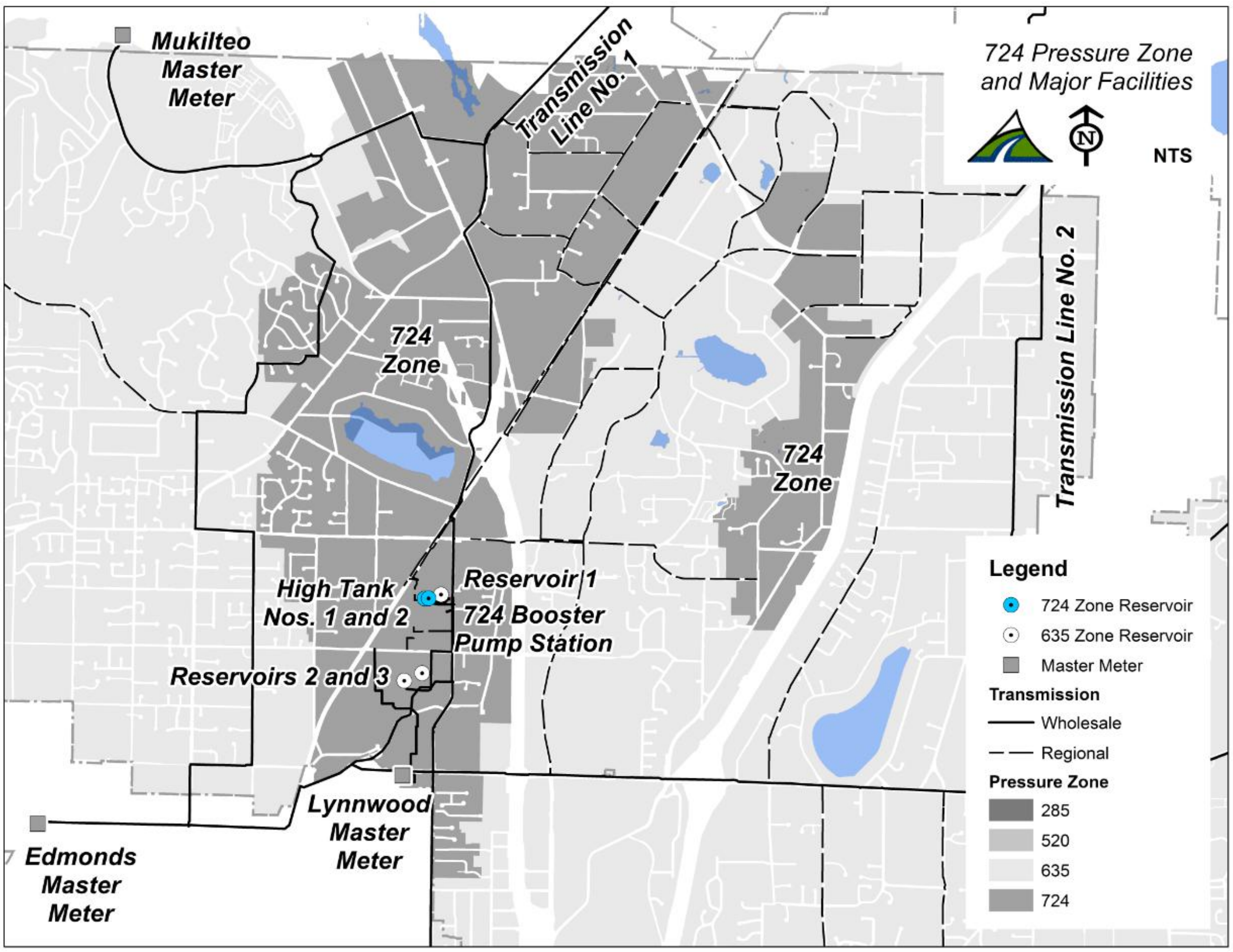
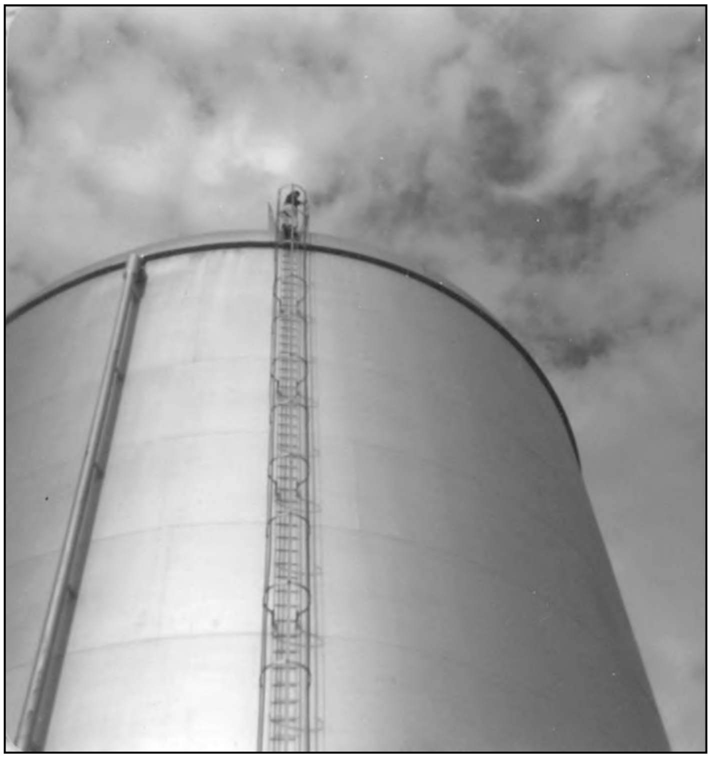


Figure 1.12: 724 Pressure Zone Facilities in Relation to the Water System

Last Updated: September, 2016

High Tank No. 1 (Standpipe)



High Tank No. 1 with Safety Ladder, circa 1965

Year Constructed:	1964	*Job No.:*	A-24
Location:	35th Ave W, Lynnwood	*Capacity:*	2.0 mg
Supplied By:	AWWD: 724 Booster Pump Station		
Discharges To:	AWWD: 724 Pressure Zone		

Major Features:

- Welded steel construction, 60-foot diameter, 96-foot height.
- Interior is epoxy-lined.
- Equipped with an impressed current cathodic protection system.
- Can be taken out of service without disruption of water supply to the 724 Zone.

Major Upgrades:

Year	*Job No.*	*Description of Work*
1980	A107-80	Exterior cleaned and recoated.
2002	A279-98A	Seismic upgrades completed.
2005	A341-03	Interior and exterior cleaned and recoated. Security improvements.
2008	A294-00	Supervisory control system upgraded.
2017	WQ127012	Exterior cleaned, paint patching

Last Updated: December, 2017

High Tank No. 2 (Standpipe)

Crane Hoisting the Roof onto High Tank No. 2, circa 2002

Year Constructed:	2002	*Job No.:*	A279-98B
Location:	35th Ave W, Lynnwood	*Capacity:*	3.1 mg
Supplied By:	AWWD: 724 Booster Pump Station		
Discharges To:	AWWD: 724 Pressure Zone		

Major Features:

- Welded steel construction, 74-foot diameter, 96-foot height.
- Interior is epoxy-lined.
- Equipped with an impressed current cathodic protection system.
- Can be taken out of service without disruption of water supply.

Major Upgrades:

Year	Job No.	Description of Work
2005	A385-05	Security ladder modified.
2008	A294-00	Supervisory control system upgraded.
2017	WQ127686	Exterior Cleaned

Last Updated: December, 2017

724 Zone Booster Pump Station

724 Booster Pump Station, 2014

Year Constructed:	2001	*Job No.:*	A279-98A
Location:	35th Ave SW, Lynnwood	*Capacity:*	5.3 mgd
Pump Types:	Three 60-hp fixed speed		
Supplied By:	AWWD: Reservoir No. 1		
Discharges To:	AWWD: High Tank Nos. 1 and 2 (724 Pressure Zone)		

Major Features:

- Prefabricated metal building on reinforced concrete foundation.
- Pump starts and stops are controlled by the water level in the District's High Tank Nos. 1 and 2. In automatic mode, the pump-start is triggered by the low level setpoint maintained in the District's supervisory control system.
- Check valves are on each pump in addition to surge protection for the station.
- Lead pump status is rotated amongst all three pumps.
- Third pump is on standby for redundancy.
- Backup on-site generator.
- Station is able to bypass the reservoirs and pump directly into the 724 Zone, if needed.
- Piping can be installed for addition of 4th pump

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A294-00	Supervisory control system upgraded.
2014	W1107C	Upgrades to pumps, motors, electrical, HVAC, instrumentation and control systems. New roof hatches and improved fall protection added.

Last Updated: December, 2017

District Buildings and Maintenance Facilities

The District provides a wide range of water services to our customers, including service installation and repair, water quality programs, billing, development services and online services. These functions require adequate space, supplies and internal support services (such as information technology, inventory and accounting) in order for the District operations to run smoothly.

The direct costs for service and indirect costs for facilities and support both play a role in determining water rates. The facilities are included here, as the capital construction and maintenance costs associated with these facilities are long-term, substantial and impact Chapter 13 - *Capital Improvement Plan* and Chapter 14 - *Financial Plan.*

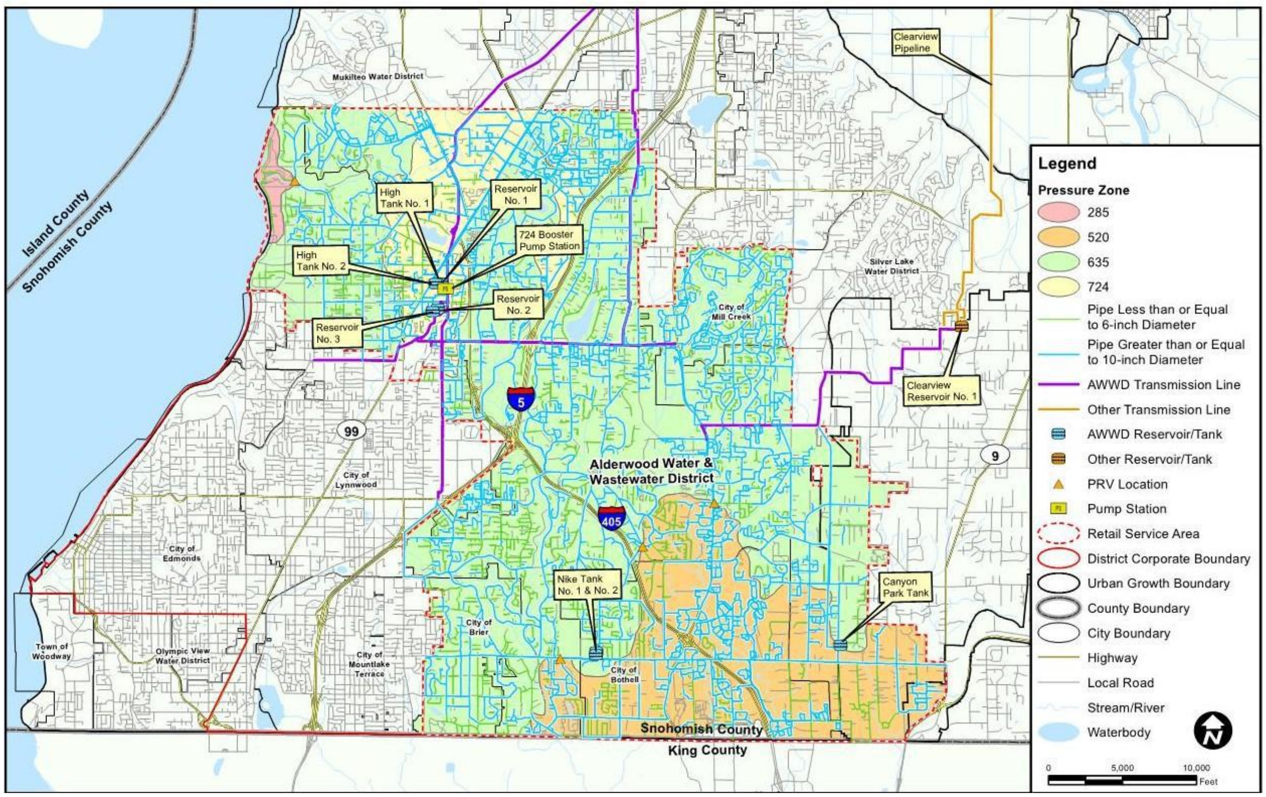
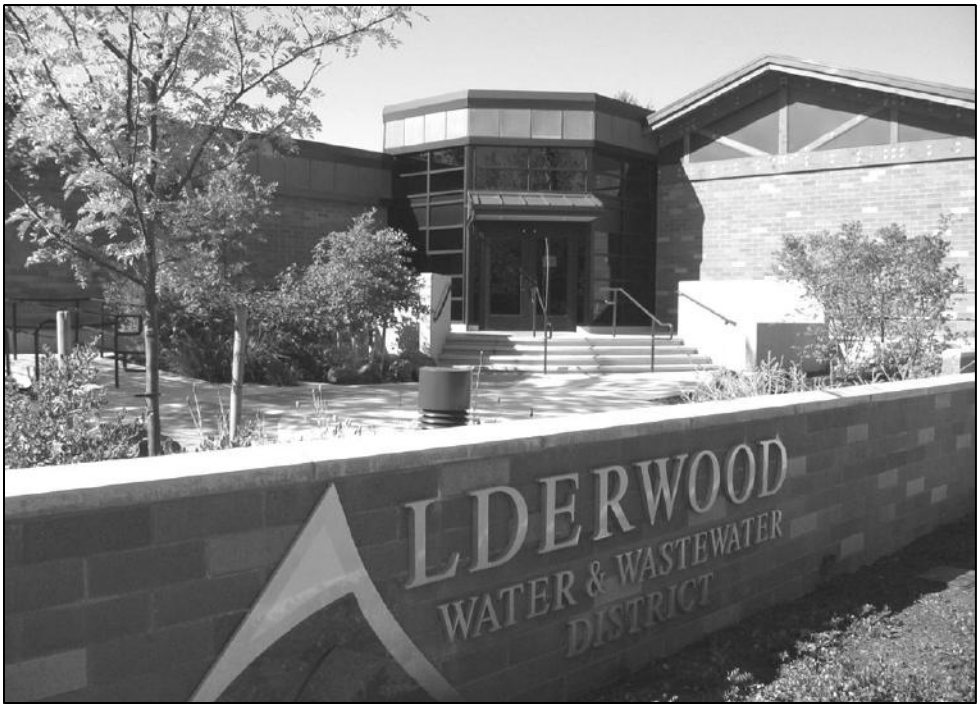


Figure 1.13: District Buildings and Facilities in Relation to the Water System

Last Updated: December, 2017

Administration Building



Administration Building After Entry Upgrades, 2011

Year Constructed:	1974 *Job No.:* A-66
Location:	156th Street SW, Lynnwood
Primary Function:	Administrative, Finance and Planning & Development Services departments
Major Features:	• Accommodates 45 full-time employees. • Location of Board of Commissioner meetings. • Conference and meeting space.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2003	A270-98A	Building remodeled and new board room added.
2004	A270-98C	Upgrades to site access and security.
2010	W0916	Added supervisory control system to generator.
2010	J1001	Upgrades to front entry and steps and sidewalk to improve accessibility.
2016	J1501	Replace portion of roof
pending		Replace main power distribution and replace generator power to building

Last Updated: December, 2017

Maintenance & Operations Building (Buildings 1 & 2)

Maintenance & Operations Main Entrance, 2014

Year Constructed:	1996	*Job No.:*	A216-94
Location:	35th Ave SW, Lynnwood		
Primary Function:	Maintenance & Operations Department		
Major Features:	Accommodates 55 full-time employees.		

Major Upgrades:

Year	*Job No.*	*Description of Work*
1996	A221-94	Supervisory control system added.
2004	A270-98A	Addition to vehicle storage and office areas.
2004	A270-98C	Upgrades to site access and security.
2008	A294-00	Supervisory control system replaced.
2014	WO62620	Security, supervisory control and access upgrades.

Last Updated: September, 2016

Decant Facility

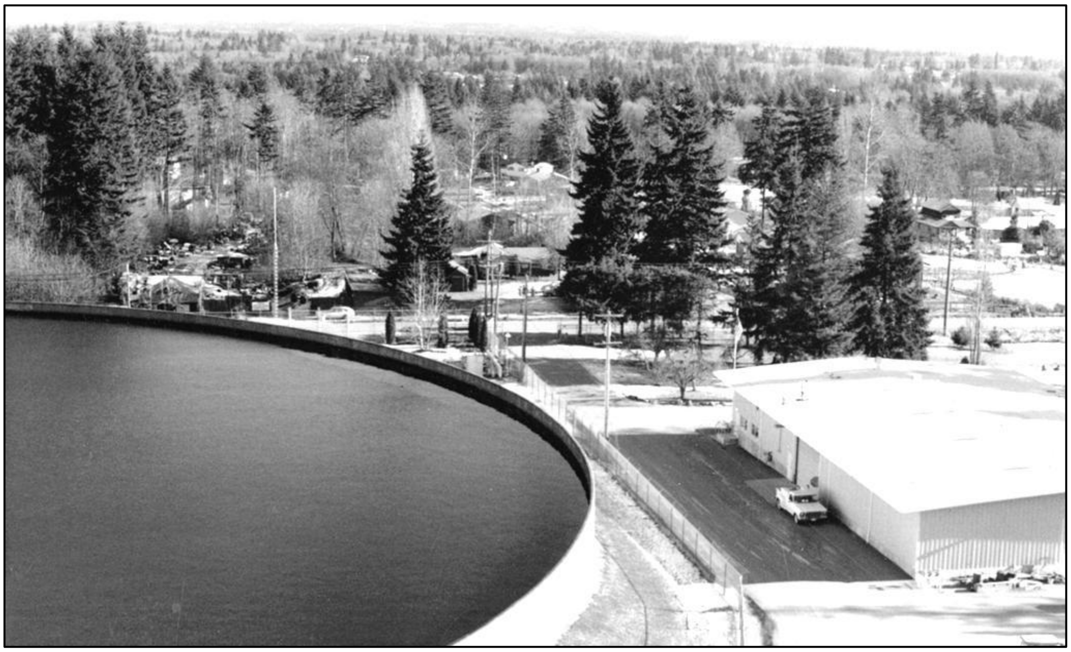
Decant Facility in Use, 2014

Year Constructed:	2007	*Job No.:*	A270-98B
Location:	35th Ave SW, Lynnwood		
Primary Function:	Separate liquids and solids from the mixture deposited by hydro excavators.		
Major Features:	Steel-frame building with decant bay, collection bay, dry storage bay and two wet storage bays.		

Major Upgrades:	<u>*Year*</u>	<u>*Job No.*</u>	<u>*Description of Work*</u>
	2012	J1002	Changed the slope of the decant bay, added safety rails and wheel stops.

Last Updated: September, 2016

Remodeled Old Maintenance Shop (ROMS) Building



ROMS Building from High Tank No. 1, circa 1977

Year Constructed:	1971	*Job No.:*	A-53
Location:	35th Ave SW, Lynnwood		
Primary Function:	Large equipment storage		

Major Features:

- Equipment parking and wash bay.
- Conference room.
- Wellness room.

Major Upgrades:

Year	*Job No.*	*Description of Work*
1989	A173-89	Building modifications.
1999	A270-98	Remodel of office space into conference and wellness rooms.
2007	A270-98B	Installation of four overhead doors and replacement of gas heaters.

Last Updated: September, 2016

Warehouse/Electrical Storage Building

Electrical Warehouse, Formerly the main Warehouse, circa 1980s

Year Constructed:	1977	*Job No.:*	A-80
Location:	35th Ave SW, Lynnwood		
Primary Function:	Electrical inventory		

Major Features:

- Approximately 5,500 sq. ft. of parking and storage space.
- Space for various paving and landscaping equipment.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2007	A270-98B	New canopy extension on north end of building.

Last Updated: September, 2016

Warehouse/Shop Building (Building 3)

Mechanic Portion of the Main Warehouse, 2005

Year Constructed:	1995	*Job No.:*	A216-94
Location:	35th Ave SW, Lynnwood		
Primary Function:	Mechanic, electrical and SCADA crew workspace; inventory warehouse; large equipment and vehicle maintenance and repair.		

Major Features:

- Accommodates 10 full-time employees.
- Approximately 16,000 sq. ft. of storage space.

Major Upgrades:

Year	*Job No.*	*Description of Work*
2008	A484-08	Heating system upgrade.

Last Updated: September, 2016

Master Meters

The following are the Master Meters used for the distribution of water supply between suppliers and wholesalers.

Everett Billing Meter Pump Station 1

Year Constructed: 1964 *Job No.:* A21A

Location: *Location: Evergreen Way Everett*

Major Features:

- Inside Pump Station.
- 30-inch Sparling propeller
- Supervisory control system.
- Owned by City of Everett

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: December, 2017

Everett Billing Meter Pump Station 2

Year Constructed: 1991 *Job No.:* A142-86

Location: Evergreen Way, Everett

Major Features:

- Pre-cast concrete vault.
- 48-inch Sparling propeller meter.
- Supervisory control system.
- Owned by City of Everett

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: December, 2017

Everett Billing Meter Clearview

Year Constructed: 2014 *Job No.:* W1019E

Location: 53rd Avenue SE and Bickford Avenue, Snohomish

Major Features:

- Pre-cast concrete vault.
- 42-inch micrometer insertion meter.
- Supervisory control system.
- Owned by City of Everett

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: December, 2017

Clearview Billing Meter CWSA Reservoir Site

Year Constructed:	2005	*Job No.:*	W271-98A
Location:	73rd Avenue SE and 160 Street SE, Snohomish		

Major Features:

- Pre-cast concrete vault.
- 42-inch Micrometer insertion meter.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Edmonds Master Meter

Year Constructed:	1966	*Job No.:*	A27
Location:	168th Street SW and 62nd Avenue W		

Major Features:

- Concrete vault.
- 10-inch magnetic flow meter with 8-inch bypass magnetic flow meter.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Lynnwood Master Meter

Year Constructed:	1962	*Job No.:*	A23
Location:	164th Street SW and Spruce Way		

Major Features:

- Concrete vault.
- Two 10-inch turbine meters.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Mountlake Terrace Master Meter

Year Constructed:	1967	*Job No.:*	A30
Location:	212th Street SW and 44th Ave W		

Major Features:
- Concrete vault.
- 10-inch turbine meter.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Mukilteo Master Meter No. 1

Year Constructed:	2011	*Job No.:*	W0905
Location:	Harbour Pointe Boulevard and Saint Andrews Drive		

Major Features:
- Precast concrete vault.
- 8-inch magnetic flow meter.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Mukilteo Master Meter No. 2

Year Constructed:	2012	*Job No.:*	W0905
Location:	Beverly Park Road and Commando Road		

Major Features:
- Precast concrete vault.
- 12-inch magnetic flow meter.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Silver Lake Master Meter

Year Constructed:	2015	*Job No.:*	W1303
Diameter and Type:	156th Street SW and Bothell-Everett Highway		

Major Features:

- Precast concrete vault.
- 12-inch magnetic flow meter.
- Supervisory control system.

Major Upgrades:

Year	*Job No.*	*Description of Work*
		None.

Last Updated: September, 2016

Clearview Facilities

The Clearview Water Supply Agency (CWSA) was created in 1996 through an interlocal agreement between the District, Silver Lake Water & Sewer District (SLWSD) and Cross Valley Water District (CVWD). This agreement allows the three districts to cooperatively construct and maintain facilities for providing water, which currently include a pump station, transmission main and a reservoir.

Each agency appoints one Commissioner to serve on the three-member governing board of CWSA and each agency is responsible for costs proportionate to its use. CWSA has no employees and currently contracts with the District for accounting and management services. Each agency also maintains one of the three major facilities. Currently, the District maintains the pump station, SLWSD maintains a portion of the transmission line and CVWD maintains the remainder of the transmission line and the reservoir. Each agency is responsible for its master meter(s) for purchases from CWSA.

A copy of the interlocal agreement for CWSA can be found in *Appendix E*.

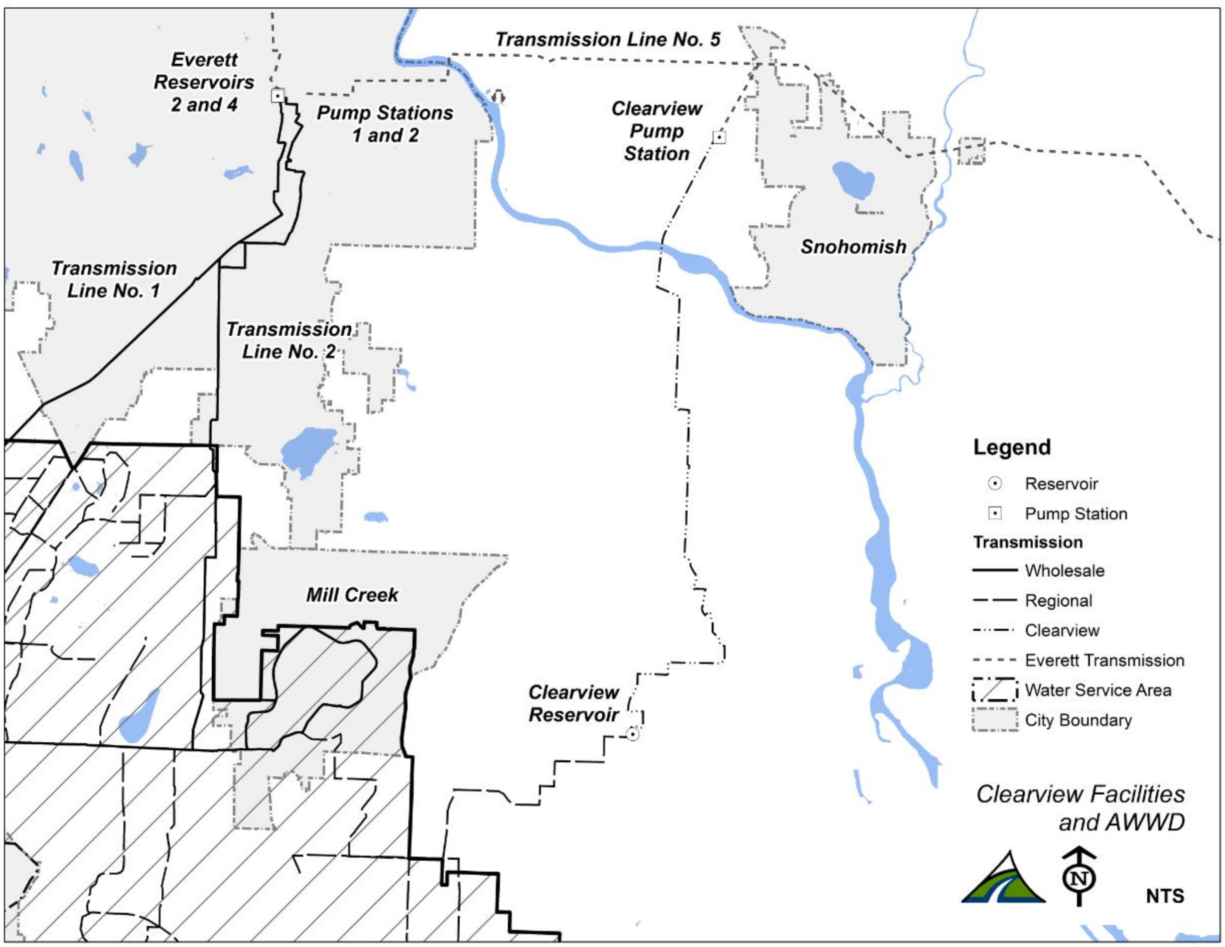


Figure 1.14: Clearview Facilities in Relation to the Water System

Last Updated: September, 2016

Clearview Pump Station

Clearview Pump Station from 64th Street SE, 2013

Year Constructed:	2005	*Job No.:*	A271-98A
Location:	64th Street SE, Snohomish		
Total Pumping Capacity:	33 mgd, 18.5 mgd dedicated to AWWD		
Pump Types:	• Two 400-hp variable speed. • Three 800-hp fixed speed.		
Supplied By:	Everett: Transmission Line 5 and the CWSA transmission main		
Discharges To:	CWSA: Reservoir No. 1 via the CWSA transmission main		
Major Features:	• Operated and maintained by AWWD for CWSA. • Backflow prevention and surge protection on pumps. • Connected to the supervisory control system. • Dedicated electrical service. • On-site backup generator.		

Major Upgrades:

Year	*Job No.*	*Description of Work*
2012	A294-00	Modified supervisory control system.
2013	W1018	Replaced variable frequency drives, modified generator.
2014	A476-08	Added HVAC system, modified surge system.

Last Updated: September, 2016

Clearview Reservoir No. 1

Clearview Reservoir During Construction, circa 2004

Year Constructed:	2005	*Job No.:*	A271-98A
Location:	73rd Avenue SE and 160th Street SE		
Total Capacity:	11.9 mg, 7.4 mg of which is reserved for AWWD		
Supplied By:	Everett: Transmission Line 5, CWSA transmission main and Clearview Pump Station		
Discharges To:	AWWD: 635 Pressure Zone		
Major Features:	• Welded-steel construction, 92-foot radius, 60-foot height. • Operated and maintained by Cross Valley Water District for Clearview.		

Major Upgrades:	*Year*	*Job No.*	*Description of Work*
			None

Last Updated: Dewcember, 2017

2. Related Plans, Agreements and Policies

The District's program to deliver water to our customers has been developed over many years in the context of various agreements, plans and policies that address water supply and land use in southwestern Snohomish County. This chapter describes key agreements and plans and summarizes the District's water service policies.

Last Updated: September, 2016

Planning Context and Related Plans – WAC 246-290-100(1)(b)

Land use planning and the provision of water and sanitary sewer services are closely connected. In many parts of the world, water is an increasingly scarce commodity that impacts a community's overall health and potential for economic growth. Through appropriate, timely and coordinated efforts, the District and other regional agencies can ensure that infrastructure is in place to ensure high-quality, reliable drinking water for the foreseeable future.

Washington State has established requirements for the contents of a Water System Plan under Washington Administrative Code (WAC) 246-290-100, known as the Municipal Water Law. In particular, the WAC requires water purveyors to demonstrate that the system will be able to address present and future water demand in a manner that is consistent with "other relevant plans and local, state and federal laws, including applicable land use plans." In practice, the District must ensure that enough capacity is provided to areas of expected growth in a timely manner through adequate planning and completion of a Consistency Statement Checklist, included in *Appendix I*.

Washington State has also established goals and requirements in relation to the 1990 Growth Management Act (GMA), under Revised Code of Washington (RCW) Chapter 36.70A. Three goals of the GMA directly impact system planning in the District:

- Consistency between land use and utility plans;
- Focus growth in urban areas to reduce sprawl; and
- Ensure adequate public facilities and services are available or provided at the time of development (known as "concurrency") to ensure health, safety and high quality of life.

The GMA further prohibits development when public facilities and services cannot be provided or maintained at an acceptable level of service (RCW 36.70A.100).

Most of our District's service area is part of the Southwest Urban Growth Area (SWUGA), designated by Snohomish County in accordance with the GMA. Urban growth is limited beyond this boundary by restrictions on provision of sanitary sewer service, ensuring that higher-density growth is located in areas already served or readily served by public facilities and services adequate for such development.

In order to complete such coordination, the District's Plan must be consistent with Snohomish County's land use planning efforts. As a County with over 700,000 population and a history of continuous growth, Snohomish County's efforts must in turn be consistent with the GMA. The County incorporates population projections developed by the Puget Sound Regional Council (PSRC) into its own planning efforts. PSRC is an association of cities, towns, counties, ports and state agencies responsible for developing regional comprehensive plans and population forecasts. Land use maps for jurisdictions served by AWWD are included in Appendix S.

To ensure that this Water Comprehensive Plan is consistent with Snohomish County's land use planning efforts and other related plans, the following documents and laws were examined:

Table 2.1: Related Planning Documents

Type / Jurisdiction	Document	Update	Applicable Partner Agency Goals / Policies
Cities			
Bothell	*Comprehensive Plan*	2015	CF-P6, CF-P7
	Water System Plan	2012	
Brier	*Comprehensive Plan*	2015	UT 2.1, 2.2, 2.3
Edmonds	*Comprehensive Plan*	2012	S-D.1-D.4
	Comprehensive Water System Plan	2010	
Everett	*Comprehensive Plan*	2015	Goals 6.7.1-6.7.5
	Water Comprehensive Plan [1]	2014	
Lynnwood	*Comprehensive Plan*	2011	WS 3-1, 3-2
	Water Comprehensive Plan	2012	
Mill Creek	*Comprehensive Plan*	2015	1.01, 1.02, 1.03, 1.04
Mountlake Terrace	*Comprehensive Plan*	2013	TR-10.6, CF-4.5, UT-1
	Water Comprehensive Plan	2009	
Mukilteo	*Comprehensive Plan*	2013	UT-8, UT-9
Counties			
Snohomish County	*Comprehensive Plan*	2015	UT-1, UT-2, IC
	Hazard Mitigation Plan	2009	
Utilities			
Cross Valley WD	*Comprehensive Water Plan*	2014	
Mukilteo WWD	*Comprehensive Water System Plan*	2010	
Silver Lake WSD	*Water Comprehensive Plan*	2010	
Laws			
RCW	*36.70A – Growth Management Act*		
WAC	*246-290 – Municipal Water Law*		

1. The City of Everett updated its 2007 Water Comprehensive Plan with an addendum

Last Updated: August, 2017

The Population and Employment chapter of the Snohomish County Comprehensive Plan provides population and employment projections through 2035. However, those forecasts should not be compared directly with the population and employment numbers provided in *Chapter 4 - Planning Data & Demand Forecast* due to differences in geographic boundaries. The population and employment numbers are presented for each city and the collective unincorporated area in the Southwest Urban Growth Area (SWUGA). The District's water service area does not align well with those boundaries since it serves portions of some of the cities and portions of the unincorporated area. Staff from Snohomish County's planning department reviewed a technical memorandum documenting the District's population estimates and demand forecast and they indicated the population numbers used in this plan appear reasonable. For information on how these plans were used to develop the water demand forecast, please see *Chapter 4 - Planning Data & Demand Forecast.*

Last Updated: September, 2016

District Wholesale Agreements

The District purchases its water supply from the City of Everett through a supply agreement that details the quantity of water, points of delivery, resale and service area, water quality, rates and charges, as well as other subjects. The District is permitted to resell the water, as long as the resale area is within Everett's wholesale service area, as approved by the Washington State Department of Health.

Table 2.2: Wholesale Water Supply Agreements

Name	Wholesale Relationship	Peak mgd	Date of Orig. Agreement	Amendment Date(s)	Expiration Date
City of Everett	Source	106.0	1960	1978, 1981, 1987, 2005	2055
City of Edmonds	Direct Customer	9.0	1966	1978, 1980, 2010	2055
City of Lynnwood	Direct Customer	10.0	1968	1978, 1980, 2010	2055
City of Mountlake Terrace	Direct Customer	6.0	1978	1978, 1980, 2010	2055
Mukilteo Water & Wastewater District	Direct Customer	5.0	2010	-	2055
Silver Lake Water & Sewer District	Direct Customer	5.0	1986	1992, 2006, 2010, 2013	2055
Cross Valley Water District	Clearview Agency	18.0	1999	2005	2054
Silver Lake Water & Sewer District	Clearview Agency	12.0	1999	2005	2054

The District wholesales water to five water utilities: The Cities of Edmonds, Lynnwood and Mountlake Terrace, Mukilteo Water and Wastewater District and Silver Lake Water & Sewer District. Additionally, as part of the Clearview Project, the District wholesales water to the Clearview Water Supply Agency, which provides water to Silver Lake Water & Sewer District and Cross Valley Water District. The City of Bothell has expressed interest in purchasing some of its water from the District for the King County portions of the City. Supply agreements with each of these wholesale customers detail the quantity of water, points of delivery, water quality, rates and charges, as well as other subjects. The District renegotiated all existing wholesale water agreements in 2010 to coincide with the expiration of the District's supply agreement with Everett.

The wholesale agreements with the cities, including Everett, are provided in *Appendix D.* The Clearview wholesale agreement, as well as several other key Clearview-related agreements, is provided in *Appendix E*.

Last Updated: September, 2016

District Interlocal Agreements

The District provides direct water service to a number of properties outside the District's service area under interlocal agreements with other water purveyors and vice versa. Typically, the agreements allow one utility to provide interim retail water service to customers in a specific portion of another utility's service area when the District's facilities are more appropriately or economically located to serve a particular property. Copies of the below agreements are located in *Appendix D*.

Table 2.3: Interlocal Water Supply Agreements

Agency / Agreement	Location	Date	Expiration Date
City of Bothell Fortin	39th Ave SE and 240th St SE	1992	After AWWD improvements are completed
City of Bothell Bristol Farms	39th Ave SE and 240th St SE	1995	After AWWD improvements are completed
City of Bothell Jumanca	15th Ave SE and 242nd St SE	2007	None
Cross Valley Water District Phillips	54th Ave SE and W Interurban Blvd	2007	After CVWD improvements are completed
Mukilteo Water & Wastewater District Alderwood Manor No. 11, Block 3, Lots 2, 3, 10	Center Rd, 8th Ave SW and 10th Ave SW	1987	None
Mukilteo Water & Wastewater District Harbour Reach	Possession Way and Harbour Reach Dr	1989	After AWWD improvements are completed
Mukilteo Water & Wastewater District Paine Field	117th St SW and Center Rd	1990	After MWWD improvements are completed
Mukilteo Water & Wastewater District Harbour Pointe Townhomes	Harbour Pointe Blvd	1994	After MWWD improvements are completed
Silver Lake Water & Sewer District Hammit and UDC	14905 Bothell-Everett Hwy	1996	None
Silver Lake Water & Sewer District Tambark Park	35th Ave W and 172nd St SE	2006	None

Last Updated: September, 2016

Franchise Agreements

Franchise agreements set out the conditions under which the District constructs, maintains, operates, replaces and repairs the water systems within public rights-of-way owned by a public land use authority.

Table 2.4: Franchise Agreements

Name	Date of Orig. Agreement	Expiration Date
City of Brier	2014	Sept. 30, 2034
City of Bothell	2016	*
City of Mill Creek	2014	April 18, 2034
City of Mukilteo	2012	July 11, 2037
Snohomish County	2016	2036**
Franchise Agreements Needed		
City of Lynnwood	-	-

*10 years with 10- year renewal, then 3-year renewals thereafter

**Initial Term expiration 2026, with renewal until 2036 that is subject to the County's right to renegotiate terms of the agreement at their discretion

Last Updated: August, 2017

Emergency Agreements

Emergency intertie, mutual aid and emergency response agreements provide a method to quickly obtain assistance from nearby agencies when needed. Assistance can be in the form of personnel, equipment, materials, or services; advance agreements ensure that details regarding quantity, pricing, time and other issues are in place before an event occurs. Emergency agreements are intended to provide short-term support during and after an incident. All of the agreements are available in *Appendix D*.

Last Updated: September, 2016

Emergency Interties

The District shares borders with ten water utilities (see *Figure 1.4)* and has emergency intertie agreements with all of them, except for Edmonds and Woodinville Water District. The agreements cover topics such as the intertie location, infrastructure ownership, metering and rates, as well as other subjects. The agreements are described further in *Chapter 6 - Water System Reliability*.

Last Updated: September, 2016

Everett Mutual Aid Agreement

The District signed an agreement among a number of water and sewer utilities in Snohomish County for providing resources to each other in response to disasters and emergencies. Topics in the agreement include, in part, protocols for making a request, protocols for responding to a request, control of resources and cost reimbursement. The agreement was signed in 1995 and updated in 2006. Per the agreement, the City of Everett maintains the official list of signatories and sends an updated list annually to all signatories, or whenever a utility is added or deleted.

Last Updated: September, 2016

Northwest Washington Incident Management Team (NWIMT)

The District signed an Interlocal agreement in 2011 to join the Northwest Washington Incident Management Team (NWIMT). NWIMT organizes a team of trained, experienced and credentialed people from member organizations that deploy to emergencies with appropriate equipment and personnel. The teams function under the federal National Incident Management System (NIMS) to support the incident management needs of local communities and agencies when requested during major emergency events.

Last Updated: September, 2016

Washington Water/Wastewater Agency Response Network (WARN)

Similar to the Everett Mutual Aid Agreement, this agreement allows water and wastewater utilities to provide resources to each other in the event of an emergency. Washington WARN is made up of utilities throughout Washington State. Topics in the agreement include, in part, procedures for making or responding to a request, the right to withdraw resources, cost reimbursement and participation in regional committees. The agreement was signed in 2010 and has not been updated since that time.

Last Updated: September, 2016

District Service Area Policies

The District has water service area policies, documented by District resolutions, covering a variety of topics. The policies include topics such as:

- Rates and fees;
- Customer categories;
- Infrastructure ownership and maintenance;
- Fire flow requirements;
- Wholesaling and wheeling water; and
- Conditions of service, including the District's responsibilities; customer responsibilities; connection fee schedule; meter and material specifications; late-comer pay back provisions; developer extension requirements; design standards; financing responsibilities; and professional engineer design requirements.

The District completed the codification of all existing resolutions in 2016. This undertaking organized the District's resolutions into one unified code book for ease of reference and understanding among customers and staff.

The 2003 Municipal Water Law established municipal water suppliers' "duty to serve" within their retail service area (RCW 43.20.260) and requires that water utilities document in their water system plan how the system responds to requests for new water service. The District's *Development Guidelines and Standards for Developer Extensions* comprehensively documents this process and is available to customers on the District's website. Additionally, the District determines whether it has adequate capacity to provide new service through the analysis performed every six years for its Water Comprehensive Plan, including the demand forecast, system analysis and related agreements sections of the Plan.

Last Updated: September, 2016

Service Area Policy

AWWD Code 5.05.020, the District "shall not install service lines that will serve water outside of the District boundary or outside of a Local Improvement District, except on terms and conditions acceptable to the District and only after approval of the Board of Commissioners of all 'Out-of-District' requests."

Last Updated: September, 2016

Conditions of Service

AWWD Code 5.05.010, “requests for installation of water service line shall be submitted upon an application form provided by the District, signed by the applicant and accompanied by such fee as required by District resolution. In addition, applicant shall pay connection charges when and in such amount as provided by District resolution.”

AWWD Code 9.10.050, states that “whenever a new water account is established, charges for water service shall commence as of the date the meter is installed, unless the meter is installed and locked off.”

The District’s Engineering Standards (Division 1, GP 18), adopted through AWWD Code 5.10.040, state that when new connections are made through the Developer Extension process, “the District will not schedule a pre-construction conference with the Contractor for installation of water or sewer until all necessary permits have been issued by public authority and are in District possession or other suitable evidence of permit application is delivered to the District.” More information about the District’s standards can be found in *Chapter 8- District Facilities Design and Construction Standards*.

The District does not have a formal annexation policy and reviews each annexation proposal on a case-by-case basis.

Last Updated: September, 2016

3. Conservation 3-1

3. Conservation

The purpose of this chapter is to describe the District's Conservation Program and how it meets the Water Use Efficiency Rule requirements administered by the Washington State Department of Health (DOH). This chapter will describe trends in conservation, the history and results of prior conservation efforts as well as outline the goals and plan for the next planning period. This chapter will also briefly explore other methods and practices that the District either currently uses or may research and implement that are related to conservation, but are not part of its regulatory compliance measures.

Water is critical to the vitality of our community. While the District's demand forecast indicates that there is plenty of water available through and beyond the planning period, it is important for the District and other regional providers to be good stewards of our shared natural resource. Working with our customers to improve water use efficiency will help us to ensure water is available long into the future.

The District's Conservation Program is a combination of both its own local measures and those of the regional Everett Water Utility Committee (EWUC). The regional measures are carried out by the City of Everett and EWUC. Conservation measures implemented by the regional program are paid for in part by the District's wholesale water rates. For the purposes of this chapter, the District assumes that the conservation benefits we receive from EWUC is equivalent to the proportion of wholesale water rates paid to the City of Everett (approximately 29% for direct retail customers and approximately 21% for wholesale customers). Local measures are implemented by District staff for our service area and customers.

Last Updated: September, 2016

Trends in Conservation

Since the early 2000s, water use per capita by District customers has declined approximately 25%. This is due in part to more efficient appliances, improved plumbing fixtures, smaller lot sizes with less landscaping, more drought-tolerant landscaping, as well as conservation pricing and informative billing practices that help customers see trends in their water use. Perhaps most importantly, use is declining due to the increasing awareness and daily decisions of our customers. The District has seen demand per capita decline across all customer categories, even as the number of customer accounts has increased. This trend is also occurring regionally and nationally.

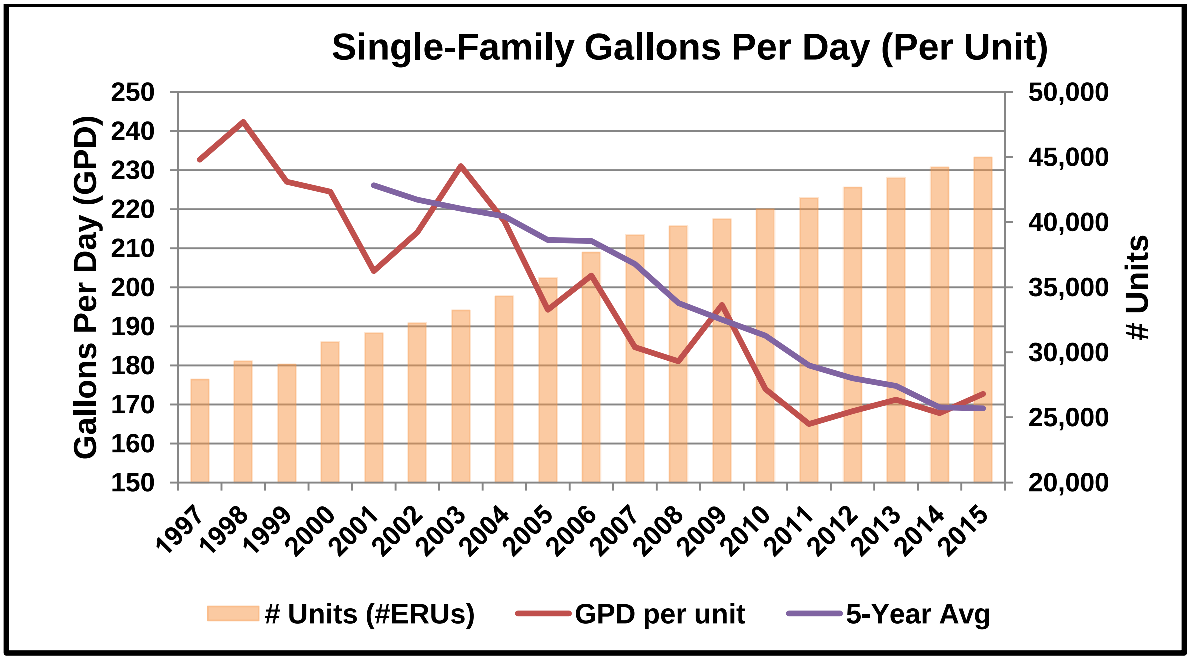


Figure 3.1: Trend in Single-Family Water Use, 1997-2015

The District currently purchases around 50% of the water produced by the City of Everett. There are a number of "fixed costs" associated with filtration, treatment, transmission and storage systems that do not change much (if at all) with changes in the volume of water. For example, if a certain piece of filtration equipment requires an employee be present at all times, the cost of that employee's time will remain the same regardless of how much water is being filtered. These costs are embedded into the District's wholesale purchase rate from Everett.

Where conservation becomes important is in reducing the "variable costs," such as the cost of electricity for pumping water or the number of crews needed to keep the system in good repair. By reducing the amount of water used, customers are in effect reducing the amount of wear and tear and increasing the lifespan of the system. In this way, conservation can delay or eliminate the need to increase pipe sizes or enlarge other facilities, which saves customers a significant amount of money in the long term.

Last Updated: September, 2016

Conservation Requirements

DOH adopted a program in 2007 as a result of the 2003 Municipal Water Law that mandated enforceable Water Use Efficiency programs for water systems in the State. The conservation plan requirements are outlined in the following documents:

- Water System Planning Handbook (April 1997)
- Municipal Water Law: Interim Planning Guidance for Water System Plan / Small System Management Program Approvals (March 2004)
- Water Use Efficiency Handbook (January 2007; amended January 2011)

The following table shows the conservation requirements of the Water Use Efficiency Rule for systems larger than 1,000 connections. The table references relevant legislation and compliance dates for each section. The District is compliant in each of the required categories.

Table 3.1: District Compliance with Water Efficiency Rule Requirements

Category	WAC Section	Requirement	District in Compliance?
Meters	246-290-496	Meter all **sources.**	**Yes**, all source interties from Everett and Clearview are metered.
		Meter all **service connections**.	**Yes**, all service connections are metered.
Data Collection	246-290-100	Provide monthly and annual **production/purchase** numbers for each source.	Yes
		Provide annual **consumption** by customer class.	Yes
		Provide "**seasonal variations**" consumption by customer class.	Yes
		Provide annual quantity **supplied to other public water systems**.	Yes
		Evaluate **reclaimed water** opportunities.	Yes
		Consider water use efficiency **rate structure**.	Yes
Distribution System Leakage	246-290-820	**Calculate** annual volume and percent using formula defined in the Rule.	**Yes. District calculates and submits reports annually. Leakage volume consistently below 10%.**
		Report annually: annual leakage volume, annual leakage percent and, for systems not fully metered, meter installation progress and leak minimization activities.	
		Develop water loss control **action plan** (if leakage is over 10% for 3-year average).	
Water Use Efficiency Goals	246-290-830	**Establish** measurable (in terms of water production or usage) conservation goals and re-establish every 6 yrs. Provide schedule for achieving goals.	**Yes**. Public meeting held to re-establish goal setting period.
		Use a **public process** to establish the goals.	
		Report annually on progress.	**Yes,** progress will be reported as part of the District's annual Water Quality report to its customers.
Water Use Efficiency Program	246-290-810	**Describe existing** conservation program.	**Yes**
		Estimate water saved over last 6 years due to conservation program.	**Yes**
		Describe conservation **goals**.	**Yes**
		Implement or evaluate **12 water use efficiency**	**Yes**

Category	WAC Section	Requirement	District in Compliance?
		measures based on system size.	
		Describe conservation **programs for next 6 years** including schedule, budget and funding mechanism.	**Yes**
		Describe how customers will be **educated** on efficiency practices.	
		Estimate **projected water savings** from selected measures.	
		Describe how efficiency program will be **evaluated** for effectiveness.	
		Estimated **leakage from transmission lines** (if not included in distribution system leakage).	**N/A,** all leakage is included in the distribution system leakage number.
Demand Forecast	246-290-100	Provide demand forecast reflecting **no additional conservation**.	**Yes**
		Provide demand forecast reflecting **savings from efficiency program**.	
		Provide demand forecast reflecting **all "cost effective" evaluated measures**.	**Yes**, costs are shared regionally and the demand forecast reflects projected savings.
Performance Reports	246-290-840	**Develop** annual report including: goals and progress towards meeting them, total annual production, annual leakage volume and percent and, for systems not fully metered, status of meter installation and actions taken to minimize leakage.	**Yes**. The performance reports are reported annually to the Department of Health. Information is included as part of the District's annual Water Quality report.
		Submit annually by July 1 to DOH and customers and make available to the public.	

Last Updated: September, 2016

Conservation Goal – WAC 246-290-830

The demand forecast for the near future indicates that the District will be able to supply and deliver water without an aggressive conservation effort (see *Chapter 4 – Planning Data and Demand Forecast*). Although demands can be met without changes in consumer behavior or large infrastructure improvements, the District's conservation practices correspond with our mission to be a leader in stewardship of the region's natural resources and are designed to enhance the efficient use of water by our customers.

The District's quantitative conservation goals are established through EWUC's regional conservation program. The goal of the program is to reduce regional demand of water within the area supplied by Everett by 2.0 million gallons per day (mgd) by the end of 2019 and 3.0 mgd by 2023. The following table shows the District's conservation goals based on Everett's calculations:

Table 3.2: District Cumulative Conservation Goals, 2015-2023 (mgd) [1]

	2015	2016	2017	2018	2019		2023
Everett Conservation Goal [2]	1.05	1.30	1.54	1.79	2.03		3.00
AWWD Proportion of Regional Conservation Goals							
Retail Goal [3]	0.30	0.38	0.45	0.52	0.59		0.87
Wholesale Goal [4]	0.22	0.27	0.32	0.38	0.43		0.63

1. mgd = million gallons per day
2. Everett Conservation Goal is the cumulative total of regional conservation measures (excluding plumbing code) shown in "Table 5-8, Summary of 2014-2019 EWUC regional conservation program," *2014 Addendum to the 2007 Comprehensive Water Plan*
3. Retail Goal assumes the portion of the EWUC regional conservation program attributable to the District is equivalent to the proportion of wholesale water rates paid to the City of Everett. For direct retail customers, this proportion is assigned 29% based on Table 4-7: Annual Water Sales by Customer Connection Category in *Chapter 4: Planning Data and Demand Forecast*.
4. For wholesale customers, the proportion assigned is 21% based on Table 4-7: Annual Water Sales by Customer Connection Category in *Chapter 4: Planning Data and Demand Forecast*.

The District's and the EWUC's collective efforts to provide conservation education and encourage conservation practices in the region has resulted in important savings of water resources as well as ever-increasing awareness of the need for conservation. While the District's number of connections has steadily increased, its demand forecast has not increased significantly, indicating that customers are using less water daily.

To attain the regional conservation goal of 3.0 MGD by 2023, it is necessary for the District to continually maintain and promote our conservation program as well as the regional program. The District plans to evaluate its progress annually as part of the annual Water Use Efficiency Performance Report to DOH and the Annual Water Quality Report provided to customers.

The District's conservation goal was established using a public process that included conducting a public hearing at the May 18, 2015 Board of Commissioners meeting to discuss the conservation goals.

Last Updated: September, 2016

Non-Revenue Water Goal – WAC 246-290-810(4)(i)

Non-revenue water is water that is not billed for, either due to accounted-for uses (e.g. construction, system flushing, or fighting fires) or unaccounted-for uses (leaks, theft, etc.). The District currently operates under a "zero known leak" policy, where leaks are repaired as soon as possible after discovery. This has contributed to a comparatively low volume of unaccounted-for non-revenue water, both in proportion to the District's total water sales as well as against other water utilities similar in size and age.

The Table below details daily water loss to the system and shows an equivalent of just over 80 gallons lost per hour per mile of pipe throughout the District's approximately 44-square mile service area. At this time, the District's goal is to sustain our high level of maintenance and repair of the system in order to maintain or reduce our existing level of unaccounted-for non-revenue water. Goals for reducing unaccounted non-revenue water were adopted after a public hearing in 2015.

Table 3.3: Unaccounted-For Non-Revenue Water [1, 2]

	2009	2010	2011	2012	2013	2014	2015
Miles of Water Pipe	619	624	632	637	649	657	672
Non-Revenue Water (mgd) [3]	2.5516	1.8556	2.3124	2.6163	2.5974	2.4206	1.6179
Non-Revenue Water / Mile (mgd)	0.0041	0.0030	0.0037	0.0041	0.0040	0.0037	0.0024

1. Non-Revenue Water (Water Balance) = Total Water Purchased – Total Water Sold.
2. Adapted from Table 4-11a: District Non-Revenue Water (Water Balance) (mg) in *Chapter 4: Planning Data and Demand Forecast*.
3. Includes unauthorized, unbilled consumption and leaks only.

For additional discussion of the District's Non-Revenue Water (Water Balance), see *Chapter 4 – Planning Data and Demand Forecast.*

Last Updated: August, 2017

Previous Conservation Program (2009-2014) – WAC 246-290-810(4)(b)

The District's previous conservation program consists of 12 measures shown in the table below. The measures for the 2009-2015 Conservation Program were primarily delivered through the Regional EWUC program, funded proportionately by the District. These measures are further described in the District's *2009 Water Comprehensive Plan*.

Table 3.4: Previous Conservation Program Measures (Six-Year Period: 2009-2014)

Measure	Sectors [1]			Category [2]			Local or Regional
	SF	MF	NR	IR	O	ICI	
1. Conservation Pricing [3]	X	X	X	X	X	X	Local
2. Bills Showing Consumption History	X	X	X	X	X	X	Local
3. Toilet Rebates – 1.6 gpf [4]	X	X	X	X			Local
4. School-Based Education	N/A			X	X		Regional
5. Public Outreach	N/A			X	X	X	Regional
6. Indoor Retrofit Kits	X	X		X			Regional
7. Outdoor Irrigation Kits	X	X			X		Regional
8. Toilet Leak Detection	X	X	X	X			Regional
9. Toilet Rebates – HET [5]			X			X	Regional
10. Clothes Washer Rebates [6]	X	X		X			Regional
11. School Irrigation System Audits			X		X	X	Regional
12. Commercial Indoor Audits			X			X	Regional

1. SF = Single-Family, MF = Multi-Family, NR = Non-Residential
2. IR = Indoor Residential, O = Outdoor, ICI = Industrial / Commercial / Institutional
3. Type of pricing structure changed in October 2013 from seasonal winter / summer rate to increasing block rate.
4. gpf = gallons per flush
5. HET = High Efficiency Toilet
6. Clothes Washer Rebate program was discontinued in 2011

Last Updated: September, 2016

Estimated Savings of Previous Conservation Program

The estimated savings of the local measures are shown below. Actual participation and savings vary from estimated savings for AWWD's local conservation methods, likely due to difficulty estimating customer adoption and the significance of external influences, such as the rate of development, the economy, weather, etc. Adjustments made to the program during implementation may also account for differences in predicted savings. For example, in the beginning of the program distribution of conservation kits was not closely monitored, but later kits were logged and customers were limited to a maximum of three indoor kits and two outdoor kits per account. Toilet rebates were also changed and reduced from three per customer to one per customer in 2012.

3.5: Estimated Conservation Savings from Local Measures, 2009-2014 (mgd) [1]

	2009	2010	2011 [6]	2012 [7]	2013 [8]	2014	*Total*
Clothes Washer Rebate [2, 6]	0.0206	0.0216	0.0000	0.0000	0.0000	0.0000	*0.0422*
Conservation Rate / Billing [3]	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	*0.3000*
Indoor Kits [2, 8]	0.0626	0.0761	0.0184	0.0129	0.0043	0.0045	*0.1789*
Outdoor Kits [2, 8]	0.0800	0.0876	0.0271	0.0183	0.0074	0.0039	*0.2243*
Toilet Rebates [2, 7]	0.0074	0.0096	0.0097	0.0047	0.0016	0.0014	*0.0345*
Education [4]	0.1258	0.1288	0.1320	0.1346	0.1346	0.1346	*0.1346*
Annual Savings	*0.3465*	*0.3737*	*0.2372*	*0.2205*	*0.1980*	*0.1944*	
Cumulative Savings [4]	*0.3465*	*0.5944*	*0.7028*	*0.7913*	*0.8547*	*0.9145*	
Cumulative Goal [5]	***0.1796***	***0.2365***	***0.2935***	***0.3499***	***0.4038***	***0.4576***	
Difference	***0.1669***	***0.3579***	***0.4093***	***0.4144***	***0.4509***	***0.4569***	***2.2833***

1. mgd = million gallons per day
2. Estimated local conservation data extrapolated from City of Everett 2007 Comprehensive Water Plan, Appendix 5-3.
   a. Indoor Kits: 5.31 gpd
   b. Outdoor Kits: 6.37 gpd
   c. Toilet Rebates: 7.04 gpd
   d. Clothes Washer Rebate: 14.60 gpd
3. The District's Equivalent Residential Unit (ERU, measured in gallons per day or gpd), dropped from an average of 194 gpd to 171 gpd over the planning period. The District estimates that consistent and aggressive conservation efforts account for approximately 30% of this drop, or 50,000 gpd in savings. In 2013, the District switched from a seasonal rate structure to an increased block rate structure, in part to further improve conservation efforts.
4. Education savings are not cumulative since a continuous effort must be made to maintain the savings each year. Estimated local savings data for this regional program is taken from "Table 5-6: Estimated Savings from 2009-2014 Conservation Program," Alderwood Water & Wastewater *2009 Comprehensive Plan*. Quantitative data for that period specific to the District is not available in Everett's *2014 Addendum to the 2007 Water Comprehensive Plan*.
5. The District's previous conservation goal was established in "Table 5-6: Estimated Savings from 2009-2014 Conservation Program," Alderwood Water & Wastewater District *2009 Water Comprehensive Plan.*
6. Clothes Washer Rebate cancelled in 2011.
7. Toilet rebates reduced from three per customer to one per customer.
8. Conservation kits are tracked by account and limited to three indoor and two outdoor kits per customer per year.

Last Updated: September, 2016

Current Conservation Program (2015 – 2023) – WAC 246-290-810(4)(a)

The District's conservation program for the upcoming planning period will continue to be a combination of measures that are part of the Regional EWUC program and the District's own efforts. Some of the measures adopted previously have been discontinued and others have been expanded or changed based on their relevancy to our customers and ability to implement. The District has identified 12 main conservation measures as part of our ongoing program.

3.6: Current Conservation Program Measures (2015 – 2023)

Measure	Sectors [1]			Category [2]			Local or Regional	Notes
	SF	MF	NR	IR	O	ICI		
1. Conservation Pricing	X	X	X	X	X	X	Local	Modification
2. Bills Showing Consumption History	X	X	X	X	X	X	Local	Continuation
3. Toilet Rebates – 1.28 gpf [3]	X	X	X	X			Local	Continuation
4. Leak / High Use Notification	X	X	X	X	X	X	Local	New
5. School-Based Education	n/a			X	X		Regional	Continuation
6. Public Outreach	n/a			X	X	X	Regional	Continuation
7. Indoor Retrofit Kits	X	X		X			Regional	Continuation
8. Outdoor Irrigation Kits / Timers	X	X			X		Regional	Modification
9. Toilet Leak Detection	X	X	X	X			Regional	Modification
10. Commercial Outdoor Audits			X		X	X	Regional	New
11. Commercial Indoor Audits			X			X	Regional	Continuation
12. Irrigation Account Audits		X	X		X	X	Regional	New

1. SF = Single-Family, MF = Multi-Family, NR = Non-Residential
2. IR = Indoor Residential, O = Outdoor, ICI = Industrial / Commercial / Institutional
3. gpf = gallons per flush

Last Updated: September, 2016

Measure 1: Conservation Pricing (Local)

The District uses conservation pricing to encourage customers to manage water use. Previously, the District billed water on a summer/winter rate for all customer categories. In October 2013, the District eliminated the summer/winter rate to encourage conservation year round. Also, the continuing shift to smaller yards was reducing summer watering and many customers were concerned about paying higher bills in the summer for the similar volumes to winter use. The new pricing method for water service is based on the applicable meter size and water usage on three increasing price tiers. Customers who do not use more water in the summer months can earn significant savings by limiting outdoor water use.

For more information about the District's rate structure, see *Chapter 14 – Financial Plan*.

Last Updated: September, 2016

Measure 2: Bills Showing Consumption History (Local)

Customer bills that provide historical consumption data allow customers to better understand how their use varies throughout the year and from year to year. This information helps customers make informed choices about how they manage their water use, including implementing conservation. The District's customer bills include two years of historical consumption data, which is shown graphically.

Last Updated: September, 2016

Measure 3: Toilet Rebates (Local)

The District offers toilet rebates for customers to replace less efficient toilets with 1.28 gallon per flush (gpf) toilets. The rebates are $75 for existing customers with toilets that do not meet current plumbing code requirements. New customers and construction are excluded since their facilities will be built with efficient toilets due to the plumbing code. This program is offered to single-family, multi-family and non-residential customers.

Last Updated: September, 2016

Measure 4: Leak / High Use Notification (Local)

The District completed installation of meters that provide enhanced leak detection and allow staff to notify customers in all sectors about abnormal or high water usage. The regular identification and notification of abnormal use or potential leaks helps to encourage either conservation or repairs.

Last Updated: September, 2016

Measure 5: School-Based Education (Regional)

As part of the Regional EWUC program, the District will continue its participation in school-based education programs including classroom presentations, teacher workshops and classroom educational materials.

Last Updated: September, 2016

Measure 6: Public Outreach (Regional) – WAC 246-290-810(4)(f)

The District will continue to participate in public outreach efforts through the Regional EWUC program, including distributing brochures, participating in transit advertising and other marketing efforts within its service area. District customers are also educated about conservation directly via:

- Bi-Monthly Water Bills;
- Annual Water Quality Report; and
- District Website.

Last Updated: September, 2016

Measure 7: Indoor Retrofit Kits (Regional)

The District offers a maximum of three free Indoor Retrofit Kits per customer per year to both existing and new single-family and multi-family customers. The kits consist of a 1.75 gpm showerhead and 1.0 gpm bathroom faucet aerators. These flow rates are lower than what is allowed under the current plumbing code.

Last Updated: September, 2016

Measure 8: Outdoor Irrigation Kits (Regional)

The District offers a maximum of two free Outdoor Irrigation Kits per single-family customer per year. Outdoor kits include devices that encourage efficient watering practices for residential landscaping. Kits typically include spring-loaded hose nozzles, hose washers and a conservation brochure. A watering timer, a moisture content indicator and a rain gauge, are offered separately upon request.

Last Updated: September, 2016

Measure 9: Toilet Leak Detection (Regional)

As part of the Regional EWUC program, the District provides free toilet leak detection dye tablets for customers and provides detailed information on how to fix leaks. This measure applies to all customers with tank-style toilets. Only tank-style toilets are targeted since most leaks occur in that type of toilet, usually via flapper leaks.

Last Updated: September, 2016

Measure 10: Commercial Outdoor Audits (Regional)

This measure provides a free audit for large commercial customers to determine the efficiencies that could be achieved through hardware improvements, operational changes or irrigation practices. The District will provide information on our customers to EWUC, who will then select which commercial properties will be eligible to receive an audit performed by a professional auditor.

Last Updated: September, 2016

Measure 11: Commercial Indoor Audits (Regional)

The District offers indoor audits to existing and new non-residential customers. This is a modified version of a measure which Everett has been implementing in its retail service area. This measure provides free indoor audits to non-residential customers to determine efficiencies that could be achieved through hardware improvements or operational changes. The District will provide information on our customers to EWUC, who will then select which commercial properties will be eligible to receive an audit performed by a professional auditor.

Last Updated: September, 2016

Measure 12: Irrigation Account Audits (Regional)

This measure provides irrigation audits to the District's largest irrigation accounts. As the largest users of water, the audit of large irrigation account holders for efficiency of systems and methods can help achieve water savings. Examples of potential system improvements include rain or moisture sensors for irrigation systems, drip or micro-irrigation systems, or water-retaining soil materials. The District will provide information on our customers to EWUC, who will then select which commercial properties will be eligible to receive an audit performed by a professional auditor.

Last Updated: September, 2016

Estimated Savings – WAC 246-290-810(4)(g)

Table 3.7: Estimated Conservation Savings from Local Measures, 2015-2023 (mgd) [1]

	2015	2016	2017	2018	2019		2023	*Total*
Conservation Rate / Billing [2]	0.0400	0.0450	0.0500	0.0550	0.0600		0.0800	*0.5400*
Toilet Rebates – 1.28 gpf [3]	0.0011	0.0011	0.0011	0.0011	0.0011		0.0011	*0.0100*
Leak / High Use Notification [4]	0.0400	0.0450	0.0500	0.0550	0.0600		0.0800	*0.5400*
School-Based Education [5]	0.1740	0.1740	0.1740	0.1740	0.1740		0.1740	*1.5660*
Indoor Kits [6]	0.0060	0.0060	0.0060	0.0060	0.0060		0.0060	*0.0540*
Outdoor Kits [6]	0.0020	0.0020	0.0020	0.0020	0.0020		0.0020	*0.0180*
Audits [7]	0.0493	0.0493	0.0493	0.0493	0.0493		0.0493	*0.4437*
Annual Savings	0.3124	0.3224	0.3324	0.3424	0.3524		0.3924	
Cumulative Savings [5]	0.3124	0.4608	0.6192	0.7876	0.9661		1.7797	

1. mgd = million gallons per day
2. The District adopted an increasing block rate structure in October 2013. Data from 2014 indicates the projected average day demand (ADD) was 0.39 mgd below the demand forecast. The District estimates that 0.04 mgd of that savings is attributable to the new rate structure and billing graphics and projects an additional savings of 0.005 mgd per year.
3. Estimated savings assumes conversion of 3.5 gallon-per-flush (gpf) toilets to a 1.28 gpf toilets, with an average of 5 flushes per day. Total savings is 11.1 gpd. The District expects that customers with pre-code toilets will continue to apply for rebates at the same rate of approximately 100 per year.
4. The District estimates that 0.04 mgd is attributable to the leak notification letters and projects an additional savings of 0.005 mgd per year
5. Education savings are not cumulative since a continuous effort must be made to maintain the savings each year. Estimated local savings data for this regional program is taken from “Table 5-8: Summary of 2014-2019 EWUC Regional Conservation Program,” City of Everett *2014 Addendum to the 2007 Water Comprehensive Plan.* The District assumes that the benefit received is proportional to rates paid to the City of Everett (29%).
6. Estimated savings extrapolated from “Table 5-8: Summary of 2014-2019 EWUC Regional Conservation Program,” Ibid.
    a. Indoor Kits: 20 gpd, 300 kits per year
    b. Outdoor Kits: 6.67 gpd, 300 kits per year
7. Estimated local savings data for this regional program is taken from “Table 5-8: Summary of 2014-2019 EWUC Regional Conservation Program,” Ibid. The District assumes that that the benefit received is proportional to rates paid to the City of Everett (29%).

Last Updated: September, 2016

Additional Conservation Measures

The District's existing practices are compliant with water use efficiency standards. The District also plans to incorporate other aspects of water conservation in the future. Examples of additional measures include:

- Service Meters: The District is a fully metered system. As of 2015, the District installed radio read meters on all of our residential accounts. The newer meters aid with reducing water loss and conservation efforts because data for exceptional usage or faulty meters is reported automatically through the radio read technology. Additional large meter testing would also increase the reliability of data and reporting from the meters.

- Leak Detection: The District's non-revenue water is consistently below the 10% threshold established by the Water Use Efficiency Rule that would require a water control action plan. In addition to routine system monitoring and surveys, the District intends to research additional methods of proactive leak detection. The District may also evaluate its leakage by using the audit methods recommended by the American Water Works Association (AWWA) Infrastructure Leakage Index (ILI) standard.

Last Updated: September, 2016

Budget, Cost-Effectiveness and Implementation Schedule – WAC 246-290-810(4)(e)

The District pays for EWUC conservation through its wholesale rates to Everett. In addition to the EWUC program, the District budgets approximately $44,000 per year to fund the District's conservation efforts, including $20,000 per year for toilet rebates. The District relies on the City of Everett's evaluation of conservation measures for cost-effectiveness, as these costs are shared for water supply amongst all of the City's direct and indirect customers. Additionally, measures which are part of the District's operations (e.g. conservation pricing, consumption history data and leak notifications) do not require additional funding beyond the District's regular operating budget. Funding is not a limiting factor for the District in maintaining the conservation program.

For more information about the City of Everett's evaluation of cost-effectiveness for the EWUC's Regional Conservation Program, please see the City of Everett *2014 Addendum to the 2007 Comprehensive Water Plan*.

Last Updated: September, 2016

4. Planning Data and Demand Forecast

4. Planning Data and Demand Forecast

"Why is this important? Because when growth picks up again, the region will be able to support economic development with well-managed water systems – systems that give residents and businesses the confidence that when they turn on the tap, high quality drinking water will be there every time."

2012 Regional Water Supply Update
Water Supply Forum for Snohomish, King & Pierce Counties

In the water service industry, where small changes in how much water customers are using can have an exponential financial impact to ratepayers, forecasting demand as accurately as possible is central to cost-effective, sustainable management of the water distribution and delivery system. A reliable forecast can help ensure that the District supplies enough drinking water for residential, non-residential and municipal uses while still allowing for growth and development. Using timely, accurate information also reduces the risk of under- or over-investing in water system infrastructure.

The purpose of this chapter is to explain what water demand forecasting is, why forecasting is important and how the demand forecast for the District is prepared. This chapter also examines existing water use, future population and employment data and other factors which affect demand.

Water use in this region and across the nation is undergoing considerable shifts from historical trends. Until fairly recently, planners expected that increased residential, commercial and industrial development would inevitably produce rising total water use in an area. That has proven not to be the case. Significant increases in water efficient designs for appliances and industrial equipment, smaller lot sizes with less landscaping, increased awareness of conservation efforts and other factors have driven down per capita water use, reduced summer peak day factors and kept overall total usage relatively flat while population has grown. This phenomenon is critical to understand in planning the water system and developing rate structures.

Last Updated: September, 2016

Purpose of Demand Forecasting

To plan for future water use and its impact on the existing water distribution system, the District must compare how much water is needed with how much water is available. Demand forecasting is a key tool for estimating how much water customers will use in the future and then for planning system management and improvement. The demand forecast informs decisions to upgrade or replace infrastructure as well as revenue forecasts for budgeting and setting rates. Table 4.1: Purpose of Demand Forecasting provides an overview of how demand forecasting supports decision-making over the 20-year planning period and beyond.

Table 4.1: Purpose of Demand Forecasting

Forecast Type	Time Frame	Purpose
Long-Term	Decades	• Future supply needs • Infrastructure sizing and capacity
Medium-Term	Years to Decades	• Determining system improvements • Infrastructure sizing and capacity
Short-Term	Months to Years	• Evaluating system condition • Forecasting revenue • Setting water rates
Day-to-Day	Days to Weeks	• Managing system operations • Optimizing pumping and reservoir levels

More specifically, *long-term* forecasting aids planning for infrastructure needed 20-30 years from now, beyond the current planning period. *Medium-term* forecasts identify necessary system improvements to meet foreseeable changes, such as an increase in growth due to a change in land use zoning or necessary changes to fire flow planning. In the *short-term*, the District is able to use known costs to set rates which are adequate to continue maintenance, operation and capital improvements. On a *daily* basis, accurate forecasting can assist with operations, ensuring that water is provided steadily to customers.

Last Updated: September, 2016

Demographic Data and Projections – WAC 246-290-100(4)(b)

Current and future population and employment projections for areas that include the District's service area have been independently developed by both the Puget Sound Regional Council (PSRC) and Snohomish County (the County). As noted above, these projections are used for planning efforts that impact regional growth. In an effort to develop the most accurate projections for modeling and capital project identification, the District evaluated both sets of data for viability.

In December 2009, PSRC issued updated data and forecasts through 2040. *Vision 2040* population projections are based on U.S. Census data and are broken down into Forecast Analysis Zones (FAZs) and Traffic Analysis Zones (TAZs). Each FAZ contains one to nine (1-9) census tracts and each census tract contains one to nine (1-9) TAZs. The PSRC values are helpful for forecasting regional trends, but these geographic areas do not align well to the District boundary. This reduces the District's confidence in FAZ and TAZ projections. In addition to the above, the 2000 and 2010 Census also significantly undercounted minorities and renters, groups which make up a proportionally larger share of the District than they do of surrounding jurisdictions.

The County's *2012 Buildable Lands Report* (BLR) examines existing uses on a parcel-by-parcel basis to identify suitable land to accommodate PSRCs population and employment targets. These targets are developed in close coordination with local planning agencies. This evaluation utilizes actual development densities, unbuildable land (e.g. water bodies, wetlands, steep slopes, utility easements), zoning and future land use designations, resulting in accurate maximum housing and employment capacities by parcel.

Table 4.2: Demographic Projections for Current Retail and Wholesale Water Service Area – WAC 246-290-100(4)(b)(i)

Service Area and Demographic Category	Existing Population	Base Year	Planning Year 6	Planning Year 10	Planning Year 20
	2015	2015	2021	2025	2035
Retail Service Area [1]					
Population	175,831	180,799	215,010	242,812	255,914
Employment	38,637	39,797	47,848	53,355	63,582
Subtotal	*214,469*	*220,596*	*262,858*	*296,167*	*319,497*
Wholesale Service Area [2]					
Population	113,746	114,595	121,334	127,109	146,200
Employment [3]	44,413	45,265	50,618	54,942	63,764
Subtotal	*158,160*	*159,860*	*171,952*	*182,051*	*209,964*
Total	**372,628**	**380,456**	**434,810**	**478,218**	**529,461**

1. Data adapted from Snohomish County *2012 Buildable Lands Report* parcel-level population and employment forecasts (June 2013 and February 2014) and 2010 Census Data. Data are interpolated from BLR projections for years 2025 and 2035.
2. Data adapted from the most recent comprehensive plans for Edmonds, Lynnwood, Mountlake Terrace and Mukilteo Water and Wastewater District.
3. Only Lynnwood and Mukilteo Water and Wastewater District accounted for employees separately.

The parcel-by-parcel County data correlates directly with District boundaries and provides more accurate analysis of growth within pressure zones. County BLR data was provided in Geographic Information System (GIS) format for analysis by the District. This data is used to update the System Analysis Chapter of this plan. Individual analyses of pressure zones are available in *Appendix H:* Demand Forecast Technical Memorandum. For more information about pressure zones, see *Chapter 1 - System Description*.

The demographic data presented is used for both the Water and Sewer Comprehensive Plans. The population and other numbers differ between plans, however, due to differences in the service areas. As a result, the served population is less than the total population. The use of the same base data set means that both plans are consistent for demographic and demand projections. The information summarized in this chapter is for the entire District and wholesale service areas.

Last Updated: September, 2016

Water Use Trends

This section describes water use by the District over time, including purchases from the City of Everett and sales to retail and wholesale customers. Water from Everett's regional supply system is distributed through the District's facilities to retail customers in several jurisdictions. Water is also delivered on a wholesale basis to jurisdictions which own and operate their own distribution systems.

As described in *Chapter 1 - System Description*, the District also maintains an artesian well on 164th Street SW, west of I-5. This is used directly by individuals as a transient, non-community source of supply (RCW 249-290-020), which means it does not have direct service connections and is not used by the same individuals each day. Since the well is not connected to the District's distribution system, the data in this section does not include use at the well.

Last Updated: September, 2016

Purchases from the Everett Regional System

Table 4.3 Annual Production Totals by Source presents water purchased over the last ten-year period from the City of Everett, excluding total purchases and water sold by Clearview Water Supply Agency (Clearview) to Silver Lake Water & Sewer District (SLWSD) and Cross Valley Water District (CVWD). Data on Clearview can be found in *Appendix E - Clearview Partnership*.

Overall purchases and sales have been steady over the past decade, despite an increase in customers and the economic recession. The District's Peaking Factor, or the ratio that results from Maximum Day Demand (MDD) divided by Average Day Demand (ADD), has declined overall during the past decade as shown in Table 4.4.

Table 4.3: Annual Production Totals by Source (mg) – WAC 246-290-100(4)(b)(ii)(A)

Year	Everett[1]		Clearview[2]	Total Delivered to District
	Pump Station No. 1	Pump Station No. 2	Pump Station	
2006	1,693.0	5,131.0	1,617.3	*8,441.3*
2007	2,439.6	3,937.8	1,900.0	*8,277.5*
2008	1,588.8	4,515.7	2,059.4	*8,163.9*
2009	1,204.2	5,362.1	2,080.3	*8,646.6*
2010	837.4	4,956.7	1,945.3	*7,739.4*
2011	3,675.8	2,506.0	1,446.2	*7,628.0*
2012	5,580.7	625.3	1,863.5	*8,069.5*
2013	5,689.7	1,015.7	1,672.1	*8,377.5*
2014	3,569.5	3,127.6	1,707.5	*8,404.6*
2015	2,909.9	4,428.4	1,612.7	*8,951.1*
Average	**6,479.5**		**1,790.4**	**8,269.9**

1. Everett pump stations are located immediately adjacent, and are used in combination. Years with significantly more pumping by one station than another generally indicates a period of performed maintenance or alternating use to extend the life of the pumping system.
2. Clearview Pump Station value does not include sales to SLWSD and CVWD.

Last Updated: September, 2016

Table 4.4 Production Characteristics. The peaking factor ratio has also fluctuated less over the past five (5) years, indicating better management of reservoir levels and pumping schedules as well as a conservation ethic that results in less outdoor water use during summer months.

Table 4.4: Production Characteristics (mgd)

Year	Annual	Annual Maximum Day Demand			Rolling Peaking Factor		
	Average Day Demand [1]	Max. Demand [2]	Date of Demand	Peaking Factor [3]	3-Year Average	5-Year Average	10-Year Average
2006	23.13	49.69	July 24	2.15	-	-	-
2007	26.69	49.60	July 11	1.86	1.87	-	-
2008	26.36	47.83	July 16	1.81	1.94	-	-
2009	28.04	51.48	July 30	1.84	1.84	1.85	-
2010	25.69	44.42	July 26	1.73	1.79	1.88	-
2011	25.47	39.77	Sept 11	1.56	1.71	1.76	-
2012	26.75	40.78	Aug 17	1.52	1.61	1.69	-
2013	27.50	44.57	Aug 7	1.62	1.57	1.65	-
2014	27.22	46.61	July 12	1.71	1.62	1.63	1.74[4]
2015	27.90	51.40	July 7	1.84	1.72	1.65	1.76
Average 2006-2015	**26.47**	**46.62**	**July 29**	**1.76**	**-**	**-**	**-**

1. Total quantity of water pumped to the District and Clearview divided by the number of days in the year. This includes demand by all wholesale customers and demand by the Clearview partners.
2. Highest recorded daily purchase for water delivered to the District and Clearview.
3. Peaking Factor = Maximum Day Demand divided by Average Day Demand.
4. 10 year average peaking factor 2004-2015

Last Updated: September, 2016

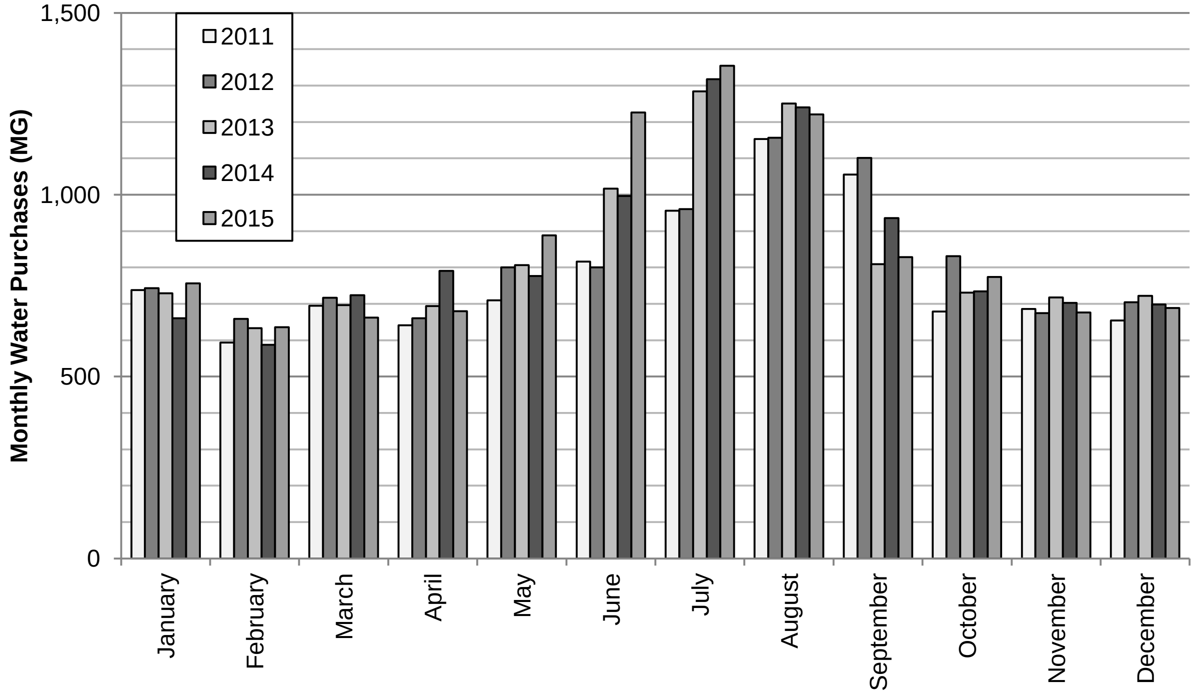
Table 4.5 Monthly Production Totals and *Figure 4.1* illustrate the monthly purchase characteristics of the District over the past five (5) years. The amount of water delivered to the system increases during the summer months, due to irrigation and other outdoor uses. In October 2013, the District switched its rate structure from a summer/winter rate structure to year-round rate with an increasing block rate structure.

Table 4.5: Monthly Production Totals (mgd) – WAC 246-290-100(4)(b)(ii)(A) [1]

Month	2011	2012	2013	2014	2015	Average
January	738.2	742.9	729.0	660.0	756.6	*725.3*
February	593.5	658.2	633.4	587.6	635.7	*621.7*
March	694.6	717.0	696.2	723.4	662.6	*698.8*
April	641.3	660.0	693.6	790.7	679.6	*693.0*
May	709.6	800.3	806.0	776.7	888.5	*796.2*
June	816.1	799.9	1,017.1	996.7	1,226.5	*971.3*
July	956.2	960.8	1,284.5	1,317.9	1,355.0	*1,174.9*
August	1,152.7	1,156.6	1,250.7	1,239.9	1,220.4	*1,204.1*
September	1,055.7	1,101.1	809.1	936.1	828.6	*946.1*
October	679.0	831.2	730.5	734.2	773.8	*749.7*
November	685.8	674.9	717.2	702.7	676.6	*691.4*
December	654.6	704.7	721.9	698.6	688.6	*693.7*
Total	**9,377.3**	**9,807.6**	**10,089.1**	**10,164.4**	**10,392.4**	**9,966.2**

1. Includes all Alderwood water purchases from the City of Everett (pump stations 1 & 2) and all Clearview water purchases from the City of Everett (pump station 3).

Figure 4.1: Monthly Production Totals – WAC 246-290-100(4)(b)(ii)(A) [1]



1. Includes all Alderwood water purchases from the City of Everett (pump stations 1 & 2) and all Clearview water purchases from the City of Everett (pump station 3).

Last Updated: September, 2016

Water Delivered to Retail and Wholesale Customers

Table 4.6: Retail Water Service Connections provides the number of retail water connections served directly by the District. At the end of 2015, the District served a total of 50,903 connections, with an average annual increase of 1.83% or approximately 881 new connections per year.

Table 4.6: Retail Water Service Connections [1]

Connection Type	2011	2012	2013	2014	2015
Single-Family	41,901	42,681	43,413	44,205	44,983
Subtract Accounts [2]	97	97	99	99	98
Single-Family Residential Subtotal	*41,998*	*42,778*	*43,512*	*44,305*	*45,081*
Multi-Family	2305	2336	2337	2,386	2,396
Mobile Home Parks	46	46	44	44	44
R/V Parks	22	22	22	22	22
Multi-Family Residential Subtotal	*2,373*	*2,404*	*2,403*	*2,452*	*2,462*
Single Commercial	869	884	894	894	904
Multi Commercial	315	312	317	319	315
Irrigation	907	939	963	992	1,023
Hotel/Motel	20	19	19	19	20
Municipal	195	195	195	194	193
Construction	15	12	12	16	15
Fire Meters	367	392	413	463	472
Detector Check (D/C) Meters	387	394	398	412	418
Non-Residential Subtotal	*3,075*	*3,147*	*3,211*	*3,309*	*3,360*
Total	**47,446**	**48,329**	**49,126**	**50,065**	**50,903**

1. Connections are for direct retail customers only.
2. Subtract accounts are accounts which are physically located within the service areas of other water purveyors, but which receive bills directly from the District. These accounts are treated as retail customers, with their associated water usage accounted for accordingly. The District is actively working with appropriate purveyors to reduce the number of subtract accounts.

Last Updated: September, 2016

Table 4.7: Annual Water Sales by Customer Connection Category presents total water sales for both retail and wholesale customers by connection category. Consistent with *Table 4.3*, annual water sales have remained steady over the past five (5) years. *Figure 4.2 Proportion of Water Sales by Major Customer Category* further illustrates the various proportions of water sales.

Table 4.7: Annual Water Sales by Customer Connection Category (mg)

	2011	2012	2013	2014	2015	*Average*
Retail Sales						
Single-Family Residential [1]	2,521.6	2,626.5	2,712.8	2,706.9	2,835.0	*2,680.6*
Single-Family Residential Subtotal	*2,521.6*	*2,626.5*	*2,712.8*	*2,706.9*	*2,835.0*	*2,680.6*
Multi-Family	838.0	841.7	853.6	853.4	921.9	*861.7*
Mobile Home Parks	146.3	144.6	139.9	142.0	145.6	*143.7*
R/V Parks	9.4	9.7	10.4	10.0	9.7	*9.8*
Multi-Family Residential Subtotal	*993.6*	*996.0*	*1,004.0*	*1,005.4*	*1,077.2*	*1,015.2*
Single Commercial	224.0	222.6	232.4	227.9	243.0	*230.0*
Multi Commercial	93.0	98.2	101.1	97.9	99.5	*97.9*
Irrigation	223.4	272.3	297.6	323.8	387.2	*300.9*
Hotel / Motel	34.3	33.6	32.0	34.9	34.7	*33.9*
Municipal	43.4	45.8	53.0	53.2	57.5	*50.6*
Construction	0.9	0.3	1.2	1.3	4.1	*1.6*
Fire Meters	0.5	0.3	1.1	0.8	0.6	*0.7*
D/C Meters	0.3	0.3	0.8	0.6	0.4	*0.5*
Non-Residential Subtotal	*619.7*	*673.4*	*719.2*	*740.3*	*827.0*	*715.9*
Subtotal - Retail	***4,134.9***	***4,295.9***	***4,436.0***	***4,452.6***	***4,739.2***	***4,411.7***
Wholesale Sales [2]						
Edmonds	1,084.0	1,052.6	1,070.2	1,064.9	1,116.7	*1,077.7*
Lynnwood	1,266.6	1,256.7	1,229.3	1,234.6	1,309.6	*1,259.4*
Mountlake Terrace	595.8	599.4	574.0	598.2	597.2	*592.9*
Mukilteo Water District [2]	147.5	281.9	442.6	490.3	493.5	*371.2*
Silver Lake Water and Sewer District[3]	0.0	0.0	0.0	0.0	138.0	*27.6*
Subtotal - Wholesale	***3,093.9***	***3,190.7***	***3,316.1***	***3,388.0***	***3,655.0***	***3,328.7***
Total Sales	**7,228.9**	**7,486.6**	**7,752.1**	**7,840.6**	**8,394.2**	**7,740.5**

1. Subtract account sales are included in the Single-Family Residential sales.
2. Mukilteo Water & Wastewater District Second Wholesale Meter came online in 2012.
3. Silver Lake Water and Sewer District did not purchase wholesale water from Alderwood until 2015.

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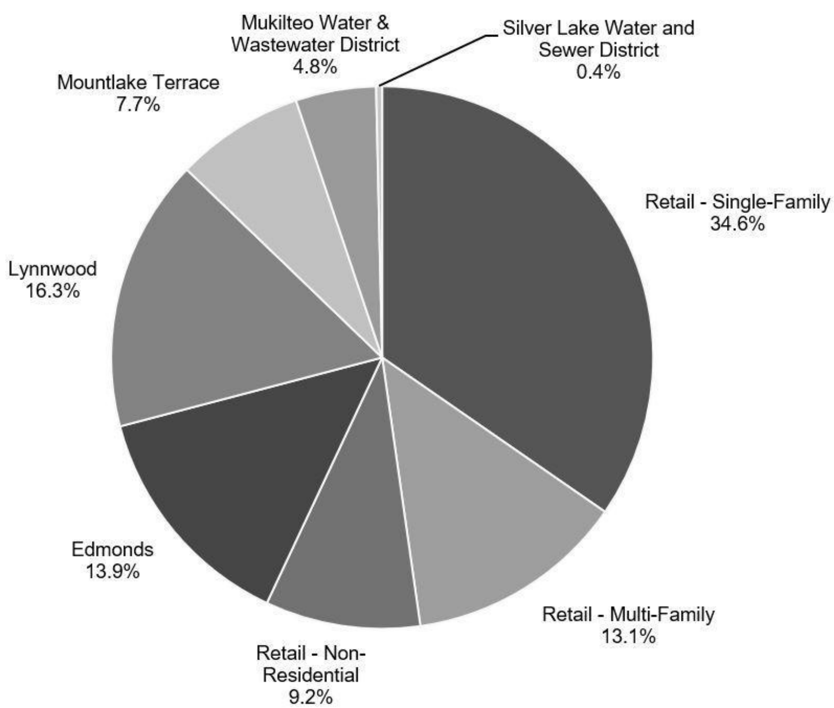
These numbers illustrate that while single-family residential customers make up over 88.5% of retail customers, they account for only 61.0% of retail water sales. Understanding the District's customer mix is important for balancing retail and wholesale water rates and supporting operations, maintenance, and capital improvements.

Figure 4.2: Proportion of Water Sales by Major Customer Category (2011-2015)



1. Mukilteo Water & Wastewater District began purchasing water in 2011.
2. Silver Lake Water and Sewer District began purchasing water in 2015.

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Table 4.8: Monthly Water Sales and the associated *Figure 4.3* provide the monthly water use characteristics of retail and wholesale customers, showing a trend consistent with purchases of sales peaking in the summer months. The summer months are also widely variable, especially in July and August, where sales fluctuate rapidly due to accelerated outdoor water use.

Monthly water sales do not match with monthly water purchases for two reasons:

1) The table does not include sales by Clearview to Silver Lake Water & Sewer District or Cross Valley Water District; and
2) Non-revenue water is not “sold” and therefore is not included below. For more information about non-revenue water, please see the section Non-Revenue Water (Water Balance) calculations.

Table 4.8: Monthly Water Sales (mg) [1]

Month	2011	2012	2013	2014	2015	Average
January	488.9	533.2	511.2	510.3	510.2	*510.8*
February	528.7	522.8	540.1	522.9	558.9	*534.7*
March	456.7	487.3	483.5	514.5	528.1	*494.0*
April	529.2	548.3	531.5	540.5	565.6	*543.0*
May	521.9	520.9	568.4	534.4	618.4	*552.8*
June	597.6	602.2	686.7	709.4	831.5	*685.5*
July	613.0	645.9	820.9	842.2	957.6	*775.9*
August	831.2	789.0	906.0	882.2	1064.0	*894.5*
September	768.2	811.1	867.3	896.2	876.6	*843.9*
October	760.0	803.7	733.7	795.3	696.1	*757.8*
November	558.0	632.5	591.0	591.8	575.2	*589.7*
December	566.2	581.5	639.6	543.7	614.1	*589.0*
Total	**7,219.8**	**7,478.3**	**7,880.0**	**7,883.4**	**8,396.2**	**7,771.5**

1. Data includes consumption by both retail and wholesale customers, but does not include Clearview water sold to Silver Lake Water and Sewer District and Cross Valley Water District.

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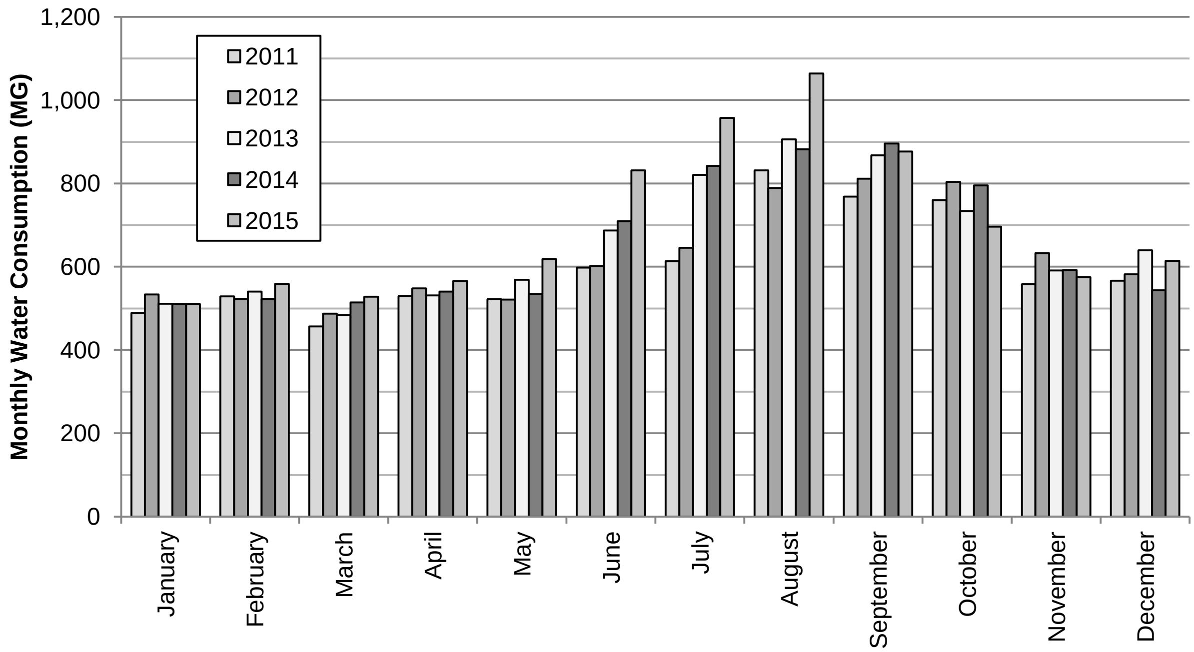
Figure 4.3: Monthly Water Sales [1]



1. Data includes consumption by both retail and wholesale customers, but does not include Clearview water sold to Silver Lake Water and Sewer District and Cross Valley Water District.

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Table 4.9: Largest Water Customers (2011-2015) provides the water sales data for the District's twenty (20) largest retail customers, which are all multi-family or non-residential accounts. Annual water use by the top 20 consumers dropped from an average of 321.3 mg from 2004-2006 to 278.2 mg from 2011-2015. This drop is consistent with the overall drop in consumption shown in Table 4.7: Annual Water Sales by Customer Connection (mg). None of these customers consume enough water to require detailed analysis or special consideration in the demand forecast.

Table 4.9: Largest Water Consumers (2011-2015) [1]

Rank	Customer Name	Customer Type	Average Water Consumption	
			Annual (mg)	Daily (gpd)
1	Avalon Bay Communities	Multi-Family	*38.43*	*105,286*
2	BRE Properties, Inc.	Multi-Family	*36.22*	*99,246*
3	Keeler's Corner	Multi-Family	*22.94*	*62,855*
4	ERP Operating, LP	Multi-Family	*22.10*	*60,555*
5	GS Mill at Mill Creek	Multi-Family	*20.65*	*56,572*
6	The Renaissance	Multi-Family	*20.00*	*54,782*
7	Fairfield Crystal Cove LLC	Multi-Family	*19.53*	*53,517*
8	Harbour Pointe Golf Course	Non-Residential	*18.60*	*50,948*
9	Green Acres Park	Multi-Family	*17.44*	*47,780*
10	Canyon Springs Apartments	Multi-Family	*15.28*	*41,859*
11	Stonemeadow Farms	Multi-Family	*15.14*	*41,480*
12	SP RGA On the Green LP	Multi-Family	*14.82*	*40,616*
13	Millwood Estates	Multi-Family	*14.59*	*39,969*
14	Wandering Creek	Multi-Family	*13.61*	*37,293*
15	Steelwave Bothell OFC Owner	Non-Residential	*12.90*	*35,345*
16	Northcreek Apartments, LLC	Multi-Family	*12.26*	*33,599*
17	Portsmith Apartment Homes	Multi-Family	*11.77*	*32,255*
18	Martha Lake Mobile Manor	Multi-Family	*11.73*	*32,131*
19	Bella Terra Apartments	Multi-Family	*11.69*	*32,021*
20	Front 9 Condominiums	Multi-Family	*11.17*	*30,594*
		Totals	**360.88**	**988,708**

1. Avalon Bay Communities and BRE Properties Inc. include multiple locations

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Development Activity

The annual rate of increase in the number of water accounts roughly coincides with the number of water meter permits issued, as shown below. Activity increased 26.9% from 2011 to 2015 and is expected to remain at or near its current rate for the 6-year CIP planning period.

Table 4.10: Development Activity (2011-2015)

Permit Type	2011	2012	2013	2014	2015	Average
Applications	33	58	68	64	58	*56*
Developer Extensions	31	59	55	64	57	*53*
Construction Starts	28	46	43	47	59	*45*
Use & Operations	33	36	30	43	54	*39*
Water Meters Sold[1]	936	968	867	995	894	*932*
Annual Increase in Accounts	947	883	797	938	839	*881*

1. Permits issued, but which may or may not have been inspected and accepted into use and operations.

The uptick in activity in 2013 and 2014 is largely the result of significant multi-family development. This data also provides insight into the number of properties which can reasonably be expected to develop or redevelop in the upcoming planning period. The majority of water meters are sold for residential subdivisions and the District expects this to continue through the planning period. There may be some increase in meters for multi-family or non-residential projects due to zoning changes throughout the Southwest Urban Growth Area (SWUGA), however because a single meter is usually sold for an entire complex any increases in permit numbers will be small.

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Non-Revenue Water (Water Balance) Calculations

A water balance calculation compares the total amount of water purchased to the amount of water sold in order to determine the remaining amount of water which was not sold and did not earn revenue. Also called “non-revenue water,” this water falls into one of three categories:

1) Authorized, unbilled consumption (e.g. flushing programs, construction permits, firefighting, etc.);
2) Unauthorized, unbilled consumption (e.g. theft, meter inaccuracies, etc.); or
3) Leaks (i.e. real losses from the distribution system).

High rates of non-revenue water can impact rates as well as water quality, depending on how the water is “lost.” The 5-Year Average shown in Table 4.11: District Non-Revenue Water (Water Balance) for non-revenue water, as a percentage of all water purchased, is used to develop the water demand forecast described later.

Table 4.11: District Non-Revenue Water (Water Balance) (mg) [1]

	2011	2012	2013	2014	2015	Average
Total Water Purchases [2]	*7,628.0*	*8,069.5*	*8,377.5*	*8,404.6*	*8,951.1*	***8,286.1***
Billed Water [3]						
Retail Sales Subtotal	*4,134.9*	*4,295.9*	*4,436.0*	*4,452.6*	*4,739.2*	***4,411.7***
As % of Water Purchases	*54.2%*	*53.2%*	*53.0%*	*53.0%*	*52.9%*	***53.2%***
Wholesale Sales Subtotal	*3,093.9*	*3,190.7*	*3,316.1*	*3,388.0*	*3,655.0*	***3,328.7***
As % of Water Purchases	*40.6%*	*39.5%*	*39.6%*	*40.3%*	*40.8%*	***40.2%***
Non-Revenue Water						
Accounted-For Non-Revenue Water [4]						
Capital Division	0.2	0.5	0.0	0.2	0.2	***0.2***
Flushing (New Construction)	0.3	0.3	1.1	0.5	0.9	***0.6***
Wastewater Division	1.1	0.7	0.6	0.4	0.7	***0.7***
Water Division	0.4	0.4	0.4	0.5	0.7	***0.5***
Water Quality Division	8.0	1.7	2.2	2.6	0.6	***3.0***
Water Use Permits	0.6	2.8	2.6	2.7	4.4	***2.6***
Subtotal	*10.5*	*6.3*	*6.9*	*6.9*	*7.4*	***7.6***
as % of Water Purchases	*0.1%*	*0.1%*	*0.1%*	*0.1%*	*0.1%*	***0.1%***
Unaccounted-For Non-Revenue Water [5]						
Subtotal	*388.6*	*576.6*	*618.5*	*557.1*	*549.5*	***538.0***
as % of Water Purchases	*5.1%*	*7.1%*	*7.4%*	*6.6%*	*6.1%*	***6.5%***
Subtotal - Non-Revenue	**399.1**	**582.9**	**625.4**	**564.0**	**556.9**	**545.7**
As % of Water Purchases	**5.2%**	**7.2%**	**7.5%**	**6.7%**	**6.2%**	**6.6%**

1. Non-Revenue Water (Water Balance) = Total Water Purchased – Total Water Sold.
2. Total water purchased, excluding water purchased by Clearview then sold to Silver Lake Water & Sewer District and Cross Valley Water District.
3. Total water sold, excluding water purchased by Clearview then sold to Silver Lake Water & Sewer District and Cross Valley Water District.
4. Authorized, unbilled consumption.
5. Unauthorized, unbilled consumption and leaks.

Various sources place the water industry average for non-revenue water between 10-20%. The Washington State Water Use Efficiency rules encourage a maximum 10% non-revenue loss rate. The District does not find a percentage ratio as helpful for determining the degree of unaccounted-for water losses or performance over time as leaks and breaks per length or volume of pipe. Policies and programs to reduce unaccounted-for water losses can be found in *Chapter 3 - Conservation Program*.

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Water Use Factors and Equivalent Residential Units (ERUs)

Water Use Factors are the annual amounts of water assigned per account of a particular customer class based on historic use. Use factors have been declining over time due to more efficient appliances, improved construction codes and plumbing fixtures, less landscaping and the use of native or drought-resistant vegetation and a strong regional conservation program. These numbers are analyzed against the projected land uses provided by Snohomish County to contribute to development of the demand forecast.

Table 4.12: Water Use Factor by Customer Category (1,000 gallons) [1, 2]

Customer Category	2011 Use Factor	2012 Use Factor	2013 Use Factor	2014 Use Factor	2015 Use Factor	5-Year Avg. Use Factor
Single-Family Residential	*60.0*	*61.4*	*62.3*	*61.2*	*62.9*	*61.6*
Multi-Family Residential [3]	*418.7*	*414.3*	*417.8*	*410.0*	*437.5*	*419.7*
Multi-Family	363.5	360.3	365.3	357.7	384.7	366.3
Mobile Home Parks	3,180.1	3,144.2	3,180.6	3,226.6	3,310.1	3,208.3
R/V Parks	426.5	439.0	471.4	455.4	440.3	446.5
Non-Residential [3]	*201.5*	*214.0*	*224.0*	*223.7*	*246.1*	*221.9*
Single Commercial	257.8	251.8	259.9	254.9	268.8	258.6
Multi Commercial	295.2	314.8	318.8	306.8	315.8	310.3
Irrigation	246.3	290.0	309.1	326.4	378.5	310.0
Hotel/Motel	1,712.7	1,766.1	1,682.3	1,835.8	1,734.1	1,746.2
Municipal	222.5	235.0	272.0	274.0	298.0	260.3
Construction	63.3	24.2	99.1	81.0	274.2	108.4
Fire Meters	1.3	0.8	2.8	1.7	1.3	1.6
Detector Check (D/C) Meters	0.7	0.8	2.0	1.6	1.1	1.2
Overall Water Use Factor	**92.5**	**87.2**	**88.9**	**88.9**	**93.1**	**90.1**

1. All values are in 1,000-gallon increments
2. The use factor is calculated by dividing the amount of water sold by the number of connections in each retail customer category.
3. Multi-Family Residential and Non-Residential use factors apply to multiple units.

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Water Use Factors assist in the calculation of Equivalent Residential Units (ERUs). One ERU equals the gallons per day (gpd) used by a single-family residence. ERUs are one method for representing all types of water use as the equivalent number of single-family households. This allows simple comparison across uses of the impact on the water and sewer system. The District uses a 5-year average gpd per single-family residence as the ERU value for the District. For 2015, one ERU is equal to the 5-year average for 2010-2014, or 169 gpd.

Table 4.13: Water Use per Connection and ERU by Customer Category [1]

Customer Category	Gallons per Day (gpd)					5-Year Average	5-Year Avg in # ERUs [3]
	2011	2012 [2]	2013	2014	2015		
Single-Family	164	168	171	168	172	169	*1.00*
Multi-Family	996	984	1,001	980	1,054		
Mobile Home Parks	8,713	8,591	8,714	8,840	9,069		
R/V Parks	1,169	1,199	1,291	1,248	1,206		
Single Commercial	706	688	712	698	736		
Multi Commercial	809	860	874	841	865		
Irrigation	675	792	847	894	1,037		
Hotel / Motel	4,692	4,826	4,609	5,030	4,751		
Municipal	610	642	745	751	816		
Construction	174	66	272	222	751		
Fire Meters	4	2	8	5	4		
D/C Meters	2	2	6	4	3		

1. gpd = (Annual Sales / Customer Connections) / Days per Year.
2. The gpd calculation for 2012 accounted for the leap year (366 days).
3. The value of 1 ERU is equivalent to the 5-year average of daily consumption for the average Single-Family residence in the District (169 gpd).

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ERUs are useful for comparing a system to itself as a measure of conservation and maintenance efforts over time. The quantity of water associated with an ERU, however, is both system-specific and point-in-time specific; and ERUs for one system do not readily apply to another system with different demographics or water use patterns.

Lowering the quantity of water represented by an ERU can thus be significant, especially in a large system such as the District's, as the utility can use the difference to meet growing demand without requiring expensive improvements or expansion to the system. The ability to delay or downsize large capital projects benefits the District, its ratepayers and its wholesale customers. Table 4.14: Total ERUs by Major Customer Category shows that overall retail demand for the District's system in 2015 was equivalent to 75,395 single-family residential units.

Table 4.14: Total Retail ERUs by Major Customer Category (gpd) [1, 2, 3]

Customer Category	# ERUs
Single-Family Residential	***44,983***
Multi-Family Residential	***17,509***
Multi-Family	*14,984*
Mobile Home Parks	*2,367*
R/V Parks	*157*
Non-Residential	***13,443***
Single Commercial	*3,949*
Multi Commercial	*1,617*
Irrigation	*6,294*
Hotel/Motel	*564*
Municipal	*935*
Construction	*67*
Fire Meters	*10*
Detector Check (D/C) Meters	*7*
Total	**75,935**

1. This table shows retail ERUs only and does not include wholesale customers.
2. ERU Count for each category (with exception of Single-Family Residential) is equal to: # of 2015 connections X (2015 average use per connection / 5-year average daily use for Single-Family Residential)
3. The ERU count for Single-Family Residential is equal to the number of Single-Family connections.

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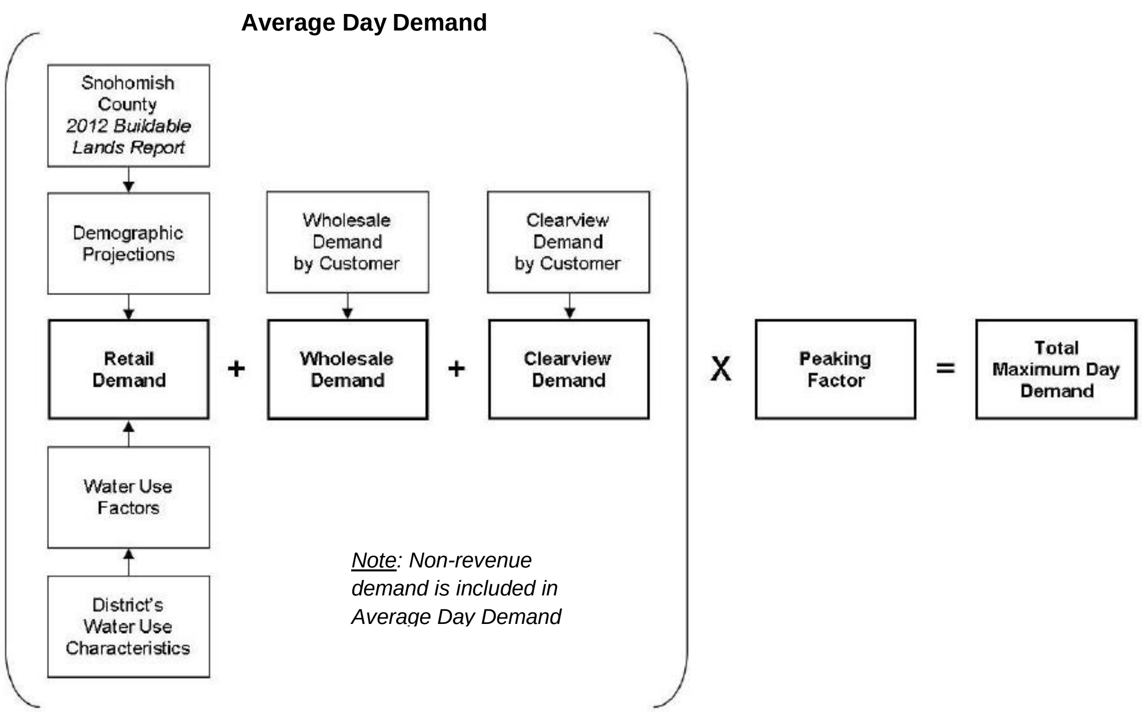
Demand Forecast

The methodology used to develop the demand forecast is shown below. This methodology is different from previous comprehensive plans in that it uses a combination of parcel-level growth estimates from Snohomish County, household size statistics by zip code and observed District-wide water use characteristics to forecast demand. Because the District manages its own pumping and the pumping for Clearview Water Supply Agency, the combined daily pumping of both operations is an important measure. Both the District and Clearview are charged the same rate from the City of Everett for purchased water. A major factor in the determination of that rate is the ratio of peak day to the average day for combined Alderwood and Clearview water purchases. For this reason, the District has chosen to present both average day demands for the District and for the combination of the District and Clearview.

Figure 4.4: Overall Water Demand Forecast Methodology



The demand forecast is used to assess hydraulic conditions within the District's distribution system, as documented in *Chapter 5 – System Analysis*.

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Table 4.15: Average Day Demand Forecast without Conservation (mgd)[1]

	2015 (actual)	2015 (Base Year)	2021 (Planning Year 6)	2025 (Planning Year 10)	2035 (Planning Year 20)
Retail Water Service Area					
Residential [2,3]	10.72	11.77	13.89	15.61	16.47
Employees [4]	1.19	1.22	1.46	1.67	1.74
Other Non-Residential [2,5]	1.08	0.83	0.83	0.82	0.82
Subtotal - Retail Avg Day Demand	*12.98*	*13.82*	*16.18*	*18.10*	*19.03*
AWWD Retail Non-Revenue Demand [2,6]	*1.53*	*1.58*	*1.74*	*1.87*	*1.94*
Subtotal - Wholesale Avg Day Demand [7,8]	*10.01*	*10.04*	*10.11*	*10.16*	*10.28*
Total AWWD Average Day Demand	**24.52**	**25.44**	**28.03**	**30.13**	**31.26**
Total AWWD ERU Count [9]	**145,496**	**150,959**	**166,302**	**178,754**	**185,443**
CWSA Wholesale Average Day Demand [10]	*3.84*	*3.90*	*4.33*	*4.63*	*5.50*
CWSA Non-Revenue Demand [11]	*0.11*	*0.17*	*0.19*	*0.20*	*0.24*
Total CWSA Average Day Demand	**3.95**	**4.07**	**4.51**	**4.83**	**5.74**
Total System – Average Day Demand	**28.47**	**29.51**	**32.54**	**34.96**	**37.00**

1. Additional guidance on how the demand forecast was calculated can be found in *Appendix H – Demand Forecast Technical Memorandum*.
2. An annual rate of change per unit is applied through 2035 (-0.67% per connection per year). Residential and Irrigation accounts consistently decreasing water use for 10+ years. The trend of modest decreases is expected to continue as appliances become even more efficient, rates encourage smart water use and conservation messages influence behavior.
3. Calculated as Number of Housing Units multiplied by the 5-Year Average Single-Family daily consumption (169 gpd).
4. Calculated as the Number of Employees multiplied by the 5-Year Average Employee daily consumption (34 gpd) for Single Commercial, Multi Commercial, Hotel/Motel and Municipal Non-Residential accounts.
5. Calculated as the 5-Year Average Sales for Irrigation, Construction, Fire and D/C Meters.
6. Calculated as the proportion of 2014 AWWD Retail Non-Revenue Demand to overall 2014 AWWD demand (this proportion is roughly 6.7% and is applied to future years).
7. Wholesale projections include Edmonds, Lynnwood, Mountlake Terrace, Mukilteo Water & Wastewater District and Silver Lake Water & Sewer District.
8. Wholesale demand calculated by analyzing trend of 10 years (when data available) of each wholesale customer (Edmonds, Lynnwood, Mountlake Terrace, Mukilteo Water and Wastewater District, Silver Lake Water & Sewer District) and applying observed annual rates of change to each. Edmonds, Lynnwood and Mountlake Terrace are all assumed to have flat demand over the 20-year planning horizon. Increase factors were applied to Mukilteo Water and Wastewater District and Silver Lake Water & Sewer District.
9. CWSA Wholesale refers to water purchased by the Clearview Water Supply Agency and subsequently sold to Silver Lake Water & Sewer District and Cross Valley Water District.
10. The 2014 value of CWSA non-revenue demand was higher than normal due to a problem with a defective billing meter. This problem existed between 2011-2014. The faulty billing meter was replaced in early 2015.

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Table 4.16: Average Day Demand Forecast with Conservation, Wholesale Estimate (mgd) [1]

	2015 (Actual)	2016 (Base Year)	2021 (Planning Year 6)	2025 (Planning Year 10)	2035 (Planning Year 20)
Retail Water Service Area					
Residential [2,3]	10.54	11.57	13.66	15.35	16.20
Employees [4]	1.17	1.20	1.43	1.63	1.71
Other Non-Residential [2,5]	1.06	0.82	0.81	0.81	0.81
Subtotal - Retail Avg Day Demand	*12.77*	*13.59*	*15.90*	*17.78*	*18.71*
AWWD Retail Non-Revenue Demand [2,6]	*1.50*	*1.56*	*1.71*	*1.84*	*1.91*
Subtotal - Wholesale Avg Day Demand [7,8]	*9.85*	*9.87*	*9.94*	*9.99*	*10.10*
Total AWWD Average Day Demand	**24.11**	**25.02**	**27.56**	**29.61**	**30.73**
Total AWWD ERU Count [9]	**143,052**	**148,423**	**163,499**	**175,677**	**182,327**
CWSA Wholesale Average Day Demand [10]	*3.77*	*3.84*	*4.25*	*4.56*	*5.41*
CWSA Non-Revenue Demand [11]	*0.11*	*0.16*	*0.18*	*0.20*	*0.23*
Total CWSA Average Day Demand	**3.88**	**4.00**	**4.44**	**4.75**	**5.64**
Total System – Average Day Demand	**27.99**	**29.02**	**31.99**	**34.36**	**36.37**

1. Applied a 1.68% Conservation Reduction to all retail and wholesale calculations. Additional guidance on how the demand forecast was calculated can be found in *Appendix H – Demand Forecast Technical Memorandum*.
2. An annual rate of change per unit is applied through 2035 (-0.67% per connection per year). Residential and Irrigation accounts consistently decreasing water use for 10+ years. The trend of modest decreases is expected to continue as appliances become even more efficient, rates encourage smart water use and conservation messages influence behavior.
3. Calculated as Number of Housing Units multiplied by the 5-Year Average Single-Family daily consumption (169 gpd).
4. Calculated as the Number of Employees multiplied by the 5-Year Average Employee daily consumption (34 gpd) for Single Commercial, Multi Commercial, Hotel/Motel and Municipal Non-Residential accounts.
5. Calculated as the 5-Year Average Sales for Irrigation, Construction, Fire and D/C Meters.
6. Calculated as the proportion of 2014 AWWD Retail Non-Revenue Demand to overall 2014 AWWD demand (this proportion is roughly 6.7% and is applied to future years).
7. Wholesale projections include Edmonds, Lynnwood, Mountlake Terrace, Mukilteo Water & Wastewater District and Silver Lake Water & Sewer District.
8. Wholesale demand calculated by analyzing trend of 10 years (when data available) of each wholesale customer (Edmonds, Lynnwood, Mountlake Terrace, Mukilteo Water and Wastewater District, Silver Lake Water & Sewer District) and applying observed annual rates of change to each. Edmonds, Lynnwood and Mountlake Terrace are all assumed to have flat demand over the 20-year planning horizon. Increase factors were applied to Mukilteo Water and Wastewater District and Silver Lake Water & Sewer District.
9. CWSA Wholesale refers to water purchased by the Clearview Water Supply Agency and subsequently sold to Silver Lake Water & Sewer District and Cross Valley Water District.
10. The 2014 value of CWSA non-revenue demand was higher than normal due to a problem with a defective billing meter. This problem existed between 2011-2014. The faulty billing meter was replaced in early 2015.

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Table 4.17: Maximum Day Demand Forecast without Conservation (mgd) [1]

	2015 (Actual)	2016 (Base Year)	2021 (Planning Year 6)	2025 (Planning Year 10)	2035 (Planning Year 20)
Retail Water Service Area					
Residential	19.72	20.50	24.19	27.18	28.69
Employees	2.19	2.12	2.54	2.88	3.03
Other Non-Residential	1.98	1.37	1.37	1.36	1.36
Subtotal - Retail Max Day Demand	*23.89*	*23.99*	*28.10*	*31.43*	*33.08*
AWWD Retail Non-Revenue Demand	*2.81*	*2.76*	*3.04*	*3.26*	*3.39*
Subtotal - Wholesale Max Day Demand	*18.42*	*17.72*	*17.84*	*17.92*	*18.13*
Total AWWD Maximum Day Demand	***45.12***	***44.47***	***48.97***	***52.61***	***54.60***
Total AWWD ERU Count	**267,713**	**263,840**	**290,557**	**312,137**	**323,935**
CWSA Wholesale Maximum Day Demand	*7.06*	*6.89*	*7.63*	*8.18*	*9.71*
CWSA Non-Revenue Demand	*0.21*	*0.30*	*0.33*	*0.35*	*0.42*
Total CWSA Maximum Day Demand	**7.27**	**7.18**	**7.96**	**8.53**	**10.13**
Total System – Maximum Day Demand	**52.39**	**51.65**	**56.93**	**61.14**	**64.73**

1. The demands in this table are the product of the demands in Table 4-15 and the 10-Year Average Peaking Factor 2005-2014 (1.74). Additional guidance on how the demand forecast was calculated can be found in the notes to table 4-15 and in *Appendix H – Demand Forecast Technical Memorandum*.

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Table 4.18: Maximum Day Demand Forecast with Conservation, Wholesale Estimate (mgd) [1]

	2015 (Existing)	2015 (Base Year)	2021 (Planning Year 6)	2025 (Planning Year 10)	2035 (Planning Year 20)
Retail Water Service Area					
Residential	19.39	20.15	23.79	26.73	28.21
Employees	2.15	2.09	2.50	2.84	2.98
Other Non-Residential	1.94	1.35	1.34	1.34	1.34
Subtotal - Retail Max Day Demand	*23.49*	*23.59*	*27.63*	*30.90*	*32.52*
AWWD Retail Non-Revenue Demand	*2.76*	*2.71*	*2.99*	*3.21*	*3.33*
Subtotal - Wholesale Max Day Demand	*18.12*	*17.42*	*17.54*	*17.62*	*17.83*
Total AWWD Maximum Day Demand	**44.37**	**43.72**	**48.15**	**51.73**	**53.68**
Total AWWD ERU Count	**263,215**	**259,408**	**285,676**	**306,893**	**318,493**
CWSA Wholesale Maximum Day Demand	*6.94*	*6.77*	*7.50*	*8.04*	*9.55*
CWSA Non-Revenue Demand	*0.20*	*0.29*	*0.32*	*0.34*	*0.41*
Total CWSA Maximum Day Demand	**7.14**	**7.06**	**7.83**	**8.38**	**9.96**
Total System – Maximum Day Demand	**51.51**	**50.78**	**55.98**	**60.11**	**63.64**

1. The demands in this table are the product of the demands in Table 4-16 and the 10-Year Average Peaking Factor 2005-2014 (1.74). Additional guidance on how the demand forecast was calculated can be found in the notes to table 4-16 and in *Appendix H – Demand Forecast Technical Memorandum*.

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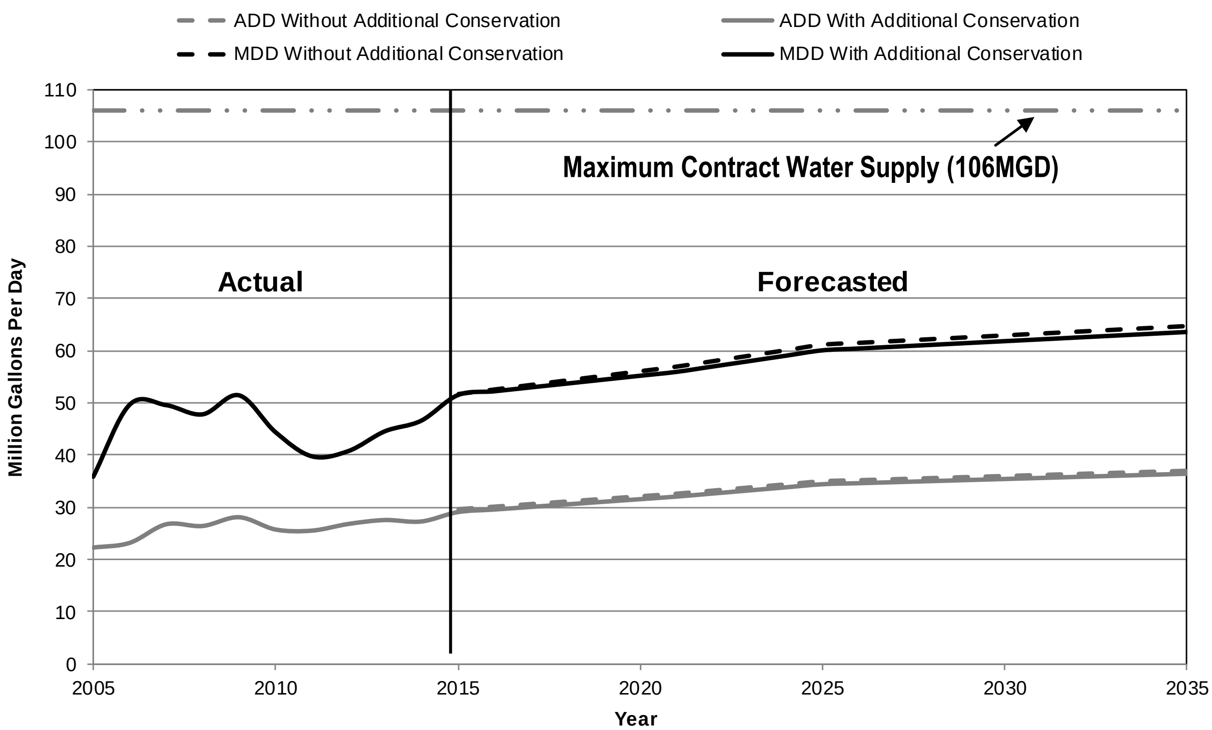
Figure 4.6: Average and Maximum Day Demand (Alderwood and Clearview) vs. Contract Maximum Supply 10/05/17



Last Updated: October, 2017

Conclusions

The following significant conclusions can be drawn from the planning data and demand forecast:

1. Despite an increase in population, overall average day demand will remain fairly flat as per capita consumption continues to decline.
2. The District's peaking factor declined over the last planning period to 1.74.
3. The District's overall ERU declined over the last planning period to 169 gpd.
4. The District's non-revenue water ratio declined over the last planning period to 6.6%.
5. If the expected rate of growth from 2025-2035 continues, the District will reach the current maximum contracted yield by well beyond 2050 for retail demand.
6. The demand forecast indicates that the emphasis of the CIP should shift from capacity projects to infrastructure repair and replacement until at least 2035.

Last Updated: September, 2016

5. System Analysis 5-1

5. System Analysis

A system analysis evaluates the ability of the water system facilities to meet current and projected customer demands including source of supply, pumping, transmission, storage, distribution and fire flow. The Washington State Department of Health (DOH) establishes guidelines for water system facilities capacities and minimum water pressure so that all the different types of demands will be met by a system for the upcoming planning period. The different demands include average day demand (regular water use by customers), peak day demand (the day with the highest water use in a calendar year), peak hour demand (the highest hourly use by customers on peak day), fire demands and storage requirements. The purpose of this chapter is to:

1) Determine whether adequate water supply, pumping, transmission, storage and distribution facilities are available to meet projected demands;
2) Examine the ability of the system to meet minimum fire flow requirements; and
3) Identify any system facility deficiencies.

This chapter will explain the minimum criteria, analysis used and conclusions for each of these items.

Facility Useful Life Considerations

Four approaches will be taken regarding evaluating the useful life of infrastructure for the water system. The impacts of these three approaches relate to the level of service provided to the customers and the risks assumed in the operation of the water system. The District's Board of Commissioners will be consulted regarding the preferred approach. The approaches considered will generally consist of the following:

- Continuation of the capital funding transfers from the Operating Fund at the recent levels;
- Replacing a uniform percentage of the water system infrastructure each year proportional to the expected service life;
- Replacing the water system infrastructure at the predicted end of the useful life; and
- Replacing the water system infrastructure based on asset management strategies temporarily modified by CIP delivery capacity.

Useful life of various components of the water system infrastructure has been set for the initial evaluation of the system. Useful life expectations will be refined in the future based on actual condition assessment. Table 5.1 below shows the initial planning level service life for water system components.

Table 5.1: Projected Water Infrastructure Useful Life

Component	Increased Monitoring	Useful Life for Planning[1]
Pipe • Concrete • Cast Iron • Ductile Iron – mortar lined • Ductile Iron - mortar lined, restrained • HDPE • PVC • Steel	• 60 years • 60 years • 85 years • 85 years • 85 years • 60 years • 40 years	• 75 years • 75 years • 100 years • 100 years • 100 years • 75 years • 50 years
Component	**Increased Monitoring**	**Useful Life for Planning[1]**
Reservoirs • Concrete - Structure • Steel - Structure • Coatings	• 85 years • 85 years • 10 years	• 100 years • 100 years • 15 years
Appurtenances • Fire Hydrants • Air-Vacuum Valves • Blow-offs • Pressure Reducing Valve	• 40 years • 35 years • 40 years • 35 years	• 50 years • 40 years • 50 years • 40 years
Equipment • Electrical Gear • Mechanical (Pumps/Motors)[2] • Instrumentation & Controls • PRV & ACV Stations	• 15 years • 35 years • 8 years • 40 years	• 20 years • 40 years • 10 years • 50 years

1. Useful life refers to the estimated lifespan of a depreciable asset during which it can be expected to contribute to system operations. Actual useful life, however, can vary greatly depending on conditions, soils, use and other external factors.
2. May vary by application.

Last Updated: August, 2017

Source Capacity – WAC 246-290-100(4)(f)(ii)

The source of water supply must be sufficient to meet projected retail and wholesale maximum day demand (MDD) for the entire District as well as for each individual pressure zone. To evaluate whether the District's available supply is adequate, the demand forecast (discussed in *Chapter 4 - Planning Data and Demand Forecast* and *Appendix H - Demand Forecast Technical Memorandum*) is compared to current available water sources. In addition to the forecasted source demand the contracted maximum supply to wholesale customers must also be considered. The City of Everett is the District's sole source of water for its retail and wholesale customers. The water supply contract executed in 2005 allows the District to utilize its existing ground water rights and use reclaimed water and the District may use other sources of water with the prior written consent of Everett. However, at this time the District only utilizes Everett water. The District can purchase up to 106 million gallons per day (mgd) from Everett, but this amount is limited to 55 mgd per connection point. The District currently uses Everett connections in two locations: the Clearview Water Supply Agency (CWSA) connection to Everett's pipeline 5 in Snohomish and the Evergreen Way connection at Everett's Reservoir 3 site. Other connection points can be established by mutual agreement. The agreement runs to January 1, 2055 and is included in *Appendix D - Supply Agreements*.

The CWSA Interlocal Joint Operating Agreement dated February 2005 allocates the District 18.5 million gallons per day (mgd) supply from the CWSA connection. The agreement allows the other CWSA partners, Cross Valley Water District and Silver Lake Water and Sewer District, to transfer or sell supply capacity to the District should the need arise and the other partners have surplus capacity. The Agreement runs to December 31, 2054 and is included in *Appendix E - Clearview Partnership*.

The firm yield (current maximum supply) for the two contracts mentioned above is 73.5 mgd (55 mgd from the Evergreen connection and 18.5 from the CWSA connection). The firm yield could be increased by adding another point of connection to the Everett system, contracting for more water from CWSA, activating a District well, or implementing the use of reclaimed water for industrial and irrigation uses.

Figure 5.0 Contracted Supply analyses; 20 year projection AWWD service area

Agency	Peak Day*
Silver Lake (via Clearview)	12
Silver Lake (Direct)[2]	5
Cross Valley (via Clearview)	18
Mukilteo Water and Wastewater District[1]	5
City of Edmonds[2]	9
City of Lynnwood[2]	10
Mountlake Terrace[2]	6
Total	65

*Projected Maximum Peak Day contract yield (mgd)

1. Contracted maximum 2033
2. Contracted maximum 2050

Source Capacity Evaluation

The population projections and corresponding customer demands from *Chapter 4 - Planning Data and Demand Forecast* show that the 73.5 mgd currently under contract will be sufficient to supply the District for the 20-year planning period and into the future, so no action on contracted source capacity is needed during this planning period.

Demands from wholesale contracts total 65 mgd should every agency withdraw their estimated maximum in 2050. This would leave 41 mgd available for direct retail customers. Currently the 20 year projection for AWWD direct service area is 36 mdg by 2035

Table 5.2: Source Capacity Analysis for Entire System (mg)

	Planning Year				
	2015 (base year)	**2021**	**2025**	**2035**	**Max [7]**
Projected Demand [1, 5]					
Total System ERUs [2]	175,100	193,000	207,400	219,500	256,000
Average Day Demand (mgd)[3]	29.5	32.5	35.0	37.0	43.2
Maximum Day Demand (mgd)[4]	51.7	56.9	61.1	64.7	73.5
Total Available Supply [6]	73.5	73.5	73.5	73.5	73.5
Source Surplus/(Deficiency)	***21.8***	***16.6***	***12.4***	***8.8***	

1. Projected demand taken from Chapter 4 - Planning Data and Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. Total System ERU is calculated from the population and employment forecast in Chapter 4.
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd)). The 5-Year average ERU for the District. Includes wholesale and Clearview Water Supply Agency demand.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. Assumes all sources of supply are available.
7. Developed by working backwards from total available supply

Last Updated: January, 2018

Projected Water Demand by Zone

285 Zone Supply Analysis

As outlined in *Chapter 1 - System Description*, the 285 zone is currently fed by the Picnic Point pressure reducing station. As shown in Table 5.3, the existing pressure reducing station can supply the 285-zone peak day demands through the planning period.

Table 5.3: Supply Analysis for 285 Zone

	Planning Year			
	2015	**2021**	**2025**	**2035**
Projected Demand [1, 5]				
285 Zone Households [2]	97	113	125	125
Average Day Demand (mgd) [3]	0.016	0.019	0.021	0.021
Maximum Day Demand (mgd) [4]	0.028	0.033	0.037	0.037
Source Capacities				
Picnic Point PRV Station [6]	2.9	2.9	2.9	2.9
Total Available Supply [7]	2.9	2.9	2.9	2.9
Source Surplus/(Deficiency)	**2.87**	**2.87**	**2.86**	**2.86**

1. Projected demand taken from Chapter 4 - Planning Data and Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. This is a single-family residential zone with minimal housing growth
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd)). The 5-Year average ERU for the District. Includes wholesale and Clearview Water Supply Agency demand.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. 6-inch PRV=1,800 gpm, 2-inch PRV=210 gpm.
7. Assumes all sources of supply are available.

Last Updated: January, 2018

520 Zone Supply Analysis

The population projections and corresponding customer demands from Chapter 4 - Planning Data and Demand Forecast are shown in Table 5.4. This table shows that the 27.31 mgd currently available from the three pressure-reducing stations (PRV) and three automatic control valves (ACV) feeding the 520 zone, as outlined in Chapter 1 - System Description, will be sufficient to supply the zone for the planning period and well into the future.

The District is contemplating a pressure reduction project, which would expand the 520 Zone and add additional lower pressure zones within the 520 pressure zone. The proposed zone expansion will not require additional sources of supply for the 520 zone. The pressure reduction and zone expansion project is discussed further in this chapter below.

The City of Bothell has requested the District work with the City of Everett and PUD No. 1 of Snohomish County (PUD) to secure wholesale water for the portion of Bothell in King County from the 520 zone. Bothell needs to provide Seattle Public Utilities with six years notice prior to ending its use of Seattle water, so any permanent water supply to that area will happen outside the six-year planning period but potentially within the 10-year planning period. Additional planning and capital improvements may be required to provide Bothell wholesale water. The City of Bothell has also requested emergency backup fire flow supplies at the Morningside Booster Pumping site in lieu of rebuilding that pump station, this will likely require Bothell to construct project D-21 shown in Table 5.12. This will also create an additional emergency intertie, which could be used as a supply intertie should a wholesale agreement be reached with Bothell.

Table 5.4: Supply Analysis for 520 Zone (mg)

	Planning Year			
	2015 (Base Year)	**2021**	**2025**	**2035**
Projected Demand [1, 5]				
520 Zone ERUs [2]	12,700	14,500	15,800	18,300
Average Day Demand (mgd) [3]	2.15	2.45	2.67	3.09
Maximum Day Demand (mgd) [4]	3.75	4.26	4.65	5.38
Source Capacities				
Canyon Park Tank ACV [6]	4.46	4.46	4.46	4.46
Nike Tank ACV 1 [7]	7.2	7.2	7.2	7.2
Nike Tank ACV 2 [7]	7.2	7.2	7.2	7.2
Lockwood Road PRV Station [8]	2.67	2.67	2.67	2.67
196th Street SE PRV Station [9]	5.12	5.12	5.12	5.12
49th Avenue SE PRV Station [9]	5.12	5.12	5.12	5.12
Total Available Supply [10]	24.57	24.57	24.57	24.57
Source Surplus/(Deficiency)	***20.82***	***20.31***	***19.92***	***19.19***

1. Projected demand taken from Chapter 4 - Planning Data and Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. 520 Zone ERU is calculated from the population and employment forecast in Chapter 4 - Planning Data and Demand Forecast.
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd)). The 5-Year average ERU for the District.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. 8-inch Automatic Control Valve (ACV)=3,100 gpm.
7. 10-inch ACV=5,000 gpm.
8. 6-inch PRV=1,800 gpm, 1-inch PRV=55 gpm.
9. 8-inch PRV=3,100 gpm, 3-inch PRV=460 gpm.
10. Assumes a 10 inch ACV is out of service.

Last Updated: January, 2018

724 Zone Supply Analyses

The 724 pressure zone is supplied by the 724 Zone (High Tank) Pump Station. Table 5.5 in the following section shows that with the improvements completed in 2015, the pump station provides sufficient supply for the 20-year planning period. As discussed below in the water storage analysis section, this zone has deficient standby storage, which can most effectively be resolved by increasing the source of supply through the construction of an additional pump station. This would provide a redundant source of supply to the pressure zone from the 635 pressure zone.

Water Supply Improvements from the 2009 Plan not completed

The 2009 Water Comprehensive Plan identified project S-10 Well No. 7 Upgrades (for Emergency Supply). In 2008 the District paid a contractor approximately $10,000 to install a 5 horsepower pump and motor in the existing well casing. The planned project estimated an expense of $330,000 in 2013. This larger planned project was not initiated and is not included as a supply project for this planning period.

Pumping Capacity – WAC 246-290-100(4)(f)(ii)

As discussed in Chapter 1 - System Description, the District currently operates four pump stations: Pump Stations 1 and 2 at the Evergreen Way site, the 724 zone (High Tank) pump station at the District's maintenance and operations facility and the CWSA pump station at 63rd Avenue SE, in Snohomish. Pump Stations 1 and 2 pump water from Everett's system at Everett's Reservoir 3 site to the District's 635 pressure zone. The 724 zone pump station pumps water from the District's 635 pressure zone to its 724 pressure zone. The CWSA pump station pumps water from Everett's pipeline 5 through the CWSA transmission system to the CWSA reservoir.

The current rated capacity of Pump Station Nos. 1 & 2 is 53.9 mgd based on pump tests conducted by the District on May 31, 2011 (28.9 mgd from pump station 1 and 25 mgd from pump station 2). The current rated capacity of the CWSA Pump Station is 33.5 mgd and is expandable to 48.5 mgd, which exceeds the 18.5 mgd contracted for by the District and provides the other CWSA partners with their contracted shares of water. The projected maximum day flows to the other CWSA partners, based on their water system plans, are approximately 1.3 mgd for Cross Valley Water District and approximately 9 mgd for Silver Lake Water and Sewer District. This leaves 4.7 mgd surplus pumping capacity in the CWSA Pump Station. However, the current maximum pumped from the CWSA is approximately 12.5 mgd.

Facility Useful Life Considerations - Pump Stations

In addition to estimates included in Table 5.1, these cycles were applied to each existing and known future pump station to develop a replacement schedule for the pump station elements. These are depicted in *Appendix B - Capital Improvement Program Technical Memorandum*.

Table 5.5: Projected Pump Station Life Cycle Activities

Activity	Initial Installation	Years after Installation							
		+10	+20	+30	+40	+50	+60	+70	+80
Instrumentation & Control Update	New	X	X	X	X	X	X	x	x
Minor Rehabilitation & Electrical Update	New		X		X		X		x
Emergency Generator Replacement	New		X		X		X		x
Major Rehabilitation					X				
Pump Station Replacement									x

The costs for these various activities listed in Table 5.5 can vary considerably based on the conditions, size and capacity of the particular pump station. Total project costs for the recent pump station improvement projects used for cost estimates can be found in *Appendix B- Capital Improvement Program Technical Memorandum*.

Last Updated: September, 2016

635 Pumping Capacity Evaluation

Pump Station No. 1

Location:	Evergreen Way, Everett	*Capacity:*	28.9 mgd

As outlined in Chapter 1 - System Description, Pump Station 1 was originally built in 1964 and rebuilt in 2011. The 2011 work was a complete rebuild with only the original building, and inlet and outlet piping remaining from the original building. The project also included the construction of a new electrical substation and secondary power feed. *Appendix B - Capital Improvement Program Technical Memorandum* should be consulted for scheduled improvements to this facility.

Last Updated: September, 2016

Pump Station No. 2

Location:	Evergreen Way, Everett	*Capacity:*	25 mgd with PS No. 1, 44 mgd alone

As outlined in Chapter 1 - System Description, Pump Station 2 was originally built in 1991 and partially rebuilt in 2014. The 2014 work included new motor starters, electrical equipment, instrumentation and controls. The building roofing was also replaced. *Appendix B - Capital Improvement Program Technical Memorandum* should be consulted for scheduled improvements to this facility.

Last Updated: September, 2016

CWSA Pump Station

Location:	63rd Ave SE, Snohomish	*Capacity:*	33.5 mgd, contracted capacity 18.5 mgd

As outlined in Chapter 1 - System Description, the CWSA Pump Station was constructed in 2005. There have been numerous upgrades to the station since then, which are listed in the System Description chapter. An operational issue related to pumping efficiency is an ongoing concern of the CWSA Board. The existing fixed-speed pumps are rarely used due to low demands from the CWSA partners. Installing a smaller fixed speed pump that produces flows of 8 mgd would allow the two primary pumps with variable frequency drives to be used more efficiently. This is a CWSA issue and would need to be approved by its Board.

Last Updated: September, 2016

Table 5.6 shows that the 635 pumping capacity, which supports overall system capacity, is sufficient for the planning period and beyond so no additional system wide pumping capacity projects are planned. Expenditures outlined in *Appendix B - Capital Improvement Program Technical Memorandum* is for routine upgrades, repairs and replacements.

Table 5.6: Pumping Capacity Analysis for 635 Zone - All District Purchased Water (mg)

	Planning Year				
	2015 (Base Year)	**2021**	**2025**	**2035**	**Max [4]**
Projected Demand [1, 2]					
Total System ERUs	175,100	193,000	207,400	219,500	256,000
Average Day Demand (mgd)[3, 5]	29.5	32.5	35.0	37.0	43.2
Maximum Day Demand (mgd)[4]	51.7	56.9	61.1	64.7	73.5
Pumping Capacities					
CWSA Pump Station [7]	18.5	18.5	18.5	18.5	18.5
Pump Station No. 1 [8, 9]	28.9	28.9	28.9	28.9	30
Pump Station No. 2 [8]	25	25	25	25	25
Total Available Supply [6, 9]	72.4	72.4	72.4	72.4	73.5
Source Surplus/(Deficiency)	***20.7***	***15.5***	***11.3***	***7.7***	***-***

1. Projected demand taken from Chapter 4 - Planning Data and Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. Total System ERU is calculated from the population and employment forecast in Chapter 4.
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd). The 5-Year average ERU for the District. Includes wholesale and Clearview Water Supply Agency demand.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. Assumes all sources of supply are available.
7. Contract amount available from the Clearview Water Supply Agency.
8. Based on May 31, 2011 pump test.
9. Fully authorized amount of 73.5 mgd available during lower reservoir levels if needed during higher demand.

Last Updated: January, 2018

724 Pumping Capacity Evaluation

724 Zone Pump Station (High Tank Pump Station)

Location: 15204 35th Ave W., Lynnwood Capacity: 5.3 mgd

As outlined in Chapter 1 - System Description, the 724 Zone Pump Station was originally built in 2001 and rebuilt in 2014. The 2014 work included replacement of the three existing vertical turbine pumps and motors, piping valves and associated equipment and provision for a future 4th pump; installation of a new motor control center and associated electrical equipment; and improvements to the instrumentation and control systems. The current rated capacity of the pump station is 5.6 mgd based on pump tests conducted by the District on May 29, 2014 (two pumps running, one in standby mode). As shown below in Table 5.5, the 724 Zone Pump Station meets the supply demands for the 724 pressure zone throughout the planning period. However, as shown below in the water storage analysis section for the 724 zone, an additional pumping source of supply to the 724 zone would reduce the standby storage deficiencies in the High Tanks and increase the supply reliability to the 724 zone. The City of Lynnwood's Water System Plan contemplated expansion of the use of 724 zone water to areas currently supplied in Lynnwood from the District's 635 zone water. This zone expansion would require a modification to the Wholesale contract and a cost sharing agreement for the proposed new 724 zone pump station. The proposed 724 pumping improvements are shown in *Appendix B - Capital Improvement Program Technical Memorandum*.

Last Updated: September, 2016

PS-4 Redundant 724 Booster Pump Station

A second 724 Booster Pump Station is identified as an improvement necessary to providing redundant supply to the 724 zone in order to meet standby storage criteria requirements.

Last Updated: September, 2016

Table 5.7: Pumping Capacity Analysis for 724 Zone (mg)

	Planning Year			
	2015 (Base Year)	**2021**	**2025**	**2035**
Projected Demand [1, 5]				
724 Zone ERUs [2]	12,300	15,300	17,800	18,400
Average Day Demand (mgd)[3]	2.08	2.59	3.01	3.11
Maximum Day Demand (mgd)[4]	3.63	4.51	5.23	5.42
Pumping Capacities				
724 zone (High Tank) Pump Station	5.6	5.6	5.6	5.6
Total Available Supply [6]	5.6	5.6	5.6	5.6
Source Surplus/(Deficiency)	**1.97**	**1.09**	**0.37**	**0.18**

1. Projected demand taken from Chapter 4 - Planning Data and Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. 724 ERU is calculated from the population and employment forecast in Chapter 4.
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd)). The 5-Year average ERU for the District.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. Assumes two pumps pumping based on May 2, 2014 pump test.

Last Updated: January, 2018

Transmission Capacity – WAC 246-290-010(267)

Transmission lines are pipes used to convey water from source, storage, or treatment facilities to points of distribution or distribution mains, and from source facilities to treatment or storage facilities. This also can include transmission mains connecting one section of distribution system to another section of distribution system as long as this transmission main is clearly defined on the plans or in an agreement. This plan defines transmission mains in one of two categories: wholesale or regional. Wholesale transmission water mains are those water mains which transfer water from the source of supply to the District's wholesale customers through the District's system, as listed in the wholesale contracts (see *Appendix D - Supply Agreements*). Regional transmission water mains are those water mains which transfer water to and between the District's pressure zones, in addition to those specifically listed in the wholesale contracts. Transmission mains tend to be 16-inches in diameter and larger. Generally, no service connections are allowed to a transmission main.

As outlined in *Chapter 1 - System Description*, transmission lines 1 and 2 deliver water from the Pump Station 1 and 2 sites on Evergreen Way to the District Service Area. Transmission line 1 is built in two segments: the first segment is 36-inch diameter pipe and the second segment is 30-inch diameter pipe, both segments are concrete cylinder pipe. Transmission line 2 is also built in two segments: the first segment is 36-inch concrete cylinder pipe and the second segment is 30-inch ductile iron pipe. Once the transmission lines enter the service area they are connected to other transmission and distribution lines in the 635 zone. The hydraulic model shows that the maximum velocity in the 30-inch segments of these transmission lines is approximately 8 feet per second at the maximum pumping rate of 53.9 mgd. The district does not expect to operate Transmission mains 1 and 2 at the maximum rate during this planning period. This is above the level of service for transmission lines established by most jurisdictions. When these 30-inch transmission line segments are slated for replacement larger diameter pipes should be considered.

As outlined in *Chapter 1 - System Description*, transmission line 3 (the CWSA Pipeline) is a 36-inch ductile iron transmission line that delivers water from the District's CWSA meter at the CWSA Reservoir site at 15830 73rd Ave SE, Snohomish WA 98296 to the District's transmission and distribution system in the 635 zone on 180th Street SE. The 18.5 million gallons per day CWSA contracted capacity results in a velocity of 4.61 feet per second, which is within the level of service standard established by most jurisdictions.

Last Updated: September, 2016

Transmission Capacity Evaluation

Transmission capacity to the District is adequate to deliver the peak day demands for the 20-year planning period.

Transmission line No. 1, discussed below, was constructed in 1962 and has a 30-inch diameter segment and 36-inch diameter segment. The concrete cylinder pipe should be investigated for structural integrity during this 20-year planning period.

The 2009 Water System Plan showed the need for several transmission mains. The projects and their status are included in Table 5.8.

Table 5.8: Transmission Improvement Needs - from 2009 WSP

Project	Description	Status
D-1	Eastside Pressure Reduction Project 24” Transmission Main	W1002, Scheduled Completion 2016 W1102C, Scheduled Completion 2017
D-3	660 Zone Connection	Project Eliminated
D-7	16" main on 45th Ave SE from Canyon Park Tank to 228th St SE	Completed, W0909
D-10	Hwy 99 System Improvements	Completed, W0502
D-34	16" Main on 35th Ave SE from 184th St SE to 180th St SE	Pending
D-35	16" Main on Filbert Road from Filbert Dr. to North Road	Pending
D-46	16" Main on Poplar Way from 214th Street SW to 218th St SW	Pending
D-47	16" Main on Filbert Road from Larch Way to Locust Way	Pending
D-48	Transmission/Distribution Piping Segregation Project	This project is not being considered under current planning process

Projects identified as transmission-related projects in Table 5.8 and noted as pending are not currently scheduled. Projects with an identified job number are included in the currently active CIP. The projects labeled “pending” are not budgeted in the Capital Improvement Program budget that was adopted in December of 2014.

Modeling used in the 2009 WSP projected flows that greatly exceed the revised flows generated by the new demand forecast. Pending projects will be re-evaluated and re-prioritized in the asset management and 100-year CIP processes.

Last Updated: September, 2016

TM-1 Transmission Main No. 1 Condition Assessment

Transmission main No. 1 runs from Pump Station 1 to approximately Reservoir No. 1 and was completed in approximately 1962. In 2017, the main will be 55 years old. The pipe is primarily concrete bar-wrapped cylinder pipe. The proposed project includes creating a baseline evaluation of the entire pipe, assessing condition, future inspection frequency and estimated remaining life. Inspection is estimated at $100,000 per mile. Evaluating six miles is estimated at a total cost of $600,000.

Last Updated: September, 2016

Storage Capacity – WAC 240-290-235

"Finished water storage facility" means a water storage structure that is integrated with a water system's distribution network to provide for variable system demands including, but not limited to, daily equalizing storage, standby storage, fire reserves, or to provide for disinfectant contact time (WAC 246-290-010(106)). Storage volume capacity requirements are generally comprised of five components:

1. Operational Storage: The volume of distribution used for day-to-day operations in non-emergency situations for water systems where water is pumped into storage tanks "on-call" rather than continuously. Storage is refilled by a pump or automatic control valve when the water level drops below a pre-set elevation, ensuring pumping of source water throughout the day.

2. Equalizing Storage: The volume of storage needed to supplement supply to consumers when the peak hourly demand exceeds the total source pumping capacity (WAC 246-290-010(99)). It is used to meet peak demand periods, such as at the beginning and end of the day. Requirements for equalizing volume are greatest on the peak day of the year and must provide a minimum pressure of 30 pounds per square inch (psi) to all customers served by that pressure zone.

3. Demand Management Storage: The volume of storage needed to supplement supply to consumers to reduce the peak day demand by supplying a source of water from storage rather than the regional supplier. It allows the purchased peak day flow to be reduced to a peak week amount. Demand Management Storage is only available in the 635 zone.

4. Standby Storage: The volume of stored water available for use during a loss of source capacity, power, or similar short-term emergency (WAC 246-290-010(244). Used to ensure enough supply is available to meet normal operating demand during a system emergency, power outage, or planned outage. Major, unforeseeable system emergencies are addressed in *Chapter 10 - Emergency* and Continuity of Business Plans.

5. Fire Suppression Storage: The volume of stored water available during fire suppression activities to satisfy minimum pressure requirements per WAC 246-290-230 (WAC 246-290-010(108)). The amount of water needed to meet minimum firefighting requirements, as calculated for each pressure zone:

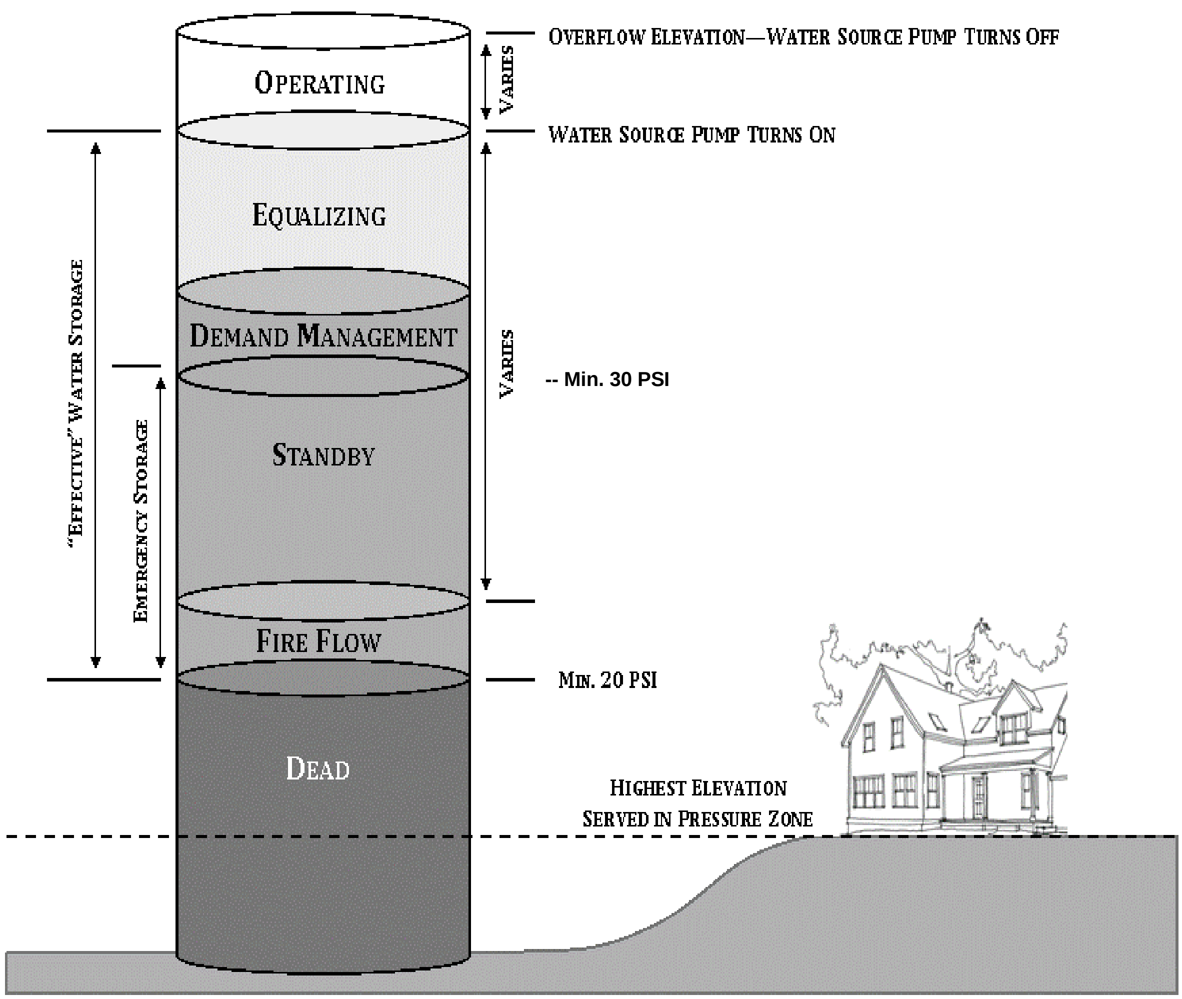
    a. (Required Fire Flow) x (Required Duration) = (Required Fire Suppression Storage)

6. Dead Storage: The volume of stored water not available to all consumers at the minimum design pressure under WAC 246-290-230 (5) and (6) (WAC 246-290-010(75). Water at the bottom of a storage facility which is physically at too low of an elevation to provide adequate pressure.

Each of the water storage components is influenced by the elevation of the highest customer served by that storage facility. The customer at the highest elevation typically has the lowest water pressure. A customer at the top of a hill will not have as much pressure as a customer at the bottom of the hill. The vertical change in elevation creates what is known as “pressure head” or “head,” which is the effect of gravity on water pressure.

The calculations for the storage components ensure that the highest-elevation customer has adequate water pressure in an emergency situation. Figure 5.0 below shows a typical storage reservoir with each of the system components.

Figure 5.0: Water System Storage Components



Last Updated: December, 2017

Storage Capacity Evaluation

The storage capacity evaluation is based on two primary criteria:

1. The ability of existing storage facilities to provide a minimum of 30 psi to the customer at the highest elevation in that pressure zone during peak hour demand conditions; and
2. The ability of existing storage facilities to provide a minimum of 20 psi to the same customer during peak day demand conditions where fire flow is needed.

These criteria are then applied to each pressure zone served by the District's reservoirs and the results shown in the following subsections:

- <u>635 Zone</u>: This zone is served by Reservoirs 1, 2 and 3 and contracted storage in the CWSA Reservoir. These storage facilities provide storage for all of the District's retail and wholesale customers (all water flows through this pressure zone).
- <u>285 Zone</u>: Located at the northwest corner of the District, this zone is served via a Pressure Reducing Station and has no additional storage facilities.
- <u>520 Zone</u>: This zone is served via Pressure Reducing Stations and Automatic Control Valves and is located towards the southern end of the District. It contains three reservoirs: The Canyon Park Tank and Nike Tanks 1 and 2. These three reservoirs provide additional storage for the 520 Zone.
- <u>724 Zone</u>: This zone is served via the 724 Booster (High Tank) Pump Station and contains two reservoirs (High Tanks 1 and 2) that provide additional storage for the 724 Zone. All the 724 zone facilities are currently at the District's Maintenance and Operations Facilities.

635 Storage Analysis

Table 5.9 shows that from a system-wide perspective, there is sufficient storage to meet the current and projected retail and wholesale storage requirements through 2035. Key conclusions from the analysis are:

- The addition of the CWSA Reservoir to the District's storage capacity has increased the amount of available storage.
- There is adequate storage in the 635 zone to support storage deficiencies or emergencies in the 520 and 724 Zones throughout the 20-Year Planning Period.
- Under the current projected growth scenario by Snohomish County and the existing overall District ERU of 169 gpd, the number of ERUs would need to almost double in order to reach maximum storage capacity in the 635 Zone.
- System - wide storage capacity will not need to be closely re-evaluated until near the end of the current 20-Year Planning Period in 2035.
- The above conclusions assume a peak customer elevation of 548.5. above sea level. Review of recent development activity is suggested to determine if higher elevation customers exist.

Table 5.9: Summary of 635 Storage Capacity

	Planning Year			
	2015 (Base Year)	2021	2025	2035
Total System (635 zone storage)				
Total System ERUs [1, 2]	175,100	193,000	207,400	219,500
Average Day Demand (mgd)	29.5	32.5	35.0	37.0
Maximum Day Demand (mgd)	51.7	56.9	61.1	64.7
Available pumping (mgd)[3]	72.4	72.4	72.4	72.4
Pumping without PS No. 2 (mgd)[4]	47.4	47.4	47.4	47.4
Reservoir No. 1	28	28	28	28
Reservoir No. 2	28	28	28	28
Reservoir No. 3	20	20	20	20
CWSA Reservoir	7.5	7.5	7.5	7.5
Available Storage @ 20 psi [5]	83.5	83.5	83.5	83.5
Reservoir No. 1	12.6	12.6	12.6	12.6
Reservoir No. 2	12.6	12.6	12.6	12.6
Reservoir No. 3	12.6	12.6	12.6	12.6
CWSA Reservoir	7.5	7.5	7.5	7.5
Available Storage @ 30 psi [5]	45.3	45.3	45.3	45.3
Operational Storage (mg)[6]	1.31	1.31	1.31	1.31
Demand Management (mg)[7]	18.28	18.28	18.28	18.28
Equalizing Storage (mg)[8]	5.23	6.27	6.58	7.74
Fire Suppression Storage[9]	1.44	1.44	1.44	1.44
	4.94	6.14	7.14	7.37
Standby Storage[10,11]	28.20	30.64	30.88	34.06
Surplus/(Deficit)	***24.10***	***19.42***	***17.87***	***13.29***

1. Projected demand taken from Chapter 4 Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. Total System ERU is calculated from the population and employment forecast in Chapter 4. Projected demand assumes there is no conservation program.
3. Assumes that all sources are pumping their firm capacity, or maximum yield with all pumps (excluding reserve standby pump), 24 hours per day.
4. Assumes PS 1 is pumping 28.9 mgd and CVWSA is supplying 18.5 mgd. (Largest source PS 2 out of service.
5. Figures derived by using an assumed elevation of the highest customer in the 635 zone at approximately 548.5 ft. above sea level.
6. The top ½ foot of reservoirs 1, 2 and 3, or approximately 1.3 mg.
7. Assumes seven (7) feet of Reservoirs 1, 2 and 3, or approximately 16.9 mg.
8. DOH Water System Design Manual Continuous pumping calculation (page 101, Equation 9-1). Assumes Peak Hour Demand equals twice the Peak Day Demand converted to gpm.
9. 6,000 gpm requirement for four (4) hours.
10. Assumes 200 gallons per ERU (ADD less than pumping with the largest source out). Standby storage completely nested in storage between 30 and 20 psi = 38.2 mg until after 2025.
11. By a letter of understanding dated December 6, 2000 between the City of Lynnwood and the District, the District has agreed to provide Lynnwood 1.63 million gallons of standby storage. This standby storage is included in the District's standby storage calculation. The letter agreement is included in Appendix D - Supply Agreements.

Last Updated: January, 2018

Consideration may be given to providing additional storage for demand management, but this consideration will take significant study and no capital project has been assigned in the Capital Improvement program. There has also been discussion regarding the provision of additional storage at the CWSA site. This would allow for greater utilization of the larger CWSA pumps. This would require agreement by the CWSA Board and significant analysis no capital project has been assigned in *Chapter 13 - Capital Improvement Program*.

Preservation of the existing storage structures is considered a capital expense and consists primarily of coatings. Recent experience with reservoir coating systems suggest a 15-year replacement period should be assumed. However, the cycle may be stretched to 20 years should the coating remain in good condition. The table below identifies the status of the various reservoirs in the system. The replacement costs were developed from the 2007 EPA Drinking Water Infrastructure Needs Survey & Assessment model formulas, escalating to 2014 costs.

The Clearview tank had new exterior coatings applied in 2015. Other older planning documents have identified a desire for the installation of a second Clearview reservoir in the future. A firm date or triggering condition has not been finalized for this installation. A tentative date of 2029 will be carried forward, but this must be reviewed and verified.

ST-25 Res. No. 1 - Recaulk Interior

The existing joint caulking of reservoir No. 1 was found to need replacement during the last inspection. Planning level cost of $100,000.

ST-26 Res. No. 1 - Meter Vault Improvements

The existing meter vault needs improvements including replacement of stairs, painting and other related updates of this 50-year plus structure. Planning level cost of $132,000.

ST-27 Res. No. 2/3 - Vacation of Admiralty Way Logging Rd.

The District owned property south of existing reservoir no. 2 & 3 is split by an unopened right-of-way. Snohomish County is being approached to vacate the property and increase the Districts future flexibility for utility uses. Planning level cost of $75,000.

ST-28 Sodium Hypochlorite Upgrade

Following the upgrade of the sodium hypochlorite system at Reservoir 1, which will be complete in 2016, the redundant systems at Reservoir 2/3, Nike Tank and Canyon Park Tank will be upgraded to current technology. In addition, a trailer-mounted generator will be further evaluated and possibly purchased. Planning level cost of $700,000.

Appendix B - Capital Improvement Program Technical Memorandum shows the projected reservoir maintenance schedule. The exteriors of Reservoirs 2 and 3 were recoated in 2008 and 2007 respectively, but premature failure of the exterior coating systems require these reservoirs to be recoated again starting in 2018.

520 Zone Storage Analysis

Table 5.10 shows that the 520 zone has adequate storage capacity to meet the needs of retail customers through 2035. These conclusions assume a peak customer elevation of 435 ft. above sea level. Review of recent development activity is suggested to determine if higher elevation customers exist.

Table 5.10: 520 Zone Storage Capacity

Planning Year	Planning Year			
	2015 (Base Year)	**2021**	**2025**	**2035**
520 Zone ERUs [1, 2]	12,700	14,500	15,800	18,300
Average Day Demand (mgd)[3, 5]	2.15	2.45	2.67	3.09
Maximum Day Demand (mgd)[4]	3.75	4.26	4.65	5.38
Available Supply (mgd)[6]	*31.77*	*31.77*	*31.77*	*31.77*
Supply without one PRV (mgd)[7]	*24.57*	*24.57*	*24.57*	*24.57*
Canyon Park Reservoir	*1.43*	*1.43*	*1.43*	*1.43*
Nike Reservoir No. 1	*2.16*	*2.16*	*2.16*	*2.16*
Nike Reservoir No. 2	*3.70*	*3.70*	*3.70*	*3.70*
Available Storage @ 20 psi [8]	*7.29*	*7.29*	*7.29*	*7.29*
Canyon Park Reservoir	*0.56*	*0.56*	*0.56*	*0.56*
Nike Reservoir No. 1	*1.02*	*1.02*	*1.02*	*1.02*
Nike Reservoir No. 2	*1.90*	*1.90*	*1.90*	*1.90*
Available Storage @ 30 psi [8]	*3.49*	*3.49*	*3.49*	*3.49*
Operational Storage (mg)[9]	*0.25*	*0.25*	*0.25*	*0.25*
Equalixzing Storage (mg)[10]	*0*	*0*	*0*	*0*
Fire Suppression Storage [11]	*1.44*	*1.44*	*1.44*	*1.44*
Standby Storage [12]	*2.54*	*2.90*	*3.16*	*3.66*
Dead Storage [13]	*1.59*	*1.59*	*1.59*	*1.59*
Surplus/(Deficit)	***3.06***	***2.70***	***2.44***	***1.94***

1. Projected demand taken from Chapter 4 - Planning Data and Demand Forecast and Appendix H - Demand Forecast Technical Memorandum.
2. 520 Zone ERU is calculated from the population and employment forecast in Chapter 4.
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd)). The 5-Year average ERU for the District.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. Pressure-Reducing Valve (PRV) Stations include the 196th St SE station, the 224th St SE/49th Ave E station and the Lockwood station. For the purpose of this analysis, source capacity is assumed to equal MDD, as hydraulic modeling indicates the PRVs can provide the necessary water supply with no limitations.
7. Assumes one of the larger two PRV stations is out of service.
8. Figures derived by using an assumed elevation of the highest customer in the 520 zone at approximately 435 ft above sea level.
9. The top one (1) foot of Canyon Park and Nike Tanks 1 and 2.
10. DOH Water System Design Manual Continuous pumping calculation (page 101). Assumes Peak Hour Demand equals twice the Peak Day Demand converted to gpm.
11. 6,000 gpm requirement for four (4) hours.
12. Use 200 gallons per ERU. ADD less than supply with largest source out of service.
13. The volume of stored water not available to all consumers at minimum design pressure.

Last Updated: January, 2018

724 Zone Storage Analysis

Table 5.11 shows that High Tanks 1 and 2 currently do not have sufficient standby storage capacity to meet the needs of retail customers. Key conclusions from the analysis are:

- Under the current projected growth scenario by Snohomish County, the 724 Zone is close to utilizing all of its existing storage capacity.
- There is adequate storage from the 635 Zone to support storage deficiencies or emergencies in the 724 Zone throughout the 20-Year Planning Period.
- Consideration should be given to an additional 724 zone pump station to reduce the standby storage shortage in this zone.
- The above conclusions assume a peak customer elevation of 640 ft. above sea level. Review of recent development activity is suggested to determine if higher elevation customers exist.

Table 5.11: 724 Zone Storage Capacity

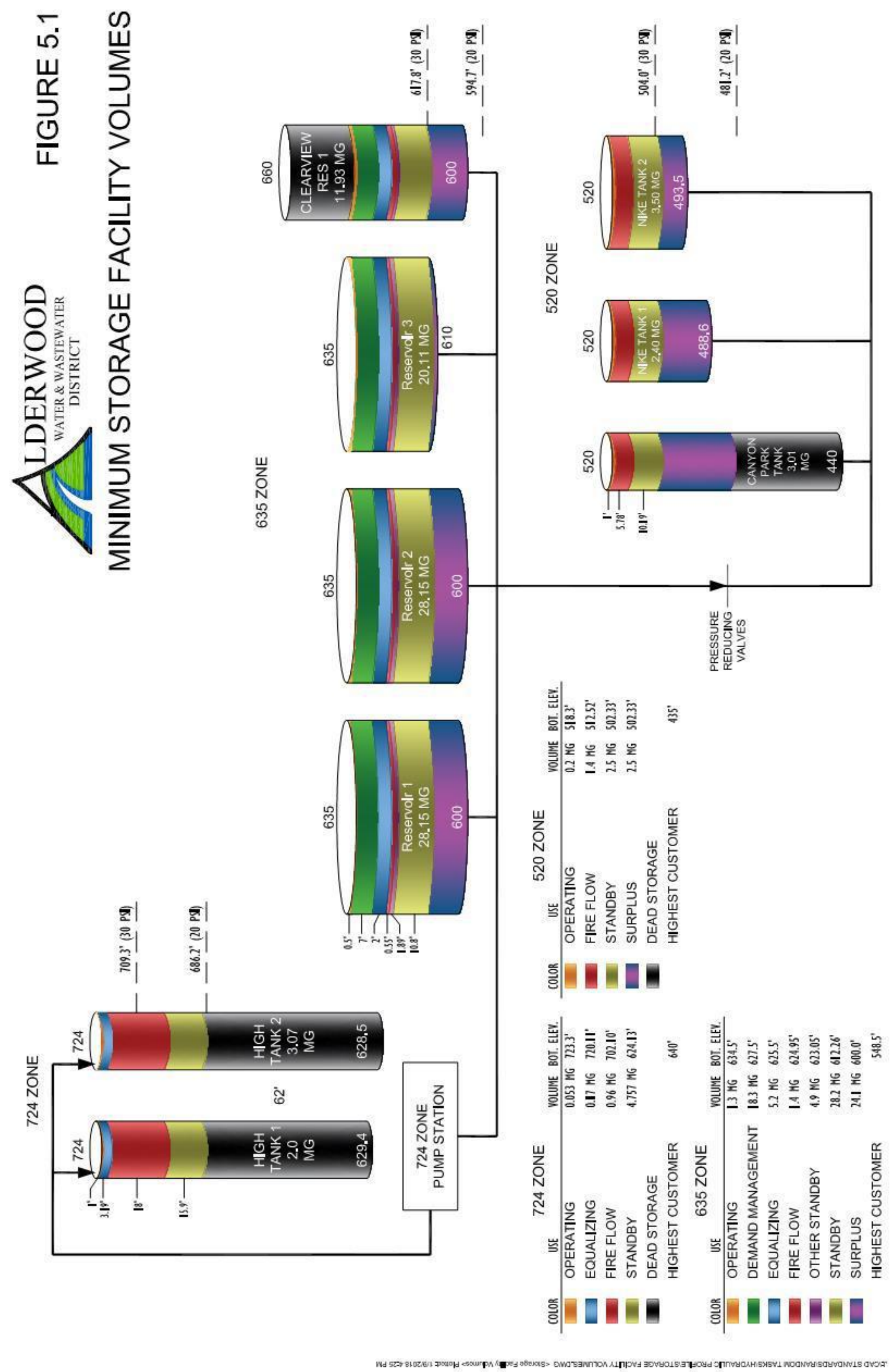
Planning Year				
	2015 (Base Year)	2021	2025	2035
724 Zone ERUs [1, 2]	12,300	15,300	17,800	18,400
Average Day Demand (mgd)[3, 5]	2.08	2.59	3.01	3.11
Maximum Day Demand (mgd)[4,7 2]	3.63	4.51	5.23	5.42
Available Supply (mgd)[6]	*5.6*	*5.6*	*5.6*	*5.6*
Supply without one source (mgd)[8]	*0*	*0*	*0*	*0*
724 Zone Reservoir No. 1	*0.8*	*0.8*	*0.8*	*0.8*
724 Zone Reservoir No. 2	*1.2*	*1.2*	*1.2*	*1.2*
Available Storage @ 20 psi [9]	*2*	*2*	*2*	*2*
724 Zone Reservoir No. 1	*0.32*	*0.32*	*0.32*	*0.32*
724 Zone Reservoir No. 2	*0.47*	*0.47*	*0.47*	*0.47*
Available Storage @ 30 psi [9]	*0.79*	*0.79*	*0.79*	*0.79*
Operational Storage (mg)[10]	*0.053*	*0.053*	*0.053*	*0.053*
Equalizing Storage (mg)[11]	*0.17*	*0.35*	*0.51*	*0.54*
Fire Suppression Storage [12]	*0.96*	*0.96*	*0.96*	*0.96*
Standby Storage [13]	*4.16*	*5.17*	*6.02*	*6.22*
Dead Storage [9]	*-3.09*	*-3.09*	*-3.09*	*-3.09*
Surplus/(Deficit)	***(3.34)***	***(4.54)***	***(4.34)***	***(4.58)***
Surplus/(Deficit) w/o standby	***0.82***	***0.63***	***1.68***	***1.64***

1. Projected demand *Chapter 4 - Demand Forecast* and *Appendix H - Demand Forecast Technical Memorandum*.
2. 724 ERU is calculated from the population and employment forecast in Chapter 4.
3. The Average Day Demand (ADD) is the Total System ERU times 169 gallons per day (gpd)). The 5-Year average ERU for the District.
4. Maximum Day Demand is the ADD times a peaking factor of 1.7.
5. Projected demand assumes there is no conservation program.
6. Assumes two pumps pumping based on May 2, 2014 pump test.
7. Actual 2014 MDD
8. Only one station providing water to the 724 zone.
9. The storage volume available in existing reservoirs at 30 and 20 psi is based on the assumed elevation of the highest customer (approximately 640 ft. above sea level).
10. Top one (1) foot of each of the High Tank Reservoirs for operating storage.
11. Assumes Peak Hour Demand equals twice the Peak Day Demand converted to gpm.
12. District data indicates structures with a 4,000 gpm requirement for four (4) hours.
13. Standby Storage: Used ADD times two.

Appendix B - Capital Improvement Program Technical Memorandum shows the projected reservoir maintenance schedule.

Last Updated: January, 2018

Figure 5.1: Minimum Storage Facility Volumes



Distribution System Analysis – WAC 246-290-100(4)(e)(iv)

As illustrated in *Chapter 1- System Description*, the District has an extensive distribution system with hundreds of miles of pipe. Some pipes were installed more than 50 years ago and could be reaching the end of their useful lives. Aging infrastructure and inadequately sized pipes for increasing customer and fire demands all contribute to system deficiencies.

The District used modeling software to evaluate the water system's performance under two scenarios:

1. Peak Hour Demand (PHD), to determine pressure deficiencies; and
2. Maximum Day Demand (MDD) with Fire Flow, to determine points within the system that do not have adequate pressure under peak day emergency conditions.

The model was updated and recalibrated in December 2012 to reflect installed or replaced water distribution pipe and the way the system is currently operated. A review of the system transmission mains and new and existing pressure zones was conducted. The results of this analysis are reflected in this plan. The elimination of the planned 660 pressure zone and the elimination of the transmission main segregation project were the most notable results of the model update.

Peak Hour Demand Results

Per WAC 246-290-230, a minimum water pressure of 30 psi must be provided to all customers during peak hour demand (PHD) conditions when Operating and Equalizing storage is depleted in the reservoirs. Small areas of low pressure (less than 30 psi) are found near reservoirs, due to high customer elevations compared to the reservoir elevations. Large areas of high pressure (greater than 120 psi) are found throughout the District due to large elevation changes within the 520 and 635 Pressure Zones. In areas where pressure is greater than 80 psi, Pressure Reducing Valves (PRVs) should be installed.

Figure 5.1: Results for Peak Hour Demand Model Analysis, 2035

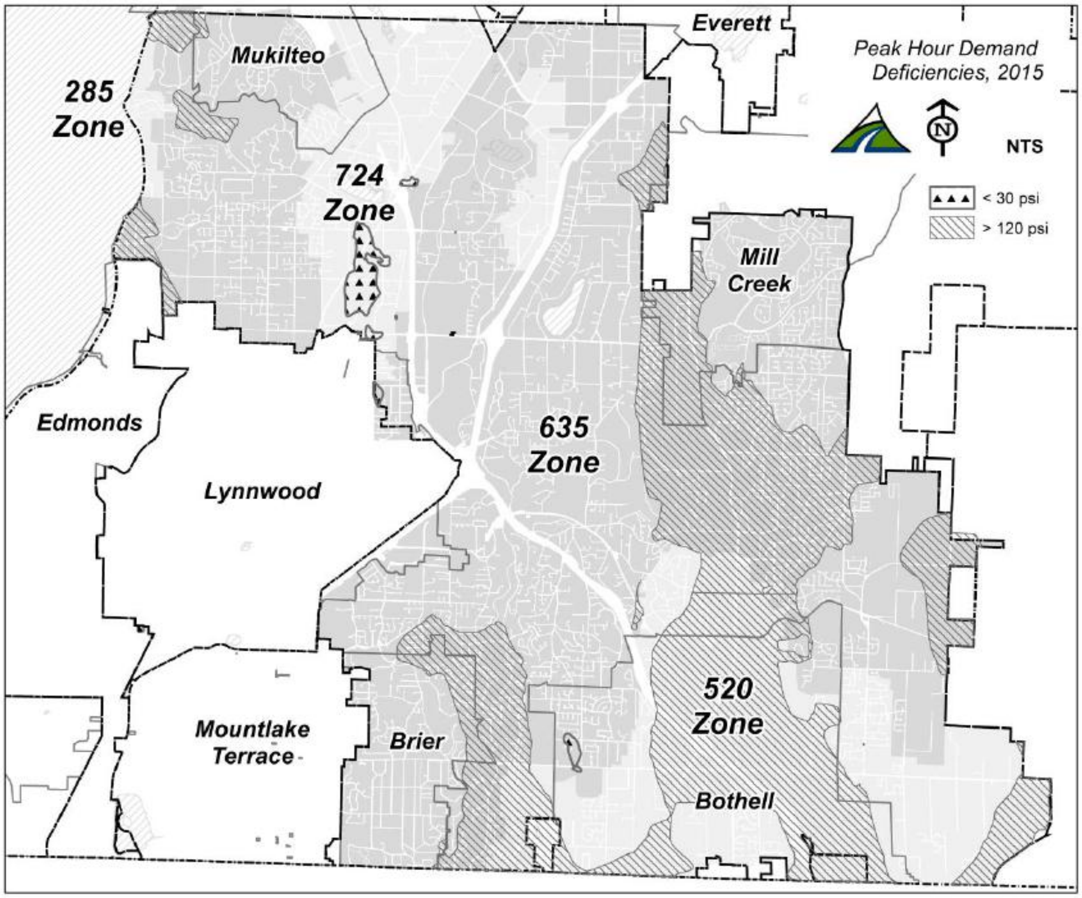


Figure 5.2 shows areas where the minimum 30 psi criterion could not be met. These low-pressure areas tend to be around the District's reservoirs and there is no remedy for low pressure in these areas. If there are undersized pipes in these areas that need to be upgraded, these assets will be considered under the District 100-year capital improvement plan and asset management plan, which are being developed and are discussed in Chapter 13 - Capital Improvement Program.

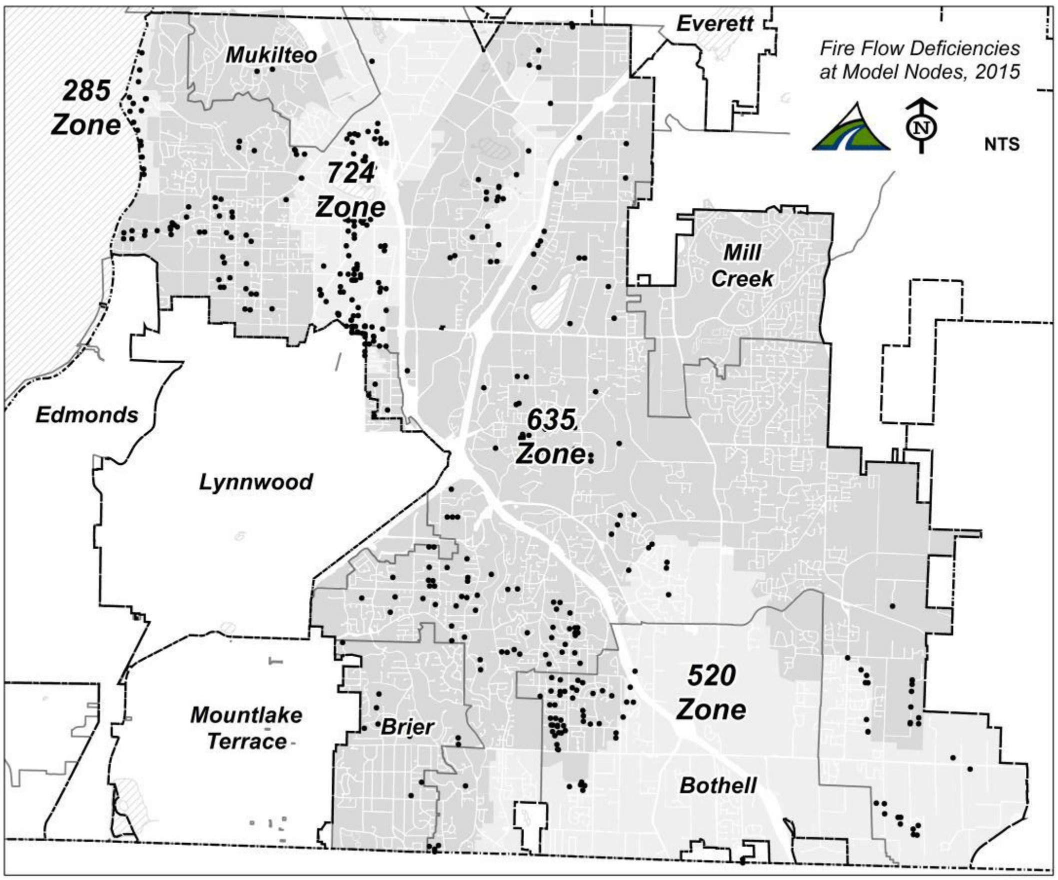
Figure 5.2 also shows areas where the pressures exceed 120 psi. The 2009 comprehensive plan contemplated expanding the 520 zone and creating a 340 zone to address portions of these high-pressure areas. Table 5.11 includes the distribution improvements to accomplish these pressure reductions. Further study is currently under way in conjunction with the District pressure reduction project.

Last Updated: September, 2016

Maximum Day Demand with Fire Flow Results

The water system is required to have adequate capacity to supply firefighting needs while providing an adequate pressure (20 psi minimum) to customers on the highest demand (peak) day of the year. The highest fire flow requirements typically occur at higher risk and higher demand areas such as commercial, industrial, or high-density housing. The model evaluated fire flow deficiencies using 1,000 gpm in the 285, 635 and 724 Pressure Zones and 1,500 gpm in the 520 Pressure Zone due to specific City of Bothell requirements.

Figure 5.2: Results for Fire Flow Analysis, 2035



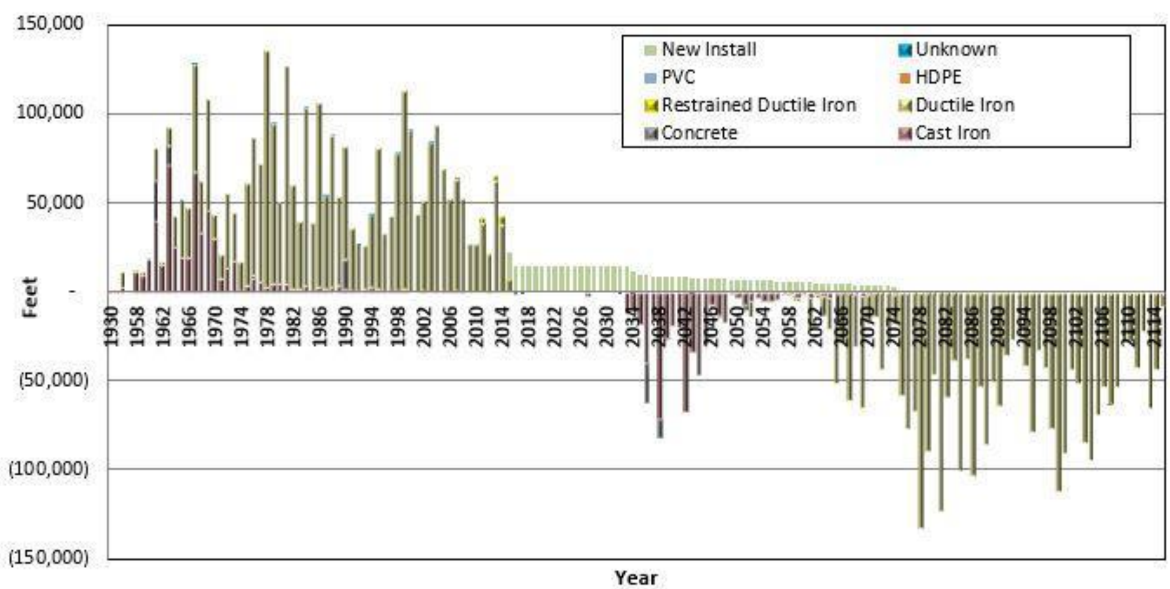
Fire flow requirements are established by local jurisdictions and are a primary criterion for appropriately sizing distribution mains. The currently adopted fire flow service criteria must be met for new development and redevelopment projects. For existing structures, the distribution system must be able to provide the fire flow requirement that was in effect at the time the structure was built, provided any improvements do not activate new fire flow requirements. Much of the District's service area was developed when the fire flow requirement was 500 gpm in Snohomish County.

Last Updated: September, 2016

Per WAC 246-290-230, a minimum water pressure of 20 psi must be provided to all customers during MDD conditions when Operating and Equalizing storage is depleted in the reservoirs. Figure 5.3 shows areas where the minimum 20 psi criterion could not be met and undersized pipes and facilities need to be upgraded. These assets will be considered under the District 100-year capital improvement plan and asset management plan, which are being developed and are discussed in *Chapter 13 - Capital Improvement Program*.

The need for water distribution from multiple sources has been identified. Previous analysis in earlier comprehensive water plans identified capacity and maintenance driven improvements. Some of these have been completed and others are still identified as outstanding. Additional concerns and needs have been identified by staff since the last water comprehensive effort. Revised modeling has not been completed as few major changes have occurred affecting capacity issues. Finally, the age of pipe is being considered in this planning effort.

Chart 5.1: Water Distribution & Transmission Replacement by Useful Life[1]



[1] Useful life refers to the estimated lifespan of a depreciable asset during which it can be expected to contribute to system operations. Actual useful life, however, can vary greatly depending on conditions, soils, use and other external factors.

Last Updated: September, 2016

Chart 5.1 above shows the replacement schedule for both water distribution and transmission systems if each is replaced at the exact end of the lifespan shown in Table 5.1. This includes replacement of only mains at the end of their lifespan and does not include any pipes identified for replacement or repair because of capacity, maintenance, risk or damage concerns. These costs for replacement at the lifecycle threshold have been included in *Appendix B - Capital Improvement Program Technical Memorandum*.

Improvements were identified in the 2009 comprehensive plan. The plan included improvements recommended to be completed during two time spans of 2009-2014 and 2015-2028. A number of these improvements were also listed in the 2003 Comprehensive Plan. Not all of the improvements scheduled for the 2009-2014 time-frame have been constructed. Further, the scheduling for all of these improvements must be reviewed as the projections have changed since the preparation of the 2009 plan. The details on which project was scheduled for which time span is included in *Appendix B - Capital Improvement Program Technical Memorandum*. The status of the various projects identified in the 2009 Comprehensive Plan is shown below.

Last Updated: September, 2016

Projects Addressing Previously Identified Deficiencies

The 2009 Water Comprehensive Plan contained projects addressing identified deficiencies. Table 5.12 below lists the projects completed or partially completed since 2009 plan was approved. These projects will be considered under the District 100-year capital improvement plan and asset management plan, which are being developed and are discussed in *Chapter 13 - Capital Improvement Program*.

Table 5.12: Distribution System Improvement Needs 2009 WSP

Project	Description	Status
D-2	12" main on Filbert from Locust Way to 10th Place W.	Pending as a replacement project, 660 zone project eliminated
D-4a	8" main on 170th Street SW from Alderwood Mall Parkway to SR 525	Completed AWD 408-05
D-4b	8" main on Fender Drive from 32nd Ave W. to 35th Ave W	Completed AWD 408-05
D-8	12" main on 45th Ave SE from 228th St SE to 240th St SE	Completed, W0909
D-9	12" main on 240th St SE from 45th Ave SE to 39th Ave SE	Pending
D-11	12" Main SR 99 Project	Completed, AWD 182-90B
D-12	12" main on 19th Ave SE from 228th St SE to 22930 19th St SE	Pending
D-20	8" main on 224th ST SE from 45th Ave SE to 49th Ave SE and along 49th Ave SE from 224th St SE to 221st St SE	Pending
D-21a	12" main on 49th Ave SE from 228th St SE to 236th St SE	Completed, W0911
D-21b	12" main on 49th Ave SE from 236th St SE to 51st Ave SE	Pending
D-22a	8" main on 15th Ave SE from SE 231st St SE to 242nd St SE	Pending
D-22b	8" main on 242nd St SE from 15th Ave SE to 19th Ave SE	Pending
D-23	8" main on 2nd Ave W from 234th Pl SW north 665 feet	Pending
D-24a	8" main on 196th St SE from SR 527 to 196th Pl SE	Pending (520 zone project)
D-24b	8" main from 513 223rd Pl SE to 22216 5th Dr SE	Pending

Project	Description	Status
D-24c	8” main on 215th St SE from Royal Ann Rd 235 ft to 21624 9th Ave SE	Pending
D-25	8” main on Fisher Rd from 60th Ave W to 72nd Ave W	Pending
D-26	8” main on 202nd Pl SW from 24th Ave W 550 feet west	Pending
D-27	8” main on 3rd Ave W from Logan Rd south 730 feet	Pending
D-28	8” main on 50th Dr SE from 211th St SE to 215th St SE	Pending
D-30	8” main on 203rd Pl SW from 12th Ave W west 300 ft to loop	Pending
D-31a	8” main on Wigen Rd from Lincoln Way to 132nd St SW	Pending
D-31b	8” main on 133 St SW from Lake Rd west to end	Pending
D-32a	12” main on easements from 3711 164th St SW (R) to 15723 40th Ave W (E)	Extensions 1168 & 1182
D-32b	8” main on Spruce Way from 164th St SW south 300 feet	Pending
D-32c	8” main on 164th St SW from 36th Ave W to Approx 41 Ave W	Pending
D-36	8” & 12” main on Ash Way, 15th Ave W & Oak Rd	Partially built by Developers, the remainder is pending
D-40	12” main on S Danvers Rd from 205th St SW to Logan Rd	660 zone project eliminated
D-41	8” main on S Danvers Rd from 3rd Ave W to Hubbard Rd	660 zone project eliminated
D-43	12” main on Picnic Point Rd from Maple Ave to Possession Ln	Pending
D-44	8” main on 36th Ave W from 214th St SW to 216th St SW	Pending
D-45	221st Place SW Looping	660 zone project eliminated
V-1	New 660 zone PRVs	660 zone project eliminated
V-2	Expanded 520 zone PRVs	W1102D, Scheduled Completion 2018

Project	Description	Status
V-3	Create 340 zone PRVs	W1102E, Scheduled Completion 2018
WM-1	Replace Substandard Fire Hydrants (approx 1,200)	Ongoing M&O program
WM-2	Water Main looping/Water Quality Improvements	Pending
WM-3	Water Main Replacement Program	Pending
WM-B	Contractor Fill Stations	Pending
WM-D	Other Distribution System Projects (generated by other agencies)	Accomplished projects through Interlocal agreements and M&O efforts
WM-E	Water Comprehensive Plan Update	Ongoing District Initiative (Living Plan). No longer a capital project.
WM-H	DCDA Replacement Program (approx 142 in system)	Single check valves are replaced with tenant improvements. Consider name change, “Single Check Replacement Program”
WM-I	Valve Vaults over 24” Valves off original trans line (21A)	Pending (Transmission Main 1 was constructed under project A-21A)
WM-J	Air Vac/Blow Off upgrade on original trans line (21A)	Pending (see note above, consider name change)
WM-K	District Wide Meter Replacement Program	Completed in 2015 by M&O staff
WM-10	Transmission Main Upgrade at I-5 Crossing (at 164th St SW)	W0806, I-5 crossing completed 2015, Connections to 164th Street Scheduled Completion 2018 (WM-10(B))
WM-11	Blow off Replacement Program – Distribution System	Pending
WM-12	Canyon Park Altitude Control Valve Replacement	W1102G, Completed in 2015
WM-13	Sodium Hypochlorite System Upgrade	W1402, Scheduled Completion 2016
WM-14	Drainage and Paving Improvements Around Reservoirs 2 & 3	Remaining systems Pending
OP-1	Computerized Maintenance Management System	J0701, Completed 2011
OP-2	Security Improvements	J0701, Purchased 2010
OP-3	Telemetry System Upgrade	Pump Stations 1,2 & HTPS completed in 2011 and 2014, Remaining Facilities Pending

Note: Projects D-20 through D-36 identified as Fire Flow Improvements in the 2009 WSP.

Modeling used in the 2009 WSP projected flows that greatly exceed the revised flows generated by the new demand forecast. Pending projects will be re-evaluated and re-prioritized in the asset management and 100-year CIP process.

Last Updated: September, 2016

D-50 Elberta Rd Watermain Replacement.

The existing water lines in the vicinity of Elberta Rd. were found to have a high frequency of breaks. The District is investigating the cause of the abnormally high number of the cast iron main. The cast-iron watermain in the area will be replaced with ductile iron. The project will include sections of open cut replacement and horizontal directional drilling under an obstructed easement and the Seattle City Light transmission lines. The project is estimated at approximately $885,000 and is currently under construction.

Last Updated: September, 2016

D-51 228th & Fitzgerald Rd Watermain Relocation

Streambed erosion has exposed a section of watermain in North Creek at this intersection. This at-risk pipe will be replaced with either a suspended or drilled section or water main. The project is estimated at approximately $380,000.

Last Updated: September, 2016

The projects identified as Distribution-Related in the above table and noted as pending are not currently scheduled. Projects with an identified job number are included in the currently active CIP. The projects labeled pending are not budgeted in the Capital Improvement Program budget that was adopted in December of 2014.

Assuming the incomplete & unscheduled projects are completed uniformly over the remaining period of 2018-2028, an average of approximately $1,650,000 per year of projects in the Distribution category would need to be completed. Ideally, planning efforts should attempt to reduce the number of pipes that must be upgraded in size prior to the end of their useful life. However, changing usage patterns, demographics, land use patterns, fire regulations and zoning can always change the best projects and it must be assumed that some level of upgrade will continue to be required. For the purposes of planning beyond 2028, it will be assumed that 70% of the current average for capacity upgrades (or $1,200,000 per year) will be required. This reduced number is an attempt to acknowledge the decreasing amount of in-fill water system that will remain to be constructed.

For the 2016-2028 timeframe, the exact scheduling and need for the identified improvements should be re - verified. For planning purposes in Scenario 3, the projects identified and still outstanding for the 2009-2015 period will be assumed to be completed from 2016-2023 and the projects of 2024-2028 will be assumed to be completed per the original 2009 Comprehensive Plan schedule. The projects identified for the final period will be assumed to not have a changed schedule.

Last Updated: September, 2016

Water Distribution – Services & Meters

The current District mapping and billing systems show approximately 50,600 retail water meters and services in the water system. Like many components of the water system, both wholesale and retail components exist. Meters designated as wholesale assets consist of six "Master Meters" which are interties between Alderwood and the wholesale customers. All other meters and services included in this group are retail meters for the direct sale of water to customers.

Construction of new master meters is typically the responsibility of the wholesale partner; the District owns and operates these meters as wholesale assets following their acceptance. There are only minor costs for replacement of obsolete equipment at the master meter locations.

All retail water meters were replaced with radio-read equipped meters (which include data logging capabilities) between 2010 and 2015. These meters include a sealed battery unit within the radio that has a projected life span of 20 years. Therefore, replacement on a 20-year cycle will be projected for the life of the CIP. Battery life may be improved in future generations of meters and new features are also likely to be added at a similar pace. In addition, AWWA is likely to continue recommending replacement of meters at the 20-year mark.

An unknown number of water services lines are installed with materials other than the currently specified copper or ductile iron. An organized preemptive schedule to replace these services is not being proposed. The current approach of handling these services is to replace those services which exhibit a history of leaks or replacing services in conjunction with another agency’s road improvement projects or District water main replacement projects. The District will continue this approach in the foreseeable future. The costs and efforts of the current service replacement approach are included in the District’s maintenance and operations budgets, or capital project budget, or franchise/outside agency project budget.

The water system also includes six master meters which are owned and operated by the District. It is anticipated that these meters will be replaced every 20 years, the SCADA components updated every 10 years and that the meter vaults are expected to last approximately 80 years. These master meters are wholesale facilities - replacement master meters will be a wholesale expense according to the wholesale contracts.

Last Updated: September, 2016

Support Facilities

For the purpose of the Capital Improvement planning process, District assets not discussed as a direct part of the water system in the preceding sections, but necessary for the proper functioning of the water utility are included in this section. This includes such assets as:

- Maintenance & Operation Buildings
- Significant Equipment, such as Vactor Trucks & bypass pumps
- Administration Building
- Communication & Data Management systems such as:
    - SCADA systems
    - Phone Systems
    - GIS Systems
    - Billing Systems
    - CMMS Systems
    - & others.
- Vehicles

The costs for the upkeep and replacement of these assets must be considered when establishing a financial plan for the utility. Known large items may be included as direct line items in the CIP. The District is considering the establishment of a separate Equipment Reserve and Replacement (ER&R) fund to address these assets. Until such time as an ER&R fund is established, allowances will be placed in the Capital Improvement for these assets. This will help prepare a more accurate financial model when evaluating the options facing the District. This approach is temporary and will be significantly revised in the future.

A specific deficiency has been identified in the SCADA communication system. The current system utilizes leased copper lines as the primary communication pathway from remote sites to the main M&O office. This is a legacy system where support from the provider is diminishing, the equipment is suffering age-related problems and does not have the capacity to handle the full range of potential uses. An evaluation and potential system-wide upgrade is included in both the water & sewer Capital Improvement Plan.

Needs have been identified for an improved GPS system, an improved GIS system, a Contract Management system and an Integrated Enterprise-wide Software Solution. While these are recognized potential expenses, budgets and schedules have not yet been included in the Capital Improvement Plan.

Future growth projections of the District and the Personnel Chapter in this WSP (among other sections) strongly suggest that staffing levels will continue to increase. However, both of the main District buildings that house staff are at or possibly slightly over capacity. The District has decided that a space needs study is necessary and is scheduled to be completed before the end of 2017. For planning purposes, it is further anticipated that additional square footage of office space, maintenance shops and garages will be necessary. Given a roughly 30% increase in infrastructure and increasing maintenance and replacement needs, a rough figure of 50% expansion will be used for planning until a space needs study is completed.

In 2014, significant District facilities were appraised by the by the District's insurance carrier for replacement value. Those values, with an added factor for allied costs are used as the replacement of existing and new costs of expansion for facilities. Buildings were assumed to have a life of 100 years, with a minor remodel at 25 years and a major remodel at 50 years. The cost of facilities utilized by both water and sewer will continue to be split 50% to each unless a different practice is adopted.

Insured values for the following items were taken from the insurance carrier listing and will be used with the assumed replacement life cycle until a revised replacement model is created:

Table 5.13: Support Facilities Planning Level Lifecycles & Costs

Item	Value	Life
SCADA Hardware & Software	$425,000	10 years
Business Hardware & Software	$1,015,000	7 years
Licensed Vehicles	$4,200,000	6 years
Construction Equipment	$550,000	10 years

Replacement of the SCADA hardware and software components assumes a full large-scale replacement/upgrade of the system on the 10th year with a 10% maintenance replacement in each intermediate year. The remainder of the assets is assumed to be replaced incrementally each year with a simple rotating replacement of multiple components.

Last Updated: September, 2016

OP-4 Emergency Power Evaluation & Administration Generator

A combined project between the water & sewer systems, an evaluation of all emergency power throughout the District including current needs, future needs and available resources will be conducted. Expansion of the emergency power capacity of the Administration Building to support the Emergency Operations Center has already been identified.

OP-5 Roofing Improvements and Fall Protection

A combined project between the water & sewer systems, modifications to various roofs including the installation of fall protection devices. This includes common use buildings between the two systems and specific buildings such as the WWTF and reservoirs.

OP-6 Remote Site Communication Evaluation & Replacement

A combined project between the water & sewer systems, the existing legacy communications, leased copper lines, utilized between the remote sites and the main operations center should be evaluated and recommendations developed for future communication between the remote sites and the main office.

ADM-4 Wireless Optimized VPN

Employing of a wireless optimized VPN solution allowing mobile devices to remain connected to the AWWD network with little or no user intervention which would provide significant productivity improvements for mobile users.

ADM-7 Enterprise GIS

Move to an enterprise Geodatabase GIS solution which will provide needed strategic asset planning, customer service and asset management that are unable to be performed with the current system.

ADM-8 Electronic Content Management System

Provide a centralized records repository for storage and management of electronic records and email to improve efficiency for records retrieval, reduce risk for compliance with public records requests, centralize location of records, allow application of records retention schedules to electronic records and email, provide efficient method for appropriate destruction of electronic records per records retention schedules and manage draft and final copies of records as appropriate.

MO-1, 3, 13, 17, & 18 Capital Tools

In an effort to keep crews properly outfitted with tools necessary to their daily tasks, the purchase of the following tools have been proposed and included as a capital need:

- Pneumatic Piercing Tool
- Air Compressor
- SSPH Slip-in Pre-Mix Heater for Asphalt
- Cues TruVue Video Transmission
- Sewer Mainline Point Repair System

MO-5 Facilities Security Upgrade

This project will bring the District up-to-date on access control to all facilities. The District will receive a patented key way system that ensures that no person can make a spare key to enter into any facilities. The patent on the old system has expired, giving people the ability to replicate keys that could potentially conform with existing locks. Using the NexGen XT System, the District will not only be able to control who has access to each facility, but it will also enable the District to see when a person enters a facility, helping to keep facilities secure.

MO-6 thru 11 & 19 Vehicles

In an effort to provide adequate transportation equipment for daily operations, the following vehicles have been proposed and included as a capital need:

- 5 Yard Dump Truck
- 2 Yard Dump Truck
- Meter Department Replacement Vehicle
- Hydrant Inspection Vehicle
- Cargo Van for Locator
- New Duty Truck F-150 4x4
- 16-Foot Cargo Trailer

MO-12 Waterfall Data Exchange

Waterfall provides a secure transfer of data between the SCADA system and the business network. This will be vital to have information from the SCADA system feed the CMMS securely so that work orders may be generated automatically. Benefits include the ability for any staff and management with access to view trending and real-time information. Duty personnel will be able to access the data and assess the situation remotely.

MO-15 Rosemont Chlorine/PH Analyzers

The Department of Health requires the District to monitor chlorine residuals. This is accomplished with daily water quality tests and CL2 analyzers set in different locations throughout the District that are connected to the SCADA system. Setting Rosemont Chlorine/PH Analyzers at seven locations within the District will create a more efficient and cost-effective process.

MO-21 Department Staffing Upgrades

The addition of supervisory positions within the department to improve workloads and create better coverage. Establishing an administrative workgroup and adding an analyst position will help establish efficiencies in the workflows of each group.

PDS-1 Modeling Software

Purchase hydraulic modeling software that is GIS based. The current water and sewer models are CAD-based and not updated regularly to reflect current data, thus limiting the District's ability to evaluate construction scenarios, accurately provide fire flow assessments and forecast issues based on pipe condition. The new software will be integrated into the Enterprise GIS solution which will not be available until after 2017.

Last Updated: September, 2016

Franchise, Outside Agency and Participation

Multiple other agencies influence or create projects and needs to which the District must respond. These projects are not part of the District's normally scheduled capacity or aged pipe replacement. These agencies may be franchise grantors who require the District to move facilities out of the way of their construction projects or partnering agencies where a cooperative effort is in the long-term public interest. With the addition of project cost accounting changes several years ago, trackable cost history is accumulating. Until such time as sufficient data is present and reviewed, the practical experience of the past will continue to be used. For the purpose of the CIP process, this plan assumes an average of $300,000 per year for this type of projects.

Last Updated: September, 2016

6. Water System Reliability

The purpose of this chapter is to examine the ability of the District to meet customer demand under a variety of conditions, including emergency situations. To accomplish this, the chapter reviews the District's water rights and current source of supply from Everett, the condition and adequacy of those supply connections, and plans for protecting the water supply and responding during a water shortage.

Last Updated: September, 2016

Adequacy of Existing Supply Sources – WAC 246-290-100(4)(f)(ii)

Evaluating whether enough water supply exists to meet current and future customer needs is critical to support the District and the region. By regularly assessing the available water supply against the projected needs, the District is able to determine well in advance whether additional water sources are needed. Since water supply projects can take many years to design, finance and construct, it is important to begin the process of constructing connections with other purveyors or developing needed water rights as early as possible. The following sections examine the District's sources of supply against the demand forecast provided in *Chapter 4 - Planning Data and Demand Forecast.*

Last Updated: September, 2016

Everett Regional Supply

The District currently purchases all of its water from the City of Everett under a 106-mgd peak day supply contract (see *Chapter 2*). Everett's regional supply comes from the Sultan River Basin, as described in *Chapter 1*. Everett's *2014 Addendum to the 2007 Comprehensive Water Plan* (CWP) documents that the Everett regional system has sufficient capacity to meet the maximum day demand supply needs of its retail and wholesale customers (including the District) through 2100.

Everett's CWP also shows that the safe yield of the watershed is greater than Everett's current water rights, after consideration of potential impacts of climate change on watershed yield. The climate change evaluation determined that climate change may negatively impact Everett's safe yield under both best- and worst-case scenarios, however the impacts do not impact safe yield until after 2100. Everett's source of supply appears to be capable of accommodating demand well beyond the 20-year planning period.

The demand forecast developed for the District's retail and wholesale customers (see Chapter 4) is within 10% of the demand forecast provided in Everett's CWP. Comparison of Everett's overall supply capability and the District's supply agreement with Everett leads the District to conclude that ample supply is available to meet the District's forecasted demand well beyond the 20-year planning period. By 2020, the District plans to examine historical weather patterns in the Sultan River Basin to determine the likelihood of drought and the potential impact of climate change.

Table 6.1: Everett Projected Demand versus Water Available by Right, 2014-2100[1]

	2014	2020	2035	2060	2100
Total Everett Demand					
Average Day Demand (mgd)	50.5	58.1	74.9	107.2	140.9
Maximum Day Demand (mgd)	85.8	102.0	130.8	179.9	227.9
MDD Instantaneous Demand (cfs) [2]	132.8	157.8	202.4	278.3	352.6
Water Rights (cfs)					
Surface Water	418.3	418.3	418.3	418.3	418.3
Ground Water	7.8	7.8	7.8	7.8	7.8
Subtotal	*426.1*	*426.1*	*426.1*	*426.1*	*426.1*
Excess / Deficiency (cfs)	**293.3**	**268.3**	**223.7**	**147.8**	**73.5**

1. Data adapted from Everett's *2014 Addendum to the 2007 Comprehensive Water Plan*.
2. cfs = cubic feet per second

Table 6.2: Demand Forecast Comparison

	2014	2020	2035
AWWD Demand per Everett Forecast [1]			
Average Day Demand (mgd)	27.7	29.5	36.2
Maximum Day Demand (mgd)	49.8	53.2	65.1
AWWD Demand per AWWD Forecast [2]			
Average Day Demand (mgd)	29.3	30.9	35.8
Maximum Day Demand (mgd)	48.8	51.7	60.0
Difference (%) [3]	2.0%	2.8%	7.8%

1. Average Day Demand (ADD) and Maximum Day Demand (MDD) taken from Everett's *2014 Addendum to the 2007 Comprehensive Water Plan* and *Alderwood Water and Wastewater District Projected Water Demand, 2014-2035*, provided to Everett on August 30, 2013. The demand forecast provided to Everett was a preliminary forecast that did not include conservation measures.
2. Average Day Demand and Maximum Day Demand taken from *Chapter 4: Planning Data and Demand Forecast*, Alternative 3 without Conservation.
3. Calculated by dividing AWWD's Forecasted MDD by Everett's Forecasted AWWD MDD.

Everett is in the process of enhancing the reliability of the regional system by applying for additional water rights, and considering construction of an emergency intertie with the City of Seattle's supply system. The reliability of Everett's system is also supported by their emergency response program, which includes response planning, vulnerability analysis and standard operating procedures during an emergency.

Last Updated: September, 2016

District Water Rights – WAC 246-290-100(4)(f)(ii)(a)

The District developed and certificated water rights for 11 wells between 1953 and 1960 as an alternative source of supply to Everett's system (shown below and provided in *Appendix O)*. Though the District currently relies on Everett for its supply, the water rights for the wells are retained to allow for backup, emergency, or supplemental supply to help meet customer demand. The District does not anticipate any need to apply for new water rights within the 20-year planning period.

Table 6.3: Groundwater Right Certificates [1]

Well No.	Certificate	Location	Date	Annual Qty (afy) [2]	Instant. Qty (gpm) [3]
1	3258-A	Sec. 21, T 27N, R 4E	Oct. 1953	1,200	750
2	2034-A	Sec. 21, T 27N, R 4E	July 1953	1,130	700
3A	1499-A	Sec. 28, T 27N, R 4E	Aug. 1953	742	700
3B	2536-A	Sec. 16, T 27N, R 4E	Sept. 1955	896	560
4	2920-A	Sec. 27, T 27N, R 4E	June 1956	576	360
5	3227	Sec. 02, T 27N, R 4E	Aug. 1956	240	150
6	3398	Sec. 12, T 27N, R 4E	Sept. 1957	1,600	1,000
7	3174	Sec. 15, T 27N, R 4E	Dec. 1957	1,600	1,000
8	3401-A	Sec. 10, T 27N, R 4E	Sept. 1958	1,120	700
9	3814	Sec. 14, T 27N, R 4E	Dec. 1957	400	250
10	4251	Sec. 16, T 27N, R 4E	Jan. 1960	480	300
			Total	*9,984*	*6,470*

1. All listed certificates are associated with primary water rights for municipal or community domestic use.
2. Acre feet per year (325,900 gallons).
3. Gallons per minute.

Of the 11 wells, two currently provide water but are not connected to the District's distribution system.

The artesian well (Well No. 5, Identification No. 01319B) located on 164th Street SW is currently used directly as a local community source of supply. Use of the artesian well is at the discretion of the public. The well serves less than 1,000 equivalent customer connections and less than 1,000 people per day.

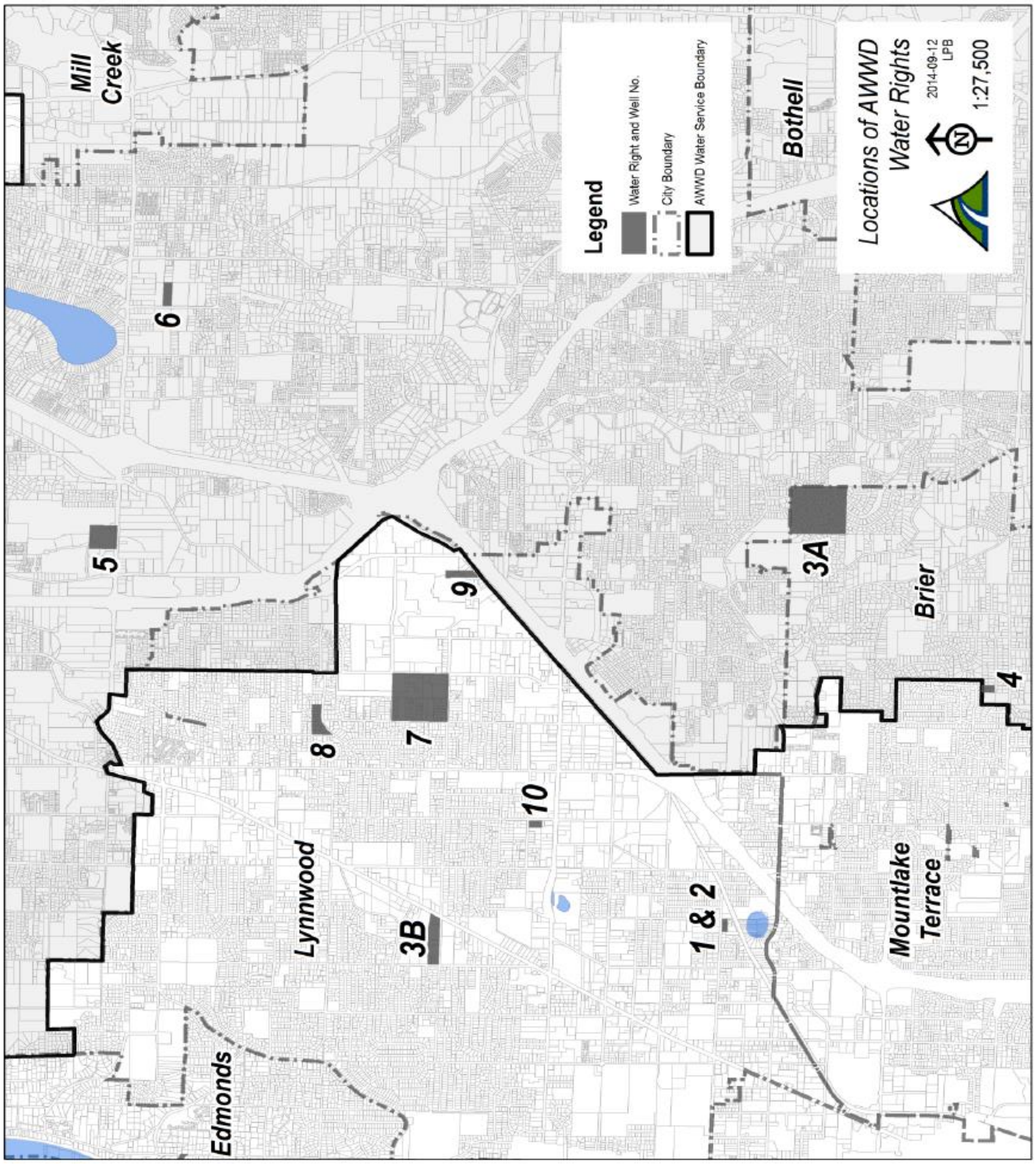
The District maintains this artesian well as a courtesy. It is not part of the District's sources of supply and the District is not dependent on it as a source. For more information on how the District maintains the artesian well, see *Chapter 7 - Water Quality Compliance*.

Well No. 7 is located on 40th Avenue West and was rehabilitated in 2008. The well provides water for District equipment use.

The District also has a water right claim to the Sultan River, which is the source of Everett's supply. The claim is dated June 20, 1974 and is for an annual quantity of 26,220-acre feet per year (afy). This certificate can also be found in *Appendix O*.

Last Updated: September, 2016

Figure 6.1: District Well Sites



Last Updated: September, 2016

Interties – WAC 246-290-100(4)(f)(vi)

The District has a number of interties in addition to its two supply connections with Everett. The District's non-emergency interties are with its wholesale customers, while its emergency interties are with both wholesale customers and neighboring utilities. These emergency facilities provide a backup water supply in the event Everett's supply is restricted or unavailable due to an emergency.

Prior to 1991, interties were established between utilities on an as-needed basis without State review or approval. Since then, DOH and DOE have developed approval requirements for new interties. The District evaluates its interties on a regular basis with its partners to ensure that both emergency interties and wholesale connections are appropriately sized and located. Additional information about the intertie agreements can be found in *Chapter 2 -Related Plans, Agreements and Policies.*

Table 6.4: Interties with Adjacent Purveyors

Purveyor	Location	Meter Size (in) [1]	Purpose
City of Bothell	240th St SE and 23rd Ave SE	8 (m)	Emergency
City of Bothell	Fitzgerald Rd and 240th St SE	12 (m)	Emergency
City of Everett	120th St SE and 2nd Ave W	4	Emergency
City of Everett	116th St SW and 5th Ave W	4	Emergency
City of Everett	116th St SE and 2nd Ave W	6	Emergency
City of Everett	84th St W and Casino Rd	36	Emergency
City of Everett	116th St SW and Highway 99	12	Emergency
City of Lynnwood	Wigen Pl and 44th Ave W	8	Emergency
City of Lynnwood	167th St SW and Highway 99	8	Emergency
City of Lynnwood	168th St SW and 48th Ave W	6, 8	Emergency
City of Lynnwood	168th St SW and 52nd Ave W	12	Emergency
City of Mountlake Terrace	38th Ave W and 228th St SW	12	Emergency
Mukilteo Water & Wastewater District	St. Andrews and 116th St SW	6	Emergency
Mukilteo Water & Wastewater District	Harbour Reach Dr and 49th Pl W	12	Emergency
Mukilteo Water & Wastewater District	115th Pl W, West of 4th Ave W	6	Emergency
Northshore Utility District	243rd Pl SW and 24th Pl W	4	Emergency
Northshore Utility District	Lockwood Rd and Carter Rd	8 (m)	Emergency
Silver Lake Water & Sewer District	143rd Pl SE and 27th Ave SE	6	Emergency
Silver Lake Water & Sewer District	Village Green Dr and 20th Dr SE	8	Emergency
Silver Lake Water & Sewer District	148th St SE and 35th Ave SE	8 (m)	Emergency
Silver Lake Water & Sewer District	144th St SE and 24th Ave SE	6, 6	Emergency
Cross Valley Water District	228th St SE and Hwy 9	8 (m)	Emergency
City of Edmonds	168th St SW and 62nd Ave W	10 (m), 8 (m, b)	Regular
City of Lynnwood	Spruce Way and 164th St SW	10 (m), 10 (m)	Regular
City of Mountlake Terrace	212th St SW and 44th Ave W	10 (m)	Regular
Mukilteo Water & Wastewater District	Beverly Park Rd and Commando Rd	12 (m)	Regular
Mukilteo Water & Wastewater District	Harbour Pointe Blvd and Saint Andrews Dr	8 (m)	Regular
Silver Lake Water & Sewer District	39th Ave SE and 180th St SE	3	Regular
Silver Lake Water & Sewer District	156th St SE and SR 527	12 (m)	Regular

1. (m) = metered connection, (b) = bypass connection

Last Updated: August, 2017

Water Reuse – WAC 246-290-100(4)(f)(vii)

The District has evaluated opportunities for using reclaimed water for irrigation, construction and/or industrial purposes. At this time, the District has no plans to invest in the distribution of reclaimed water due to the significant cost of required facilities, the limited potential use of reclaimed water within the District's service area, and the ability of the Everett regional system to fully meet water demands well into the future. The District remains open to proposals with Snohomish County, King County, or other parties related to reclaimed water, if alternative funding sources can be identified to finance the necessary infrastructure.

Last Updated: September, 2016

Picnic Point Wastewater Treatment Facility

Our District's Picnic Point Wastewater Treatment Facility (WWTF), located in the northwest portion of the District's service area, offers a potential source of reclaimed water. Space is reserved at the WWTF site for the future addition of equipment and facilities necessary to convert the current quality of treated effluent from the equivalent of Class C to Class A reclaimed water, which can be used for a wider variety of applications. The necessary improvements would include the addition of chlorination facilities, chemical storage, pumping equipment and controls.

Primary uses of reclaimed water generated at this site could be a source of irrigation water at Harbour Pointe Golf Course, located approximately 1.3 miles to the north of the WWTF, or as a fill station for construction purposes.

Last Updated: September, 2016

Satellite Reclaimed Water Facility

Another potentially significant user of reclaimed water located within the District's service area is the golf course at Mill Creek Country Club, in the northeastern portion of the District. Due to its location, conveyance of reclaimed water from the Picnic Point WWTP would be costly. A more feasible approach to provision of reclaimed water would be the construction of a satellite facility in close proximity to the country club.

Last Updated: September, 2016

Brightwater Treatment Plant

King County's Brightwater Treatment Plant offers another potential source of reclaimed water. The facility produces up to 7 mgd of reclaimed water for irrigation, wetland and industrial uses. Although no treatment facilities would be required by the District to utilize this source of reclaimed water, significant investment would be needed to connect to the Brightwater reclaimed water transmission line and then convey the resource to potential users.

Last Updated: September, 2016

Reliability of Existing Supply Sources – WAC 246-290-100(4)(f)(v)

The District receives its water from Everett via three supply connections. The two original connections are to Everett's Reservoir 3, which feeds into the District via Pump Station Nos. 1 and 2. The Clearview connection provides additional system redundancy during normal operations, when the Clearview pump station, reservoir and pipeline facilities supply the eastern portion of the District's water service area. However, in the event supply is unavailable from Pump Station Nos. 1 and 2, supply from the Clearview system can serve the District's entire service area. Similarly, in the event that water supplied by the Clearview facilities is cut off, the eastern portion of the District's service area can be completely supplied by water via the District's connections to Everett's Reservoir 3.

The supply system's reliability is further bolstered by the provision of backup power supplies at the three pump stations. Pump Station Nos. 1 and 2 each have redundant independent, direct supply from Snohomish PUD No. 1, fed from different upstream power feeds and substations. Both of the stations can also be run from either of the power feeds at a reduced power capacity. The Clearview Pump Station has the capability of being supplied from two different PUD sub stations in addition to auxiliary power from an on-site generator.

Last Updated: December, 2017

Source Protection – WAC 246-290-100(4)(g)

Water purveyors are required to have policies and procedures in place to safeguard the source of the drinking water supply. The resulting program is important for ensuring the quality and quantity of the water available, preventing contamination and managing activity near the water source. For the Everett supply, where the watershed is primarily owned by government agencies, controlling access and types of recreational activities is especially important.

Last Updated: September, 2016

Everett

The City of Everett has had a source water protection plan in place for many years to protect its Sultan River Basin supply from water quality impairment. The protection program was updated in October 2006 as part of Everett's Water Comprehensive Plan. This plan covers the regional surface water supply system, including supplies received by the District and is available on the City of Everett's website.

Last Updated: September, 2016

Wellhead Protection Program (Well No. 5)

In 1997, the District prepared a wellhead protection plan (WHPP) for Well No. 5, pursuant to the Safe Drinking Water Act. The WHPP addresses the following four main elements:

- A delineated wellhead protection area for the well;
- An inventory of potential wellhead contamination sources within the wellhead protection area;
- A management plan that will reduce the likelihood that potential contaminant sources will pollute the drinking water supply; and
- Contingency plans for providing alternative sources of supply should contamination occur.

The Wellhead Protection Area (WHPA) is divided into four zones based on the travel time of groundwater to the well. The zones delineated for Well No. 5 are for a 1-year, 5-year and 10-year travel time, as well as a buffer zone extending beyond the 10-year time-of-travel zone that includes the entire contribution area to the well. Each zone is depicted in the WHPP.

The WHPP lists several different risk categories from which potential aquifer contamination could occur. These include:

- Land use related risks;
- Underground storage tanks;
- Stormwater runoff;
- Septic tanks; and
- Hazardous materials generation and transportation.

An inventory of specific sites and activities having contamination potential was updated in the fall of 2014, in conjunction with development of this comprehensive plan. The inventory update indicated that land uses and activities in the WHPA include more mixed use and multi-family development. Large redevelopment projects typically require soil amendment or remediation for contaminated sites, which will improve groundwater quality in the area. Details regarding the inventory, including locations of identified and potential contaminant sites, are provided in a technical memorandum located in *Appendix P*.

The District has developed emergency shut-down procedures for Well No. 5 in the event that the well is no longer a viable source. These procedures include identification of the appropriate public officials to be notified and the steps for informing the public. If Well No. 5 should become contaminated or unusable, the District's supply will not be impacted in any way. Well No. 5 is maintained only as a courtesy to the District's customers, not as a normal source of supply.

Several local, regional and state spill response plans cover the area surrounding Well No. 5. Details regarding spill response planning can be found in Section 4 of the WHPP. In recent years the District has increased our spill response coordination with Snohomish County emergency management organizations.

Last Updated: September, 2016

Water Shortage Response Planning – WAC 246-290-100(4)(f)(iii)

The City of Everett has a Drought Response Plan (DRP) that describes what steps it would take in the event that water supplies became limited or unavailable. The DRP establishes a general framework of procedures for managing water supply during periods of weather-related shortages. The plan outlines data needs, coordination efforts, internal operational adjustments and management of supply and demands as part of a four-stage approach to addressing a shortfall event. Each stage provides an increasingly aggressive set of actions to be implemented as drought conditions become more severe:

- Advisory Stage: The public is informed that a water shortage may occur and is encouraged to use water wisely.
- Voluntary Stage: The public is requested to voluntarily meet demand-reduction goals. During this stage, Everett and the District will implement supply-side actions and recommend voluntary actions for their retail customers.
- Mandatory Stage: Everett and the District will implement more aggressive supply-side actions and will limit or prohibit certain retail water use activities.
- Emergency Stage: If supply conditions worsen and the mandatory stage does not meet the required demand reduction, this stage will establish emergency restrictions, which may include rate surcharges.

As outlined in its supply agreement with Everett, the District will share in implementing conservation and emergency measures as necessary during times when the DRP is in effect. Everett has a draft DRP which is also contained in Appendix C.

Last Updated: September, 2016

7. Water Quality Compliance

The United States Environmental Protection Agency (USEPA) sets legal limits on contaminants in the public water supply. These limits balance maximum acceptable contaminant levels to protect human health as well as what level of removal is achievable with current technology. Under the Safe Drinking Water Act (40 CFR 141-143), individual states have the authority to set and enforce drinking water standards that meet or exceed the standards set by USEPA. Washington State has established standards beyond the federal standards in Chapter 246-290 WAC, enforced by the Department of Health (DOH).

This chapter evaluates the District's compliance with applicable state and federal drinking water regulations. Included in this chapter:

- Water Quality Monitoring Programs, including information on daily, monthly, quarterly, annual and triennial water sampling programs;
- Water Quality Protection Programs, including cross-connection control, disinfection, unidirectional flushing and valve inspection and maintenance programs; and
- How the District complies with the annual Consumer Confidence Report and public notification requirements.

last Updated: September, 2016

Water Quality Monitoring Programs

As a system which distributes purchased drinking water, the District is not responsible for monitoring water quality at source of supply, but is responsible for monitoring water quality throughout the distribution system. The District adds supplementary chlorine to the water at key storage facilities in the 635 and 520 Pressure Zones. This helps keep free chlorine (also known as "chlorine residual") within a specific range to minimize the potential for biological contamination in the system.

The artesian well (Well No. 5) located on 164th Street SW is a transient, non-community (TNC) system. This well is not connected to the distribution system and is not treated or chlorinated, but is regularly tested for bacteriological contamination, nitrate and over 25 other inorganic compounds.

Well No. 7, located on 40th Avenue W, provides water for the City of Lynnwood and District equipment use only. It is not connected to the distribution system and is not treated, chlorinated, or tested.

Last Updated: September, 2016

Daily Chlorine Residual Sampling – WAC 246-290-300(6)

The District tests for the presence of chlorine residual in the distribution system to measure how potable, or drinkable, water in the system is. The presence of a residual indicates that enough chlorine was added to both inactivate microorganisms and protect water from recontamination in the distribution system or reservoirs.

Each business day, staff members measure chlorine residual and pH at a number of locations throughout the District. It is important to measure pH at the same time, since chlorine works most effectively between pH values of 6.5 to 8.5. These samples are not sent to a lab, since sunlight, higher temperatures and the mixing of the water in a sample container can degrade the chlorine and give false results.

Table 7.1: Annual Chlorine Residual Results, 2009 – 2015 (ppm)

	2009	2010	2011	2012	2013	2014	2015
Sample Range [1]	0.3 – 1.3	0.2 – 1.4	0.3 – 1.2	0. 2 – 1.4	0.2 – 1.1	0.2 – 1.1	0.5-1.3
Average Value [1]	0.8	0.8	0.7	0.6	0.6	0.6	0.6

1. The Maximum Allowable Level (MCL) for residual chlorine disinfectant is 4.0 parts per million (ppm).

The District averages 0.7 parts per million (ppm: 1 ppm is about 3 drops in 42 gallons) of free residual chlorine throughout the distribution system. If a sample is at 0.2 ppm or less, staff will flush the area and bring in fresh water with a higher residual. At the points in the system farthest away from the disinfection facilities, the District samples to ensure that the minimum 0.2 ppm chlorine residual requirement is met.

Last Updated: September, 2016

Monthly Bacteriological Sampling – WAC 246-290-300(3)

The District's primary responsibility is to provide safe, clean drinking water to our customers. The easiest way to determine the District's success in this regard is through monthly bacteriological testing in order to prevent the spread of waterborne illness and identify distribution problems within the system. Samples are taken at the same time each month, ideally at the beginning of the week, to ensure that there is adequate time to complete sampling, send it to a certified lab for analysis and get the results. If a sample comes back positive for the presence of coliform bacteria, it also provides enough time within the same week for staff to conduct "repeat" samples.

Table 7.2: Required Routine Bacteriological Samples[1]

Retail Population by Category	Existing Population	Base Year Year 0	Planning Year 6	Planning Year 10	Planning Year 20 [2]
	2014	2015	2021	2025	2035
Population	175,789	180,754	214,944	242,728	266,707
Employment	38,638	39,797	47,848	53,355	66,236
Total	*214,427*	*220,551*	*262,793*	*296,083*	*332,943*
Monthly Samples	**120**	**150**	**150**	**150**	**180**

1. Data from *Appendix F*.

The District currently takes 150 routine bacteriological samples each month (see the sampling procedures and certified lab information in *Appendix F*) throughout the distribution system and at Well No. 5. Per Washington State regulations, the District will need to increase the number of sample sites as population served increases per WAC 246-290-300.

At its routine sample sites, the District uses water quality sample stations installed at the meter, rather than using a hose bib or other sampling location that could potentially be contaminated. The stations provide a uniform, sanitary sampling environment that limits the likelihood of outside contaminants affecting the sample and other sampling errors.

Table 7.3: Annual Bacteriological Results, 2009 – 2014

	2009	2010	2011	2012	2013	2014	2015
Sample Range [1, 2]	N/D	0.0 – 1.6%	0.0 – 1.6%	N/D	0.0 – 0.8%	0.0 – 0.8%	N/D
Average Value	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%

1. The Maximum Allowable Level (MCL) for bacteriological contamination is no more than 5% positive results from the samples taken each month.
2. N/D = None Detected.

Last Updated: September, 2016

Quarterly Disinfection Byproduct Sampling – WAC 246-290-300(6)

Some forms of chlorine react with the organic material naturally found in surface water sources to form harmful disinfection byproducts (DBPs). The amount formed depends on the amount of disinfectant, temperature and length of contact time with the water supply. Because the District uses a chemical disinfectant (chlorine), it is required to monitor Stage 2 DBPs, which include trihalomethanes (THMs) and haloacetic acids (HAA5s). USEPA establishes both a maximum operational level and a maximum contaminant level (MCL). The operational level is set lower than the MCL to provide early warning to system operators.

Table 7.4: Annual Disinfection Byproduct Results, 2009 – 2014 (ppb)

	2009	2010	2011	2012	2013	2014	2015
Trihalomethanes (THMs) [1]							
Sample Range	28.3 – 46.9	29.4 – 54.1	27.3 – 55.0	29.8 – 53.1	24.8 – 53.7	35.6 – 54.9	49.3 - 73
Average Value [3]	36.7	41.5	41.1	47.8	36.9	47.5	57.5
Haloacetic Acids (HAA5s) [2]							
Sample Range	18.7 – 42.3	20.7 - 46.6	23.1 – 48.9	21.4 – 37.4	16.5 – 33.0	27.7 – 37.3	28 - 35.7
Average Value	28.5	31.3	34.9	34.8	23.4	33.2	33.2

1. The Maximum Contaminant Level Goal (MCLG) for THMs is 80 parts per billion (ppb, or about one drop per 14,000 gallons).
2. The MCLG for HAA5s is 60 ppb.
3. The average is the highest running annual average of the eight (8) sites monitored that year.

The sites the District uses for sampling are within the distribution system and are located at sites also used for monthly bacteriological sampling. Samples are taken once every three months. The summarized test results are available in the Annual Water Quality Report, available on the District's website (www.awwd.com).

Last Updated: September, 2016

Annual Inorganic Chemical Sampling – WAC 246-290-300(4)

DOH regulates levels of nitrate in the water supply to prevent health effects from nitrate on the ability of blood cells to carry oxygen. Nitrate is typically found in fertilizers or liquid waste discharged from septic tanks and is found in groundwater supplies. Annually, the District completes a full inorganic compounds (IOC) report for Well No. 5, which tests for nitrate as well as over 25 additional compounds and characteristics of the water. The District uses a more comprehensive sample report in order to compare the characteristics of the water year-over-year and detect changes before they cause a health hazard. Results can be found on the District's website at www.awwd.com.

Last Updated: November 7, 2014

Triennial Lead and Copper Sampling – WAC 246-290-300(5)

DOH regulates levels of lead and copper in the public water supply to prevent health effects from high or long-term exposure. Typically, lead and copper get into the water from distribution lines and on-site plumbing, such as lead or copper pipe and fixtures, rather than from the water source. Water samples must show that the District's supply is below the lead and copper action levels established by USEPA. If the test indicates that the levels of copper and lead exceed the action level, the District is required to take steps to reduce the corrosivity of the water.

Samples taken from the District have consistently shown levels of lead and copper well below the action level. As a result, the District is currently on a reduced monitoring schedule and is required to test the distribution system every three (3) years instead of every six (6) months. Results can be found in the Annual Water Quality Report, available on the District's website (www.awwd.com).

Last Updated: November 13, 2014

Water Quality Protection Programs

In addition to regularly testing the water and protecting the water supply at the source, water system operators must meet additional water quality protection, prevention and inspection standards. The District has a number of programs and procedures in place to meet these requirements and prevent contamination of the water supply, including a cross-connection control program, disinfection facilities placed throughout the District, a unidirectional flushing program and a valve inspection and maintenance program.

Last Updated: October 29, 2014

Cross-Connection Control Program – WAC 246-290-490

A *cross-connection* occurs when a potable water supply is connected to a system that contains liquid of unknown or uncertain quality. Under abnormal conditions, the water can flow in reverse (“backflow”) and allow pollutants or contaminants back into the water supply. *Cross-connection control* is the method or procedure used to prevent contamination of the drinking water from backflow because of those abnormal pressure changes. A *cross-connection control program* is the implementation of a written plan to educate the public about cross-connection control as well as to monitor and manage such connections. The type of backflow prevention assembly depends on the type of hazard on the customer’s side of the connection and whether it is a residential, commercial, or industrial use.

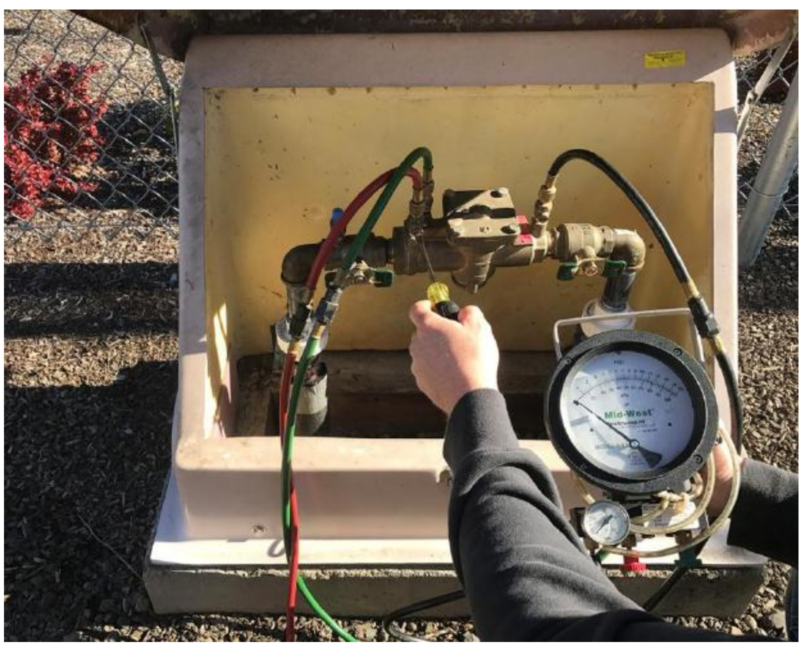


Table 7.5: Backflow Prevention Assemblies within the District's Service Area

	2009	2010	2011	2012	2013	2014 [2]	2015
Existing Backflow Prevention Assemblies [1]							
In Service	2,073	2,219	2,284	2,388	2,545	2,384	2,561
Tested	1,782	1,990	2,052	1,631	2,112	2,375	2,556
Failed	102	102	92	72	86	129	107
Proportion Passing	*94.3%*	*94.9%*	*95.5%*	*95.6%*	*95.9%*	*94.6%*	*95.9%*
Proportion Not Tested	*14.0%*	*10.3%*	*10.2%*	*31.7%*	*17.0%*	*0.4%*	*0.2%*
New and Removed Backflow Prevention Assemblies [1]							
Installed	101	91	113	153	154	172	125
Tested	99	88	102	141	148	172	125
Failed	8	5	11	9	3	25	16
Removed from Service	0	1	0	1	1	0	4
Proportion Passing	*91.9%*	*94.3%*	*89.2%*	*93.6%*	*98.0%*	*85.5%*	*87.2%*
Proportion Not Tested	*2.0%*	*3.3%*	*9.7%*	*7.8%*	*3.9%*	*0.0%*	*0.0%*
Total Backflow Prevention Assemblies	***2,174***	***2,309***	***2,397***	***2,540***	***2,698***	***2,556***	***2,681***

1. Data from XC2, the District's computerized backflow prevention device tracking system.
2. The District stopped counting assembly bypasses as separate devices per the advice of DOH. Devices which were previous double-counted under the new guidance are no longer shown for 2014.

The District is required to develop and implement a cross-connection control program. Alderwood Code 5.15 establishes the program within the District's service area and gives the District the authority to implement and enforce the program. This resolution adopts the Washington State regulations and the American Water Works Association (AWWA) guidelines regarding cross-connection control. A copy of the resolution and the written Cross-Connection Control Program is contained in *Appendix G*.

Backflow prevention assemblies are tested by private, DOH-certified, backflow assembly testers. The District has a computerized system that is used to generate reminder letters to inform our customers when their device is due for its annual inspection and testing. The District also owns more than 30 backflow prevention assemblies which are inspected annually by DOH-certified District personnel.

Last Updated: September, 2016

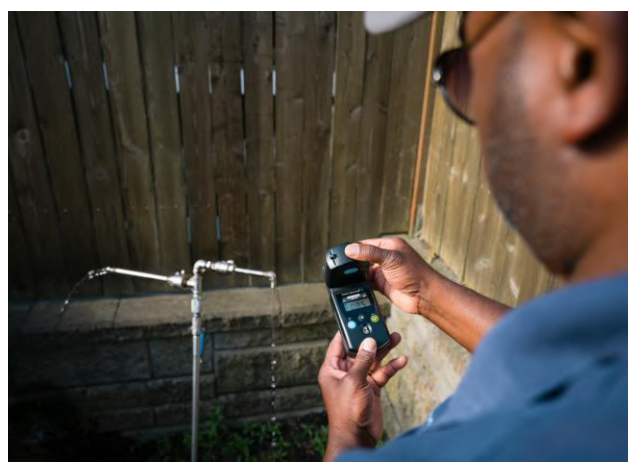
Disinfection Program

Disinfection is an important step for making water safe to drink. For water supplies which come from surface water, such as Everett's Spada reservoir supply, the federal Surface Water Treatment Rule applies (40 CFR 141-142). The rule requires water purveyors to filter and disinfect water in order to prevent waterborne illness. Primary methods for disinfecting water include chlorination, ozone and ultraviolet light. Everett is responsible for filtering and disinfecting their water supply before it reaches the District and the District is responsible for disinfection within the District's service area.

The District uses sodium hypochlorite disinfection facilities, located at the Reservoir No. 1, Reservoir Nos. 2 and 3, Nike Tank Nos. 1 and 2, and the Canyon Park Tank sites, to provide additional chlorination at the outlet of each reservoir. The re-chlorination facilities at Reservoir No. 1 provides adequate chlorine residual to the 724 Zone, so no re-chlorination facilities are required for High Tank Nos. 1 and 2. In order to meet the State's disinfection and disinfection byproduct requirements, the District constantly monitors chlorine residual with in-line analyzers that report to the SCADA system. For more information about the disinfection facilities, please see *Chapter 1 - System Description.*

Water supplied from the City of Everett has a chlorine residual of approximately 0.7 to 1.0 ppm. Currently the District is operating one of its four disinfection facilities (at Reservoir No. 1) at a low rate. The typical downstream residual is approximately 0.2 to 1.1 ppm. All preventive maintenance on the disinfection facilities is performed per the manufacturer's recommendations. Chlorine Residual Analyzers are calibrated monthly.

Last Updated: November 7, 2014



Unidirectional Flushing Program

Unidirectional flushing (UDF) is a type of water main maintenance used to improve water quality and restore pipe capacity. The maintenance crew isolates an area of the distribution system by opening and closing specific valves. The water flow coming in to the area is then effectively directed to an open fire hydrant or blow-off assembly (a pipe extension at the end of a water main to allow flushing). This creates flushing velocities that efficiently clean the main by scouring any sediment, biofilms, corrosion products (from pipe degradation), or tuberculation (buildup of rust) out of the water main. Since the water flows at a higher velocity, the water can be run for a shorter period of time and uses significantly less non-revenue water than traditional flushing.

Before and after flushing, crews measure gallons per minute (gpm), static and residual pressures, pH, chlorine residual, turbidity and temperature. During flushing, staff measures flushing time (time until the water is clear) and flushing velocity. Fire hydrants are chosen carefully and operated slowly to minimize the impacts to surrounding properties and prevent pressure surges in the system.

The District has established 23 flushing zones and each zone is flushed once every seven years. UDF is only conducted during the winter months in order to limit the program's impact on the District's peaking factor and to maximize the use of our staff for other projects during the summer months.

Last Updated: September, 2016

Valve Inspection and Maintenance Program

Valves are installed at multiple points in a water system in order to minimize both the number of customers out of service and the loss of water during service repairs or an emergency. It is common to place valves at street intersections, service connections, fire hydrants and blow-off assemblies. Typically installed in valve boxes or vaults, valves stop or control the flow of water in pipes.

A crew is assigned to inspect, operate, maintain and repair valves throughout the system. This inspection is coordinated to precede areas assigned to the UDF program, developer and District construction projects, city, county and state road overlay projects and the hydrant inspection program. Tasks of the valve inspection and maintenance program include:

- Inspecting transmission system valves, pressure zone isolation valves, system separation valves and distribution system valves;
- Ensuring isolation and separation valves are closed;
- Repairing and maintaining valves as needed; and
- Raising valve boxes in streets during a road improvement project, so that valve boxes are flush with the road surface.

American Water Works Association (AWWA) recommends that valves be operated at least once every two (2) years. The District is currently inspecting and operating its valves every seven (7) years to align with the UDF program.

Last Updated: September, 2016

Annual Water Quality Report – WAC 246-290-72001

The Consumer Confidence Rule (CCR) requires systems to provide customers with water quality information on an annual basis. For the CCR, community water systems are required to provide an annual water quality report to all customers including:

- Information on the source of drinking water;
- A brief definition of terms;
- If regulated contaminants are detected, the maximum contaminant levels goal (MCLG) and the MCL established by USEPA and the level detected;
- If an MCL is violated, information on potential health effects; and
- If USEPA requires it, information on levels of unregulated contaminants.

The Annual Water Quality Report is available on the District's website (www.awwd.com).

Last Updated: September, 2016

Public Notification Rule – WAC 246-290-71001

The Public Notification Rule (PNR) requires systems to notify their customers of acute violations when they occur. If violations have the potential for "serious adverse effects," consumers and the State must be notified within 24 hours of the violation. The notice must explain the violation, potential health effects, corrective actions and whether consumers need to use an alternate water source. Less serious violations must also be reported to consumers; however, the timeline for notification varies depending on the severity of the violation. The District follows the rules and guidance established by DOH for public notification.

Last Updated: September, 2016

8. District Facilities Design and Construction Standards 8-1

8. District Facilities Design and Construction Standards

Design and construction standards are adopted by the District to ensure long-term system viability, economic efficiency and a consistent level of service and quality throughout the service area. These standards facilitate the planning, design and construction of water system projects by both outside developers, consulting engineers and our District staff. The current comprehensive format for standards was originally adopted in 1995 (Resolution 2280-95). The standards are updated regularly to reflect industry best practices, changes to local, State and Federal laws and improvements suggested by our staff to improve the ease and efficiency of maintaining the District's facilities.

This chapter explains the purpose of design and construction standards, provides a brief overview of the District's standards since implementation and standard review procedures. The District's standards can be found online (www.awwd.com\standards) or at the District's Administrative Office.

Last Updated: September, 2016

Purpose of Standards

In designing and constructing water facilities within the District, our customers, contractors, suppliers, consultants and our District staff are required to comply with the District's standards and any applicable local, State, or Federal requirements. Standards are developed for a number of purposes, including regulatory compliance, contractual purposes and technical guidance, but also to balance cost and constructability against the need to provide sustainable service to future generations. The District's standards serve as minimum guidelines for the design, construction, operation and maintenance of the water system by addressing:

- *Customer Service*: Ensuring water quality and continuity of service, preventing failure, demonstrating technical credibility and providing value to our customers;
- *Environmental Impact*: Reducing the potential for leaks and impacts to critical habitat, bodies of water and the stability of slopes;
- *Occupational Health and Safety*: Minimizing the risk of injury during construction and maintenance of a system component; and
- *Public Health*: Specifying materials that are safe to use with drinking water and designs that protect against cross-contamination and provide adequate fire protection.

Specific goals for the standards of the water system include:

- Ease of use to enable compliance;
- Maintaining hydraulic capacity, or the volume of water a pipe can carry with a given material and water pressure;
- Maintaining structural integrity under normal service conditions;
- Minimizing or eliminating leaks at joints for the expected life of the asset;
- Providing a range of acceptable materials or design options;
- Reaching the minimum-designed life expectancy of all system assets; and
- Specifying safe materials for contact with drinking water throughout the life of the asset in all foreseeable conditions, including for cross-connection control.

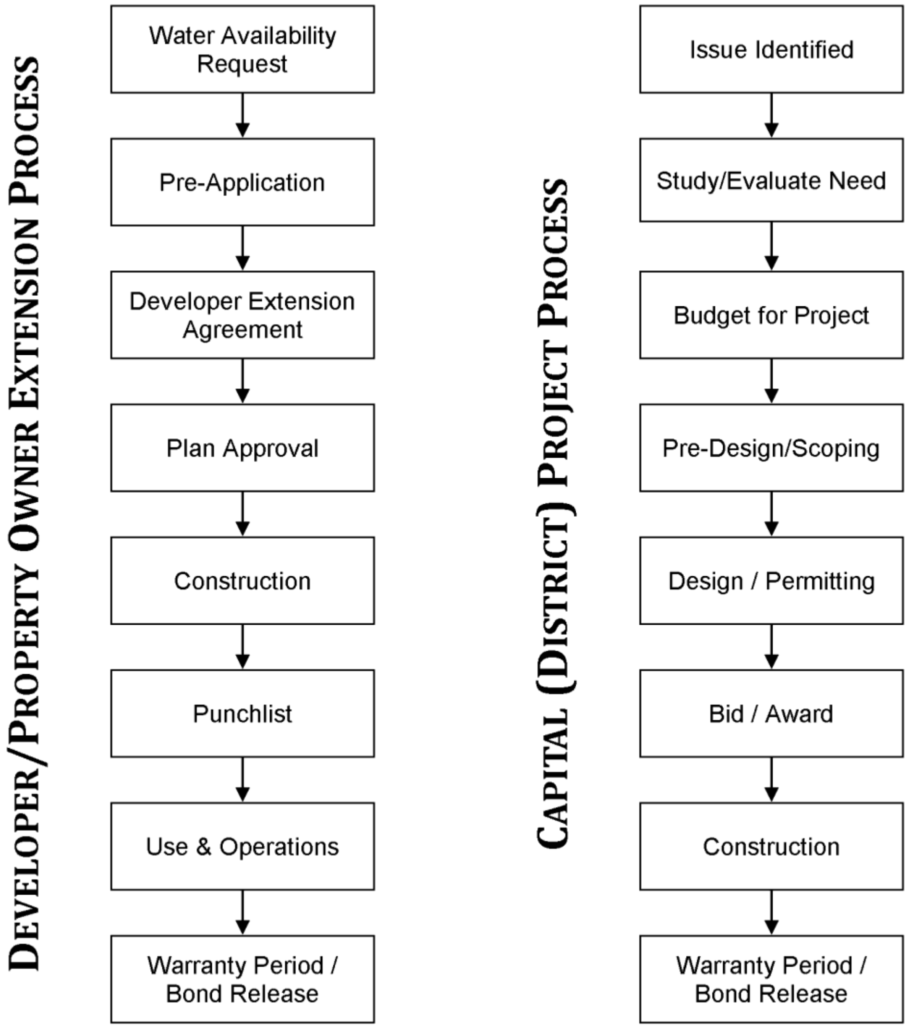
Last Updated: September, 2016

Project Procedures

For new water system facilities, the District has specific policies and project procedures, which differ slightly depending on whether the project is initiated by the District or by an outside party. The review procedure for developers and property owners is described in detail in the District's standards, available on the District's website or at the District's Administrative Office. The general steps that must be followed for project review are summarized below.

Individual water system project designs must be forwarded to the Washington State Department of Health (DOH) for additional review and approval, except for distribution system projects (e.g. transmission mains), which are eligible for alternative review under WAC 246-290-125. Projects related to the construction of new or upsized distribution mains (i.e. larger than the existing main) do not need to be submitted to DOH if the utility has an approved comprehensive plan that includes specifications for distribution mains and Construction Completion Reports are maintained for each project. The District meets both of these criteria and does not typically submit plans for distribution main projects to DOH. The District is still required to submit plans for other, non-distribution related projects, such as pump stations, reservoirs and transmission mains.

Figure 8.1: General Project Processes by Type



Last Updated: September, 2016

Design Standards

The District's design standards include performance, sizing and materials criteria required in the design of all water system improvements. The standards adopted by the District meet or exceed the minimum requirements established by WAC 246-290 and conform to the guidelines established by the American Water Works Association (AWWA).

Last Updated: September, 2016

Distribution System Pressure Requirements

The District's minimum pressure requirement meets the standard in WAC 246-290-230:

1. A minimum of 30 psi (pounds per square inch) at the customer's meter during peak hour demand conditions; and
2. A minimum of 20 psi during fire flow and peak day demand conditions.

While WAC 246-290-230 does not currently establish maximum allowable pressures within the distribution system, the District does attempt to limit maximum system pressures where feasible for the safety of customers, contractors and staff and to ensure the maximum possible life for the system. Property owners are required to install Pressure Reducing Valves (PRVs) where required by the current edition of the Uniform Plumbing Code (UPC).

Last Updated: September, 2016

Fire Flow Requirements

Fire flow requirements are established by local jurisdictions and are a primary criterion for appropriately sizing distribution mains and storage facilities. The water system is required to have adequate supply, storage and distribution capacity to supply firefighting needs while providing an adequate level of service to customers on the highest demand day of the year. The highest fire flow requirements typically occur at higher risk and higher demand areas such as commercial, industrial, or high-density housing.

The currently adopted fire flow service criteria must be met for new development and redevelopment projects. For existing structures, the distribution system must be able to provide the fire flow requirement that was in effect at the time the structure was built, provided any improvements do not activate new fire flow requirements.

Last Updated: September, 2016

Source Capacity Requirements

Facilities which supply water to the District must be designed to meet the forecasted 20-Year Maximum Day Demand (MDD) and be able to replenish the supply in a water storage facility. For more information about the current demand forecast, see *Chapter 4 - Planning Data and Demand Forecast*.

Last Updated: September, 2016

Construction Standards

District staff inspects water facilities as they are installed and upon completion of a project. All materials, installation and workmanship must be in accordance with the current District standards, the current edition of the State of Washington's *Standard Specifications for Road, Bridge and Municipal Construction* (as amended by the District), American Water Works Association (AWWA) guidelines and the governing jurisdictional authority.

If the project does not meet District standards or deviates from the approved construction plans, a corrective punch list is made of items that must be completed before the District accepts the facilities. The complete requirements for acceptance of a project into use and operation are included in the District's standards.

Any contractor using water during construction must first obtain approval from the District, in order to accurately track unmetered water consumption.

Last Updated: September, 2016

Major Updates to Design and Construction Standards

Prior to adoption in 1995, the District's standards were a series of detail sheets approved individually by resolution. Resolution 2280-95 established a comprehensive set of guidelines and provided the General Manager with the authority to make minor updates to the standards administratively, rather than requiring Board approval for clarifying modifications. Major changes to the standards approved by the Board include:

Pre-Developer Guidelines and Standards

1932 Original engineering standards adopted, which allowed for wood and steel pipe.

1957 Transitioned from wood and steel pipe to cast iron pipe and established minimum water main sizes for streets (6 inches) and cul-de-sacs (4 inches).

1958 Established standards for the construction and ownership of fire lines, hydrants, sprinkler systems, fire system meters and gate valves.

1972 Established comprehensive standards for developer water extensions, including requiring an application to connect, the provision of easements, bonds or other guarantees and record drawings.

1977 Transitioned from cast iron pipe to ductile iron pipe per industry standard.

1978 Revised the blow-off assembly and added thrust blocking for fire hydrants.

1980 Required developers to install service meters and appurtenances in new subdivisions and maintain them for a period of one year after acceptance.

1982 Added requirements for clearance between water and sewer lines.

1983 Revised the blow-off assembly standard material from galvanized to PVC.

1984 Clarified inspection standards, added pipe specifications by size, required the District design all public portions of developer extensions and that all public and private portions be designed and constructed to the District standards, added television inspection and latecomer agreement requirements and set a fee for the sale of construction water.

Required a painted concrete valve marker for valves outside of paved areas.

1985 Allowed drive-over meter boxes.

1987 Required backflow assemblies for certain at-risk water uses.

Developer Guidelines and Standards “A”

Effective June 1995

- Adopted all existing guidelines and standards as a single, comprehensive set.

Developer Guidelines and Standards “B”

Effective March 1996

- Added approved “Confined Space Entry Program” in accordance with Washington State standards.

Developer Guidelines and Standards “C”

Effective August 2000

- Specified center stem hydrants and included a list of approved hydrants.
- Added approved joint restraint systems.
- Revised pipe classes for ductile iron pipe to align with local standards.

Developer Guidelines and Standards “D”

Effective December 2006

- Clarified requirements for materials and installation.

Developer Guidelines and Standards “E”

Effective July 2010

- Clarified trenchless installation standards.
- Increased insurance requirements for contractors as recommended by the Washington Water & Sewer Risk Management Pool.
- Extended warranty period to two (2) years.
- Established lift station standards for smaller sites.

Developer Guidelines and Standards “F”

Effective May 2013

- Increased cash performance bond amounts to reflect construction cost increases.
- Added minimum water service line size of 1 inch for both 3/4-inch and 1-inch meter installations.
- Required lead-free components and materials.

Developer Guidelines and Standards “G”

Effective July 2015

- Clarified early use requirements.
- Addressed system abandonment.
- Revised standard detail drawings for clarity.

Last Updated: September, 2016

9. Maintenance and Operations 9-1

9. Maintenance and Operations

The purpose of the maintenance and operations chapter is to describe the existing programs used by the District to inspect, operate, maintain, repair, replace and sustain the water source of supply, pumping, transmission, storage and distribution system and to evaluate the potential impact of desired future programs and known challenges. This chapter examines five program areas: maintenance, facilities, prevention programs, recordkeeping and regulatory requirements. As these programs are developed, upgraded or expanded to meet growing demand, the District will need to evaluate the need for additional staff.

For information about the District's facilities, please see *Chapter 1 – System Description.*

Last Updated: September, 2016

Infrastructure Maintenance Programs

The installation, maintenance and operation of sources of supply, pumping stations, water transmission, storage and distribution systems requires significant investment by a community. In order to ensure that the District's system meets the needs of our current customers while preparing for the future, the District maintains its facilities on a regular schedule to ensure reliable service, maximize the useful life of our assets and keep rates stable.

The unidirectional flushing and valve inspection and maintenance programs are described in *Chapter 7 – Water Quality*. Transmission main inspection is completed by the valve maintenance crew and is also described in *Chapter 7*.

The following subsections describe the major programs the District uses to promote a sustainable, affordable water system.

Last Updated: September, 2016

Distribution System Repair and Replacement

The distribution system repair and replacement program is responsible for distribution mains, pressure reducing stations, service lines and fire hydrant assemblies found throughout four pressure zones. Our water distribution employees perform the following functions:

- Servicing and repairing distribution facilities;
- Adding connections to water mains (also known as “tapping the main”); and
- Installing new water infrastructure.

The District also replaces polypropylene service lines with copper service lines as local jurisdictions complete road overlay projects. Water main replacement is typically completed by outside contractors as part of a capital improvement project.

Part of an effective preventative maintenance program is to track the condition of system assets over time. This helps prolong the life of the water distribution system by preventing small issues from becoming larger, making the repairs costlier or requiring facility replacement.

As the water distribution system grows and ages, maintenance and staffing needs may need to increase to retain the existing maintenance schedule. The District is currently assessing what levels of service are needed in new program areas such as a water leak detection program, a distribution pipe condition assessment program, a formal polypropylene service line replacement program, an enhanced hydrant replacement program, and expanding a program to remove obstructions and vegetation from easements.

Performance Indicator: Water System Integrity

This measures the number of leaks and breaks within the utility-owned water system per 100 miles of water main (does not include service line breaks). Breaks can either be caused by condition, such as age, soil type, or pipe type; or a human cause, such as water “hammer” (a pressure surge) from an improperly operated hydrant.

District Goal:

3 or Less Water Distribution System Failures per 100 Miles of Water Main per Year.

	2011	2012 [4]	2013	2014	2015
Condition Failures / Year	6	6	9	8	8
Human-Caused Failures / Year	0	1	3	3	12
Total Failures / Year [1]	*6*	*7*	*12*	*11*	*20*
Miles of Water Main	632	637	649	657	665
Rate / 100 Miles of Main	***0.9***	***1.1***	***1.8***	***1.7***	***2.1***
AWWA National Median [2, 3, 4]	***31.0***	***12.0***	***13.0***	***-***	***9.0***

1. The District does not currently track leaks in its computerized maintenance system as a failure. Leaks are typically fixed within a few business days of discovery, depending on severity and workload.
2. American Water Works Association (AWWA) periodically completes a benchmarking survey to evaluate water and wastewater utilities in five primary areas. Data for each year is compiled from the benchmarking report for that survey year and is available at http://www.awwa.org. Data is the national median for utilities 100,001 - 500,000 population served.
3. N/S: Survey was not completed that year.
4. Leak data and break data provided in separate responses (2012 forward) instead of combined data (2011 and previous).

Interpretation:

The District’s system is performing extremely well, as indicated by rates far below the national median and the national top performers. Breaks are also within a consistent range each year and spaced throughout the District’s service area. A steady increase in breaks year-over-year or groups of breaks would indicate that portions of the system are reaching the end of their useful life.

Last Updated: September, 2016

Metering

Water meters are provided for each customer in order to accurately record water use. The District has recently completed a meter replacement program that converted over 45,000 existing manual-read or touch-read meters to radio-read meters. Historically, our meter reading staff did not install or maintain meters. The District anticipates that the switch to radio-read meters will enable one work crew to perform all work relating to meters, creating efficiencies and allowing the remaining staff to focus on other priorities.

The implementation of radio-read meters will allow staff to more frequently test large (over 3”) meters per manufacturer recommendations and ensure that those meters are recording usage as accurately as possible. Radio-read meters also allow the District to provide customers with detailed information, upon request, about their usage and to catch potential leaks. By finding and fixing leaks in a timely manner, both our customers and the District can better conserve water.

In the future, the District plans to use Global Positioning System (GPS) devices to record the specific locations of our meters, which can be easily hidden by vegetation due to their small size and underground locations.

Last Updated: September, 2016

Pressure Reducing Valve (PRV) Stations

Located at distribution points between pressure zones, PRV stations are important to ensure that the water pressure delivered to customers is not too high. Our District staff maintains the system’s PRV stations by flushing the internal control valves, checking upstream and downstream pressures and visually inspecting for broken seals, leaks and other station integrity problems. The District has updated its PRV station design standard to minimize ground water infiltration, improve access control, Supervisory Control and Data Acquisition (SCADA) monitoring, safety, physical space for ease of access, heating and ventilation. The District plans to use our computerized maintenance management system (CMMS) to improve preventative maintenance of PRV stations in the future.

Last Updated: September, 2016

Pump Stations

Pump stations permit the District to pump water into its transmission system and reservoirs, and allow gravity to serve our customers. District staff operates and maintains both District-owned and Clearview-owned pump stations. Pump stations can be programmed to start and stop pumps automatically, based on the water levels in reservoirs. Pump stations can also be operated manually if needed. Except during summer peaking when the District tries to maximize efficiency and minimize peak-day quantities purchased from the City of Everett, the District utilizes the top five feet of its reservoirs as normal operating range and sets pump controls accordingly.

The District plans to complete input of the preventative maintenance programs into CMMS. The District is also evaluating the need for an additional pump station to provide added redundancy to the District's ability to supply the 724 pressure zone.

Last Updated: September, 2016

Reservoirs

District staff schedules reservoir cleaning to provide clean and safe drinking water to customers and to inspect structural integrity and piping. Inspection requires reservoirs to be removed from service, unless robotic devices and/or divers are used. Work is typically performed in the fall and winter months, the low water usage period, when it is least likely to disrupt service to our customers. It takes staff between two to four weeks to clean the outside and six to eight weeks to clean the inside of a reservoir, depending on the size and type of structure.

Table 9.1: Reservoir Cleaning Schedule, 2016-2025

Reservoir	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
635 Pressure Zone Reservoirs										
Reservoir No. 1 – Interior					X					X
Reservoir No. 1 – Exterior		X			X			X		
Reservoir No. 2 – Interior	X					X				
Reservoir No. 2 – Exterior			X			X			X	
Reservoir No. 3 – Interior		X					X			
Reservoir No. 3 – Exterior	X			X			X			X
724 Pressure Zone Reservoirs										
High Tank No. 1 – Interior					X					X
High Tank No. 1 – Exterior		X			X			X		
High Tank No. 2 – Interior	X					X				
High Tank No. 2 – Exterior		X			X			X		
520 Pressure Zone Reservoirs										
Nike Tank No. 1 – Interior		X					X			
Nike Tank No. 1 – Exterior		X			X			X		
Nike Tank No. 2 – Interior			X					X		
Nike Tank No. 2 – Exterior		X			X			X		
Canyon Park Tank – Interior					X					X
Canyon Park Tank – Exterior		X			X			X		
Clearview Water Supply Agency – Reservoir Maintained by Cross Valley Water District										
Clearview Tank – Interior				X					X	
Clearview Tank – Exterior				X		X			X	

After cleaning and inspection, the reservoirs are disinfected prior to refilling. Refilling is completed slowly so that water quality samples can be taken multiple times to ensure that the tank cleaning was completed properly. Once the reservoir is refilled to the normal operating level and samples have demonstrated that the water meets purity standards, the reservoir is put back into service.

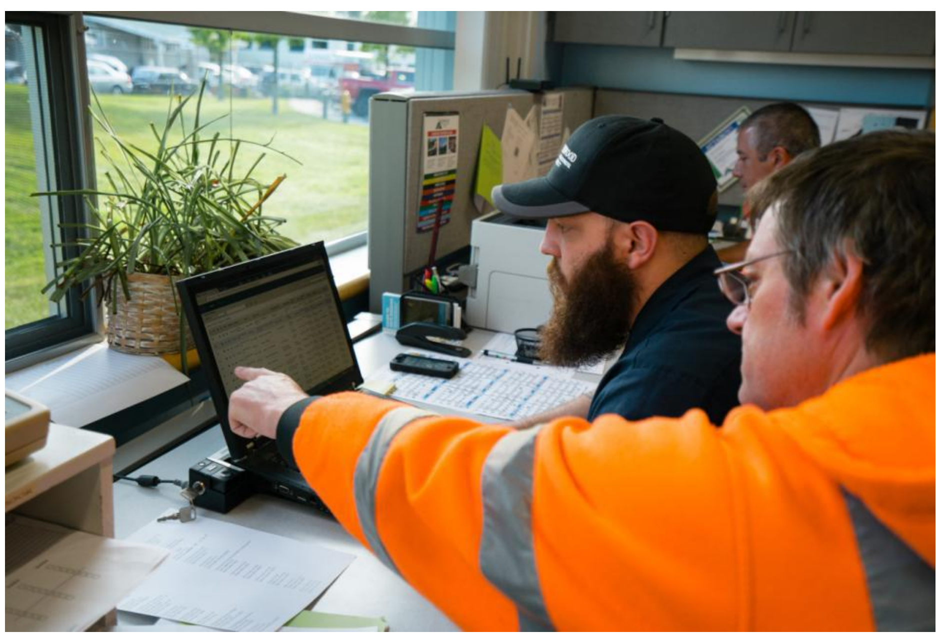
The District maintains all of the above reservoirs, except the Clearview tank, which is maintained by the Cross Valley Water District.

Last Updated: September, 2016

After-Hours Staffing – WAC 246-290-420(9)

It is a priority of the District to provide high-quality, reliable service to our customers at all times. This requires ensuring that the system infrastructure is functioning at all hours of the day through an after-hours program, where District staff are on call and available to respond 24 hours a day, 7 days a week. Duty personnel are readily available to solve problems over the phone as well as respond in person as needed to such emergencies as leaks, locate requests and pump station malfunctions. Our staff is also responsible for monitoring system alarms, reservoir levels and pump failures through the SCADA system. Duty staff has the capability to call out additional staff and coordinate with other agencies when needed.

Last Updated: September, 2016



Preventative Maintenance and Monitoring Programs

Preventative maintenance and monitoring programs are a priority for the District. By constantly monitoring and evaluating the system, the District ensures that facilities last their entire expected life and provide maximum value and benefit to our customers. This section outlines the programs used to regularly assess and monitor the water distribution system.

Performance Indicator: Water System Planned Maintenance Ratio

This indicator measures the degree to which the District is investing in planned preventative maintenance.

District Goal:

Spend 45% or more of water system maintenance hours on planned (preventative) maintenance.

Maintenance Type [1]	2010	2011	2012	2013	2014
Preventative (Hours) [2]	5,600	15,700	12,800	13,400	14,700
Corrective (Hours) [3]	12,400	26,200	23,600	25,100	21,700
Total Hours	*18,000*	*41,900*	*36,400*	*38,500*	*36,400*
Planned Ratio (%)	***31%***	***37%***	***35%***	***35%***	***40%***
AWWA National Median [4, 5, 6]	***N/S***	***40%***	***43%***	***38%***	***NYA***

1. Maintenance hours include work from water, water quality and meter crews, mechanics, electricians and SCADA staff. Hours shown do not include training, meetings, or other activities and therefore are not equivalent to full-time employees.
2. Preventative maintenance includes work completed on a predetermined schedule, as well as hours devoted to predictive maintenance, which is work completed in response to monitored signals.
3. Corrective maintenance is hours spent on assets which are no longer working (i.e. a break, leak, or blockage).
4. American Water Works Association (AWWA) periodically completes a benchmarking survey to evaluate water and wastewater utilities in five primary areas. Data for each year is compiled from the benchmarking report for that survey year and is available at http://www.awwa.org. Data is the national median for utilities 100,001 - 500,000 population served.
5. N/S: Survey was not completed that year.
6. NYA: Survey data not yet available

Interpretation:

The District is currently performing below the national average. This is primarily due to a series of unforeseen separations from illness or departure. In 2014, the District filled the vacant water positions and anticipates that this ratio will improve.

Fire Hydrants

The primary purpose of the fire hydrant maintenance program is to ensure that hydrants are visible, accessible and operable. Inspection and maintenance on a regular basis is important for detecting and correcting potential problems to make sure that hydrants will perform as expected in an emergency. Everything from normal wear and tear to accidents, vandalism, overgrown vegetation, mechanical malfunctions and improperly opened valves can impact the operability of a fire hydrant.

Hydrants are visually inspected before being operated, lubricated and painted. Hydrants that do not work properly or that are “substandard” are referred to our distribution system repair staff for reinstallation, repair, or replacement. Substandard hydrants are simply hydrants that do not meet the currently adopted District standard, typically because they have two ports instead of three, although they are still functional. The District is currently replacing “substandard” fire hydrants as time allows. New hydrants are typically installed by developers or through Interlocal agreements with other jurisdictions.

Supervisory Control and Data Acquisition (SCADA) Program

Supervisory Control and Data Acquisition (SCADA) is an automated operating system tool that allows District personnel to remotely view performance of equipment at District PRV stations, pump stations, chlorination facilities and reservoirs. It records data for trend analysis and provides an overview of the entire system, which allows our staff to monitor and manage system processes.

District staff is focused on managing and upgrading the current SCADA system to improve the longevity of its components. Staff is responsible for the operation and maintenance of the system, servers and all related equipment. Development of an annual preventative maintenance program is also a priority.

Major challenges for the SCADA program are to ensure that our staffing levels are adequate for fulfilling and updating preventative maintenance programs and that the unique technical skills of those employees working on the system are developed within the current workforce.

Last Updated: September, 2016

Security

Security of the District's facilities falls into three primary categories: physical security, active security and preventative security. The District regularly inspects its satellite facilities and renovates existing facilities to restrict and monitor unauthorized access. As part of the emergency planning process, the District plans to regularly update its various vulnerability assessments to evaluate emerging security issues and add needed improvements to the Capital Improvement Program.

Additional information about the District's emergency planning efforts can be found in *Chapter 10 – Emergency Planning*.

Last Updated: September, 2016

Facility, Equipment and Fleet Maintenance and Inventory

The District completes preventative maintenance on its buildings, equipment and vehicles in order to maximize the performance, safety, value and availability of needed resources. The District is investigating the potential benefits of implementing an asset management system.

Last Updated: September, 2016

Facility Maintenance

In order to improve work quality and provide cost effectiveness to our customers, facility maintenance is primarily conducted by District staff. Our staff is responsible for janitorial services and grounds, as well as electrical and mechanical maintenance at all District buildings and facilities. The desired effect of these facility maintenance programs is to ensure reliable service to customers, increase the life of facility components and present well-kept facilities to our customers and neighbors.

In the future, the District will need to focus on developing preventative maintenance programs and expanding facilities maintenance to other areas, such as HVAC maintenance.

Last Updated: September, 2016

Equipment and Fleet Maintenance

The purpose of the equipment and fleet maintenance program is to increase the longevity of mechanical assets, provide diagnosis and repair of equipment malfunctions and to complete preventative maintenance on District equipment and vehicles. The District's fleet is on a rotational maintenance schedule based on mileage, which is tracked through the fuel management system. Our staff is also responsible for annual emissions testing and for weatherizing vehicles on a biannual basis.

Equipment and fleet maintenance is primarily completed by District staff in order to best utilize customer resources. Equipment and vehicles are replaced as needed. As vehicles are replaced, the District is examining the use of hybrid, electric and biodiesel vehicles in order to lessen the environmental and cost impact of the vehicle miles traveled by our staff.

Last Updated: September, 2016

Inventory

In order to effectively complete maintenance and operation of system infrastructure, the District keeps inventory of needed parts and equipment in stock. Inventory is tracked through the District's maintenance management system.

Quarterly and annual checks are completed in cooperation with the Finance Department to ensure accuracy of supplies and accounting. The use of an automated tracking system enables inventory staff to receive parts and pay vendors in a timely manner, which helps improve the District's credit rating and relationship with regular vendors.

The District is examining storing inventory at satellite facilities to lessen the amount of staff time spent travelling across the District to retrieve regularly-used parts and materials. Our staff is also in the process of implementing a barcode system to improve accuracy of tracking, ensure restocking of parts in a timely manner and to allow crews to check out "bundles" of parts commonly used on work orders.

Last Updated: September, 2016

Recordkeeping and Reporting

All organizations rely on information to function effectively. Good recordkeeping includes appropriately recording, storing and managing records so that information is available when it is needed. It is important to have processes in place which encourage good recordkeeping practices and provide context to the information stored. The District uses a number of methods to create, share and store data, including those described below.

Last Updated: September, 2016

Maintenance Management System

The District currently uses a computerized maintenance management system (CMMS) to track the design, installation, maintenance and replacement of assets. Assets include facilities (i.e. pump stations and chlorination facilities), buildings, vehicles, large and small equipment, water pipes, pumps and personnel. Automating preventative maintenance helps significantly with scheduling staff, ensuring adequate supplies are available for maintenance work, tracking trends and improving the District's ability to respond to emergencies. All work completed by the Maintenance & Operations Department and all capital projects are currently documented in the CMMS system.

CMMS is not currently being utilized to its full potential. Increased utilization of the program may require evaluation of staff resources to administer CMMS and additional licenses for increased use by staff in departments other than Maintenance & Operations.

Last Updated: September, 2016

Mapping and Geographic Information System (GIS) Program

Accurate maps of the water system are critical to everyday functions, such as locating facilities and pipes, identifying record drawings and providing customers with meter location and other useful information. The District currently uses a schematic map of District facilities overlaid onto Snohomish County parcel data. This map is modified over time to reflect record drawings, new construction and field corrections.

The District recently began the process of converting its existing CAD-based (Computer Aided Design) system into a GIS-based map and viewer. When the District began system-wide mapping efforts in the late 1990s, CAD was chosen as the tool for map development. As the District grew and GIS tools improved, the District determined that switching its schematic map system was critical to improving staff efficiency, customer service and consistency between programs.

The District is developing a phased approach to the GIS conversion. In 2016, our staff will launch a Global Positioning System (GPS) program to locate assets in the field and assist with the data conversion. This provides survey-grade data and greatly improves the accuracy of existing mapped assets. In the future, the District expects to equip key personnel with GPS devices in order to constantly improve the quality of District data and maps.

Last Updated: September, 2016

Recordkeeping and Reporting

The District strives to comply with all recordkeeping and reporting requirements of the Washington State Department of Health (DOH) and the Public Records Act (PRA). Currently, records for the District are kept in multiple locations. A records management committee is charged with the oversight of records for the District and with procuring an electronic records management system. As part of this process, our staff is evaluating which records can be stored solely in electronic format in order to free up physical space for other uses.

In the future, the District expects to use the new electronic records management system to track all paper and electronic records and improve the District’s ability to respond to public records requests. Moving in this direction will require an analysis of the staff, resources and equipment needed to manage this program.

Last Updated: September, 2016

Regulatory Environment

State and federal legislative bodies enact regulations on the water industry in order to promote public health and minimize or eliminate environmental impacts. Compliance with these regulations requires that organizations develop and implement standards that meet or exceed the law. Due to the increasing number of regulations and anticipated future regulations, the District examines the requirements holistically in order to limit duplication of effort.

The water quality program is described in *Chapter 7 – Water Quality*. The primary regulations which impact water services are described below.

Last Updated: September, 2016

Sanitary Surveys

Washington State Department of Health (DOH) conducts sanitary surveys of the District's water system facilities, operations and records every three to five years to ensure the District is meeting all current requirements and to identify any issues which may pose a public health risk. All sanitary surveys review the District's planning and management documents, pump stations, chlorination facilities, reservoirs, cross-connection control program, staff certifications and the distribution system. DOH provides its written results to the District. Any upgrades to the system are accomplished by the District prior to the next sanitary survey.

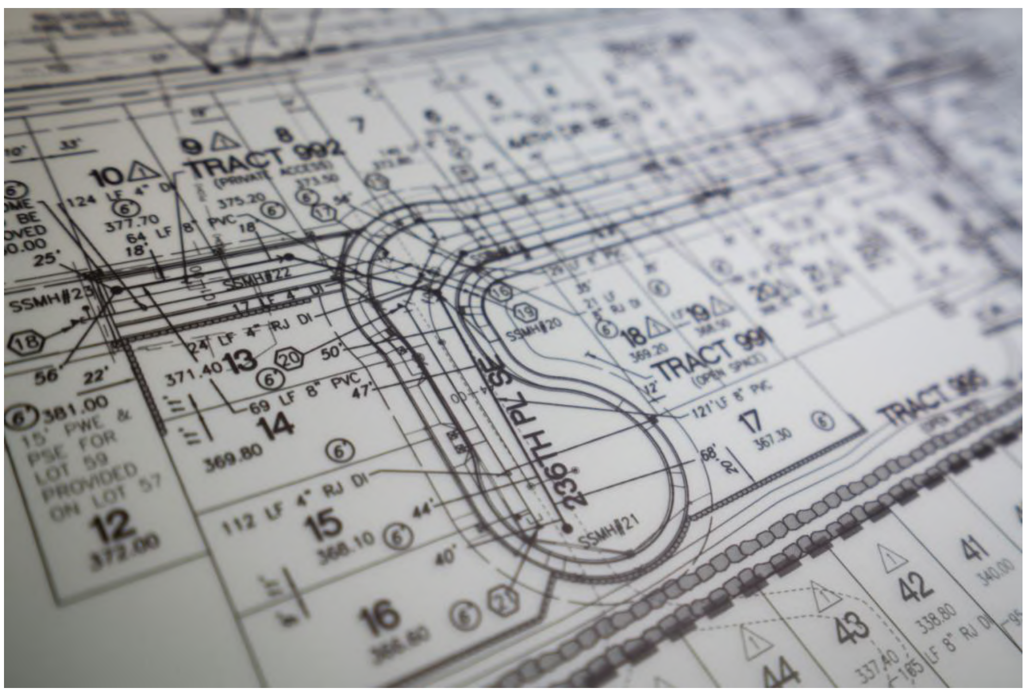
Last Updated: September, 2016

Potential Future Requirement: Unregulated Contaminant Monitoring

Under the 1996 Amendments to the Safe Water Drinking Act (SWDA), the United States Environmental Protection Agency (EPA) has established the Unregulated Contaminant Monitoring (UCM) program to work with local drinking water agencies in order to collect data for suspected drinking water contaminants. Every five years, a list of up to 30 contaminants is provided to participating agencies.

Because the District purchases all of its water from the City of Everett, the requirements of the Unregulated Contaminant Monitoring Rules (UCMRs) 1 and 2 did not apply to the District. Most recently, the District participated in UCMR3, which included testing for volatile organic compounds (VOCs), synthetic organic compounds, heavy metals and hormones. The District anticipates participating in future UCMRs as the rules are released by EPA.

Last Updated: September, 2016



TRACT 992
TRACT 991
236TH PL SE
SSMH#22
SSMH#23
SSMH#21

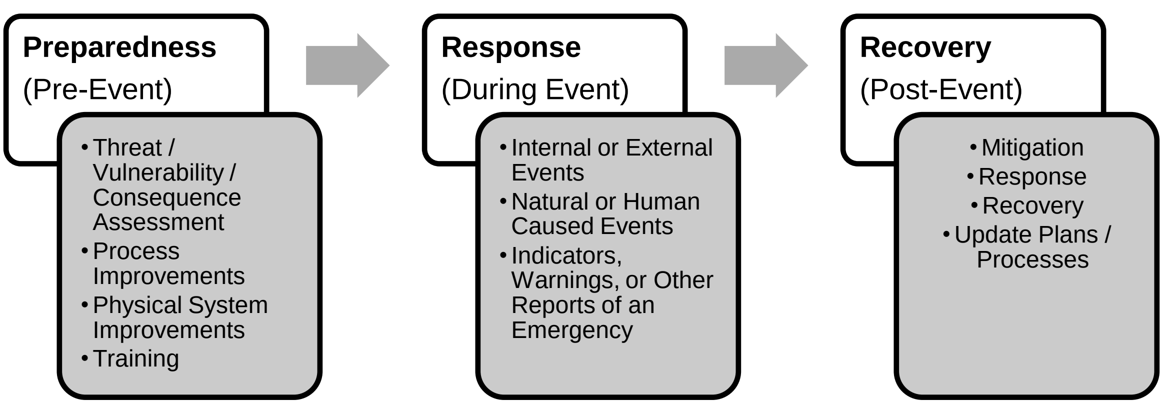
10. Emergency Planning – WAC 246-290-415(2)(d)

The District continuously provides water and wastewater services that are vital for the health and economic viability of the community and for maintaining a high standard of living for our customers. These services are often undervalued or overlooked, since they fail so rarely. Significant damage to the system can cause both catastrophic immediate health effects in addition to cascading, disruptive impacts to other sectors of the community and economy. Impacts can easily extend well beyond the closure of schools, businesses and hospitals.

In order to effectively prepare for an emergency, the District must assume that all of its customers are dependent on its services. In other words, 100% of the District's customers are reliant on the District's water supply and probably do not have alternative sources (such as a well) or an emergency store (approximately one gallon per day per person). The United States Department of Homeland Security (DHS) has designated water and wastewater systems as "critical infrastructure," or systems that are vital to the basic functions of the nation. DHS and the United States Environmental Protection Agency (EPA) work to identify and reduce risks to water and wastewater infrastructure, improve system resiliency and to develop standards for emergency planning and response.

Complacency on the part of the District can have significant consequences. To maintain reliable service and ensure the safety of District customers, investing in the District's preparation to sustain or quickly reestablish service through all types of emergencies must outweigh the low probability of an event occurring. The District has established a standing employee committee responsible for developing, implementing and maintaining the District's emergency preparedness, response and recovery efforts. The three primary phases and subcomponents of emergency planning are shown below:

Figure 10.1: Emergency Planning Components



This chapter describes the District's efforts in each of the phases.

Last Updated: September, 2016

Preparedness

There are many different types of emergencies that can affect the District and our ability to provide service to our customers. Earthquakes are of particular concern due to the potential for widespread damage and high likelihood of major, long-term disruption. Other emergencies, such as severe weather or landslides, can also have a high impact but tend to be localized and manageable under the District's existing capabilities. For the purposes of this chapter, the District's customers include our retail customers as well as those organizations that depend on the District in order for them, in turn, to provide their services in an emergency, such as wholesale customers, the Clearview Water Supply Agency, fire departments, hospitals and the Snohomish Health District. In turn, the District is equally dependent on the City of Everett for wholesale water, local agencies for transportation infrastructure and Snohomish County PUD for power. Preparation for emergencies includes developing and strengthening partnerships with these and other key public agencies to ensure timely and effective response.

It is clear that the consequences of disruption to the District's system are high and that destruction or debilitation of the District's infrastructure and facilities will have cascading impacts to emergency services, the economy, public health, as well as to the confidence of the community in the District. The District recognizes that is it not possible to fully eliminate vulnerabilities to its systems or resources, as there are many influences beyond our control. Continuous improvement of the system in response to vulnerability assessments and minor emergencies is critical to maintaining vigilance and ensuring the safety of District customers.

The 2002 Bioterrorism Act requires the District to have completed an assessment of the water system's vulnerabilities (e.g. vandalism, sabotage, natural events or terrorist attack) and have an up-to-date emergency plan. These plans are not available to the general public. They have, however been provided to the required state and federal agencies. Documentation of completion of these plans is available in *Appendix J*.

Last Updated: September, 2016

Hazard Mitigation Plan

In order to receive pre-event mitigation funding and post-event grant funding, the District is required to prepare a hazard mitigation plan. The planning process assesses known natural hazards to identify short- and long-term strategies that minimize the potential loss of life, injury and damage that can result from a natural disaster. Strategies can include policy changes, projects and other activities that strengthen the District's infrastructure against natural hazards. Primary natural hazards that are of concern to the District include earthquakes, landslides and severe weather.

The District currently fulfills this requirement by cooperatively planning with Snohomish County. Snohomish County's *Hazard Mitigation Plan* is available online at http://www.snohomishcountywa.gov.

Last Updated: September, 2016

Vulnerability Assessment and Emergency Response Plans

The purpose of a vulnerability assessment is to evaluate the system for potential weakness and to identify policies, processes and corrective actions that can reduce risks to the system. Planning for potential threats to the District, shown in *Table 10.1: Examples of Potential Threats to District Infrastructure, Facilities and* Resources, allows us to make strategic improvements to maximize customer resources and minimize the likelihood and impact of emergencies on the system. Essentially, a vulnerability assessment provides a road map for prioritizing preventative work. The District's goal is to review our vulnerability assessments and emergency plan annually and to update these documents after every significant event or as the system changes and as required by State or Federal law.

Table 10.1: Examples of Potential Threats to District Infrastructure, Facilities and Resources

Natural Causes	Human Causes	Workforce	Infrastructure
Drought Earthquake Landslide Severe Weather Tsunami Volcanic Eruption	Contamination Cross-Bores Cyber Threat Intrusion Tampering Terrorism	Disgruntled Employees Pandemic Sabotage Theft Inadequate Training	Accidents Breaks Corrosion Failure (Age)

The purpose of an emergency response plan is to describe the actions and resources needed to limit or eliminate the impact of natural disasters or attacks on the system. The District is currently updating our emergency response plan, including developing a plan for prioritization of damage assessments and repairs during emergency response and recovery.

Last Updated: September, 2016

System Improvements

Currently, very little of the District's infrastructure has exceeded its planned operating life, or the length of time it was designed to last. Assets have been well-maintained over time, which allows the District to proactively plan for replacement prior to failure. As technology improves and more critical infrastructure systems are integrated with one another, the links between them blur traditional forms of securing the District's systems. While these improvements increase the efficiency and strength of the community and economy, they also provide more opportunities for disruption. Infrastructure is an especially easy target because it covers large areas, is largely unnoticed and it is difficult to detect intrusion or tampering.

The investigation of asset management methods, further described in *Chapter 13 – Capital Improvement Program*, could greatly assist the District in mitigating or eliminating vulnerabilities throughout the system and limiting damage during an emergency. Results of the vulnerability assessment are also added to the regular work program or the Capital Improvement Program (CIP) on an ongoing basis. The District plans to evaluate various risk assessment methodologies to apply to CIP proposals and assist with prioritizing projects.

Typical preventative system improvements may include:

- Intrusion detection devices;
- Physical barriers and lighting;
- Tamper-proofing of facilities;
- Rekeying of locks and an access policy;
- Continuous updating and protection of computerized or other electronic systems;
- Emergency preparedness and response training;
- Careful use and storage of chemicals;
- Security screening of employees and contractors;
- Power and telecommunications redundancy (i.e. backup generators at remote sites); and
- Regular interaction with other utilities and partner agencies, including local law enforcement and businesses, to build relationships and understanding about the importance of the water and wastewater systems.

Last Updated: September, 2016

Education and Training

The District is facing the upcoming retirement of approximately one third of our employees over the next five to ten years. Many of these employees have served at the District for well over a decade and have developed considerable expertise and familiarity with the system they helped to design, build and maintain. Succession planning is crucial for passing on this knowledge in-house and sustaining the District well into the future.

Current employees are encouraged to complete the minimum National Incident Management System (NIMS) training (ICS-100, ICS-200, ICS-700 and ICS-800) as well as to attend training offered by the District's Safety and Emergency Preparedness Coordinator. Emergency preparedness training is currently not mandatory for all of our employees at the District. Over the upcoming planning period, the standing committee will evaluate what levels and types of training are most appropriate for each work group.

Last Updated: September, 2016

Multi-Agency Coordination

The District does not operate independently – we depend on transportation, telecommunication, energy, manufacturing and other sectors to provide our services. We rely on the City of Everett as our source of supply and on local agencies to keep roads and bridges in good repair. As noted in the introduction to this section, other agencies are equally reliant on the District to provide services. Fire departments and hospitals cannot function for long without the District's infrastructure being intact. This interdependency between organizations means that during an emergency we must all work together in close coordination to restore service.

Cooperation between local, state and federal partner agencies during the planning process is critical for effective response and recovery during an incident. While the District has some existing agreements in place, described in *Chapter 2 – Related Plans, Agreements and Policies*, the District plans to expand and improve these partnerships during the upcoming planning period.

Last Updated: September, 2016

Communication

Clear, effective communication is a necessary and vital part of preparing for, responding to and recovering from an emergency. Customers, employees and other agencies all need to know what to expect from the District and when service will be available. During an emergency, District staff will need to provide accurate, timely and consistent messaging that clearly relays information to those who need it. Just as we have a wide variety of customers, we also have a wide variety of emergencies we will need to respond to. Developing potential messages and practicing communication strategies in advance is critical for ensuring the District is as transparent as possible about emergency response and can better meet the needs and expectations of our customers and the public.

The District's existing communication plan includes key contact information for staff, schools, hospitals, partner agencies and news organizations; communication policies and protocols; notification procedures; and worksheets for responding to frequently asked questions. The standing committee is updating the existing communication plan as part of its work during the upcoming planning period.

Last Updated: September, 2016

Response

Local responders are responsible, at a minimum, for the first and final phases of emergency response. In a particularly large regional event, such as an earthquake, the District should expect that it may not receive adequate outside assistance for days, weeks, or possibly even months. Water and wastewater systems are particularly important to recovery efforts after a natural disaster. Full-fledged emergencies are also often overwhelming and chaotic in the first few hours of response. The standing committee is examining tools and processes it can provide to prepare employees to function successfully at the beginning of an emergency and to ensure continuity of service for our customers throughout the response period.

The District handles minor emergencies every day and has have well-practiced processes in place to handle these issues effectively. Swift response times, though beneficial, have an unintended consequence: District customers are accustomed to near-immediate restoration of service. The longer the District and the region go without a major emergency, the more important it becomes to manage customer expectations and to educate the community about how to prepare. As noted previously, the District's standing committee is in the process of updating its emergency response plan.

Last Updated: September, 2016

Recovery

The recovery phase of an emergency begins once the initial impacts from that emergency are stabilized and District operations begin to return to normal. At this point, the District is able to begin rebuilding and replacing infrastructure and most customers have access to water and wastewater services. These services may not yet be available within all homes and businesses, but alternatives are in place until the systems can be fully restored and operational. As with the emergency itself, the recovery phase can last weeks, months, or years, depending on the scope and scale of the incident. The District will need to restore our water and wastewater infrastructure and facilities in order for the community to fully rebuild and recover.

The District understands that while it is not possible to know the unique circumstances of an emergency in advance, it can anticipate the most likely needs during the recovery process. Recognizing and planning for these needs in advance can help inform the District's strategy during an emergency response and improve the District's ability to act. Recovery planning can also ensure that the District has the resources to rebuild affected portions of the system in a way that mitigates potential hazards and enhances the sustainability of the system. Completion of the vulnerability assessment update and identification of which elements of the system are most critical for providing service will direct the District's recovery planning efforts.

Last Updated: September, 2016

11. Personnel 11-1

11. Personnel

Our employees are a vital resource in accomplishing the mission of the District. They manage the utility billing process and provide customer service, assist developers in following District standards when expanding the systems, ensure that District infrastructure is built and maintained in a reliable and effective manner and protect District ratepayers by delivering clean and safe drinking water in compliance with all required regulations and laws. These are important jobs that have a direct impact on the health of the community. Because the work of District employees is so important, the purpose of organizational staffing and development programs is to recruit, develop and retain the best available talent. This chapter describes the current workforce and the various efforts the District is undertaking, or will be in the future.

Last Updated: September, 2016

The Workforce

Employees at the District work under one of four departments that report directly to a General Manager, the organization's chief executive officer. Those four departments are: Administrative Services, Engineering & Development Services, Maintenance & Operations and Finance.

Due to population growth, regulatory requirements, infrastructure maintenance needs, less reliance on professional services and consultants, re-organization and many other factors, the District's workforce has grown by approximately 15% over the past five years. This change has allowed for better regulatory compliance, increased cost efficiency and a higher level of service for District customers. Currently, the District provides 0.46 million gallons per day (mgd) of water per full-time equivalent (FTE) employee.

The District is committed to increasing efficiencies in the future through process improvement, evaluating the level of success and effectiveness of the current work programs.

Last Updated: October, 2017

Staffing Turnover

Over 13% of the workforce has been employed at the District for 20 years or more. The District historically has a low turnover rate, averaging approximately 6% on an annual basis during the past five years.

The longevity of the current workforce provides many benefits including experience, institutional knowledge, familiarity with the community and security. However, longevity and low turnover rates do not come without challenges. If trends continue, the age groups of employees that will see the most growth over the next five years are those in their 20s and 50s. This means the District workforce will have many new, inexperienced employees and many longer serving, experienced employees who are beginning to think about retirement.

In order to capitalize on the strength of its workforce and prepare for vacancies in key positions, the District plans to implement a succession planning program. Although the District believes that outside competition is vital to success and requires all leadership positions be filled through a recruitment process that includes external candidates, it also believes that developing lines of succession will ensure that our customers and ratepayers will continue to benefit from the skills of the current workforce into the future. This effort will better prepare the District to deal with work program expansion, the loss of a key employee, reorganization, or filling a newly created position.

The District is currently implementing and planning to expand a leadership development program to support succession planning efforts. The program includes many goals such as increasing the number of internships offered at the District and providing targeted training and development opportunities to employees. The District believes that developing good leaders will increase innovation, creativity, efficiency and productivity while improving communication, clarifying the District's mission and vision and ensuring the organization is prepared for the future. The leadership development program is in line with the District's mission to be a leader in customer service, environmental stewardship and regulatory compliance. Our customers will benefit from the programs objectives which are to support the District's goal of being a desired employer in the region, engage and retain employees, prepare for future job vacancies, break down communication barriers and increase the level of decision making at the District.

Last Updated: September, 2016

Certifications and Training

The District is currently undergoing efforts to intensify a learning environment for its employees. The District believes that these efforts will enable the organization to remain competitive and efficient and adapt to change more effectively in the future.

As a water service provider, the District is required by the Washington State Department of Health to have certain certification levels within the workforce. The following table lists some of the employees that have obtained the required state certifications:

Table 11.1: Water Certifications Required by Department of Health

Position	Certifications
M & O Director	WDM IV
M & O Superintendent	WDM IV, CCS
Field Operations Manager – Water Quality	WDM II, CCS
Cross Connection Technician	CCS, BAT

M & O = Maintenance & Operations
BAT = Backflow Assembly Tester
CCS = Cross Connection Control Specialist
WDM = Water Distribution Manager

The District encourages employees to earn certifications by paying for annual certification fees and course tuition as well as providing time off work for training and testing. The District also provides and pays for staff opportunities to earn continuing education units (CEUs) for the purpose of maintaining certification levels.

Training plans have been developed to ensure that required certification levels are kept and that other needed skills are developed within the workforce. These training plans will also help the District reach succession planning goals.

Last Updated: August, 2017

Levels of Service

The District expects that work program growth will impact staffing needs over the coming years. The Maintenance & Operations Chapter identified several areas where growth may occur in the future, including:

- Easement Inspection and Maintenance
- Equipment and Fleet Maintenance
- Financial Analysis and Billing
- Fire Hydrant Inspection
- Management Analysis
- Project Engineering
- Recordkeeping and Reporting
- Supervision and Management
- Supervisory Control and Data Acquisition (SCADA)
- Training Coordination
- Water Leak Detection
- Water Quality Monitoring

Decisions regarding development or growth of any work program will ultimately be made by the Board of Commissioners after factoring in population growth, community demographics, regulatory requirements, the economy, available budgeted resources, the desires of District customers and other factors.

Last Updated: September, 2016

Safety

The District’s safety program applies to all employees of the District as well as vendors, contractors and visitors. The program has been developed on the principle that all accidents and on-the-job injuries can be prevented through increased awareness and the implementation of sound policies, practices and procedures. District management is charged with providing the safest workplace possible and all employees are accountable for following all written or unwritten rules, being aware of hazards and preventing accidents and injuries.

As part of its efforts to keep employees safe, the District has an accident prevention program. The purpose of the program is to outline management and employee responsibilities in regards to safety, the duties and functions of the safety committee, hazard prevention and reporting procedures, emergency plans, as well as orientation and training efforts. The District also has programs and procedures in other areas including confined space entry, fire safety, first aid, accident investigations, climbing and lifting, lock-out / tag-out, fall protection, personal protective equipment (PPE) and hazard communication. Employees are provided training in these areas on a regular basis. The District recently implemented a morning joint stabilization exercise program in an effort to avoid on-the-job musculoskeletal and lumbar injuries.

In the event that an on-the-job injury does occur, the District works with the injured employee in order to ensure they return to work as soon as possible. The District has aggressively implemented a light duty/modified job assignment program that provides doctors more options to release injured employees back to work.

In the past five years, the District's safety program has had a positive impact on reducing the number of hours employees are injured and away from work.

The District plans to have its safety programs reviewed and assessed by the Department of Labor & Industries (L&I) and the Occupational Health and Safety Administration (OSHA) to identify opportunities for future success. There are also plans to evaluate the potential effectiveness of requiring employee physicals not only before but during employment and to ensure that required safety training is appropriately matched with individual job specifications.

Last Updated: September, 2016

12. Information Technology 12-1

12. Information Technology

Effective information technology (IT) solutions help employees accomplish the District's mission by managing information related to service, infrastructure and resources. Employees use these tools to maintain the systems that deliver clean water, collect and treat wastewater, bill for services, communicate with customers, share information, plan for future needs and maintain compliance with regulations. Since employees are one of the District's most vital resources, the purpose of the technology program is to enhance their productivity to allow them to focus on efforts that best serve our customers now and in the future. This chapter describes the current program and improvement efforts.

Last Updated: September, 2016

Current State

In addition to common productivity tools like spreadsheets and email, delivering service to our customers relies on numerous business applications. While it's impractical to list all these applications, several of the software packages most critical to our operations are:

Table 12.1: Current Software Environment

Software Type	Purpose
Maintenance Management	Protects the safety and reliability of system infrastructure by managing work orders, preventative maintenance, assets, purchasing and inventory.
Meter Reading Software and Utility Billing Software	Keeps the District financially viable by tracking water use and billing customers for services provided.
Financial Reporting	Provides the information needed to set rates, track money and generate reports required for financial monitoring and audits.
SCADA	Supervisory Control and Data Acquisition software operates the equipment that controls water flow, volume, collection and treatment of water.
Timekeeping	A tool for managing employee attendance and hours, allowing employees to continue to repair and maintain our system infrastructure, meet customer service needs and attend to other operational needs.
Payroll (Software as a Service)	Pays the employees that deliver our services, keeping them on the job.
Maps	Provides the information necessary to locate our assets and infrastructure for repairs, protection and maintenance.
Construction Project Management	Manages construction project documentation to ensure new infrastructure, major upgrades and extensions are implemented according to standards and regulations, allowing our system to remain safe and reliable.

The District's current technology portfolio is the result of the historical practice of workgroups selecting the best solution for their desired function. While this often provides the most specialized tools, it also results in trying to manage the same information in several places, resulting in duplicate data entry, data integrity issues and increased support requirements.

Last Updated: June 10, 2015

Strategic Direction

To effectively control customer costs and maximize investments, the District is moving to a more holistic philosophy where solutions are selected and implemented according to the combined needs of the entire District. The fast rate of technological evolution provides opportunities to continually evaluate, upgrade, or replace technology. Solutions will be selected by balancing requirements with standardization benefits while prioritizing consolidation and integration. To support this strategic shift, the District is mitigating risks by implementing process improvement strategies, improving communication between departments, providing necessary resources and promoting collaboration, adaptability and unity of direction. Meeting business needs with the fewest possible solutions, or a single enterprise solution, will improve efficiencies and make our staff and services more competitive.

Last Updated: September, 2016

Planned Improvements

The following table describes IT projects the District will pursue over the next three to five years to address identified needs, enhance productivity, control costs and improve service to our customers. *Chapter 13 – Capital Improvement Plan* also includes these projects.

Table 12.2: IT Projects

Project	Purpose
Infrastructure Replacement	Replace aging servers and storage solutions to maintain business operations and meet records retention requirements.
IT Integration	Consolidate and integrate systems to minimize duplicate data entry and maximize data integrity and accessibility.
Electronic Records Management	Implement tools that will reduce liability by improving our ability to maintain and manage records and comply with legal retention requirements.
Geographic Information Systems (GIS)	Implement solutions that support industry best practices for providing map information related to our system and improve our ability to locate buried assets.
Website Redesign	Identify and implement improvements to our website to increase access to information, provide greater options and flexibility to help our customers to manage their accounts, and promote engagement with our community.
Communication \ Intranet	Implement solutions that will improve communication and accessibility to information that personnel need to make great decisions and take action.
Asset Management	Implement tools that will inform strategic repair and replacement decisions for infrastructure to support cost effective service and risk management.

In accordance with our new strategic direction, IT projects are managed, governed and prioritized based on the combined needs of the District through collaboration with all departments and stakeholder representatives. Relationships and impacts between projects are also continually monitored and managed.

The next several years will be a time of change, opportunity and improvement for IT within the District. The success of these efforts will depend on the participation, cooperation and inspiration of District employees.

Last Updated: September, 2016

13. Capital Improvement Program

A capital improvement program identifies, prioritizes, budgets and schedules projects to address system deficiencies and needs. These deficiencies and needs are identified in other chapters of this Plan. The projects proposed in this chapter are intended to resolve the deficiencies and needs related to the following:

1) Recurring maintenance issues or repairs;
2) Preventative maintenance issues;
3) Capacity improvements to infrastructure for future growth;
4) Replacement of infrastructure at the end of useful life;
5) Planning for replacement of capital support items such as support facilities, software and vehicles; and
6) Coordination with franchise and wholesale contract agencies.

This chapter will explore several of the options for establishing a capital improvement program for the District and present the recommended program. Detailed information related to this chapter, including project listings, individual project sheets and project costs, can be found within the Capital Improvement Program Technical Memorandum located in the Appendix.

System Overview – WAC 290-290-100(4)(a)

As discussed in Chapter 1 - System Description and Chapter 5 - System Analysis, the District's retail water service boundary covers approximately 44 square miles spanning from Puget Sound to just east of the Bothell-Everett Highway (State Route 527) and from the King/Snohomish County line northward to just south of Paine Field.

The District's water system currently consists of:

- Two connection points to the Everett water system;
- Four pressure zones served directly by three pump stations and indirectly by one pump station, (the Clearview Water Supply Agency pump station);
- Three automatic control stations;
- Three active pressure reducing stations;
- Over 660 miles of pipe including transmission mains;
- Eight water storage facilities;
- Over 50,000 services and meters;
- Support facilities at the District Administrative and Maintenance and Operations sites;
- Many information technology components consisting of hardware and software packages (shared with sewer system); and
- 152 vehicles and pieces of moving equipment used to maintain and support the system (shared with sewer system).

The following sections describe how a capital improvement program for this expansive system was developed and how the future needs of the system are anticipated to be met.

Last Updated: September, 2016

Capital Improvement Program Development

When developing a Capital Improvement Program (CIP), numerous models can be utilized. The District's 2009 Water System Plan (WSP), for example, identified two general categories of improvements. The first category addressed the needs and deficiencies identified by modeling and system analysis. The second category addressed ongoing annual capital projects to address fire flow, pressure, or recurring maintenance issues. In addition to those criteria, this current program will add infrastructure useful life and condition assessments as considerations when developing future projects. This CIP relies heavily on the improvements identified in the 2009 WSP, but suggests investing in a more rigorous asset management approach for the District to further refine CIP project priorities.

This CIP also considered input from a wide range of staff and other sources regarding needs that may not be captured by the more traditional evaluation approaches used in previous planning efforts.

The CIP is divided into functional categories for budget and tracking proposed improvements to the water system including:

- Supply Facilities;
- Automatic Control and Pressure Reducing Stations;
- Pump stations;
- Transmission Mains;
- Storage Facilities;
- Distribution Mains;
- Services and Meters;
- Capital Support Items; and
- Franchise / Other Agencies.

Last Updated: September, 2016

Basis for CIP Cost Estimates

Planning level construction cost estimates for linear projects were based on a review of several recent projects within the District. The comparison is available in *Appendix B – Capital Improvement Program Technical Memo*. These projects tended to include a selection of smaller sized jobs because of the recent project requirements. The prices used were taken from the District's Project Cost, Time and Expense tracking system and included all costs from initial pre-design through final completion inclusive of internal staff time. These costs were then compared against other industry sources to develop a set of planning level estimates. These estimates may vary from the other planning estimates when special conditions apply or more detailed cost estimates have been prepared as a part of the pre-design efforts. Table 13.1 shows the cost per lineal foot for water main replacement projects.

Last Updated: September, 2016

Table 13.1: Projected Water Main Replacement Cost

Replacement Diameter	Total Project Cost on a Linear Foot Basis
8"	$325
12"	$390
16"	$455
18"	$485
24"	$600
30"	$680

Planning level construction cost estimates for non - linear improvements were individually estimated. These estimates are considered to be very general in nature; final project costs are expected to be within a range of -50% to +100% of the planning estimate. All numbers are in 2014 dollar value and inflation has not been included.

None of the planning level construction cost estimates include specialized construction techniques such as the use of trenchless applications, nor do they give consideration for special materials or equipment.

Last Updated: September, 2016

Capital Improvement Program Approaches

The CIP development reviewed four different scenarios. The four scenarios generally consist of:

1) Scenario One: Continuation of the Capital Funding based on transfers from the Operating Fund at current levels;
2) Scenario Two: Replacing a uniform percentage of the water system infrastructure each year;
3) Scenario Three: Replacing the water system infrastructure at the predicted end of its useful life; and
4) Scenario Four: Replacing the water system infrastructure based on asset management strategies temporarily modified by CIP delivery capacity.

The continuation approach and the uniform percentage approach are primarily illustrative examples and are prepared without detailed analysis. Scenario Three and Scenario Four are assessed in significantly more detail. The following is a discussion related to the four different scenarios and concludes with Scenario Four, the preferred path. All supporting information related to these Scenarios can be found in Appendix B - Capital Improvement Program Technical Memo.

Scenario One – Continuation of existing funding

Since 2012, the District's fiscal policy has been to transfer $3.5 million into the water capital improvement fund each year from the water operating fund. This scenario reviews the long-term sustainability of this approach to funding capital improvements.

Recent history and review of the collected Water General Facility Charges (GFC) show variability in the annual amounts collected. For the purposes of this scenario, collecting an average of $1,500,000 per year from GFC was used; this results in a total annual non-debt funding for the water CIP of $5,000,000. Using an average of replacement costs listed in Table 13.1 above weighted by the amount of pipe sizes present of the system results in an average replacement cost of $350 per foot, all inclusive. An adjustment was included for the pump stations and the reservoirs, but all other capital uses such as support functions were not included.

Scenario results:

Miles of water main	660 miles
Equivalent miles for Pump Stations & Reservoirs	+86 miles
Total equivalent miles	746 miles

(746 miles of pipe x 5,280 feet/mile x $350/foot)

$5,000,000 per year

= 276-year replacement cycle

While this scenario is an obvious simplification of the replacement needs, it does illustrate the future reliability challenges with a simple replacement of infrastructure at a set dollar limit per year.

Last Updated: September, 2016

Scenario Two – Replacement of a uniform percentage of Infrastructures

The District has approximately 660 miles of water pipe in the ground. Each type has an estimated useful life span as shown in Table 5.1, *Chapter 5 – System Analysis*. A weighted average of pipe useful life within the District is 99.6 years. The equivalent length of pipe for the pump stations, the reservoirs and other facilities was calculated in the same fashion as Scenario One. Furthermore, the expected useful life of all water facilities is considered to be the same as pipe even though the actual useful life span of the pump station component is lower than that of pipe.

Scenario results:

Total equivalent miles	746 miles
Average life span	÷ 99.57 years
	7.5 miles per year

7.5 miles of pipe x 5,280 feet/mile x $350/foot

= **$13,850,000 per year water Capital Replacement Program**

This scenario is also a simplification of replacement program schedule; but it does illustrate the funding challenges with replacing a set percentage of infrastructure each year.

Last Updated: September, 2016

Scenario Three – Replacement of infrastructure at the end of useful life

Scenario Three, compared to the first two scenarios, is much more comprehensive in its analysis. The basic premise behind Scenario Three is replacing infrastructure at the end of its estimated useful life. This requires detailed tracking of all of the District's assets to ensure that infrastructure is replaced when its approximated useful life has been reached. Budgetary considerations are directly related to when existing assets are anticipated to require replacement and financial plans (i.e., *Chapter 14 - Financial Plan*) are prepared accordingly.

As part of Scenario Three development and to track replacement of infrastructure at the end of useful life, the large majority of District assets were documented, assessed and tracked. This extensive undertaking is documented in *Appendix B - Capital Improvement Program Technical Memo*. As part of the detailed Scenario Three analysis, all AWWD water system assets were divided into the major categories shown in Table 13.2. These categories form the basis of the entire Capital Improvement Program and will be repeatedly used in Scenarios Three and Four, as well as the corresponding financial analysis.

Table 13.2: Infrastructure Categories Considered in Scenario Three

Category	Quantity	Type
Supply Facilities	2	Connections
Automatic Control/Pressure Reducing	7	Stations
Pump Stations	3	Facilities
Transmission Mains	355,499	Feet
Storage Facilities	8	Reservoirs
Distribution Mains	3,128,534	Feet
Services & Meters	50,600	Services
Capital Support Items	2	Sites
Franchise / Other Agencies	Multiple	Agencies

The infrastructure categories shown in Table 13.2 above are discussed in *Chapter 5 – System Analysis* and in *Chapter 1 - System Description*. Projected expenses for each category are contained in one of three capital program expense items for CIP budgeting and financial planning as shown in *Chapter 14 – Financial Plan*. The capital support items and franchise/other agencies categories are shown as separate items, while the remaining categories are consolidated into the capital projects item in *Chapter 14 - Financial Plan.*

All District assets within each of the categories in Table 13.2 were assessed based on the year they were installed or constructed. From this baseline, a schedule for estimated time of replacement was created to ensure that assets are replaced at the end of their estimated useful life. Cost projections based upon this replacement schedule were created to ensure financial planning be directly related to the replacement schedule. Finally, in addition to replacing existing assets based upon the useful life schedule, additional system needs are identified and planned as part of the overall plan.

Last Updated: September, 2016

Based upon these assumptions, Table 13.3 shows the estimated expenses for the capital program for years 2016 through 2025 by category for Scenario Three. The detailed cost projections are located within *Appendix B – Capital Improvement Program Technical Memo*, which contains costs for the six-, ten-, 20- and 100-year scenarios.

Table 13.3: Annual Costs for Infrastructure Categories Considered in Scenario Three (In Millions, 2014 Dollars)

Category	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Supply Facilities	$0.50	$0	$0.20	$0.50	$0	$0	$0	$0	$0	$0
Automatic Control & Pressure Reducing Stations	$0.20	$0	$0.30	$0.40	$0.54	$0.15	$0	$0.20	$0.20	$0.70
Pump Stations	$0	$0	$0	$0	$0	$0.05	$0	$0	$0.75	$1.25
Trans. Mains	$8.12	$3.61	$3.17	$0	$3.58	$0	$0	$0	$0	$0
Storage Facilities	$0.25	$0.59	$4.17	$0	$0.40	$0	$0.29	$0	$0.30	$0
Distribution Mains	$1.64	$5.40	$0.69	$0.58	$18.52	$0.18	$0.18	$0.18	$0.61	$0.28
Services & Meters	$0	$0	$0.58	$0.27	$0.27	$0.29	$0.29	$0.28	$0	$0.09
Capital Projects Subtotal	$10.71	$9.6	$9.11	$1.75	$22.91	$0.67	$0.76	$0.66	$1.86	$2.32
Capital Support Items	$0.45	$1.12	$0.48	$0.48	$0.48	$0.78	$4.70	$0.48	$4.98	$0.48
Franchise / Other Agencies	$0.51	$0.88	$0.30	$0.30	$0.80	$0.30	$0.30	$0.30	$0.30	$0.30
Total Capital Program Expenses	$11.67	$11.60	$9.89	$2.53	$24.19	$1.75	$5.76	$1.44	$7.14	$3.10

Last Updated: September, 2016

Scenario Four – Path forward CIP

Scenario Three, described previously, is a combination of known scheduled projects and upcoming activities at an expected end of useful life. While very useful for gauging long-term needs, it does not account for actual conditions of assets at the end of useful life and detailed replacement programming. Scenario Four, the chosen CIP approach, uses the assumptions and analysis conducted in Scenario Three as a baseline but is also an adaptive approach to evaluating assets near the end of useful life to maximize the use of an asset while reducing operational risks. Some assets will last longer than the predicted useful life; others may require replacement prior to the end of its expected useful life. Accounting for these variations can:

- Reduce risk by replacing assets that are deteriorating faster than expected;
- Maximize investments by retaining assets that remain serviceable longer than expected;
- Extend asset useful life and minimize costs with effective rehabilitation; and
- Provide the expected level of service to the consumers at the lowest net lifetime costs.

Scenario Four will discuss each of the infrastructure categories identified in Table 13.2 in more detail as well as the District's current ability to deliver projects, the validity of capacity projects proposed by previous planning efforts, hydraulic modeling of system capacity and asset management. Detailed information related to each category can be found in *Appendix B – Capital Improvement Program Technical Memo*.

Supply Facilities

The District has long term supply contracts with the City of Everett and Clearview Water Supply Agency (CWSA) (see *Chapter 2 – Related Plans, Agreements and Policies*). *Chapter 5 – System Analysis* included the automatic control and pressure reducing stations in its analysis of the sources of supply for the 285 and 520 zones. This chapter separately discusses the automatic control and pressure reducing stations leaving only supplemental treatment and the artesian well in the Supply Facilities category.

No plans exist for modifications at the artesian well site.

As shown in *Chapter 1 – System Description*, the District has four sodium hypochlorite systems that are maintained and operated to provide additional disinfection for the distribution system. The District is considering improvements for these facilities including:

- The purchase of a trailer-mounted sodium hypochlorite system to provide both redundancy and emergency response in 2019;
- The replacement of the sodium hypochlorite system at Reservoir No. 1, which is under construction and will be completed in 2017; and
- Upgrading the remaining three sites, with design in 2018 and construction in 2019.

Thereafter, replacement of these systems is expected at 15-year intervals.

All other costs for maintaining supply are incorporated within the rate structure set by the City of Everett or the CWSA in the wholesale water supply contracts (see *Chapter 2 – Related Plans, Agreements and Policies*).

Last Updated: September, 2016

Automatic Control and Pressure Reducing Stations

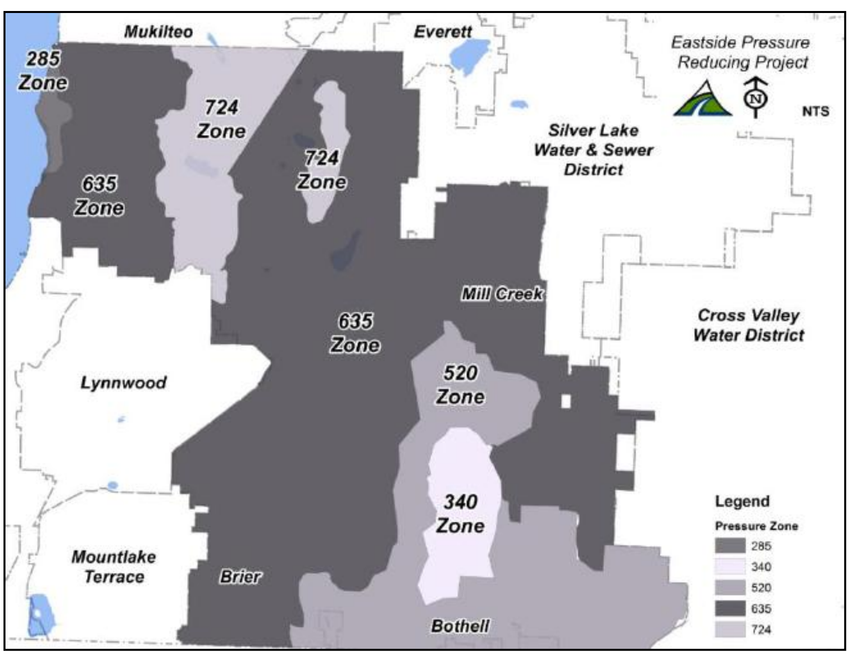
As shown in Chapter 5 – System Analysis, the District currently operates three automatic control valve stations and four pressure reducing valve stations. There are also two pressure reducing valve stations that are currently not in service. All the automatic control valve stations and one of the active pressure reducing valve stations are connected to the Supervisory Control and Data Acquisition (SCADA) system. The station at 49th Ave SE is scheduled to have its lid replaced in 2018, but due to low usage it will not be connected to SCADA at that time.

Each station is assumed to have a useful life of 40 years and the vault is assumed to have a useful life of 80 years. Further, it is assumed that each station that is not connected to the SCADA system should be connected during its next upgrade. For reference, the Lockwood PRV was installed in 2013 and the Canyon Park ACV was replaced in 2015 per the current design standard for long term facilities and their costs were approximately $390,000 and $470,000 respectively. The Canyon Park station was constructed above ground, while the Lockwood Station was constructed underground. Replacing the station's internal components is assumed to be approximately one fourth of the cost of a new station.

The Eastside Water Pressure Reduction Project is scheduled to be constructed from 2018 to 2020. This project contemplates creating a new 340 pressure zone and expansion of the 520 pressure zone which will require the construction of new PRV stations and replacement of one existing station. Figure 13.1 shows the current plan for the Eastside Water Pressure Reduction Project. A detailed analysis is currently being conducted as a part of the preliminary engineering for the project to finalize the scope and configuration of the project.

Last Updated: December, 2017

Figure 13.1: 520 Zone Expansion & 340 Zone Creation



Pump Stations

The District currently owns and maintains three pump stations. The District also operates and maintains the Clearview Pump Station on behalf of the Clearview Water Supply Agency. The three District-owned stations have all been rehabilitated between 2010 and 2014 as discussed in previous chapters. Based on the useful life of the various components listed in Table 5.5, *Chapter 5 – System Analysis*, an incremental approach is taken when planning for pump stations and only the class of components at the end of their useful life would be considered for replacement.

Chapter 5 – System Analysis also discusses the need for a new booster pump station to act as a redundant source of supply for the 724 zone, but the new pump station site and station sizing has not been completed. Planning level estimates are shown for 2025 and 2026 at $2.5 million with preliminary design beginning in 2025.

Last Updated: September, 2016

Transmission Mains

The District's water system has a backbone of larger water mains categorized as transmission mains. Replacement of these larger capacity mains will be considered as a separate activity from the distribution mains. The replacement schedule assumes the same longevity as the distribution mains and is shown in Table 5.1 *Chapter 5 – System Analysis*. This scenario includes replacement of mains at the end of their useful life as well as replacement or repair due to capacity, maintenance, risk or damage concerns. Transmission line No. 1 was constructed in 1962 and has a 30-inch diameter segment and a 36-inch diameter segment. This concrete cylinder pipe should be investigated for structural integrity in 2017 under this scenario. No other transmission mains are scheduled for increased monitoring or replacement under this scenario.

Several capacity projects from the previous Plan that are discussed in *Chapter 5 – System Analysis* are included in this Scenario Four. The D-1 Eastside Water Pressure Reduction Project 24-inch transmission main is being built in phases, with the first phase currently under construction. All phases of this project are scheduled to be completed in 2017. Projects D-34 and D-35 are pending verification by the modeling efforts discussed in Chapter 5 – System Analysis and are scheduled for 2020-21 time frame. Projects D-46 and 47 are also pending model verification and scheduled for the 2027-28 time frame.

Last Updated: September, 2016

Storage Facilities

As shown in Chapter 1 – System Description, the District maintains and operates 8 water storage facilities and participates in the operation of the shared use of the Clearview reservoir. The locations of the various reservoirs and standpipes providing water storage to the system are also shown in that chapter. *Chapter 5 - System Analysis* has identified no additional storage requirements for the 20-year planning period.

Preservation of the existing storage structures are considered a capital expense and consists primarily of maintaining the coatings. Recent experience with reservoir coating systems suggest a 15-year recoating period should be assumed. However, the cycle may be stretched to 20 years should the coating remain in good condition. The recoating schedule is shown in Table 5.1 *Chapter 5 – System Analysis*.

Last Updated: September, 2016

Distribution Mains

The District's water system is largely comprised of water distribution mains. The replacement schedule for both water distribution and transmission mains if each is replaced at the end of its useful life is shown in Table 5.1, C*hapter 5 – System Analysis*. This includes replacement of only mains at the end of their useful life and does not include any pipes identified for replacement or repair because of capacity, maintenance, risk or damage concerns. Table 5.12 in Chapter 5 - System Analysis lists the distribution improvements contemplated in the 2009 comprehensive plan. The projects listed in this table that have not been completed and are still being considered have been included in the replacement schedule in *Appendix B - Capital Improvement Program Technical Memorandum*.

Last Updated: September, 2016

Services & Meters

As discussed in Chapter 5 – System Analysis, the District maintains approximately 50,600 retail water meters and services lines in the water system. There are no expenses for retail service lines and meters in the ten-year cost projections. The meter replacement program for retail services is scheduled to begin in 2031 and is included in the 20-year scenario detailed in *Appendix B – Capital Improvement Program Technical Memo*.

As shown in Chapter 6 – Water System Reliability, in Table 6.4 Interties with Adjacent Purveyors, the District has several metered and unmetered connections with adjacent purveyors. The replacement schedules and costs for metered interties is similar to those schedules shown for automatic control and pressure reducing stations discussed above and shown in *Chapter 5 – System Analysis*. Schedules and costs for the meter replacements at Pump Stations 1 and 2 are included with the pump station upgrades discussed above.

Last Updated: September, 2016

Capital Support Items

As discussed in *Chapter 5 – System Analysis*, Capital Support Items are District assets not discussed as a direct part of the water system in the preceding sections, but which are necessary for the proper functioning of the water utility are included in this category. The costs for the upkeep and replacement of these capital support items which include major equipment and vehicles, communications and data management systems, etc., must be considered when establishing a financial plan for the utility. Repairs, replacements and upgrades to the Administration Building and the M&O Facilities are also included in this category and are discussed in *Chapter 1 – System Description*.

Last Updated: September, 2016

Franchise, Outside Agency and Participation

Multiple other agencies influence or create projects and needs that the District must address. These projects are not part of the District's normally scheduled program based on capacity or useful life, but are required due to Franchise or other Interlocal agreements. This plan assumes an average expense of $300,000 per year for this type of project, which is shown in Table 13.3 above. For example, a City or County road widening project may necessitate relocation of District water and sewer lines or meters.

Last Updated: September, 2016

Scenario Four Planned Projects

Table 13.4 presents the District's schedule of CIP projects planned based on the preferred approach, Scenario Four, between 2016 and 2025. The projects earlier in the schedule are more specific and have been validated and the later years tend to be more programmatic. This presented table is part of a larger 100-year planning tool which will be routinely updated as part of the District's Living Plan process (see *Appendix B – Capital Improvement Program Technical Memo*). Completion of this program will require the successful implementation of several programs and an increase in levels of staffing.

Table 13.4: Annual Costs for Infrastructure Categories Considered in Scenario Four (In Millions)

Category	2016	2017	2018	2019	2020	2021	2025
Supply Facilities	$0.55	$0	$0.2	$0.5	$0	$0	$0
Automatic Control & Pressure Reducing Stations	$0.58	$5.40	$0.02	$0.04	$0.54	$0.15	$0.07
Pump Stations	$0	$0	$0	$0	$0	$0.05	$1.43
Transmission Mains	$9.30	$3.99	$3.11	$0	$0.28	$2.57	$0
Storage Facilities	$0.16	$0.42	$2.36	$2.14	$0.86	$0	$0
Distribution Mains	$1.33	$3.29	$1.20	$4.05	$5.33	$.43	$0.37
Services & Meters	$0	$0	$0.06	$0.89	$0	$0.02	$0.14
Capital Projects Subtotal	**$11.93**	**$13.11**	**$6.96**	**$7.61**	**$7.01**	**$7.02**	**$2.00**
Capital Support Items	$1.22	$0.26	$0.95	$0.43	$0.43	$0.46	$4.48
Franchise / Other Agencies	$0.51	$0.77	$0.30	$0.30	$0.80	$0.30	$0.30
Total Capital Program Expenses	**$13.66**	**$14.10**	**$8.21**	**$8.35**	**$8.24**	**$7.78**	**$6.78**

Appendix B – Capital Improvement Technical Memorandum contains more detailed descriptions and locations for the proposed CIP projects.

Last Updated: September, 2016

CIP Delivery Capacity

The District’s ability to actually deliver projects needs to be considered. Scenario Four starts from the needs-based Scenario Three and modifies it based on current known priorities. Proceeding with a recommended list of capital improvements that cannot be realistically delivered in the recommended time does not meet the District's objective of an implementable plan. In the near future the District’s ability to deliver projects will need to be increased to match the need.

A review of the District’s capacity to deliver projects with its existing staffing levels has been completed at a conceptual level; however, several caveats must be applied when utilizing historical data. The types of projects that have been completed in the last decade have some variances from the types of projects that are being proposed in the upcoming decade. Several large projects such as the Picnic Point Wastewater Treatment Facility (WWTF) and state route 99 water main replacement project (SR 99) can skew the data because of the very large project costs. A final caveat to consider is the movement away from a relying heavily on consultants for the capital project delivery approach (which was useful for delivery of those very large projects) and the current approach, which uses a larger proportion of in-house design. The in-house approach is anticipated to deliver lower-cost, higher-quality projects. This approach is also likely to require more District staff time to complete projects.

The ten-year delivery history of capital projects per project manager at the District was approximately $5.5 million. Removing the years the PPWWTF and SR 99 projects were expending significant dollars, the average was about $3.6 million per project manager. However, this was delivered utilizing consultants, so a direct comparison to in-house design of projects is not completely appropriate. Working backwards from standard industry design costs versus a project manager’s salary results in a rough estimate of $1 million of construction contract delivered per project manager per year. This must be tracked as the District begins delivering projects using a higher percentage of in-house design efforts and the projections revised accordingly. The initial projections for four project managers at the District are $4 to $14 million dollars annually. For planning purposes, it is assumed that the currently employed four project managers can deliver $14 million worth of capital projects annually using both in-house and consultant design services. Actual in-house capacity for the District’s project managers is being developed and evaluated while several larger projects taking place in the next several years will primarily utilize the consultant design approach. Additional analysis of staffing and delivery capacity will be ongoing and used in developing future CIP and staffing needs.

Last Updated: September, 2016

Validation of Previously Proposed Capital Projects

A number of projects on the CIP list are projects originally identified in previous comprehensive planning efforts. As documented in Chapter 5 – System Analysis, a number of these projects have been completed. A list of previously identified projects which have not been completed also exists. There is concern with the list of previous projects in both scope and time. Since the preparation of the previous comprehensive plan, the economic downturn changed many of the population and growth pattern projections that the modeling was based upon. Further, the revision in approach to the use of Clearview water into the District system and the decision to not create the recommended 660 zone changes the base assumptions used in the model. The model also significantly overstated the projected average and maximum day demands compared to actual activity over the past six years. Therefore, prudence suggests that the fire flow and pressure projects suggested in the previous Comprehensive Plan that have not been constructed should be verified before significant monies are spent on design or the construction is scheduled. It is recommended that beginning in approximately mid-2017, with the completion of the D-1 Transmission main, the existing water model be recalibrated and re-evaluated to properly model the improvements created by this transmission project.

Planning for these fire flow and pressure projects is scheduled to occur after validation modeling in 2017. Project delivery was also constrained to reflect the maximum annual project delivery discussed above and as shown in the CIP tables (Appendix B – Capital Improvement Program Technical Memo). Design work would begin in 2018 following validation efforts in 2017 with construction of selected projects beginning in 2019. The CIP will be updated as soon as the hydraulic model is recalibrated and system deficiencies are prioritized.

Last Updated: September, 2016

Validation of System Capacity

The current water hydraulic model was updated during the 2009 comprehensive planning effort. The District is currently considering purchasing updated modeling software that will function with future technological improvements at the District. As mentioned in the section above, there are differences between existing conditions and the assumptions built into the current model. Further, an updated model could look for additional or new capacity concerns within the existing water system. Accurate specific information can greatly increase the precision of a model's predictions. Calibrating the new model using data logging of pressures or flows at pumping stations, pressure reducing stations, select points in the distribution system, master meters and reservoir levels will improve the confidence in the modeling software and its output regarding capacity or pressure deficiencies. Other than the purchase of updated modeling software, this modeling effort would have no impact on the proposed Capital Improvement Program until results of the updated model become available in several years. At that time, any identified issues would be included in a future CIP update.

For preparation of the Scenario 4 planned projects shown in Table 13.4, the theoretical replacement schedule of Scenario 3 was modified. Identifying the issues has been very useful, but creating financial plans, staffing plans and rate increases based on the unverified assumptions used to create the Plan is not prudent. Until the proposed Asset Management plan is implemented, selecting which pipes are actually at the end of their life and needing replacement is very difficult. For Scenario 4 planning purposes, 100% of the replacement based on age (for the period of 2019 & 2025) were included until more robust confirmation of the exact timing for the need for replacement was developed. This was chosen as most replacements based on age occur outside the 20-year Scenario Four planning window, allowing re-evaluation in the next update.

Last Updated: September, 2016

Asset Management

A significant portion of the long-range Capital Improvement Program (CIP) involves replacing system elements as those components wear out at the end of their useful life. However, a blind replacement approach of pipes at the end of a predicted useful life span would leave the District replacing components before they reach the end of their useful life or responding to the emergency replacement of components that fail before their projected useful life span. This uninformed process would result in either failures causing disruption of service and unacceptable risks or replacing facilities which have many years of service left, leading to unnecessary additional costs. Validation of the proposed replacements is an important part of a responsible approach to the CIP.

Several approaches exist to address the effective management of the useful life of assets. The approach being recommended is the creation of a robust asset management plan. The District's asset management plan would likely be based on the EPA Framework for Asset Management as Discussed in Appendix A – Asset Management Plan Technical Memo.

Last Updated: September, 2016

14. Financial Plan 14-1

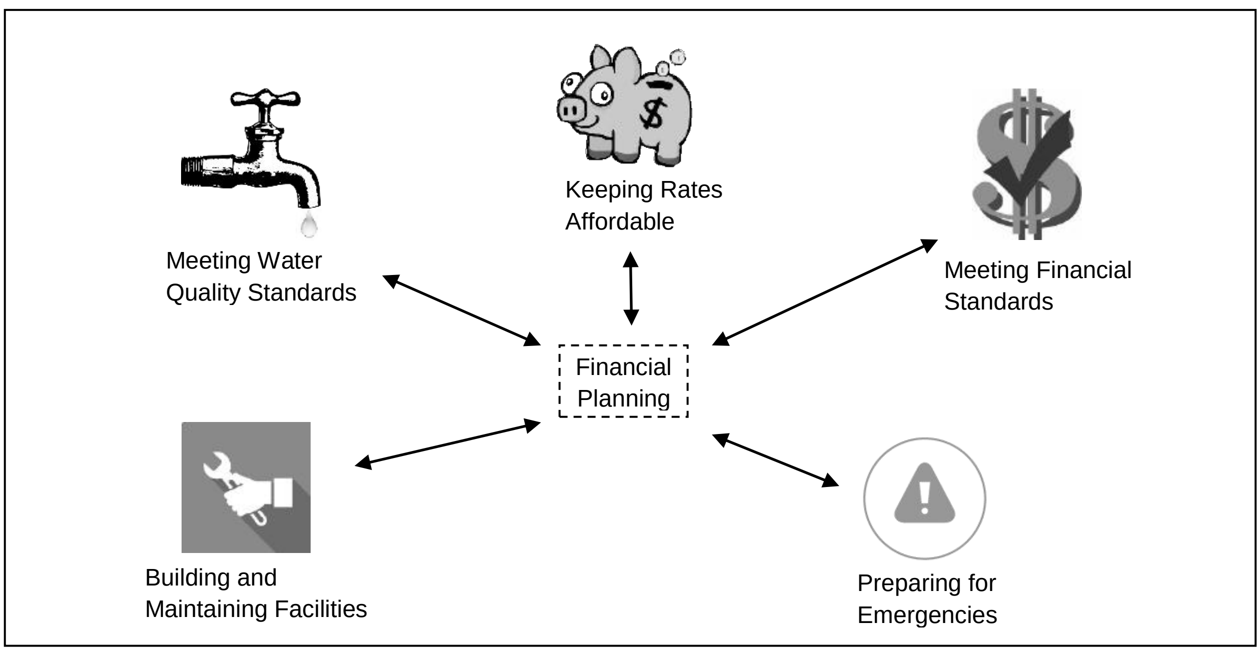
14. Financial Plan

The District has a sound financial program in place to fund maintenance and operations activities and capital improvements. This chapter provides an overview of the financial position of the District's water system and develops a financial plan to implement the programs and improvements identified throughout this Water Comprehensive Plan, including reviews of the sources of funds (revenues) and uses of funds (expenses) for the water system. A financial plan is presented with projected operating and capital costs of the system for the six-year period 2016–2021, the ten-year period 2016–2025 and the twenty-year period 2016-2035. The bases of the operating costs are the 2015 year-end actual and 2016-2017 budgeted amounts of water system revenues, expenses and project totals. The capital costs are based on the capital improvements plan presented in Chapter 13 – Capital Improvement Program.

The financial functions at the District manage the tension between several competing factors – providing safe and reliable water service, building and properly maintaining facilities for water service and meeting strict regulations for water quality standards – while setting affordable rates and maintaining appropriate levels of reserves for debt obligations, emergencies and spikes in expenses. The Finance Department strives to use sophisticated tools and innovative ideas to constantly improve the management of these inter-related parts and communicate financial information to internal and external stakeholders.

Figure 14.1 below presents the competing factors managed through financial planning.

Figure 14.1: Competing Factors Managed through Financial Planning



Last Updated: September, 2016

Overview of Financial Planning Process

Figure 14.2: Overview of the Financial / Rate Framework

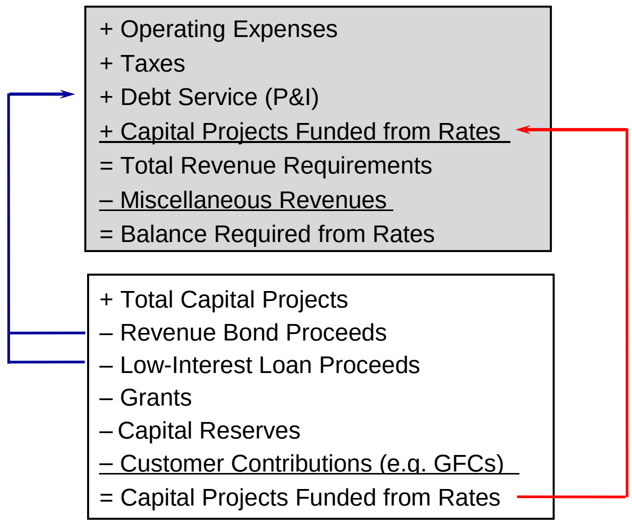


Figure 14.2 demonstrates the basic financial and rate setting framework in place at the District. This chapter will cover each line of the diagram in greater detail.

Last Updated: September, 2016

Past Financial Performance

The past five years of financial information for the water utility were evaluated to gain an understanding of the past performance and current financial status of the utility.

Table 14.1 provides a summary of the five-year financial history (2011-2015) for the District's water utility. As can be seen from the table, the District's revenue has exceeded operating expenses thereby maintaining a positive cash balance during the five-year period. The District has also used bonds and Federal and State subsidized loans as a supplemental source of revenue to meet the funding needs of the District's capital improvement program.

Table 14.1: Summary of Five-Year Financial History ($000s)

OPERATING ACTIVITY	2011	2012	2013	2014	2015
Sources of Funds					
Rate Revenues	27,090	29,186	27,695	31,199	33,045
Miscellaneous Revenues	1,848	2,986	2,760	5,733	3,957
Total Sources of Funds - Operating	**28,938**	**32,172**	**30,455**	**36,933**	**37,002**
Uses of Funds					
Operating Expenses	19,354	24,070	21,228	25,207	25,869
Taxes	1,048	1,086	1,147	1,185	1,258
Transfer to CIP from Rate Revenue	2,500	3,500	3,500	3,500	3,500
Debt Service	4,515	4,564	4,570	4,522	5,423
Total Uses of Funds - Operating	**27,417**	**33,220**	**30,446**	**34,414**	**36,050**
Annual Surplus / (Deficit) of Funds - OPERATING ACTIVITY	**1,521**	**(1,048)**	**9**	**2,518**	**952**
CAPITAL ACTIVITY	**2011**	**2012**	**2013**	**2014**	**2015**
Sources of Funds					
Transfer from Operating (Rates)	2,500	3,500	3,500	3,500	3,500
General Facilities Charges	696	912	943	986	953
Contributions by Developers	39	81	146	163	170
Outside Funding (Bonds / Loans)	-	-	-	2,166	362
Total Sources of Funds - Capital	**3,235**	**4,493**	**4,589**	**6,814**	**4,985**
Uses of Funds					
Capital Projects and Acquisitions	4,385	12,458	9,885	5,455	2,534
Capital Support Items					
Franchise / Outside Agency Participation					
Transfer to Operating (Meter Repl. Program)	-	-	-	2,000	1,000
Total Uses of Funds - Capital	**4,385**	**12,458**	**9,885**	**7,455**	**3,534**
Annual Surplus / (Deficit) of Funds - CAPITAL ACTIVITY	**(1,149)**	**(7,965)**	**(5,296)**	**(641)**	**1,451**

Note: The District did not track capital expenses in the three major categories used in Table 14-5 (Capital Projects, Capital Support Items, Capital Franchise Outside Agency & Participation) until 2015. The line “Capital Projects and Acquisitions” in the table above represents the total of all three categories.

As can be seen in Table 14.1, the utility has historically had adequate funding to meet each year’s operating needs, with the exception of 2012. In the capital fund, annual deficits are expected as projects are funded largely from bond and loan proceeds received in prior years.

Last Updated: September, 2016

Existing Long-Term Debt

Tables 14.2 and 14.3 illustrate the District's existing long-term debt repayment schedules. The District borrows money as needed through revenue bonds or subsidized loans in order to finance the construction and replacement of system infrastructure. Using debt to finance capital activity also helps allocate payment for the District's infrastructure to several "generations" of customers.

Table 14.2: Summary of Long-Term Debt ($000s) Payable by Repayment Period, Water Fund

Year	Principal Payable	Interest Payable	Total Debt Service Payable
2016	3,293	1,346	4,639
2017	3,589	1,226	4,814
2018	4,081	1,249	5,330
2019	2,191	1,105	3,296
2020	2,056	1,034	3,090
2021-2025	10,664	3,982	14,646
2026-2030	10,213	1,590	11,803
2031-2035	2,804	345	3,150
2036-2040	2,447	150	2,597
2041-2045	512	8	519
Total Outstanding Debt	**41,850**	**12,033**	**53,883**

Table 14.3: Summary of Long-Term Debt ($000s) by Issuance, Water Fund

Debt Issuance	AS OF DECEMBER 31, 2015		
	Principal (P) Outstanding	Interest (I) Outstanding	Total (P + I) Outstanding
PWTF - Reservoir Cover	$728	$18	$747
PWTF - Low Pressure	389	12	401
DWSRF - Pump Station 2 / Booster Station Upgrade	10,403	2,062	12,465
DWSRF - Pressure Zones Project	2,531	380	2,910
2009 Refunding Bond	9,055	734	9,789
2010 Revenue Bond Series B	18,744	8,828	27,572
Total Outstanding Debt	**$41,850**	**$12,033**	**$53,883**

Last Updated: September, 2016

Review of the District's Water Rates

In 2013 the District adopted a new water rate structure that meets its financial requirements. The new structure moved the District away from the winter/summer rates to an inclining block rate structure. It was felt that the winter/summer structure did not reward customers for their efforts to conserve water in the summer, while inclining block rates encourage water conservation efforts year-round. The District currently bills on a bi-monthly basis. Its rate structure consists of a base charge by meter size, consumption included in the base charge by meter size and a usage charge per hundred cubic feet (ccf) of water delivered depending on the tier the consumption occurs in. A rate of $2.40 per ccf is charged for consumption in the first tier, a rate of $2.90 per ccf is charged for consumption in the middle (second) tier and a rate of $3.50 per ccf is charged for the top (third) tier. The water bill for a District single-family customer with a 5/8-inch by 3/4-inch meter and 10 ccf of usage is $35.65 per month. Analysis of the impact of any necessary revenue adjustments that could impact these rates is provided later in this chapter.

Table 14.4 provides the 2016 adopted water rates of the District.

Table 14.4: Overview of the District's Current Water Rates

Meter Size	Bi-monthly Base Charge	Consumption (CCF) Included in Base Charge	Water Consumption Rate per CCF: $2.40 Bottom Tier	$2.90 Middle Tier	$3.50 Top Tier
3/4" x 5/8"	$ 29.90	4	5 - 14	15 - 50	> 50
3/4" x 3/4"	42.31	6	7 - 21	22 - 75	> 75
1"	67.15	10	11 - 35	36 - 125	> 125
1 1/2"	129.23	20	21 - 70	71 - 250	> 250
2"	203.74	32	33 - 112	113 - 400	> 400
3"	402.43	64	65 - 224	225 - 800	> 800
4"	625.95	100	101 - 350	351 - 1,250	> 1,250
6"	1,246.82	200	201 - 700	701 - 2,500	> 2,500
8"	1,991.89	320	321 - 1,120	1,121 - 4,000	> 4,000
10"	5,220.46	840	841 - 2,940	2,941 - 10,500	> 10,500

Last Updated: September, 2016

Development of the Financial Plan

A financial plan was developed to address projected revenues and expenses of the water system for 2016-2021, 2016-25 and 2016-35. The six-year financial plan demonstrates the District's ability to meet its operational and capital improvement needs through rate revenue.

In developing the financial forecast, four cost components were reviewed: operating expenses (including all expenses incurred by the District's main departments: commissioners, administrative services, planning & development services, finance and water maintenance & operations), taxes, debt service and capital improvements funded from rates. The District's adopted 2016-2017 water system budget was used as a starting point. Projections for future years were obtained by applying annual escalation factors. The escalation factors ranged from two percent to 7.5 percent depending on the type of cost being escalated. Medical benefits were escalated at 7.5 percent due to the recent trends and increases. General Facility Charges (GFCs) were escalated based on the 20-year average annual growth in the Seattle Construction Cost Index, as reported by the Engineering News Record. The basic assumption behind the growth in revenue is that the number of water connections will grow 1.5 percent each year, with no change in water use habits. In other words, growth in demand is driven solely by growth in customer base. This assumption is consistent with the long-term regional trend of flat or declining per capita water use. These same values were used for other growth-related factors in the financial plan.

Last Updated: September, 2016

Overall Revenues

The first component of the financial plan reviews the sources of funds of the water system. There are two primary types of revenues received for operations:

- Rate revenues – received from water sales to customers and
- Miscellaneous revenues – received from water connection fees, investment interest, penalties for late payment, lease revenue and other items.

Rate revenues are projected to total approximately 92% of overall revenues during 2016 – 2021.

Rate revenues are projected to be $33.5 million in 2016. Revenue growth was projected at 1.5% for growth in connections in 2016. In 2017, revenue growth is attributable to a projected 1.5% growth in connections and a 2% rate increase for retail customers. Beyond 2017, rate increases are projected as needed to recover costs and meet the District's fiscal policy requirements. The annual rate of growth in the number of connections is held steady at 1.5% throughout this financial plan. These assumptions result in projected rate revenue of approximately $39.5 million in 2021. The majority of miscellaneous revenue is from investment interest and general facilities charges (50% of water general facilities charges are allocated to the water operating fund). In 2016, the District expects to collect $2.95 million from miscellaneous revenues. In 2021, miscellaneous revenues are expected to total $2.98 million.

The total revenues available to the operating and capital needs of the water system therefore total $36.4 million in 2016 and increase to $42.5 million by 2021, as shown later in this chapter in Table 14.6.

The second part of the financial plan is a review of the uses of funds, or expenses, of the utility. Uses of funds include operating & maintenance expenses, taxes/transfer payments, debt service and capital improvement projects funded from rates. These costs are summarized below and are provided in Table 14-6, later in this chapter.

Last Updated: September, 2016

Operating Expenses

Year-end estimates for 2015 and the adopted 2016-2017 budget were used as starting points for the operating expenses of the water system. Operating expenses were further categorized by the District's departments: commissioners, administrative services, planning & development services, finance and maintenance & operations. As stated previously, escalation factors were applied to the 2016-17 budgeted amounts to obtain projected costs for 2018 through 2021. Overall operating expenses are projected to range from $26.9 million in 2016 to $31.7 million in 2021.

Last Updated: September, 2016

Taxes

In addition to sales taxes paid on purchased goods and services, the water system has two tax obligations. One tax is the state public utility tax calculated as 5.029% of the rate revenues of the utility. There is also the B&O excise tax of 1.5% on various service fees. There are certain exemptions for wholesale and irrigation sales that reduce the total tax obligation. Total taxes for the projected six-year period range from $1.3 million in 2016 to $1.6 million in 2021. The projected tax payments for the period assume no tax rate change over time.

Last Updated: September, 2016

Debt Service

There are currently five outstanding debt issuances related to the water system. These will be analyzed in three categories: Public Works Trust Fund loans, Drinking Water State Revolving Fund loans and Revenue Bonds.

Public Works Trust Fund

The District has two outstanding Public Works Trust Fund loans: 1) the 1999 Reservoir Cover project, with an annual obligation of approximately $192,000 and 2) the Low-Pressure project, with an annual obligation of $83,000.

Last Updated: September, 2016

Drinking Water State Revolving Fund

The District has one outstanding Drinking Water State Revolving Fund (DWSRF) loan, for upgrades to District water pumping facilities. The District began its payments on this DWSRF loan in 2015 and the average annual obligation starting in 2016 will be roughly $170,000. A second DWSRF loan was signed for a water system project that is currently under design with construction scheduled for 2016-2017. As part of this agreement, the District expects to receive the $10.4 million in loan proceeds in 2015, 2016 and 2017, depending on the project schedule. It is expected that the annual payments on this DWSRF loan will be approximately $520,000, beginning in 2018. This loan, though in progress, has been incorporated into all aspects of the water financial plan.

Last Updated: September, 2016

Revenue Bonds

The District has two revenue bonds that funded other capital projects. The District pays roughly $3.2 million annually for the 2009 Refunding Bond of $23.9 million and pays roughly $935,000 annually for the 2010 Series B Revenue Bond of $18.8 million. The payments for these bond issues often vary significantly each year of the projected period, in such a way that keeps the District's overall debt service obligation relatively level.

The District assumes that no new bonds or loans will be required to fund capital requirements in the next six years. Beyond 2021, the District expects to have capital needs that will require the issuance of revenue bonds. Between 2024 and 2035, the District expects to accelerate the replacement of aging infrastructure, which will likely require debt financing. To adequately fund the capital plan, this financial plan assumes that a bond issue in the amount of $50 million will be required in 2028, although eventual timing and amounts will depend on a number of factors. Due to the significantly decreased availability of funds from the PWTF and DWSRF programs, the District expects to exclusively use revenue bonds to finance future capital needs.

As shown in Table 14.6, later in this Chapter, total debt payments equal $4.6 million in 2016. Due to normal repayment and the 2018 maturity of the 2009 Refunding Bond, total debt service is projected to decrease to $3.0 million by 2021. The District has a policy of transferring 50% of general facility charges collected for new water connections to the operating fund to pay toward growth related debt. The remaining 50% of the GFC revenue stays in the capital fund.

Last Updated: September, 2016

Capital Improvement Projects Expenses and Funding

The capital improvement plan (CIP) of the utility contains needed infrastructure improvements. The modeling for this Plan identified a number of projects to improve fire flow and pressure related issues. The CIP also contains a number of renewal and replacement and growth-related projects. Renewal and replacements are, as the name suggests, the replacement of existing and worn out (depreciated) facilities. Some of the renewal and replacement projects are also major maintenance projects, such as reservoir recoating, while some are required due to regulations. Growth related facilities, on the other hand, are those related to system expansion and new customers. This financial plan has incorporated the capital projects outlined in the previous sections of this Plan.

The District currently transfers $3.5 million annually from water rate revenue to the water capital fund. Due to an expected acceleration of capital improvements expenses, the District expects to increase this amount to $5.0 million in 2019 and to adjust this amount as needed to adequately fund the capital program. In this way rates are also used to fund capital projects in future years. This assumption is built into the financial plan, as can be seen in Table 14.6.

Annual capital project costs for the six-year plan range from a low of $9.2 million in 2018 to a high of $15.3 million in 2017. Project costs are inflated by 2.83% per year (the 20-year average annual increase in the Seattle area Construction Cost Index (CCI), as published by the Engineering News Record magazine). Funding for the CIP will come from a mix of sources that include available capital funds, Developer/GFCs, subsidized loans and bonds. The District currently has a capital reserve balance of roughly $10 million and a balance of roughly $21.8 million in available capital funds. The District plans to use approximately $21.2 million of these funds, ending 2021 with approximately $600,000 in available capital funds.

Developer contributions/GFCs are escalated annually by the same 2.83% factor mentioned above from 2016 – 2021 and beyond. By resolution, the District adjusts its GFC each year in accordance with the CCI. GFCs are discussed in more detail below. A DWSRF loan will finance $10.0 million in project costs over the projected six-year planning period. A summary of the water system capital improvement program is presented in Table 14.5.

WATER CIP	2016	2017	2018	2019	2020	2021
Beginning Balances						
Available Capital Funds	21,816	16,437	11,516	7,530	4,674	2,219
Capital Reserve	10,000	10,000	10,000	10,000	10,000	10,000
Net Beginning Balance	**31,816**	**26,437**	**21,516**	**17,530**	**14,674**	**12,219**
Revenues to Capital Program						
Transfer from Operating (Rates)	3,500	3,500	3,500	5,000	5,500	6,000
General Facilities Charges (capital portion 50%)	893	920	946	973	1,000	1,029
Contributions by Developers	206	212	754	775	797	820
Outside Funding (Bonds / Loans)	4,258	5,783	-	-	-	-
Total Revenues to Capital Program	**8,858**	**10,415**	**5,200**	**6,748**	**7,298**	**7,849**
Expenses of Capital Program						
Capital Projects	12,436	14,264	7,785	8,760	8,292	8,544
Capital Support Items	1,267	224	1,062	495	509	559
Franchise / Outside Agency Participation	534	848	339	350	952	365
Total Expenses to Capital Program	**14,237**	**15,335**	**9,186**	**9,604**	**9,752**	**9,468**
Less: Transfer to Operating - Meter Repl.	-	-	-	-	-	-
Surplus / (Deficit) of Capital Funds	**(5,379)**	**(4,920)**	**(3,987)**	**(2,856)**	**(2,455)**	**(1,619)**
Ending Balances						
Available Capital Funds	16,437	11,516	7,530	4,674	2,219	600
Capital Reserve	10,000	10,000	10,000	10,000	10,000	10,000
Net Ending Balance	**26,437**	**21,516**	**17,530**	**14,674**	**12,219**	**10,600**

Table 14.5: Summary of Water Capital Improvement Program ($000s)

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As can be seen in Table 14.5, the capital reserve balance remains fully funded at $10 million over the six-year period. The available capital funds balance is projected to decrease over the period. Also of note above is the increase in capital funding from rates, starting in 2019.

As a result of using bonds and loans for capital financing purposes, debt service payments have an impact on rates. However, the District achieves equity of rates by spreading the cost of these projects over time to existing and new customers to the utility. In this way, several "generations" of customers will contribute proportionately to the cost of the improvement over its useful life.

These various funding sources are discussed in more detail to follow.

Internal Sources of Funds

General Facility Charge (GFC) revenue provides a means of balancing the cost requirements for new utility infrastructure to meet customer growth between existing customers and new customers. This charge is assessed to new customers as they “buy-in” to the system. By implementing fair and equitable GFCs, existing customers will not be burdened by the cost of growth as these fees are used to pay for growth-related capital improvements or to offset the debt payments related to the growth-related capital improvements.

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External Sources of Funds

The District has been effective in the past at securing loan funds for the Capital Improvement Program (CIP) and should continue to closely monitor future opportunities to obtain these potential funding sources. These funding sources are listed and described below. It is important to note that these sources rarely provide full funding of a construction project. It is also important to note that the State legislature has been divesting some of these funds to support general government functions and the District cannot rely on them as significant sources of CIP funding. Aside from revenue bonds, the District may receive outside financing for water-related projects through three programs - Drinking Water State Revolving Fund, Public Works Trust Fund and the Infrastructure Assistance Coordinating Council. Following is a description of each of these programs.

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Drinking Water State Revolving Fund

The Washington Department of Health (DOH) manages these funds. In August 1996 Congress reauthorized the Safe Drinking Water Act (SDWA) and appropriated funding for states to develop their Drinking Water State Revolving Fund (DWSRF) loan programs. Each state receives annual allocations in the form of a Capitalization Grant.

DWSRF loans are available to all community public water systems and non-profit, non-community public water systems, except federally and state-owned systems. At the time of writing, loans have terms ranging from six to twenty years. The standard interest rate is 1.5 percent, although reduced interest rates are available for systems with high affordability indexes. Other eligibility criteria apply to this funding source.

Last Updated: September, 2016

Public Works Trust Fund

The Public Works Trust Fund (PWTF) is a loan program established by the Washington State Legislature to assist cities, towns, counties and special purpose districts with funding for different types of public works projects. The projects can include streets, roads, drainage systems, solid waste facilities, water systems and sanitary sewer systems. The emphasis of allocating funds is based on replacement and/or repair of existing systems. Funds are granted to rehabilitate or replace an existing system serving an existing population.

At the time of writing, PWTF loans are issued at a maximum term of 30 years. The interest rate ranges from 0.5 percent for a 10-year term to 2.0 percent for a 30-year term. A debt service coverage requirement is not imposed on the PWTF loan. Funding for this trust fund exists at the discretion of the State legislature and may not be available long-term.

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Infrastructure Assistance Coordinating Council

One key resource in identifying other funding programs is the Infrastructure Assistance Coordinating Council (Council). The Council is comprised of state and local organizations that provide funding for infrastructure repair and development. The purpose of the Council is to assist local governments in coordinating funding efforts for infrastructure improvements. This is an important resource as the Council will be aware of any new funding opportunities that may arise.

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Revenue Bonds

Revenue bonds are another external source of funding for capital projects. The sale of revenue bonds is the most common source of funds for construction of major utility improvements. Water rates and charges are the main sources of funds for debt service (principal and interest) payments. A determination of the utility's ability to repay debt is an important consideration. A debt service coverage ratio (total annual revenue, less annual M&O and tax expenses, divided by annual debt service) is calculated and the utility's finances are reviewed in order to verify payments are feasible. Coverage ratios of 1.25 (25 percent more than the debt payment) are typical, but coverage of 1.75 is a more prudent financial target. The financial review for approval of a revenue bond is thorough and generally includes both current and past budgets, financial statements, budgetary practices and policies and reserve level balances.

Similar to revenue bonds, other bond financing approaches include utility local improvement districts (ULIDs), special assessment districts (SADs) and other funding for projects that serve and benefit a limited service area within the District's total service area. With such methods, the costs of those improvements are shared only by those customers benefiting from those improvements. While the District does have outstanding ULIDs, it is unlikely that they will be used as a financing tool over the twenty-year planning period. The developer extension agreement has largely replaced the ULID as the preferred method of local system expansion.

While the above list of possible grant, loan and other funding opportunities for the District is not exhaustive, it does highlight the most probable outside funding sources available to the District for its capital improvements.

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Summary of Financial Projections

A summary of the financial plan and resulting financial status of the water system is provided below in Table 14.6. This is an abbreviated summary of a more detailed analysis that was developed by the District and provides a summary of the major elements of the District's analysis, along with the findings and conclusions.

Table 14.6: Summary of the District's Six/Ten/Twenty-Year Financial Operating Plan ($000s)

	2016	2017	2018	2019	2020	2021	2025	2035
Beginning Balances								
Available Operating Funds	4,441	4,253	3,859	5,536	5,569	5,720	9,450	12,303
Operating Reserve	6,633	6,882	7,049	7,263	7,511	7,808	9,061	13,322
Rate Stabilization Reserve	7,064	7,064	7,064	7,064	7,064	7,064	7,064	8,290
Wholesale Rate Stabilization Reserve *	429	429	322	402	503	503	589	455
Debt Reserves	3,427	3,427	3,427	1,015	1,015	1,015	1,015	5,000
Total Beginning Balances	**21,995**	**22,055**	**21,721**	**21,281**	**21,663**	**22,110**	**27,180**	**39,371**
Sources of Funds								
Rate Revenues	33,473	34,461	35,570	36,740	38,106	39,528	45,153	63,432
Miscellaneous Revenues	2,951	2,817	2,840	2,873	2,925	2,984	3,342	4,642
Use of Available Operating Cash	-	500	750	-	-	-	1,000	-
Total Sources of Funds	**36,424**	**37,779**	**39,160**	**39,613**	**41,032**	**42,513**	**49,495**	**68,073**
Uses of Funds								
Operating Expenses	26,902	27,910	28,587	29,455	30,461	31,664	36,747	54,029
Taxes	1,323	1,389	1,433	1,480	1,534	1,591	1,815	2,543
Transfer to CIP from Rate Revenue	3,500	3,500	3,500	5,000	5,500	6,000	6,000	7,000
Debt Service	4,639	4,814	5,330	3,296	3,090	2,985	2,871	3,772
Total Uses of Funds	**36,364**	**37,613**	**38,850**	**39,231**	**40,584**	**42,240**	**47,432**	**67,344**
Annual Surplus / (Deficit) of Funds	**60**	**165**	**310**	**382**	**448**	**273**	**2,063**	**729**
Surplus/(Deficit) as % of Rate Revenue	**0.2%**	**0.5%**	**0.9%**	**1.0%**	**1.2%**	**0.7%**	**4.6%**	**1.1%**
Ending Balances								
Available Operating Funds	4,502	3,918	3,419	5,918	6,017	5,993	10,513	13,032
Operating Reserve	6,633	6,882	7,049	7,263	7,511	7,808	9,061	13,322
Rate Stabilization Reserve	7,064	7,064	7,064	7,064	7,064	7,064	7,064	8,290
Wholesale Rate Stabilization Reserve *	429	429	322	402	503	503	589	455
Debt Reserves	3,427	3,427	3,427	1,015	1,015	1,015	1,015	5,000
Total Ending Balances	**22,055**	**21,721**	**21,281**	**21,663**	**22,110**	**22,383**	**28,242**	**40,099**
Debt Service Coverage Ratios:								
Before Rate Adjustments	4.35	4.16	4.12	6.85	7.71	8.31	9.92	8.12
After Rate Adjustments	4.35	4.37	4.31	7.16	8.06	8.68	10.25	8.44

Table 14.6 above assumes a revenue bond issuance in the amount of $50,000,000 in 2028. This new issuance is assumed to have a term of 30 years at 5.0% interest. The debt service payments include debt service payments for the PWTF and DWSRF loans, both existing and new and the new bonds.

As can be seen from the above table, in order for the District to fund the full capital plan (as detailed in Table 14.5) and meet all operating expenses (given projected inflation), rate adjustments will be required. It is important to note that this level of adjustment is predicated upon an assumed 1.5 percent growth in the number of connections each year. Should this growth slow down, or not occur, the level of required rate adjustment may need to be increased, or CIP could be deferred and debt financing delayed. This would reduce the revenue requirement to a certain degree. If CIP funding from rates is reduced, this would reduce the upward pressure on rates, but over time it would also negatively impact the goal of funding the rehabilitation and replacement of capital infrastructure. To reduce CIP funding from rates also lowers the District's debt service coverage ratio which can impact future bond interest rates, thereby increasing future service rates.

Two indicators of financial viability are reserve levels and debt service coverage ratios. As can be seen in Table 14.6, the debt service coverage ratios vary each year (depending largely on the schedule of existing debt service), but do not drop below the target value of 1.75. The capital reserve balance is mandated by District policies to be set at the greater of 2% of original asset value or $10 million. This reserve is currently fully funded and is projected to remain fully funded throughout the planning period.

At the time of writing, no rate changes have been made in over two years and the next rate adjustment is not expected until late 2016. To implement future needed adjustments, the District developed a long-term projection of rate increases. The rate increase projection plan includes annual increases that range from 0.0% to 2.0%, as summarized in Table 14.7.

Table 14.7: Ten-Year Summary of Projected Rate Adjustments

	2016	2017	2018	2019	2020
Projected Rate Adjustments	0.0%	2.0%	2.0%	2.0%	2.0%

	2021	2022	2023	2024	2025
Projected Rate Adjustments	2.0%	2.0%	1.0%	1.0%	1.5%

The actual timing and magnitude of any rate adjustment will depend on the District's rate study and policy decisions. The District's fiscal policies, which were updated in 2013, state that rate studies should be conducted every three years using standard industry methodology.

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Rate Impacts

The rate impacts are lower than cost of living adjustments by the end of the ten-year projected period. In Table 14.8 below is a summary of the anticipated rate impact to a "typical" residential customer using 1,000 cubic feet (10 CCF) of water in a month with a 5/8 x 3/4-inch meter.

Table 14.8: Summary of the Projected Rate Impacts ($/Month) to a Typical Residential Customer [1]

	$/Month	Annual $ Change
2015	$35.65	$0.00
2016	$35.65	$0.00
2017	$36.36	$0.71
2018	$37.09	$0.73
2019	$37.83	$0.74
2020	$38.59	$0.76
2021	$39.36	$0.77
2022	$40.15	$0.79
2023	$40.55	$0.40
2024	$40.95	$0.40
2025	$41.57	$0.62

1. Assumes a 5/8" x 3/4" meter @ 10 CCF per month.

The average single-family residence uses roughly 7 ccf per month, which costs $26.95 per month or $323.40 per year. Based on Snohomish County's real median household income of $71,092, water service accounts for 0.45% of the median household budget. This value is known as the water service affordability indicator. The EPA standard is that wastewater service in excess of 2.5% of income constitutes a "large economic impact" (Affordability Assessment Tool for Federal Water Mandates, AWWA, 2013). The District's rates are thus well within general affordability standards.

Based upon the financial plan presented in this chapter, it appears that the rate impacts will be lower than projected inflationary impacts. At the end of the ten-year planning period, the rates will have increased roughly $5.92 per month over 2015 rates for a typical single-family customer. If the District tied its rates to inflation, assumed at 2.0% annually starting in 2016, the monthly rate in 2025 would be $42.61 per month. This compares to the actual projected 2025 rate of $41.57 per month.

The phased-in rate adjustments presented in Table 14.8 should be applied to both the meter and usage charges in order to generate the appropriate level of revenue needed to fully meet operational and capital costs throughout the six-year review period.

Asset Management and the Uncertainty of Future Rates

As mentioned in Chapter 13 - Capital Improvement Program, the District is on the cusp of embarking on a formal asset management program. Specifically, it is expected that before the next Water Comprehensive Plan is adopted, the District will have expanded GIS and SCADA systems and initiated an advanced system for cataloging, assessing and tracking the condition of assets such as pump stations, water mains and reservoirs. Once these technical systems are in place, the District will have the tools to make the best possible decisions about which capital projects to pursue and when. Given that the District began installing water infrastructure in the 1930s, certain assets are around 80 years old and nearing the end of their predicted useful lives. An asset management program will help the District make sound decisions as to the order of replacement and whether rehabilitation can add more life to assets.

It is important to mention that an asset management program will definitely bring changes to how the District prioritizes projects and the types of projects it chooses to pursue. It is likely that the program will more accurately identify aging and critical infrastructure in need of replacement or upgrade, resulting in an overall acceleration of the capital improvement program – within the next six years. An accelerated capital program is likely to increase water rates beyond the amounts listed in tables 14-7 and 14-8. Although it is impossible to predict those impacts with reliability, the asset management shift *could* result in rate increases that range from two to five percent per year, instead of the annual increases listed in the table 14-7. This chapter has shown that the District is in a strong financial position and can initially afford to fund expanded capital activity from available balances. But the expanded capital output would soon necessitate rate adjustments beyond what is covered in the rate impact tables above.

The transition from building new infrastructure to replacing aged infrastructure will be noticeable to our customers. For most residents in our service area, the price of their share of the water system was wrapped into the price of their homes. But the charge for replacing aging water system infrastructure will ultimately be covered by water rate revenue.

Beyond the effects of capital funding, there are outside factors that also add uncertainty to the future of rates. Aside from the variables that typically impact rates (operating costs, capital funding, e.g.), the following list of variables adds additional uncertainty to the level of water rates over the next six – ten years:

- Water quality regulations
- Climate change / drought
- Water consumption habits (driven by trends of smaller single-family residential lots, dense multi-family construction, more efficient appliances and conservation)

The following section makes conclusions about the financial position of the District and attempts to address how the District is managing the above risks.

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Summary

The financial plan results presented in this chapter indicate that water rates for the six-year projected time horizon of 2016 to 2021 will require adjustments to fund the projected M&O, capital and debt service requirements. This chapter identifies the overall level of rate impact that may occur should the capital improvement program provided in Chapter 13 - Capital Improvement Program move forward. However, the District conducts a detailed rate study at least once every three years to set new rates. The rate study evaluates the District's overall financial picture and develops rate strategies that fully fund the comprehensive needs of the water and wastewater systems on a stand-alone basis by analyzing:

- Long-term capital investment funding;
- Expenses incurred to operate, maintain and manage the system;
- Debt repayment and issuance of new debt;
- Cash flow needs; and
- Performance against targets set forth in fiscal policies.

The District will be conducting a detailed rate study in 2016. The rate study will build on the financial planning in this comprehensive plan and develop detailed rates that are consistent with District fiscal policies such that sufficient revenues are generated to meet the financial needs of the District. The 2016 rate study will also set new GFCs based on an inventory of the District's current and expected future assets.

The District has demonstrated its commitment to responsible management of the utility by past rate adjustments and by funding adequate levels of operations, capital, reserves and capital funding from rates. Continued prudent fiscal management will enable the water utility to continue to operate on a financially sound basis.

Several factors give the District a financial advantage as we face an uncertain future. The 50-year water supply contract with the City of Everett provides the District with the security of knowing that rates will not drastically change from year to year. Furthermore, provisions of the agreement are such that the District can manage the price paid through efficient management of its system. Thus, good management can lessen the need for rate increases, saving the District's ratepayers' money.

The District's large retail customer base and large wholesale demand makes it the single largest purchaser of water from the City of Everett. The District purchases over half of Everett's treated water. These facts allow the District to maintain its favorable negotiating position and achieve favorable prices for purchased water. The large customer base also allows the District to benefit from economies of scale. Investments in productivity – such as paperless billing, use of GIS applications and radio-read meters – will generate significant cost savings for the District and would not be possible without a large, densely populated customer base.

Finally, the District partners with several local water districts and utility associations to share best practices and resources. The District's participation in Washington Association of Sewer and Water Districts (WASWD) and Sno-King Alliance (among others) results in real collaboration and collective strategizing. Recently this participation bore fruit in the form of a lobbying alliance that proposed legislation that sets clear rules and allows for a vote of the people when cities wish to assume water and sewer districts. This bill passed and became effective in July 2015.

The District also strives to understand and manage the many risks present in the economy, political environment and our service area specifically. While the District does benefit from the contract with the City of Everett, a steep rise in Everett's costs would also hurt the District. For this and other such large unknowns, the District maintains fully funded reserves, including an operating reserve of 90 days of M&O expenses for the water system and a rate stabilization reserve in the amount of 15% of annual water rate revenue.

After an unusually severe drought played out in 2015, the District considered the risk to its revenues if customers significantly reduced water consumption over an extended period of time. As can be seen in southern California, an extended drought can result in a "downward equilibrium spiral" in which a utility must regularly raise rates due to decreasing customer demand. The District's water rate structure at least partially protects against this risk, by collecting a higher percentage of revenue in the base portion of the rate. Also, the increasing price usage tiers encourage conservation in both normal times and drought conditions. In short, the rate structure makes a higher share of its revenue "predictable" while encouraging customers to manage water use. To further protect against the spiral, the District has fully funded reserves which could be tapped in times of emergency. A simple modeling exercise found that a 15% reduction in water demand over the course of a calendar year would result in a $1.6 million reduction in water revenue. By comparison, wastewater revenue would be reduced by roughly $400,000.

A final challenge worthy of mention is that of a local population boom. The humming regional economy and a housing shortage in Seattle are working together to create a rising demand for housing and employment in the District's retail service area. The addition of light rail transit options within the next decade is expected to make the District an even more attractive place to live and work. To the District, this means more water demand and the addition of more assets to serve more customers. In response, the District is preparing by expanding its maintenance and operations capacity and ongoing in-house planning efforts to help maintain high levels of service for current and future customers.

Although the District expects continued housing development in its retail service area, the average daily household water use continues to decline. In this way, we expect only modest increases in overall water demand and water expense as a result of new connections. Weather plays a much greater role in determining the overall water budget. It is through regular strategic analysis of economic, regulatory and local conditions that the District strives to maintain and improve upon its strong financial position. Going forward, the District plans to increasingly rely on strategic asset management and a culture of continuous process improvement as its main strategies for providing affordable high-quality water service to its customers.

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