City of Snohomish Comprehensive Water System Plan

August 2011

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Certification

This Comprehensive Water System Plan for the City of Snohomish was prepared under the direction of the following registered professional engineers.

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Executive Summary

PURPOSE OF THE PLAN

The City of Snohomish's (City) water system is a major infrastructure, much of which is invisible to the people that receive water from it. The water system requires qualified staff to operate and maintain it, and an ongoing capital improvement program to replace old components to meet the requirements mandated by federal and state laws. The primary purpose of the City's Comprehensive Water System Plan (WSP) is to identify and schedule water system improvements that correct existing system deficiencies and ensure a safe and reliable supply of water to current and future customers. This WSP complies with Washington State Department of Health (DOH) regulations under Washington Administrative Code (WAC) 246-290-100, which requires water purveyors to update their water system plans every six years.

CHANGES SINCE THE LAST WSP

The City's last WSP was completed in 1994. The following changes have occurred since the last update that affect water system planning for the City.

- In response to the events of September 11, 2001, the United States Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (H.R. 3448), which became effective June, 12, 2002. The act requires all public water systems serving a population of over 3,300 persons to prepare a water system Vulnerability Assessment Plan and update or prepare an Emergency Response Plan.
- The 2003 Municipal Water Law (HB1338), which became effective September 9, 2003, identifies additional elements related to water rights, system capacity, service area consistency and conservation that are required in all water system plans.
- The DOH Water Use Efficiency Rule became effective on January 22, 2007, to ensure that water systems have a reliable supply of water and are using water more efficiently.
- The DOH *Water System Design Manual* was updated in December of 2009. The revisions primarily address water demand requirements and water system physical capacity analysis, both of which affect the City.
- Drinking water regulations are continually evolving to ensure that water purveyors are providing a safe and reliable water supply to their customers. Additional water quality monitoring requirements and revisions to existing regulations, such as the Groundwater Rule, and Stage 1 and 2 Disinfectants/Disinfection By-products Rule, have been implemented since the last WSP was completed.

SUMMARY OF KEY ELEMENTS

The WSP presents a description of the existing water system and service area, forecast of future water demands, policies and design criteria for water system operation and improvements, water system analyses, the operations and maintenance program, staffing requirements, a schedule of improvements and a financial plan to accomplish the improvements. The WSP also includes several ancillary elements, which include a water use efficiency program, cross-connection control program,

a water quality monitoring plan, a wellhead protection and watershed control program, and an emergency response plan. A summary of the key issues related to these elements is provided in the following sections.

Water Service Area

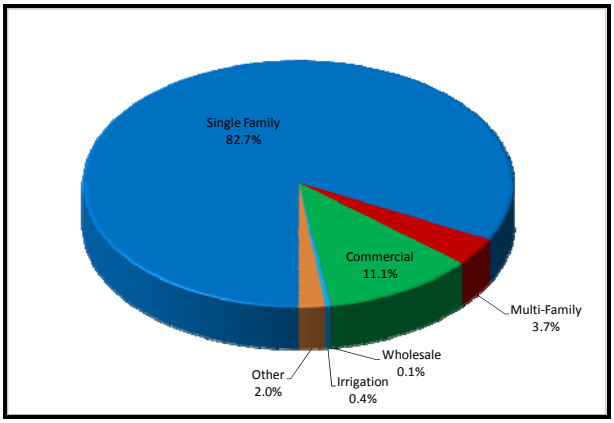
The City provides water service to approximately 3,081 customer accounts within its existing water service area boundary, which extends beyond the City's corporate limits. The City is responsible for providing public water service, utility management and water system development within the water service area. The City will provide water service within the retail water service area if the following conditions can be met.

- The City has sufficient capacity to serve water in a safe and reliable manner.
- The applicant is in compliance with all applicable local plans, development regulations, and utility standards and policies.
- Sufficient water rights and supply are available.
- The City can provide such service in a timely and reasonable manner.

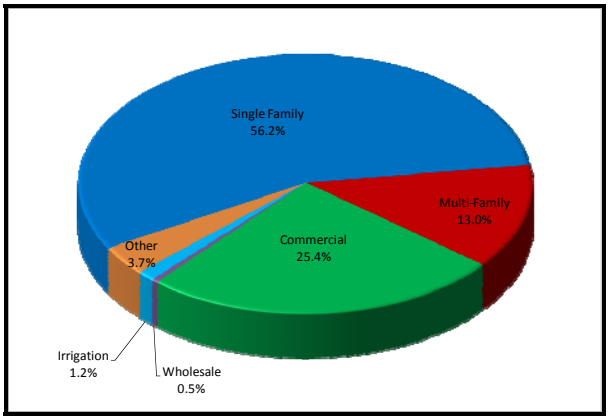
Properties located outside the city limits must be annexed to the City as a condition of receiving water service. The City will not provide new water service to customers along the City's Water Treatment Plant Transmission Main.

The City provides water service to primarily residential customers, which make up approximately 83 percent of all customer accounts, and use approximately 56 percent of all water supplied.

2008 Water Connections



2008 Water Consumption



Existing Water System

The City was originally provided water by a water company established in 1887, which provided water to the community from Blackman's Lake. Following several fires in the early 1900s, the existing water facilities were replaced with a dam on the Pilchuck River, a 12-inch wood stave transmission main and an open ground-level reservoir, all of which have either been abandoned or replaced. In the late 1920s and early 1930s, the City replaced the original wood stave pipe distribution system with cast iron pipe. At this time a diversion dam, which is still in operation today, was constructed on the Pilchuck River in nearly the same location as the original dam. The

City now serves its customers with water from the Pilchuck River and the City of Everett's (Everett) Transmission Line No. 5. A summary of these sources is shown in **Table ES-1.**

Table ES-1
Supply Facilities Summary

DOH No.	Source Name	Location	Pressure Zone	Capacity (gpm)	Current Status
S01	Pilchuck River	NE 09 29N 07E	218, 261, 336 and 472 Zones	1,181	Active
S02	Terrace Avenue Intertie	2014 Terrace Ave	362 and 425 Zones	1,200	Active
S03	Park Avenue Intertie	Approx. Park Ave and Rainbow Pl	450 Zone	3,500	Active
S04	King Charley's Intertie	Lake Ave and 56th St SE	438 Zone	1,600	Active
S05	Bickford Avenue Intertie	Bickford Ave and 52nd St SE	384 Zone	1,075	Active
S01	NEPA Intertie	Three Lakes Rd and Highway 2	278 Zone	1,200	Active

The City's water system has two storage facilities located in the 218 Zone, one located in the 362 Zone, and one located at the water treatment plant which provides gravity storage to the Water Treatment Plant Transmission Main customers in the 261, 336 and 472 Zones, as shown in **Table ES-2**.

Table ES-2
Storage Facilities Summary

Reservoir	Location	Pressure Zone	Year Constructed	Material	Capacity (MG)	Dimensions (feet)	Base Elevation (feet)	Overflow Elevation (feet)	Overall Height (feet)
Reservoir No. 1	Pine Ave and 13th Street	218 Zone	1925	Concrete	1.50	154 x 106 (Ground Level)	207.7	218.2	10.5
Reservoir No. 2	Pine Ave and 13th Street	218 Zone	1953	Concrete	5.00	282 x 198 (Ground Level)	197.4	218.2	20.9
Reservoir No. 3	1701 Terrace Avenue	362 Zone	1991	Steel	2.70	81 (Diameter)	296.5	362.0	68.0
Backwash Tank	2504 Menzel Lake Road	472 Zone	1980	Steel	0.50	54 (Diameter)	444.0	472.0	32.0

More than 66 miles of water main ranging in size from 1 to 18 inches conveys water from these facilities to water system customers. As shown in **Table ES-3**, most of the water main (approximately 54 percent) within the service area is 6 or 8-inch diameter, and an additional 40 percent of all water main is 12-inch diameter or larger.

Table ES-3
Water Main Diameter Inventory

Diameter (inches)	Length (feet)	Percentage of Total
1	266	0.1%
1.5	1,568	0.5%
2	4,873	1.4%
3	788	0.2%
4	8,913	2.6%
6	82,524	23.7%
8	103,702	29.8%
10	5,115	1.5%
12	87,140	25.0%
16	20,407	5.9%
18	33,000	9.5%
Totals	***348,295***	***100%***

Past Water Usage and Conservation

In general, the City has experienced a slight trend of decreasing water supply and system-wide water demand from 2003 to 2008, primarily due to the promotion of water use efficiency within the system, including new buildings with low-flow plumbing fixtures and the repair of water main leaks. During this same time period, the average amount of water demand per person has decreased from approximately 106 gallons per day (gpd) in 2003, to 95 gpd in 2008. The City's average per capita demand of 99 gpd from 2003 through 2008, and average demand per equivalent residential unit (ERU) of 213 gpd are slightly less than the average for the Puget Sound area. The City's historical water supply is shown in **Table ES-4**.

Table ES-4
Historical Water Supply and System Demand

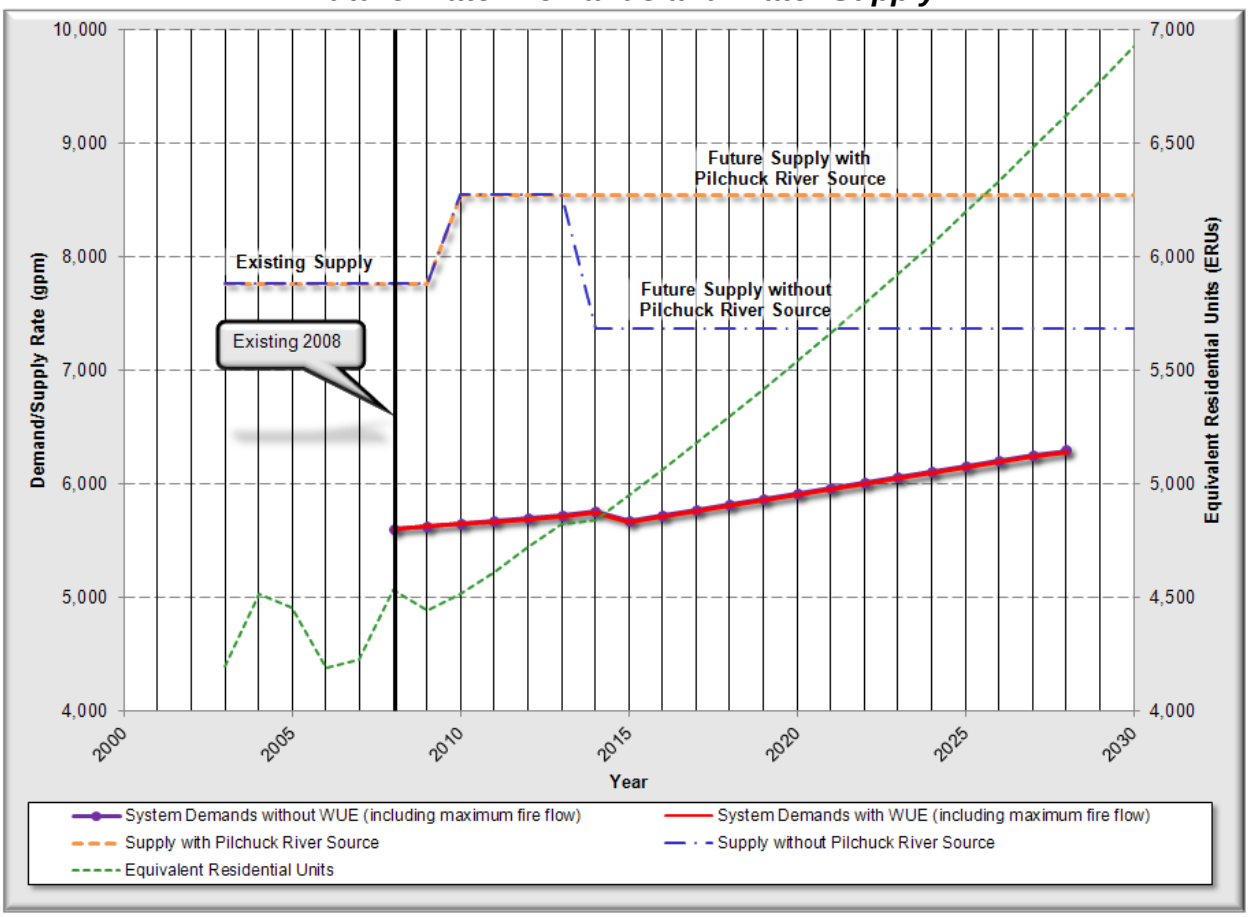
Year	Average Water Service Population	Annual Supply (gallons)	Average Daily Demand (gpm)	Average Demand Per Capita (gal/day/capita)
2003	9,189	357,088,924	679	106
2004	9,190	355,030,675	675	106
2005	9,303	328,745,602	625	97
2006	9,438	331,513,512	631	96
2007	9,537	315,730,780	601	91
2008	9,712	337,562,316	642	95
2003 - 2008 Average				***99***

The City's average amount of distribution system leakage from 2003 to 2008 was 9.8 percent. The City's Water Use Efficiency Program identifies a water use reduction goal of 7,644 gpd on an average annual basis by January 1, 2014, and to reduce the rolling 3-year average distribution system leakage (DSL) to less than 10 percent by the end of 2011.

Future Water Demands and Water Supply

Overall water demand within the City's system is expected to increase by up to 11 percent within the next 6 years, and by up to 52 percent within the next 20 years, depending on the amount of future water use reductions from the City's Water Use Efficiency Program. The City is considering plans to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Everett's Transmission Line No. 5. The City's sources are sufficient to meet the projected demands of the system well beyond 2028, with and without the Pilchuck River source, as shown in **Chart ES-1**.

Chart ES-1
Future Water Demands and Water Supply



Water Source and Quality

The City's water supply is provided by a diversion dam on the Pilchuck River and connections to Transmission Line No. 5. The City's water treatment plant filters the water from the Pilchuck River. Treated water is conveyed to the City's distribution system 14 miles to the southwest through the Water Treatment Plant Transmission Main.

The City has four connections to Transmission Line No. 5, which serve the northern pressure zones. One additional connection serves the City-owned and operated NEPA Pallet water system. Water supply is treated by Everett before it reaches the City and is not rechlorinated or subjected to any additional treatment prior to entering the City's distribution system.

The drinking water regulations are constantly changing and will require additional monitoring and reporting in the future in an effort to ensure safe drinking water for the public. Therefore, it is imperative that the City stays abreast of the regulations to maintain compliance.

Operations and Maintenance

The City's operations and maintenance organization is staffed by well-qualified, technically trained personnel. City staff regularly participates in safety, training and certification programs to keep abreast of the latest changes in the water industry and to ensure a smooth and safe operation of the water system. The current staff of supervisory personnel and field crew, in which many are responsible for the water system and other utilities, have effectively operated the water system in the past. At the current staffing level, the City is capable of adequately operating the water system and complying with the minimum DOH requirements, but many of the preventative maintenance tasks are not being accomplished at the desired frequency. The City will add staff in the future, as necessary and as allowed by budget, to complete the preventative maintenance tasks at the desired frequency and to meet the increasing requirements of system operation and maintenance, due to customer growth and increased regulatory requirements.

The City has taken several steps to prepare for emergency situations. An Emergency Response Plan and a vulnerability assessment have been prepared that conform to the requirements of the Bioterrorism Act of 2002. The documents contain a vulnerability assessment of the City's water system facilities, a contingency operation plan for responding to emergency events, a list of water personnel responsible for making decisions in emergency situations and other elements.

Water System Evaluation

The existing water system was evaluated to determine its ability to meet the policies and design criteria of the City and those mandated by DOH. The results of the evaluation are summarized below.

- The City does not currently meter the treated water leaving the water treatment plant or the water conveyed to the backwash tank. The City plans to install meters with telemetry at these locations.
- During peak demand periods, the water treatment plant influent valve fully opens and allows water into the water treatment plant at a rate exceeding the capacity of the filters. The City plans to install piping and a control valve between the backwash tank and the Water Treatment Plant Transmission Main to allow treated water to flow from the backwash tank directly to the transmission main during peak demand periods.

- The City currently manually adjusts a zone valve between the 362 and 218 Zones to supplement the Pilchuck River water supply to Reservoirs No. 1 and No. 2 with water from Transmission Line No. 5. The City plans to install an altitude valve with telemetry to allow water from Transmission Line No. 5 to supplement the Pilchuck River water supply in Reservoirs No. 1 and No. 2.
- A booster pump station is needed for system redundancy and for future storage requirements related to growth. A 4,950 gallon per minute (gpm) booster pump station is proposed to improve back-up and fire flow supply to the 362 and 425 Zones.
- The water treatment plant is currently capable of operating at a maximum capacity of 1.7 million gallons per day (MGD), 0.46 MGD less than its original design capacity due to the current filters' hydraulic capacity limitation. If the City decides to maintain the Pilchuck River source as a source of supply, the City plans to perform improvements at the water treatment plant, including structural upgrades to the water treatment plant building, installation of a SCADA system to improve remote control and monitoring, electrical and control upgrades, new stationary fish screens, diversion dam weir and fish ladder modifications, replacement of the water treatment plant influent control valve, modification of the outlet weir of the flocculation tank and installation of filter effluent pumps.
- The existing telemetry control panels, controllers and radios are no longer supported by their manufacturers. Additionally, the HMI computer system that monitors the SCADA system will not operate on modern computer systems and the City cannot collect digital historical data. The City plans to replace five existing SCADA electrical and control panels, upgrade an additional control panel and install a new HMI computer system.
- Several areas of the water system have in-line isolation valves spaced at distances greater than the City standard of 700 feet. The City plans to install isolation valves as necessary.
- Several areas of the system require replacement of existing water mains to resolve deficiencies related to low fire flows, aging water main and undesirable materials.

Proposed Water System Improvements and Financing Plan

Improvements to the water system are necessary, primarily to resolve existing system deficiencies, but also to accommodate the increase in water demands from future growth. If the City decides to maintain the Pilchuck River source and water treatment plant, improvements identified for the first six years of the Capital Improvement Program (2011 to 2016) are estimated to cost approximately $5,012,000, which results in an average expenditure of approximately $835,000 per year. Improvements in the following six years (2017 to 2022) are estimated to cost approximately $5,503,000.

Should the City decide to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Transmission Line No. 5, improvements identified for the first six years of the Capital Improvement Program (2011 to 2016) are estimated to cost approximately $6,572,000, which results in an average expenditure of approximately $1,095,000 per year. Improvements in the following six years (2017 to 2022) are estimated to cost approximately $2,226,000.

The financial analysis is intended to illustrate the feasibility of funding the operation and maintenance and capital improvements recommended for the water system for the next six years. The first six years of capital improvements can be funded from a combination of sources that include low interest Public Works Trust Fund loans, connection charges, rates and reserves. The cost of operating and maintaining the water system and funding the capital improvements over the upcoming six years will likely require an increase in rates and connection charges.

Contents

Introduction

1

WATER SYSTEM OWNERSHIP AND MANAGEMENT

The City of Snohomish (City) is a municipal corporation that owns and operates a public water system within and outside of its city limits. Water system data on file at the Washington State Department of Health (DOH) for the City's system is shown in **Table 1-1**.

Table 1-1
Water System Ownership Information

Information Type	*Description*
System Type	Group A - Community - Public Water System
System Name	Snohomish, City of
County	Snohomish
DOH System ID Number	80915 8
Owner Number	005492
Owner Name	Tim Heydon, Public Works Director
Address	116 Union Avenue, Snohomish, WA, 98290
Contact	Mr. Tim Heydon, Public Works Director
Contact Phone Number	360-568-3115 (City Hall)

OVERVIEW OF EXISTING SYSTEM

In 2008, the City provided service to approximately 3,081 customer connections, or 4,535 equivalent residential units (ERUs), within the City's retail water service area, which extends beyond the city limits. The city limits comprise an area of approximately 3.57 square miles and the existing retail water service area is approximately 5.3 square miles. The 2008 population within the city limits was 9,020, while water service was provided to approximately 9,712 people.

Water supply to the City is provided by a water treatment plant that diverts water from the Pilchuck River approximately 14 miles northeast of the City and by the City of Everett through four interties on Transmission Line No. 5. Water storage is provided by four reservoirs that have a total capacity of 8.85 million gallons (MG). In addition, the City's water system has nine pressure zones with four pressure reducing stations and approximately 66 miles of water main. A summary of 2008 data for the City's water system is shown in **Table 1-2**.

Table 1-2
2008 Water System Data

Description	*Data*
Water Service Population	9,712
Water Service Area	5.3 Square Miles
Total Connections	3,081
Total ERUs	4,535
Demand per ERU	204 gallons per day
Annual Supply	337,562,316 gallons
Average Day Demand	642 gallons per minute
Distribution System Leakage (3-year Rolling Average)	10.6%
Maximum Day/Average Day Demand Factor	2.20
Peak Hour/Maximum Day Demand Factor	1.80
Number of Pressure Zones	9
Treatment Plant Design Capacity	2.16 MGD
Treatment Plant Current Capacity	1.70 MGD
Everett Intertie Capacity	7,375 gallons per minute
Number of Reservoirs & Total Capacity	4 (8.85 MG)
Number of Pressure Reducing Stations	4
Total Length of Water Main	66 miles

The City also owns and operates the NEPA Pallet Water System located near the intersection of Highway 2 and Three Lakes Road. The system is supplied by the City of Everett's Transmission Line No. 5 and provides service to the NEPA Pallet Container Company and one residential customer. Water system data on file at the DOH for the NEPA Pallet system is shown below in **Table 1-3**.

Table 1-3
NEPA Pallet Ownership Information

Information Type	Description
System Type	Group A - Non-Transient Non-Community
System Name	NEPA Pallet
County	Snohomish
DOH System ID Number	AA475 K
Owner Number	005492
Address	116 Union Avenue, Snohomish, WA, 98290
Contact	Mr. Tim Heydon, Public Works Director
Contact Phone Number	360-568-3115 (City Hall)

AUTHORIZATION AND PURPOSE

In March 2009, the City authorized RH2 Engineering, Inc., (RH2) to prepare a comprehensive water system plan as required by state law under WAC 246-290-100. In accordance with WAC 246-290-100, the plan shall be updated and submitted to the DOH every six years. The previous *Comprehensive Water System Plan* was prepared for the City in 1994. The purpose of this updated *Comprehensive Water System Plan* (WSP) is as follows.

- To evaluate existing water demand data and project future water demands.
- To analyze the existing water system to determine if it meets minimum requirements mandated by DOH and the City's own policies and design criteria.
- To identify water system improvements that resolves existing system deficiencies and accommodates future needs of the system for at least 20 years into the future.
- To prepare a schedule of improvements that meets the goals of the City's financial program.
- To evaluate past water quality and identify water quality improvements, as necessary.
- To document the City's operations and maintenance program.
- To prepare water use efficiency, emergency response, cross connection control, watershed protection and water quality monitoring plans.
- To comply with all other DOH water system plan requirements.

SUMMARY OF WSP CONTENTS

The following is brief summary of the content of the chapters in the WSP.

- The **Executive Summary** provides a brief summary of the key elements of this WSP.
- **Chapter 1** introduces the reader to the City's water system, the objectives of the WSP and the WSP's organization.
- **Chapter 2** presents the water service area, describes the existing water system and identifies the adjacent water purveyors.

- **Chapter 3** presents related plans, and land use and population characteristics.
- **Chapter 4** identifies existing water demands and projected future demands.
- **Chapter 5** presents the City's operational policies and design criteria.
- **Chapter 6** discusses the City's water source and water quality monitoring program.
- **Chapter 7** discusses the water system analyses and existing system deficiencies.
- **Chapter 8** discusses the City's operations and maintenance program.
- **Chapter 9** presents the proposed water system improvements, and their estimated costs and implementation schedule.
- **Chapter 10** summarizes the financial status of the water utility and presents a plan for funding the water system improvements.
- The **Appendices** contain additional information and plans that supplement the main chapters of the WSP.

DEFINITION OF TERMS

The following terms are used throughout this WSP.

Capital Facilities Charge: A one-time fee paid by a property owner when connecting to the City's water system. This fee pays for the new customer's equitable share of the cost of the existing system. This fee offsets the costs of providing water to new customers and recognizes that the existing water system was largely built and paid for by the existing customers.

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

Connection Charge: A one-time fee paid by a property owner when connecting to the City's system and is made up of both the Capital Facilities Charge and Meter Service Connection Charge.

Cross-Connection: Any physical connection, actual or potential, between a water system and any source of non-potable substance that, therefore, presents the potential for contaminating the public water system.

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

- **Average day demand (ADD):** The total amount of water delivered to the system in a year divided by the number of days in the year.
- **Maximum day demand (MDD):** The maximum amount of water delivered to the system during a 24-hour time period of a given year.
- **Peak hour demand (PHD):** The maximum amount of water delivered to the system, excluding fire flow, during a one-hour time period of a given year. A system's peak hour demand usually occurs during the same day as the maximum day demand.

Distribution System Leakage: Water that is measured as going into the distribution system but not metered as going out of the system.

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

Fire Flow: The flow rate of water required during fire fighting, which is usually expressed in terms of gallons per minute (gpm).

Head: A measure of pressure or force exerted by water. Head is measured in feet and can be converted to pounds per square inch (psi) by dividing feet by 2.31.

Head Loss: Pressure reduction resulting from pipeline wall friction, bends, physical restrictions or obstructions.

Hydraulic Elevation: The height of a free water surface above a defined datum; the height above the ground to which water in a pressure pipeline would rise in a vertical open-end pipe.

Maximum Contaminant Level (MCL): The maximum permissible level of contaminant in the water that the purveyor delivers to any public water system user, measured at the locations identified under WAC 246-290-300, Table 3.

Meter Service Connection Charge: The installation charge or hook-up fee is paid by a property owner to reimburse the City for the cost incurred to make the physical connection to the water system. This cost includes both direct and indirect cost for installing the service line off the system's water main to the customer's water meter. The charge also includes the cost of the water meter and meter box.

Potable: Water suitable for human consumption.

Pressure Zone: A portion of the water system that operates from sources at a common hydraulic elevation. For example, 218 Zone refers to the City's lower pressure zone that has reservoirs with an overflow elevation of 218 feet.

Purveyor: An agency, subdivision of the state, municipal corporation, firm, company, mutual or cooperative association, institution, partnership, or persons or other entity owning or operating a public water system. Purveyor also means the authorized agents of such entities.

Supply: Water that is delivered to a water system by one or more supply facilities, which may consist of supply stations, booster pump stations, springs and wells.

Storage: Water that is stored in a reservoir to supplement the supply facilities of a system and provide water supply for emergency conditions. Storage is broken down into the following five components, which are defined and discussed in more detail in **Chapter 7**: 1) operational storage; 2) equalizing storage; 3) standby storage; 4) fire flow storage; and 5) dead storage.

LIST OF ABBREVIATIONS

The abbreviations listed in **Table 1-4** are used throughout this WSP.

Table 1-4
Abbreviations

Abbreviation	*Description*
ADD	Average Day Demand
AWWA	American Water Works Association
CCR	Consumer Confidence Report
CIP	Capital Improvement Program
City	City of Snohomish
County	Snohomish County
DBP	Disinfection By-Product
DOH	Department of Health
DSL	Distribution System Leakage
EPA	Environmental Protection Agency
ERU	Equivalent Residential Unit
fps	feet per second
GMA	Growth Management Act
gpm	gallons per minute
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MG	Million Gallons
MGD	Million Gallons per Day
mg/l	milligrams per liter
OSHA	Occupational Safety & Health Administration
PDD	Peak Day Demand
PHD	Peak Hour Demand
psi	pounds per square inch
PUD	Snohomish County Public Utility District No. 1
SDWA	Safe Drinking Water Act
SOC	Synthetic Organic Chemical
SWTR	Surface Water Treatment Rule
THM	Trihalomethane
UGA	Urban Growth Area
USGS	United States Geological Survey
VOC	Volatile Organic Chemical
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety & Health Act

Water System Description

2

INTRODUCTION

This chapter describes the City of Snohomish's (City) existing and future water service areas and water service agreements and provides a thorough description of the water system and its individual components. The results of the evaluation and analyses of the existing water system are presented later in **Chapter 7**.

WATER SERVICE AREA

History

The Snohomish River valley's flat land and favorable soils began drawing settlers from Seattle in the late 1850s for agricultural use. A railway was developed through the valley and into the community of Snohomish in the 1880s and brought with it the lumber industry and the need for the community's first water system, which was originally constructed entirely of wood stave pipe. This water system was developed in 1884 and involved the pumping of water from a stream tributary to the Snohomish River located north of First Street. A water company was formed in 1887 that used the community's topography to provide water via gravity from Blackman's Lake.

In 1891, additional water was provided to the City via a pumping station and storage reservoir situated on the Pilchuck River to support the City's numerous lumber mills. Shortly after the City of Snohomish was incorporated in 1890, major fires disrupted business throughout the City, with 35 businesses destroyed in the 1911 fire. Over the next decade, the City was rebuilt and in 1920, reached a population of over 3,000 people, which remained relatively constant for the next 40 years. In 1912, the existing water supply facilities were replaced with a dam on the Pilchuck River, a 12-inch wood stave transmission main and an open ground-level reservoir, which have all been either abandoned or replaced. An additional reservoir was constructed in 1925 at the same site as the original reservoir. This reservoir, Reservoir No. 1, has an existing capacity of 1.0 million gallons (MG).

In the late 1920s and early 1930s the City replaced the wood stave pipe distribution system with cast iron pipe. At this time a diversion dam, which is still in operation today, was constructed on the Pilchuck River in nearly the same location as the original dam. Since the construction of the diversion dam was completed in 1934, a fish ladder and a continuous flow fingerling bypass were installed to keep the intake screen free of fingerlings.

A 5.0 MG reservoir, Reservoir No. 2, was constructed in 1953 at the same site as Reservoir No. 1 and the original reservoir. Reservoirs No. 1 and 2 remain in operation today and provide the only storage for the City's 218 Zone. In the early 1950s, the City of Everett constructed Transmission Line No. 5 near the northern boundary of the Snohomish City limits. Shortly after construction of this transmission main, the City installed an emergency connection on Terrace Avenue. Although originally intended for emergency use only, the City eventually began using this connection for continuous water service to the northern portion of the City. This led to increased development north of 13th Street and created the need for additional transmission main connections, four of which are in service today, to serve the City's water service customers.

The City adopted a historic district ordinance in 1973 that prohibited inappropriate alterations and demolitions of historic buildings and structures, in addition to encouraging new structures to mimic the historic character of the district. In the following year, the 36-block area encompassing the historic business district was placed on the National Register of Historic Places.

Beginning in the 1980s, the City became a more popular destination for Everett and King County workers to call home as major highways allowed for easier commutes throughout the region. Throughout this period of growth the City was able to maintain its agricultural roots, although the Snohomish School District became the City's major employer. Most of the residential growth occurred north of the City limits as farmland was developed into rural subdivisions and small acreage, single-family parcels. These areas received water service from the City's interties along Everett's Transmission Line No. 5.

In 1981, a direct filtration water treatment plant was constructed near the Pilchuck River diversion dam to treat water being supplied to Reservoirs No. 1 and 2. Soon after the water treatment plant was constructed, the original transmission main from the water treatment plant to the City was replaced and the City began serving the existing residential customers along the transmission main alignment. Many of these customers previously had illegal, unmetered connections to the transmission main and were not officially metered until the new transmission main was constructed. A 0.33 MG backwash tank located at the water treatment plant is utilized for backwashing the water treatment plant filtration cells and provides storage for customers along the Water Treatment Plant Transmission Main.

The City constructed Reservoir No. 3, a 68-foot tall, 2.52 MG steel standpipe, and immediately put it into operation in August 1991 to serve the City's 362 Zone. This reservoir is located one block east of Terrace Avenue and one block north of 16th Street, and is supplied by the Terrace Avenue intertie on Transmission Line No. 5. Reservoir No. 3 allows the City to limit the peak demands at the Terrace Avenue intertie and provides a limited amount of supply to the 358 Zone in the event that Transmission Line No. 5 is shut down. Temporary storage for the 384, 425, 438 and 450 Zones may also be provided by Reservoir No. 3, as was accomplished in January 2009 when supply was not available from Everett due to a planned shutdown of the filtration plant.

In an effort to reduce the amount of re-chlorination necessary to maintain the appropriate level of disinfection, the City covered and lined Reservoirs No. 1 and 2 in 1992. At the same time, piping upgrades between the two reservoirs were completed. This increased the usable storage of the system by 1.0 MG, as the two reservoirs were originally designed to operate in series with each other, with Reservoir No. 1 serving as overflow storage for Reservoir No. 2. Although the piping upgrades connecting the two reservoirs increased the City's overall storage capacity, approximately 0.5 MG of storage from Reservoir No. 1 was displaced as a result of these upgrades. This is because Reservoir No. 2 was originally constructed at a slightly lower elevation than Reservoir No. 1 and now dictates the water level in Reservoir No. 1. The two reservoirs now combine to provide approximately 6.0 MG of domestic and fire flow storage to the 218 Zone, and are operated at the same water level.

Geology

The City is located in western Snohomish County, Washington, near the confluence of the Pilchuck and Snohomish Rivers. The City is primarily located on glacial deposits on the uplands above the floodplains of the Snohomish and Pilchuck Rivers. The last glacial epoch, which began

approximately 15,000 years ago, deposited sand and gravel from advancing glaciers, which was overridden and compressed by glacial ice. Glacial till, or hardpan, was deposited concurrently with the movement of glacial ice. The hardpan is a dense mixture of sand, silt and gravel. As glaciers retreated between 10,000 and 13,500 years ago, additional layers of loose sand and gravel were deposited within surficial depressions underlain by glacial till and advance outwash. The Snohomish and Pilchuck River floodplains are filled with a 40 to 120-foot thick layer of post-glacial sand, silt and gravel sediment deposited by their respective rivers.

The geologic units immediately underlying the City's retail water service area are comprised primarily of a 10 to 70-foot thick layer of glacial till, with isolated areas underlain by thin layers (2 to 50 feet) of recessional outwash at higher elevations. Advance outwash is only exposed at the surface, along steep slopes above the stream channels of the Pilchuck River and Cemetery Creek.

Topography

The topography of the City's water service area varies greatly in elevation. The north side of the service area is the highest, with land sloping gradually downward from State Highway 2 to the Snohomish River. Ground elevations range from over 300 feet near the crossing of State Route 9 and State Highway 2, to sea level in downtown Snohomish and along the Snohomish River. Steep slopes are located near the Pilchuck River, where the elevations rapidly drop nearly 200 feet.

Water Service Area

The City is located in western Snohomish County, Washington, approximately one mile west of the confluence of the Pilchuck and Snohomish Rivers. The City boundaries encompass an area of approximately 3.5 square miles, as shown in **Figure 2-1**. The existing water distribution system extends south to Harvey Airfield and 108th Street SE, north to 52nd Street SE, east to South Machias Road and west to approximately 88th Drive SE. The City's existing water distribution system extends beyond the City limits, including south of the Snohomish River, east of the Pilchuck River along 92nd Street SE and 86th Street SE along Orchard Avenue, west of Highway 9 along 89th Avenue SE and along the water transmission pipeline from the water treatment plant to the City limits, as shown in **Figure 2-1**.

The City's water service area boundary was defined in the *1991 North Snohomish County Coordinated Water System Plan*. The City is responsible for providing public water service, utility management and water system development within this area. However, requests for new water service outside the City limits will not be granted until such property is annexed into the City limits. The City Council may grant exceptions in the event of public health emergencies, pre-existing contractual obligations that limit the City's ability to require annexation, or as stated in the Growth Management Act. The Urban Growth Area (UGA) boundary extends north to approximately State Highway 2, east to the Pilchuck River, south to the Snohomish River, including Harvey Airfield, and west to approximately 83rd Avenue SE, encompassing an area of approximately 4.9 square miles. The City's retail water service area boundary generally follows the UGA boundary and also includes those parcels that are served directly from the Water Treatment Plant Transmission Main. The City expects to transfer service to existing customers along the Water Treatment Plant Transmission Main to adjacent water purveyors such that the retail water service area corresponds to the UGA.

The City's existing water rights can be used throughout the defined water service area per the 2003 Municipal Water Law. The place of use for the City's water rights is the City of Snohomish and, according to the law, the place of use is defined as the area served. Thus, the City can use its water rights outside its corporate boundaries if the use is within the defined service area. **Figure 2-3** displays the existing retail water service area as well as the future water service area.

The City's future water service area differs from the existing retail water service area in that it includes the Cross Valley Water District overlap area and it does not include the parcels that are currently being served along the Water Treatment Plant Transmission Main. The City is considering plans to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Transmission Line No. 5. However, service to remote customers who are currently served off of the Water Treatment Plant Transmission Main will need to be maintained. The City is evaluating alternatives for service to these customers, including the feasibility of transferring the services to the Snohomish County Public Utility District No. 1 (PUD).

At the end of 2008, the City provided service to approximately 3,081 customer connections, or 4,535 equivalent residential units (ERUs), within the City's water service area, which extends beyond the City limits. The City limits comprise an area of approximately 3.5 square miles, and the existing retail water service area is approximately 5.3 square miles. The 2008 population within the City limits was approximately 9,020.

WATER SERVICE AGREEMENTS

Water Service Area Agreement

All water purveyors located within a Critical Water Supply Service Area (CWSSA) are required to have a water service area agreement that identifies the external boundary of their water service area. North Snohomish County was declared a CWSSA on October 19, 1988. The City prepared and signed a water service area agreement during the development of the *North Snohomish County Coordinated Water System Plan*, which was finalized in 1991. A copy of this agreement is contained in **Appendix A**.

City of Everett Water Service Agreement

An informal water service agreement has existed between the City and the City of Everett (Everett) since at least 1925 to supplement the City's existing water supply. Although a formal contract for this water service does not currently exist, Everett plans to continue providing water supply to the City from Transmission Line No. 5, which serves the northern zones of the existing retail water service area. Everett owns and operates meters at each connection along Transmission Line No. 5, and provides the City with bimonthly water consumption and billing information. The City is currently pursuing a formal water service agreement with Everett to assure the availability of water for the City's continued use in the future.

NEPA Pallet Water Service Agreement

The City owns and operates the NEPA Pallet Water System located near the intersection of Highway 2 and Three Lakes Road. The system is supplied directly from Transmission Line No. 5.

The system serves the NEPA Pallet Company and one residential customer. It is unknown when the water system was connected to Transmission Line No. 5 and when the City began operating the water system. Ownership and operation of the NEPA Pallet Water System may be transferred to the PUD in the future.

Wholesale Water Service Agreements

Informal water service agreements exist between the City and two wholesale customers, the Green Velvet Water Department and the Snohomish River Road Water District. The Green Velvet Water Department meter is located at 520 North Carpenter Road along the Water Treatment Plant Transmission Main. The Snohomish River Road Water District meter is located at 5804 Lowell River Road, and primarily serves agricultural customers south of the Snohomish River.

SATELLITE SYSTEM MANAGEMENT

A Satellite System Management Agency (SSMA) is defined as a person or entity that is certified by the Washington State Department of Health (DOH) to own or operate more than one public water system without the necessity for a physical connection between such systems. SSMAs were created to stop the proliferation of small water systems, many of which could not meet federal and state water quality and water system planning regulations. Based on the success of SSMAs, DOH made recommendations to the legislature to include rules for designating entities as qualified SSMAs.

In July 1995, Senate Bill 5448 became law, governing approval of new water systems and setting forth requirements for SSMAs. The goal of the law is to ensure that the people of Washington State will receive safe and reliable water supplies in the future from professionally managed or properly operated water systems. SSMAs can provide three different levels of service:

1. Ownership of the satellite system;
2. Operations and management of the satellite system; or
3. Contract services only.

The service can be provided to new systems, existing systems that are no longer viable or existing systems placed into receivership status by DOH.

The City is not currently a SSMA but it owns and operates the NEPA Pallet water system. General water system data for NEPA Pallet is summarized on the DOH Water Facilities Inventory (WFI) Form, a copy of which is contained in **Appendix A**.

The City has been approached by neighboring water systems, many of whom are served directly from their own connection to Transmission Line No. 5, requesting satellite system management or to be directly served by the City's water system. However, the City does not wish to provide satellite system management service to small neighboring water systems. Instead, the City desires to directly serve these small neighboring water systems and will evaluate providing these services on a case by case basis. Requests for service have been denied by the City mostly because of undersized water mains in the neighboring systems. The City requires that systems requesting direct services meet the City's minimum standards for water main design, which are contained in **Appendix H**. The Snohomish County PUD is an approved SSMA and currently operates several satellite systems in the area.

INVENTORY OF EXISTING WATER FACILITIES

This section provides a detailed description of the existing water system and the current operation of the facilities. The analysis of the existing water facilities is presented in **Chapter 7**.

Pressure Zones

The City currently serves customers within an elevation range of approximately sea level in areas adjacent to the Snohomish River to approximately 290 feet along Terrace Avenue in the eastern portion of the system and along Bickford Avenue in the northwestern portion of the system. The wide range of elevations requires that the water pressure is increased or reduced to maintain pressures that are safe and sufficient to meet the system's flow requirements. The City achieves this by dividing the water system into eight distinct pressure zones, as shown in **Figure 2-1**.

The pressures in the 362 Zone and the 218 Zone are regulated by reservoir levels, as illustrated in the hydraulic profile, **Figure 2-2**. Pressures in the 218 Zone, which has a maximum hydraulic elevation of 218 feet, are established by the surface water levels in Reservoirs No. 1 and 2. The 218 Zone is primarily located south of 9th Street and includes downtown Snohomish and the areas surrounding Harvey Airfield. Service elevations in the 218 Zone range from approximately sea level to 145 feet. Pressures in the 362 Zone, which has a maximum hydraulic elevation of 362 feet, are established by the surface water level in Reservoir No. 3. The 362 Zone predominately serves the central portion of the City limits. Service elevations in the 362 Zone range from approximately 85 to 240 feet.

The 384, 425, 438 and 450 Zones are supplied with water directly from Transmission Line No. 5 through interties located adjacent to the transmission line. The 384 Zone is supplied by the Bickford Avenue Intertie along Transmission Line No. 5. The 384 Zone has a maximum hydraulic elevation of 384 feet and serves the northwestern portion of the City limits along Bickford Avenue between State Highway 9 and 52nd Street SE. Service elevations within this zone range from approximately 120 to 190 feet.

The 425 Zone is supplied by the Terrace Avenue Intertie with water from Transmission Line No. 5. The 425 Zone has a maximum hydraulic elevation of 425 feet and serves the northeastern portion of the City limits along Terrace Avenue between 15th Street and 22nd Street. Elevations within this zone range from approximately to 250 to 290 feet.

The 438 Zone is supplied by the King Charley's Intertie with water from Transmission Line No. 5, located at King Charley's on 99th Avenue SE. The 438 Zone, which has a maximum hydraulic elevation of 438 feet, primarily serves the area along 99th Avenue SE and 22nd Street in the northern portion of the City limits. Service elevations within this zone range from approximately 220 to 270 feet.

The 450 Zone is supplied by the Park Avenue Intertie with water from Transmission Line No. 5, located on Park Avenue at Cascade View Elementary. The 450 Zone, which has a maximum hydraulic elevation of 450 feet, primarily serves the northeastern portion of the City limits along Park Avenue, including Cascade View Elementary and the Clark's Pond single-family residential development. Service elevations within this zone range from approximately 220 to 265 feet.

The City currently serves approximately 74 connections along the Water Treatment Plant Transmission Main between the Pilchuck River diversion dam and Reservoirs No. 1 and 2. The

water surface elevation of the water treatment plant backwash storage tank is approximately 442 feet, and pressures must be reduced with two pressure reducing valves along OK Mill Road and South Machias Road to achieve satisfactory service pressures. Pressure reducing valve (PRV) No. 2 is located near the intersection of OK Mill Road and Russell Road and serves customers at a maximum hydraulic elevation of approximately 428 feet. PRV No. 1 is located at the intersection of South Machias Road and Debuque Road and serves customers at a maximum hydraulic elevation of 456 feet.

The City owns and operates the NEPA Pallet Water System which is supplied by the NEPA Intertie near the intersection of Highway 2 and Three Lakes Road. The NEPA Pallet Water System has a hydraulic elevation of approximately 278 feet and serves the NEPA Pallet Company and one residential customer. The elevation at this intertie is approximately 80 feet.

Supply Facilities

Introduction

The City's water supply is provided by a diversion dam on the Pilchuck River and connections to Transmission Line No. 5. The Pilchuck River source is the system's primary water supply and the City's current goal is to provide at least one-half of the system's water supply from the Pilchuck River source (Resolution 1022). From 2006 to 2010, the City's water treatment plant was operating under restrictions imposed by DOH as a result of a DOH sanitary survey and a Comprehensive Performance Evaluation performed by the Cadmus Group. The restrictions were imposed because the facility did not have automatic plant shutdown capabilities, filter-to-waste facilities and individual filter effluent turbidimeters. These restrictions remained in place until the identified administrative, operational and capital improvement upgrades were completed in 2010. The Pilchuck River diversion dam was constructed in 1934 and is located in Granite Falls, Washington, approximately 14 miles northeast of Snohomish City limits.

The Everett water purchased by the City is supplied from Transmission Line No. 5, which is located north of the Snohomish City limits. The City does not currently have a formal agreement with Everett for the use of water from Transmission Line No. 5. The City uses Everett water to supply the northern zones of its water service area and to supplement the City's 218 Zone during high demand periods and as a backup to the Pilchuck River supply.

Pilchuck River Diversion Dam

Pilchuck River

The City's water treatment plant, constructed in 1981 with a design capacity of 1,500 gallons per minute (gpm), treats water from the Pilchuck River. Water is diverted from the river by a 10-foot-tall diversion dam located at River Mile 26.3. The intake structure is equipped with a mechanical screen and a motor used to keep the screen free of debris. Diverted water flows by gravity from the intake structure to the water treatment plant and enters a flocculation tank where aluminum sulfate and liquid polymer are added to the water prior to

filtration. The water treatment method is direct filtration through four granular media cells with a total area of 500 square feet. In addition to the chemicals added for flocculation, a filter aide is added for filtration, soda ash is added for pH adjustment and chlorine is added for disinfection. Treated water is conveyed to the City's distribution system 14 miles southwest through the Water Treatment Plant Transmission Main.

Although the original design capacity was 1,500 gpm, the current average supply from the Pilchuck River source is approximately 800 gpm, with a typical peak production rate of approximately 1,000 gpm. Restrictions were imposed by DOH in June 2006 that limited the Water Treatment Plant to operating a maximum of 8 hours per day because it did not have automatic shut-down or filter-to-waste capabilities. When the treatment plant is not in operation, customers served directly from the transmission main are supplied with treated water from the 330,000 gallon backwash supply storage tank which is located on the water treatment plant site.

Water Treatment Plant Backwash Supply Storage Tank

Upgrades to the water treatment plant were recently completed in 2010 to address all of the deficiencies identified in the survey and evaluation. These upgrades include the addition of four filter-to-waste pumps and piping with motor actuated valves for each filtration cell; installation of new filter media and recoating the interior of each filtration cell; replacement of the generator's manual transfer switch with an automatic transfer switch; and the installation of new control panels and a programmable logic control unit, which allows fully automated control of the water treatment plant. The water treatment plant may now be operated at 1,181 gpm, 24 hours per day.

City of Everett Interties

The City has four connections to Transmission Line No. 5, which serve the northern pressure zones. One additional connection serves the NEPA Pallet Water System. Water supply is treated by Everett before it reaches the City and is not rechlorinated or subjected to any additional treatment prior to entering the City's distribution system. Everett does not limit the amount of water that the City can withdraw from the connections on an annual or instantaneous basis. The Everett interties consist of a below-grade concrete vault with a flow meter and a second below-grade concrete vault equipped with two pressure reducing valves to maintain the pressure of the supply from Everett. The Terrace Avenue Intertie is equipped with two pressure reducing valve vaults which supply two different pressure zones. A summary of the interties providing water to the City's system is shown in **Table 2-1**.

Table 2-1
Intertie Facilities Summary

Intertie	Location	Pressure Zone	Capacity (gpm)	Master Meter Size (Inches)	PRV Size (inches)
Bickford Avenue Intertie	Bickford Ave and 52nd St SE	384 Zone	1,075	10	10, 6 and 2
King Charley's Intertie	Lake Ave and 56th St SE	438 Zone	1,600	8	8 and 4
Park Avenue Intertie	Approx. Park Ave and Rainbow Pl	450 Zone	3,500	10	10 and 3
Terrace Avenue Intertie	2014 Terrace Ave	362 Zone	1,200	8	10 and 6
	2014 Terrace Ave	425 Zone			8 and 3
NEPA Intertie	Three Lakes Rd and Highway 2	278 Zone	1,200	4	4

Storage Facilities

The City's water system has four storage facilities that provide storage to the 218, 362 and 472 Zones. A summary of the storage facilities is shown in **Table 2-2** and a detailed description of each facility is provided below. Additional data is also contained in **Appendix B**.

Table 2-2
Storage Facilities Summary

Reservoir	Location	Pressure Zone	Year Constructed	Material	Capacity (MG)	Dimensions (feet)	Base Elevation (feet)	Overflow Elevation (feet)	Overall Height (feet)
Reservoir No. 1	Pine Ave and 13th Street	218 Zone	1925	Concrete	1.00	154 x 106 (Ground Level)	207.7	218.2	10.5
Reservoir No. 2	Pine Ave and 13th Street	218 Zone	1953	Concrete	5.00	282 x 198 (Ground Level)	197.4	218.2	20.9
Reservoir No. 3	1701 Terrace Avenue	362 Zone[1]	1991	Steel	2.52	81 (Diameter)	296.5	362.0	68.0
Backwash Tank	2504 Menzel Lake Road	472 Zone	1980	Steel	0.33	54 (Diameter)	444.0	472.0	32.0

(1) The Reservoir No. 3 operating area includes the 362, 384, 425, 438 and 450 Zones if normally closed zone valves between the zones are opened.

Reservoir No. 1

Reservoir No. 1 is located at the intersection of Pine Avenue and 13th Street on the same site as Reservoir No. 2. The reservoir provides 1.0 MG of water storage for the 218 Zone. The 10.5-foot-deep, below-grade reservoir was constructed as an open reservoir in 1925, and was covered and lined in 1992. A polypropylene cover is scheduled to replace the existing Hypalon cover in 2012.

The reservoir measures approximately 154 feet by 106 feet at the ground surface. The storage volume per foot of height varies from the reservoir's base elevation of 207.7 feet to the reservoir's overflow elevation of 218.2 feet. A 12-inch-diameter ductile iron water main serves as the reservoir's inlet pipe, and a 10-inch-diameter ductile iron pipe serves as the reservoir's outlet pipe, which connects directly to Reservoir No. 2.

Reservoir No. 1

A CMU block building is located at the same site between Reservoirs No. 1 and 2 that houses the chlorination equipment and the electronic water level gauge for the two reservoirs. The site is fully enclosed and secured with a chain link fence, topped with barbed wire. Additional data on Reservoir No. 1 and the City's other reservoirs is contained in **Appendix B**.

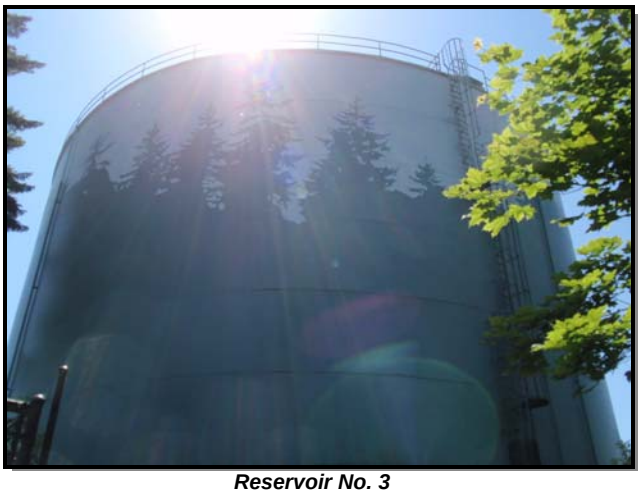
Reservoir No. 2

The 5.0 MG Reservoir No. 2 is located on the same site as Reservoir No. 1, and together they provide water storage directly to the 218 Zone. The 20.9-foot-deep, below-grade reservoir was constructed in 1953, and was covered and lined in 1992. A polypropylene cover is scheduled to replace the existing Hypalon cover in 2010.

The reservoir measures approximately 282 feet by 198 feet at the ground surface. The storage volume per foot of height varies from the reservoir's base elevation of 197.4 feet to the reservoir's overflow elevation of 218.2 feet. Two cast iron water mains, 10-inches and 16-inches in diameter, serve as the inlet pipes for the reservoir. The piping connecting Reservoirs No. 1 and 2 was installed in 1992 to enable Reservoir No. 2 to synchronize with the water level in Reservoir No. 1. Approximately 0.5 MG of storage from Reservoir No. 1 was displaced as a result of the piping modifications because Reservoir No. 2 was originally constructed at a slightly lower elevation than Reservoir No. 1. An additional 16-inch-diameter cast iron water main serves as the reservoir's outlet pipe.

Reservoir No. 2

Reservoir No. 3



Reservoir No. 3

The 2.7 MG Reservoir No. 3 is located at the end of a residential neighborhood near the eastern boundary of the Snohomish City limits. The 81-foot-diameter, 68-foot-tall steel stand pipe was constructed in 1992 and provides approximately 35,500 gallons of storage per foot height for the 362 Zone. The actual storage capacity of the reservoir is 2.2 MG as the weir within the tank was constructed at a height of 64 feet. A single 16-inch diameter ductile iron water main serves as the reservoir's common inlet/outlet pipe. The reservoir's two 10-inch-diameter altitude valves, which are set at 61.5 feet, are located within a below-grade concrete vault and control the inflow and outflow to the reservoir when the telemetry system is inoperative. The City has used Reservoir No. 3 to supply the 384, 425, 438 and 450 Zones during periods of interrupted service from Transmission Main No. 5.

Distribution and Transmission System

The City's water service area contains approximately 66 miles of water main ranging in size from 1 to 18 inches. As shown in **Table 2-3**, most of the water main (approximately 54 percent) within the service area is 6 or 8-inch-diameter, and an additional 40 percent of all water main is 12-inches in diameter or larger.

Table 2-3
Water Main Diameter Inventory

Diameter (inches)	Length (feet)	Percentage of Total
1	266	0.1%
1.5	1,568	0.5%
2	4,873	1.4%
3	788	0.2%
4	8,913	2.6%
6	82,524	23.7%
8	103,702	29.8%
10	5,115	1.5%
12	87,140	25.0%
16	20,407	5.9%
18	33,000	9.5%
Totals	***348,295***	***100%***

All of the water main in the City's system is constructed of asbestos cement, cast iron, copper, ductile iron, galvanized iron, permastran, polyethylene, PVC and steel, with 35 percent of the water main constructed of cast iron and 38 percent constructed of ductile iron. All new water main installations are required to use ductile iron water main in accordance with the City's development and construction standards. A detailed breakdown of the City's water main material inventory is shown in **Table 2-4**.

Table 2-4
Water Main Material Inventory

Material	Length (feet)	Percentage of Total
Asbestos Cement	33,000	9.5%
Cast Iron	121,918	35.0%
Copper	868	0.2%
Ductile Iron	130,734	37.5%
Galvanized Iron	6,450	1.9%
Permastran	50,824	14.6%
Polyethylene	668	0.2%
PVC	1,212	0.3%
Steel	2,621	0.8%
Totals	***348,295***	***100%***

The life expectancy of water main is generally 50 years. Approximately 36 percent of water main within the system is at least 40 years old and is reaching or has reached its life expectancy. The majority of this older water main is cast iron. The remainder of the water main in the City's water system is primarily 30 years old or less and is generally in good condition. A detailed breakdown of the City's water main installation year inventory is shown in **Table 2-5**.

Table 2-5
Water Main Installation Year Inventory

Year Installed	Length (feet)	Percentage of Total
Unknown	17,874	5.1%
1920s	4,082	1.2%
1930s	46,449	13.3%
1940s	3,809	1.1%
1950s	14,178	4.1%
1960s	38,995	11.2%
1970s	23,801	6.8%
1980s	130,425	37.4%
1990s	30,211	8.7%
2000s	38,472	11.0%
Totals	***348,295***	***100%***

Pressure Reducing Stations

Pressure reducing stations are connections between adjacent pressure zones that allow water to flow from the higher pressure zone to the lower pressure zone by reducing the pressure of the water as it flows through the station, thereby maintaining an optimal range of pressures in the lower zone. A pressure reducing station is essentially a below-grade vault (typically concrete) that normally contains two pressure reducing valves, sometimes a pressure relief valve, piping and other appurtenances. The pressure reducing valve hydraulically varies the flow rate through the valve (up to the flow capacity of the valve) to maintain a constant set pressure on the downstream side of the valve for water flowing into the lower pressure zone.

Pressure reducing stations can serve multiple purposes. They can function as an active supply facility by maintaining a continuous supply of water into a lower zone that has no other source of supply. Pressure reducing stations can also function as standby supply facilities that are normally inactive (no water flowing through them). The operation of this type of station is typically triggered by a drop in water pressure near the downstream side of the station. A typical application of this function is a pressure reducing station that is only needed to supply additional water to a lower zone during a fire flow situation. The pressure setting of the control valve within the station allows it to remain closed during normal system operation and open only during high demand conditions, like fire flows, to provide the additional supply needed.

The City's water system has a total of four active pressure reducing stations, as shown in profile view in **Figure 2-2**. Two of the pressure reducing stations are located along the Water Treatment Plant's Transmission Main on South Machias Road at Dubuque Road (PRV No. 1) and OK Mill Road at Russell Road (PRV No. 2). The pressure reducing stations reduce the pressure in the transmission main to adequate levels for the customers served directly off of the transmission main. The remaining two pressure reducing stations are located at the intersection of 9th Street and Avenue A, and at the intersection of 10th Street and Avenue D. These two pressure reducing stations function as standby supply facilities to provide water to the 218 Zone from the 362 Zone during fire flow situations and occasionally during peak demand events. A summary of these PRVs is shown in **Table 2-6** and a listing of all pressure reducing stations and related data is contained in **Appendix B**.

Table 2-6
Pressure Reducing Station Inventory

PRV	Location	Pressure Zone (From)	Pressure Zone (To)	PRV Size (inches)
PRV No. 1	South Machias Road and Dubuque Road	336 Zone	261 Zone	12 and 3
PRV No. 2	OK Mill Road and Russell Road	472 Zone	336 Zone	12 and 3
9th Street and Avenue A	9th Street and Avenue A	358 Zone	222 Zone	12 and 3
10th Street and Avenue D	10th Street and Avenue D	358 Zone	222 Zone	6 and 2

The City has three additional PRV stations that are currently inactive. These are located near the intersection of Bickford Avenue and Seneca Avenue, OK Mill Road and Newberg Road, and OK Mill Road and Creswell Road. The City does not currently have plans to operate these stations.

Water System Interties

Water system interties are physical connections between two adjacent water systems. Interties are normally separated by a closed isolation valve or control valve. Emergency supply interties provide water from one system to another during emergency situations only. An emergency situation may occur when a water system loses its main source of supply or a major transmission main and is unable to provide a sufficient quantity of water to its customers. Normal supply interties provide water from one system to another during non-emergency situations and are typically supplying water at all times.

The City's water system currently has four normal supply interties with Everett. These supply interties provide water to the City's northern pressure zones that cannot be directly served by the City's Pilchuck River source, as well as to the 218 Zone during fire flow situations and occasionally during peak demand events. The City has been purchasing water from Everett since at least 1925,

although a formal agreement does not exist between the City and Everett for these normal supply interties.

An informal water service agreement exists between the City and the PUD for emergency purposes along the Water Treatment Plant Transmission Main. The City and PUD can enact a mutual aid agreement and intertie the two systems hydrant-to-hydrant using PUD equipment.

An additional normal supply intertie provides water to the NEPA Pallet Water System from Everett. The City currently has no plans for future interties with new parties.

Telemetry and Supervisory Control System

Successful operation of any municipal water system requires gathering and using accurate water system information. A telemetry and supervisory control system gathers information and can efficiently control a system by automatically optimizing facility operations. A telemetry and supervisory control system also provides instant alarm notification to operations personnel in the event of equipment failure, operation problem, flood, fire or other emergency situations.

The City's telemetry and supervisory control system was installed in approximately 1990 and manufactured by RUGID Computer, Inc. The system consists of master telemetry units at both the City shop located at 1801 First Street and at the water treatment plant. The system operates the water treatment plant and Reservoirs No. 1, 2 and 3. Five telemetry stations exist throughout the water system and are located at the water treatment plant, the chlorine building and the flow vault on the same site as Reservoirs No. 1 and No. 2, the Terrace Avenue pressure reducing station and Reservoir No. 3. The transmitting and receiving telemetry units communicate to each other using radio communication, except in the case of the chlorine building and the flow vault, which are physically connected with cables. The City has plans to upgrade the telemetry and supplemental control system in 2011 to a more reliable system.

Water System Operation and Control

Overview

Water supply is provided by the City's Pilchuck River diversion dam and through four metered connections from Everett's Transmission Line No. 5 that follows an alignment through the north of the Snohomish City limits, as shown in **Figure 2-1**. The Pilchuck River source is the system's primary water supply and the City's current goal is to provide at least one-half of the system's water supply from the Pilchuck River source (Resolution 1022).

Pilchuck River Water Source

Water from the Pilchuck River is diverted by a 10-foot tall diversion dam and flows by gravity to the water treatment plant where the water is treated via direct filtration methods. Treated water is conveyed to the City's distribution system 14 miles to the southwest through the Water Treatment Plant Transmission Main, which serves customers along the transmission main and fills Reservoirs No. 1 and 2. When an operator is not present at the water treatment plant, a 330,000 gallon storage tank supplies treated water to the customers along the Water Treatment Plant Transmission Main. Reservoirs No. 1 and 2 directly serve the 218 Zone. During periods of high demands or emergency

conditions such as a fire event, water supply to the 218 Zone can be supplemented from the 9th Street and Avenue A and 10th Street and Avenue D PRV stations, or by opening a zone valve such that water from the 358 Zone supplies Reservoirs No. 1 and No. 2.

City of Everett Transmission Line No. 5 Water Source

Water supply to the City's 362, 384, 425, 438 and 450 Zones is provided directly through four metered connections on Transmission Line No. 5. The Bickford Avenue Intertie provides water directly to the 384 Zone. A zone valve at the intersection of Highway 9 and 72nd Street SE is normally closed and restricts the movement of water between the 384 and the 362 Zones. The King Charley's Intertie provides water directly to the 438 Zone. A zone valve that is normally closed restricts the movement of water between the 438 and 450 Zones. The Park Avenue Intertie provides water directly to the 450 Zone. Zone valves that are normally closed restrict the movement of water between the 450 and 362 Zones. The Terrace Avenue Intertie provides water directly to the 425 Zone and fills Reservoir No. 3, which serves the 362 Zone. The zone valves between the 362, 425, 438 and 450 Zones can be opened to allow Reservoir No. 3 to supply all four northern zones. The settings of the Terrace Avenue Intertie and water usage throughout the system dictate the amount of water flowing into or out of Reservoir No. 3. Water supply to Reservoir No. 3 is controlled by a level transducer which fills the reservoir when the water level drops to 45 feet and closes when the water level reaches 61.5 feet. An altitude valve provides secondary control of the amount of water flow into or out of Reservoir No. 3 if the level transducer fails. Two zone valves restrict the movement of water between the 362 Zone and the 218 Zone and are both normally closed.

ADJACENT WATER SYSTEMS

The largest water systems adjacent to the City's water service area is the Cross Valley Water District and the PUD. Several smaller water systems are located within, or in the vicinity of the City's water service area, many of which are supplied by Transmission Line No. 5. Fourteen water systems located adjacent to or within the City's service area boundary are shown in **Figure 2-3**. A brief description of each water system follows.

Aldercrest Water Users

The Aldercrest Water Users system is located within the eastern portion of the City's water service area and entirely within Snohomish City limits. The system has approximately 21 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Blackman's Lake Water District

Blackman's Lake Water District is a small water system located within the northern portion of the City's water service area, and provides water service to customers both inside and outside the Snohomish City limits. The system has approximately 18 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Circle H Mobile Home Park

The Circle H Mobile Home Park water system is located east of the City's water service area, adjacent to the NEPA Pallet Water System. The system has approximately 67 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Cross Valley Water District

The Cross Valley Water District is located to the west and south of the City's service area boundary. Cross Valley has over 6,500 service connections. Water is supplied to the system by Everett and two groundwater wells. Cross Valley has a large service area that is mostly situated between Bothell and Monroe, but also extends north to the City limits of Snohomish and Everett. The City and Cross Valley Water District are negotiating the transfer of ownership of existing Cross Valley Water District water mains within the City's UGA. Service to existing customers would be transferred to the City. The area that the City is anticipated to take over, identified as the "Cross Valley Water District/Snohomish District Overlap" in the *2010 North Snohomish County Coordinated Water System Plan*, has been reproduced in **Figure 2-3**, and is denoted by triangular hatching.

Joywood Water Line

The Joywood Water Line system is located north of the City's water service area. The system supplies approximately 37 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Lakeview Water District

The Lakeview Water District is located within the northern portion of the City's water service area and entirely within Snohomish City limits. The system has approximately 12 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

North Ridge Water Corporation

The North Ridge Water Corporation is located within the northeast portion of the City's water service area and has approximately 45 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Pilchuck 26 Tracts

The Pilchuck 26 Tracts water system is located east of the City's water service area, adjacent to the NEPA Pallet Water System. The system has approximately 23 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Schluter Water Association

The Schluter Water Association is a small water system located within the northwest portion of the City's water service area, and provides water service to customers both inside and outside the Snohomish City limits. The system has approximately 79 service connections. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Snohomish County PUD

The Snohomish County PUD provides water service throughout Snohomish County including to the north and east of City limits and adjacent to the Water Treatment Plant Transmission Main. Water is supplied to the system in these locations by Everett's Transmission Lines No. 2, 3, 4 and 5. An emergency intertie will be installed by the PUD in Fall 2011 to supply water to the Water Treatment Plant Transmission Main in the event that the Water Treatment Plant is not operational. This would allow the City to continue to supply the Water Treatment Plant Transmission Main customers in the event of an emergency. The City is currently negotiating a formal intertie agreement with the PUD and expects that an agreement will be reached by the end of 2011.

Wilkshire Lane Water District

The Wilkshire Lane Water District is located within the northwest portion of the City's water service area. The system has approximately 122 customers. Water is supplied to the system by Everett's Transmission Line No. 5. There are no plans for interties between this system and the City.

Land Use and Population

3

INTRODUCTION

The *City of Snohomish Comprehensive Plan* was originally prepared in 1995 and was last updated in November 2007. The plan was developed to meet the requirements of the State of Washington's Growth Management Act (GMA). The GMA requires, among other things, consistency between land use and utility plans and their implementation.

This chapter demonstrates the compatibility of the Comprehensive Water System Plan (Plan) with other plans, identifies the designated land uses within the existing and future service area, and identifies population projections within the City of Snohomish's (City) planning area.

COMPATIBILITY WITH OTHER PLANS

Introduction

To ensure that the Comprehensive Water System Plan is consistent with the land use policies that guide it and other related plans, the following planning documents were examined.

- Growth Management Act
- *City of Snohomish Comprehensive Plan* (Comprehensive Plan)
- *Snohomish County Comprehensive Plan*
- *North Snohomish County Coordinated Water System Plan*

Growth Management Act

The State of Washington Growth Management Act of 1990 (and its multiple amendments) defined four goals relevant to this Plan.

1. Growth and services should be in urban areas.
2. There should be consistency between land use and utility plans and their implementation.
3. There should be concurrency of growth with public facilities and services.
4. Critical areas should be designated and protected.

Urban Growth Area

The GMA requires that Snohomish County (County) and the City cooperate in designating an Urban Growth Area (UGA). As part of the development of its 1995 *Comprehensive Plan*, the City and the County designated a UGA that would accommodate the City's projected population growth and provide resource conservation. The City continues to coordinate occasional updates to the UGA with the County. The current UGA is shown in **Figure 3-1**.

Consistency

The GMA requires planning consistency from two perspectives. First, it requires consistency of plans among jurisdictions. This means that City and the County plans and policies must be consistent (RCW 36.70A.100). Second, the GMA requires the implementation of the WSP be consistent with the comprehensive plans (RCW 36.70A.120).

The 2003 Municipal Water Law also requires that water system plans be consistent with local plans and regulations. The signed consistency statement checklists from the City and County's planning departments included in **Appendix D** document the determination that this WSP is consistent with their plans and regulations.

Concurrency

Concurrency means that adequate public facilities and services be provided at the time growth occurs. For example, growth should not occur where schools, roads and other public facilities are overloaded. To achieve this objective, the GMA directs growth to areas already served or readily served by public facilities and services (RCW 36.70A.110). It also requires that when public facilities and services cannot be maintained at an acceptable level of service, new development should be prohibited (RCW 36.70A.110).

Critical Areas

The GMA requires that critical areas be designated and protected. Critical areas include fish and wildlife habitat, flood zones, aquifer recharge areas, streams, creeks, rivers, lakes, wetlands and other surface water, as well as geologic hazard areas such as steep slopes and liquefaction zones. Designated critical areas within the City's retail water service area are shown in **Figure 3-2**. **Appendix E** contains a SEPA checklist that addresses other environmental concerns.

City of Snohomish Comprehensive Plan

The City adopted its first *Comprehensive Plan* in 1964 to help guide growth of the community while protecting the Historic District and maintaining the City's identity. The *Comprehensive Plan* was significantly revised in 1976. Another significant revision was adopted in 1995 in response to the GMA. Several revisions to the 1995 *Comprehensive Plan* have occurred since its original adoption, with the last occurring on November 20, 2007.

The Land Use Element of the City's 2007 *Comprehensive Plan* is the City's vision of how growth and development should occur over a 20-year horizon. While the Land Use Element goals and policies set forth general standards for locating land uses, the Land Use Map, which has been reproduced and is shown in **Figure 3-1**, indicates geographically where certain types of uses may be appropriate. **Figure 3-1** also shows the City's Historic District boundary, which was adopted as an ordinance in 1973 and placed on the National Register of Historic Places in 1974. Located in downtown Snohomish, the 36-block area includes predominantly historic business and single-family land uses and prohibits inappropriate alterations and demolitions of historic buildings and structures. In addition, new structures are encouraged to mimic the historic character of the district.

The Land Use Element seeks to accommodate population and employment growth while preserving the community's character and protecting environmentally critical areas. It considers the general

location of land uses, as well as their appropriate intensity and density given current development trends. The Utilities, Transportation System and Capital Facilities Elements ensure that new development will be adequately serviced without compromising existing levels of service, similar to the principal of concurrency as defined in the GMA. The City's WSP is reviewed and taken into consideration during the development of and subsequent revisions to the Capital Facilities Element of the *Comprehensive Plan*.

The City encompasses an area of approximately 2,286 acres or 3.57 square miles. Vacant land within the city limits for single-family residential use is nearly depleted and infilling is expected. It is expected that much of the new single-family residential developments will occur outside of the city limits but within the UGA. The City's UGA consists of approximately 3,154 acres, or approximately 4.93 square miles.

Snohomish County Comprehensive Plan

The Snohomish County Council adopted the *Snohomish County Comprehensive Plan* on June 28, 1995. The plan was effective on July 10, 1995. Since that time, the plan has been amended several times to incorporate UGA changes, Capital Facility Plan changes and land use changes. The most recent amendment was effective on December 22, 2008. The plan consists of the following five sections.

1. General Policy Plan
2. Future Land Use Map
3. Transportation Element
4. Capital Facilities Plan
5. Park and Recreation Comprehensive Plan

The County's *Comprehensive Plan* guides development in rural, unincorporated Snohomish County and designates land use in the unincorporated UGA. Similar to the City's *Comprehensive Plan*, the County's plan contains the following land use goals that "form the basis of the County's land use strategy and:

- provide for a supply and distribution of land use types to accommodate the majority of county population and employment growth within urban growth area;
- reduce land consuming urban development patterns and provide structure for urban development within neighborhoods or urban centers;
- reduce development pressures and patterns of sprawl within rural areas;
- conserve agricultural, forest and mineral resource lands of long-term commercial significance; and
- preserve and protect open space, scenic and cultural resources."

North Snohomish County Coordinated Water System Plan

The *North Snohomish County Coordinated Water System Plan* (CWSP), dated October 1991, is the result of a study performed by Economic and Engineering Services, Inc. (EES) under the direction of the Snohomish County Water Utility Coordinating Committee (WUCC), Snohomish County, Tulalip

Tribes and the Snohomish County Public Utility District (PUD). The members of the WUCC represent all public water systems with more than ten service connections that provide service within the Critical Water Supply Service Area (CWSSA). The Snohomish County Council declared North Snohomish County a CWSSA on October 19, 1988.

The purpose of the CWSP is to assist the area's water utilities in establishing an effective process for planning and development of public water systems and restricting the proliferation of small public water systems. The CWSP accomplishes this by establishing future service area boundaries, minimum design standards, service review procedures, appeals procedures, long-term regional water supply strategy, water conservation program and goals, and the satellite system management program. As can be seen in the following sections of this WSP, the City has established policies, design criteria and goals that meet or exceed the requirements and goals of the CWSP.

LAND USE

The city limits currently encompass an area of approximately 2,286 acres. The City's UGA encompasses an additional 868 acres outside of the current city limits, with a total area of approximately 3,154 acres. The existing retail water service area encompasses an additional 257 acres outside of the current UGA, with a total area of approximately 3,411 acres. The Land Use Map, shown in **Figure 3-1**, guides development within the retail water service area. Land use within the UGA is designated by the City, and land use outside the UGA is designated by Snohomish County, as shown on **Figure 3-1**.

Most of the area within the current city limits, approximately 41 percent, is designated for residential use. Approximately 5 percent is commercial land; approximately 12 percent is designated for business use, including the Historic Business District; approximately 6 percent is for industrial use; and approximately 11 percent of the land use is for public facilities or open space. Of the remaining 25 percent of the land area within the city limits, approximately 3 percent is mixed use; approximately 1 percent is urban horticulture; and approximately 21 percent includes non-designated rights-of-way and water bodies.

A similar percentage of land, approximately 50 percent, is designated for residential use within the current UGA and outside the city limits. Approximately 2 percent is designated for business use; approximately 10 percent is for industrial; approximately 16 percent is for the airport; approximately 6 percent is for open space and urban horticulture; and approximately 16 percent includes non-designated rights-of-way and water bodies.

Of the area outside the UGA and within the retail water service area, approximately 69 percent is designated for agricultural use; approximately 4 percent is for rural business; approximately 3 percent is for residential use; and approximately 24 percent includes non-designated rights-of-way and water bodies.

Transfer of Development Rights

The City plans to implement a transfer of development rights program, which allows important agricultural lands along the Snohomish and Pilchuck Rivers to be conserved. Owners of agricultural land within a specified area are eligible to sell the development rights of the land, while keeping the ability to use the land in a manner that optimizes natural resources. Developers who purchase development rights from agricultural land owners can use them to develop or redevelop land to a

higher density within the designated receiving area known as the Pilchuck District, which is shown in **Figure 3-1**.

POPULATION

Household Trends

Snohomish is primarily a residential community comprised largely of single-family residences. In 2008, the Office of Financial Management (OFM) estimated that 2,269 housing units, or 62 percent, within the city limits were single-family detached homes and approximately 1,419 housing units, or 38 percent, had two or more units. It is projected that in 2025, 56 percent of the total housing units within the city limits will be single-family detached homes and approximately 44 percent will be two or more unit residences.

According to the U.S. Census Bureau, the average household size in Snohomish was 2.45 persons in 2000, which has decreased from 2.49 in 1990. The average number of people per household was 2.69 for owner-occupied housing units and 2.19 for renter-occupied units. The average household size in all of Snohomish County was 2.65 persons per household in 2000. The lower average household size in Snohomish reflects the relatively low percentage of single-family homes in the Snohomish community, in comparison with other cities in Snohomish County.

Snohomish County performed a buildable lands analysis of the UGA to determine the additional housing unit capacity within the City's UGA. The analysis, dated October 2007, examined each parcel of land and determined the additional housing unit capacity available based on parcel area, constructability and land use designation. The results indicated that approximately 1,900 additional housing units could be constructed within the City's UGA at the time of the analysis.

Existing and Future Population

Snohomish County has experienced rapid population growth and extensive physical developments in recent years. The County's population increased nearly 50 percent from 1990 to 2008 based on OFM estimates. Within the city limits, the population has increased nearly 40 percent during the same time period, with the majority of the growth occurring between 1990 and 2000 as the Snohomish School District grew in size and the City became a bedroom community for City of Everett and King County workers. The City's population has increased approximately 6 percent since 2000. Installation of a sewer trunk line in the west and northern portion of the UGA promotes further growth within the UGA that was otherwise unlikely to occur between the Bickford Avenue corridor and approximately the intersection of 22nd Street and Park Avenue. **Table 3-1** illustrates the City's historical population growth since 1990 and projected future growth within the city limits.

Population projections were presented in the City's 2007 Comprehensive Plan and projections for within the city limits are shown in **Table 3-1.**

Table 3-1
Population Trends and Projections within the City Limits

Year	Population
Historical	
1990	6,499
1991	6,601
1992	6,697
1993	6,988
1994	7,352
1995	7,609
1996	7,943
1997	8,016
1998	8,326
1999	8,376
2000	8,494
2001	8,565
2002	8,575
2003	8,640
2004	8,585
2005	8,700
2006	8,920
2007	8,970
2008	9,020
Projected	
2014 (+ 6 years)	10,254
2018 (+10 years)	11,169
2028 (+ 20 years)	13,830

NOTE: The historical and projected populations represent the population within the city limits.

The actual population served by the water system differs from the population that resides within the city limits. The northern portion of the city limits has numerous small water systems that obtain water service directly from the City of Everett. The City also provides water service to customers outside the city limits along the Water Treatment Plant Transmission Main and other outlying areas. The actual population served by the water system, shown in **Table 3-2**, is calculated in **Chapter 4** using the number of residential units served and the average household size.

Table 3-2
Water System Population Projections

Year	Population
Historical	
2003	9,189
2004	9,190
2005	9,303
2006	9,438
2007	9,537
2008	9,712
Projected	
2014 (+ 6 years)	10,774
2018 (+10 years)	11,759
2028 (+ 20 years)	14,624

These population projections, along with the historical per capita water use data presented in **Chapter 4**, form the basis for determining future water demands for the City's water system.

Water Demands

4

INTRODUCTION

A detailed analysis of system demands is crucial to the planning efforts of a water supplier. A demand analysis first identifies current demands to determine if the existing system can effectively provide an adequate quantity of water to its customers under the most crucial conditions, in accordance with federal and state laws. A future demand analysis identifies projected demands to determine how much water will be needed to satisfy future growth of the water system and continue to meet federal and state laws.

The magnitude of water demands is typically based on three main factors:

1. Population;
2. Weather; and
3. Water use classification.

Population and weather have the two largest impacts on water system demands. Population growth has a tendency to increase the annual demand, whereas high temperature has a tendency to increase the demand over a short period of time. Population does not solely determine demand because different populations use varying amounts of water. The use varies based on the number of users in each customer class, land use density and irrigation practices. Water conservation efforts also impact demands and can be used to accommodate a portion of system growth without increasing a system's supply capacity.

Demands on the water system determine the size of storage reservoirs, supply facilities, water mains and treatment facilities. Several different types of demands were analyzed and are addressed in this chapter, including average day demand, maximum day demand, peak hour demand, fire flow demand, future demands and a demand reduction forecast based on the proposed Water Use Efficiency program.

Certificate of Water Availability

In accordance with the requirements of the Growth Management Act (GMA), the City of Snohomish (City) must identify that water is available prior to issuing a building permit. A Certificate of Water Availability (CWA) is issued if there is sufficient water supply to meet the domestic water service and fire flow requirements of the proposed building. The requirement for providing evidence of an adequate water supply was codified in 1990 under Title 19.27.097 of the Revised Code of Washington (RCW) in the Building Code Section. To assist governments with implementing these requirements, the Department of Health has developed a handbook titled *Guidelines for Determining Water Availability for New Buildings*.

EXISTING WATER DEMANDS

Water Use Classifications

The City has divided all water customers into seven different classes for billing purposes. These consist of single-family residential, multi-family residential, commercial, City accounts, school districts, parks and open space, and irrigation. For planning purposes, the water customers have been combined into six different groups: 1) single-family residential; 2) multi-family residential; 3) commercial; 4) wholesale; 5) irrigation; and 6) other. The City defines a single-family residential customer as a connection that serves a detached dwelling or a dwelling with four or fewer attached units. All connections serving dwellings with five or more attached units are considered multi-family residential customers. The "other" user group consists of parks and open space, school districts and City billing classes. The demand analysis that follows will report on the water use patterns of these six user groups.

Water Consumption

Water consumption is the amount of water used by customers of the system as measured by the customer's meters. **Table 4-1** shows the historical average number of connections, annual consumption and average daily consumption per connection for each customer class from 2003 through 2008.

As shown in **Charts 4-1 and 4-2**, the single-family residential class represents approximately 83 percent of all connections, but only 56 percent of total system consumption. This is due to the lower consumption per connection of the single-family residential customers as compared to other customer classes. The higher consumption of non single-family residential customers is expected since these customers include multi-family residential customers where one connection typically serves several units, commercial customers that include the system's highest individual water users, and wholesale customers who distribute water to multiple customers within their system.

Table 4-1
Average Annual Metered Consumption and Service Connections

Year	Customer Class						Totals
	Single Family	Multi-Family	Commercial	Wholesale	Irrigation	Other	
Average Number of Connections							
2003	2,459	106	336	2	12	61	2,976
2004	2,445	108	337	2	12	60	2,964
2005	2,470	108	342	2	12	61	2,994
2006	2,501	108	339	2	12	62	3,024
2007	2,515	110	340	2	13	60	3,039
2008	2,547	113	346	2	12	61	3,081
Annual Consumption (gallons)							
2003	192,271,156	35,404,336	77,460,636	1,696,464	1,640,364	19,663,424	328,136,380
2004	176,789,800	37,557,080	92,353,316	1,436,908	1,573,044	16,847,952	326,558,100
2005	159,917,912	35,518,032	75,829,248	1,133,220	1,750,320	14,382,544	288,531,276
2006	183,521,052	34,357,136	69,693,404	1,292,544	1,749,572	16,859,920	307,473,628
2007	173,096,176	34,565,080	68,626,008	1,084,600	1,929,840	11,603,724	290,905,428
2008	151,944,980	35,147,024	68,905,760	1,254,396	3,369,740	9,980,564	270,602,464
Average Daily Consumption Per Connection (gal/day/conn)							
2003	214	915	631	2,324	375	881	
2004	198	953	752	1,968	359	765	
2005	177	901	608	1,552	400	648	
2006	201	872	563	1,771	399	745	
2007	189	861	554	1,486	407	534	
2008	163	852	545	1,718	759	447	
2003 - 2008 Average	190	892	609	1,803	450	670	

Chart 4-1
2008 Water Connections by Customer Class

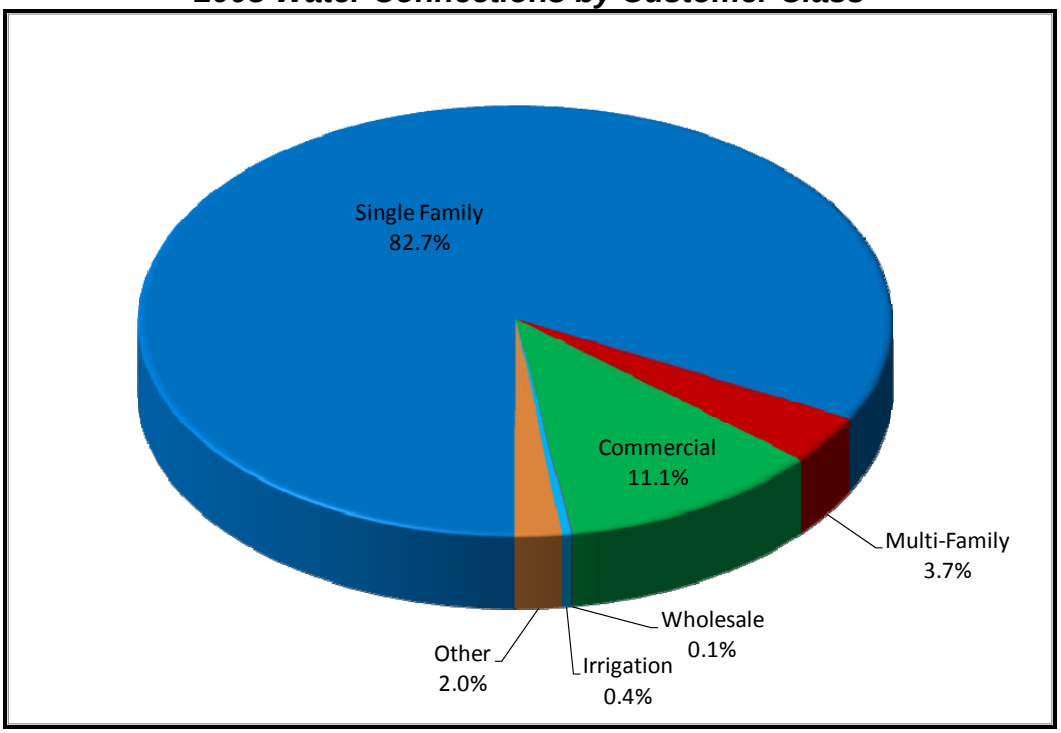


Chart 4-2
2008 Water Consumption by Customer Class

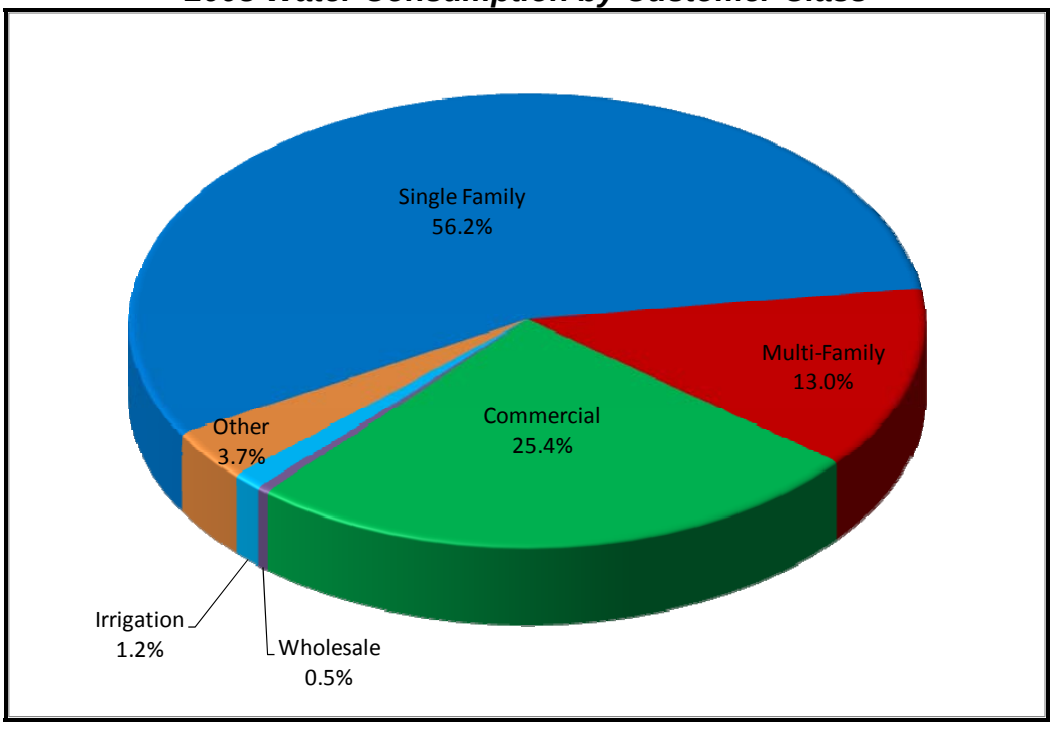


Table 4-2 shows the system's largest water users in 2008 and their total metered consumption for the year. The total water consumption of these 20 water accounts represents approximately 15 percent of the system's total consumption in 2008. The list of accounts in the table consists of commercial facilities, industrial facilities, schools and multi-family residences. As with all water system customers, the City promotes water conservation efforts to the largest water users to ensure that water is used as efficiently as possible. The City's Water Use Efficiency program is contained in **Appendix F**.

Table 4-2
2008 Largest Water Users

Name	*Address*	*Annual Consumption (gallons)*
Delta Rehabilitation Center, Inc.	1705 Terrace Avenue	6,373,403
Seattle-Snohomish Mill	9525 Airport Way	4,368,624
Haggen Foods	1301 Avenue D	3,847,979
Fred Meyer	2801 Bickford Avenue	3,286,940
Merry Haven Health Care	800 Tenth Street	3,025,122
Snohomish Mobile Home Park	1330 Avenue D	1,918,753
Snohomish Affordable Housing Group	707 Avenue D	1,836,468
Home Depot Store 4745	2601 Bickford Avenue	1,801,309
Snohomish School Dist. #201	1506 Fifth Street	1,622,525
Snohomish School Dist. #201	601 Glen Avenue	1,589,611
Reigning Properties	11100 92nd Street SE	1,480,395
Occupant	1120 Avenue D	1,464,686
C.D.J. Inc.	627 Avenue A	1,431,772
Occupant	1411 Avenue D	1,415,314
C.D.J. Partnership	707 Avenue A	1,281,413
City of Snohomish	2115 Second Street	1,072,707
Star Center Mall	821 Second Street	1,053,257
Pilchuck Veterinary Hospital	11308 92nd Street SE	891,678
Kohls	2909 Bickford Avenue	869,984
Snohomish School Dist. #201	1506 Fifth Street	783,210
Largest Water Users Total		41,415,151
Water System Total		270,602,464
Percent of Total		15%

Residential Population Served

The population within the city limits was 9,020 in 2008. The City does not provide water service to all residents within the city limits. Outside the city limits, the City serves water to some customers, including south of the Snohomish River, east of the Pilchuck River along 92nd Street SE and 86th Street SE, along Orchard Avenue, west of Highway 9 along 89th Avenue SE and along the Water Treatment Plant Transmission Main.

Table 4-3 presents the computation of the actual residential population served by the City's water system. As shown in the table, the residential population served by the City's water system is based on the recorded number of residential units served and the average residential household size. The number of residential units for single-family connections (4 unit housing or smaller) served by the City's water system was estimated from data presented in the City's *2007 Comprehensive Plan* and the 2000 U.S. Census for years 2000 and 2004. The average household size for each housing unit classification is presented in the City's *2007 Comprehensive Plan*. The total residential population served by the City's water system in 2008 was 9,712.

Table 4-3
Residential Population Served

Description	2003	2004	2005	2006	2007	2008
Single Unit Housing (Total Units)	2,190	2,168	2,180	2,198	2,199	2,217
Average Single Unit Household Size (People Per Unit)	2.84	2.84	2.84	2.84	2.84	2.84
Calculated Single Unit Residential Population Served	6,226	6,163	6,197	6,248	6,252	6,302
2 Unit Housing (Total Units)	300	301	306	312	316	322
Average 2 Unit Household Size (People per Unit)	2.09	2.09	2.09	2.09	2.09	2.09
Calculated 2 Unit Residential Population Served	628	629	640	652	660	673
3 and 4 Unit Housing (Total Units)	413	442	478	516	551	591
Average 3 and 4 Unit Household Size (People Per Unit)	1.88	1.88	1.88	1.88	1.88	1.88
Calculated 3 or 4 Unit Residential Population Served	778	833	900	972	1,038	1,112
5+ Unit Housing (Total Units)	1,071	1,077	1,077	1,077	1,092	1,118
Average 5+ Unit Household Size (People per Unit)	1.45	1.45	1.45	1.45	1.45	1.45
Calculated 5+ Unit Residential Population Served	1,556	1,565	1,565	1,565	1,587	1,625
Total Residential Population Served	***9,189***	***9,190***	***9,303***	***9,438***	***9,537***	***9,712***

NEPA Pallet Water Consumption

The City also owns and operates the NEPA Pallet Water System, which is supplied directly from the City of Everett's Transmission Line No. 5. The system serves the NEPA Pallet Company and one residential customer. The City also monitors chlorine levels at a sampling station within the NEPA Pallet system. **Table 4-4** shows the historical number of connections, annual consumption and average daily consumption per connection of each customer class for the NEPA Pallet Water System from 2003 through 2008. In general, the average daily consumption per connection for

these customers is higher than the average for single-family and commercial customers served by the City's main distribution system.

Table 4-4
NEPA Pallet Annual Metered Consumption and Service Connections

Year	Customer Class			Totals
	Single Family	Commercial	Other[1]	
Number of Connections				
2003	1	1	1	3
2004	1	1	1	3
2005	1	1	1	3
2006	1	1	1	3
2007	1	1	1	3
2008	1	1	1	3
Annual Consumption (gallons)				
2003	94,996	412,148	7,470	514,614
2004	117,436	244,596	7,470	369,502
2005	399,432	270,028	7,470	676,930
2006	109,956	378,488	7,470	495,914
2007	53,108	340,340	7,470	400,918
2008	74,800	474,232	7,470	556,502
Average Daily Consumption Per Connection (gal/day/conn)				
2003	260	1,129	20	
2004	322	670	20	
2005	1,094	740	20	
2006	301	1,037	20	
2007	146	932	20	
2008	205	1,299	20	

(1) The City monitors chlorine levels at a sampling station within the NEPA Pallet water system 249 days per year. This process uses 30 gallons per day, or an average of 20 gallons per day throughout each year.

The annual consumption in the NEPA Pallet Water System has remained relatively constant from 2003 through 2008. A water main break in September 2005 is the cause of the abnormally high 2005 annual consumption total. Upon completion of the water main repair, the customer received an adjustment on its bill

Water Supply

Water supply, or production, is the amount of water supplied to the system, as measured by the meters at each supply source. Water supply is different than water consumption in that water supply is essentially the recorded amount of water put into the system and water consumption is the recorded amount of water taken out of the system. The measured amount of water supply of any system is typically larger than the measured amount of water consumption, due to non-metered water use and water loss (i.e., distribution system leakage). **Table 4-5** summarizes the total amount of water supplied to the City's system from 2003 through 2008, the calculated average day demand and the average demand per capita for each year.

Table 4-5
Historical Water Supply and Per Capita Demand

Year	Average Water Service Population	Annual Supply (gallons)	Average Daily Demand (gpm)	Average Demand Per Capita (gal/day/capita)
2003	9,189	357,088,924	679	106
2004	9,190	355,030,675	675	106
2005	9,303	328,745,602	625	97
2006	9,438	331,513,512	631	96
2007	9,537	315,730,780	601	91
2008	9,712	337,562,316	642	95
2003 - 2008 Average				***99***

In general, the City has experienced a slight trend of decreasing water supply and system-wide water demand since 2003, as shown in **Table 4-5**. The decline over the last six years is likely due to water use efficiency (WUE) practices, including new buildings with low-flow plumbing fixtures and the repair of water main leaks. In 2005, the Governor authorized the Department of Ecology to declare a state-wide drought emergency. The significant reduction in supply from 2004 to 2005 is likely due to extensive media coverage promoting water conservation during that year.

Table 4-6 summarizes the total amount of water supplied to the NEPA Pallet Water System from 2003 through 2008 and the calculated average day demand for each year. The NEPA Pallet system has maintained a relatively consistent water demand since 2003, with the exception of 2005, which experienced extremely high demands in the September and October billing cycles.

Table 4-6
NEPA Pallet Historical Water Supply

Year	Annual Supply (gallons)	Average Daily Demand (gpm)
2003	508,640	0.97
2004	430,848	0.82
2005	813,076	1.55
2006	604,384	1.15
2007	542,861	1.03
2008	592,416	1.13

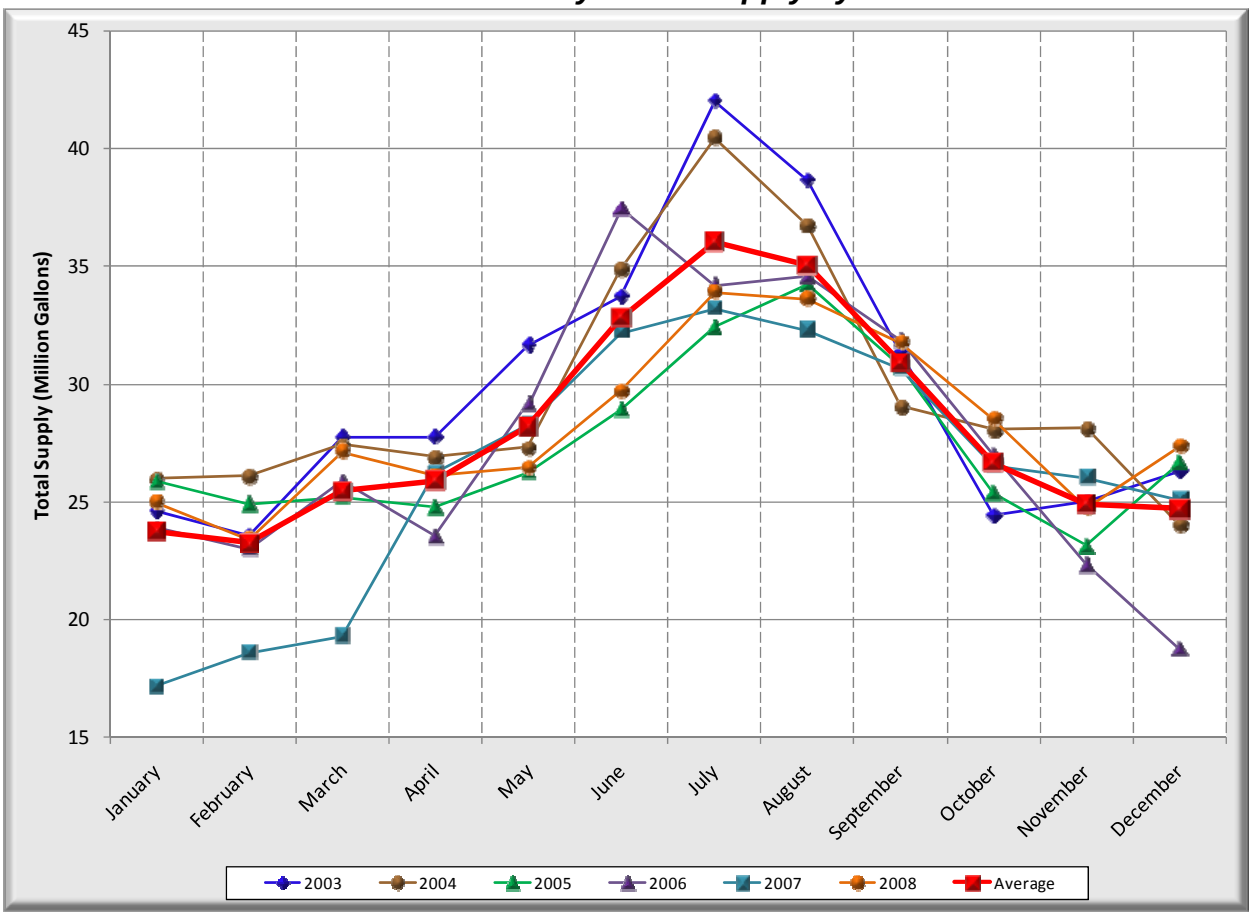
Table 4-7 shows the average demand of the City's pressure zones based on 2008 water demand data. The City's largest pressure zone, the 218 Zone, accounts for approximately 54 percent of the total system demand.

Table 4-7
2008 Demands by Pressure Zone

Pressure Zone	2008 Annual Supply (gallons)	Average Daily Demand (gpm)	Percent of Total Demand (%)
Distribution System			
218	182,457,045	347	54.1%
362	96,462,860	184	28.6%
384	25,762,591	49	7.6%
425	18,960,050	36	5.6%
438	5,281,541	10	1.6%
450	818,193	1.6	0.2%
Water Treatment Plant Transmission Main			
261	1,372,945	2.6	0.4%
336	961,493	1.8	0.3%
472	5,485,599	10	1.6%
Total	337,562,316	642	100%

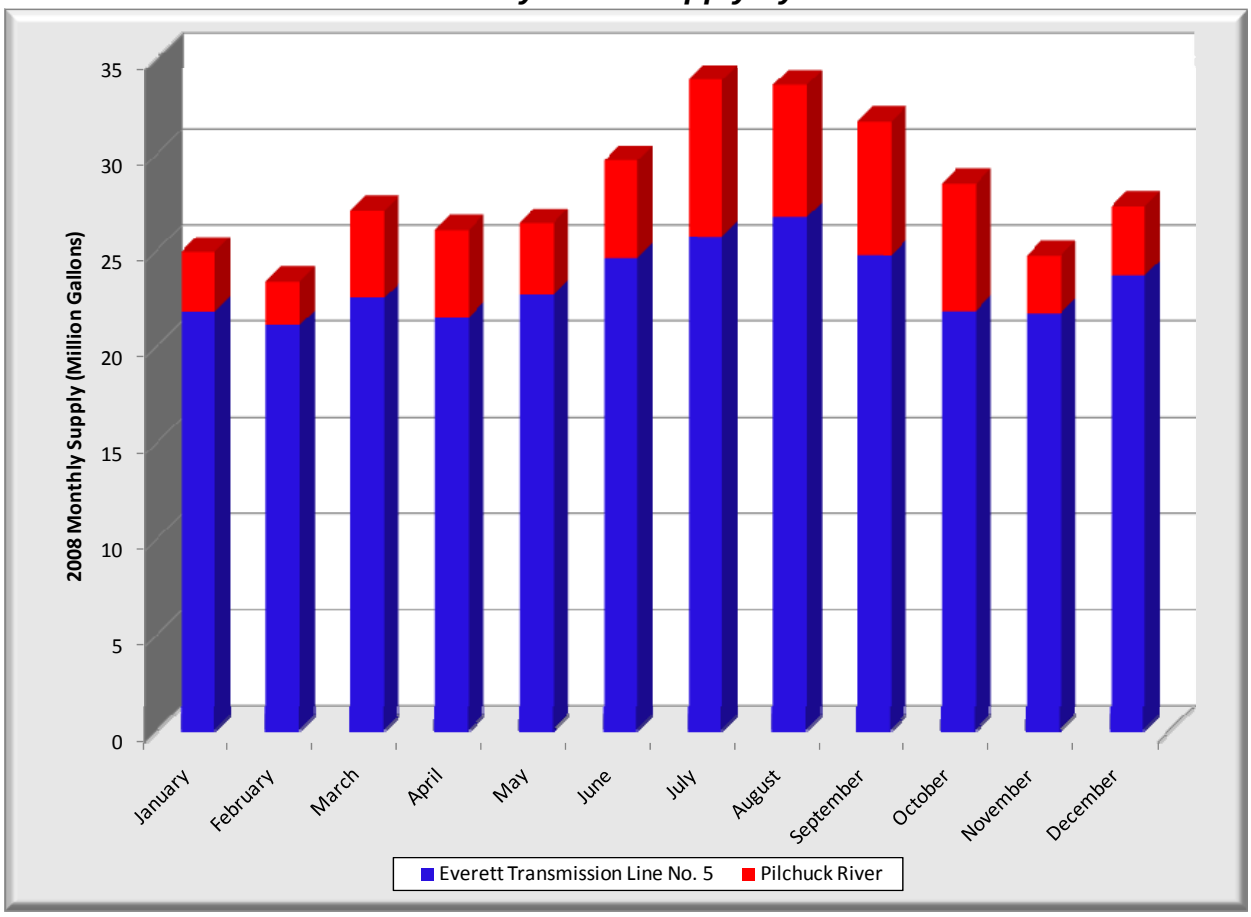
Like most other water systems, the City's water use varies seasonally. **Chart 4-3** shows the historical amount of water supplied to the City's system for each month from 2003 to 2008.

Chart 4-3
Historical Monthly Water Supply by Year



As shown in **Chart 4-3**, water supply increases significantly during summer months, primarily due to irrigation. The City's highest water use typically occurs in July and August. On average, the amount of water supplied during these months is approximately 21 percent of the total supply for the entire year. It is expected that the water supply in these months would be considerably higher if not for the City's current utility rates, which are designed to encourage water conservation. The water rates are set so that customers that use over 400 cubic feet in a two month billing cycle are billed an additional $2.68 for every 100 cubic feet of water consumed in excess of 400 cubic feet. Water production from the Pilchuck River source and the water supplied by Everett's Transmission Line No. 5 is increased to meet the additional demand during these peak periods, as shown in **Chart 4-4**. The region experienced a relatively mild summer in 2008, which is apparent from the lower peak summer supply and the fairly similar supply levels over the months of July, August and September.

Chart 4-4
2008 Monthly Water Supply by Source



Distribution System Leakage

The difference between the amount of water supply and water consumption is the amount of distribution system leakage (DSL). The amount of DSL in a water system is calculated as the difference between the amount of water supply and the amount of authorized water consumption. There are many sources of DSL in a typical water system, including water system leaks, inaccurate supply metering, inaccurate customer metering, illegal water system connections or water use, fire hydrant usage, water main flushing, and malfunctioning telemetry and control equipment resulting in overflowing of reservoirs. Several of these types of usages, such as water main flushing and fire hydrant usage may be considered authorized uses if they are tracked and estimated. Although real losses from the distribution system such as reservoir overflows and leaking water main should be tracked for accounting purposes, these losses must be considered leakage.

The amount of DSL in the City's system has remained relatively constant from 2003 through 2007, as shown in **Table 4-8**. Although the City's 2008 supply and consumption records were reviewed in detail, some of the data shown may not be accurate, as evidenced by the abnormally low authorized consumption total. Inaccurate customer metering, billing or data recording is likely the cause of this improbable value. The WUE Rule, which became effective in 2007, establishes a DSL standard of

10 percent or less based on a rolling three-year average. The City has met this standard for all years prior to 2008.

The City intends to minimize the amount of DSL in the system through its customer meter replacement program, continuing to record the amount of water used for flushing the distribution system and construction purposes, and conducting leak detection surveys of the system. Snohomish County Fire District No. 4 will continue to provide the City with estimates of water used during training and other uses.

Table 4-8
Distribution System Leakage

Water Use Classification	2003	2004	2005	2006	2007	2008
Authorized Consumption (gallons)						
Metered Customer Use	328,136,380	326,558,100	288,531,276	307,473,628	290,905,428	270,602,464
Fire Department Training	---	1,584,000	1,584,000	1,584,000	1,584,000	1,900,578
Hydrant Use Permits	---	248,500	189,700	300,000	612,420	2,975,895
WWTP Headworks Cleaning	---	320,580	641,160	558,960	411,000	411,000
Total Authorized Consumption	328,136,380	328,711,180	290,946,136	309,916,588	293,512,848	275,889,937
Total Production (gallons)						
Total Production/Supply	357,088,924	355,030,675	328,745,602	331,513,512	315,730,780	337,562,316
Distribution System Leakage						
Total Distribution System Leakage (gal)	28,952,544	26,319,495	37,799,466	21,596,924	22,217,932	61,672,379
Total Distribution System Leakage (%)	8.1%	7.4%	11.5%	6.5%	7.0%	18.3%
Rolling 3-Year Average DSL (%)	8.1%	7.8%	9.0%	8.5%	8.3%	10.6%

The amount of DSL in the NEPA Pallet system has varied substantially since 2003, as shown in **Table 4-9**. Although 2004 supply and consumption records were reviewed in detail, some of the data shown is not accurate, which is evident from the negative DSL value presented in the table. The City intends to conduct a leak detection survey of the NEPA Pallet system as part of an effort to reduce the amount of DSL to less than 10 percent based on a rolling three-year average.

Table 4-9
NEPA Pallet Distribution System Leakage

Water Use Classification	2003	2004	2005	2006	2007	2008
Authorized Consumption (gallons)						
Total Authorized Consumption	514,614	369,502	676,930	495,914	400,918	556,502
Total Supply (gallons)						
Total Supply	508,640	430,848	813,076	604,384	542,861	592,416
Distribution System Leakage						
Total Distribution System Leakage (gal)	-5,974	61,346	136,146	108,470	141,943	35,914
Total Distribution System Leakage (%)	-1.2%	14.2%	16.7%	17.9%	26.1%	6.1%
Rolling 3-Year Average DSL[1] (%)	---	14.2%	15.5%	16.3%	20.3%	16.7%

(1) Rolling 3-Year Average DSL excludes 2003 data.

Equivalent Residential Units

The demand of each customer class can be expressed in terms of equivalent residential units (ERUs) for demand forecasting and planning purposes. One ERU is equivalent to the amount of water used by a single-family residence. The number of ERUs representing the demand of the other customer classes is determined from the total demand of the customer class and the unit demand per ERU from the single-family residential demand data.

Table 4-10 presents the computed number of ERUs for each customer class from 2003 through 2008 for the City's retail water service area. The annual demands per ERU shown are based on consumption data that was computed for each customer class and the average amount of DSL from each year. Much like the average day demand, the system's average demand per ERU varies from year to year based on factors such as weather. However, such factors can affect single-family residential customers differently than multi-family, commercial, irrigation and the other customer classes.

The average demand per ERU from 2003 through 2008 was 213 gallons per day. This is below the typical range of between 250 and 300 gallons per day (gpd) for single-family demand in the Puget Sound area. This demand per ERU value will be used later in this chapter to forecast ERUs in future years, based on estimated future demands, and also to determine the capacity (in terms of ERUs) of the existing system in **Chapter 7**.

Table 4-10
Equivalent Residential Units (ERUs)

Year	Average Number of Connections	Total ERUs	Average Annual Demand (gallons)	Demand per ERU (gal/day/ERU)
Single Family Residential (ERU Basis)				
2003	2,459	2,459	209,235,868	233
2004	2,445	2,445	192,204,089	215
2005	2,470	2,470	182,206,626	202
2006	2,501	2,501	197,869,680	217
2007	2,515	2,515	187,867,896	205
2008	2,547	2,547	189,543,357	204
2003 - 2008 Average				213
Multi-Family Residential				
2003	106	453	38,528,176	233
2004	108	519	40,831,679	215
2005	108	549	40,468,392	202
2006	108	468	37,043,355	217
2007	110	502	37,514,802	205
2008	113	589	43,844,061	204
Commercial				
2003	336	990	84,295,241	233
2004	337	1,277	100,405,594	215
2005	342	1,171	86,398,023	202
2006	339	950	75,142,396	217
2007	340	997	74,482,429	205
2008	346	1,155	85,956,305	204
Wholesale				
2003	2	22	1,846,149	233
2004	2	20	1,562,192	215
2005	2	18	1,291,164	202
2006	2	18	1,393,602	217
2007	2	16	1,177,158	205
2008	2	21	1,564,793	204

Table 4-10
Equivalent Residential Units (ERUs) – Continued

Year	Average Number of Connections	Total ERUs	Average Annual Demand (gallons)	Demand per ERU (gal/day/ERU)
Irrigation				
2003	12	21	1,785,099	233
2004	12	22	1,710,198	215
2005	12	27	1,994,273	202
2006	12	24	1,886,363	217
2007	13	28	2,094,529	205
2008	12	56	4,203,573	204
Other				
2003	61	251	21,398,392	233
2004	60	233	18,316,924	215
2005	61	222	16,387,125	202
2006	62	230	18,178,116	217
2007	60	169	12,593,965	205
2008	61	167	12,450,228	204
System-Wide Totals				
2003	2,976	4,196	357,088,924	233
2004	2,964	4,516	355,030,675	215
2005	2,994	4,456	328,745,602	202
2006	3,024	4,191	331,513,512	217
2007	3,039	4,226	315,730,780	205
2008	3,081	4,535	337,562,316	204

Table 4-11 presents the computed number of ERUs for the NEPA Pallet system from 2003 through 2008. Due to the small size of the system, the demand per ERU used in the NEPA Pallet calculations was assumed to be the same as the demand per ERU calculated in **Table 4-10** for the City's water distribution system.

Table 4-11
Equivalent Residential Units (ERUs) – NEPA Pallet Water System

Year	Average Number of Connections	Average Annual Demand (gallons)	Demand per ERU (gal/day/ERU)	Total ERU's
Single Family Residential				
2003	1	95,276	233	1.1
2004	1	139,759	215	1.8
2005	1	485,120	202	6.6
2006	1	136,056	217	1.7
2007	1	73,276	205	1.0
2008	1	80,711	204	1.1
Commercial				
2003	1	413,364	233	4.9
2004	1	291,089	215	3.7
2005	1	327,956	202	4.4
2006	1	468,328	217	5.9
2007	1	469,585	205	6.3
2008	1	511,705	204	6.9
System-Wide Totals				
2003	2	508,640	233	6.0
2004	2	430,848	215	5.5
2005	2	813,076	202	11.0
2006	2	604,384	217	7.6
2007	2	542,861	205	7.3
2008	2	592,416	204	8.0

Average Day Demand

Average day demand (ADD) is the total amount of water delivered to the system in a year divided by the number of days in the year. The ADD is determined from historical water use patterns of the system and can be used to project future demand within the system. ADD data is typically used to determine standby storage requirements for water systems. Standby storage is the volume of a reservoir used to provide water supply under emergency conditions when supply facilities are out of service. Water production records from the City's water treatment plant and wholesale sources were reviewed to determine the system's ADD. The system's ADD from 2003 through 2008 is shown in **Table 4-5**.

Maximum Day Demand

Maximum day demand (MDD) is the maximum amount of water used throughout the system during a 24-hour time period of a given year. MDD typically occurs on a hot summer day when lawn watering is occurring throughout much of the system. In accordance with WAC 246-290-230 - Distribution Systems, the distribution system shall provide fire flow at a minimum pressure of 20 pounds per square inch (psi) during maximum day demand (i.e., MDD) conditions. Supply facilities (wells, springs, pump stations, interties, etc.) are typically designed to supply water at a rate that is equal to or greater than the system's MDD.

The MDD is typically determined from the combined flow of water into the system from all supply sources and reservoirs on the maximum day. While the City's daily reservoir flow data information is available, the MDD cannot be determined because daily wholesale supply records from the interties are unavailable. Therefore, the system's MDD could not be computed based on actual system data. Instead, a typical MDD/ADD factor for similar sized systems in the Puget Sound Region of 2.20 was applied to the system's actual ADD. This results in an estimated MDD of 1,413 gallons per minute (gpm) for 2008.

Peak Hour Demand

Peak hour demand (PHD) is the maximum amount of water used throughout the system, excluding fire flow, during a one-hour time period of a given year. In accordance with WAC 246-290-230 - Distribution Systems, new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 psi during PHD conditions. Equalizing storage requirements are typically based on PHD data.

The PHD, like the MDD, is typically determined from the combined flow of water into the system from all supply sources and reservoirs. Hourly water production records and chart recordings of reservoir levels are available for all of the City's storage facilities, but not for all of the City's supply facilities. Therefore, the system's PHD could not be computed based on actual system data. Instead, a PHD/MDD factor typically calculated in similar sized systems of 1.80 was applied to the system's estimated MDD. This resulted in an estimated PHD of 2,543 gpm for 2008.

Table 4-12 shows the peaking factors of the water system based on the average day, maximum day and peak hour demand data presented above. The MDD/ADD ratio of 2.20 is within the typical range of 1.2 to 2.5 for most systems. The estimated PHD/MDD ratio of 1.8 is within the typical range of 1.3 to 2.0 for most systems. These peaking factors will be used later in this chapter in conjunction with projected average day demands to estimate the system's future maximum day and peak hour demands.

Table 4-12
Maximum Day Demands and Peaking Factors

Demand Type	Date	Demand (gpm)
Average Day Demand (ADD)	2008	642
Maximum Day Demand (MDD)	Daily supply data unavailable Assumed MDD/ADD = 2.20	1,413
Peak Hour Demand (PHD)	Hourly data unavailable Assumed PHD/MDD = 1.80	2,543

Peaking Factors

Maximum Day Demand/Average Day Demand (MDD/ADD) (typ. value assumed)	2.20
Peak Hour Demand/Maximum Day Demand (PHD/MDD) (typ. value assumed)	1.80
Peak Hour Demand/Average Day Demand (PHD/ADD)	3.96

Fire Flow Demand

Fire Flow Demand is the amount of water required during fire fighting as defined by applicable codes. Fire flow requirements are established for individual buildings and expressed in terms of flow rate (gpm) and flow duration (hours). Fighting fires imposes the greatest demand on the water system because a high rate of water must be supplied over a short period of time, requiring each component of the system to be properly sized and configured to operate at its optimal condition. Adequate storage and supply is useless if the transmission or distribution system cannot deliver water at the required rate and pressure necessary to extinguish a fire.

General planning-level fire flow requirements were established for the different land use categories to provide a target level of service for planning and sizing future water facilities in areas that are not fully developed. The general fire flow requirement based on land use is shown in **Table 4-13**. It is anticipated that fire flow requirements of future buildings will be lower than the older buildings because all buildings 10,000 square feet and larger are now required to have sprinkler systems.

The water system analyses presented in **Chapter 7** are based on providing sufficient fire flow in accordance with these general planning-level fire flow requirements and the fire flow requirements of existing buildings. The fire flow requirements shown in the table do not necessarily equate to actual existing or future fire flow requirements for all buildings. Improvements to increase the available fire flow to meet actual fire flow requirements greater than those shown in the table shall be the responsibility of the developer.

Table 4-13
General Planning-Level Fire Flow Requirements

Land Use Category	Fire Flow Requirement (gpm)	Flow Duration (hours)
Single Family Residential	1,000	2
Low Density Residential	1,000	2
Medium Density Residential	1,750	2
High Density Residential	2,500	3
Historic Business	2,500	3
Mixed Use	2,500	3
Public Facilities	3,000	3
Commercial	3,500	3
Airport Industrial	4,000	4
Business Park	4,000	4
Industrial	4,000	4
Schools	4,000	4
All Other Land Uses	3,000	3

As shown in **Table 4-13**, the City's general planning-level fire flow requirements range from a minimum of 1,000 gpm for a duration of two hours for single-family residential lots, which is the majority of the area within the city limits north of the Snohomish River, to a maximum of 4,000 gpm for a duration of four hours for industrial, business park and school areas, which are primarily located along Bickford Avenue and south of the Snohomish River.

FUTURE WATER DEMANDS

Basis for Projecting Demands

Future demands were calculated from the results of the existing per capita demand computations shown in **Table 4-5** and the projected population data from **Chapter 3**. Future demand projections were computed with and without water savings expected from implementing the water use efficiency measures contained in the City's WUE Program in **Appendix F**. The calculated future per capita demand of 99 gpd was used for all demand projections without savings from WUE measures.

The City's WUE Program presents a goal of 7,644 gpd additional water use reduction by the year 2013. This goal is equivalent to 1 percent water use reduction from 2008 through 2013. The calculated future per capita demand with savings from WUE measures reflects the goals established in the City's WUE Program and was used for all years following 2013 in the 20-year forecasting period.

Demand Forecasts and Conservation

The basis for the demand projections and analyses in other chapters of this Comprehensive Water System Plan (WSP) utilize 2008 as a base year. The demand forecasts were updated in March 2011 to include annual demand projections from 2009 through 2018 and demand projections through 2032. The actual 2009 and 2010 ADDs were calculated to be 613 gpm and 530 gpm, respectively, which are less than the projected 2009 and 2010 ADDs and are both less than the actual 2008 ADD. Since the demand projections and the analyses in other chapters utilize 2008 as a base year, they are more conservative than what would be calculated based on 2010 demands. Water savings from the City's Water Use Efficiency program and reductions in water use due to weather patterns and economic conditions likely contributed to the decrease in water demand between 2008 and 2010.

Table 4-14 presents the 20-year water demand forecast for the City's water system. The actual demand data from 2008 is also shown in the table for comparison purposes. The future average day demands were projected based on population estimates for the given years and the estimated demand per capita. The future maximum day and peak hour demands were computed from the projected average day demands and the existing system peaking factors shown in **Table 4-12**. The future demand projections are also shown with and without estimated additional reductions in water use from achieving the WUE goals.

Table 4-14
Future Water Demand Projections

Description	Actual[1]	Projected											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2032
Population Data													
Population	9,712	9,922	10,068	10,287	10,511	10,739	10,774	11,012	11,256	11,505	11,759	14,624	15,953
Increase from Base Year 2008		210	356	575	799	1,027	1,061	1,300	1,544	1,792	2,047	4,912	6,241
Demand Basis Data (gal/day/capita)													
Avg Day Demand without WUE Measures	95	99	99	99	99	99	99	99	99	99	99	99	99
Avg Day Demand with WUE Measures		95	95	95	95	95	95	95	95	95	95	95	95
Average Day Demand (gpm)													
Demand without WUE Measures	642	657	667	682	697	713	715	731	748	765	782	978	1,069
Demand with WUE Measures		655	664	678	692	707	710	726	743	760	777	973	1,064
Maximum Day Demand (gpm)													
Demand without WUE Measures	1,413	1,445	1,467	1,499	1,533	1,568	1,573	1,609	1,645	1,683	1,721	2,152	2,353
Demand with WUE Measures		1,441	1,461	1,492	1,523	1,556	1,561	1,597	1,634	1,671	1,709	2,141	2,341
Peak Hour Demand (gpm)													
Demand without WUE Measures	2,543	2,600	2,640	2,699	2,760	2,822	2,831	2,896	2,962	3,029	3,098	3,874	4,235
Demand with WUE Measures		2,593	2,629	2,685	2,742	2,801	2,810	2,875	2,941	3,008	3,077	3,853	4,214

(1) 2008 Maximum Day and Peak Hour Demand values are based on actual Average Day Demand amounts for the given year and typical peaking factors, and do not necessarily represent actual peak demands for this year.

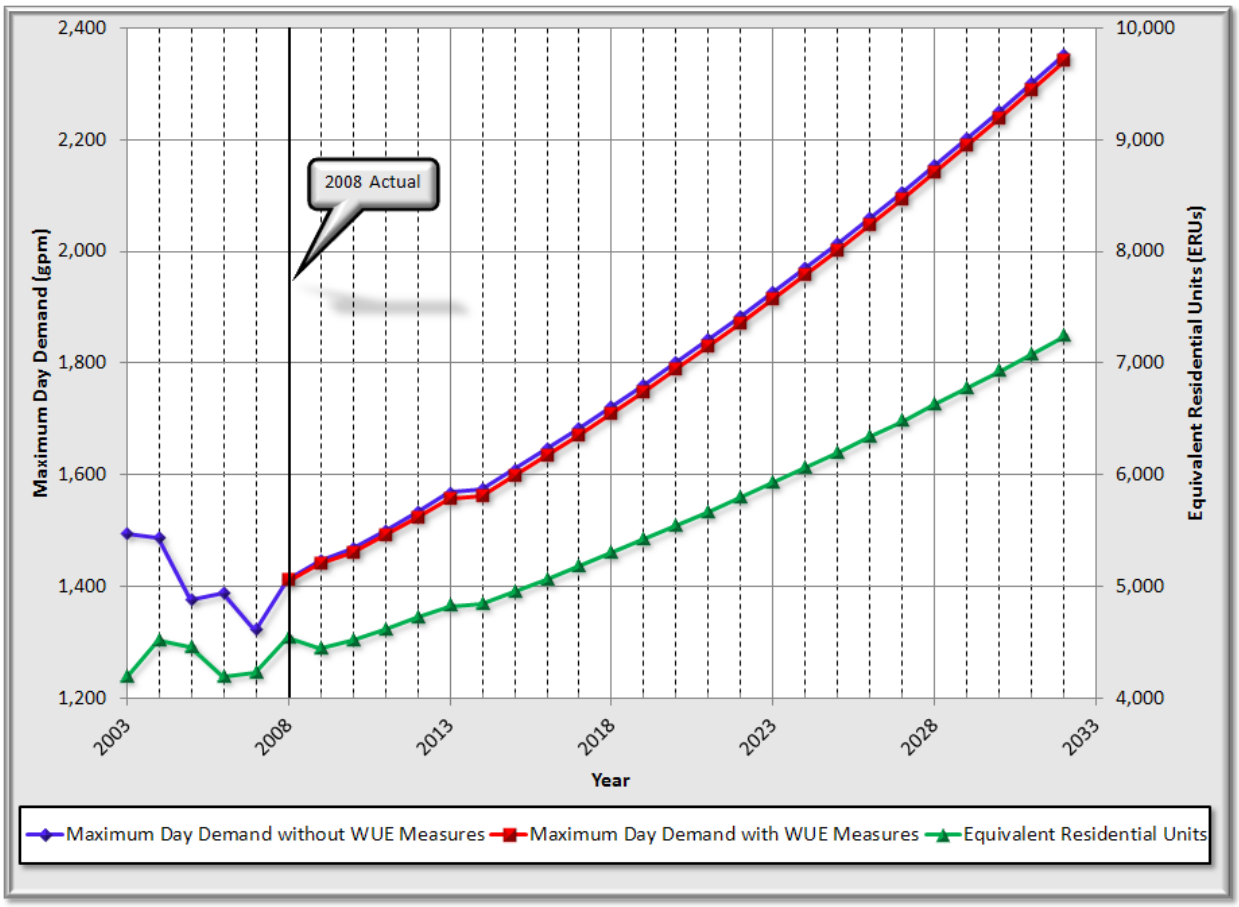
The analysis and evaluation of the existing water system with proposed improvements, as presented in **Chapters 7** and **9**, is based on the 6- and 20-year projected demand data without WUE savings. This ensures that the future system will be sized properly to meet all requirements, whether or not additional water use savings are achieved. However, the City will continue to pursue reductions in water use by implementing the WUE Program contained in **Appendix F** of this WSP.

Table 4-15 presents the existing and projected ERUs of the system. The 6- and 20-year ERU forecast is based on the projected water demand data. The historical and projected water demand and ERU data from **Tables 4-14** and **4-15** is also shown graphically in **Chart 4-5**.

Table 4-15
Future ERU Projections

Description	Actual	Projected											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2032
Demand Data (gpm)													
ADD without WUE Measures	642	657	667	682	697	713	715	731	748	765	782	978	1,069
ERU Basis Data (gal/day/ERU)													
Demand per ERU without WUE Measures	204	213	213	213	213	213	213	213	213	213	213	213	213
Equivalent Residential Units (ERUs)													
Total System ERUs	4,535	4,446	4,514	4,615	4,719	4,825	4,841	4,951	5,064	5,179	5,297	6,625	7,241

Chart 4-5
Future Water Demand and ERU Projections



Policies and Design Criteria

5

INTRODUCTION

The City of Snohomish (City) operates and plans water service for City residents and businesses according to the design criteria, laws and policies that originate from the seven agencies shown in **Table 5-1**. The agencies are listed from those with the broadest to the narrowest authority.

Table 5-1
Regulatory Agencies

Agency	*Design Criteria/Laws/Policies*
U.S. Department of Health and Human Services	Federal Regulations
U.S. Environmental Protection Agency	Federal Regulations
Washington State Department of Health	State Regulations
Washington State Department of Ecology	State Regulations
Snohomish County Council	County Regulations
Snohomish City Council	Administrative Policies
American Water Works Association	Design Criteria

These laws, design criteria and policies guide the City's operation and maintenance of the water system on a daily basis, and its planning for growth and improvements. The agencies' overall objective is to ensure that the City provides high quality water service at a fair and reasonable cost to its customers. The agencies also set the standards the City must meet to ensure the water supply is adequate to meet existing and future water demands. The system's ability to meet these demands is detailed in **Chapter 7** and the recommended improvements are identified in **Chapter 9**.

The highest three governmental entities establishing policies and laws – the U.S. Government, Washington State and Snohomish County Council – establish requirements in statutes, regulations or ordinances. The Snohomish City Council adopts regulations and policies that cannot be less stringent or in conflict with those established by governments above them. The City's policies take the form of by-laws, policies, standards, memoranda and operational procedures, many of which are summarized in this chapter.

The policies associated with the following categories are presented in this chapter.

- Supply
- Customer Service
- Facilities
- Finance
- Organization

SUPPLY POLICIES

Quality Protection

- The City will pursue steps to meet or exceed all water quality laws and standards.
- The City will take all reasonable measures to protect its system and customers.

Cross-Connection Control

- The City has a responsibility to protect the public water system from contamination due to cross connections. Cross connections that can be eliminated will be eliminated.
- The City has a cross-connection control program for eliminating cross connections. A copy of the City's Cross-Connection Control Program is contained in **Appendix G**.
- The City has staff who are certified for backflow prevention and inspection.
- The City will comply with the backflow prevention assembly installation and testing requirements as indicated in Washington Administrative Code (WAC) 246-290-490, and as published in the Pacific Northwest Section, American Water Works Association (AWWA) manual *Cross-connection Control Manual Accepted Procedure and Practice*.

Quantity

- The City will plan for at least a 20-year projected use of its supply sources so that future water resource limitations can be handled effectively.
- The City will ensure the capacity of the system, including its supply facilities, storage and transmission mains, is sufficient to meet the maximum day demands of the system.
- The City will endeavor to supply at least one-half of its water from the Pilchuck River source as long as in-stream flows can be protected.
- The City will endeavor to maximize use of the Pilchuck River source by pumping from the 218 Zone into the upper pressure zones to manage the City's water demand from the City of Everett's Transmission Line No. 5 to reduce cost.

Fire Flow

The City will plan to provide the following minimum fire flows for future development for future planning level design.

- Single-Family and Low Density Residential: 1,000 gallons per minute (gpm) for a 2-hour duration.
- Medium Density Residential: 1,750 gallons per minute (gpm) for a 2-hour duration.
- High Density Residential: 2,500 gallons per minute (gpm) for a 3-hour duration.
- Historic Business (bound by 1st Street, 2nd Street, Avenue D and Union Avenue) and Mixed Use: 2,500 gpm for a 3-hour duration.
- Public Facilities: 3,000 gpm for a 3-hour duration.
- Commercial: 3,500 gpm for a 3-hour duration.

- Airport Industrial, Business Park, Industrial and Schools: 4,000 gpm for a 4-hour duration.
- All other land uses: 3,000 gpm for a 3-hour duration.

Actual fire flow requirements, as determined by the local fire marshal, may differ from those shown based on such factors as proposed use and building size. Improvements to increase the available fire flow to meet actual fire flow requirements greater than those shown shall be the responsibility of the developer. In areas where development can meet fire flow requirements by installing water mains sized per this Comprehensive Water System Plan (WSP), but the City desires larger pipes for fire flow in other areas, the City will endeavor to pay the cost difference associated with the increased pipe size.

Water Use Efficiency

- The City has and will continue to promote the efficient and responsible use of water and will conserve water.
- The City has established water use efficiency goals through a public process. Water use efficiency goals will be evaluated and reported annually and updated at least every six years as part of the WSP update.
- The City's *Water Use Efficiency Program*, which is contained in **Appendix F**, describes the City's current adopted program.

Regional Participation

- The City will continue to participate in regional supply management and planning activities to protect the environment, reduce cost of service, increase reliability, improve water quality and secure needed quantity. The City is a current member of the Everett Water Utilities Committee. Participation includes attending meetings, funding assistance, group purchasing, inter-utility training, providing information for studies and performing water quality monitoring tasks, as needed.

CUSTOMER SERVICE POLICIES

Water Service and Connection

- The City will strive to provide potable water service to the people within the City's retail water service area, provided all policies related to service can be met.
- All proposed developments within the City's retail water service area shall connect directly to the City's water system, unless deemed unfeasible by the City at the time of the request.
- Water system extensions required to provide water service to proposed developments shall be approved by the City and must conform to the City's adopted design criteria and construction standards and specifications, as shown in the City's Construction Standards and Specifications, which are contained in **Appendix H**. All costs of the extension shall be borne by the developer or applicant.
- The City will enter into a franchise agreement and obtain all appropriate Snohomish County (County) permits prior to performing any proposed water utility improvements within County right-of-way.
- The City has the duty to serve all customers within the retail water service area if all of the following conditions can be met.

1. The City has sufficient capacity to serve the water in a safe and reliable manner.
2. The applicant is in compliance with all applicable local plans, development regulations, and utility standards and policies.
3. Sufficient water rights and supply are available.
4. The City can provide such service in a timely and reasonable manner.

- The City will not extend water service to properties outside its retail water service area unless a special agreement with an adjacent purveyor exists, due to topography or other limiting factors and the following conditions are met.
    1. The designated water purveyor cannot provide such service in a timely and reasonable manner.
    2. The designated water purveyor agrees to transfer the retail water service area.
    3. The change complies with the requirements of the Snohomish County Comprehensive Plan and the North Snohomish County Coordinated Water System Plan.
    4. The extension is approved in a WSP amendment.
    5. Sufficient water rights and supply are available.
    6. The City has sufficient capacity to serve the water in a safe and reliable manner.
    7. The property to receive water service is annexed to the City.
    8. The City can provide such service in a timely and reasonable manner.
    9. The applicant is in compliance with all applicable local and state plans, regulations and statutes.
- Properties located outside the city limits must be annexed to the City as a condition of receiving water service.
- The City will not provide new water service to customers along the City's Water Treatment Plant Transmission Main.
- Water service can be extended within the retail water service area if the project is in compliance with the City's utility standards and policies, WSP, water rights, Snohomish County's adopted land use plan, and zoning and development regulations.
- Service to existing customers located outside of city limits supplied by the Water Treatment Plant Transmission Main will be transferred to Snohomish County PUD (PUD) pending successful negotiations between the PUD and the City. To the maximum extent possible, the PUD will install and serve these customers from its own distribution system. All services currently served by the City will be disconnected from the Water Treatment Plant Transmission Main when service is transferred to the PUD.
- The PUD shall not serve additional connections off the Water Treatment Plant Transmission Main other than those currently supplied by the City.
- All applications for connection to or use of City water services shall be made on forms furnished by the City and shall be filed with the City. Such applications shall include the name of the property owner, property address, legal description of the property, the

dimensions and locations of any buildings on the property, the purpose for which the water service is to be used, a description of the course of the water line from the point of its connection with the water main to the building to be served and any other information as requested by the City.

- Water system capacity, pressure and fire flow will be evaluated at the time of the water service application. The City will use the capacity analysis contained in **Chapter 7** to evaluate sources of supply, treatment, storage, distribution system and water rights capacity available to the applicant.
- Delays resulting from non-technical conditions that affect the City's ability to provide new water service are the responsibility of the applicant. These conditions include, but are not limited to, environmental assessments, local regulations and annexation procedures. When extensions are denied, disputes can be brought to the City Council for discussion and resolution.
- Individual wells may be installed on existing lots of record within the City's retail water service area if the City determines it is unfeasible to provide direct connection to the City's water system at the time of the request. This option is strictly limited to individual cases where timely and reasonable service is not possible.

Personnel and Staffing

- Personnel shall receive training and Washington State Department of Health certification as specified in the job description for the position.
- Staffing levels shall be such that:
    1. Service is provided to customers in a timely and responsive manner;
    2. Operational and maintenance requirements are satisfied; and
    3. Response to emergency situations is timely and competent.

Annexations

- Areas annexed without existing municipal supply will be served by the City. Properties in annexed areas will be required to connect to the City water system when:
    1. A City permit is issued for the addition of one or more rooms to an existing structure; or
    2. A City permit is issued for the creation of one or more new lots; or
    3. Five years have passed from the date of annexation and a building structure is within 200 linear feet of an existing sewer main.
- Areas annexed with existing municipal supply must meet the City's standards.
- The City will follow state guidelines in the assumption of facilities in annexation areas.
- Service to areas outside of the city limits without annexation will be evaluated on a case by case basis with consideration of City Code requirements by the City Council.

Temporary Services

- Temporary service is only allowed if there are plans for timely permanent water service that meet City standards and during construction as approved by the City Engineer. All other situations requiring temporary services will be evaluated by the City Council.

Emergency Service

- Compliance with standards may be temporarily deferred for emergency water service.
- Policy criteria may be temporarily waived for emergency service.
- The City will endeavor to maintain normal water service to all customers when either the water treatment plant, Water Treatment Plant Transmission Main or Transmission Line No. 5 are out of service. The City will plan to provide redundant water system facilities to accomplish this. If the Water Treatment Plant or the Plant Transmission Main are out of service, water from Transmission Line No. 5 will be used to supply the distribution system. Should Transmission No. 5 also be out of service, the City will endeavor utilize an intertie connection with the PUD.

Planning Boundaries

- The City's retail water service area and existing and future water service areas will be designated in the current WSP and will be consistent with the *North Snohomish County Coordinated Water System Plan*.
- The City will follow State of Washington guidelines in assuming portions of adjacent water systems as a result of annexation.

Satellite System Management

- The City will not consider providing satellite system management or ownership services within or adjacent to the City's retail water service area.

FACILITY POLICIES

This section describes the planning criteria and policies used to establish an acceptable hydraulic behavior level and a standard of quality for the water system. Additional criteria are contained in the City's construction standards, a copy of which is included in **Appendix H**.

Minimum Standards

All proposed developments within the City's existing and future retail water service area shall conform to the City's adopted design criteria, construction standards and specifications in addition to the requirements of governmental agencies.

Pressure

- The City will endeavor to maintain a maximum pressure of 100 pounds per square inch (psi) in the water mains during normal demand conditions, excluding pressure surges. Individual residences are responsible for reducing system pressures over 80 psi.

- The City will endeavor to maintain a minimum pressure of 40 psi at customer meters during normal demand conditions, excluding a fire or emergency.
- The City will endeavor to maintain a minimum pressure of 30 psi at customer meters during peak and all other demand conditions, excluding a fire or emergency.
- During fire conditions, the City will endeavor to maintain a minimum pressure of 20 psi at customer meters and throughout the remainder of the system.
- During a failure of any part of the system, the maximum pressure will not exceed 150 psi.

Velocities

- During normal demand conditions, the City will ensure the velocity of water in a water main is less than 5 feet per second (fps).
- During emergency conditions such as a fire, and for design purposes, the City will endeavor to ensure the velocity of water in a water main does not exceed 8 fps.

Storage

- Storage within the distribution system must be of sufficient capacity to supplement supply when system demands are greater than the supply capacity (equalizing storage) and still maintain sufficient storage for proper pump operation (operational storage), fire suppression (fire flow storage) and other emergency conditions (standby storage).
- Gravity standby storage must be located above the elevation that yields a 20 psi service pressure to the highest service in the zone under peak hour demand conditions. The City will endeavor to maintain a minimum standby storage volume of 200 gallons per equivalent residential unit (ERU).
- Gravity fire flow storage must be located above an elevation that yields a 20 psi service pressure to all services in the zone under maximum day demand conditions.
- The City will provide sufficient standby storage for an emergency condition in which a major supply source is out of service. The volume of storage will be sufficient to maintain uninterrupted supply to the system during an emergency condition for a duration of at least two days.
- The City will provide sufficient storage for a fire condition equal to the system's maximum fire protection water demand and the required duration.
- The City will have high-water level and low-water level alarms for each storage facility at the City Shop. Alarms will be transmitted through the water system's Supervisory Control and Data Acquisition (SCADA) system located at the City Shop (Water SCADA System).
- A water level indicator for each storage facility will be transmitted to the Water SCADA System located at the City Shop.
- Storage facilities will be located in areas where they will satisfy the following requirements:
- Minimize fluctuations in system pressure during normal demands;
- Maximize the use of storage facilities during fires and peak demands;
- Improve the reliability of supply to the City; and

- Maintain water quality by usage cycling. Consideration may also be given to internal tank mixing devices.

Transmission and Distribution

- Unless deemed impractical by the City, transmission and distribution mains will be looped to increase reliability and fire flow capacity and to decrease head losses.
- New water main shall maintain at least 10 foot horizontal separation and 18 inches of vertical separation from non-potable pipes.
- All mains will comply with the generally recognized design criteria from the AWWA and Department of Health guidelines that follow.
    1. All new construction will be in accordance with the City's construction standards, a copy of which is included in **Appendix H**.
    2. Distribution system design assumes that adequately-sized service lines will be used. All residential service lines will be 5/8-inch or larger. Service lines will be the same size as the meter or larger. All service lines from a 5/8-inch meter shall be 1-inch poly pipe.
    3. The minimum diameter of distribution mains will be 8 inches in all locations unless otherwise approved by the City. Water mains not required to carry fire flow, as determined by the City, may be a smaller diameter. All water mains will be ductile iron pipe, cement lined and standard thickness Class 52. The City may consider other piping materials for specialized applications on a case by case basis.
    4. All new distribution mains will utilize a hydraulic analysis to assist in determining water main size.
    5. All new mains providing fire flow will be sized to provide the required fire flow at a minimum residual pressure of 20 psi during maximum day demand conditions, while maintaining a maximum pipeline velocity of less than 8 fps. New water mains in commercial, industrial and school areas shall be a minimum of 12 inches in diameter and looped.
    6. Valve installations will satisfy the following criteria.
        a. Zone valves will be located at all pressure zone boundaries to allow future pressure zone realignment without the need for additional pipe construction.
        b. Isolation valves will typically be installed in the lines to allow individual pipelines to be shut down for repair or installation services. Unless it is impractical to do so, the distance between in-line isolation valves shall not exceed 600 feet. In residential areas, valve spacing will be such that isolation will limit the number of temporary out-of-service connections to less than 30. Maximum valve spacing in commercial, school or multi-family residential areas will not exceed 400 feet. Isolation valves shall be installed near dead-end runs and at each end of water main runs on private easements. Four valves shall be provided per cross and three valves per tee. The City may reduce the number of and distance between valves for new construction based on the system's configuration.

c. Air/vacuum release valves will be placed at all high points, or "crowns," in all pipelines and must have City approval prior to installation.

d. Blow-off assemblies shall be located at main dead ends where there is not a fire hydrant or as required by the City to allow flushing of distribution main lines. Locations of blow-off assemblies shall be determined based on ease of access and the ability to dispose of flushed water. The blow-off assembly shall be installed in the utility right-of-way except when an access and construction easement is provided for in writing for the City.

e. Individual check valves will be installed on all new or replacement customer service setters.

7. Fire hydrant installations will satisfy the following criteria.

a. Fire hydrants serving detached single-family dwellings or duplex dwellings on individual lots will be located not more than 600 feet on center, such that all single-family lots are within 300 feet of a fire hydrant, as measured along the path of vehicular access, but not closer than 50 feet unless approved by the Snohomish County Fire District No. 4 (Fire District).

b. Fire hydrants serving any use other than detached single-family dwellings or duplex dwellings on individual lots will be located not more than 400 feet on center, and will be located so that at least one hydrant is located within 200 feet of all structures, but not closer than 50 feet, unless approved by the Fire District.

c. A minimum of one fire hydrant shall be installed per intersection unless deemed unnecessary by both the Fire District and the City.

d. Prior to fire hydrant installation, the Fire District will review and approve all proposed fire hydrant locations to ensure the correct number and spacing of fire hydrants for each project.

Supply and Booster Pump Stations

- All future booster pump stations will be modified and constructed to comply with the following minimum standards.

1. All structures will be designed to minimize combustibility, where practical.

2. All buildings will have adequate heating, cooling, ventilation, insulation, lighting and work spaces necessary for on-site operation and repair.

3. Sites will be fenced to improve security, reduce vandalism and reduce the potential for City liability.

4. Each station will be equipped with a flow meter and all necessary instrumentation to assist personnel in operating and troubleshooting the facility.

5. Emergency power capability will be provided to at least one supply or booster pump station per pressure zone.

- Pumps will be operated automatically, with flexibility in pump start/stop settings.

- Stations will be operated with the provision for at least two methods of control to minimize system vulnerability.
- Manual override of stations will be provided locally at stations and at the Water SCADA System.
- Stations will be monitored with alarms for the following conditions.
    1. Pump started automatically or manually.
    2. Power phase failure.
    3. Power outage/generator running.
    4. Communication failure.
    5. Flood in structure.
    6. Low suction pressure.
    7. High and low discharge pressure.
    8. Intrusion.
    9. Smoke detector.
    10. Heat detector.
- Stations will have the following indicators.
    1. Local flow indication and totalizing.
    2. Flow indication and totalizing at the Water SCADA System.
    3. Recording of combined supply flow to the system.
    4. Discharge pressure gauges.
    5. Motor amperage gauges.
    6. Alarm indicators for all items included under station monitoring.
    7. Appropriate hazardous material signage on exterior of buildings.
- Booster pump stations will be placed wherever necessary to fulfill the following criteria.
    1. Provide supply redundancy to a pressure zone.
    2. Improve the hydraulic characteristics of a pressure zone.
    3. Maximize storage availability and transmission capacity.
    4. Improve water quality (i.e., increase circulation) and quantity.

Pressure Reducing Stations

- All pressure reducing valves will be placed in vaults that are large enough to provide ample workspace for field inspection and valve repair.
- Vaults will be provided with adequate drainage to prevent water accumulation and equipped with sump pumps to prevent vault flooding.

- Pressure relief valves may be provided on the low pressure side of the pressure reducing valves to prevent the system from over-pressurizing in case of a pressure reducing valve failure.

Control

- The City's control system must be capable of efficiently operating the water system's components in accordance with this WSP and in response to reservoir levels, system pressures and abnormal system conditions.

Maintenance

- Facility and equipment breakdown is given the highest maintenance priority. Emergency repairs are to be made even if overtime labor is involved.
- Equipment will be scheduled for replacement when it becomes obsolete and as funding is available.
- Worn parts will be repaired, replaced or rebuilt before they represent a high failure probability.
- Spare parts will be stocked for all equipment items whose failure will impact the ability to meet other policy standards.
- Equipment that is out of service will be returned to service as soon as possible.
- A preventive maintenance schedule will be established for all facilities, equipment and processes.
- Tools will be obtained and maintained to repair all items whose failure will impact the ability to meet other policy standards.
- Dry, heated shop space will be available for maintenance personnel to maintain facilities.
- All maintenance personnel will be trained and certified to efficiently perform their job descriptions.
- Maintenance will be performed by the water maintenance staff or other approved sources and supervised by the Senior Maintenance Worker or the Public Works Operations Manager.
- Written records and reports showing the operation and maintenance history will be maintained on each facility and item of equipment.

Joint Use

- All joint-use facilities (with other public water systems) must comply with the City policy and design standards.
- All joint-use facilities will be maintained by the City.
- Joint-use facilities will be pursued only in those areas that improve reliability or reduce operating costs.

FINANCIAL POLICIES

General

- The City will set rates that comply with state regulations.
- Rates and additional charges established for the City should be:
- Cost-based rates that recover current, historical and future costs associated with the City's water system and services;
- Equitable charges to recover costs from customers, commensurate with the benefits they receive; and
- Adequate and stable source of funds to cover the current and future monetary needs of the City.
- Existing City customers pay the direct and indirect costs of operating and maintaining the facilities through water rates. In addition, the water rates will include debt service incurred to finance the City's capital assets serving existing customers, if required.
- New customers seeking to connect to the water system will be required to pay connection fees and charges for an equitable share of the historical cost of the system and for the system's Capital Improvement Program (CIP). Connection charge revenues in conjunction with rate revenue, will be used to fund the growth CIP and existing system CIP when designed to provide for growth.
- New and existing customers will be charged for extra services through separate ancillary charges based on the costs to provide the services. Ancillary charges can increase equitability, as well as operating efficiency, by discouraging unnecessary demand for services. The charges will be reviewed regularly and updated on an as-needed basis to reflect increases in operating or material costs. Revenue from ancillary charges will be used to finance annual operations and maintenance or existing system CIP requirements.
- The City will maintain information systems that provide sufficient financial and statistical information to ensure conformance with rate setting policies and objectives.
- User charges must be sufficient to provide cash for the expenses of operating and maintaining the system. To ensure the fiscal and physical integrity of the utility, an amount should also be set aside each year and retained for capital expenditures.
- A non-restricted contingency reserve amount will be maintained to cover unanticipated emergencies and fluctuations in cash flow.
- Water rates will strive to equitably charge customers with different service requirements based on the cost of providing the water service. Service requirements relate to the total volume of water used, peak rates of use and other factors.
- Water rates will be tiered to encourage the efficient use of water.
- Fees and charges are calculated based on the service provided. Rates will be the same for all customers of the same class within the retail water service area.

Connection Charges

Owners of properties that have not been assessed, charged or borne an equitable share of the cost of the water system will pay one or more of the following connection charges prior to connection to a water main.

- Utility Connection Fee: A utility connection fee shall be assessed for each new water connection. The basis of the utility connection fee is to provide means by which water service customers bear an equitable share of the cost of construction and replacement of major water utility facilities and equipment.
- Utility Capital Facility Charge: A utility capital facility charge shall be assessed for each new water connection. The basis for the utility capital facility charge shall be the water service size and shall provide the City with funds to construct major water utility facilities and equipment.
- Project Development Fee: A project development fee will be assessed against all new connections established in a defined special development area. The basis for the project development fee shall be the water service size.

ORGANIZATIONAL POLICIES

Staffing

- Personnel certifications will meet or exceed Washington State standards.
- The Water Department will promote staff training.

Relationship with Other Departments

- The Finance Department is responsible for customer billing, payment collection, project cost accounting and fund activity reporting.
- The Human Resources Department is responsible for employee records and salary schedules.
- The Police Department and/or the Water Department are responsible for enforcing violations of City water ordinances.
- The Fire District uses water utility facilities for fire protection and establishes fire flow requirements.
- The Fire District is responsible for emergency responses to hazardous events at water system facilities.
- The Fire District or its representative is responsible for hydrant fire flow testing under the supervision of the Water Department.

Water Source and Quality

6

INTRODUCTION

The two basic objectives of a water system are to provide a sufficient quantity of water to meet customer usage demands and to provide high quality water. **Chapter 7** discusses the City of Snohomish's (City) ability to supply a sufficient quantity of water and identifies future source requirements. This chapter discusses the City's existing water sources, water rights, water quality regulations and water quality monitoring results.

EXISTING WATER SOURCES AND TREATMENT

Water Sources

The City's water treatment plant, constructed in 1981 with a design capacity of 1,500 gallons per minute (gpm), treats water from the Pilchuck River. Water is diverted from the river by a 10-foot-tall diversion dam and flows by gravity to the water treatment plant where the water is treated via direct filtration methods. Treated water is conveyed to the City's distribution system 14 miles to the southwest through the Water Treatment Plant Transmission Main, which serves customers along the transmission main and fills Reservoirs No. 1 and 2. The Pilchuck River source had been the system's primary water supply until recent years, in which the City has become more reliant on City of Everett (Everett) water while upgrades to the water treatment plant were being completed.

The City has four connections to Everett's Transmission Line No. 5, which serve the City's northern pressure zones. Everett does not currently limit the amount of water that the City can withdraw from the connections on an annual or instantaneous basis. Additional information on each of the City's existing sources is presented in **Chapter 2**.

Water Treatment

The City's water treatment plant treats the water from the Pilchuck River intake structure and diversion dam by direct filtration. Once the diverted water reaches the water treatment plant, it enters a flocculation tank where aluminum sulfate and liquid polymer are added to the water prior to filtration. A chemical monitoring and tracking system constantly adjusts the dosages of the chemicals being added to the water depending on the properties of the raw water entering the water treatment plant. On average, the City adds approximately 81 pounds of aluminum sulfate per day and 5.6 pounds of liquid polymer per day.

The water then passes through four granular media cells with a total area of 500 square feet. In addition to the chemicals added for flocculation, a filter aid is added for filtration after backwashing at an average rate of 0.18 pounds per day, soda ash is added for pH adjustment at an average rate of 100 pounds per day and chlorine gas is added automatically by the system at a set rate of 1.4 parts per million.

The City does not add fluoride to the Pilchuck River water or the water purchased from Everett. Water supply is treated by Everett (including fluoridation) before it reaches the City and is not rechlorinated or subjected to any treatment prior to entering the City's distribution system.

WATER RIGHTS

Overview

A water right is a legal authorization to use a specified amount of public water for specific beneficial purposes. The water right amount is expressed in terms of instantaneous withdrawal rate and annual withdrawal volume. Washington State law requires users of public water to receive approval from the Washington State Department of Ecology (Ecology) prior to actual water use. This approval is granted in the form of a water right permit or certificate. Water right claims are another type of water right document which may or may not represent a water right that was created prior to adoption of the relevant water code. Claims were filed by individuals and entities with Ecology during and opening of the claims registry. Claims were necessary to protect a perfected water right established prior to 1917 for surface water and 1945 for groundwater. Surface water rights were also required to have been put to full beneficial use prior to 1932. Ecology did not perform any review of the information provided on a claim form when it was received.

The process for obtaining a state-issued water right involves first obtaining a water right permit, then a water right certificate. A water right permit provides permission to develop a water right by constructing, developing and testing the water source. A water right permit remains in effect until a water right certificate is issued (if all terms of the permit are met) or the permit has been canceled. A water right certificate is issued by Ecology following a review process and determination that the amount of water put to beneficial use is consistent with the amount and conditions indicated on the water right permit.

A water right permit is issued by Ecology only if the proposed use meets the following requirements:

- Water will be put to beneficial use;
- No impairment to existing or senior rights;
- Water is available for appropriation; and
- Issuance of the requested water right will not be detrimental to the public welfare.

The water right decision process also considers existing basin management plans, stream closures, instream flows, hydraulic continuity (surface water interconnected to groundwater), seawater intrusion, utilization of existing water sources, water conservation and availability of alternative water supplies, among other things. The water right decision process is increasingly becoming more complex and time consuming due to the many competing interests for water, environmental issues and regulatory requirements.

Municipal Water Law

The 2003 Municipal Water Law (MWL) (Second Engrossed Second Substitute House Bill 1338; Chapter 5, Laws of 2003; 58th Legislature; 2003 1st Special Session; Municipal Water Supply--Efficiency Requirements) clarified municipal water rights and allowed a municipal water supplier's place of use to be changed to match the current service area. The MWL allowed changes to the water right place of use to occur via the approval of the service area by the Washington State Department of Health (DOH), as opposed to the previous method of the water right change application process with Ecology. This law was the subject of a lawsuit which questioned the

constitutionality of portions of the law but, on October 28, 2010, the Washington State Supreme Court unanimously ruled that all parts of the MWL are constitutional.

Ecology is currently evaluating their original guidance document (Policy 2030) that addressed the implementation of the MWL to see if any minor changes are necessary before it will be reissued. It is anticipated that any changes will be relatively minor and that the future policy guidance will be very similar, if not identical, to the guidance originally provided. In such a case, the City's inchoate water right for the Pilchuck River would be in good standing and the City would be allowed to grow into that water right.

The MWL states that inchoate rights are in good standing. However, Ecology's Policy 2030 states that Ecology interprets the statute as requiring active compliance with the beneficial use definitions in Revised Code of Washington (RCW) 90.03.015(4). They state that:

> If a water right holder's use of water does not meet the definition of a water right for municipal water supply purposes for five or more years (note: serving 15 or more residential connections – note added to citation), then the water rights would be valid only to the extent it had been beneficially used during that period, with any nonuse resulting in relinquishment of the right unless the non-use is excused by one of the other exemptions to relinquishment. (See RCW 90.14.140: "Sufficient cause" for nonuse defined – Rights exempted.)

The MWL establishes the entire Pilchuck River water right as being in good standing. However, if the City was to eliminate the Pilchuck diversion entirely or decided to reduce its use to a level where the Pilchuck River source serves less than 15 residences, the right would no longer be considered a municipal purpose water right and would be subject to relinquishment of any unused water due to non-use for five or more consecutive years. Complete elimination of this diversion, particularly if it included removal of the pipeline and any ancillary facilities, could also be viewed as abandonment of a municipal water right and the right could be lost in its entirety.

Should the City wish to cease use of the Pilchuck River source but preserve the ability to utilize the water right in the future, the water right could be temporarily donated into the Trust Water Rights Program (see discussion below). The quantity eligible for transfer would be the maximum historic use. All water rights held in the Trust Water Rights Program are protected from relinquishment during that period of time. The remaining inchoate portion would remain with the City for potential use in the future provided that the City could not be deemed to have abandoned the right by, for example, removing the pipeline and terminating use of the water diversion and treatment facility. The trust water right statute makes it clear that the amount of water in trust and used by the City cannot exceed the amount put to beneficial use in the five year period preceding the donation to Trust Water Rights Program. This means that the City could not put the water it currently uses in trust and then keep using water and identify it as coming from the inchoate portion of the water right.

In the event of a general adjudication of water rights, the inchoate portion of the right could be at risk unless the City can demonstrate good faith and due diligence in further developing the remainder of the right.

Existing Water Rights and Claims

The City currently holds a surface water right certificate for its Pilchuck River source. A summary of this water right information is presented in **Table 6-1**. This source is being utilized by the City to

provide water supply to the southern portion of the existing system. The Pilchuck River water right certificate was issued on February 28, 1974, with a priority date of December 9, 1931. This water right certificate was granted for the maximum use of 5.0 cubic feet per second (cfs) and 3,000 acre-feet per year for municipal supply. The place of use on the City's water right certificate is defined as the "area served by the City of Snohomish."

The water right certificate is included in **Appendix G**.

Table 6-1
Existing Water Right

DOH No.	Source Name	Permit or Certificate Number	Priority Date	Primary or Supplemental Right	Existing Water Rights			
					Instantaneous		Annual	
					(gpm)	(cfs)	(acre-ft)	(gpm)
S01	Pilchuck River	S1-00500C	12/9/1931	Primary	2,244	5.0	3,000	1,859

In response to the Water Right Registration Act of 1967, the City filed water right claim No. 43282 dated October 15, 1973, to document the historical instantaneous use of the Pilchuck River water right. The City claimed continuous use of 2.5 cfs that had been put to beneficial use since 1890. A copy of this water right claim is included in **Appendix G**. A water right claim is a claim by a party (i.e., the City) that they have a valid vested water right that pre-dates the adoption of the surface water code in 1917 and that should, in effect, be grandfathered into the water rights records of the State. Ecology is not authorized to make a final determination of the validity or extent of a water right claim. Such a determination may be made only through what is known as a general adjudication of water rights and is conducted by the Superior Court of the County in which the waters are located. However, Ecology may make "tentative determinations" related to the extent and validity of any rights represented by a water right claim. Given the early development in and around the City, and without conducting extensive research into the history of water use by the City, it appears that this claim may represent a valid vested water right for an amount not to exceed the claimed amount of 2.5 cfs with a priority date of 1890.

Implications for the City of Snohomish

Water use records indicate that the City has not fully perfected its water right for diversion of water from the Pilchuck River. In addition, the diversion of water in recent years has been reduced because of restrictions imposed by DOH. In June 2006 DOH limited the water treatment plant to operating a maximum of 8 hours per day, because it did not have automatic shut-down and filter-to-waste capabilities. Upgrades to the water treatment plant were completed in and the water treatment plant may now be operated at 1,181 gpm, 24 hours per day. However, this results in some uncertainty about the status of some portions of the Pilchuck River water right. Because the purpose of use on the City's surface water certificate is identified as Municipal Supply, the quantity of water actually put to beneficial use is perfected and is not subject to relinquishment due to five or more consecutive years of non-use without sufficient cause. Any remaining water in the certificate that has never been put to beneficial use is an inchoate right and with the recent Supreme Court ruling on the Municipal Water Law, will be considered a right in good standing. The result is that the unused portion of the water right will remain with the City provided the full development of the water right is being pursued with due diligence. As stated above, Ecology may not reduce a

municipal water right unless it is done as a result of a water right change application submitted by the water right holder, in response to a general adjudication of water rights, or to respond to misrepresentation of the facts by the water right holder. The City has not submitted a water right change application and does not currently have plans to do so, there has not been a general adjudication of the waters of the Pilchuck River and there is no indication of any misrepresentation of facts. The result is that the City's Pilchuck River water right is currently intact and in good standing. As stated previously, the inchoate portion of the right could be at risk in a general adjudication of water rights unless the City can demonstrate good faith and due diligence in further developing the remainder of the right.

Based on a 2009 evaluation of the City's long-term water supply alternatives, the City plans to continue evaluating two long-term water supply alternatives.

1. The City continuing to supply the 218 Zone from the Pilchuck River source. Backup or emergency supply to the 218 Zone and supply to all other pressure zones will be provided by Everett's Transmission Line No. 5.
2. The City phasing out the Pilchuck River source within the six-year planning period and supplying the distribution system entirely with water from Transmission Line No. 5.

If the Pilchuck River source is phased out and the City supplies the distribution system entirely with water from Transmission Line No. 5, the City could be found to have abandoned its municipal purpose water right and that right could be lost. Washington State case law provides for the loss of a municipal purpose water right via abandonment, in spite of the fact that such rights are exempt from relinquishment under the statute.

Common law abandonment occurs when there is intentional nonuse of the water or voluntary relinquishment of a water right. The intent to abandon may be shown by explicit declarations or inferred from the parties' conduct (*An Introduction to Washington Water Law*, Office of the Attorney General, January 2000, Christine O. Gregoire, James K. Pharris, P. Thomas McDonald).

Managing the Risk

If the Pilchuck River source is phased out and the City supplies the distribution system entirely with water from Transmission Line No. 5, there are four potential means of avoiding abandonment of the Pilchuck River water right.

1. Continuing to maintain the Water Treatment Plant Transmission Main and all water treatment plant facilities in good working order would demonstrate intent to retain the water right. An evaluation of the costs for continued maintenance of these facilities is shown in **Chapter 9**.
2. The City could place the water right in the Trust Water Right Program. The trust program is aimed at restoring instream flows in critical salmon and steelhead streams and water rights can be put into the trust program in several ways. There are short- or long-term leases in which the State (and sometimes other organizations such as the Washington Water Trust) compensates the water right holder for placing the water right into trust. Longer term leases generally result in more compensation because of the longer period of benefits to instream flows.

3. The water right holder may donate their water right to the trust program. In such cases, no compensation is provided but the donor may receive "good will" in the community for having donated the water right. These donations may also be short- or long-term donations. Donations may qualify as charitable contributions for tax purposes.
4. The water right holder may sell their water right to the Trust Water Rights Program. This is a permanent transaction and compensation is provided to the water rights holder for purchase of the water right.

In each of the four cases, the quantity of water to be placed in trust will be limited to the maximum amount of water that has historically been put to beneficial use. If the City continues to divert a reduced quantity of water from the Pilchuck River through the six-year planning period and then decides to put the Pilchuck River water right into the trust program, the quantity eligible for trust would be determined by the quantities used during the five years preceding the trust donation. If the City continues to repair the treatment system and increase its capacity and the quantity of water diverted from the Pilchuck River, the quantity of water that is eligible for the trust water right program would also increase.

When water is removed from trust, the water right holder gets the entire quantity placed in trust back for their use. If the City placed 50 percent of the Pilchuck River water right into trust, they would receive the same amount upon removal of the water right from the trust. If the City wishes to pursue this course of action, the historic beneficial use of their water right for the preceding five-year period will need to be determined.

The State of Washington has identified 16 critical salmon habitat basins in Washington State, including the Snohomish Basin. Within the Snohomish Basin, the Pilchuck River has been identified as the highest priority stream for salmon recovery. As a result, the City should carefully evaluate its options regarding its Pilchuck River water right. It should be determined if the City envisions needing the Pilchuck River source in the future. If the City determines the Pilchuck River source is necessary to supply its distribution system and wishes to retain a legal interest in the water, the City should pursue one of the options under the Trust Water Rights Program. Given the Pilchuck River's high salmon recovery priority, the City may receive significant compensation for the water right. If the City determines the Pilchuck River source is not necessary to supply its distribution system and does not have a need to retain this water right, options should be considered to surrender the Pilchuck River water right but the City should seek to obtain as much compensation for that right as possible.

Recommendation

The City should fully evaluate its options with respect to its existing Pilchuck River water right and ensure that the consequences of any actions or inactions associated with the right to divert water from the Pilchuck River are fully understood.

Water Rights Evaluation

An evaluation of the City's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands. **Table 6-2** compares the maximum instantaneous water right rate with the maximum day demand of the system and the maximum annual water right volume with the average day demand of the system. As shown in the table, the

City has sufficient water rights (both instantaneous and annual amounts) to meet the demands of the existing customers.

Table 6-2
Existing Water Rights Evaluation

Description	Instantaneous Rights/ Maximum Day Demand (gpm)	Annual Rights/ Average Day Demand	
		(acre-feet)	(gpm)
Total Certificated Water Rights	2,244	3,000	1,859
Existing (2008) Water Demand	1,413	1,036	642
Surplus (or Deficient) Rights	831	1,964	1,217

Table 6-3 summarizes the results of the future water rights evaluation, which compares the water rights of the existing sources with the future 6- and 20-year demand projections of the system. The analysis considered future demand projections with and without additional water use reductions from planned water use efficiency efforts, as shown in **Table 6-3**. The results of the future water rights evaluation indicate the City has sufficient annual water rights to meet the projected average day and instantaneous rights to meet the maximum day demands through 2028, should the City continue to supply its system from the Pilchuck River source.

Table 6-3
Future Water Rights Evaluation

Description	Instantaneous Rights/ Maximum Day Demand (gpm)	Annual Rights/ Average Day Demand (acre-ft)	Annual Rights/ Average Day Demand (gpm)
Year 2014 Without Conservation			
Total Certificated Water Rights	2,244	3,000	1,859
Projected (2014) Water Demand	1,573	1,153	715
Surplus (or Deficient) Rights	***671***	***1,847***	***1,144***
Year 2028 Without Conservation			
Total Certificated Water Rights	2,244	3,000	1,859
Projected (2028) Water Demand	2,152	1,578	978
Surplus (or Deficient) Rights	***92***	***1,422***	***881***
Year 2014 With Conservation			
Total Certificated Water Rights	2,244	3,000	1,859
Projected (2014) Water Demand	1,561	1,145	710
Surplus (or Deficient) Rights	***683***	***1,855***	***1,149***
Year 2028 With Conservation			
Total Certificated Water Rights	2,244	3,000	1,859
Projected (2028) Water Demand	2,141	1,570	973
Surplus (or Deficient) Rights	***103***	***1,430***	***886***

Water Rights Planning

The City's supply facility does not currently have the capability to provide supply to the system at their maximum instantaneous water rights. Since June 2006, the City's water treatment plant has been operating under restrictions imposed by DOH as a result of a DOH sanitary survey and a Comprehensive Performance Evaluation performed by The Cadmus Group. The restrictions will remain in place until identified administrative, operational and capital improvement upgrades have been completed. One of the restrictions requires a certified operator be present when the water treatment plant is operating. The restriction limits the water treatment plant to operating only 8 hours per day at an average rate of 394 gpm.

Upgrades to the water treatment plant are currently being completed and include the addition of four filter-to-waste pumps and piping with motor actuated valves for each filtration cell; installation of new filter media and recoating the interior of each filtration cell; replacement of the generator's manual transfer switch with an automatic transfer switch; and the installation of new control panels and a programmable logic controller, which allows fully automated control of the water treatment plant. Most of these improvements are complete, while the remaining improvements were scheduled to be completed by January 2011. Once complete, the water treatment plant may be operated at 1,181 gpm, 24 hours per day. Thus, the facilities are not able to fully utilize their existing

water rights until the remaining improvements are complete. However, the City's facilities are sufficient to supply the water system through 2028 and likely beyond. The City will strive to use its existing water sources efficiently by continuing the current water use efficiency measures and implementing proposed measures, as outlined in the City's Water Use Efficiency Program, which is included in **Appendix F**.

WATER SUPPLY PLANNING

Existing Water Supply

The City's water system currently has normal supply interties with Everett along Transmission Line No. 5. The City's 345, 358, 368 and 418 Zones are currently supplied with water from Transmission Line No. 5. Water supply to the City's 218 Zone and customers along the Water Treatment Plant Transmission Main is currently provided by the Pilchuck River source.

Everett's raw water supply originates in the Spada Reservoir created by the Culmback Dam on the Sultan River, approximately 25 miles east of Everett. The raw water passes through the Snohomish County PUD Power House prior to entering the Chaplain Reservoir. The water from the reservoir is delivered to the Everett Water Filtration Plant prior to delivery to the City of Everett and several other water systems. As a regional water provider, Everett provides water to over 400,000 people in Snohomish County.

Water from the Pilchuck River is diverted by a 10-foot-tall diversion dam and flows by gravity to the water treatment plant where the water is treated via direct filtration methods. Treated water is conveyed to the City's distribution system 14 miles to the southwest through the Water Treatment Plant Transmission Main, which serves customers along the transmission main and fills Reservoirs No. 1 and 2. When an operator is not present at the water treatment plant, a 330,000 gallon storage tank supplies treated water to the customers along the Water Treatment Plant Transmission Main. Reservoirs No. 1 and 2 directly serve the 218 Zone. During periods of high demands or emergency conditions such as a fire event, water supply to the 218 Zone can be supplemented from the 9th Street and Avenue A and 10th Street and Avenue D pressure reducing valve (PRV) stations, or by opening a zone valve such that water from the 358 or 418 Zones supplies Reservoirs No. 1 and 2.

Long-term Water Supply

The City is currently evaluating phasing out the Pilchuck River source and supplying the distribution system entirely with water from Transmission Line No. 5. If the Pilchuck River source is phased out, water service to remote customers who are currently served off of the Water Treatment Plant Transmission Main will need to be maintained. The City is evaluating alternatives for service to these customers, including the feasibility of transferring the services to the Snohomish County Public Utility District No. 1.

DRINKING WATER REGULATIONS

Overview

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to

delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, the DOH is the agency responsible for implementing and enforcing the drinking water regulations. For the State of Washington to maintain primacy (delegated authority to implement requirements) under the SDWA, the State must adopt drinking water regulations that are at least as stringent as the federal regulations. In meeting these requirements, the State, in cooperation with the EPA, has published drinking water regulations that are contained in Chapter 246-290 of the Washington State Administrative Code (WAC).

Existing Regulations

The SDWA was enacted in 1974 as a result of public concern about water quality. The SDWA sets standards for the quality of drinking water and requires water treatment if these standards are not met. The SDWA also sets water testing schedules and methods that water systems must follow. In 1986, the SDWA was amended as a result of additional public concern and frequent contamination of groundwater from industrial solvents and pesticides. The 1986 Amendments require water systems to monitor and treat for a continuously increasing number of water contaminants identified in the new federal regulations. The EPA regulated approximately 20 contaminants between 1974 and 1986. The 1986 Amendments identified 83 contaminants that the EPA was required to regulate by 1989. Implementation of the new regulations has been marginally successful due to the complexity of the regulations and the associated high costs. To rectify the slow implementation of the new regulations, the SDWA was amended again and re-authorized in August of 1996.

In response to the 1986 SDWA Amendments, the EPA established six rules known as the Phase I Rule, the Phase II and IIb Rules, the Phase V Rule, the Surface Water Treatment Rule (SWTR), the Total Coliform Rule, and the Lead and Copper Rule. The EPA regulates most chemical contaminants through the Phase I, II, IIb and V Rules. Additional drinking water regulations have been published since these six rules were first established, and the EPA is continually proposing new rules for promulgation. The City's currently active surface water source is affected by these rules.

The EPA set two limits for each contaminant regulated under the rules. The first limit is a health goal, referred to as the Maximum Contaminant Level Goal (MCLG). The MCLG is zero for many contaminants, especially known cancer-causing agents (carcinogens). The second limit is a legal limit, referred to as the Maximum Contaminant Level (MCL). The MCLs are equal to or higher than the MCLGs. However, most MCLs and MCLGs are the same, except for contaminants that are regulated as carcinogens. The health goals (MCLGs) for these are typically zero because they cause cancer and it is assumed that any amount of exposure may pose some risk of cancer. A summary of each rule follows.

To fully understand the discussion that follows, a brief definition of several key terms is provided below.

- Organic Chemicals – Animal or plant produced substances containing carbon and other elements such as hydrogen and oxygen.
- Synthetic Organic Chemicals (SOCs) – Manmade organic substances, including herbicides, pesticides, and various industrial chemicals and solvents.
- Volatile Organic Chemicals (VOCs) – Chemicals, as liquid, that evaporate easily into the air.

- Inorganic Chemicals (IOCs) – Chemicals of mineral origin that are naturally occurring elements. These include metals such as lead and cadmium.

Phase I Rule

The Phase I Rule, which was the EPA's first response to the 1986 Amendments, was published in the Federal Register on July 8, 1987, and became effective on January 9, 1989. This rule provided limits for eight VOCs that may be present in drinking water. VOCs are used by industries in the manufacture of rubber, pesticides, deodorants, solvents, plastics and other chemicals. VOCs are found in everyday items such as gasoline, paints, thinners, lighter fluid, mothballs and glue, and are typically encountered at dry cleaners, automotive service stations and elsewhere in industrial processes. The City currently complies with all contaminant monitoring requirements under this rule.

Phase II and IIb Rules

The Phase II and IIb Rules were published in the Federal Register on January 30, 1991, and July 1, 1991, and became effective on July 30, 1992, and January 1, 1993, respectively. These rules updated and created limits for 38 contaminants (organics and inorganics), of which 27 were newly regulated. Some of the contaminants are frequently applied agricultural chemicals (nitrate), while others are more obscure industrial chemicals. The City currently complies with all contaminant monitoring requirements under these rules.

Phase V Rule

The Phase V Rule was published in the Federal Register on July 17, 1992, and became effective on January 17, 1994. This rule set standards for 23 additional contaminants, of which 18 are organic chemicals (mostly pesticides and herbicides) and 5 are IOCs (such as cyanide). The City currently complies with all contaminant monitoring requirements under this rule.

Surface Water Treatment Rule

The SWTR was published in the Federal Register on June 29, 1989, and became effective on December 31, 1990. Surface water sources such as rivers, lakes, and reservoirs (which are open to the atmosphere and subject to surface runoff), and groundwater sources that are under the direct influence of surface water (referred to as GWI sources), are governed by this rule. The SWTR seeks to prevent waterborne diseases caused by the microbes *Legionella* and *Giardia lamblia*, which are present in most surface waters. The rule requires disinfection of all surface water and GWI sources. All surface water and GWI sources must also be filtered, unless a filtration waiver is granted. A filtration waiver may be granted to systems with pristine sources that continuously meet stringent source water quality and protection requirements. Currently, the Pilchuck River source is classified as a surface water source, and is subject to the SWTR. The City currently complies with all requirements under this rule.

Interim Enhanced Surface Water Treatment Rule

The EPA proposed the Interim Enhanced Surface Water Treatment Rule (IESWTR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became

effective on February 16, 1999, concurrent with the Stage 1 Disinfectants/Disinfection By-products Rule. The rule primarily applies to public water systems that serve 10,000 or more people and use surface water or GWI sources. The rule also requires primacy agencies (i.e., DOH) to conduct sanitary surveys of all surface water and GWI systems, regardless of size. The rule is the first to directly regulate the protozoan *Cryptosporidium* and has set the MCLG for *Cryptosporidium* at zero. Water systems affected by this rule needed to comply with it by December 16, 2001. The City currently complies with all requirements under this rule.

Long Term 1 Enhanced Surface Water Treatment Rule

This is the follow-up rule to the IESWTR that became effective in December of 1998. The final Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was published on January 14, 2002, and became effective February 13, 2002. The rule addresses water systems using surface water or groundwater under the direct influence of surface water serving fewer than 10,000 people. The rule extends protections against *Cryptosporidium* for smaller water systems. The rule also requires individual filter effluent turbidimeters and a combined filter effluent turbidimeter. The filters at the City's water treatment plant did not have individual filter effluent turbidimeters until upgrades were completed in 2010. Therefore, the City is in compliance with these regulations.

Total Coliform Rule

The Total Coliform Rule was published in the Federal Register on June 29, 1989, and became effective on December 31, 1990. The rule set both health goals (MCLGs) and legal limits (MCLs) for total coliform levels in drinking water, and the type and frequency of testing that is required for water systems. The rule requires more monitoring than prior requirements, especially for small systems. In addition, every public water system is required to develop a coliform monitoring plan, subject to approval by DOH.

Coliform is a group of bacteria, some of which live in the digestive tract of humans and many animals, and are excreted in large numbers with feces. Coliform can be found in sewage, soils, surface waters and vegetation. The presence of any coliform in drinking water indicates a health risk and potential waterborne disease outbreak, which may include gastroenteric infections, dysentery, hepatitis, typhoid fever, cholera and other infectious diseases.

The rule established the MCLG for total coliform at zero. To comply with the legal limit, systems must not find coliform in more than 5 percent of the samples taken each month. For smaller systems like the City's that take fewer than 20 samples per month, 1 sample that contains coliform would exceed the legal limit and trigger the follow-up sampling requirements. A copy of the City's Coliform Monitoring Plan is contained in **Appendix K**. The City currently complies with all contaminant monitoring requirements under this rule.

Lead and Copper Rule

The Lead and Copper Rule was published in the Federal Register on June 7, 1991, and became effective on December 7, 1992. On January 12, 2000, the EPA published minor revisions to the rule in the Federal Register, which primarily improved the implementation of the rule. On June 29, 2004, additional minor revisions and clarifications on several requirements of the Lead and Copper Rule were published by the EPA. The rule identifies action levels for both lead and copper. An action level is different than a MCL in that a MCL is a legal limit for a contaminant, and an action level is a trigger for additional prevention or removal steps. The action level for lead is greater than

0.015 milligrams per liter (mg/L). The action level for copper is greater than 1.3 mg/L. If the 90th percentile concentration of either lead or copper from the group of samples exceeds these action levels, a corrosion control study must be undertaken to evaluate strategies and make recommendations for reducing the lead or copper concentration below the action levels. The rule requires systems that exceed the lead level to educate the affected public about reducing its lead intake. Systems that continue to exceed the lead action level after implementing corrosion control and source water treatment may be required to replace piping in the system that contains the source of lead. Corrosion control is typically accomplished by increasing the water's pH to make it less corrosive, which reduces its ability to break down water pipes and absorb lead or copper.

Lead is a common metal found throughout the environment in lead-based paint, air, soil, household dust, food, certain types of pottery, porcelain, pewter, brass and water. Lead can pose a significant risk to health if too much of it enters the body. Lead builds up in the body over many years and can cause damage to the brain, red blood cells and kidneys. The greatest risk is to young children and pregnant women. Lead can slow normal mental and physical development of growing bodies.

Copper is a common, natural and useful metal found in our environment. It is also a trace element needed in most human diets. The primary impact of elevated copper levels in water systems is stained plumbing fixtures. At certain levels (well above the action levels), copper may cause nausea, vomiting and diarrhea. It can also lead to serious health problems in people with Wilson's disease. Long-term exposure to elevated levels of copper in drinking water could also increase the risk of liver and kidney damage. The City currently complies with all contaminant monitoring and treatment requirements under this rule.

Radionuclides Rule

The EPA established interim drinking water regulations for radionuclides in 1976 under the SDWA. MCLs were established for alpha, beta and photon emitters, and radium 226/228. Radionuclides are elements that undergo a process of natural decay and emit radiation in the form of alpha or beta particles and gamma photons. The radiation can cause various kinds of cancers, depending on the type of radionuclide exposure from drinking water. The regulations address both manmade and naturally occurring radionuclides in drinking water.

The 1986 amendments to the SDWA finalized the regulations for radionuclides by eliminating the term "interim." The amendments also directed the EPA to promulgate health-based MCLGs, as well as MCLs. The EPA failed to meet the statutory schedules for promulgating the radionuclide regulations, which resulted in a lawsuit. In 1991, the EPA proposed revisions to the regulations, but a final regulation based on the proposal was never promulgated. The 1996 amendments to the SDWA directed the EPA to revise a portion of the earlier proposed revisions, adopt a schedule, and review and revise the regulations every six years, as appropriate, to maintain or improve public health protection. Subsequent to the 1996 Amendments, a 1996 court order required the EPA to either finalize the 1991 proposal for radionuclides or ratify the existing standards by November 2000.

The final rule was published in the Federal Register on December 7, 2000, and became effective on December 8, 2003. The rule established an MCLG of zero for the four regulated contaminates and MCLs of 5 picocuries per liter (pCi/L) for combined radium-226 and radium-228; 15 pCi/L for gross alpha (excluding radon and uranium); 4 mrem/year for beta particle and photon radioactivity;

and 30 ug/L for uranium. The City currently complies with all contaminant monitoring requirements under this rule.

Watershed Control Program

The Washington State mandate for watershed protection and the required elements of a watershed control program are contained in WAC 246-290-135 Source Protection, which became effective in July of 1994. In Washington State, DOH is the lead agency for the development and administration of the State's Watershed Control Program.

A watershed control program is a proactive and ongoing effort of a water purveyor to exercise surveillance over the conditions and activities within the watershed affecting source water quality to protect the health of its customers as outlined in WAC 246-290-668, Watershed Control. All federally defined Group A public water systems that use surface water or groundwater as their source are required to develop and implement a watershed control program. All required elements of a watershed control program must be documented and included in the purveyor's Comprehensive Water System Plan (applicable to the City) or Small Water System Management Program (not applicable to the City) at least every six years. A copy of the City's Watershed Control Program is contained in **Appendix H**.

Consumer Confidence Report

The final rule for the Consumer Confidence Report (CCR) was published in the Federal Register on August 19, 1998, and became effective on September 18, 1998. Minor revisions were posted in the Federal Register on May 4, 2000. The CCR is the centerpiece of the right to know provisions of the 1986 Amendments to the SDWA. All community water systems, like the City, were required to issue the first report to customers by October 19, 1999. The annual report must be updated and re-issued to all customers by July 1st of each year thereafter.

The CCR is a report on the quality of water that was delivered to the system during the previous calendar year. The reports must contain certain specific elements, but may also contain other information that the purveyor deems appropriate for public education. Some, but not all, of the information that is required in the reports includes the source and type of the drinking water, type of treatment, contaminants that have been detected in the water, potential health effects of the contaminants, identification of the likely source of contamination, violations of monitoring and reporting, and variances or exemptions to the drinking water regulations. A copy of the City's latest CCR is contained in **Appendix M**.

Stage 1 Disinfectants/Disinfection By-products Rule

Disinfection by-products (DBPs) are formed when free chlorine reacts with organic substances, most of which occur naturally. These organic substances (called precursors) are a complex and variable mixture of compounds. The DBPs themselves may pose health risks. Trihalomethanes is a category of DBPs that had been regulated prior to this rule. However, systems with groundwater sources that serve a population of less than 10,000 were not previously required to monitor for trihalomethanes.

The EPA proposed the Stage 1 Disinfectants/Disinfection By-products Rule (D/DBPR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became

effective on February 16, 1999. The rule applies to the City and most other water systems that add a chemical disinfectant to the drinking water during any part of the treatment process. The rule reduced the MCL for total trihalomethanes, which are a composite measure of four individual trihalomethanes, from the previous interim level of 0.10 mg/L to 0.08 mg/L. The rule established MCLs and requires monitoring of three additional categories of DBPs: 1) 0.06 mg/L for five haloacetic acids; 2) 0.01 mg/L for bromated; and 3) 1.0 mg/L for chlorite. The rule also established maximum residual disinfectant levels (MRDLs) for chlorine (4.0 mg/L), chloramines (4.0 mg/L) and chlorine dioxide (0.8 mg/L). The rule requires systems using surface water or groundwater directly influenced by surface water to implement enhanced coagulation or softening to remove DBP precursors, unless alternative criteria are met. Compliance with this rule must have been satisfied by December 16, 2001, for large surface water systems (those serving over 10,000 people) and by December 16, 2003, for smaller surface water systems and all groundwater systems. The City currently complies with all contaminant monitoring requirements under this rule.

Unregulated Contaminant Monitoring Regulation

The EPA established the Unregulated Contaminant Monitoring Regulation (UCMR) to generate data on contaminants that are being considered for inclusion in new drinking water standards. The information collected by select public water systems will ensure that future regulations established by the EPA are based on sound science. The rule was first published in the Federal Register on September 17, 1999, and was subsequently amended on March 2, 2000, and January 11, 2001. The UCMR became effective on January 1, 2001.

Three separate lists of unregulated contaminants are maintained under the UCMR: List 1, List 2 and List 3. Contaminants are organized on the tiered lists based on the availability of standard testing procedures and the known occurrence of each contaminant, with List 1 containing contaminants that have established standard testing procedures and some, but insufficient, information on their occurrence in drinking water. Monitoring for contaminants on the three lists is limited to a maximum of 30 contaminants within a 5-year monitoring cycle, and the EPA is required to publish new contaminant monitoring lists every 5 years. As new lists are published, contaminants will be moved up in the lists if adequate information is found to support additional monitoring. All public water systems serving more than 10,000 people and a randomly selected group of smaller water systems are required to monitor for contaminants. The City currently monitors for some unregulated contaminants.

Arsenic

The EPA established interim drinking water regulations for arsenic in 1976 under the SDWA. Arsenic is highly toxic, affects the skin and nervous system, and may cause cancer. The 1986 SDWA amendments require the EPA to conduct research to assess health risks associated with exposure to low levels of arsenic. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90-day public review period. The final rule, which was published in the Federal Register on January 22, 2001, was to become effective on March 23, 2001, except for certain amendments to several sections of the rule. However, because of the national debate regarding the science and costs related to the rule, the EPA announced on May 22, 2001, that it was delaying the effective date for the rule to allow time to reassess the rule and afford the public a full opportunity to provide further input. On

October 31, 2001, the EPA reaffirmed the final rule as published on January 22, 2001. The Arsenic Rule subsequently became effective on February 22, 2002.

The rule sets the MCLG of arsenic at zero and reduces the MCL from the previous standard of 0.05 mg/L to 0.01 mg/L. Arsenic's monitoring requirements is consistent with the existing requirements for other inorganic contaminants. The regulation required the City to begin monitoring by January 23, 2006. The City currently complies with all contaminant monitoring requirements under this rule.

Filter Backwash Recycling Rule

The 1986 SDWA Amendments required the EPA to promulgate a regulation governing the recycling of filter backwash water within public water systems' treatment processes. Public water systems using surface water or groundwater under the direct influence of surface water, which utilize filtration processes and recycling must comply with the rule. The rule aims to reduce risks associated with recycling contaminants removed during filtration. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90-day public review period. The final rule was published in the Federal Register on June 8, 2001, and became effective on August 7, 2001.

The rule requires filter backwash water be returned to a location that allows complete treatment. In addition, filtration systems must provide detailed information regarding the treatment and recycling process to the State. The regulation requires water systems to have complied with the rule starting December 8, 2003, if filter backwash water was recycled. The City complied with these requirements prior to the publication of this rule, and currently complies with all contaminant monitoring requirements under this rule.

Stage 2 Disinfectants/Disinfection By-products Rule

This rule is the second part of the D/DBPR, of which the Stage 1 D/DBPR became effective in February 1999. The Stage 2 Disinfectants/Disinfection By-products Rule (Stage 2 D/DBPR) was published on January 4, 2006, in the Federal Register and became effective March 6, 2006. The EPA implemented this rule simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule.

Similar to the Stage 1 D/DBPR, this rule applies to most water systems that add a disinfectant to the drinking water other than ultraviolet light or those systems which deliver such water. The Stage 2 D/DBPR changes the calculation procedure requirement of the MCLs for two groups of DBPs total trihalomethanes (TTHM) and five haloacetic acids (HAA5) by requiring each sampling location to determine compliance with MCLs based on their individual annual average DBP levels (termed the Locational Running Annual Average), rather than utilizing a system-wide annual average. The rule also proposes new MCLGs for chloroform (0.07 mg/L), trichloroacetic acid (0.02 mg/L) and monochloroacetic acid (0.03 mg/L).

Additionally, the rule requires systems to document peak DBP levels and prepare an Initial Distribution System Evaluation (IDSE) report to identify Stage 2 D/DBPR compliance monitoring sites. IDSEs require each water system to prepare a separate IDSE plan and report, with the exception of those systems who obtain a 40/30 Certification or a Very Small System (VSS) Waiver. In order to qualify for the 40/30 Certification, all samples collected during Stage 1 monitoring must have TTHM and HAA5 levels less than or equal to 0.040 mg/L and 0.030 mg/L, respectively. The first stage of the IDSE schedule required systems serving 100,000 or more people to submit IDSE plans by October 1, 2006. Systems serving 50,000 to 99,999 people had to submit IDSE plans by

April 1, 2007, while systems serving 10,000 to 49,999 people had to submit plans by October 1, 2007. Systems serving fewer than 10,000 people had to submit an IDSE plan by April 1, 2008 if they did not qualify for 40/30 Certification or a VSS Waiver. The City's IDSE was originally submitted to the EPA on September 29, 2006 and was approved on April 18, 2007. The City's IDSE Standard Monitoring Report was submitted to the EPA on May 6, 2009 and approved on May 7, 2009. The City currently complies with all contaminant monitoring requirements under this rule and will begin sampling two sites per quarter in April 2012.

Long Term 2 Enhanced Surface Water Treatment Rule

Following the publishing of the IESWTR, the EPA introduced the LTIESWTR to supplement the preceding regulations. The second part of the regulations of the LT1ESWTR, which became effective in February 2002, are mandated in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The final rule was published in the Federal Register on January 5, 2006, and became effective on March 6, 2006. The final rule was implemented simultaneously with the Stage 2 D/DBPR described in the previous section. This rule applies to all systems that use surface water or GWI sources.

This rule establishes treatment technique requirements for filtered systems based on their risk level for contamination calculated from the system's average *Cryptosporidium* concentration. Requirements include up to 2.5-log *Cryptosporidium* treatment in addition to existing requirements under the IESWTR and LT1ESWTR. Filtered systems that demonstrate low levels of risk will not be required to provide additional treatment. Unfiltered systems under this rule must achieve at least a 2-log inactivation of *Cryptosporidium* if the mean levels in the source water remain below 0.01 oocysts/L. If an unfiltered system elects not to monitor, or the mean level of *Cryptosporidium* exceeds 0.01 oocysts/L, the LT2ESWTR requires the system to provide a minimum 3-log inactivation of *Cryptosporidium*. All unfiltered systems are also required to utilize a minimum of two disinfectants in their treatment process.

The LT2ESWTR also addresses systems with unfinished water storage facilities. Under this rule, systems must either cover their storage facilities or achieve inactivation and/or removal of 4-log virus, 3-log *Giardia lamblia* and 2-log *Cryptosporidium* on a state-approved schedule. Lastly, the rule extends the requirement of the disinfection profiles mandated under the LT1ESWTR to the proposed Stage 2 D/DBPR. The City complied with these requirements prior to the publication of this rule, and currently complies with all contaminant monitoring requirements under this rule.

Groundwater Rule

The EPA promulgated the Groundwater Rule (GWR) to reduce the risk of exposure to fecal contamination that may be present in public water systems that use groundwater sources. The GWR also specifies when corrective action (which may include disinfection) is required to protect consumers who receive water from groundwater systems from bacteria and viruses. The GWR applies to public water systems that use groundwater and to any system that mixes surface and ground waters if the groundwater is added directly to the distribution system and provided to consumers without treatment equivalent to surface water treatment

The City does not actively use any groundwater sources and, therefore, is not impacted by the Groundwater Rule.

Future Regulations

Drinking water regulations are continuously changing in an effort to provide higher quality and safer drinking water. Modifications to the existing rules described above and implementation of new rules are planned for the near future. A summary of upcoming drinking water regulations that will most likely affect the City is presented below.

Radon

In July of 1991, the EPA proposed a regulation for radon, as well as three other radionuclides. The 1996 SDWA Amendments required the EPA to withdraw the 1991 proposal due to several concerns that were raised during the comment period. A new proposed regulation was published in the Federal Register on November 2, 1999. Comments on the proposed rule were due to the EPA by February 4, 2000. Final federal requirements for addressing radon were delayed until 2008, but have not yet been published. The rule proposes a 300 pCi/L MCL for community water systems that use groundwater or an alternative, less stringent MCL of 4,000 pCi/L for water systems where their state implements an EPA-approved program to reduce radon risks in household indoor air and tap water. It is not currently known when or what a radon regulation may require as adopted by the EPA or what will be the rule's implementation schedule. Because the final radon rule requirements are uncertain, the impact of this rule on the City is unknown at this time.

Unregulated Contaminant Monitoring Regulation Revisions

In accordance with the original Unregulated Contaminant Monitoring Regulation (UCMR), the EPA is proposing an updated contaminant monitoring list for the next five-year monitoring cycle, in addition to other minor revisions to the UCMR. The proposed rule was published August 22, 2005, in the Federal Register, and the comment period for the proposed revisions closed on October 21, 2005. The revisions include a list of 26 chemicals that will be monitored during the 2007 through 2011 monitoring cycle, and approves several new testing methods to conduct the monitoring. For this cycle, all systems serving more than 100,000 people and a larger representative sample of smaller water systems than mandated under the original rule will be required to monitor for contaminants. The rule also requires additional water system data to be reported with the monitoring results, establishes a procedure for determining minimum reporting levels and proposes several revisions to the implementation of the monitoring program.

SOURCE WATER QUALITY

This section presents the current water quality standards and the results of the City's recent source water quality monitoring efforts. A discussion of the water quality requirements and monitoring results for the City's distribution system is presented in the section that follows.

Drinking Water Standards

Drinking water quality is regulated at the Federal level by the EPA and at the State level by DOH. Drinking water standards have been established to maintain high quality drinking water by limiting the levels of specific contaminants (i.e., regulated contaminants) that can adversely affect public health and are known or likely to occur in public water systems. Non-regulated contaminants do not

have established water quality standards and are generally monitored at the discretion of the water purveyor and in the interest of customers.

The regulated contaminants are grouped into two categories of standards: primary and secondary. Primary standards are drinking water standards for contaminants that could affect health. Water purveyors are required by law to monitor and comply with these standards and notify the public if water quality does not meet any one of the standards. Secondary standards are drinking water standards for contaminants that have aesthetic effects, such as unpleasant taste, odor or color (staining). The national secondary standards are unenforceable federal guidelines or goals where federal law does not require water systems to comply with them. However, states may adopt their own enforceable regulations governing these contaminants. The State of Washington has adopted regulations that require compliance with some of the secondary standards. Water purveyors are not required to notify the public if water quality does not meet secondary standards.

Source Monitoring Requirements and Waivers

The City is required to perform water quality monitoring at its active source for IOC and physical substances, organic chemicals and radionuclides. The monitoring requirements that the City must comply with are specified in WAC 246-290-300. A description of the source water quality monitoring requirements and procedures for each group of substances is contained in the City's Water Quality Monitoring Plan that is included in **Appendix K**.

In 1994, DOH developed the Susceptibility Assessment Survey Form for water purveyors to complete to determine a drinking water source's potential for contamination. The results of the susceptibility assessment may provide monitoring waivers that allow reduced source water quality monitoring. DOH assigned high susceptibility rating for the Pilchuck River, based on the results of the susceptibility assessment survey. This source was granted a susceptibility waiver that allowed the City to avoid monitoring of SOCs during the 2002 to 2004 and 2005 to 2007 three-year compliance periods. However, for the 2008 to 2010 three-year compliance period, the City will need to monitor herbicide, insecticide and pesticide SOCs with two samples every three years.

Source Monitoring Results

The quality of the City's source has been good and meets or exceeds all drinking water standards, except for slightly higher than allowable levels of turbidity at the Pilchuck River source, which is apparent on a seasonal basis at the water treatment plant. Monitoring of IOCs and physical substances was accomplished once per year since 1993, although monitoring is required once during the 2008 to 2010 three-year compliance period. Nitrate monitoring has also been performed once per year since 2001. The results of IOC (including nitrate) monitoring in April 2008 and VOC monitoring in June 2009 for the City's source indicate that all primary and secondary standards were met. The results of radionuclide monitoring, which was done in June 2009, indicated that the City's source was in compliance with the regulations. As required by DOH, the City sampled once in 1998 for the chemical ethylene dibromide (EDB), which was once commonly used as a pesticide and gasoline additive, and the chemical dibromo-chloropropane (DBCP), which resulted in the City meeting the regulatory requirements. Since then, the City has been granted a state waiver for these SOC compounds through 2010. Most recently, the City sampled for arsenic in 2003, 2007 and 2008 and found that the levels were well below the MCLs, per the arsenic rule.

DISTRIBUTION SYSTEM WATER QUALITY

Monitoring Requirements and Results

The City is required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, DBP, lead and copper, and asbestos in accordance with Chapter 246-290 WAC. A description of the distribution system water quality monitoring requirements and procedures are contained in the City's Water Quality Monitoring Plan that is included in **Appendix K**.

The City has been in compliance with all monitoring requirements for the past several years. A summary of the results of distribution system water quality monitoring within the City's system is presented below.

Coliform Monitoring

The City is required to collect a minimum of 10 coliform samples per month from different locations throughout the system, based on a population served of 12,123 in 2008. The results of coliform tests from July 2009 and years prior were all satisfactory, except for two positive samples in June 2004, one in November 2007 and one in December 2007. In addition, the City monitors for coliforms in the NEPA Pallet system by obtaining one sample per month at the master meter.

Disinfectant Residual Concentration Monitoring

Disinfection requirements applicable to the City's Pilchuck River source are contained in WAC 246-290-662 for filtered systems, which states that a minimum 0.2 mg/L disinfectant residual concentration shall be maintained at the point the water enters the system and that the disinfectant residual concentration in the distribution system is detectable in at least 95 percent of the samples taken each calendar month. In an effort to comply with these requirements, the City has established a chlorination target to maintain a positive disinfectant residual in the distribution system. The water samples collected by the City for coliform analysis are also tested for residual disinfectant concentration. As of April 1, 2009, the City has been collecting two samples daily in a north pressure zone and have been rotating zones weekly. The City has also been collecting two samples daily from the 218 Zone. The disinfection residual has fluctuated; however, they have all measured positive. The monthly average residual for the entire distribution system is 0.53 mg/L. Therefore, the City is in compliance with these regulations.

Lead and Copper Monitoring

The Lead and Copper Rule identifies the action level for lead as being greater than 0.015 mg/L and the action level for copper as being greater than 1.3 mg/L. The City's water treatment plant adjusts pH to reduce lead and copper levels. The results of the tests from the 2006 monitoring period, which included 10 sample sites, indicate a range of less than 0.001 mg/L to 0.002 mg/L for lead and a range of 0.02 mg/L to 0.333 mg/L for copper. The results of the tests from the 2002 monitoring period, which included 10 sample sites, indicate a range of less than 0.001 mg/L to 0.006 mg/L for lead and a range of 0.005 mg/L to 0.44 mg/L for copper. These results indicate that 90th percentile concentration of lead and copper from each group of samples were below their action levels.

Therefore, the City is in compliance with these regulations. No lead and copper testing has been conducted in the NEPA Pallet Water System.

The City has participated in Everett's Regional Monitoring Plan (RMP) since at least 1998 and plans to continue to participate until such time that the City no longer qualifies for the RMP. This would occur following construction of the proposed 362/425 Zone Booster Pump Station, identified as CIP F1 in **Chapter 9**, which would allow the City to blend water from the Pilchuck River source with water purchased from Everett.

As part of the City's current participation with Everett's RMP, one sample is collected in the 362 Zone, which is currently only supplied by Everett's Transmission Line No. 5. In 2009, the City collected 19 samples in the 218 Zone to meet the reduced monitoring compliance requirement of 20 total samples. Once the City is not eligible to participate in Everett's RMP, substantial impact on the City's monitoring program is not anticipated since test results are consistently well below the action level for both lead and copper at all sampling locations. At that time, the City plans to collect ten samples in the 362 Zone and 10 samples in the 218 Zone. A copy of the City's RMP Participation Agreement is shown in **Appendix K**.

Asbestos

Asbestos monitoring is required if the sources are vulnerable to asbestos contamination or if the distribution system contains more than 10 percent of asbestos cement (AC) pipe. Although none of the City's sources are susceptible to asbestos contamination, AC pipe comprises approximately 10 percent of the City's distribution system. Therefore, the City must monitor for asbestos in the distribution system. The current MCL for asbestos is 7 million fibers per liter (MFL) and greater than 10 microns in length. Monitoring must be accomplished during the first three-year compliance period of each nine-year compliance cycle. The water sample must be taken at a tap that is served by an asbestos cement pipe under conditions where asbestos contamination is most likely to occur. The City's most recent sample in 2009 detected asbestos at 1.4 MFL, which is under its MCL of 7 MFL. Asbestos monitoring is not required for the NEPA Pallet system.

Disinfectants/Disinfection By-products Monitoring

TTHM and HAA5 are disinfection by-products that are formed when free chlorine reacts with organic substances (i.e., precursors), most of which occur naturally. Formation of TTHM and HAA5 is dependent on such factors as amount and type of chlorine used, water temperature, concentration of precursors, pH and chlorine contact time. TTHM and HAA5 have been found to cause cancer in laboratory animals and are suspected to be human carcinogens.

The City is required to monitor for trihalomethanes because the Pilchuck River source is classified as surface water and requires disinfection. The City currently has an approved IDSE monitoring plan and has maintained compliance with all results of Phase One through quarterly monitoring. The City has since then transitioned to Phase Two and are continuing with quarterly monitoring. Monitoring in 2009 resulted in haloacetic acid concentrations being less than the 0.06 mg/L MCL and TTHM concentrations less than the 0.08 mg/L MCL at four sample locations. Therefore, the City is in compliance with these regulations.

Water System Analysis

7

INTRODUCTION

This chapter presents the analysis of the City of Snohomish's (City) existing water system. Individual water system components were analyzed to determine their ability to meet policies and design criteria under both existing and future water demand conditions. The policies and design criteria are presented in **Chapter 5** and the water demands are presented in **Chapter 4**. A description of the water system facilities and current operation is presented in **Chapter 2**. The last section of this chapter presents the existing and projected system capacity analyses that were performed to determine the maximum number of equivalent residential units (ERUs) that can be served by the City's existing water system.

PRESSURE ZONES

The ideal static pressure of water supplied to customers is between 40 and 80 pounds per square inch (psi). Pressures within a water system's distribution system are commonly as high as 120 psi, requiring pressure regulators on individual service lines to reduce the pressure to 80 psi or less. It is difficult for the City's water system, and most others, to maintain distribution pressures between 40 and 80 psi, primarily due to the topography of the water service area.

Table 7-1 lists the City's pressure zones, the highest and lowest elevation served in each zone and the minimum and maximum distribution system pressures within each zone, based on maximum static water conditions (full reservoirs and zero demands). While this table presents the results of the evaluation of pressures based on the adequacy of the pressure zones (under static conditions), the hydraulic analysis section later in this chapter presents the results of the evaluation of pressures based on the adequacy of the water mains (under dynamic conditions).

The City is currently providing water at pressures of at least 40 psi in the 261, 336, 362, 384, 425, 438 and 450 Zones. The low pressures in the 218 Zone occur at service connections between 4th Street and 7th Street and between Avenue B and Avenue J. The low pressure in the 472 Zone occurs at the location of the first parcel served along the Water Treatment Plant Transmission Main. However, this customer has an individual booster pump station to increase pressures to a satisfactory level.

Although the low pressure of 35 psi does not fall within the ideal pressure range, these pressures meet the Washington State Department of Health (DOH) minimum pressure requirement of 30 psi, as described in the Distribution and Transmission System Section later in this chapter. A pressure reducing valve improvement recommended in **Chapter 9** will provide water at pressures of at least 40 psi during normal operating conditions and above 30 psi during peak demand conditions.

Table 7-1
Minimum and Maximum Distribution System Static Pressures

Pressure Zone	Highest Elevation Served		Lowest Elevation Served	
	Elevation (feet)	Static Pressure (psi)	Elevation (feet)	Static Pressure (psi)
Distribution System				
218 Zone	137	35	8	91
362 Zone	243	52	78	123
384 Zone	249	58	140	106
425 Zone	298	55	214	92
438 Zone	267	74	219	95
450 Zone	263	81	219	100
Water Treatment Plant Transmission Main				
261 Zone	70	83	60	87
336 Zone	140	85	90	107
472 Zone	440	14	140	144

All of the City's pressure zones have areas of pressure higher than 80 psi. The highest pressures occur near pressure reducing valve (PRV) No. 2, along the Water Treatment Plant Transmission Main and west of the intersection of Bonneville Avenue and 14th Street.

The City recommends individual services that have pressures greater than 80 psi to install customer-owned pressure regulators to reduce the pressures to acceptable levels per the plumbing code. In **Table 7-1**, the listed pressures are calculated in the water main and the actual service pressure is lower due to the required pressure regulators. The City has accepted these relatively high pressures in the system due to the pressure regulator requirement; therefore, pressure zone improvements will not be necessary in these areas. Where pressure zone improvements recommended in **Chapter 9** increase pressures to above 80 psi, pressure regulators will be recommended on the services, if none currently exist.

SOURCE CAPACITY EVALUATION

This section evaluates the combined capability of the City's existing sources (four existing wholesale supply sources and one surface water source) to determine if they have sufficient capacity to meet the overall demands of the system, based on existing and future water demands. The section that follows will address the evaluation of the individual facilities to determine if they have sufficient capacity to meet the existing and future demands of the individual zone, or zones, that they supply.

Analysis Criteria

Supply facilities must be capable of adequately and reliably supplying high quality water to the system. In addition, supply facilities must provide a sufficient quantity of water at pressures that meet the requirements of section 246-290-230 of the Washington Administrative Code (WAC). The

evaluation of the combined capacity of the sources in this section is based on the criteria that they provide supply to the system at a rate that is equal to or greater than the maximum day demand (MDD) of the system.

Source Capacity Analysis Results

Typically, the evaluation of the combined capacity of the sources is based on the criteria that they provide supply to the system at a rate that is equal to or greater than the MDD of the system. However, since the 384, 425, 438 and 450 Zones are supplied directly by Transmission Line No. 5, the City's system must be capable of supplying the maximum rate of fire flow and the peak hour flow to account for the lack of available storage in these zones. The City does not provide fire protection for the customers directly connected to the Water Treatment Plant Transmission Main in the 261, 336 and 472 Zones. As a result, the supply to these customers is based on a rate that is equal to the peak hour demands (PHD) of these zones. The customers are expected to be transferred to the Snohomish County Public Utility District (PUD) by 2014. Therefore, the demand for these customers was not included in the source capacity evaluation for 2014 and beyond. The City is considering plans to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Transmission Line No. 5. For the purposes of this analysis, the future projections include the City's source capacity with and without the Pilchuck River source. Based on these criteria, the capability of the City's active sources to meet existing demand requirements is presented in **Table 7-2**.

Table 7-2
Water Source Capacity Evaluation

Description	Existing	Future Projections			
		With Pilchuck River Source		Without Pilchuck River Source	
	2008	2014	2028	2014	2028
Required Source Capacity (gpm)					
261/336/472 Zones Peak Hour Demand	59	0	0	0	0
384/425/438/450 Zones Peak Hour Demand	383	354	330	354	330
384/425/438/450 Zones Max Fire Flow Requirement	4,000	4,000	4,000	4,000	4,000
218/362 Zones Maximum Day Demand	1,167	1,376	1,969	1,376	1,969
Totals	5,609	5,730	6,299	5,730	6,299
Available Source Capacity (gpm)					
Pilchuck River	394	1,181	1,181	0	0
City of Everett Interties	7,375	7,375	7,375	7,375	7,375
Totals	7,769	8,556	8,556	7,375	7,375
Surplus or Deficient Source Capacity (gpm)					
Surplus or Deficient Amount	2,159	2,826	2,256	1,645	1,076

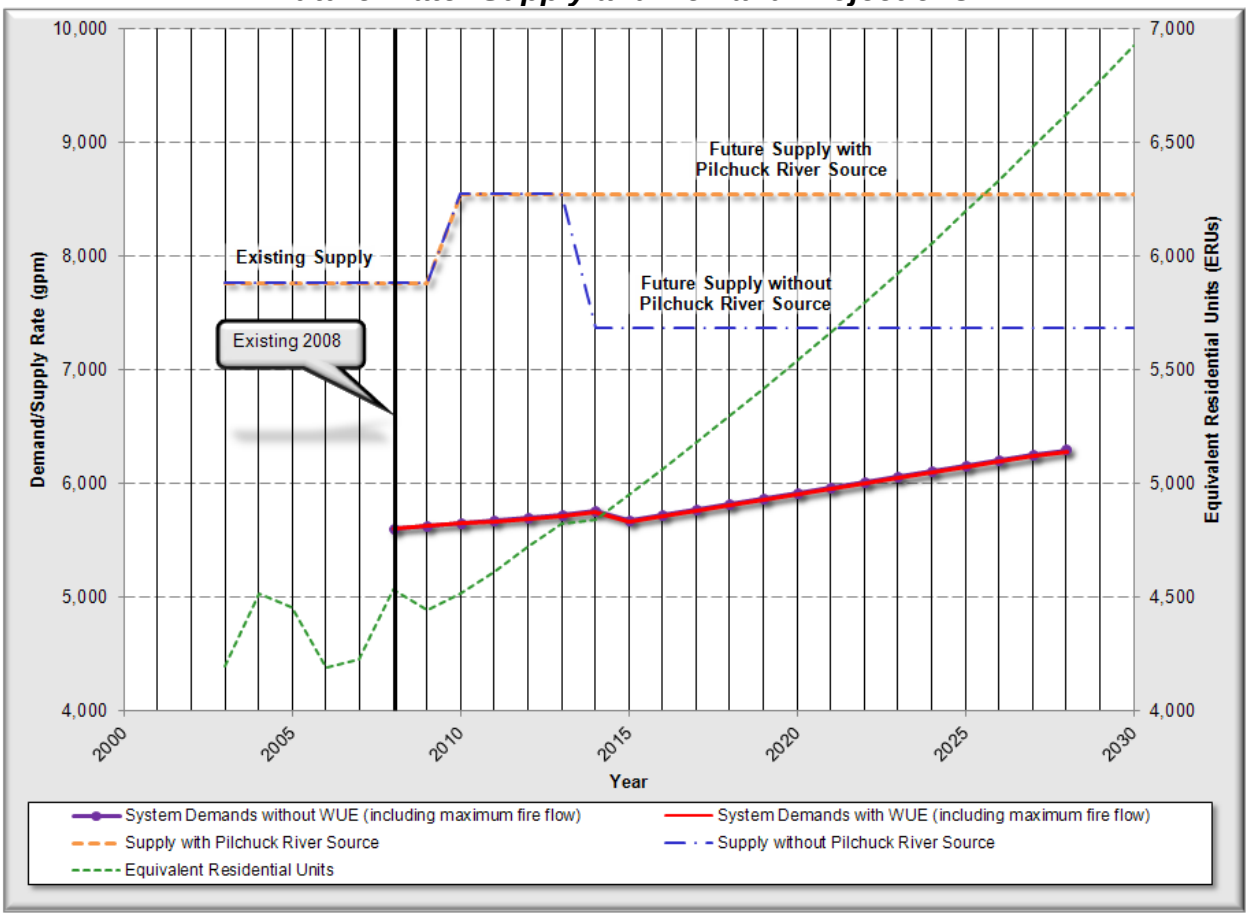
The City plans to expand the 362 Zone to include the 438 and 450 Zones, as well as a portion of the 384 Zone. For the purposes of this analysis, this pressure zone reconfiguration was assumed to take place in 2014.

The demands used in the evaluation for 2014 and 2028 are future demand projections without reductions from water use efficiency efforts, as shown in **Table 4-14** of **Chapter 4**. Therefore, if additional reductions in water use are achieved in the future, the total source capacity required in the future will be less than that shown in the table. The future demand requirements do not include the

261, 336 and 472 Zones because service to existing customers along the Water Treatment Plant Transmission Main are expected to be transferred to the PUD prior to 2014.

The results of the analysis indicate that the City has approximately 2,159 gallons per minute (gpm) of surplus source capacity to meet existing demands. The City's sources are sufficient to meet the projected demands of the system well beyond 2028 with and without the Pilchuck River source, as shown in **Chart 7-1**.

Chart 7-1
Future Water Supply and Demand Projections



Facility Deficiencies

Deficiencies at the water treatment plant were identified by DOH in 2006 following a sanitary survey and a Comprehensive Performance Evaluation performed by The Cadmus Group. These deficiencies resulted in restrictions being placed on the water treatment plant until identified administrative, operational and capital improvement upgrades have been completed at the water treatment plant. One of the restrictions imposed by DOH required a certified operator be present when the water treatment plant was operating, which limited the water treatment plant to operating only eight hours per day, at an average rate of 394 gpm.

One of the operational deficiencies is the water treatment plant's ability to properly treat raw water from the Pilchuck River during seasonal occurrences of high turbidity. Upon reaching raw water

turbidity levels of approximately 30 nephelometric turbidity units (NTUs), the plant is typically shut down.

Upgrades to the water treatment plant were recently completed in 2010 to address all of the deficiencies identified in the survey and evaluation. These upgrades include the addition of four filter-to-waste pumps and piping with motor actuated valves for each filtration cell; installation of new filter media and recoating the interior of each filtration cell; replacement of the generator's manual transfer switch with an automatic transfer switch; and the installation of new control panels and a programmable logic control unit, which allows fully automated control of the water treatment plant. The water treatment plant may now be operated at 1,181 gpm, 24 hours per day.

The City does not currently meter the treated water leaving the water treatment plant or the water conveyed to the backwash tank and plans to install meters at both locations in 2012. Additionally, during peak demand periods the water treatment plant influent valve fully opens and allows water into the water treatment plant at a rate exceeding the capacity of the filters. The City plans to install piping and a control valve between the backwash tank and the water treatment plant transmission main in 2014 to allow treated water to flow from the backwash tank directly to the transmission main during peak demand periods. These improvements are identified in **Chapter 9**.

WATER SUPPLY FACILITIES EVALUATION

This section evaluates the existing supply facilities to determine if they have sufficient capacity to provide water supply at a rate that meets the existing and future demands of the one or more zones that they supply. This section also identifies facility deficiencies that are not related to the capacity of the supply facilities.

Analysis Criteria

The evaluation of supply facilities to determine if they have adequate capacity is based on one of two criteria, as follows. If the pressure zone that the facility provides supply into has water storage, then the amount of supply required is equal to the MDD. If the pressure zone that the facility provides supply into does not have water storage, then the amount of supply required is equal to the PHD and the maximum fire flow requirement of the zone. The higher supply requirement of the latter criteria is due to the lack of equalizing and fire flow storage that is typically utilized to provide short-term supply during times of peak system demands.

Existing Water Supply Facilities Evaluation

Five hydrants are located along the Water Treatment Plant Transmission Main which directly provide water to the 261, 336 and 472 Zones. However, the City does not provide these hydrants with the required fire flow and as a result, the maximum fire flow requirement was not considered in the water supply evaluation by zone, shown in **Table 7-3**, even though there is no storage for these zones.

Table 7-3
Existing Supply Evaluation by Zone

Description	261 Zone 336 Zone 472 Zone	218 Zone	362 Zone	384 Zone	425 Zone	438 Zone	450 Zone
Required Supply (gpm)							
Maximum Day Demand	N/A	764	404	N/A	N/A	N/A	N/A
Peak Hour Demand	59	N/A	N/A	194	143	40	6
Max Fire Flow Requirement	N/A	N/A	N/A	4,000	4,000	4,000	4,000
Available Supply (gpm)							
Pilchuck River	1,181	1,122	N/A	N/A	N/A	N/A	N/A
City of Everett Interties	N/A	N/A	1,057	1,075	1,200	1,600	3,500
Surplus or Deficient Supply (gpm)							
Surplus or Deficient Amount	1,122	358	653	-3,119	-2,943	-2,440	-506

Water supply is provided to the 218 Zone from the Water Treatment Plant Transmission Main, which also supplies the 261, 336 and 472 Zones. Thus, the available supply to the 218 Zone is the difference between the current operating capacity of the water treatment plant and the PHDs of the 261, 336 and 472 Zones.

Similarly, water supply is provided to the 362 and 425 Zones from the Terrace Avenue intertie. The available supply to the 362 Zone is the difference between the capacity of the Terrace Avenue intertie and the peak hour demand of the 425 Zone. The results of the analysis, shown in **Table 7-3**, indicate that the existing configuration and capacity of the supply facilities is sufficient to meet the existing demands in all zones except the 384, 425, 438 and 450 Zones. All of these zones are capable of providing PHDs but do not have the capacity to entirely supply the maximum fire flow requirement.

Future Water Supply Facilities Evaluation

As previously described, the future projections include the City's source capacity with and without the Pilchuck River source as the City considers plans to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Transmission Line No. 5. Service to existing customers along the Water Treatment Plant Transmission Main is expected to be transferred to the PUD. Costs associated with transferring these customers to the PUD are unknown at this time and are not included in the City's Capital Improvements Program (CIP) shown in **Chapter 9**. Additionally, the 2014 and 2028 projections include the expanded 362 Zone, which includes the existing 362, 438 and 450 Zones, as well as a portion of the 384 Zone. A check valve installed as part of CIP PZ1 will allow water to be conveyed from the 362 Zone to the 384 Zone during emergency conditions in the 384 Zone. Accounting for these changes, the future supply requirement for the City's pressure zones is summarized in **Tables 7-4** and **7-5**. The projected supply available to the 218 Zone from the City of Everett interties is the maximum capacity of the interties, less the combined required supply of the 362, 384 and 425 Zones. As shown in **Tables 7-4** and **7-5**, the City's active sources have sufficient capacity to meet the future demand requirements with the construction of the proposed 362/425 Zone Booster Pump Station as recommended in **Chapter 9**.

Table 7-4
2014 Supply Evaluation by Zone

Description	218 Zone	362 Zone	384 Zone	425 Zone
Required Supply (gpm)				
Maximum Day Demand	918	490	86	N/A
Peak Hour Demand	N/A	N/A	N/A	140
Maximum Fire Flow Requirement	N/A	N/A	N/A	4,000
Available Supply (gpm)				
Pilchuck River	1,181	N/A	N/A	N/A
City of Everett Interties	2,658	5,100	1,075	1,200
Proposed 362/425 Zone Booster Pump Station	N/A	800	N/A	3,175
Surplus or Deficient Supply (gpm)				
Surplus or Deficient Amount with Pilchuck River Source	262	5,410	989	235
Surplus or Deficient Amount without Pilchuck River Source	1,740	5,410	989	235

Table 7-5
2028 Supply Evaluation by Zone

Description	218 Zone	362 Zone	384 Zone	425 Zone
Required Supply (gpm)				
Maximum Day Demand	1,293	676	86	N/A
Peak Hour Demand	N/A	N/A	N/A	175
Maximum Fire Flow Requirement	N/A	N/A	N/A	4,000
Available Supply (gpm)				
Pilchuck River	1,500	N/A	N/A	N/A
City of Everett Interties	2,437	5,100	1,075	1,200
Proposed 362/425 Zone Booster Pump Station	N/A	800	N/A	3,175
Surplus or Deficient Supply (gpm)				
Surplus or Deficient Amount with Pilchuck River Source	207	5,224	989	200
Surplus or Deficient Amount without Pilchuck River Source	1,145	5,224	989	200

The demands used in the existing and future evaluations do not include reductions from enhanced water use efficiency efforts. Therefore, if additional reductions in water use are achieved through water use efficiency (WUE) efforts, the total source capacity required in the future would be less than that shown in **Tables 7-4** and **7-5**.

Facility Deficiencies

The pressure reducing stations at the Bickford, King Charley's and Park Avenue interties do not have drains and commonly have standing water at the bottom of the vault. All of the City's pressure reducing stations are regularly maintained by GC Systems, Inc. and are pumped of standing water annually.

STORAGE FACILITIES

This section evaluates the City's existing reservoirs to determine if they have sufficient capacity to meet the existing and future storage requirements of the system. This section also identifies facility deficiencies that are not related to the capacity of the reservoirs.

Analysis Criteria

Water storage is typically made up of the following components: operational storage; equalizing storage; standby storage; fire flow storage; and dead storage. Each storage component serves a different purpose and will vary from system to system. A definition of each storage component and the criteria used to evaluate the capacity of the City's reservoirs is provided below.

Operational Storage - Volume of the storage tank used to supply the water system under normal conditions when the source or sources of supply are not delivering water to the system (i.e., sources are in the off-mode). Operational storage is essentially the average amount of draw down in the tank during normal operating conditions, which represents a volume of storage that will most likely not be available for equalizing storage, fire flow storage or standby storage. The operational storage in the City's reservoirs is the amount of storage between the fill set point level and the overflow elevation of the reservoir.

Equalizing Storage - Volume of the storage tank used to supply the water system under peak demand conditions when the system demand exceeds the total rate of supply of the sources. DOH requires that equalizing storage be stored above an elevation that will provide a minimum pressure of 30 psi at all service connections throughout the system during PHD conditions. Because the City's supply sources primarily operate on a "call on demand" basis to fill the storage tanks, the equalizing storage requirements are determined using the standard DOH formula that considers the difference between the system PHD and the combined capacity of the supply sources.

$$\mathbf{ES = (PHD - Q_S)(150\ minutes)}, \text{ but in no case less than zero}$$

Where:

ES = Equalizing Storage, in gallons.

PHD = Peak Hour Demand, in gpm.

Q_S = Sum of all installed and active sources, except emergency supply, in gpm.

The capacity of the sources that supply each of the City's zones are sufficient to meet the peak hour demands of these operating areas. Therefore, the equalizing storage requirement for these pressure zones is zero. The equalizing storage analyses also considered the supply capacity available to the system as a whole to ensure that the zones that transfer storage through PRVs or booster pump stations have sufficient supply capacity to do so.

Standby Storage - Volume of the storage tank used to supply the water system under emergency conditions when supply facilities are out of service due to equipment failures, power outages, loss of supply, transmission main breaks and any other situation that disrupts the supply source. DOH requires that standby storage be stored above an elevation that will provide a minimum pressure of 20 psi at all service connections throughout the system. The criteria for determining the standby storage requirements for the City's system, which has multiple supply sources, is based on the standard DOH formula that requires that the amount is sufficient to supply the system for a 48-hour

period when the primary supply facility is out of service and the system is experiencing demands that are close to average day demands (ADD).

$$\mathbf{SB = (2\ days)[(ADD)(N) - t_m\ (Q_S - Q_L)]}$$

Where:

SB = Standby Storage, in gallons.

ADD = Average Day Demand per ERU, in gpd/ERU.

N = Number of ERUs.

Q_S = Sum of all installed and continuously available sources, except emergency supply, in gpm.

Q_L = The capacity of the largest source available to the system, in gpm.

t_m= Time the remaining sources are pumped on the day when the largest source is not available, in minutes. Unless otherwise restricted, this value is 1,440 minutes.

The standby storage analysis was completed for each reservoir operating area. For both operating areas, the largest capacity source that was assumed to be out of service was the Park Avenue Intertie. The standby storage analyses also considered the supply capacity available to the system as a whole with the largest source, the Park Avenue Intertie, out of service to ensure that the zones that transfer storage through PRVs or booster pump stations have sufficient supply capacity to do so.

DOH recommends that the minimum standby storage volume be no less than 200 gallons per ERU. In all cases, this calculation determined the standby storage volume required for the City's reservoir operating areas.

Fire Flow Storage - Volume of the storage tank used to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement. The magnitude of the fire flow storage is the product of the fire flow rate and duration of the system's maximum fire flow requirement established by the local fire authority. DOH requires that fire flow storage be stored above an elevation that will provide a minimum pressure of 20 psi at all points throughout the distribution system under MDD conditions. The fire flow storage requirements shown in the analyses that follow are based on a maximum fire flow requirement of 4,000 gpm, for a 4-hour duration in all zones.

Dead Storage - Volume of the storage tank that cannot be used because it is stored at an elevation that does not provide system pressures that meet the minimum pressure requirements established by DOH without pumping. This unusable storage occupies the lower portion of most ground level reservoirs. Water that is stored below an elevation that cannot provide a minimum pressure of 20 psi is considered dead storage for the analyses that follow.

Storage Analysis Results

Existing Storage Analysis

The storage analyses are based on an evaluation of the existing storage facilities providing water to three operating areas during normal operating conditions: 1) the 218 Zone, which is within the

operating area of Reservoirs No. 1 and No. 2; 2) the 362 Zone, which is within the operating area of Reservoir No. 3; and 3) the 261, 336 and 472 Zones, which are within the operating area of the water treatment plant backwash tank. Although the 384, 425, 438 and 450 Zones are not served by one of the City's reservoirs during normal operations, their demands are allocated in the storage requirements for the 362 Zone operating area.

Storage analyses were also performed for the system operating during emergency conditions when Transmission Line No. 5 is not available to supply the 362, 384, 425, 438 and 450 Zones. The operating area of Reservoir No. 3 can be expanded to include the 362, 384, 425, 438 and 450 Zones if normally closed zone valves between the zones are opened. To be conservative, demands of the 384, 425, 438 and 450 Zones are included in the required storage calculations for the 362 Zone but may not be available at desired pressures if fed solely off of Reservoir 3. In the event that Transmission Line No. 5 is not available to directly supply the 384, 425, 438 and 450 Zones, the City uses Reservoir No. 3 to provide supply to the zones while Transmission Line No. 5 is offline. The resulting pressures at the system's highest elevation, which is located in the 425 Zone, range from 20 to 27 psi when Transmission Line No. 5 is offline.

As shown in **Table 7-6**, the maximum combined storage capacity of the City's reservoirs is approximately 9.35 million gallons (MG). However, the total amount of usable storage for operational, equalizing, standby and fire flow purposes is reduced to 8.52 MG during normal operating conditions and 6.64 MG during emergency conditions when the Everett supply is offline. The dead storage is due to the water services that are located at the highest elevations within the water system or near a storage tank. The results of the existing storage evaluation, as shown in **Table 7-6**, indicate that the City has a surplus of storage in each operating area except the backwash tank during normal operating conditions and in the Reservoirs No. 1 and No. 2 operating area during emergency conditions when the Everett supply is offline.

Table 7-6
Existing Storage Evaluation

Normal Operating Conditions

Description	Operating Area: Reservoirs No. 1 & No. 2 (218 Zone)	Operating Area: Reservoir No. 3 (362 Zone)	Operating Area: Backwash Tank (261, 336 and 472 Zones)	Totals
Available/Usable Storage (MG)				
Maximum Storage Capacity	6.50	2.52	0.33	9.35
Dead (Non-usable Storage)[1]	-0.50	0.00	-0.33	-0.83
Total Available Storage	6.00	2.52	0.00	8.52
Required Storage (MG)				
Operational Storage	3.46	0.60	0.09	4.14
Equalizing Storage	0.00	0.00	0.00	0.00
Standby Storage	0.49	0.40	0.04	0.93
Fire Flow Storage	0.96	0.96	0.00	1.92
Totals	4.91	1.95	0.13	6.99
Surplus or Deficient Storage (MG)				
Surplus or Deficient Amount	1.09	0.57	-0.13	1.53

Emergency Conditions - Everett Supply Offline

Description	Operating Area: Reservoirs No. 1 & No. 2 (218 Zone)	Operating Area: Reservoir No. 3 (362, 384, 425, 438 and 450 Zones)	Operating Area: Backwash Tank (261, 336 and 472 Zones)	Totals
Available/Usable Storage (MG)				
Maximum Storage Capacity	6.50	2.52	0.33	9.35
Dead (Non-usable Storage)[1]	-0.50	-1.88	-0.33	-2.71
Total Available Storage	6.00	0.64	0.00	6.64
Required Storage (MG)				
Operational Storage	3.46	0.60	0.09	4.14
Equalizing Storage	0.00	0.00	0.00	0.00
Standby Storage	0.49	0.40	0.04	0.93
Fire Flow Storage	0.96	0.96	0.00	1.92
Totals	4.91	1.95	0.13	6.99
Surplus or Deficient Storage (MG)				
Surplus or Deficient Amount	1.09	-1.31	-0.13	-0.35

(1) Approximately 0.5 MG of storage from Reservoir No. 1 was displaced as a result of the piping upgrades completed in 1992.

Future Storage Analysis

Future storage requirements of the system were computed for the 6 and 20-year planning periods based on 2014 and 2028 demand projections. The analyses were performed to determine the adequacy of the City's existing reservoirs to meet future storage requirements without additional improvements to the system. The future storage requirements shown in **Table 7-7** do not include the pressure zone or facility improvements recommended in **Chapter 9**. The future storage analysis is shown with the Pilchuck River source and is unaffected if the City decides to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Transmission Line No. 5. The backwash storage tank was not included in the future storage analyses as it will be used exclusively for backwashing the water treatment plant filtration cells once all customers along the Water Treatment Plant Transmission Main are transferred to the PUD.

Table 7-7
Future Storage Evaluation with No Improvements

Normal Operating Conditions

Description	2014 Operating Area			2028 Operating Area		
	Reservoirs No. 1 & No. 2 (218 Zone)	Reservoir No. 3 (362 Zone)	Totals	Reservoirs No. 1 & No. 2 (218 Zone)	Reservoir No. 3 (362 Zone)	Totals
Available/Usable Storage (MG)						
Maximum Storage Capacity	6.50	2.52	9.02	6.50	2.52	9.02
Dead (Non-usable Storage)[1]	-0.50	0.00	-0.50	-0.50	0.00	-0.50
Total Available Storage	6.00	2.52	8.52	6.00	2.52	8.52
Required Storage (MG)						
Operational Storage	3.46	0.64	4.09	3.46	0.64	4.09
Equalizing Storage	0.00	0.00	0.00	0.00	0.00	0.00
Standby Storage	0.57	0.40	0.97	0.80	0.53	1.32
Fire Flow Storage	0.96	0.96	1.92	0.96	0.96	1.92
Totals	4.98	2.00	6.98	5.21	2.13	7.34
Surplus or Deficient Storage (MG)						
Surplus or Deficient Amount	1.02	0.52	1.54	0.79	0.39	1.18

Emergency Conditions - Everett Supply Offline

Description	2014 Operating Area			2028 Operating Area		
	Reservoirs No. 1 & No. 2 (218 Zone)	Reservoir No. 3 (362, 384, 425, 438 and 450 Zones)	Totals	Reservoirs No. 1 & No. 2 (218 Zone)	Reservoir No. 3 (362, 384, 425, 438 and 450 Zones)	Totals
Available/Usable Storage (MG)						
Maximum Storage Capacity	6.50	2.52	9.02	6.50	2.52	9.02
Dead (Non-usable Storage)[1]	-0.50	-1.88	-2.38	-0.50	-1.88	-2.38
Total Available Storage	6.00	0.64	6.64	6.00	0.64	6.64
Required Storage (MG)						
Operational Storage	3.46	0.64	4.09	3.46	0.64	4.09
Equalizing Storage	0.00	0.00	0.00	0.00	0.00	0.00
Standby Storage	0.57	0.40	0.97	0.80	0.53	1.32
Fire Flow Storage	0.96	0.96	1.92	0.96	0.96	1.92
Totals	4.98	2.00	6.98	5.21	2.13	7.34
Surplus or Deficient Storage (MG)						
Surplus or Deficient Amount	1.02	-1.36	-0.34	0.79	-1.49	-0.70

(1) Approximately 0.5 MG of storage from Reservoir No. 1 was displaced as a result of the piping upgrades completed in 1992.

The results of the analyses shown in **Table 7-7** indicate that a surplus of storage is available in each operating area and system-wide during normal operating conditions through the 20-year planning period based on DOH minimum storage requirements. However, without improvements, the Reservoir No. 3 operating area will have a storage deficiency of 1.36 MG in 2014 and 1.49 MG in 2028 during emergency conditions. Improvements to eliminate portions of the existing dead storage in the Reservoir No. 3 operating area and provide redundant supply to the 362, 384, 425, 438 and 450 Zones are scheduled for completion within the six-year planning period as shown in **Chapter 9**.

The future storage evaluation with the implementation of these improvements is shown in **Table 7-8**.

Table 7-8
Future Storage Evaluation with Improvements

Description	2014 Operating Area			2028 Operating Area		
	Reservoirs No. 1 & No. 2 (218 and 425 Zones)	Reservoir No. 3 (362 and 384 Zones)	Totals	Reservoirs No. 1 & No. 2 (218 and 425 Zones)	Reservoir No. 3 (362 and 384 Zones)	Totals
Available/Usable Storage (MG)						
Maximum Storage Capacity	6.50	2.52	9.02	6.50	2.52	9.02
Dead (Non-usable Storage)[1]	-0.50	-0.67	-1.17	-0.50	-0.67	-1.17
Total Available Storage	6.00	1.85	7.85	6.00	1.85	7.85
Required Storage (MG)						
Operational Storage	3.46	0.64	4.09	3.46	0.64	4.09
Equalizing Storage	0.00	0.00	0.00	0.00	0.00	0.00
Standby Storage	0.61	0.35	0.97	0.86	0.47	1.32
Fire Flow Storage	0.96	0.96	1.92	0.96	0.96	1.92
Totals	5.03	1.95	6.98	5.27	2.07	7.34
Surplus or Deficient Storage (MG)						
Surplus or Deficient Amount	0.97	-0.10	0.87	0.73	-0.21	0.52

(1) Approximately 0.5 MG of storage from Reservoir No. 1 was displaced as a result of the piping upgrades completed in 1992.

The results of the analyses shown in **Table 7-8** indicate that a surplus of storage is available to the system in the 6 and 20-year planning period based on DOH minimum storage requirements. The proposed 362/425 Zone Booster Pump Station will allow the City to convey water from the Reservoir No. 1 and No. 2 operating area to supplement the Reservoir No. 3 operating area during emergency conditions.

Facility Deficiencies

The City's storage facilities are in good overall condition. Reservoirs No. 1 and No. 2 need their hypalon covers replaced with polypropylene covers. Reservoir No. 3 has paint chipping on its east side and is in need of repainting. A new cover is scheduled to be installed on Reservoir No. 1 in 2012 and the City has obtained quotes regarding the exterior painting of Reservoir No. 3, which is scheduled to be completed in 2011. A cathodic inspection of the reservoirs was performed by Aquavision in May 2009. Aquavision also performs regular interior cleaning of the reservoirs every two years. Other proposed maintenance tasks are identified in the Capital Improvements Program in **Chapter 9**.

DISTRIBUTION AND TRANSMISSION SYSTEM

This section evaluates the City's existing distribution and transmission system (i.e., water mains) to determine if they are adequately sized and looped to provide the necessary flow rates and pressures to meet the system's existing and future requirements. This section also identifies deficiencies that are not related to the capacity of the water mains.

Analysis Criteria

Distribution and transmission mains must be capable of adequately and reliably conveying water throughout the system at acceptable flow rates and pressures. The criteria used to evaluate the City's distribution and transmission system is the state mandated requirements for Group A water systems contained in WAC 246-290-230, Distribution Systems. The pressure analysis criteria states that the distribution system "…shall be designed with the capacity to deliver the design peak hour demand quantity of water at 30 psi under peak hour demand flow conditions measured at all existing and proposed service water meters." It also states that if fire flow is to be provided, "… the distribution system shall also provide MDD plus the required fire flow at a pressure of at least 20 psi at all points throughout the distribution system."

Hydraulic analyses of the existing system were performed under existing PHD conditions to evaluate its current pressure capabilities and identify existing system deficiencies. The existing system was also analyzed under existing MDD conditions to evaluate the current fire flow capabilities and identify additional existing system deficiencies. Additional hydraulic analyses were then performed with the same hydraulic model under future MDD conditions, and with the proposed improvements to demonstrate that the identified improvements will eliminate the deficiencies and meet the requirements far into the future. The following is a description of the hydraulic model, the operational conditions and facility settings used in the analyses.

Hydraulic Model

Description

A computer-based hydraulic model of the existing water system was created using version 8.0 of the WaterGEMS program, developed by Bentley Systems, Inc. All water mains in the City's water system, including dead-end mains, were included in the model and were based on AutoCAD water system maps and as-built records provided by the City. The junction node elevation data was extracted from a topographic map that was generated from a 2002 aerial survey of the City. A hydraulic model node diagram that provides a graphical representation of the model of the water system is contained in **Appendix N**.

Demand Data

The hydraulic model of the existing system contains 2008 ADD data. Consumption data from 2008 metered billing records were distributed based on the recorded usage for each parcel to the closest representative junction node of the model. The peaking factors calculated in **Chapter 4** were used to analyze the system under MDD and PHD conditions.

The hydraulic model of the proposed system contains six-year demand levels that are projected for 2014 and 20-year demand levels that are projected 2028. The distribution is based on the City's estimated future demand levels in each pressure zone.

Facilities

The hydraulic model of the existing system contains all active existing system facilities. For the proposed system analyses in 2014 and 2028, the hydraulic model contains all active existing system

facilities and proposed system improvements identified in **Chapter 9** for the 6 and 20-year planning periods, respectively.

The facility settings for the pressure analyses corresponded to a PHD event in the water system. All sources of supply that are currently available to the system, or will be available in the future for the 2014 and 2028 analyses, during a peak period were operating at their normal summertime pumping rates. The reservoir levels were modeled to reflect full utilization of operational and equalizing storage. The operational conditions for the pressure analyses are summarized in **Table 7-9**.

Table 7-9
Hydraulic Analyses Operational Conditions

Description	PHD Pressure Analysis			Fire Flow Analysis		
	2008	2014	2028	2008	2014	2028
Demand	2008 PHD	2014 PHD	2028 PHD	2008 MDD	2014 MDD	2028 MDD
Reservoir No. 1 Hydraulic Grade Line (HGL) (ft)	210.7	210.7	210.7	208.0	208.0	208.0
Reservoir No. 2 HGL (ft)	210.7	210.7	210.7	208.0	208.0	208.0
Reservoir No. 3 HGL (ft)	345.5	345.5	345.5	320.6	320.6	320.6
Bickford Avenue Intertie HGL (ft)	384	384	384	384	384	384
King Charley's Intertie HGL (ft)	438	438	324	438	438	324
Park Avenue Intertie HGL (ft)	450	450	334	450	450	334
Terrace Avenue Intertie HGL (ft)	425	425	425	425	425	425
9th Street and Avenue A PRV HGL (ft)	197	197	197	197	197	197
10th Street and Avenue D PRV HGL (ft)	203	203	203	203	203	203
Proposed Bickford Avenue and 62nd Pl PRV HGL (ft)	N/A	N/A	330	N/A	N/A	330
Water Treatment Plant	ON	ON	ON	ON	ON	ON
Proposed 362/425 Zone Booster Pump Station	N/A	ON	ON	N/A	ON	ON

Separate fire flow analyses were performed on the system to size distribution system improvements and calculate fire flow availability. The hydraulic model for the fire flow analyses contains settings that correspond to MDD events. All sources of supply that are currently available to the system during a peak period were operating at their normal pumping rates, and the reservoir levels were modeled to reflect full utilization of operational, equalizing and fire flow storage, based on the maximum planning level fire flow requirement. **Table 7-9** summarizes the operational conditions for the fire flow analyses for the existing, 2014 and 2028 systems.

Hydraulic analyses were also performed without the Pilchuck River source in the six and 20-year planning periods. The resulting distribution system pressures and fire flows are equivalent to those with the Pilchuck River source because all water from the water treatment plant transmission main is conveyed through Reservoirs No. 1 and No. 2 prior to entering the distribution system and the equalizing storage component for which the reservoir levels are drawn down is calculated to be the same with and without the Pilchuck River source.

Calibration

Hydraulic model calibration is the process of adjusting hydraulic model data so the model closely reflects actual system pressures and flows under similar demand and operating conditions. Initial Darcy-Weisbach roughness coefficients were entered into the model based on computed estimates

of the coefficients from available pipe age and material data. For example, assuming that the internal surface of water pipes become rougher as it gets older, older water mains were assigned higher roughness coefficients than new water mains. Additional calibration of the model was achieved using field fire flow and pressure data, which was collected throughout the system for this purpose. Extensive analyses were performed to adjust the hydraulic model to reflect the results of the field fire flow and pressure data. Additional field fire flow and pressure tests were also performed following a review of water main as-builts to confirm pipe size, location and configuration. However, approximately 20 percent of the City's field fire flow results were found to be inconsistent with the hydraulic model results. These inconsistent testing locations are all located at the extents of the City's water system, and are generally located along dead end portions of the water system. Hydraulic model calibration of the remaining testing locations was achieved by adjusting the roughness coefficients of the water mains and elevations of the junction nodes in the model until the model results reflected an acceptable level of accuracy. The average accuracy of the calibrated model was better than 99 percent of the actual field data collected in these testing locations, with a range of 100 to 88 percent accuracy at individual analysis locations. It is recommended that the City continue to identify water main diameter and configuration discrepancies resulting in the inconsistencies between the field calibration data and the modeled results.

Hydraulic Analyses Results

Several hydraulic analyses were performed to determine the capability of the system to meet the pressure and flow requirements identified in **Chapter 5** and contained in WAC 246-290-230. The first analysis was performed to determine the pressures throughout the system under existing (i.e., 2008) PHD conditions. The results of this analysis were used to identify locations of low and high pressures. To satisfy the minimum pressure requirements, the pressure at all water service locations must be at least 30 psi during PHD conditions. In addition, the system should not have widespread areas with high pressures, generally considered to be more than 120 psi. A summary of the pressure deficiencies identified from the results of this analysis is contained in **Table 7-10**. Also shown in **Table 7-10** is a summary of representative nodes in the 384, 438 and 450 Zones that are recommended to be converted to the 362 Zone.

Table 7-10
Pressure Analysis Summary

Description	Approximate Location	Existing Pressure Zone	Proposed Pressure Zone	Node Number	Pressure (psi) Existing System	Future 2014	Future 2028
Low Pressure Areas							
Single Family Residential	5th Street between Avenue B and Avenue H	218	218	J-526	30.2	30.7	30.3
Single Family Residential	7th Street between Avenue H and Avenue J	218	218	J-843	31.5	32.0	31.7
Single Family Residential	9th Street between Ash Court and Root Avenue	218	218	J-611	35.1	35.5	35.1
High Pressure Areas							
Business Park	West of Bickford Avenue and 19th Street	384	362	J-759	105.6	105.5	85.8
Industrial	Bonneville Avenue Industrial Loop near 14th Street	362	362	J-41	115.3	114.5	112.6
Pressure Zone Conversion Areas							
Medium Density Residential	Intersection of Washington Avenue and Weaver Way	384	362	J-884	65.6	65.5	45.8
Business Park	Intersection of Bickford Avenue and 19th Street	384	362	J-753	83.4	83.4	63.6
Single Family Residential	Intersection of Lake Avenue and 22nd Street	438	362	J-684	85.6	85.6	42.4
Single Family Residential	Lake Crest Drive Dead End	438	362	J-683	94.8	94.8	51.7
Single Family Residential	Rainbow Place Dead End	450	362	J-91	100.1	100.1	51.9
Single Family Residential	Intersection of Pine Avenue and Clark Avenue	450	362	J-846	99.5	99.5	51.6

The second set of analyses was performed to determine the capability of the existing water system to provide fire flow throughout the system under MDD conditions. A separate fire flow analysis was performed for each node in the model to determine the available fire flow at a minimum residual pressure of 20 psi at all points throughout the distribution system and a maximum allowable water main velocity of 8 feet per second (fps). More than 500 fire flow analyses were performed to comprehensively evaluate the water system. For each node analyzed, the resulting fire flow was compared to its general planning level fire flow requirement, which was assigned according to its land use classification. As is typical of most water systems, the City's distribution system was constructed to meet fire flow requirements that were in place at the time of construction. Land use classification changes and/or increase in fire flow requirements over time may create deficiencies. A summary of the results of the analyses for representative system nodes is presented in **Table 7-11**.

Table 4-9 in **Chapter 4** lists the general planning level fire flow requirements for each land use classification. Since the fire flow requirement varies for buildings within each land use classification, the land use based fire flow requirements are only used as a general target for the primary purpose of the system-wide analyses that were performed for this Comprehensive Water System Plan (WSP). Additional improvements may be needed in areas where actual fire flow requirements exceed the planning level targets and shall be the responsibility of the developer. The results of the fire flow analyses were used to identify undersized water mains and proposed water main improvements. A summary of the fire flow deficiencies is contained near the end of this section.

The Snohomish County Fire District No. 4 (Fire District) is aware that full fire flows cannot be achieved from the hydrants along the City's Water Treatment Plant Transmission Main, from hydrants east of the Pilchuck River in the 218 Zone and at an adjacent location at the northerly end of Cypress Avenue as water main serving this area is 4 inches in diameter. The City plans to document a formal request to the Fire District that the hydrants not be used for fire training purposes as they have limited fire flow capacity.

Table 7-11
Fire Flow Analysis Summary

Description	Approximate Location	Existing Pressure Zone	Node Number	Available Fire Flow (gpm)			Target Fire Flow (gpm)
				Existing System	Future w/Improvements 2014	Future w/Improvements 2028	
Single Family Residential	Intersection of 90th Avenue and 80th Street	218	J-721	733	1,478	1,668	1,000
Single Family Residential	Riverview Road west of SR 9	218	J-484	733	1,381	1,381	1,000
Agriculture	Intersection of Lowell Snohomish River Road and SR 9	218	J-827	762	762	3,641	3,000
Airport/Industrial	Airport Way east of Harvey Airfield	218	J-821	1,361	1,362	4,015	4,000
Historic Business District	Intersection of Maple Avenue and Pearl Street	218	J-575	1,533	1,533	3,568	2,500
Freshman Campus	Driveway for Freshman Campus	218	J-822	2,622	2,620	4,500	4,000
Single Family Residential	Intersection of 86th Street and 113th Avenue	218	J-624	62	64	4,500	1,000
Medium Density Residential	Intersection of 9th Street and Ash Court	218	J-627	2,410	2,418	2,621	1,750
Industrial	Bonneville Avenue Industrial Loop near 14th Street	362	J-41	2,243	2,244	4,500	4,000
Single Family Residential	Along Lake Mount Drive	362	J-26	742	767	1,371	1,000
Commercial	Safeway near Avenue D and 13th Street	362	J-138	3,101	3,098	4,500	3,500
Single Family Residential	Emerson Street Dead End	362	J-26	742	767	1,371	1,000
Public	Park Avenue near Hill Park	362	J-785	1,927	1,883	3,700	3,000
Business Park	West of Bickford Avenue and 19th Street	384	J-759	3,037	3,029	4,500	4,000
Business Park	West of Weaver Road and Bickford Avenue intersection	384	J-842	3,060	3,037	4,500	4,000
Business Park	Snohomish Station	384	J-894	2,520	2,520	4,500	3,500
Medium Density Residential	Near Stone Ridge Drive	425	J-696	1,271	1,373	3,023	1,750
Single Family Residential	Intersection of Holly Vista Drive and 16th Street	425	J-686	746	772	1,372	1,000
Single Family Residential	Intersection of 22nd Street and 105th Drive	438	J-950	751	777	1,430	1,000
Business Park	Intersection of 30th Street and SR 9	438	J-762	1,381	1,382	4,324	4,000
Public	Park Avenue near Rainbow Elementary	450	J-113	3,767	3,796	4,302	4,000
Single Family Residential	Clark Avenue Dead End	450	J-848	751	769	1,142	1,000

Once all deficiencies were identified, proposed water main improvements were included in the model, and pressure and fire flow analyses were performed throughout the system to demonstrate that the improvements will eliminate the deficiencies and meet the flow and pressure requirements. These analyses were modeled under projected year 2028 MDD conditions to ensure that the improvements are sized sufficiently to meet future demands. A summary of the results of these analyses is shown in **Table 7-11** for the same areas that were summarized from the existing water system analyses. The results of the analyses indicate that all fire flow deficiencies are resolved with the proposed improvements. A description of these improvements and a figure that shows their locations are presented in **Chapter 9**. A description of the deficiencies identified from the hydraulic analyses is presented in the following section.

Deficiencies

This section presents a summary of the distribution and transmission system deficiencies that were identified from the results of the hydraulic analyses of the existing water system during PHD conditions and also includes deficiencies not related to the capacity of the water mains. These deficiencies will be eliminated upon completion of the proposed improvements that are presented in **Chapter 9**.

Pressure Deficiencies

- Moderately low pressures in the 218 Zone along 5th Street between Avenue B and Avenue H (approximately 30 psi).

- Moderately low pressures in the 218 Zone along 7th Street between Avenue H and Avenue J (approximately 32 psi).
- Moderately low pressures in the 218 Zone along 9th Street between Ash Court and Root Avenue (approximately 35 psi).
- High pressures in the 384 Zone in the business park area west of the Bickford Avenue and 19th Street intersection (approximately 106 psi).
- High pressures in the 362 Zone in the Bonneville Avenue Industrial Loop near 14th Street (approximately 115 psi).

Fire Flow Deficiencies

The following areas have low fire flows that do not meet the City's target fire flow levels during MDD conditions.

- Low fire flow throughout the single-family residential development west of State Route (SR) 9 in the 218 Zone near the intersection of 90th Avenue SE and 80th Street SE, primarily due to the undersized 6-inch water main on 5th Street crossing SR 9.
- Low fire flow near the single-family residential development west of SR 9 in the 218 Zone along Riverview Drive, primarily due to the undersized 6-inch water main on 5th Street crossing SR 9.
- Low fire flow along Lowell Snohomish River Road due to the undersized 10-inch water main crossing the Snohomish River and the undersized 6-inch water main serving the area.
- Low fire flow along Airport Way due to the undersized 10-inch water main crossing the Snohomish River and the undersized 8-inch water main serving the area.
- Low fire flow throughout the Snohomish High School Freshman Campus primarily due to the undersized 6 and 8-inch water main loop around the school.
- Low fire flow throughout the single-family residential development east of the Pilchuck River due to the undersized 2-inch polyethylene water main crossing the Pilchuck River and the lack of looped water main in the area.
- Low fire flow along 9th Street between single-family and medium density residential neighborhoods due to the undersized 8-inch water main in 9th Street between Pine Avenue and Ash Court.
- Low fire flow in the industrial area along Bonneville Avenue due to the undersized 8-inch looped water main in the area.
- Low fire flow throughout the single-family residential development along Lake Mount Drive, primarily due to the undersized 4-inch dead-end water main in Lake Mount Drive.
- Low fire flow throughout the commercial area east of Avenue D between 10th Street and 13th Street due to the undersized 8-inch looped water main throughout the commercial development.

- Low fire flow throughout the single-family residential development along Emerson Street due to the undersized 6-inch dead-end water main in Emerson Street.
- Low fire flow along Park Avenue near Hill Park due to the undersized 6 and 8-inch water main in Park Avenue and 17th Place.
- Low fire flow throughout the business park area west of Bickford Avenue at approximately 66th Street SE due to the undersized 12-inch water main connecting the development to water main on Bickford Avenue, and the lack of looped water main in the area.
- Low fire flow throughout the business park west of the intersection of Weaver Road and Bickford Avenue due to the undersized 8-inch water main connecting the development to water main on Bickford Avenue and the 8-inch looped water main serving the area.
- Low fire flow throughout areas in the Snohomish Station business park development due to the undersized 8-inch water main serving areas of the development.
- Low fire flow in the medium density residential area near Stone Ridge Drive due to the 8-inch dead-end water main in Terrace Avenue and Stone Ridge Drive.
- Low fire flow throughout the single-family residential development near the intersection of Holly Vista Drive and 16th Street due to the undersized 6-inch dead-end water main in Holly Vista Drive and 16th Street that serves the area.
- Low fire flow in the single-family residential development along 22nd Street due to the dead-end that has been created by the closed zone valve at the intersection of 22nd Street and Park Avenue.
- Low fire flow in the business park near the intersection of 30th Street and SR 9 due to the undersized 8-inch dead-end water main in 30th Street.
- Low fire flow at Rainbow Elementary on Park Avenue due to the undersized 12-inch dead-end water main in Park Avenue and lack of looped water main in the area.
- Low fire flow throughout the single-family residential development along Clark Avenue due to the undersized 6-inch water main in 22nd Street east of Park Avenue.

Other Deficiencies

Several areas throughout the system have sufficient fire flow; however, high water velocities are experienced in the system because the water mains are undersized to carry the fire flows at acceptable water velocities. Operating the system with high water velocities can potentially damage the system due to the high surge pressures that commonly occur with high water velocities. Water main improvements identified in **Chapter 9** have been sized to prevent water velocities from exceeding 8 fps.

Some areas of the system have water mains that are more than 50 years old, which is beyond the average life expectancy of water mains. Most of the older water mains are located in the City's downtown area in the 218 Zone. The City is planning to replace these in the future, as shown in the schedule of planned improvements in **Chapter 9**. All new water main installations are required to

use cement-mortar lined ductile iron water main, in accordance with the City's Construction Standards and Specifications, which are contained in **Appendix H**.

PRESSURE REDUCING STATIONS

This section evaluates the City's existing pressure reducing stations to identify deficiencies related to their current condition and operation capability.

Evaluation and Deficiencies

The City has a total of ten operational pressure reducing stations, including two PRVs along the Water Treatment Plant Transmission Line, five PRVs at Transmission Line No. 5 interties and one PRV at the Transmission Line No. 5 intertie for the NEPA Pallet water system. All ten pressure reducing stations are functioning properly. Some of the stations have drainage problems, which interferes with access to the valves and piping.

Proposed improvements for additional pressure reducing stations and pressure setting changes to existing PRVs are addressed in **Chapter 9**.

TELEMETRY AND SUPERVISORY CONTROL SYSTEM

This section evaluates the City's existing telemetry and supervisory control system to identify deficiencies related to its condition and current operational capability.

Evaluation and Deficiencies

The City's telemetry system was installed in approximately 1990 and includes a master telemetry unit at the City shop located at 1801 First Street. Five telemetry stations exist throughout the water system and are located at the water treatment plant, the chlorine building and the flow vault on the same site as Reservoirs No. 1 and No. 2, the Terrace Avenue pressure reducing station and Reservoir No. 3. The transmitting and receiving telemetry units communicate to each other using radio communication, except in the case of the chlorine building and the flow vault, which are physically connected with cables. The existing telemetry control panels, controllers and radios are no longer supported by their manufacturers. Additionally, the HMI computer system that monitors the SCADA system will not operate on modern computer systems and the City cannot collect digital historical data.

Proposed improvements to the telemetry system are addressed in **Chapter 9**.

SYSTEM CAPACITY

This section evaluates the capacity of the City's existing and future water system components (supply, storage, transmission and water rights) to determine the maximum number of ERUs it can serve. Once established, system capacity becomes useful in determining how much capacity is available in the water system to support new customers that apply for water service through the building permit process. The system capacity information, together with the projected growth of the system expressed in ERUs, as shown in **Chart 4-5** of **Chapter 4**, also provides the City with a schedule of when additional system capacity is needed.

Analysis Criteria

The capacity of the City's system was determined from the limiting capacity of the source, storage and transmission facilities. The source capacity analysis was based on the limiting capacity of the supply facilities in terms of treatment, water rights and intertie capacity, and the system's estimated MDD per ERU, with the exception of the annual water right capacity, which was based on the system's ADD per ERU. The treatment capacity was determined from the capacity of the Water Treatment Plant Transmission Main and the transmission mains that convey water from the interties to the distribution system.

The storage capacity analysis was based on the storage capacity for equalizing and standby storage and the computed storage requirement per ERU. Operational, dead and fire flow storage capacity were excluded from the storage analysis because these components are not directly determined by water demand or ERUs. For the analyses, a reserve amount equivalent to the existing operational, dead and fire flow storage requirements was deducted from the total available storage capacity to determine the storage capacity available for equalizing and standby storage. This storage capacity available for equalizing and standby storage was divided by the existing number of ERUs presented in **Chapter 4** to determine the storage requirement per ERU. The ERU-based demand data was derived from the ADD of the system and demand peaking factors from **Chapter 4**.

Existing Capacity Analysis Results

A summary of the results of the existing system capacity analysis is shown in **Table 7-12**.

The results of the existing system capacity analysis indicate that the limiting capacity of the system is storage, which can currently support up to a maximum of approximately 2,832 ERUs. The existing water system has a deficiency of approximately 1,704 ERUs. As described previously in this chapter, the storage deficiency is a result of dead storage due to water services that are located at the highest elevations of the 425 Zone. Improvements scheduled within the six-year planning period, shown in **Chapter 9**, resolve the existing storage deficiency. The proposed improvements eliminate the existing dead storage and result in the system having a surplus of storage and a surplus of available capacity. All other water system components have sufficient capacity to support existing water system customers.

Table 7-12
Existing System Capacity Analysis

ERU-Based Demands	
Average Day Demand Per ERU (gal/day)	204
Maximum Day Demand Per ERU (gal/day)	449
Peak Hour Demand Per ERU (gal/day)	807
Source Capacity - Treatment and Intertie Supply	
Treatment and Intertie Supply Capacities (gal/day)	11,186,667
Maximum Day Demand Per ERU (gal/day)	449
Maximum Supply Capacity (ERUs)	24,936
Source Capacity - Annual Water Rights and Intertie Supply	
Annual Water Right & Intertie Supply Capacity (gal/day)	13,296,960
Average Day Demand Per ERU (gal/day)	204
Maximum Annual Water Right and Intertie Capacity (ERUs)	65,209
Source Capacity - Instantaneous Water Rights and Intertie Supply	
Instantaneous Water Right & Intertie Supply Capacity (gal/day)	13,851,576
Peak Day Demand Per ERU (gal/day)	449
Maximum Instantaneous Capacity (ERUs)	30,877
Storage Capacity	
Maximum Equalizing and Standby Storage Capacity (gal)	579,997
Equalizing and Standby Storage Requirement Per ERU (gal)	205
Maximum Storage Capacity (ERUs)	2,832
Transmission Capacity	
Transmission Capacity (gal/day)	26,621,500
Maximum Day Demand Per ERU (gal/day)	449
Maximum Transmission Capacity (ERUs)	59,343
Maximum System Capacity	
Based on Limiting Facility - Storage	2,832
Unused Available System Capacity	
Maximum System Capacity (ERUs)	2,832
Existing (2008) ERUs	4,535
Surplus Capacity (ERUs)	-1,704

Future Capacity Analysis Results

A summary of the results of the six-year projected system capacity analysis with the Pilchuck River source is shown in **Table 7-13**. The results of the six-year projected system capacity analysis

without the Pilchuck River source is shown in **Table 7-14**. The six-year projected system capacity analysis includes improvements that are planned to be completed within the six-year planning period, as described in **Chapter 9**. These improvements include the construction of the 362/425 Zone Booster Pump Station. The results of the 2014 system capacity analysis indicate that the proposed improvements will increase the system capacity to approximately 9,211 ERUs, both with and without the Pilchuck River source, based on the limiting component of the City's storage system. The future water system will have a surplus of approximately 4,370 ERUs with the construction of these improvements regardless of the City potentially abandoning the Pilchuck River diversion dam, decommissioning the water treatment plant and supplying the distribution system entirely with water from Transmission Line No. 5.

Table 7-13
2014 Future System Capacity Analysis with the Pilchuck River Source

ERU-Based Demands	
Average Day Demand Per ERU (gal/day)	213
Maximum Day Demand Per ERU (gal/day)	468
Peak Hour Demand Per ERU (gal/day)	842
Source Capacity - Treatment and Intertie Supply	
Treatment and Intertie Supply Capacities (gal/day)	12,320,000
Maximum Day Demand Per ERU (gal/day)	468
Maximum Supply Capacity (ERUs)	26,332
Source Capacity - Annual Water Rights and Intertie Supply	
Annual Water Right & Intertie Supply Capacity (gal/day)	13,296,960
Average Day Demand Per ERU (gal/day)	213
Maximum Annual Water Right and Intertie Capacity (ERUs)	62,524
Source Capacity - Instantaneous Water Rights and Intertie Supply	
Instantaneous Water Right & Intertie Supply Capacity (gal/day)	13,851,576
Peak Day Demand Per ERU (gal/day)	468
Maximum Instantaneous Capacity (ERUs)	29,606
Storage Capacity	
Maximum Equalizing and Standby Storage Capacity (gal)	1,842,108
Equalizing and Standby Storage Requirement Per ERU (gal)	200
Maximum Storage Capacity (ERUs)	9,211
Transmission Capacity	
Transmission Capacity (gal/day)	26,621,500
Maximum Day Demand Per ERU (gal/day)	468
Maximum Transmission Capacity (ERUs)	56,899
Maximum System Capacity	
Based on Limiting Facility - Storage	9,211
Unused Available System Capacity	
Maximum System Capacity (ERUs)	9,211
Projected (2014) ERUs	4,841
Surplus Capacity (ERUs)	4,370

Table 7-14
2014 Future System Capacity Analysis without the Pilchuck River Source

Demands Per ERU Basis	
Average Day Demand Per ERU (gal/day)	213
Peak Day Demand Per ERU (gal/day)	468
Peak Hour Demand Per ERU (gal/day)	842
Source Capacity - Intertie Supply	
Intertie Supply Capacity (gal/day)	10,620,000
Peak Day Demand Per ERU (gal/day)	468
Maximum Supply Capacity (ERUs)	22,699
Storage Capacity	
Maximum Equalizing and Standby Storage Capacity (gal)	1,842,108
Equalizing and Standby Storage Requirement Per ERU (gal)	200
Maximum Storage Capacity (ERUs)	9,211
Transmission Capacity	
Limiting Transmission Capacity (gal/day)	22,560,600
Peak Day Demand Per ERU (gal/day)	468
Maximum Transmission Capacity (ERUs)	48,220
Maximum System Capacity	
Based on Limiting Facility - Storage	9,211
Unused Available System Capacity	
Maximum System Capacity (ERUs)	9,211
Projected (2014) ERUs	4,841
Surplus Capacity (ERUs)	4,370

Operations and Maintenance

8

INTRODUCTION

The City of Snohomish's (City) water operations and maintenance program consists of the following elements.

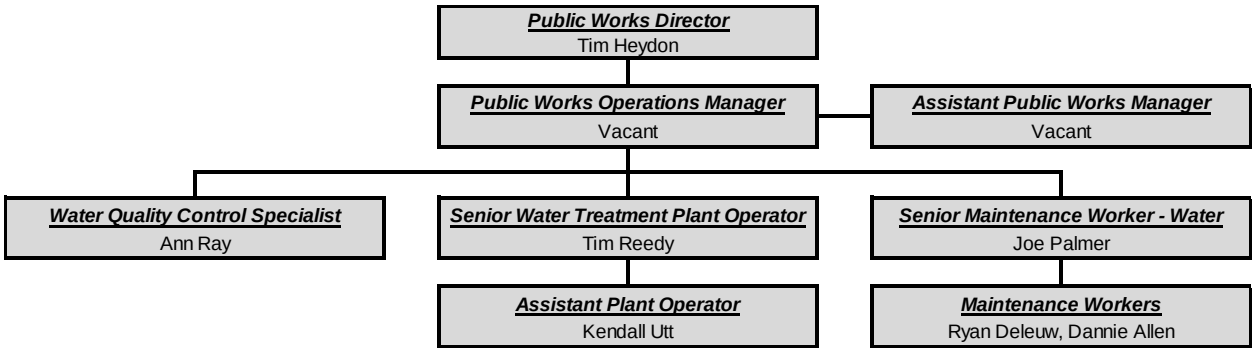
- Normal operation of the water supply, treatment and distribution systems.
- Emergency operation of the water system, when one or more of the components is not available for normal use due to natural or man-made events.
- A preventive maintenance program to ensure that the water system is receiving maintenance in accordance with generally accepted standards.
- A cross-connection control program, as required by law, to ensure that there is no compromise of the water system's integrity due to contamination introduced from a customer's operation.

NORMAL OPERATIONS

Organizational Structure

The City's water division is part of the Public Works Department. The Public Works Operations Manager reports to the Public Works Director. The Water Quality Control Specialist, Assistant Public Works Manager, Senior Water Maintenance Worker and Senior Water Treatment Plant Operator report to the Public Works Operations Manager. Additional technical and support staff include administrative support, water resources and GIS specialist. The department's organizational chart is shown in **Figure 8-1.** The essential functions of the various positions and groups are discussed later in this chapter.

Figure 8-1
Public Works Functional Organization Chart



The current water division operations and maintenance staff consists of several maintenance personnel that function under the Public Works Operations Manager, as shown in **Figure 8-1**. The water system tasks that are performed by the operations and maintenance staff include inspecting, testing, installing and repairing system facilities; routine operation and preventive maintenance; water

quality sampling; regulatory compliance monitoring; recordkeeping; administrative tasks; general clerical work; and corrective or breakdown maintenance required in response to emergencies.

Washington State law (Chapter 246-292 WAC) requires that the City's water system be operated under the direct supervision of a certified operator, or Water Distribution Manager. The water treatment process is required to be supervised by a certified Water Treatment Plant Operator appropriate for the complexity of the treatment process. In addition, specialty certification is required for backflow device testing and cross-connection control program activities and management. **Table 8-1** shows the current certifications of the City's water operations and maintenance staff. It is City policy to maintain a well qualified, technically trained staff. The City annually allocates funds for personnel training, certification and membership in professional organizations such as the American Water Works Association (AWWA). The City believes that the time and money invested in training, certification and professional organizations are repaid many times in improved safety, skills and confidence.

Table 8-1
Personnel Certification

Name	Position	Certification
Tim Heydon	Public Works Director	WDM-4
Tim Reedy	Senior Water Treatment Plant Operator	WTPO-3, WDM-2
Kendall Utt	Water Treatment Plant Operator	WTPO-2, WDM-2, CCS
Ann Ray	Water Quality Specialist	WDM-2, CCS
Joe Palmer	Senior Maintenance Worker	WDM-2, WDS, CCS

Certification Definitions

WDM - Water Distribution Manager
WDS - Water Distribution Specialist
BTO - Basic Treatment Operator
WTPO - Water Treatment Plant Operator
CCS - Cross-connection Control Specialist

Personnel Responsibilities

The key responsibilities of the water operations and maintenance management and staff are summarized below.

Public Works Director – Provides overall direction and guidance to the division; approves priorities and activities; and functions as Operation Manager during position vacancy.

Public Works Operations Manager – Under administrative direction, directs, manages, supervises and coordinates the activities and operations of the Public Works Operation Division within the Public Works Department, including street maintenance, water treatment, water distribution, stormwater and wastewater collections, and wastewater treatment services and activities. Coordinates assigned activities with other divisions, departments and outside agencies, and provides highly responsible and complex administrative support to the Public Works Director.

Assistant Public Works Manager – Assists the Public Works Operations Manager with managing, supervising and coordinating the activities and operations of the Public Works Operation Division within the Public Works Department, including street maintenance, water treatment, water distribution, stormwater and wastewater collections, and wastewater treatment services and activities. Coordinates assigned activities with other divisions, departments and outside agencies, and provides highly responsible and complex administrative support to the Public Works Operations Manager.

Senior Maintenance Worker – In charge of operating the water system, performing inspections, maintenance, sampling and relaying critical information, assessing facilities, and providing recommendations to the Operations Manager. Under direction, leads, oversees, assigns, reviews and participates in the more complex and difficult work of staff responsible for semi-skilled and skilled tasks involved in the construction, maintenance and repair of public works systems and facilities, including City streets, facilities, sewer and water utility systems. Ensures adherence to safe work practices and procedures; provides training to lower level personnel; and inspects potential job sites to determine the resources necessary for project completion.

Maintenance Worker – Under supervision (Maintenance Worker I) or general supervision (Maintenance Worker II), performs a variety of semi-skilled and skilled maintenance and repair tasks to the City's water system and other City owned facilities, and operates maintenance and construction tools and equipment. This is a broad classification with individual positions assigned to specific functional areas; duties and assignments may overlap depending on the operational needs of the department and staffing levels.

Water Quality Control Specialist – Under direction, performs a variety of duties involved in the prevention of water supply contamination by inspecting water systems and wastewater pre-treatment devices for conformance with standards and regulations; ensures the protection of publicly owned treatment works and the receiving waters, including lakes, rivers and streams, from improper pre-treatment of waste discharge; reviews construction plans and specifications; administers the City's cross-connection control, pre-treatment and water quality compliance programs; and performs a variety of routine and non-routine chemical field testing of water. Responds to water quality complaints and inquiries; provides information and assistance to other departments, contractors, engineers and the general public in person, by telephone or in the field; and maintains a variety of records and logs.

Senior Water Treatment Plant Operator – Under direction, leads, oversees, assigns, reviews and participates in the more complex and difficult work of staff responsible for operating and maintaining the City's water treatment plant, diversion dam and related facilities to assure an adequate supply of potable water to City residents and businesses; collects water samples for chemical testing purposes; ensures adherence to safe work practices and procedures; and provides training to lower level personnel.

Assistant Water Treatment Plant Operator – Under general supervision, operates and maintains the City's water treatment plant, diversion dam and related facilities to assure an adequate supply of potable water to City residents and businesses; collects water samples for chemical testing purposes; and maintains plant equipment.

Available Equipment

The water department has several types of equipment available for daily routine operation and maintenance of the water system. The equipment is stored at the City Shop and the water treatment plant. If additional equipment is required for specific projects, the City will rent or contract with a

local contractor for the services needed. A stock of supplies in sufficient quantities for normal system operation and maintenance and short-term emergencies is stored at the water treatment plant. A list of major equipment and chemicals used in the normal operation of the water system is shown in **Table 8-2**. In addition, equipment from other City functions, such as street, drainage, and parks are available if needed.

Table 8-2
Water Department Equipment List

Quantity	Description	Size/Special Features
	Equipment Inventory	
1	Pickup	1/2 Ton
2	Pickup	3/4 Ton
1	Van	1 Ton
1	Truck	Utility Body
1	Flat Bed Truck	
1	Dump Truck	
1	Cement Mixer	
1	Trailer	
3	Backhoe	
1	Tractor	
3	Lawn Mower	
1	Lawn Mower	Flail
1	Compactor	Jumping Jack
2	Generator	Portable
5	Weed Eater	
3	Pipe Saw	
3	Chain Saw	
Varies	Miscellaneous Equipment	
	Chemical Inventory	
Varies	Aluminum Sulfate	
Varies	Chlorine Gas	
Varies	Filter Aide	
Varies	Liquid Chlorine	
Varies	Liquid Polymer	
Varies	Soda Ash	

Service, Equipment and Supply Vendors

The list in **Table 8-3** identifies the typical vendors for service, materials, supplies and chemicals. The City maintains adequate supplies and materials for normal operation. The suppliers are local and maintain adequate materials for unusual needs.

Table 8-3
Service, Equipment and Supply Vendors List

Name	Address	Phone	Products
Engineering and Technical Services			
City Engineer Steve Schuller, P.E.	116 Union Avenue Snohomish, WA 98290	360-568-3115	Engineering Support
RH2 Engineering, Inc.	12100 NE 195th Street, Suite 100 Bothell, WA 98011	425-951-5400 800-720-8052	Engineering Support
Murray, Smith & Associates, Inc.	2707 Colby Avenue, Suite 1110 Everett, WA 98201	425-252-9003	Engineering Support
Laboratory and Analytical Services			
City of Everett	11525 Knudson Road Burlington, WA 98233	425-257-8230	Water Quality Testing
AMTest	13600 NE 136th Place, Suite C Kirkland, WA 98034	425-885-1664	Water Quality Testing
Materials and Supplies			
United Pipe and Supply	13019 41st Avenue NE Marysville, WA 98271	360-653-1671 877-832-5192	Pipes, Valves, Fittings
HD Fowler	6016 29th Drive NE Marysville, WA 98271	360-651-2400 800-659-6199	Pipes, Valves, Fittings
HB Jaeger Company, LLC	10105 Airport Way, Suite A Snohomish, WA 98296	360-568-5958 425-486-5958	Pipes, Valves, Fittings
Ferguson Enterprises, Inc.	1012 132nd SW Everett, WA 98204	425-742-4748	Pipes, Valves, Fittings
GC Systems, Inc.	2310 Inter Avenue Puyallup, WA 98372	253-939-8322 800-525-9425	Valve Maintenance
Equipment and Service			
Service Electric Co., Inc.	1615 First Street Snohomish, WA 98290	800-577-4779 360-568-6966	Electrical Services
Snohomish County PUD No. 1	2320 California Street Everett, WA 98206	425-783-1000	Electrical Services
Northern Systems, LLC Art Larson	9009 W Mall Drive APT 2108 Everett, WA 98208	425-210-2381 425-745-5466	System and Control Integration
RH2 Engineering, Inc. James Swanson	12100 NE 195th Street, Suite 100 Bothell, WA 98011	425-951-5400 425-951-5386	System and Control Integration
Water and Wastewater Automation, LLC	7220 52nd Street NE, Marysville, WA 98270	360-657-0300 425-739-0005	Water and Wastewater Support
PumpTech, Inc.	13251 Northup Way Bellevue, WA 98005	888-644-6686 425-644-8501	Pumps and Service
D & G Backhoe, Inc.	2808 Old Hartford Road Lake Stevens, WA 98258	425-355-0348 425-334-3918	Excavation
Ace Equipment Rentals	702 2nd Street Snohomish, WA 98290	360-568-1300	Machinery Rentals
Top Food and Drug	1301 Avenue D Snohomish, WA 98290	360-568-1395	Bottled Water

Routine Operations

Routine operations involve the analysis, formulation and implementation of procedures to ensure that the facilities are functioning efficiently and meeting pressure and water quality requirements and other system demands.

The utility's maintenance procedures should be updated to meet current standards as time allows. The City's available water system staff is slightly inadequate to accomplish the preventative maintenance tasks listed later in this chapter in the Staffing section. However, emergency repairs are made promptly so customers receive high quality water service. The City plans to use this chapter as the water department's established preventive maintenance program and schedule.

Continuity of Service

As a municipality, the City of Snohomish has the structure, stability, authority and responsibility to assure that water service will be continuous. For example, changes in the City council or staff would not have a pronounced effect on the City's customers or quality of service.

Routine Water Quality Sampling

The Washington State Department of Health (DOH) has adopted federal regulations that specify minimum monitoring requirements for water systems. The sampling requirements depend on the population served, source type and treatment provided. The specific requirements are contained in WAC 246-290-300. The City currently performs all routine coliform sampling throughout the distribution system, taking a total of ten samples each month. A further discussion of the water quality monitoring program is contained in **Chapter 6** and **Appendix F** of this Comprehensive Water System Plan (Plan).

Cross-connection Control

The City drafted a cross-connection control program in 1999 to comply with WAC 246-290-490 pertaining to contamination of potable water due to cross-connections. Currently, the City's water department is working closely with the City's building department to arrive at mutual agreement on cross-connection control requirements. Backflow prevention devices are required at service connections where a potential for contamination exists. The cross-connection control plan was updated with this Plan and is included in **Appendix G**, along with a list of cross-connection control devices under City control. The staff members with Cross-Connection Control Specialist certifications are shown in **Table 8-1**.

Recordkeeping and Reporting

DOH has enacted regulations for recordkeeping and reporting procedures for operations and water quality testing that may be found in WAC 246-290-480.

Recordkeeping

Records shall be kept for chlorine residual and other information as specified by DOH. DOH requires retention of critical records dealing with facilities and water quality issues as summarized below.

- Bacteriological analysis results: five years.
- Chemical analysis results: for as long as the system is in operation.
- Daily source meter readings: ten years.
- Water treatment plant records: ten years.
- Other records of operation and analyses as may be required by DOH: three years.

- Documentation of actions to correct violations of primary drinking water standards: three years after last corrective action.
- Records of sanitary surveys: ten years.
- Project reports, construction documents and drawings, inspection reports and approvals: life of the facility.
- Where applicable, daily records of chlorine residual, fluoride level, water treatment plant performance and turbidity: three years.

The City's recordkeeping procedure is as follows.

1. Water quality records, including all sampling results, are filed at the City Shop and are backed up electronically to a local server on an annual basis.
2. Cross-connection records and all customer letters are filed at the City Shop and are backed up electronically to a local server. Customer letters are also filed at City Hall in the property files for each individual address.
3. Backflow assembly tester certifications and test reports are filed at the City Shop for one year and are then moved to a file at City Hall.

Reporting

The City's 24-hour notice procedures are consistent with DOH and Environmental Protection Agency guidelines, and are described in the City's Emergency Response Plan. The City utilizes standard DOH notices as applicable. Tim Heydon, Public Works Director, is the person identified to speak on the City's behalf as these situations dictate.

The City must report the following to DOH:

- Within 48 hours: A failure to comply with the primary standards or treatment technique requirements specified in Chapter 246-290 WAC;
- Within 48 hours: A failure to comply with the monitoring requirements specified in Chapter 246-290 WAC;
- Within 48 hours: A violation of a primary maximum contaminant level (MCL);
- Within one business day: A backflow incident, per WAC 246-290-490 (8)f; and
- As soon as possible, but no later than 24 hours after the violation is known: National Primary Drinking Water Regulation (NPDWR) violations and situations with significant potential to have serious adverse effect on human health as a result of short-term exposure, which require Tier 1 public notices per 40 CFR 141.202.

The City must submit all applicable reports to DOH as required by Chapter 246-290 WAC. Monthly reports are due by the tenth day of the following month, unless otherwise specified. Daily and annual source meter readings must be made available to DOH on request. Records regarding the status of monitoring waivers must be submitted during each monitoring cycle. Waiver information is updated annually by DOH, and the utility is provided with a testing schedule.

A water facilities inventory and report form (WFI) must be submitted to DOH within 30 days of any change in name, category, ownership or responsibility for management of the water system.

The City must notify DOH of the presence of:

- Coliform in a sample within ten days of notification by the testing laboratory; and
- Fecal coliform or E. coli in a sample by the end of the business day in which the City is notified by the testing laboratory.

When a coliform MCL violation is determined, the City must:

- Notify DOH within 24 hours of determining acute coliform MCL violations;
- Notify DOH before the end of the next business day when a non-acute coliform MCL is determined; and
- Notify water customers in accordance with WAC 246-290-71001 through 71007 and the Environmental Protection Agency's (EPA) Public Notification Rule.

If volatile organic compound monitoring is required, a copy of the results of the monitoring and any public notice must be sent to DOH within 30 days of receipt of the test results.

Other Reports

Several other reports are required for state agencies, including the Department of Revenue, Department of Labor and Industries, Department of Social and Health Services, Department of Ecology and the Employment Security Department. All reports are to be completed according to their instructions.

Operations and Maintenance Records

Facilities Operations and Maintenance Manuals

Operations and maintenance manuals are available for staff member's reference. These manuals are kept on file at the water treatment plant and utilities office. The City intends to maintain its policies of requiring complete operation and maintenance manuals for all new equipment and facilities.

Mapping and As-Built Drawing Records

Maintenance of as-built drawings is essential to maintenance crews, city planners, developers and anyone else needing to know how the water system is laid out. A master drawing of the water system is maintained by the Public Works Department mapping technician to provide an accurate water system map for use by all City personnel. This drawing is created from record and field drawings that contain water main information such as size, material and year installed.

Operations and Maintenance Records

Records are stored at the City Shop or in the City's computer database for the following items.

- Backflow and cross-connections
- Confined spaces
- Hydrant repairs
- Hydrant meter forms
- Hydrant databases
- Precipitation
- Water usage
- Water used for construction
- Water consumable inventory

- Water maintenance
- Water main notes
- Water worksheets
- Water main flushing
- Bacteriological tests
- Inorganic chemical tests
- Volatile organic compound tests
- Synthetic organic compound tests
- Water samples from new developments and Capital Improvement Program projects
- Lead and copper tests
- Chlorination levels
- Customer complaints
- Vandalism forms

Safety Procedures and Equipment

Safety is the concern and responsibility of all water operations and maintenance staff. To maintain the highest level of safety, the City has taken steps toward educating its staff and providing resources to ensure a safe working environment. The City continuously improves the safety program as the requirements and affected operations change. The American Water Works Association publishes a manual entitled *Safety Practices for Water Utilities* (M3) that describes safety programs and provides guidelines for safe work practices and techniques for a variety of water utility work situations.

The following procedures should be followed for operations and maintenance tasks that involve the most common potential workplace hazards in the City's water system.

Use of Chlorine, Chlorine Products, Primary Coagulant and Filter Aide

Standard Procedure – Handle with care, provide adequate ventilation, and wear safety glasses and rubber gloves.

Working in Confined Spaces

Standard Procedure – Follow state requirements for confined space entry.

Working around Heavy Equipment

Standard Procedure – Obtain proper training and follow all safety procedures. Use noise protection equipment.

Working in Traffic Areas

Standard Procedure – Wear proper clothing and provide adequate signage and flagging for work area. Certified flaggers are used when traffic management requires flagging around a work site.

Working on or around Water Reservoirs

Standard Procedure – Follow proper safety harness procedures for working on tall structures. Entry of a reservoir is a confined space work area and those regulations and procedures apply.

Working on Asbestos Cement (AC) Water Main

Standard Procedure – Obtain proper training and follow all safety procedures for working with asbestos materials.

The water utility personnel are required to take training courses on the following topics.

- Asbestos Cement Pipe Handling
- Confined Space Entry
- Hazardous Waste
- Fall Protection
- Hearing Protection
- Competent Persons
- Laboratory Safety
- Electrical Hazards
- Heavy Equipment Operation
- CPR and First Aid
- Blood-Borne Pathogens
- Traffic Flagging
- Lockout-Tagout
- Water distribution
- Cross-connection control

The City's facilities are equipped with confined space entry equipment, oxygen-gas meters and lockout-tagout equipment where appropriate. Each City vehicle is equipped with first aid and blood-borne handling kits. The City also owns flagging signs and equipment for safe handling of traffic.

The Public Works Department follows all appropriate OSHA and WISHA regulations in its day to day operations and complies with the following State requirements.

- WAC 296-809-500 to 800: Entry into confined spaces.
- WAC 296-155-650 to 66411 Part N: Shoring of open ditches.
- WAC 296-155-429: Lockout-tagout for work on energized or de-energized equipment or circuits.
- Chapter 296-155 WAC Part C1: Fall restraint for access to the top of the City's water reservoirs.
- Manual on Uniform Traffic Control Devices: Traffic control for work in the public right-of-way.

EMERGENCY OPERATIONS

Capabilities

The City is equipped to accommodate short-term system failures and abnormalities. The general water system emergency response capabilities are as follows.

Multiple Supply Capability

The City could lose the operation of the Pilchuck River source without adversely impacting its ability to meet the normal demands of its customers. The City could also lose operation of an intertie along Transmission Line No. 5 without adversely impacting its ability to meet the normal demands of customers by opening zone valves and supplying water to the impacted zone from other areas of the distribution system. Service to customers along the Water Treatment Plant Transmission Main can be maintained through an emergency intertie with the Snohomish County Public Utility District No. 1 described in **Chapter 2**. The City has also signed interlocal agreements with adjacent utilities connected to the City of Everett's (Everett's) Transmission Lines to supplement the distribution system in the event of an emergency.

Reservoirs

Water storage is provided by three active reservoirs that are located at two different sites. The duplication of reservoirs in the 218 Zone provides sufficient redundancy to prevent service disruption when one of the reservoirs is out of service for cleaning, painting, repairs or any other reason. Reservoir No. 3 is filled from the Everett supply, and can also serve the 218 Zone through pressure reducing stations. The 386, 425, 438 and 450 Zones are directly served by Everett's Transmission Line No. 5 and do not currently have storage facilities.

Distribution System

The City has attempted to loop water mains wherever possible to improve water circulation (i.e. water quality) and minimize impacts to the system in the event that a portion of the distribution system must be taken out of service for maintenance or repairs. Additionally, the zone valves between the 362, 386, 425, 438 and 450 Zones can be opened to allow Reservoir No. 3 to supply all three northern zones.

Emergency Equipment

The City is equipped with the necessary tools to deal with common emergencies. If a more serious emergency should develop, the City will hire a local contractor to make repairs to alleviate the emergency condition. The City also has a mutual aid agreement with nearby water systems.

Emergency Telephone

The water department has an established emergency procedure for the public to contact water department personnel through the City Hall phone system (360-568-3115) or 911. The police or answering service can reach the water department on-call personnel. Emergency contact information, including cell phone, pager and home phone numbers, is provided to each City department.

On-call Personnel

The on-call person is required to respond to a call within 60 minutes, but can often respond to a call within 30 minutes. A list of emergency telephone numbers is provided to each on-call employee. New employees are not placed on-call until they are familiar with the water system and maintenance procedures and are properly certified by the State of Washington.

Contacts

The City maintains a list of adjacent utility contacts for routine and emergency use, shown in **Table 8-4**.

Table 8-4
Utility and Agency Contacts

Agency	Contact	Phone	Address
Utility Contacts			
City of Everett	Water Division	425-257-8800	3200 Cedar Street Everett, WA 98201
Snohomish County PUD No. 1	Water Division	425-738-8450	2320 California Street Everett, WA 98206
Cross Valley Water District	Wayne Lawrence	360-668-6766 425-339-7742	8802 180th Street SE Snohomish, WA 98296
Schluter Water System	Ted and Laura Stonebridge	360-794-6758	13402 247th Avenue SW Monroe, WA 98272
Agency Contacts			
Washington State Department of Health	Richard Rodriguez	253-395-6771	20435 72nd Avenue S, Suite 200 K17-12 Kent, WA 98032

Material Readiness

Some critical repair parts, tools and equipment are kept on-hand and in fully operational condition. As repair parts are used, they are re-ordered. Inventories are kept current and are adequate for most common emergencies that can reasonably be anticipated. The City has ready access to an inventory of repair parts, including parts required for repair of each type and size of pipe within the service area.

Emergency Response Plan

In 2004, the City prepared an *Emergency Response Plan* (ERP) to assist in preparing for emergency events related to the City's water supply and distribution system. The ERP should be updated in accordance with the requirements of the Bio-Terrorism Act of 2002 amendments to the Safe Drinking Water Act.

The updated ERP should contain a vulnerability assessment of the City's water system facilities, a contingency operation plan for responding to emergency events, a list of water personnel responsible for making decisions in emergency situations and other elements. The ERP will contain

confidential and/or sensitive information and is exempt from the Public Disclosure Act. However, it will be available to City staff and can be reviewed by regulatory agencies on a need to know basis.

Public Notification

The Federal Safe Drinking Water Act (SDWA), WAC 246-290-71001 through 71007, and the EPA Public Notification Rule require purveyors to notify their customers if any of the following conditions occur.

- National Primary Drinking Water Regulation (NPDWR) violations.
- Failure to comply with a primary MCL described under WAC 246-290-310.
- Failure to comply with a surface water treatment technique.
- Failure to comply with monitoring requirements under Chapter 246-290 WAC.
- Operation under a variance or exemption.
- Failure to comply with the requirements of any schedule that has been set under a variance or exemption.
- Failure to comply with testing procedures as prescribed by drinking water regulations.
- Occurrence of a water-borne disease outbreak or other water-borne emergency.
- Exceedance of the secondary maximum contaminant level (SMCL) for fluoride.
- Availability of unregulated contaminant monitoring data.
- Issuance of a departmental order.
- Failure to comply with a departmental order.
- Issuance of a category red operating permit by DOH.

Public notice requirements for each type of violation or situation are organized into three tiers per 40 CFR 141.201 through 208 and are based on the seriousness of the violation and the potential for adverse health effects. Tier 1 public notices are required for NPDWR violations and situations with significant potential to have serious adverse effects on human health as a result of short-term exposure. Public notices in this tier must be provided as soon as possible (no later than 24 hours after the violation is known). The DOH must also be notified within this timeframe, and it may require repeat or additional notices.

Tier 2 public notices are required for all other NPDWR violations and situations not covered in Tier 1 with the potential to have serious adverse effects on human health. Public notices under Tier 2 requirements, with the exception of turbidity violations, must be provided as soon as possible, but no later than 30 days after the violation is known. Turbidity violations must be reported to DOH as soon as possible, but no later than 24 hours after the violation is known, to determine whether a Tier 1 public notice will be necessary. Repeat notices must be issued for as long as the violation persists.

All other NPDWR violations and situations not included in Tier 1 and Tier 2 are grouped within Tier 3. Tier 3 public notices must be provided within one year of the City learning of the violation or beginning operations under a variance or exemption. The notice must be repeated annually for as long as the violation, variance, exemption or other situation persists.

PREVENTIVE MAINTENANCE

Maintenance schedules that meet or exceed manufacturer's recommendations have been established for all critical components in the water system. The following schedule is used as a minimum for preventive maintenance, and manufacturer's recommendations should be followed where conflict exists.

Storage Facilities

Daily	Visual and audio inspections. Check security and inspect facilities for proper operation.
Bi-Annually	Check interior condition, vents, hatches, etc. on tanks.
As Needed	Clean and/or repaint interior and exterior as needed on tanks (estimated 10 to 20 year frequency).

Distribution System

Annually or As Needed	Leak survey.
Annually	Flushing.

Water Treatment Plant

Daily	Log and record run hours, motor starts, chemicals used, chemicals added, chlorine solution generated, fuse indicators, backwash volumes, volume delivered and current supply rate; visually inspect pumps; check pump packing; check pump oil levels; check all equipment for proper function and operation; check security.
Annually	Measure treatment train media.
Annually	Check all valves and screens; check control valve settings; re-grease pumps; change pump oil.
As Needed	Maintain electrical and mechanical equipment; paint structures and piping; equipment calibration; indoor and outdoor facility maintenance and repairs.

Engine Generator Sets

Weekly	Operate to achieve normal operating temperatures; observe output.
Semi-Annually	Routine maintenance in accordance with manufacturer's recommendations.
As Needed	Replace fluids and filters in accordance with manufacturer's recommendations (or more frequently depending on amount of use).
As Needed	Perform tune-up; replace parts as necessary.

Pressure Reducing Stations

Annually	Flush and check all valves and screens; check pressure settings; rebuild and paint every five years or as necessary.

Isolation Valves

Annually	Operate full open/closed; uncover where buried; clean out valve boxes and repair as necessary. Repair and/or install valve marker posts as necessary.

Hydrants

Annually	Check for leakage and visual damage. Operate and flush; check drain rate; lubricate as necessary; measure pressure; paint as necessary. Check nozzle and cap threads, and clean and lubricate per manufacturer's recommendations. Replace lost and damaged gaskets. Check and operate the auxiliary valve in accordance with the valve maintenance schedule. Leave in open position. Inspect drain system to ensure proper drainage and protection from freezing weather.

Meters

2 to 20 Year Intervals	Time and measure volume of meter-delivered flow; dismantle, clean and inspect all parts; replace worn or defective parts; retest meter for accuracy. Frequency varies based on meter size. Customer meters shall be replaced when reading problems are encountered.

Air and Vacuum Release Valve Assemblies

Annually	Flush and inspect, repair as needed.

Blowoff Assemblies

Annually	Flush and inspect, repair as needed.

Telemetry and Control System

Daily	Backup program and data.
Monthly	Visually inspect cabinets and panels for damage, dust and debris.
Semi-Annually	Inspect inside of cabinets and panels for damage, dust and debris. Vacuum clean all modules. Test alarm indicator units. Clean and flush all pressure sensitive devices. Visually inspect all meters to coordinate remote stations.
Annually	Check master and remote telemetry units for proper operation; repair as necessary.

Tools and Equipment

Rolling Stock	
Weekly	Check all fluid levels and brakes. Fluid levels and brakes are checked each time the equipment is used if less than weekly.
As Needed	Replace fluids and filters in accordance with manufacturer's recommendations (or more frequently depending on type of use); preventive maintenance per manufacturer's recommendation.
Tools	
As Needed	Clean after each use; lubricate and maintain as necessary; inspect for damage and wear before each use; preventive maintenance performed per manufacturer's recommendation.

STAFFING

The preventive maintenance procedures, as well as the normal and emergency operations of the utility, are described in the previous sections. The hours of labor and supervisory activity required to effectively execute the ongoing maintenance and operations schedules form the basis for determining adequate staffing levels.

Current Staff

The current staff includes management and supervisory personnel with partial time allocated to the water system, water treatment plant operators and maintenance workers engaged in operating and maintaining the water system. There are currently three field crew and two plant operators assigned to the water system. The Operations Manager and Public Works Director are involved in other activities and can only partially devote time to water operations and maintenance. The City Engineer, Assistant Public Works Manager and Water Quality Control Specialist, while important to the City, are not considered as operations or maintenance staff in this analysis. Therefore, the water utility is supported by approximately five full-time staff equivalents.

Current Staff Required

The amount of time annually available for each staff member for operations and preventative maintenance of the water system is shown in **Table 8-5**.

Table 8-5
Time Available Per Year Per Person

Beginning Hours Available	2,080
Less average vacation of 3 weeks per year	-120
Less average sick leave of 2 weeks per year	-80
Less holidays of 11 days per year	-88
Less average training of 40 hours per year	-40
Less average small tasks other than above of 1 hour per day	-219
Net Available Hours Per Year Per Person	1,533

The estimated hours of work required to achieve optimum operation and maintenance of the water system is shown in **Table 8-6**. The table identifies the staffing time for maintenance tasks, operational tasks, capital improvements and construction of water system facilities. The upper section of the table identifies the staffing time requirements for recommended preventive maintenance tasks, and the lower section identifies the staffing time requirements for recommended operations tasks. The estimates of the time required for each component are based on a composite of similarly sized utilities in the region that are considered to have a responsible preventive and corrective water system maintenance program.

The regional productivity rates are modified as appropriate to reflect the characteristics of the utility being analyzed. System complexity and geographic characteristics can have a significant impact on productivity. The City's characteristics were considered when adjusting the regional values in this analysis.

To achieve the level of operations and maintenance shown in **Table 8-6**, approximately 7.9 full-time personnel are required for the water system alone. The City's current available water system staff is slightly inadequate to meet these requirements. At the current staffing level, the City is capable of adequately operating the water system and complying with the minimum DOH requirements. However, the preventive maintenance tasks listed previously in this chapter have not been accomplished at the desired frequency shown due to the shortage of staff. The City should plan to add additional staff as necessary to complete the preventative maintenance tasks as long as the water treatment plant remains in operation.

Table 8-6
Current Staff Required

Description	Total Units In System	Frequency (Times/Year)	Time/Unit (Hours)	Time/Year (Hours)
Preventive Maintenance				
Hydrants	418	1	1	418
Isolation Valves, Hydrant Valves	933	1	0.5	467
Air and Vacuum Release Valves	40	1	0.5	20
Blowoff Assemblies	30	1	0.5	15
Blowoffs (other)	14	25	0.57	200
Leak Survey of Water Mains (10%)	6.6 miles	1	40	264
Hydrant/Water Main Flushing	Intermittent	84	16	1,344
Pressure Reducing Stations	4	1	6	24
Interties	5	1	6	30
Sources	2	1	50	100
Water Treatment Plant	1	365	8	2,920
WTP Transmission Main and Fish Ladder Cleaning	Intermittent	24	24	576
Reservoirs	3	1	30	90
Telemetry and Control System	1	12	4	48
Operations				
Monitor System	1	260	1	260
False Alarm Response	1	24	2	48
Groundskeeping	3	20	8	480
Inventory	1	1	40	40
Meter Repair/Replacement	150	1	4	600
Main Breaks/Leak Repair	20	1	8	160
System Failures	12	1	8	96
Hydrant Repairs	20	1	8	160
Service Connections	20	1	8	160
Main Connections	2	1	24	48
Water Quality Sampling	7	260	0.285	519
Locates	1	390	1	390
Service Requests	Intermittent	150	4	600
Administration	1	260	8	2,080
Total Staff Required				
Total Hours Required				12,156
Total Full-Time Staff Required (based on 1,533 hours per year per person)				***7.9***

Future Estimated Staff Required

The estimated work units and labor hours required to operate and maintain the water system should the City close the water treatment plant and fully supply the system with water from Everett's Transmission Line No. 5 is shown in **Table 8-7**.

Table 8-7
Estimated Future Staff Required without Water Treatment Plant

Description	Total Units In System	Frequency (Times/Year)	Time/Unit (Hours)	Time/Year (Hours)
Preventive Maintenance				
Hydrants	418	1	0.5	209
Isolation Valves, Hydrant Valves	933	1	0.25	233
Air and Vacuum Release Valves	14	20	0.58	162
Blowoff Assemblies	14	25	0.58	203
Leak Survey of Water Mains (10%)	5.2 miles	1	40	208
Hydrant/Water Main Flushing	Intermittent	84	16	1,344
Booster Pump Station	1	1	40	40
Pressure Reducing Stations	7	1	6	42
Interties	5	1	6	30
Sources	1	1	50	50
Water Treatment Plant	0	365	8	0
Reservoirs	3	1	30	90
Telemetry and Control System	1	12	4	48
Operations				
Monitor System	1	260	1	260
False Alarm Response	1	24	2	48
Groundskeeping	3	20	8	480
Inventory	1	1	40	40
Meter Repair/Replacement	150	1	4	600
Main Breaks/Leak Repair	20	1	8	160
System Failures	12	1	8	96
Hydrant Repairs	20	1	8	160
Service Connections	20	1	8	160
Main Connections	2	1	24	48
Water Quality Sampling	7	260	0.285	519
Locates	1	390	1	390
Service Requests	Intermittent	150	4	600
Administration	1	260	8	2,080
Total Staff Required				
Total Hours Required				8,301
Total Full-Time Staff Required	***(based on 1,533 hours per year per person)***			***5.4***

Based on anticipated work activities and crew productivity, it is estimated that 5.4 full-time staff equivalents are needed to adequately operate and maintain the water system and water supply. It is anticipated that the two current Water Treatment Plant Operators will be moved to or shared with other City departments upon the closure of the water treatment plant. This will provide the City sufficient staff to complete the preventative maintenance tasks listed previously in this chapter. As the water system continues to expand and age, there will be a need for additional staff to perform operations and preventive maintenance tasks. The estimated future staff required should be re-evaluated upon closure of the water treatment plant and adjusted to meet the needs of the water system at that time.

OPERATIONS AND MAINTENANCE IMPROVEMENTS

The City is in the process of completing preliminary telemetry and supervisory control improvements that will greatly enhance the routine operation of the water system and fulfill the recordkeeping needs. The City also recently replaced the water treatment plant generator's manual transfer switch with an automatic transfer switch. These improvements allow the existing operations staff to concentrate on preventive maintenance, equipment repair and the other specialized needs of the organization, while eliminating the "human factor" from routine tasks and increasing system efficiency and reliability.

Additional telemetry and supervisory control improvements have been proposed and are addressed in **Chapter 9** as part of the City's Capital Improvement Program.

Water System Improvements

9

INTRODUCTION

This chapter presents proposed improvements to the City of Snohomish's (City) water system that are necessary to resolve existing system deficiencies and accommodate the projected growth of water customers. The water system improvements were identified from an evaluation of the results of the water system analyses presented in **Chapter 7**. The water system improvements have been sized to meet both the existing and future demand conditions of the system.

A Capital Improvement Program (CIP) number has been assigned to each proposed improvement. Numbers assigned to the improvements start at the south end of the system and generally, increase incrementally to the north, as shown in **Figures 9-1** and **9-2**. The improvements are also illustrated in the hydraulic profile of the future water system with the Pilchuck River source, shown in **Figure 9-3**, and without the Pilchuck River Source, shown in **Figure 9-4**. The improvements are organized and presented in this chapter according to the following categories:

- Water system improvements since 1994;
- Water main improvements;
- Pressure zone improvements;
- Pressure reducing station improvements;
- Facility improvements;
- Miscellaneous improvements; and
- Developer funded improvements.

The remainder of this chapter presents a brief description of each group of improvements, the criteria for prioritization, the basis for the cost estimates and the implementation schedule.

DESCRIPTION OF IMPROVEMENTS

This section provides a general description of each group of improvements and an overview of the deficiencies they will resolve. Most of the improvements are necessary to resolve existing system deficiencies. Improvements have also been identified for some undeveloped areas to provide major facilities that will be required when development occurs in those areas. These developer-funded projects include localized on and off-site water main improvements that may or may not be associated with overall water distribution, but are necessary when the property served by the water main is redeveloped or expanded. The costs associated with these improvements shall be borne by the developers rather than the existing water customers. The locations of improvements in the undeveloped areas are shown schematically in **Figures 9-1** and **9-2** and will most likely be altered to fit the layout of the future developments.

Water System Improvements Since Last Water System Plan

The water system has undergone several changes since 1994, when the City last updated its Comprehensive Water System Plan (WSP). The City has implemented many of the recommended projects as scheduled in the 1994 CIP, including distribution system and water treatment plant

improvements. **Table 9-1** lists the CIP projects that have been completed, along with additional projects that have also been completed since the City's last WSP. In addition to these major projects, the City has implemented many smaller projects, including water main replacements and extensions.

Table 9-1
Improvements Completed Since 1994

Project Description	Year
Distribution System	
8-inch Water Main in Avenue C from 2nd Street to 5th Street	1999
8-inch Water Main in 14th Place from Pine Avenue to the West End	2000
Kendall Plat/Ludwig 12-inch Water Line Upgrade	2007
8-inch Water Main in Mill Street	2007
8-inch Water Main in Toughy Court	2007
High School Upgrade Project	2007
Snohomish Station	2007
10th Street and Avenue D PRV	2008
Jaeger Water Line	2008
Clark's Pond Water Main	2009
Rose Lane Water Main	2009
Snohomish Station Residential	2009
Storage Facilities	
Reservoir No. 2 Cover Replacement	2009
Water Treatment Plant	
Filter to Waste Capability	2009
Control Panels and Programmable Logic Controller	2009

Water Main Improvements

The following water main improvements were identified based on the results of the distribution and transmission system analyses discussed in **Chapter 7**. Most of the water main improvements will replace existing distribution water main and are grouped in the "Annual Water Main Replacement Program" project (CIP WM1). The individual water main improvement projects within this group are numbered 1 through 78, as shown in **Figures 9-1** and **9-2**. The other water main improvements are mostly larger diameter water mains that function more like transmission than distribution mains and are identified as individual projects (CIP WM2 through WM4).

Future Water Main Extensions and Replacements

All new water main extensions and replacements shall be installed in accordance with the City's Construction Standards and Specifications, which are contained in **Appendix H**. All new water main shall be cement-mortar lined ductile iron pipe and sized by a hydraulic analysis to ensure that all pressure, flow and velocity requirements, as stated in **Chapter 5**, are met. In general, new water mains that will carry fire flow in residential areas shall be a minimum of 8 inches in diameter and

looped for multi-family residential developments and single family transmission purposes. New water mains in commercial, business park, industrial, school and airport areas shall be a minimum of 12 inches in diameter and looped. New water main extensions or replacements within Snohomish County (County) right-of-way require the appropriate County permits prior to construction of the improvements.

CIP WM1: Annual Water Main Replacement Program

Deficiency: Most of the water main improvements shown in **Figures 9-1** and **9-2** are required to resolve existing system fire flow deficiencies caused primarily by older undersized water mains installed prior to the local government adoption of fire flow requirements.

Improvement: Replace existing water main with new ductile iron water main in accordance with the City's Construction Standards and Specifications, which are contained in **Appendix H**. The individual water main improvements grouped under this project are numbered 1, 2, 3, etc., as shown in **Figures 9-1** and **9-2**. The selection of specific projects will be accomplished annually during the City's budget development process and will be guided by the prioritization presented later in this chapter. This provides the City with the flexibility to coordinate these projects with other projects that may occur within the same area. An allowance of $0 for the first year, $200,000 for the second year, $300,000 for the third year, $350,000 for the fourth year, $400,000 for the fifth year and $450,000 for the sixth year has been established for the annual replacement of the water mains.

CIP WM2: 2nd Street 12-inch State Route 9 Crossing

Deficiency: All water supplied to the area west of State Route (SR) 9 and north of the Snohomish River in the 218 Zone is currently provided by one 6-inch water main crossing SR 9. This proposed improvement is necessary to improve fire flow and reliability to this area.

Improvement: Install new 12-inch water main in 2nd Street from Avenue J to Ludwig Road, including crossing under SR 9. Construction of this improvement is underway and is expected to be complete by the end of 2010.

CIP WM3: State Route 9 Crossing 12-inch Water Main

Deficiency: The City's storage facilities are located in the eastern portion of the service area. Although there is existing 12-inch water main connecting the service areas on the east and west sides of SR 9 within the 362 Zone, this proposed water main is necessary to improve reliability within the system.

Improvement: Install new 12-inch water main underneath SR 9 to connect the water main proposed in CIP DF10. This project was completed in November 2010.

Pressure Zone Improvement

The following pressure zone improvement is proposed to consolidate existing pressure zones that have been formed by multiple interties to Transmission Line No. 5. A brief description of the existing deficiency and proposed improvement is provided below.

CIP PZ1: Conversion of 384, 438 and 450 Zones to 362 Zone

Deficiency: The 384, 438 and 450 Zones are currently closed zones (i.e., do not have water storage) and are supplied with water directly from Transmission Line No. 5 through three interties.

The individual capacity of the 384, 438 and 450 Zone interties is not sufficient to supply the maximum fire flow requirement of the zones.

Improvement: Convert the 438, 450 and a portion of the 384 Zone to the existing 362 Zone by installing a PRV on Bickford Avenue at approximately 62nd Place SE and abandoning the existing inactive Bickford Avenue PRV. A check valve shall be installed in the proposed PRV vault to allow water to be conveyed from the 362 Zone to the 384 Zone during emergency conditions in the 384 Zone. Open the three existing normally closed zone valves on 22nd Street near Park Avenue and Pine Avenue. Change the PRV settings on the King Charley's and Park Avenue interties to provide supply to the 362 Zone only during peak demand or emergency conditions.

Pressure Reducing Station Improvement

The following pressure reducing station improvement was identified to resolve an existing system deficiency.

CIP PRV1: 10th Street and Avenue D Pressure Setting Adjustment

Deficiency: Isolated areas of the 218 Zone experience pressures below 30 psi during peak demand conditions during the 2014 pressure analysis.

Improvement: Change the PRV settings on the 10th Street and Avenue B PRV to provide a minimum pressure of 30 psi throughout the 218 Zone during peak and all other demand conditions, excluding an emergency.

Facility Improvements

The following water system facility improvements were identified from the results of the water system analyses that are discussed in **Chapter 7**. The improvements are primarily necessary to resolve existing system deficiencies, but have also been sized to accommodate projected growth.

CIP F1: 362/425 Zone Booster Pump Station

Deficiency: The City has an existing storage deficiency in the Reservoir No. 3 operating area and requires an additional source of supply to provide fire flow to the 425 Zone. This improvement is necessary regardless of the City's decision to maintain the Pilchuck River source as a source of supply.

Improvement: Install a new pump station that will function as the back-up supply facility for the 362 Zone and the back-up and fire flow supply facility for the 425 Zone. The pump station will supply the zones in conjunction with Transmission Line No. 5. Additionally, install 12-inch water main from Reservoirs No. 1 and No. 2 to the proposed pump station, and from the proposed pump station to existing 362 and 425 Zone water mains at the intersection of Pine Avenue and 13th Street to convey supply throughout the zones. The new pump station will have a maximum capacity to satisfy the largest fire flow requirement and maximum daily demand (MDD) of the 362 and 425 Zones, estimated at approximately 5,000 gallons per minute (gpm). The recommended pump arrangement is two 800 gpm pumps for providing domestic service to the 362 Zone, two 175 gpm pumps for providing domestic service to the 425 Zone and one 3,000 gpm pump to supplement the fire flow supply to the 425 Zone. An engine generator set for emergency power supply will be included in the improvements. The actual pump capacities and final configuration will be determined during the preliminary design phase of the project.

CIP F2: Increase Water Treatment Plant Capacity (2.16 MG) (if Pilchuck River Source is Maintained)

Deficiency: The water treatment plant is currently capable of operating at a maximum capacity of 1.7 million gallons per day (MGD), 0.46 MGD less than its original design capacity due to the current filters' hydraulic capacity limitation.

Improvement: The necessary improvements were identified by Murray, Smith and Associates (MSA) as part of a 2009 Water Treatment Plant Evaluation. The improvements include structural upgrades to the water treatment plant building, installation of a SCADA system to improve remote control and monitoring, electrical and control upgrades, new stationary fish screens, diversion dam weir and fish ladder modifications, replacement of the water treatment plant influent control valve, modification of the outlet weir of the flocculation tank and installation of filter effluent pumps. This improvement is necessary only if the City desires to maintain the Pilchuck River source as a source of supply.

CIP F3: Water Treatment Plant Transmission Main Replacement (if Pilchuck River Source is Maintained)

Deficiency: The 2009 Water Treatment Plant Evaluation prepared by MSA identified the need to replace the water treatment plant transmission main in approximately 2030, based on the average service life of the pipe materials.

Improvement: Replace approximately 32,800 linear feet (LF) of 18-inch asbestos cement pipe and approximately 43,900 LF of 12-inch permastran pipe with 16-inch ductile iron. Replace the two active PRVs along the transmission main. This improvement is necessary only if the City desires to maintain the Pilchuck River source as a source of supply.

CIP F4: Supply Water System Entirely with Everett Water (if Pilchuck River Source is Abandoned)

Deficiency: The 2009 Water Treatment Plant Evaluation prepared by MSA identified the need to abandon the Pilchuck River diversion dam and decommission the water treatment plant should the City decide to abandon the Pilchuck River source and supply the distribution system entirely with water from Transmission Line No. 5.

Improvement: Install improvements to allow the Snohomish County PUD No. 1 (PUD) to supply the City's existing customers along the water treatment plant transmission main and decommission the Pilchuck River diversion dam, intake, fish ladder and water treatment plant.

CIP F5: Emergency Intertie with PUD

Deficiency: The City desires to have an emergency intertie to supply water to the Water Treatment Plant Transmission Main in the event that the water treatment plant is not operational. This would allow the City to continue to supply the Water Treatment Plant Transmission Main customers in the event of an emergency. The City is currently negotiating a formal intertie agreement with the PUD and expects that an agreement will be reached by the end of 2011. The City will coordinate with the PUD and the Washington State Department of Health (DOH) to ensure all requirements of Washington Administrative Code (WAC) 246-290-132 (4) are satisfied.

Improvement: The PUD will install a 2-inch-diameter emergency intertie in Robe Menzel Road (approximately 675 feet northwest of the intersection of Robe Menzel Road and 29th Place NE) by the fall of 2011. The intertie will include a vault, PRV and meter, and will connect the existing PUD water system to the City's Water Treatment Plant Transmission Main.

CIP F6: Water Treatment Plant Meters

Deficiency: The City does not currently meter the treated water leaving the water treatment plant or the water conveyed to the backwash tank. This improvement is necessary regardless of the City's decision to maintain the Pilchuck River source as a source of supply.

Improvement: Install two below-grade vaults, meters and appurtenances to meter the treated water leaving the water treatment plant and the water conveyed to the backwash tank. Install telemetry equipment at each meter. The City plans to install these meters in 2012, regardless of the decision to maintain or abandon the Pilchuck River source as a source of supply.

CIP F7: Reservoirs No. 1 and No. 2 Altitude Valve and Meter

Deficiency: The City currently manually adjusts a zone valve between the 362 and 218 Zones to supplement the Pilchuck River water supply to Reservoirs No. 1 and No. 2 with water from Transmission Line No. 5.

Improvement: Install an altitude valve, meter, vault and appurtenances to allow water from Transmission Line No. 5 to supplement the Pilchuck River water supply to Reservoirs No. 1 and No. 2. Install telemetry equipment at the proposed meter.

Miscellaneous Improvements

The following miscellaneous improvements are planning efforts and program elements that are required to comply with various water regulations or are improvements that do not fit into one of the previous categories.

CIP M1: Telemetry System Replacement and Upgrade Project

Deficiency: The existing telemetry control panels, controllers and radios are no longer supported by their manufacturers. Additionally, the HMI computer system that monitors the SCADA system will not operate on modern computer systems and the City cannot collect digital historical data.

Improvement: Replace the five existing SCADA electrical and control panels at the Terrace Avenue intertie, both reservoir sites, the water treatment plant and at the City shop. Upgrade an additional control panel at the water treatment plant. Install a new HMI computer system at the City shop for remote operation and monitoring purposes. Remote alarm notification and computer access will be added to the system and RAM-W security rules will be implemented.

CIP M2: In-line Isolation Valve Installation Program

Deficiency: Areas of the water system have in-line isolation valves spaced at distances greater than the City standard of 700 feet.

Improvement: Install approximately five in-line isolation valves a year. This is an on-going program to ensure the distance between in-line isolation valves is no greater than 700 feet.

CIP M3: Storz Hydrant Fitting Installation Program

Deficiency: Many of the older hydrants within the City's water system are not equipped with Storz hydrant fittings which allow firefighters to quickly connect to a hydrant.

Improvement: Install approximately 30 Storz hydrant fittings a year. This is an on-going program to ensure all hydrants within the City's water system have Storz hydrant fittings.

CIP M4: Security System Improvements

Deficiency: The City does not have an adequate security system at the water treatment plant or the two reservoir sites.

Improvement: Install security cameras and intrusion alarms at the water treatment plant and the two reservoir sites.

CIP M5: Reservoir No. 3 Exterior Coating

Deficiency: The exterior of Reservoir No. 3 needs recoating.

Improvement: Recoat the exterior of Reservoir No. 3.

CIP M6: Backwash Tank Interior and Exterior Recoating

Deficiency: The interior and exterior of the backwash tank needs recoating.

Improvement: Recoat the interior and exterior of the backwash tank.

CIP M7: Pine Avenue Hydrant Conversion (10th Street to 13th Street)

Deficiency: The existing 8-inch water main in Pine Avenue is not sufficient to provide adequate fire flow to Emerson Elementary School, located on the east side of Pine Avenue.

Improvement: Verify that the two existing hydrants on Pine Avenue between 10th Street and 13th Street are connected to the 8-inch water main. Disconnect both hydrants from the 8-inch water main and connect them to the existing 16-inch water main in Pine Avenue to provide adequate fire flow at Emerson Elementary School.

CIP M8: Reservoir No. 1 Floating Cover Replacement

Deficiency: Reservoir No. 1's floating cover is in need of replacement.

Improvement: Replace the Reservoir No.1 floating cover.

CIP M9: Water Use Efficiency Program

Deficiency/Requirement: Several water use efficiency measures must be carried out on an ongoing basis to comply with State water use efficiency requirements.

Improvement: The City will continue to implement its water use efficiency measures on an ongoing basis and will implement the Water Loss Control Action Plan included in **Appendix F**.

CIP M10: WSP Update

Deficiency/Requirement: The WAC 246-290-100 requires that the City's WSP be updated every six years and submitted to DOH for approval.

Improvement: Update the WSP every six years to meet the requirements that are in effect at the time of the update.

Developer Funded Improvements

The following water system improvement costs shall be borne by the developers, rather than the existing water customers, unless over-sizing of the improvements provides benefit to the existing customers. Improvements have been identified for the undeveloped areas of the City's existing and expected service area to illustrate the major facilities that will be required to properly serve that area. Additional developer funded projects include localized on-site water main improvements that are not associated with overall water distribution, but would be necessary if the property served by the water main is redeveloped or expanded. The locations of the facilities are shown schematically in **Figures 9-1** and **9-2**.

CIP DF1: Lincoln Avenue Soccer Fields 16-inch Water Main

Deficiency: Development that occurs south of the City limits on Lincoln Avenue will require 16-inch water main to improve reliability and fire flow in the area.

Improvement: Upon further development of the adjacent properties, replace the existing 1-inch polyethylene pipe with 16-inch ductile iron water main.

CIP DF2: Airport Water Main Improvements

Deficiency: Airport/Industrial and agricultural development that occurs near Harvey Airfield and south of the Snohomish River will require 12 and 16-inch water mains to improve fire flow and reliability in the area. The existing water main south of the Snohomish River is not looped.

Improvement: Install new 16-inch water main in Avenue D across the Snohomish River on the Avenue D Bridge, as well as 12 and 16-inch ductile iron water main in Airport Way from Lowell Snohomish River Road to SR 9. Install 12-inch water main in the SR 9 right-of-way from Airport Way to Lowell Snohomish River Road, and in Lowell Snohomish River Road from Airport Way to the last hydrant on Lowell Snohomish River Road.

CIP DF3: Snohomish River Bridge 12-inch Water Main

Deficiency: All water supplied to the area south of the Snohomish River is currently provided by one 10-inch water main on the Avenue D Bridge. Airport/Industrial and agricultural development that occurs near Harvey Airfield and south of the Snohomish River will require an additional connection to the City's water system north of the Snohomish River to improve fire flow and reliability within the system.

Improvement: Install new 12-inch water main on the existing Snohomish River Bridge or the proposed Snohomish River Bridge scheduled to be completed by 2015. The Washington State Department of Transportation is currently completing an environmental documentation study, scheduled to be completed in June 2011, to choose a preferred alternative for a new bridge.

CIP DF4: Pilchuck District Water Main

Deficiency: Future high density residential units and retail development within the City's Pilchuck District will require 8 and 12-inch water main to provide adequate levels of fire flow service to the area.

Improvement: Replace the existing water main throughout the Pilchuck District with 8 and 12-inch water main.

CIP DF5: East of Pilchuck River 12-inch Water Main

Deficiency: Agricultural development that occurs east of the Pilchuck River between 2nd Street and 10th Street will require 12-inch water main to improve reliability and fire flow in the area.

Improvement: Upon further development of the adjacent properties, replace the existing 1, 2 and 4-inch water main with 12-inch water main.

CIP DF6: Orchard Avenue Water Main Improvements

Deficiency: Development that occurs east of the City limits near and along Orchard Avenue will require 12 and 16-inch water main to improve reliability and fire flow in the area.

Improvement: Upon further development of the adjacent properties, replace the existing 1-inch polyethylene and 6-inch ductile and cast iron pipe with new 12 and 16-inch water main.

CIP DF7: 16th Street 362 Zone Extension

Deficiency: The City is currently evaluating plans to acquire a portion of the Cross Valley Water District within the City's City limits and UGA, near 89th Avenue SE, as shown as the overlap area in **Figure 2-3**. Single-family residential and business park development that occurs in this area will require either 8 or 12-inch diameter water mains in order to provide the City's planning-level fire flow requirement to the area. The City desires to provide service to these customers via the 362 Zone.

Improvement: Install new 12-inch water main in 16th Street from the existing 12-inch water main dead end to 89th Avenue SE. Install 8-inch water main in 89th Avenue SE from 16th Street to 77th Street SE, including replacement of existing 2-inch galvanized iron and 6-inch cast iron water main. Close a valve at the intersection of 89th Avenue SE and 77th Street SE to provide separation between the 362 and 218 Zones. The City's existing 218 Zone customers on 89th Avenue SE shall have individual PRVs installed to maintain pressures below 80 psi as a result of being supplied by the 362 Zone.

CIP DF8: Weaver Way Water Main

Deficiency: Single-family residential and business park development that occurs near Weaver Way will require 12-inch water main to provide adequate levels of fire flow service to the area.

Improvement: Install 12-inch water main in 89th Avenue from Weaver Way to 16th Street.

CIP DF9: Bickford Avenue Business Park 12-inch Water Main

Deficiency: Business park development that occurs west of Bickford Avenue at approximately 66th Street SE will be required to install 12-inch water main to loop the existing water main and improve reliability and fire flow in the area.

Improvement: Install 12-inch water main within the business park area located west of Bickford Avenue from approximately 66th Street SE to State Route 9.

CIP DF10: Lakeview Ridge Water Main

Deficiency: A local improvement district proposal has taken place to allow the Lakeview Ridge Water District to be supplied by the City. The Lakeview Ridge Water District customers are currently served by 2 and 4-inch water main.

Improvement: Install 12-inch water main in 20th Street from Bickford Avenue to SR 9, in Lake Avenue from 22nd Street to Lake Place and in Lake Place from Lake Avenue to the Lake Place dead-end.

CIP DF11: West of Bickford Avenue Business Park Loop

Deficiency: Business park development that occurs west of Bickford Avenue between approximately 62nd Place and Weaver Way will be required to install 12 and 16-inch water main to improve reliability and fire flow in the area.

Improvement: Install 12-inch water main west of Bickford Avenue between approximately 62nd Place and Weaver Way, and 16-inch water main at approximately 62nd Place from Bickford Avenue to the proposed 12-inch loop.

CIP DF12: Bickford Avenue and 59th Street 16-inch Water Main

Deficiency: Business park development that occurs west of Bickford Avenue at approximately 59th Street will be required to install 16-inch water main to improve reliability and fire flow in the area.

Improvement: Upon further development of the adjacent properties, replace the existing 8-inch ductile iron pipe with 16-inch water main.

CIP DF13: Snohomish Station 12-inch Water Main

Deficiency: Snohomish Station was constructed within the last three years in a business park area east of Bickford Avenue in the northwest portion of the City limits. Extensive field testing and engineering was performed to ensure fire flows could be provided that were acceptable to Snohomish County Fire District No. 4 (Fire District). Some of the businesses within Snohomish Station have sprinkler systems and individual fire pumps to meet the fire flow requirements of the Fire District.

Improvement: Upon new businesses occupying space or new development occurring within Snohomish Station, replace the existing 8-inch water main with 12-inch water main.

CIP DF14: Lake Avenue Business Park 12-inch Water Main

Deficiency: Business park development that occurs between Lake Avenue (99th Avenue SE) and State Route 9 will be required to install a 12-inch water main loop to provide adequate levels of fire flow service to the area.

Improvement: Install 12-inch water main upon further development of the adjacent properties.

CIP DF15: Park Avenue to King Charley's 12-inch Water Main

Deficiency: The single family residential development that occurs along 56th Street and Park Avenue will require 12-inch water main to provide adequate levels of fire flow service to the area.

Improvement: Install 12-inch water main upon further development of the adjacent properties.

ESTIMATING COSTS OF IMPROVEMENTS

Project costs for the proposed improvements were estimated by the City and RH2 Engineering, Inc. (RH2) based on costs of similar, recently constructed projects in the City and around the Puget Sound area. The cost estimates, which are presented in 2010 dollars, include the estimated construction cost of the improvement and indirect costs for engineering preliminary design, final design, construction management services, permitting, and legal and administrative services. The construction cost estimates also include a contingency and sales tax.

Construction cost estimates for water main projects were determined from the water main unit costs (i.e., cost per foot-length) shown in **Table 9-2** and the proposed diameter and approximate length of each improvement.

Table 9-2
Water Main Unit Costs

Water Main Diameter (inches)	Construction Cost Per Foot Length (2010 $/LF)
8	$130
12	$160
16	$178

The unit costs for each water main size are based on estimates of all construction-related improvements, such as materials and labor for the water main installation, water services, fire hydrants, fittings, valves, connections to the existing system, trench restoration, asphalt surface restoration and other work for a complete installation. The unit costs also include a contingency and sales tax.

PRIORITIZING IMPROVEMENTS

The water system improvements were evaluated against established criteria to schedule projects that will correct the most deficiencies and meet the greatest need for improvement prior to projects correcting fewer deficiencies. A description of the criteria and method for prioritizing each category of improvements are provided below.

Water Main Improvements

Table 9-3 lists criteria that were established for prioritizing the water main improvements. The criteria are based on the underlying deficiencies of the existing water main that will be replaced by the proposed water main improvements. The criteria are arranged in five different categories with a weight factor assigned to each category. The criterion given the most weight is the Existing Water Main Fire Flow Capability and the Existing Water Main Maintenance/Breaks categories.

Table 9-3
Water Main Improvements Priority Ranking Criteria

Points	Category	Weight Factor	Weighted Points
	Existing Water Main Maintenance/Breaks		
3	High Maintenance Requirements/High Frequency of Breaks	4	12
2	Annual Maintenance/Low Frequency of Breaks	4	8
1	No Maintenance and No History of Problems	4	4
	Existing Water Main Fire Flow Capability		
3	Available Fire Flow is 74% or Less of Required Fire Flow	4	12
2	Available Fire Flow is 75-89% of Required Fire Flow	4	8
1	Available Fire Flow is 90-100% or More of Required Fire Flow	4	4
	Existing Water Main Year of Installation		
3	Before 1960	3	9
2	1960 - 1980	3	6
1	After 1980	3	3
	Existing Water Main Material		
3	Asbestos Cement	3	9
2	Galvanized Iron, Steel, or Cast Iron	3	6
1	Ductile Iron or PVC	3	3
	Existing Water Main Benefit Area		
3	Large Benefit Area (i.e. transmission main)	2	6
2	Medium Benefit Area	2	4
1	Small Benefit Area (i.e. localized area)	2	2

The Existing Water Main Maintenance/Breaks category ranks the water main improvements based on the number of reported leaks or breaks that the City currently has on record. The Existing Water Main Fire Flow Capability category ranks the water main improvements based on the ability of the existing water mains to provide the required fire flow, as determined from the results of the hydraulic analyses in **Chapter 7**. The Existing Water Main Year of Installation category ranks the water main improvements based on the age of the existing water mains. The Existing Water Main Material category ranks the water main improvements based on the material of the existing water main. The Existing Water Main Benefit Area category ranks the water main improvements based on the size of the area that will benefit from the replacement.

The water main priority ranking criteria were applied to the annual water main replacement projects, which are grouped under CIP WM1. CIP 1 through 78, as shown in **Figures 9-1** and **9-2**, are presented in **Table 9-4** and sorted by CIP number with their priority ranking. CIP 1 through 78 are presented in **Table 9-5** and sorted by their priority ranking and total points.

Table 9-4
Prioritized Annual Water Main Replacement Projects (Sorted by Number)

No.	Priority[1]		Estimated	Size		Description		
	Rank	Points	Cost	Length (ft)	Diam (in)	In	From	To
1	L	25	$57,000	325	8	1st St	Lincoln Ave	Pine Ave
2	M	29	$243,000	1,382	8	Pine Ave	Wood St	Center St
			$65,000	368	8	Center St	Lincoln Ave	Pine Ave
3	M	30	$152,000	862	8	Lincoln Ave	Grove St	Center St
4	H	33	$75,000	426	8	Alder Ave	1st St	Lincoln Ave
			$53,000	300	8	Pearl St	Willow Ave	Alder Ave
5	M	30	$471,000	2,180	12	Pilchuck Park Rd	Cypess Ave	Pine Ave
6	H	41	$83,000	469	8	Willow Ave	Pearl St	Lincoln Ave
7	H	33	$122,000	616	8	Pearl St	Willow Ave	Maple Ave
8	H	33	$80,000	371	12	Maple Ave	1st St	Maple Ave
			$101,000	467	12	Maple Ave	Maple Ave	Cedar Ave
			$35,000	160	12	Cedar Ave	Maple Ave	1st St
9	H	35	$110,000	624	8	Maple Ave	1st St	Rainier Street
10	M	26	$56,000	195	12	Bowen St	Maple Ave	State Ave
11	M	29	$353,000	1,632	12	2nd St	Union Ave	Pine Ave
12	M	27	$41,000	189	12	Maple Ave	2nd St	Bowen St
13	H	35	$37,000	171	12	Cedar Ave	Rainier Street	2nd St
14	H	43	$47,000	266	8	Cedar Ave	1st St	Pearl St
			$94,000	434	12	Cedar Ave	Pearl St	Rainier Street
15	M	26	$38,000	213	8	Glen Ave	Pearl St	Union Ave
16	M	27	$125,000	576	12	Union Ave	1st St	2nd St
17	M	27	$291,000	1,652	8	Avenue A	2nd St	5th St
18	M	27	$96,000	543	8	Avenue A	1st St	2nd St
19	M	29	$766,000	3,482	12	1st St	Lincoln Ave	Avenue E
20	H	33	$53,000	243	12	Avenue A	1st St	Avenue A Dead End
21	M	27	$96,000	546	8	Avenue B	1st St	2nd St
22	M	27	$101,000	571	8	Avenue C	1st St	2nd St
23	H	31	$39,000	180	12	Avenue C	1st St	Walking Path
24	M	27	$290,000	1,649	8	Avenue D	1st St	4th St
25	M	27	$288,000	1,638	8	Avenue E	2nd St	5th St
26	L	18	$311,000	1,767	8	2nd St	Avenue E	Avenue J
27	L	24	$14,000	66	12	Avenue G	1st St	2nd St
28	M	27	$287,000	1,630	8	Avenue G	2nd St	5th St
29	M	26	$359,000	1,663	12	1st St	Avenue E	Avenue I
30	H	35	$276,000	1,567	8	Avenue H	2nd St	5th St
31	M	27	$255,000	1,448	8	Avenue I	2nd St	5th St
32	H	35	$131,000	746	8	Avenue J	2nd St	4th St
33	H	33	$49,000	281	8	4th St	Avenue J	Riverview Ln
34	M	27	$290,000	1,649	8	Avenue F	2nd St	5th St
35	L	25	$93,000	526	8	Avenue D	4th St	5th St
36	M	27	$286,000	1,624	8	Avenue B	2nd St	5th St
37	H	33	$244,000	1,129	12	Union Ave	2nd St	Glen Ave (Cent. Elem)
			$23,000	108	12	Glen Ave (Cent. Elem)	Glen Ave (Cent. Elem)	~3rd St
			$119,000	550	12	Glen Ave	4th St	Cent. Elem
38	M	29	$292,000	1,659	8	5th St	Maple Ave	Avenue B
39	L	25	$99,000	561	8	Glen Ave	4th St	5th St
40	L	25	$152,000	863	8	Union Ave	~3rd St	5th St
41	M	26	$444,000	2,055	12	Freshman Campus Loop	~6th St	~7th St
			$30,000	124	16	Maple Ave Driveway	Freshman Campus Loop	Maple Ave
42	L	22	$70,000	326	12	6th St	Avenue D	Avenue C
			$113,000	641	8	6th St	Avenue C	Avenue A
43	M	30	$68,000	316	12	5th St	Avenue F	Avenue G
44	L	22	$51,000	291	8	5th St	Avenue I	Avenue J

(1) Priority: H = High, M = Medium, L = Low

Table 9-4
Prioritized Annual Water Main Replacement Projects (Sorted by Number)
(Continued)

No.	Priority[1] Rank	Priority[1] Points	Estimated Cost	Size Length (ft)	Size Diam (in)	Description In	Description From	Description To
45	L	25	$267,000	1,518	8	Avenue J	4th St	7th St
46	H	33	$77,000	435	8	Avenue K	7th St	8th St
47	L	20	$101,000	469	12	~ Eigth St	Avenue D	Avenue C E
48	L	22	$50,000	282	8	7th St	Avenue A	Avenue B
			$105,000	594	8	Avenue B	6th St	7th St
49	L	25	$134,000	761	8	Root Ave	9th St	Root Ave Dead End
			$88,000	500	8	Holiday St	Root Ave	Lincoln Ave
			$166,000	945	8	Lincoln Ave	Holiday St	Maple Ave
50	H	31	$49,000	226	12	6th St	Pine Ave	~Mill Ave
51	M	29	$44,000	248	8	Pine Ave	6th St	Garden Ct
52	M	29	$134,000	759	8	7th St	Pine Ave	Mill Ave
53	M	27	$162,000	748	12	Pine Ave	Maple Ave	9th St
54	L	25	$51,000	288	8	Long St	Mill Ave	~Pilchuck Ave
55	L	20	$93,000	528	8	Pilchuck Ave	Long St	10th St
			$59,000	336	8	Short St	Pilchuck Ave	Mill Ave
56	L	25	$83,000	472	8	10th St	Pilchuck Ave	Bluff Ave Dead End
57	L	22	$44,000	249	8	10th St	Maple Ave	Harrison Ave
			$110,000	623	8	Harrison Ave	9th St	10th St
			$35,000	200	8	Cleveland Ave	Cul-de-Sac	10th St
			$44,000	250	8	10th St	Cleveland Ave	Harrison Ave
58	H	33	$83,000	469	8	Emerson St	Pine Ave	Emerson St Cul-de-Sac
59	H	38	$54,000	308	8	Root Ave	10th St	VanJan St
60	M	26	$88,000	406	12	Ryan Ct	Avenue A	Ryan Ct Cul-de-Sac
61	M	30	$59,000	247	16	Avenue D	10th St	10th & Ave D PRV
62	L	24	$151,000	855	8	77th Pl	90th Ave	91st Ave
63	H	34	$420,000	1,944	12	Bonneville Ave	Avenue D	14th St
			$301,000	1,392	12	Industrial Loop	Bonneville Ave	Bonneville Ave
			$119,000	550	12	15th St	Bickford Ave	Bonneville Ave
64	M	28	$248,000	1,148	12	Avenue D	13th St	10th St
65	L	20	$316,000	1,461	12	Safeway Commercial Loop	Avenue D	Avenue D
66	M	30	$68,000	384	8	Hillcrest Dr	Summit St	Summit St Cul-de-Sac
67	H	34	$49,000	279	8	Park Ave	13th St	Pulliam Pl
			$64,000	364	8	Park Ave	18th Pl	17th Pl
			$121,000	561	12	Park Ave	17th Pl	~16th St
			$64,000	295	12	17th Pl	17th Ct	Pine Ave
68	L	24	$397,000	1,835	12	Top Foods Commercial	Ferguson Park Rd	13th St
69	M	30	$64,000	364	8	Suncrest Dr	14th St	15th St
70	H	35	$111,000	632	8	15th St	Pine Ave	Park Ave
71	M	26	$44,000	251	8	16th St	Terrace Ave	Holly Vista Dr
72	H	34	$278,000	1,288	12	Pine Ave	15th St	17th Pl
73	M	26	$206,000	951	12	Oak Ave	Ferguson Park Rd	Lake Mount Dr
74	M	27	$213,000	1,212	8	Lake Mount Dr	Ferguson Park Rd	~99th Ave
			$138,000	786	8	Ferguson Park Rd	Lake Mount Dr	W. Side Ferguson Park
			$12,000	56	12	Ferguson Park Rd	~Ave D	W. Side Ferguson Park
75	M	26	$104,000	480	12	Terrace Ave	Terrace Intertie	Stone Ridge Dr
			$120,000	556	12	Stone Ridge Dr	Terrace Ave	Easement
			$28,000	129	12	Easement	Stone Ridge Dr	Delta Rehab Center
76	L	20	$20,000	113	8	22nd St	Park Ave	Cul-de-Sac Entrance
77	L	20	$143,000	663	12	Weaver Way	Washington Ave	Weaver Way Cul-de-Sac
78	L	20	$79,000	365	12	23rd St	Washington Ave	23rd St Cul-de-Sac
Total			**$14,572,000**					

(1) Priority: H = High, M = Medium, L = Low

Table 9-5
Prioritized Annual Water Main Replacement Projects (Sorted by Priority)

No.	Priority[1] Rank	Priority[1] Points	Estimated Cost	Size Length (ft)	Size Diam (in)	Description In	Description From	Description To
14	H	43	$47,000	266	8	Cedar Ave	1st St	Pearl St
			$94,000	434	12	Cedar Ave	Pearl St	Rainier Street
6	H	41	$83,000	469	8	Willow Ave	Pearl St	Lincoln Ave
59	H	38	$54,000	308	8	Root Ave	10th St	VanJan St
9	H	35	$110,000	624	8	Maple Ave	1st St	Rainier Street
13	H	35	$37,000	171	12	Cedar Ave	Rainier Street	2nd St
30	H	35	$276,000	1,567	8	Avenue H	2nd St	5th St
32	H	35	$131,000	746	8	Avenue J	2nd St	4th St
70	H	35	$111,000	632	8	15th St	Pine Ave	Park Ave
63	H	34	$420,000	1,944	12	Bonneville Ave	Avenue D	14th St
			$301,000	1,392	12	Industrial Loop	Bonneville Ave	Bonneville Ave
			$119,000	550	12	15th St	Bickford Ave	Bonneville Ave
67	H	34	$49,000	279	8	Park Ave	13th St	Pulliam Pl
			$64,000	364	8	Park Ave	18th Pl	17th Pl
			$121,000	561	12	Park Ave	17th Pl	~16th St
			$64,000	295	12	17th Pl	17th Ct	Pine Ave
72	H	34	$278,000	1,288	12	Pine Ave	15th St	17th Pl
4	H	33	$75,000	426	8	Alder Ave	1st St	Lincoln Ave
			$53,000	300	8	Pearl St	Willow Ave	Alder Ave
7	H	33	$122,000	616	8	Pearl St	Willow Ave	Maple Ave
8	H	33	$80,000	371	12	Maple Ave	1st St	Maple Ave
			$101,000	467	12	Maple Ave	Maple Ave	Cedar Ave
			$35,000	160	12	Cedar Ave	Maple Ave	1st St
20	H	33	$53,000	243	12	Avenue A	1st St	Avenue A Dead End
33	H	33	$49,000	281	8	4th St	Avenue J	Riverview Ln
37	H	33	$244,000	1,129	12	Union Ave	2nd St	Glen Ave (Cent. Elem)
			$23,000	108	12	Glen Ave (Cent. Elem)	Glen Ave (Cent. Elem)	~3rd St
			$119,000	550	12	Glen Ave	4th St	Cent. Elem
46	H	33	$77,000	435	8	Avenue K	7th St	8th St
58	H	33	$83,000	469	8	Emerson St	Pine Ave	Emerson St Cul-de-Sac
23	H	31	$39,000	180	12	Avenue C	1st St	Walking Path
50	H	31	$49,000	226	12	6th St	Pine Ave	~Mill Ave
3	M	30	$152,000	862	8	Lincoln Ave	Grove St	Center St
5	M	30	$471,000	2,180	12	Pilchuck Park Rd	Cypess Ave	Pine Ave
43	M	30	$68,000	316	12	5th St	Avenue F	Avenue G
61	M	30	$59,000	247	16	Avenue D	10th St	10th & Ave D PRV
66	M	30	$68,000	384	8	Hillcrest Dr	Summit St	Summit St Cul-de-Sac
69	M	30	$64,000	364	8	Suncrest Dr	14th St	15th St
2	M	29	$243,000	1,382	8	Pine Ave	Wood St	Center St
			$65,000	368	8	Center St	Lincoln Ave	Pine Ave
11	M	29	$353,000	1,632	12	2nd St	Union Ave	Pine Ave
19	M	29	$766,000	3,482	12	1st St	Lincoln Ave	Avenue E
38	M	29	$292,000	1,659	8	5th St	Maple Ave	Avenue B
51	M	29	$44,000	248	8	Pine Ave	6th St	Garden Ct
52	M	29	$134,000	759	8	7th St	Pine Ave	Mill Ave
64	M	28	$248,000	1,148	12	Avenue D	13th St	10th St
12	M	27	$41,000	189	12	Maple Ave	2nd St	Bowen St
16	M	27	$125,000	576	12	Union Ave	1st St	2nd St
17	M	27	$291,000	1,652	8	Avenue A	2nd St	5th St
18	M	27	$96,000	543	8	Avenue A	1st St	2nd St
21	M	27	$96,000	546	8	Avenue B	1st St	2nd St
22	M	27	$101,000	571	8	Avenue C	1st St	2nd St
24	M	27	$290,000	1,649	8	Avenue D	1st St	4th St
25	M	27	$288,000	1,638	8	Avenue E	2nd St	5th St
28	M	27	$287,000	1,630	8	Avenue G	2nd St	5th St
31	M	27	$255,000	1,448	8	Avenue I	2nd St	5th St
34	M	27	$290,000	1,649	8	Avenue F	2nd St	5th St
36	M	27	$286,000	1,624	8	Avenue B	2nd St	5th St
53	M	27	$162,000	748	12	Pine Ave	Maple Ave	9th St
74	M	27	$213,000	1,212	8	Lake Mount Dr	Ferguson Park Rd	~99th Ave
			$138,000	786	8	Ferguson Park Rd	Lake Mount Dr	W. Side Ferguson Park
			$12,000	56	12	Ferguson Park Rd	~Ave D	W. Side Ferguson Park

(1) Priority: H = High, M = Medium, L = Low

Table 9-5
Prioritized Annual Water Main Replacement Projects (Sorted by Priority)
(Continued)

No.	Priority[1] Rank	Priority[1] Points	Estimated Cost	Size Length (ft)	Size Diam (in)	Description In	Description From	Description To
10	M	26	$56,000	195	12	Bowen St	Maple Ave	State Ave
15	M	26	$38,000	213	8	Glen Ave	Pearl St	Union Ave
29	M	26	$359,000	1,663	12	1st St	Avenue E	Avenue I
41	M	26	$444,000	2,055	12	Freshman Campus Loop	~6th St	~7th St
			$30,000	124	16	Maple Ave Driveway	Freshman Campus Loop	Maple Ave
60	M	26	$88,000	406	12	Ryan Ct	Avenue A	Ryan Ct Cul-de-Sac
71	M	26	$44,000	251	8	16th St	Terrace Ave	Holly Vista Dr
73	M	26	$206,000	951	12	Oak Ave	Ferguson Park Rd	Lake Mount Dr
75	M	26	$104,000	480	12	Terrace Ave	Terrace Intertie	Stone Ridge Dr
			$120,000	556	12	Stone Ridge Dr	Terrace Ave	Easement
			$28,000	129	12	Easement	Stone Ridge Dr	Delta Rehab Center
1	L	25	$57,000	325	8	1st St	Lincoln Ave	Pine Ave
35	L	25	$93,000	526	8	Avenue D	4th St	5th St
39	L	25	$99,000	561	8	Glen Ave	4th St	5th St
40	L	25	$152,000	863	8	Union Ave	~3rd St	5th St
45	L	25	$267,000	1,518	8	Avenue J	4th St	7th St
49	L	25	$134,000	761	8	Root Ave	9th St	Root Ave Dead End
			$88,000	500	8	Holiday St	Root Ave	Lincoln Ave
			$166,000	945	8	Lincoln Ave	Holiday St	Maple Ave
54	L	25	$51,000	288	8	Long St	Mill Ave	~Pilchuck Ave
56	L	25	$83,000	472	8	10th St	Pilchuck Ave	Bluff Ave Dead End
27	L	24	$14,000	66	12	Avenue G	1st St	2nd St
62	L	24	$151,000	855	8	77th Pl	90th Ave	91st Ave
68	L	24	$397,000	1,835	12	Top Foods Commercial	Ferguson Park Rd	13th St
42	L	22	$70,000	326	12	6th St	Avenue D	Avenue C
			$113,000	641	8	6th St	Avenue C	Avenue A
44	L	22	$51,000	291	8	5th St	Avenue I	Avenue J
48	L	22	$50,000	282	8	7th St	Avenue A	Avenue B
			$105,000	594	8	Avenue B	6th St	7th St
57	L	22	$44,000	249	8	10th St	Maple Ave	Harrison Ave
			$110,000	623	8	Harrison Ave	9th St	10th St
			$35,000	200	8	Cleveland Ave	Cul-de-Sac	10th St
			$44,000	250	8	10th St	Cleveland Ave	Harrison Ave
47	L	20	$101,000	469	12	~ Eigth St	Avenue D	Avenue C E
55	L	20	$93,000	528	8	Pilchuck Ave	Long St	10th St
			$59,000	336	8	Short St	Pilchuck Ave	Mill Ave
65	L	20	$316,000	1,461	12	Safeway Commercial Loop	Avenue D	Avenue D
76	L	20	$20,000	113	8	22nd St	Park Ave	Cul-de-Sac Entrance
77	L	20	$143,000	663	12	Weaver Way	Washington Ave	Weaver Way Cul-de-Sac
78	L	20	$79,000	365	12	23rd St	Washington Ave	23rd St Cul-de-Sac
26	L	18	$311,000	1,767	8	2nd St	Avenue E	Avenue J
Total			***$14,572,000***					

(1) Priority: H = High, M = Medium, L = Low

Other Improvements

The additional pressure zone, pressure reducing station and facility improvements were prioritized based on existing deficiencies, safety concerns, maintenance requirements and capacity requirements. The miscellaneous improvements were prioritized based on regulatory requirements and assessment of the water system needs. The priority order of these improvements is reflected in the schedule of improvements, which is presented in the next section.

SCHEDULE OF IMPROVEMENTS

The results of prioritizing the improvements were used to assist in establishing an implementation schedule that can be used by the City for preparing its six-year CIP and yearly Water Department

budget. The implementation schedule for the proposed improvements should the City decide to maintain the Pilchuck River source, is shown in **Table 9-6**. The implementation schedule for the proposed improvements without the Pilchuck River source is shown in **Table 9-7**. In both cases, an allowance of $0 for the first year, $200,000 for the second year, $300,000 for the third year, $350,000 for the fourth year, $400,000 for the fifth year and $450,000 for the sixth year has been established for the annual replacement of the water mains. The City will identify and schedule the replacement of water mains to be funded by the annual water main replacement program during the annual budget process. This provides the City with the flexibility to coordinate these projects with road or other projects within the same area. The developer funded improvement projects and their associated cost estimates are shown near the bottom of the table. However, the implementation dates for these improvements are not shown, due to the uncertainty of the timing of the future developments that will be responsible for these improvements.

Table 9-6
Proposed Improvements Implementation Schedule with Pilchuck River Source

CIP No.	Description	Estimated Cost (2010 $$)	20-Year Schedule of Improvements Planned Year of Project and Estimated Cost in 2010 $$ 2011	2012	2013	2014	2015	2016	2017-2022	2023-2030
	Water Main Improvements									
WM1	Annual Water Main Replacement Program	$14,572,000	$0K	$200K	$300K	$350K	$400K	$450K	$1,861K	$11,011K
WM2	CSO Water Main Improvements (Constructed in 2010)	$0								
WM3	State Route 9 Crossing 12-inch Water Main	$210,000							$210K	
	Pressure Zone Improvements									
PZ1	Conversion of 384, 438 and 450 Zones to 362 Zone	$90,000				$90K				
	Pressure Reducing Station Improvements									
PRV1	10th Street and Avenue D Pressure Setting Adjustment	$3,000				$3K				
	Facility Improvements[1]									
F1	362/425 Zone Booster Pump Station	$1,567,000			$313K	$1,254K				
F2	Increase Water Treatment Plant Capacity (2.16 MG)	$3,277,000							$3,277K	
F3	Water Treatment Plant Transmission Main Replacement	$18,000,000								$18,000K
F4	Not Applicable - Supply Water System Entirely with Everett Water	$0								
F5	Emergency Intertie with PUD	$120,000	$120K							
F6	Water Treatment Plant Meters	$60,000		$60K						
F7	Reservoirs No. 1 and No. 2 Altitude Valve and Meter	$75,000		$75K						
	Miscellaneous Improvements									
M1	Telemetry System Replacement and Upgrade Project	$220,000	$220K							
M2	In-line Isolation Valve Installation Program	$200,000		$50K	$50K	$50K	$50K			
M3	Storz Hydrant Fitting Installation Program	$60,000		$5K	$5K	$5K	$5K	$5K	$35K	
M4	Security System Improvements	$50,000		$15K	$35K					
M5	Reservoir No. 3 Exterior Recoating	$325,000	$325K							
M6	Backwash Tank Interior and Exerior Recoating	$207,000		$207K						
M7	Pine Avenue Hydrant Conversion (10th Street to 13th Street)	$50,000				$50K				
M8	Reservoir No. 1 Floating Cover Replacement	$200,000		$200K						
M9	Water Use Efficiency Program	$66,500		$3.5K	$3.5K	$3.5K	$3.5K	$3.5K	$21K	$28K
M10	Comprehensive Water System Plan Update	$360,000					$120K		$120K	$120K
	Total Estimated Costs of City Funded Improvements	***$39,712,500***	***$665K***	***$816K***	***$707K***	***$1,805K***	***$579K***	***$459K***	***$5,524K***	***$29,159K***
	Developer Funded Improvements									
DF1	Lincoln Avenue Soccer Fields 16-inch Water Main	$248,000	Timing of Project Based on Timing of Future Developments							
DF2	Airport Water Main Improvements	$3,519,000	Timing of Project Based on Timing of Future Developments							
DF3	Snohomish River Bridge 12-inch Water Main	$101,000	Timing of Project Based on Timing of Future Developments							
DF4	Pilchuck District Water Main	$2,466,000	Timing of Project Based on Timing of Future Developments							
DF5	East of Pilchuck River 12-inch Water Main	$2,573,000	Timing of Project Based on Timing of Future Developments							
DF6	Orchard Avenue Water Main Improvements	$933,000	Timing of Project Based on Timing of Future Developments							
DF7	16th Street 362 Zone Extension	$587,000	Timing of Project Based on Timing of Future Developments							
DF8	Weaver Way Water Main	$825,000	Timing of Project Based on Timing of Future Developments							
DF9	Bickford Avenue Business Park 12-inch Water Main	$352,000	Timing of Project Based on Timing of Future Developments							
DF10	Lakeview Ridge Water Main	$489,000	Timing of Project Based on Timing of Future Developments							
DF11	West of Bickford Avenue Business Park Loop	$283,000	Timing of Project Based on Timing of Future Developments							
DF12	Bickford Avenue and 59th Street 16-inch Water Main	$497,000	Timing of Project Based on Timing of Future Developments							
DF13	Snohomish Station 12-inch Water Main	$1,096,000	Timing of Project Based on Timing of Future Developments							
DF14	Lake Avenue Business Park 12-inch Water Main	$326,000	Timing of Project Based on Timing of Future Developments							
DF15	Park Avenue to King Charley's 12-inch Water Main	$892,000	Timing of Project Based on Timing of Future Developments							
	Total Estimated Costs of Developer Funded Improvements	***$15,187,000***								

(1) Cost estimates for CIP F2, F3 and F4 were prepared in a 2009 Water Treatment Plant and Water Supply Study by Murray, Smith & Associates and are presented in 2008 dollars.

Table 9-7
Proposed Improvements Implementation Schedule without Pilchuck River Source

CIP No.	Description	Estimated Cost (2010 $$)	20-Year Schedule of Improvements Planned Year of Project and Estimated Cost in 2010 $$ 2011	2012	2013	2014	2015	2016	2017-2022	2023-2030
	Water Main Improvements									
WM1	Annual Water Main Replacement Program	$14,572,000	$0K	$200K	$300K	$350K	$400K	$450K	$1,861K	$11,011K
WM2	CSO Water Main Improvements (Constructed in 2010)	$0								
WM3	State Route 9 Crossing 12-inch Water Main	$210,000							$210K	
	Pressure Zone Improvements									
PZ1	Conversion of 384, 438 and 450 Zones to 362 Zone	$90,000				$90K				
	Pressure Reducing Station Improvements									
PRV1	10th Street and Avenue D Pressure Setting Adjustment	$3,000				$3K				
	Facility Improvements[1, 2]									
F1	362/425 Zone Booster Pump Station	$1,567,000			$313K	$1,254K				
F2	Not Applicable - Increase Water Treatment Plant Capacity (2.16 MG)	$0								
F3	Not Applicable - Water Treatment Plant Transmission Main Replacement	$0								
F4	Supply Water System Entirely with Everett Water	$1,560,000				$1,560K				
F5	Emergency Intertie with PUD	$120,000	$120K							
F6	Water Treatment Plant Meters	$60,000		$60K						
F7	Reservoirs No. 1 and No. 2 Altitude Valve and Meter	$75,000		$75K						
	Miscellaneous Improvements									
M1	Telemetry System Replacement and Upgrade Project	$220,000	$220K							
M2	In-line Isolation Valve Installation Program	$200,000		$50K	$50K	$50K	$50K			
M3	Storz Hydrant Fitting Installation Program	$60,000		$5K	$5K	$5K	$5K	$5K	$35K	
M4	Security System Improvements	$50,000		$15K	$35K					
M5	Reservoir No. 3 Exterior Recoating	$325,000	$325K							
M6	Backwash Tank Interior and Exerior Recoating	$207,000		$207K						
M7	Pine Avenue Hydrant Conversion (10th Street to 13th Street)	$50,000				$50K				
M8	Reservoir No. 1 Floating Cover Replacement	$200,000		$200K						
M9	Water Use Efficiency Program	$66,500		$3.5K	$3.5K	$3.5K	$3.5K	$3.5K	$21K	$28K
M10	Comprehensive Water System Plan Update	$360,000					$120K		$120K	$120K
	Total Estimated Costs of City Funded Improvements	***$19,995,500***	***$665K***	***$816K***	***$707K***	***$3,365K***	***$579K***	***$459K***	***$2,247K***	***$11,159K***
	Developer Funded Improvements									
DF1	Lincoln Avenue Soccer Fields 16-inch Water Main	$248,000	Timing of Project Based on Timing of Future Developments							
DF2	Airport Water Main Improvements	$3,519,000	Timing of Project Based on Timing of Future Developments							
DF3	Snohomish River Bridge 12-inch Water Main	$101,000	Timing of Project Based on Timing of Future Developments							
DF4	Pilchuck District Water Main	$2,466,000	Timing of Project Based on Timing of Future Developments							
DF5	East of Pilchuck River 12-inch Water Main	$2,573,000	Timing of Project Based on Timing of Future Developments							
DF6	Orchard Avenue Water Main Improvements	$933,000	Timing of Project Based on Timing of Future Developments							
DF7	16th Street 362 Zone Extension	$587,000	Timing of Project Based on Timing of Future Developments							
DF8	Weaver Way Water Main	$825,000	Timing of Project Based on Timing of Future Developments							
DF9	Bickford Avenue Business Park 12-inch Water Main	$352,000	Timing of Project Based on Timing of Future Developments							
DF10	Lakeview Ridge Water Main	$489,000	Timing of Project Based on Timing of Future Developments							
DF11	West of Bickford Avenue Business Park Loop	$283,000	Timing of Project Based on Timing of Future Developments							
DF12	Bickford Avenue and 59th Street 16-inch Water Main	$497,000	Timing of Project Based on Timing of Future Developments							
DF13	Snohomish Station 12-inch Water Main	$1,096,000	Timing of Project Based on Timing of Future Developments							
DF14	Lake Avenue Business Park 12-inch Water Main	$326,000	Timing of Project Based on Timing of Future Developments							
DF15	Park Avenue to King Charley's 12-inch Water Main	$892,000	Timing of Project Based on Timing of Future Developments							
	Total Estimated Costs of Developer Funded Improvements	***$15,187,000***								

(1) Cost estimates for CIP F2, F3 and F4 were prepared in a 2009 Water Treatment Plant and Water Supply Study by Murray, Smith & Associates and are presented in 2008 dollars.

(2) CIP F9 was originally included with F4 in the 2009 Water Treatment Plant and Water Supply Study by Murray, Smith & Associates but has been separated as part of this CIP because the City desires to implement this improvement whether or not the entire system is to be supplied with Everett water.

Future Project Cost Adjustments

All cost estimates shown in the tables are presented in 2010 dollars. These cost estimates will need to be adjusted to account for the effects of inflation and changing construction market conditions to determine future costs at the actual time of project implementation. Future costs can be estimated using the Engineering News Record (ENR) Construction Cost Index for the Seattle area or by applying an estimated rate of inflation that reflects the current and anticipated future market conditions.

Financial Plan

10

INTRODUCTION

This chapter was prepared by FCS Group to provide a financial program that allows the water utility to remain financially viable during the next 6-year planning period and beyond, and provide stable revenue for execution of the capital improvement program (CIP) identified in this water system plan (WSP). This viability analysis considers the historical financial condition of the utility, the sufficiency of utility revenues to meet current and future financial and policy obligations, the need to provide sufficient revenue to meet operation and maintenance needs and the utility's ability to support the financial impact related to the completion of the identified projects in the CIP. Furthermore, this chapter provides a review of the utility's current rate structure with respect to rate adequacy, equity, promotion of water conservation and customer affordability. The City is considering plans to abandon the Pilchuck River diversion dam, decommission the water treatment plant and supply the distribution system entirely with water from Transmission Line No. 5. For the purposes of this analysis, the future projections include the City's source capacity with the Pilchuck River source. Consistent with Washington Administrative Code (WAC) 246-290-100 requirements, potential rate structure refinements that encourage water demand efficiency are identified. **Appendix O** presents backup documentation related to this financial plan.

PAST FINANCIAL PERFORMANCE

This section includes a historical summary of financial performance as reported by the City of Snohomish (City) on the fund resources and uses arising from cash transactions specific to the water utility.

Comparative Financial Statement

The City's enterprise funds operate on a cash basis; therefore, annual balance sheets and income statements are not prepared. **Table 10-1** summarizes the available level of financial detail for the previous 6 years (2005 through 2010). Noteworthy findings and trends are highlighted to demonstrate the historical performance and condition of the utility.

Table 10-1
Summary of Historical Fund Resources and Uses Arising from Cash Transactions

Water Fund 401	2005	2006	2007	2008	2009	2010
Beginning Net Cash and Investment	**$ 94,503**	**$ 104,991**	**$ 99,673**	**$ 131,470**	**$ 374,378**	**$ 635,056**
Revenues and Other Sources						
Licenses and Permits	$ 3,210	$ 3,960	$ 4,410	$ 6,760	$ 3,600	$ 3,210
Intergovernmental	-	-	43,601	2,231	8,536	11,324
Charges for Goods and Services	1,407,383	1,503,992	1,587,366	1,823,899	2,019,041	1,983,071
Miscellaneous	39,992	45,553	35,652	33,316	33,753	45,935
Other Financial Sources	-	(11,245)	-	-	-	-
Total Revenue and Other Sources	**$ 1,450,585**	**$ 1,542,260**	**$ 1,671,029**	**$ 1,866,206**	**$ 2,064,930**	**$ 2,043,540**
Total Resources	**$ 1,545,088**	**$ 1,647,251**	**$ 1,770,702**	**$ 1,997,676**	**$ 2,439,308**	**$ 2,678,596**
Total Operating Expenditures	**$ 1,111,977**	**$ 1,369,043**	**$ 1,247,465**	**$ 1,372,660**	**$ 1,605,293**	**$ 1,583,945**
Debt Service	219,685	178,535	218,522	221,028	187,070	76,350
Capital Outlay	-	-	-	4,611	6,437	-
Total Expenditures	**$ 1,331,662**	**$ 1,547,578**	**$ 1,465,987**	**$ 1,598,299**	**$ 1,798,800**	**$ 1,660,295**
Other Financial Uses	108,435	-	173,244	25,000	-	125,000
Total Expenditures and Other Uses	**$ 1,440,097**	**$ 1,547,578**	**$ 1,639,231**	**$ 1,623,299**	**$ 1,798,800**	**$ 1,785,295**
Excess (Deficit) of Resources Over Uses	**$ 104,991**	**$ 99,673**	**$ 131,471**	**$ 374,377**	**$ 640,508**	**$ 893,301**
Nonrevenues	-	-	-	-	-	-
Nonexpenditures	-	-	-	-	(5,452)	-
Ending Net Cash and Investments	**$ 104,991**	**$ 99,673**	**$ 131,471**	**$ 374,377**	**$ 635,056**	**$ 893,301**

Notes:
Includes minor rounding.
2010 figures are estimated.

Findings and Trends

Through a combination of rate increases and customer growth rate, rate revenues have been increasing every year, with the exception of 2009 to 2010.

Total expenses have increased every year, with the exception of 2008 caused by reduction of other financial uses, and 2010 due to reduction in debt service.

Overall, with the exception of 2005, total revenues have exceeded total expenses raising ending fund balances from year to year.

The operations and maintenance (O&M) coverage ratio (service revenues divided by operating expenses) remained above 100 percent, ranging from 126.6 percent in 2005 to 125.2 percent in 2010. A ratio below 100 percent leaves little capacity for capital.

The operating ratio (total operating expenses divided by total operating revenues) remained below 90 percent every year except 2006, when the ratio was 100.34 percent. A ratio greater than 90 percent indicates there is little room for new debt service and capital replacement without additional rate increases. A ratio greater than 100 percent indicates that operating expenses exceed operating revenues and is indicative of an unsustainable financial condition.

CURRENT FINANCIAL STRUCTURE

This section summarizes the current financial structure used as the baseline for the capital financing strategy and financial forecast developed for this WSP.

Financial Plan

The City's water utility is responsible for funding all of its related costs through user fees. It does not depend on general tax revenues or general fund resources. The primary source of funding for the water utility is derived from ongoing charges every other month for service, with additional revenues coming from miscellaneous fees, licenses and permits, and intergovernmental transfers. The City controls the level of user charges by ordinance, and subject to statutory authority, can adjust user charges as needed to meet financial objectives.

The financial plan can only provide a qualified assurance of financial feasibility if it considers the total system costs of providing water services, both operating and capital. To meet these objectives, the following elements have been completed.

1. **Capital Funding Plan**: Identifies the total CIP obligations of the planning period. The plan defines a strategy for funding the CIP, including an analysis of available resources from rate revenues, existing reserves, connection and capital facility fees, debt financing, and any special resources that may be readily available (e.g., grants, developer contributions, etc.). The capital funding plan impacts the financial plan through the use of debt financing (resulting in annual debt service) and the assumed rate revenue resources available for capital funding.
2. **Financial Forecast**: Identifies future annual non-capital costs associated with the operating, maintenance and administration of the water system. Included in the financial plan is a reserve analysis that forecasts cash flow and fund balance activity along with testing for satisfaction of actual or recommended minimum fund balance policies. The financial plan ultimately evaluates the sufficiency of utility revenues in meeting all obligations, including cash uses such as operating expenses, debt service, capital outlays, and reserve contributions, as well as any coverage requirements associated with long-term debt, and identifies the future adjustments required to fully fund all utility obligations in the projection period.

Capital Funding Plan

The CIP developed for this WSP identifies $5.03 million in project costs over the 6-year planning period and $39.71 million in the 20-year planning period (total costs do not include developer donated capital). This CIP consists of supply, replacement, and extension projects. Costs are stated in 2010 dollars and are escalated by 4.0 percent annually to the year of planned spending for financing projections.

A summary of the 20-year CIP is shown in **Table 10-2**. As shown, each year has varied capital cost obligations depending on construction schedules and infrastructure planning needs. Approximately 13.0 percent (2010 dollars) of the capital costs are included in the 6-year planning period. The Water Main Replacement Program and the 362/425 Zone Booster Pump Station account for 65.0 percent of the 6-year CIP. **Table 10-3** provides the detail for the 6-year CIP.

Table 10-2
6- and 20-Year CIP

Year	2010 $	Inflated
2011	$ 665,000	$ 691,600
2012	815,500	882,045
2013	706,500	794,716
2014	1,805,500	2,112,180
2015	578,500	703,834
2016	458,500	580,149
Subtotal	**$ 5,029,500**	**$ 5,764,523**
2017 to 2030	34,683,000	69,406,671
Total	**$ 39,712,500**	**$ 75,171,194**

Table 10-3
6-Year CIP (2010 Dollars)

Project	2011	2012	2013	2014	2015	2016	Total
Annual Water Main Replacement Program	$ -	$ 200,000	$ 300,000	$ 350,000	$ 400,000	$ 450,000	$ 1,700,000
Conversion of 384, 438 and 450 Zones to 362 Zone				90,000			90,000
10th Street and Avenue D Pressure Setting Adjustment				3,000			3,000
362/425 Zone Booster Pump Station			313,000	1,254,000			1,567,000
Emergency Intertie with PUD	120,000						120,000
Water Treatment Plant Meters		60,000					60,000
Water Treatment Plant Chlorination Time Improvements			40,000				40,000
Water Treatment Plant Piping Configuration				150,000			150,000
Reservoirs No. 1 and No. 2 Altitude Valve and Meter		75,000					75,000
Telemetry System Replacement and Upgrade Project	220,000						220,000
In-line Isolation Valve Installation Program		50,000	50,000	50,000	50,000		200,000
Storz Hydrant Fitting Installation Program		5,000	5,000	5,000	5,000	5,000	25,000
Security System Improvements		15,000	35,000				50,000
Reservoir No. 3 Exterior Recoating	325,000						325,000
Backwash Tank Interior and Exterior Recoating		207,000					207,000
Pine Avenue Hydrant Conversion (10th Street to 13th Street)				50,000			50,000
Reservoir No. 1 Floating Cover Replacement		200,000					200,000
Comprehensive Water System Plan Update					120,000		120,000
Total	**$ 665,000**	**$ 812,000**	**$ 743,000**	**$ 1,952,000**	**$ 575,000**	**$ 455,000**	**$ 5,202,000**

Capital Financing Strategy

An ideal capital funding strategy would include the use of grants and low-cost loans when debt issuance is required. However, these resources are very limited and competitive in nature and do not provide a reliable source of funding for planning purposes. It is recommended that the City pursue these funding avenues but assume bond financing to meet needs for which the City's available cash resources are insufficient. Revenue bonds have been used as the debt funding instrument in this analysis. The capital financing strategy developed to fund the CIP identified in this WSP assumes the following funding resources:

- Accumulated capital cash reserves;
- Annual revenue collections from connection charges (connection fee and capital facilities fee);
- Annual cash from rates earmarked for system reinvestment funding;

- Annual transfers of excess cash (over minimum balance targets) from operating reserve, if any;
- Interest earning on capital reserve balances and other miscellaneous capital resources; and
- Revenue bond financing.

Based on information provided by the City, the Capital Reserve (432) begins 2011 with $0 in cash reserves. A transfer of $512,000 is assumed to be made from the Operating Fund to help fund capital. System reinvestment funding in the amount of $175,479 in 2011 increasing to $213,497 by 2016, is assumed to help fund annual repair and replacement (R&R) projects. Annual connection charge revenue collections are assumed at an annual amount of $62,000 in 2011, increasing to $435,000 by 2016, ranging from 26 to 110 new connections per year. This type of planning looks at average growth over the 20-year period and does not take into consideration the current economic conditions, which can have a negative impact on annual growth in connections and revenue generated from connection charges. It is assumed that if the growth is not occurring at the planned rate, the timing of some of the capital projects would be adjusted accordingly.

The cash resources described above, coupled with additional transfers from the operating reserve and interest earnings are forecasted to fund 100 percent of the 20-year CIP. **Table 10-4** presents the corresponding 20-year capital financing strategy.

Table 10-4
20-Year Capital Funding Strategy

Year	Capital Expenditures 2010$	Capital Expenditures Escalated	Connection Fee Revenue	Capital Facility Fee Revenue	Rate Funded System Reinvestment	Revenue Bond Financing	Cash Funding	Total Financial Resources
2011	$ 665,000	**$ 691,600**	$ 32,630	$ -	$ 175,479	-	$ 483,491	**$ 691,600**
2012	815,500	**882,045**	287,797	143,284	182,498	-	268,465	**882,045**
2013	706,500	**794,716**	293,332	116,254	189,798	-	195,333	**794,716**
2014	1,805,500	**2,112,180**	299,921	118,865	197,390	1,400,000	96,004	**2,112,180**
2015	578,500	**703,834**	82,732	120,833	205,285	-	294,983	**703,834**
2016	458,500	**580,149**	96,797	123,572	213,497	-	146,284	**580,149**
Subtotal	**$ 5,029,500**	**$ 5,764,523**	**$ 1,093,208**	**$ 622,808**	**$ 1,163,946**	**$ 1,400,000**	**$ 1,484,560**	**$ 5,764,523**
2017 to 2030	34,683,000	**69,406,671**	5,811,948	2,054,984	4,061,475	38,000,000	19,478,264	**69,406,671**
Total	**$ 39,712,500**	**$ 75,171,194**	**$ 6,905,157**	**$ 2,677,792**	**$ 5,225,421**	**$ 39,400,000**	**$ 20,962,825**	**$ 75,171,194**

The 20-year capital funding plan identifies 47.59 percent of cash funding for capital projects. The cash funding is broken down between 9.19 percent connection fee revenue, 3.56 percent capital facility fee revenue, 6.95 percent rate funded system reinvestment and 27.89 percent from capital fund balance. It is assumed that revenue bonds will cover the remaining capital costs. Based on the allocation of capital projects, renewal and replacement versus expansion based, only a portion of the connection fee revenue is applied towards capital in 2015 and 2016. The remaining revenue is accumulated in the Connection Fee Fund 471 and is used on an annual basis dependent on the nature of the capital in a given year.

AVAILABLE FUNDING ASSISTANCE AND FINANCING RESOURCES

Feasible long-term capital funding strategies must be defined to ensure that adequate resources are available to fund the CIP identified in this WSP. In addition to the utility's resources, such as accumulated cash reserves, capital revenues, and rate revenues designated for capital purposes,

capital needs can be met from outside sources such as grants, low-interest loans, and bond financing. The following is a summary of the City's water utility resources and outside resources.

Utility Resources

Water utility resources appropriate for funding capital needs include accumulated cash in the capital reserve, rate revenues designated for capital spending purposes, and capital-related charges such as, connection charges and other connection fees. The first two resources will be discussed in the **Financial Policies** section. Capital-related charges are discussed below.

Capital Connection Charges

A connection fee and a capital facility fee (connection charge), as provided for by Revised Code of Washington (RCW) 35.92.025, refers to a one-time charge imposed on new customers as a condition of connection to the utility system. The purpose of the connection charge is two-fold: to promote equity between new and existing customers and to provide a source of revenue to fund capital projects. Revenue can only be used to fund utility capital projects or to pay debt service incurred to finance those projects.

The City currently charges all new water customers a combined connection charge of $2,379 per equivalent residential unit (ERU), made up of a the connection fee (growth) portion of $1,255 and capital facility fee (existing) portion of $1,124. This financial analysis recommends increasing the combined charge to $3,960 per ERU based on the projected infrastructure needs identified in this WSP and as discussed later in this chapter.

Local Facilities Charges

While a connection charge is the manner in which new customers pay their share of general facilities costs, local facilities funding is used to pay the costs of local facilities that connect each property to the system's infrastructure. Local facilities funding is often overlooked in rate forecast because it is funded up-front by either connecting customers, developers, or through an assessment to properties, but never from rates. Although these funding mechanisms do not provide a capital revenue source toward funding CIP costs, the discussion of these charges is included in this chapter, as they are an impact to the new customer of the system.

A number of mechanisms can be considered toward funding local facilities. One of the following scenarios typically occurs: (a) the utility charges a connection fee based on the cost of the local facilities (under the same authority as the capital facilities charge); (b) a developer funds extension of the system to its development and turns those facilities over to the utility (contributed capital); or (c) a local assessment is set up called a Utility Local Improvement District (ULID/LID) which collects tax revenue from benefited properties.

A local facilities charge is a variation of the connection charge authorized through RCW 35.92.025. It is a City-imposed charge to recover the cost related to service extension to local properties. Often called a front-footage charge and imposed on the basis of footage of main "fronting" a particular property, it is usually implemented as a reimbursement mechanism to a city for the cost of a local facility that directly serves a property. It is a form of connection charge and thus can accumulate up to 10 years of interest. It typically applies to instances when no developer-installed facilities are needed through developer extension due to the prior existence of available mains already serving the developing property.

The developer extension is a requirement that a developer install on-site and sometimes off-site improvements as a condition of extending service. These are in addition to the connection charge required and must be built to City standards. The City is authorized to enter into developer extension agreements under RCW 35.91.020. Part of the agreements between the City and the developer for the developer to extend service might include a latecomer agreement, resulting in a latecomer charge to new connections to the developer extension.

Latecomer charges are a variation of developer extensions whereby new customers connecting to a developer-installed improvement make a payment to the City based on their share of the developer's cost (RCW 35.91.020). The City passes this charge on to the developer who installed the facilities. This is part of the developer extension process, and defines the allocation of costs and records latecomer obligations on the title of affected properties. No interest is allowed, and the reimbursement agreement cannot exceed 20 years in duration.

LID/ULID is another mechanism for funding infrastructure that assesses benefited properties based on the special benefit received by the construction of specific facilities (RCW 35.43.042). Most often used for local facilities, some ULIDs also recover related general facilities costs. Substantial legal and procedural requirements can make this a relatively expensive process, and there are mechanisms by which a ULID can be rejected.

Outside Resources

This section outlines various grant, loan and bond opportunities available to the City through federal and state agencies to fund the CIP identified in the WSP.

Grants and Low Cost Loans

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However, these assistance programs have been mostly eliminated, substantially reduced in scope and amount, or replaced by loan programs. Remaining miscellaneous grant programs are generally lightly funded and heavily subscribed. Nonetheless, even the benefit of low-interest loans makes the effort of applying worthwhile. Grants and low-cost loans for Washington State utilities are available from the Washington State Department of Ecology (Ecology) and the Department of Community, Trade and Economic Development (CTED). Each department offers programs for which the City might be eligible. They are primarily targeted at sewer programs or low-income and/or rural communities, however.

Department of Community, Trade and Economic Development

CTED has four grant and loan programs that the City might be eligible for. These programs are:

- The Community Development Block Grants General Purpose Grant;
- The Community Economic Revitalization Board (CERB) Grant and Loan Program;
- The Public Works Trust Fund (PWTF) Loan Program; and
- The Drinking Water State Revolving Fund (DWSRF) Loan Program.

While the CERB and DWSRF programs are currently funded and accepting applications, the PWTF is providing no funding in the 2009 to 2011 biennium and may or may not be restored in the near future. Regardless, each of these programs is described in greater detail below.

Community Development Block Grants General Purpose Grants

These grants are made available to small cities, towns and counties in Washington State carrying out significant community and economic development projects that principally benefit low and moderate income persons.

- Eligible applicants are Washington State cities and towns with population less than 50,000 and counties with a population less than 200,000 that are non-entitlement jurisdictions or are not participants in a Housing and Urban Development (HUD) Urban County Entitlement Consortium.
- Eligible projects include public facilities for water, wastewater, storm sewer and streets. Approximately $13 million is expected to be available in 2011 with a maximum single grant amount of $1.5 million.
- The application deadline is January 20, 2011.

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

Community Economic Revitalization Board

CERB primarily offers low-cost loans; grants are made available only to the extent that a loan is not reasonably possible. The CERB targets public facility funding for economically disadvantaged communities, specifically targeting job creation and retention. Priority criteria include the unemployment rates, number of jobs created and/or retained, wage rates, projected private investment and estimated state and local revenues generated by the project. Traditional construction projects are offered at a maximum dollar limit per project of $1 million. A local match of 25 percent is targeted.

Eligible applicants include cities, towns, port districts, special purpose districts, federally recognized Indian tribes, and municipal corporations.

The CERB's policy is that all loans made by the CERB will be secured by a general obligation pledge of the taxing power of the borrowing entity. Terms do not exceed 20 years, including available payment deferral of interest and principal for up to 5 years. Interest rates match the most current rate of Washington State bonds (not to exceed 10 percent).

Further detail is available at http://www.choosewashington.com.

Public Works Trust Fund

Cities, towns, counties and special purpose districts are eligible to receive loans from the PWTF for water, sewer, storm, roads, bridges and solid waste/recycling projects. Funds may be used for repair, replacement, rehabilitation, reconstruction and improvements including reasonable growth (generally the 20-year growth projection in the comprehensive plan).

PWTF loans are available at interest rates of 0.5, 1 and 2 percent with the lower interest rates given to applicants who pay a larger share of the total project costs. The loan applicant must provide a minimum local match of funds of 5 percent towards the project cost to qualify for a 2 percent loan, 10 percent for a 1 percent loan, and 15 percent for a 0.5 percent loan. The useful life of the project determines the loan term up to a maximum of 20 years.

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

Drinking Water State Revolving Loan Program

Funding historically targets protection of public health, compliance with drinking water regulations and assistance for small and disadvantaged communities. Recent legislation requires $7 million be provided for "green" or environmentally beneficial infrastructure. In the 2010 loan cycle $58 million was available. Loans range from $50,000 to $8 million.

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

Rural Development Loan Program

Rural Development (RD) funds a grant and loan program for rural communities (less than 10,000 people) for water and wastewater projects. The amount of grant relative to loan is based on the income level of the community and how high rates will be relative to household income. If a grant is offered, the recipient also needs to accept loan funding. The terms for loans are typically on the order of 3.5 to 4.5 percent interest for 40 years. For the most recent year on record, RD obligated $19.3 million in loans and grants. Because RD is a federal program, compliance with the National Environmental Policy Act (NEPA) is required. RD has a standardized format for the NEPA Environmental Report that needs to be prepared to document impacts and proposed mitigation measures for a project. The NEPA Environmental Report that is produced typically satisfies the documentation requirements for other federal agencies.

Bond Financing

General Obligation Bonds

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

RCW 39.36.020(2)(a)(ii) and (b) states,

> *Counties, cities, and towns are limited to an indebtedness amount not exceeding one and one-half percent of the value of the taxable property in such counties, cities, or towns without the assent of three-fifths of the voters therein voting at an election held for that purpose.*
>
> *(b) In cases requiring such assent counties, cities, towns, and public hospital districts are limited to a total indebtedness of two and one-half percent of the value of the taxable property therein.*

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

Revenue Bonds

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

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

Build America Bonds

(From munibondadvisor.com) The Economic Recovery and Reinvestment Act (ERR Act) created a new form of bonds known as Build America Bonds (BABs). BABs are taxable and, through federal subsidies or tax credits, are intended to reduce municipal borrowing costs.

The ERR Act created two types of BABs. The first type of BABs provide a federal subsidy to investors equal to 35 percent of the interest payable by the issuer (Tax Credit BABs). The second type of BABs provide a direct federal subsidy that will be paid to state and local governments in an amount equal to 35 percent of the interest (Direct Payment BABs). Both types of BABs must be issued before January 1, 2011.

Tax Credit BABs provide a 35 percent interest subsidy (net of the tax credit) to investors that results in a federal subsidy to the issuer equal to approximately 25 percent of the total return to the investor (interest and the tax credit). Tax Credit BABs may be issued to finance any governmental purpose for which tax-exempt government bonds (excluding private activity bonds) could be issued including current refunding and one advance refunding. The bonds must comply with all requirements applicable to the issuance of tax-exempt governmental bonds.

Direct Payment BABs offer a larger federal subsidy than Tax Credit BABs; however, they are subject to more restrictions. In general, Direct Payment BABs may be issued to finance capital expenditures for any governmental purpose for which tax-exempt government bonds may be issued, excluding private activity bonds and excluding refunding bonds. Costs of issuance paid from Direct Payment BAB proceeds are limited to 2 percent. In order to receive a federal subsidy, issuers will be required to submit a payment request form no earlier than 90 days, and no later than 45 days, before each interest payment date. Issuers will receive the requested payment within 45 days of the date the form is filed with the Internal Revenue Service. In the future, the payment procedures may be changed to an electronic platform.

Financing for a project may be subdivided into two issues; one comprised of traditional tax-exempt municipal bonds and one comprised of BABs.

This funding source has currently expired. It may be available again as legislature is attempting to acquire more funds.

Further detail is available at http://www.munibondadvisor.com/BuildAmericaBonds.htm.

FINANCIAL FORECAST

The financial forecast, or revenue requirement analysis, forecasts the amount of annual revenue that needs to be generated by water rates. The analysis incorporates operating revenues, O&M expenses, debt service payments, rate-funded capital needs, and any other identified revenues or expenses related to operations, and also determines the sufficiency of the current level of rates. Revenue needs are also impacted by debt covenants (typically applicable to revenue bonds) and specific fiscal policies and financial goals of the City.

The analysis determines the amount of revenue needed in a given year to meet that year's expected financial obligations. For this analysis, two revenue sufficiency criteria have been developed to reflect the financial goals and constraints of the City: Cash needs must be met, and debt coverage requirements must be realized. In order to operate successfully with respect to these goals, both tests of revenue sufficiency must be met.

- Cash Test – The cash flow test identifies all known cash requirements for the City in each year of the planning period. Capital needs are identified and a capital funding strategy is established. This may include the use of debt, cash reserves, outside assistance, and rate funding. Cash requirements to be funded from rates are determined. Typically, these include O&M expenses, debt service payments, depreciation funding or directly funded capital outlays, and any additions to specified reserve balances. The total annual cash needs of the utility are then compared to projected cash revenues using the current rate structure. Any projected revenue shortfalls are identified and the rate increases necessary to make up the shortfall are established.

- Coverage Test – The coverage test is based on a commitment made by the City when issuing revenue bonds and some other forms of long-term debt. For purposes of this analysis, revenue bond debt is assumed for any needed debt issuance. As a security condition of issuance, the City would be required per covenant to agree that the revenue bond debt would have a higher priority for payment (a senior lien) compared to most other utility expenditures; the only outlays with a higher lien are O&M expenses. Debt service coverage is expressed as a multiplier of the annual revenue bond debt service payment. For example, a 1.0 coverage factor would imply that no additional cushion is required. A 1.25 coverage factor means revenue must be sufficient to pay O&M expenses, annual revenue bond debt service payments, plus an additional 25 percent of annual revenue bond debt service payments. The excess cash flow derived from the added coverage, if any, can be used for any utility purpose, including funding capital projects. Targeting a higher coverage factor can help the City achieve a better credit rating and provide lower interest rates for future debt issues.

In determining the annual revenue requirement, both the cash and coverage sufficiency test must be met and then the test with the greatest deficiency drives the level of needed rate increase in any given year.

Current Financial Structure

The City maintains a fund structure and implements financial policies that target management of a financially viable and fiscally responsible enterprise fund utility.

Separate accounting is provided for utility restricted and unrestricted cash reserves. Restricted reserves typically include funds set aside as part of revenue bond covenants and cannot be used for purposes other than financial payment on outstanding revenue bond debt obligations. Unrestricted cash is maintained in the Water Operating Fund (401) and the Utilities Capital Fund (432). Restricted funds include Fund 451 Utility Bond Reserve, 471 Utility Connection Fee Reserve and 473 Utility System Replacement Reserve. The financial plan has considered the use and maintenance of the operating and capital funds. The debt fund is set by covenant and is only used to make final debt payments or accumulate additional funds for new issues. The Connection Fee and System Replacement Reserves are only used to fund renewal, replacement and growth type capital.

Fiscal Policies

A brief summary of the key financial policies employed by the City, as well as those recommended and incorporated in the financial program are discussed below.

Minimum Fund Balances

Operating reserves are designed to provide a liquidity cushion to ensure that adequate cash working capital will be maintained to deal with significant cash balance fluctuations, such as seasonal fluctuations in billings and receipts, unanticipated cash expenses, or lower than expected revenue collections. The City's current policy is to maintain a minimum balance in the Operating Fund equal to 90 days of O&M. This target is prudent for a water utility, given the variability in revenue collections due to changing weather patterns that can significantly affect revenue collections during the summer season.

The City does not have a formal policy for cash reserves in the Capital Fund; discussions with City staff and the consulting engineer established an internal target of $500,000 per year. A capital contingency reserve is an amount of cash set aside in case of an emergency should a piece of equipment or a portion of the utility's infrastructure fail unexpectedly. The reserve also could be used for other unanticipated capital needs including capital project cost overruns. Industry practice range from maintaining a balance equal to 1 to 2 percent of fixed assets, an amount equal to a 5-year rolling average of CIP costs, or an amount determined sufficient to fund an equipment failure (other than catastrophic failure). The final target level should balance industry standards with the risk level of the City.

System Reinvestment

The purpose of system reinvestment funding is to provide for the replacement of aging system facilities to ensure sustainability of the system for ongoing operation. Each year, the utility's assets lose value, and as they lose value they are moving toward eventual replacement. That accumulating loss in value and future liability is measured for reporting purposes through annual depreciation expense, which is based on the original cost of the asset. While this reported expense reflects the consumption of the existing asset and its original investment, the replacement of that asset will likely cost much more, factoring in inflation and construction conditions. Therefore, the added annual replacement liability is even greater than the annual depreciation expenses.

The City's historical practice has been to fund R&R projects from rates based on the annual R&R requirement and availability of resources. In the analysis, these monies are transferred from the Operating Fund to the Utility System Replacement Reserve and are made available for capital spending based on the type of capital scheduled for a particular year (R&R versus growth). Because

this is a discretionary decision, the transfer can be suspended in order to avoid unnecessary rate increases, or when the Operating Fund balance is not high enough to support the transfer. Even though this is a discretionary policy, it is strongly recommended to continue funding system reinvestment on an annual basis through rates in order to maintain a healthy capital replacement program. In addition to system reinvestment funding, cash in excess of minimum Operating Fund balance targets are planned for transfer to the Capital Fund, and made available for capital spending. The rate analysis assumed a $175,000 transfer in 2011, escalated at construction cost inflation thereafter.

Debt Management

It is prudent to consider policies related to debt management as part of broader utility financial policy structure. Debt management policies should be evaluated and formalized, including level of acceptable outstanding debt, debt repayment, bond coverage and total debt coverage targets. The City's existing bond covenants require a 1.25 debt coverage test. The City has an internal policy of 1.50. The internal coverage target of 1.50 allows for the use of connection and capital facility fee revenue as well as bond reserve monies as part of total resources available.

Financial Forecast

The financial forecast is developed from 2011 budget documents along with other key factors and assumptions to develop a complete portrayal of the water utility annual financial obligations. The following is a list of the key revenue and expense factors and assumptions used to develop the financial forecast.

- Revenue – The City has two general revenue sources: revenue from charges for service (rate revenue) and miscellaneous (non-rate) revenue. In the event of a forecasted annual shortfall, rate revenue can be increased to meet the annual revenue requirement. The City's budget 2011 revenue is based on 2010 budget figures. Non-rate revenues are forecast to increase with inflation or growth depending on the nature of the revenue.

- Connection Charge Revenue – The connection fee of the connection charge was updated as part of the new capital provided in this WSP, and is applied to the projected new ERUs starting in 2012. Based on the projected growth outlined in **Chapter 3** of this WSP, the capital facility fee and connection fee will generate between $62,000 in 2011 and $435,000 in 2016.

- Growth – Rate revenue were escalated based on the growth rate in **Chapters 3** and **4** of this WSP, which on average was approximately 2.25 and 2.27 percent per year (not including a minor reduction of 70 ERUs in 2014, which will be transferred to Snohomish Public Utility District). The growth rate projected seems to be higher than the recent trends experienced by the City; therefore, actual growth should be closely monitored.

- Expenses – O&M expense projections are based on the 2011 budget and are forecasted to increase with general cost inflation of 3.0 percent, labor cost inflation of 2.0 to 2.7 percent, medical cost inflation of 10.0 percent. Excise tax projections use the 2011 budget; future taxes are calculated based on forecasted revenues and prevailing tax rates.

- Existing Debt – The City currently has a total of two outstanding debt issues: an RECD loan with an annual payment of approximately $76,000 per year, which runs through 2021 and a zero interest loan with an annual payment approximately $20,000, which runs through 2015.
- Future Debt – The capital financial strategy developed for this WSP forecasts the need to issue new debt in the amount of $1.40 million in 2014 to help pay for the 362/425 Zone Booster Pump Station. An additional $38.00 million is anticipated in new debt in 2030 to pay for the Water Treatment Plant Transmission Main replacement should the City decide to continue operating the Pilchuck River source. The City actively pursues low-cost loans, where appropriate, and issues revenue bonds to finance capital projects costs in excess of available cash resources. The analysis performed assumes all revenue bond financing for both debt issues.
- Revenue Bond Assumptions – The forecast assumes a revenue bond interest rate of 5.0 percent, an issuance cost of 1.5 percent and a term of 30 years.
- Transfers to Capital – Any Operating Fund balance above the minimum requirement is assumed to be available to fund capital projects and is projected to be transferred to the capital fund.
- Operating Fund Balance – The 2011 Operating Fund balance (401) is expected to end the year at 54 days of O&M, below the 90 day target. In 2012 the ending operating fund balances meet the 90 days of O&M target.
- Capital Fund Balance – The 2011 Capital Fund balance is expected to end the year below the target of $500,000, at approximately $28,000. In 2012 and 2013 the ending Capital Fund balances meet the $500,000 target levels, and exceed the target thereafter. The balances assume receipt of the Federal Emergency Management Agency (FEMA) reimbursement.

Although the financial plan is completed for the 20-year planning period of this WSP, the rate strategy focuses on the shorter-term planning period 2011 through 2016. It is imperative that the City revisit the proposed rates every 2 to 3 years to ensure that the rate projections developed remain adequate. Any significant changes should be incorporated into the financial plan and future rates adjusted as needed.

Table 10-5 summarizes the annual revenue requirement based on the forecast of revenues, expenditures, fund balances and fiscal policies.

Table 10-5
6-Year Financial Forecast

Financial Forecast	2011	2012	2013	2014	2015	2016
Revenues						
Rate Revenues Under Existing Rates	$ 1,873,350	$ 1,915,566	$ 1,958,595	$ 1,965,089	$ 2,009,623	$ 2,055,165
Non-Rate Revenue	54,362	50,089	56,323	57,579	62,119	63,789
Total Revenue	**$ 1,927,712**	**$ 1,965,655**	**$ 2,014,918**	**$ 2,022,668**	**$ 2,071,742**	**$ 2,118,954**
Expenses						
Cash O&M Expenses	$ 1,617,936	$ 1,681,432	$ 1,748,971	$ 1,814,661	$ 1,889,672	$ 1,968,908
Existing Debt Service	96,200	95,950	96,600	96,100	96,500	76,750
New Debt Service	-	-	-	98,997	98,997	98,997
Rate Funded System Reinvestment	175,479	182,498	189,798	197,390	205,285	213,497
Total Expenses	**$ 1,889,615**	**$ 1,959,880**	**$ 2,035,369**	**$ 2,207,148**	**$ 2,290,454**	**$ 2,358,152**
Surplus (Deficiency)	$ 38,097	$ 5,775	$ (20,451)	$ (184,479)	$ (218,713)	$ (239,198)
Additions to Meet Coverage	$ -	$ -	$ -	$ -	$ -	$ -
Total Surplus (Deficiency)	$ 38,097	$ 5,775	$ (20,451)	$ (184,479)	$ (218,713)	$ (239,198)
% of Rate Revenue	0.00%	0.00%	1.04%	9.39%	10.88%	11.64%
Annual Rate Adjustment	**5.00%**	**5.00%**	**4.80%**	**4.80%**	**4.80%**	**4.80%**
Rate Revenues After Rate Increase	$ 1,967,018	$ 2,111,912	$ 2,262,999	$ 2,379,488	$ 2,550,216	$ 2,733,194
Net Cash Flow After Rate Increase	**$ 127,054**	**$ 192,246**	**$ 268,645**	**$ 209,079**	**$ 294,694**	**$ 404,733**
Coverage After Rate Increase	n/a	n/a	n/a	20.38	21.44	22.53

Notes:
Coverage assumes the use of Connection Charge revenue and revenue bond reserve.

The financial forecast indicates the need for a 5.0 percent rate increase in 2011 and 2012, followed by 4.8 percent rate increases thereafter. The initial rate increases are required to cover the existing level of O&M expenses and to rebuild and maintain adequate ending fund balance targets, while the following increases are there to support the capital program.

City Funds and Reserves

Table 10-6 shows a summary of the projected City Operating and Capital Fund ending balances through 2016, based on the rate forecasts presented herein. The operating forecast has a minimum target of 90 days of O&M expenses. The Capital Fund target balance is set at $500,000 per year. With the exception of 2011, the Operating and Capital Fund balances are maintained near the target levels and exceed them in 2014 and thereafter.

Table 10-6
Ending Cash Balance Summary

Ending Fund Balances	2011	2012	2013	2014	2015	2016
Operating Fund	$ 241,145	$ 414,600	$ 431,253	$ 447,451	$ 465,947	$ 485,484
Capital Fund	28,030	427,091	496,562	608,336	607,802	864,947
Total	**$ 269,175**	**$ 841,691**	**$ 927,815**	**$ 1,055,787**	**$ 1,073,748**	**$ 1,350,431**
Combined Minimum Target Balance	$ 898,943	$ 914,600	$ 931,253	$ 947,451	$ 965,947	$ 985,484

CURRENT AND PROJECTED RATES

Current Rates

The City's current rate structure consists of two rate components, fixed and volume, and is not separated by class. The fixed bimonthly charge is dependent on meter size and includes an allowance of water based on meter size. The volume charge is a uniform rate, equal for all levels of use, once the allowance is exceeded. The water rates include a low income/senior discount applied to the meter charges. An outside City multiplier of 1.5 to the inside City rates is applied to both the fixed and the volume charges. **Table 10-7** shows the existing rate structure.

Table 10-7
2010 Existing Rate Structure

Meter	Allowance (per 100 cubic feet)	Bimonthly	Variable (per 100 cubic feet)
5/8-inch	4	$ 39.30	$ 3.24
1-inch	10	100.60	3.24
1.5-inch	23	226.40	3.24
2-inch	41	402.50	3.24
3-inch	92	905.50	3.24
4-inch	164	1,609.70	3.24
6-inch	267	3,621.88	3.24
Discount	8	9.83	3.24
Non-Metered	0	93.90	N/A

Note: Assumes outside City customers rates are a multiple of 1.5

Projected Rates

The Municipal Water Law (Washington House Bill 1338) was enacted in 2003 to address water conservation issues in Washington State. The law states the following requirements for rate setting principals, ". . . evaluation of the feasibility of adopting and implementing water delivery rate structures that encourage water conservation" (H.B. 1339. Sec. 7 (4)(a)(B)). To address the conservation of House Bill 1338 the City assessed several conservation rate structure options:

- Option 1: the City considered passing the entire increase through the volume charge only. Putting more weight on the volume charge sends a greater price signal to users.
- Option 2: the City considered eliminating the allowance it currently includes in the fixed charges. Eliminating the allowance can reduce wasteful/discretionary type of usage by charging for all usage. If customers receive a greater allowance then they consume, there is no incentive to conserve, and can potentially send a counter conservation message.
- Option 3: the City considered a separate single-family residential 4 tiered block structure. Under a block-type structure, once a customer reaches a certain threshold, the unit cost of water increases for all use thereafter. This type of structure can provide incentive to lower users by pricing the lower blocks at a lower cost, while at the same time sending a price signal to high users, by pricing the upper blocks appropriately.

The City selected the first option, passing the entire increase through the variable charge for 2011. The following year rate increases are passed through on an across-the-board basis, applying proportionally to the fixed and variable rate components. **Table 10-8** shows the proposed rates for the 6-year planning period.

Table 10-8
6-Year Proposed Rates

Meter	Allowance (per 100 cubic feet)	2011	2012	2013	2014	2015	2016
5/8-inch	4	$ 39.30	$ 41.27	$ 43.25	$ 45.32	$ 47.50	$ 49.78
1-inch	10	100.60	105.63	110.70	116.01	121.58	127.42
1.5-inch	23	226.40	237.72	249.13	261.09	273.62	286.75
2-inch	41	402.50	422.63	442.91	464.17	486.45	509.80
3-inch	92	905.50	950.78	996.41	1,044.24	1,094.36	1,146.89
4-inch	164	1,609.70	1,690.19	1,771.31	1,856.34	1,945.44	2,038.82
6-inch	267	3,621.88	3,802.97	3,985.52	4,176.82	4,377.31	4,587.42
Discount	8	9.83	10.32	10.82	11.34	11.88	12.45
Volume Rate (ccf)		$ 3.63	$ 3.81	$ 3.99	$ 4.18	$ 4.38	$ 4.59

Notes: Assumes outside City customers rates are a multiple of 1.5.

Table 10-9 shows bimonthly bill comparisons for the proposed annual increases.

Table 10-9
Bimonthly Bill Comparisons

Rate Increase	5.00%	5.00%	4.80%	4.80%	4.80%	4.80%
Existing Bimonthly Bill	2011	2012	2013	2014	2015	2016
$ 71.70	$ 75.57	$ 79.35	$ 83.16	$ 87.15	$ 91.33	$ 95.72
$ Difference	$ 3.87	$ 3.78	$ 3.81	$ 3.99	$ 4.18	$ 4.38

Note: Assumes inside the City, 5/8-inch meter, 14 ccf bimonthly usage.

AFFORDABILITY

A common affordability index used by agencies to prioritize low-cost loan awards is whether rates exceed 1.5 percent of the median household income for the demographic area. The median household income for the City in the 2009 American Community Survey was $54,243. The 2009 figures were escalated based on the Consumer Price Index (CPI) for the 2010 year; the following years assumed a 3 percent escalation. **Table 10-10** presents the City's rates with the projected rate increases annually for the forecast period, tested against the 1.50 percent affordability threshold.

Table 10-10
Affordability Test

Year	Inflation	Median Household Income	1.5% Monthly Threshold	Projected Monthly Bill (7 ccf)
2009	---	$ 54,243	$ 67.80	
2010	1.59%	55,107	68.88	
2011	3.00%	56,760	70.95	$ 37.79
2012	3.00%	58,463	73.08	39.67
2013	3.00%	60,217	75.27	41.58
2014	3.00%	62,023	77.53	43.57
2015	3.00%	63,884	79.85	45.67
2016	3.00%	65,800	82.25	47.86

Note: CPI averages are through October 2010.

Applying the 1.50 percent test, the City's rates are forecasted to remain well within the indicated affordability range through 2016.

CONNECTION CHARGES

As discussed in the **Utility Resources** section of the chapter, connection charges are sources of funding provided through development and growth and are typically used by utilities to support capital need. The underlying premise of the connection charge is that new growth (i.e., new customers) will pay an equitable share of system costs (existing infrastructure and new capital needs) through an up-front charge for system capacity.

In the absence of a connection charge, growth related capital costs would be borne in large part by existing customers. In addition, the net investment in the utility already collected from existing customers, through rates, charge and/or assessments, would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments. To establish equity, a connection charge should recover a proportionate share of the existing (capital facility fee) and future infrastructure costs (connection fee) from a new customer. From a financial perspective, a new customer should become financially equivalent to an existing customer by paying the connection charge.

The method used to determine the connection charge includes provisions for both the City's investment in existing system capacity and its planned investments in system expansion. The resulting system cost is then spread proportionally over the total customer base served. The components that can be included in the connection charge are described below.

- Capital Facility Fee/Existing Cost Basis – The original cost of the existing system is determined from utility records. In accordance with statute, interest costs are added at the rate of interest applicable at the time of construction for up to a 10-year period, not to exceed 100 percent of the construction costs. This cost is net of donated facilities and non-utility cash payments, whether from grants, developers or through ULID assessments. Although not required by state law, outstanding debt principal which is not being paid for by connection charge revenue (net of existing cash balances) is then subtracted from this cost

basis to avoid double-charging in recognition that new customer will be paying this portion of the debt service through their monthly user rates.

- Capacity Fee/Future Cost Basis – Future facilities needed to serve growth and improve the system for regulatory compliance are also included in the connection charge. The future cost basis can include utility capital projects planned for construction and identified in an approved comprehensive system planning document. It is important to note that current year dollars are used when calculating the connection charge (not inflated dollars). This approach assumes that the connection charge will be updated annually to track construction cost inflation. Projects directly funded by developers, grants or special property assessments are not included in the calculation. Replacement projects are most often excluded from the calculation unless they are needed to increase the size of the system. The capital improvement program has been allocated between existing and future customers based on engineering and planning criteria.
- Customer Base/System Capacity – The sum of the existing cost basis and future cost basis is divided by the total customer base to determine the maximum allowable connection charge. The customer base represents ERUs that can be supported by the planned system capacity. The customer base was determined from the City's current customer statistics based on the number of accounts weighted by meter size using American Water Works Association (AWWA) flow factors. Once the existing level of ERUs was established, the growth rate provided in this WSP was applied to calculate the total future projected ERUs through 2030.

Table 10-11 summarizes the connection charge analysis and results.

Table 10-11
Connection Charge

Existing Capital Facility Fee	**$**	**1,124**
Connection Fee Basis		
Capital Improvement Plan		**2010 $**
Total Future Projects	$	39,712,500
less: Repair and Replacement		(33,228,160)
less: Contributed/Donated Capital		-
Total Connection Fee Basis	**$**	**6,484,340**
Customer Base		
Existing Residential Equivalent Units		4,503
Future Residential Equivalent Units		2,286
Total Customer Base		**6,789**
Resulting Charge		
Capital Facility Fee	**$**	**1,124**
Connection Fee Basis		
Allocable Portion	$	6,484,340
Allocable Customer Base		2,286
Connection Fee	**$**	**2,836**
Total Connection Charge	**$**	**3,960**

The updated connection charge increased by $1,581 from the previous charge of $2,379. Due to the limited availability of existing asset data, the capital facility fee (existing cost basis) was not updated. The increase in the combined connection charge was from the future growth related capital identified in this WSP. Once existing asset data is available, the capital facility fee should be updated based on the new figures. The charge should be escalated annually with an accredited escalation index, such as the Engineering News Record Construction Cost Index (ENR-CCI). The increase in the charge is attributed to an increase in the future facilities portion of the charge.

CONCLUSION

The results of this analysis indicate that rate increases are necessary to fund ongoing operating needs and future debt requirements to fund the CIP. Implementation of the proposed rate increases should provide for continued financial viability while maintaining generally affordable rates. The City has adopted the 2011 5.0 percent rate increase effective January 1, 2011.

It is important to remember that the analysis performed in this chapter assumes growth rates from **Chapters 3** and **4** of this WSP, which are projected to be higher than the trends the City is currently experiencing. These growth rates, however, are consistent with the projections prepared by the Snohomish County Planning Department and shown in the City's 2007 *Comprehensive Plan*. In addition, the analysis assumes that the new connection charge will be adopted and become effective starting 2012. If the reduced growth trends continue, or the proposed connection charge is not adopted, the proposed annual rate increase will need to be updated and revised.

It is recommended that the City regularly review and update the key underlying assumptions that compose the multi-year financial plan to ensure that adequate revenues are collected to meet the total water utility financial obligations.