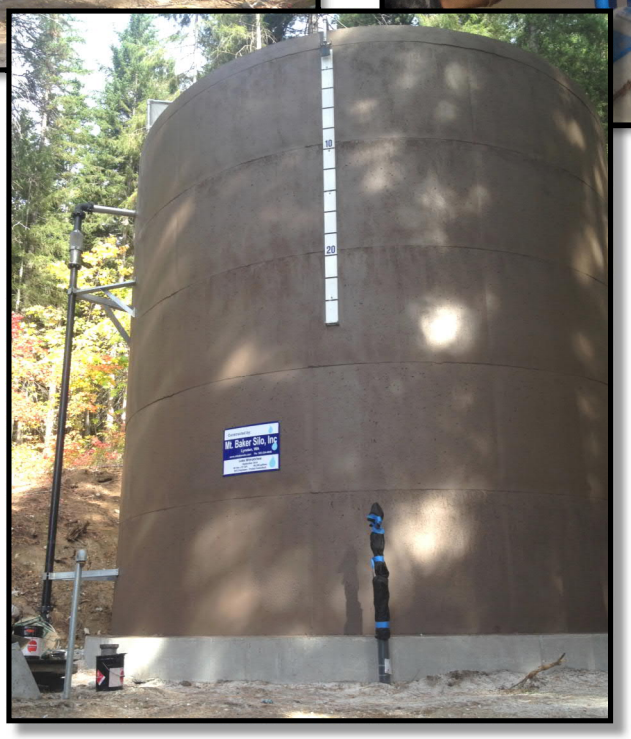
Lake Wenatchee Water District

2019 WATER SYSTEM PLAN



Prepared By

RH2

Final
April 22, 2020

Lake Wenatchee Water District 2019 Water System Plan

Final

April 22, 2020

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Certification

This Water System Plan for the Lake Wenatchee Water District was prepared under the direction of the following registered professional engineers.

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Signed: 11/19/2019

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Signed: 11/19/2019

Lake Wenatchee Water District
2019 Comprehensive Water System Plan
Chapters - Table of Contents

1 | INTRODUCTION AND WATER SYSTEM DESCRIPTION

INTRODUCTION

This chapter describes the history of the Lake Wenatchee Water District (District) and provides a description of the existing infrastructure. The District operates two water systems within its boundary:

- Lake Wenatchee Water District: Washington State Department of Health (DOH) ID No. AC567H, Group A; and
- Mountain Park/Zufall Water System: DOH ID No. 47059H, Group B.

For this Water System Plan (WSP), any discussion of the District means both water systems, unless specifically stated otherwise.

DISTRICT LOCATION

The District is located along the north shore of Lake Wenatchee in west central Chelan County (County). Lake Wenatchee is located on State Highway 207 approximately 7 miles north of State Highway 2 from Coles Corner. The Stevens Pass Summit on Highway 2 is located approximately 27 miles to the west, and the City of Wenatchee, adjacent to the Columbia River, is located 40 miles southeast on State Highway 2. All distances listed are driving distances, not direct line.

HISTORY AND BACKGROUND

DISTRICT FORMATION

The District was created by the County Commissioners in April 2006, resulting from a public referendum in favor of forming a public water district. The purpose and goal of creating a public district was to establish an integrated water supply and distribution system to replace five private community associations providing water along the north shore of Lake Wenatchee. As a result of the public referendum, the County Commission adopted Resolution 2006-65 on May 30, 2006, which formed the District and established the District's boundaries (**Appendix B**).

Property owners of an integrated utility gain advantages, including fire protection, improved water supply reliability, water quality, increased property values, and improved ability to secure a mortgage. Also, land sales or building permits may be contingent upon water service being available.

The United States Forest Service's (USFS) Lake Wenatchee Ranger Station is located within the District's retail water service area. At the present time, the USFS has no plans to participate in the District's planning process or become part of the District.

ORIGINAL WATER SYSTEMS

Domestic water service along the north shore of Lake Wenatchee is provided by numerous public and private systems. The five systems that combined to form the District are shown on the map in **Appendix B** and are as follows:

- Group A Water Systems
  - Brown Road Water Users Association [DOH ID No. 08850]
  - Lake Wenatchee Water Users Association (LWWUA) [DOH ID No. 45073]
  - Whispering Pines Water Users Association [DOH ID No. 96093]
- Group B Water Systems
  - Mountain Park/Zufall [DOH ID No. 47059]
  - Lester Addition Water Company

Mountain Park/Zufall is owned and operated by the District, but is still classified as a separate Group B water system and is not interconnected with the other systems.

There are several existing residences within the District's boundary that have their own water source. The sources of water supply for these individual systems are either individual wells or surface or spring supplies. No survey or evaluation of these private sources has been performed.

Chapter 1 of the District's 2011 WSP included detailed descriptions of the configuration and condition of the five original water systems prior to forming the District. For the sake of brevity, those descriptions have been relocated to **Appendix B**.

2011 WATER SYSTEM PLAN

With the formation of the District, in 2009 the DOH entered into an Interagency Agreement with the District to develop a WSP for the consolidation of the five core water systems to meet the planning requirements under Chapter 246-290 Washington Administrative Code (WAC).

The District's initial WSP, approved by DOH on May 11, 2011 (DOH Project No. 10-0910), was developed to meet the planning requirements contained within Chapter 246-290 WAC and to provide a plan for meeting the water system needs of the five water systems through an integrated regional water supply and distribution system. The 2011 WSP summarized the conditions of the existing water systems, evaluated the existing and proposed water demands, considered alternatives to providing water service, proposed a recommended capital improvement plan, operations and maintenance plan, and water use efficiency plan, and proposed methods to finance improvements.

During development of the 2011 WSP, the five existing water systems were inspected within the District's retail water service area to evaluate their condition and determine the feasibility of incorporating components, portions, or entire water systems into the District's water system.

The condition and age of the existing source of supply and storage facilities of the private associations and informal user groups varied. While all five systems met minimum DOH standards for either Group A or Group B systems, numerous components within each of the water systems were reaching the end of their useful life and needed to be replaced. Compliance with the minimum system standards of DOH, including requirements for operation, maintenance, testing, and reporting, represented significant investments in capital facilities, maintenance, and operations – a substantial burden for the individual systems. The goal of the integrated water system was to use the best components from each water

system to ensure that the minimum standards are met for reliability, quality, and quantity of water supply at a reasonable cost to the benefitting properties.

SYSTEM CONSOLIDATION

Following approval of the 2011 WSP, RH2 Engineering, Inc., prepared the *District System Consolidation Project Report*, which was completed in November 2012, and approved by DOH on December 6, 2012 (DOH Project No. 12-1110). The report outlined the system improvements to combine the water systems and replace obsolete components.

2014-2015 CONSTRUCTION PROJECTS

The culmination of the work from 2006 to 2012 was construction of new water system infrastructure. The projects were funded by a Local Improvement District (LID) and a grant from the United States Department of Agriculture (USDA) Rural Development. The $3.6 million project began design in 2012, construction commenced in June 2014, and was completed in October 2015. The Mt. Park system was left physically separate from the other systems due to the high cost of installing over a mile of pipe to serve ten or fewer connections. A map of the benefitted LID properties is included in **Appendix B**.

DISTRICT MEETINGS

The District has regularly scheduled public meetings at 10:00 am on the second Thursday of each month at the Lake Wenatchee Fire and Rescue Station 91 located at 21696 Lake Wenatchee Highway.

WATER SERVICE AREA

The District's retail water service area shown on **Figure 1.1** covers approximately 1.8 square miles and encompasses private and USFS lands. These properties are located on or adjacent to Lake Wenatchee along the Lake Wenatchee Highway.

The existing water service area also is represented by the retail water service area boundary. The future retail service area is coincident with the District boundary. The existing retail water service area is not in a critical water supply service area. There are no other overlapping private or public purveyors within the retail water service area, except for the USFS's Lake Wenatchee Ranger Station complex.

TOPOGRAPHY OF SERVICE AREA

The water service area occupies a broad glacier-carved valley at the headwaters of the main stem of the Wenatchee River. Immediately south and north of Lake Wenatchee, the topography is mountainous and steep. Lake Wenatchee is approximately 5 miles in length and a little less than 1 mile wide, covering approximately 2,500 acres.

Much of the developable land within the water service area is owned by the federal government and managed by USFS. The mountainous slopes close to the north shore of Lake Wenatchee will limit development of privately-held lands in these areas. Wetlands also will constrain development within the water service area, which have been identified north of Lake Wenatchee using Chelan County GIS. **Figure 1.2** identifies the locations of wetlands and water bodies.

The topography of the areas where water service is provided by the District varies greatly in elevation, as shown in **Figure 1.1**. The lowest elevation within the existing service area is along the Lake Wenatchee waterfront, which has an elevation of approximate1y 1,880 feet. The highest elevation

TOWNSHIP 27 N

RANGE 16 E

RANGE 17 E

Mt Park

Lakeview Dr

Brown Rd

White River

Lake Wenatchee

N Shore Dr

Lake Wenatchee Hwy

2200

2400

2000

3000

2800

2600

2400

2200

2000

10 11
15 14

11 12
14 13

12 7
13 18

7 8
18 17

13 18
24 19

18 17
19 20

LEGEND

SERVICE AREAS

- LWWD CURRENT & RETAIL SERVICE AREA
- LWWD DISTRICT BOUNDARY
- NORTHSHORE PARK WATER ASSOC.
- USFS DISTRICT RANGER STATION
- ALPINE WATER DISTRICT

Figure 1.1: Service Area

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 1/4 mile

0" 1/2" 1"

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/5/2019

FILE NAME: LWWSP19-P-SA.DWG

JOB: LWW 217.010

RH2

TOWNSHIP 27 N

RANGE 16 E

RANGE 17 E

LWWD Boundary

Lake Wenatchee Hwy

N Shore Dr

Lakeview Dr

Brown Rd

White River

Fall Creek

Whipering Pines Spring

Barnard Creek

Lake Wenatchee

LEGEND

LAND USE

- RP (Rural Public Lands and Facilities)
- RR 2.5 (Rural Residential 2.5)
- RR 5 (Rural Residential 5)
- RR 10 (Rural Residential 10)
- RR 20 (Rural Residential 20)
- RRR (Rural Recreational / Residential)
- RW (Rural Waterfront)
- FC (Commercial Forest)
- Wetland

Figure 1.2: Land Use

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 1/4 mile

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/5/2019

JOB: LWW 217.010

FILE NAME: LWWSP19-P-LU.DWG

currently served within the existing service area is at an elevation of approximately 2,335 feet, near the 2409 Zone Reservoir.

RELATED PLANS

The following document provides additional information on the District's domestic water system and was consulted in the preparation of this WSP:

- *Chelan County Comprehensive Plan*, 2017 and annual updates.

This document provides population, planning, and land use information for the County. Additionally, population projection information from state and federal sources were incorporated into this WSP, as will be discussed in **Chapter 2**.

EXISTING WATER SYSTEM DESCRIPTION

The distribution system and facilities for the water system are shown in **Figure 1.3**, with enlargements shown in **Figures 1.3A** through **1.3E**. The system currently serves a combined total of 156 accounts, with approximately 126 of these accounts using water.

The water system is supplied by four groundwater wells, two storage tanks, and one booster pump station (BPS). The system is divided into four pressure zones. The 2128 and 2409 Zones are served the LWWUA and Whispering Pines Tanks, respectively. The 2230 Zone is supplied through a pressure reducing valve (PRV) from the 2409 Zone. Mt. Park is a separate Group B system and served directly by the Mt. Park well.

A vertical representation of the District is shown on the hydraulic profile in **Figure 1.4**.

SOURCE DESCRIPTIONS

Homestead Well [S01]

The 8-inch-diameter well was drilled in 2012 to a total depth of 292 feet, with a casing installed to 58 feet below grade. The ground conditions below 28 feet are primarily sandstone and shale, with the water entering primarily from a depth of 277 feet. There is no well screen. The static water level is 85 feet below the top of casing. The well is sealed with bentonite to 57 feet. The well was equipped in 2015 with a 5 horsepower (hp), 55 gallons per minute (gpm) pump. Drawdown was tested at approximately 5 feet at 50 gpm and 15 feet at 100 gpm, with an additional 7 feet if the Brown Road Well is running. The well discharges into the Combined Booster Station, where it is metered and liquid chlorine is injected.

Brown Road Well [S02]

The well was constructed in 1993 and equipped in 2002, with the pump replaced in 2015. The well is approximately 255 feet deep, with a static water surface elevation of 66 feet below the top of casing. The well is cased to 23 feet and sealed with bentonite, but it is unknown if it is equipped with a well screen. It is assumed to be an open bottom casing. The shallow casing was keyed into bedrock and should preclude any of the shallow water from directly entering the well. The well discharges into the Combined Booster Station, where it is metered and liquid chlorine is injected. Old records indicate the pump is a Grundfos model 60S75-13, though the average metered output of 53 gpm is significantly lower than the 80 gpm that would be expected from that pump model.

DISTRICT BOUNDARY

LAKE WENATCHEE WATER USERS RESERVOIR (2128 ZONE)

WHISPERING PINES RESERVOIR (2409 ZONE)

LAKEVIEW PRV

COMBINED BOOSTER

HOMESTEAD WELL

LAKE WENATCHEE WATER USERS WELL

FIR Dr. PRV

MOUNTAIN PARK WELL

BROWN ROAD WELL

Lake Wenatchee Hwy

N. Shore Dr

Lakeview Dr

Fir Dr

Maple Dr

Brown Rd

Fir Rd

LAKE WENATCHEE

LEGEND

WATERMAIN SIZES

- 2" HDPE
- 2" PVC
- 3" PVC
- 4" PVC
- 6" PVC
- 8" PVC

PRESSURE ZONES

- MT PARK
- 2128'
- 2230'
- 2409'

Figure 1.3: System Overview

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 1/8 mile

0" 1/2" 1"

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 10/21/2019 JOB: LWW 217.010

FILE NAME: LWWSP19-P-SYSMAP.DWG

RH2

LEGEND

METER
VALVE
HYDRANT
AIR VALVE

WATERMAIN SIZES

- SERVICE LINE
- 2" HDPE
- 2" PVC
- 3" PVC
- 4" PVC
- 6" PVC
- 8" PVC

PRESSURE ZONES

- MT PARK
- 2128'
- 2230'
- 2409'

(2) 2" BRASS
CURB STOPS

Lake Wenatchee Hwy

2" BRASS
CURB STOP

N. Shore Dr

LAKE WENATCHEE

12" PIPE FOR CT
MOUNTAIN PARK WELL

W

2" BRASS
CURB STOP

WELL HOUSE

Figure 1.3A: Mt Park System

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 100 ft
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 10/21/2019
JOB: LWW 217.010
FILE NAME: LWWSP19-P-SYSMAP.DWG

RH2

WHISPERING PINES
2409 ZONE RESERVOIR

Lakeview Dr

LAKEVIEW
Dr. PRV

FIR Dr. PRV

Fir Dr

Maple Dr

Old Brown
Rd Reservoir

HOMESTEAD
WELL

12" PIPE FOR CT

COMBINED
BOOSTER

BROWN
ROAD WELL

LEGEND

HYDRANT
AIR VALVE
METER
VALVE

WATERMAIN SIZES

- SERVICE LINE
- 2" HDPE
- 2" PVC
- 3" PVC
- 4" PVC
- 6" PVC
- 8" PVC

PRESSURE ZONES

- MT PARK
- 2128'
- 2230'
- 2409'

Figure 1.3B: 2230 & 2409 ZONES

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 200 ft
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 10/21/2019
FILE NAME: LWWSP19-P-SYSMAP.DWG

JOB: LWW 217.010

Lake Wenatchee Water District

RH2

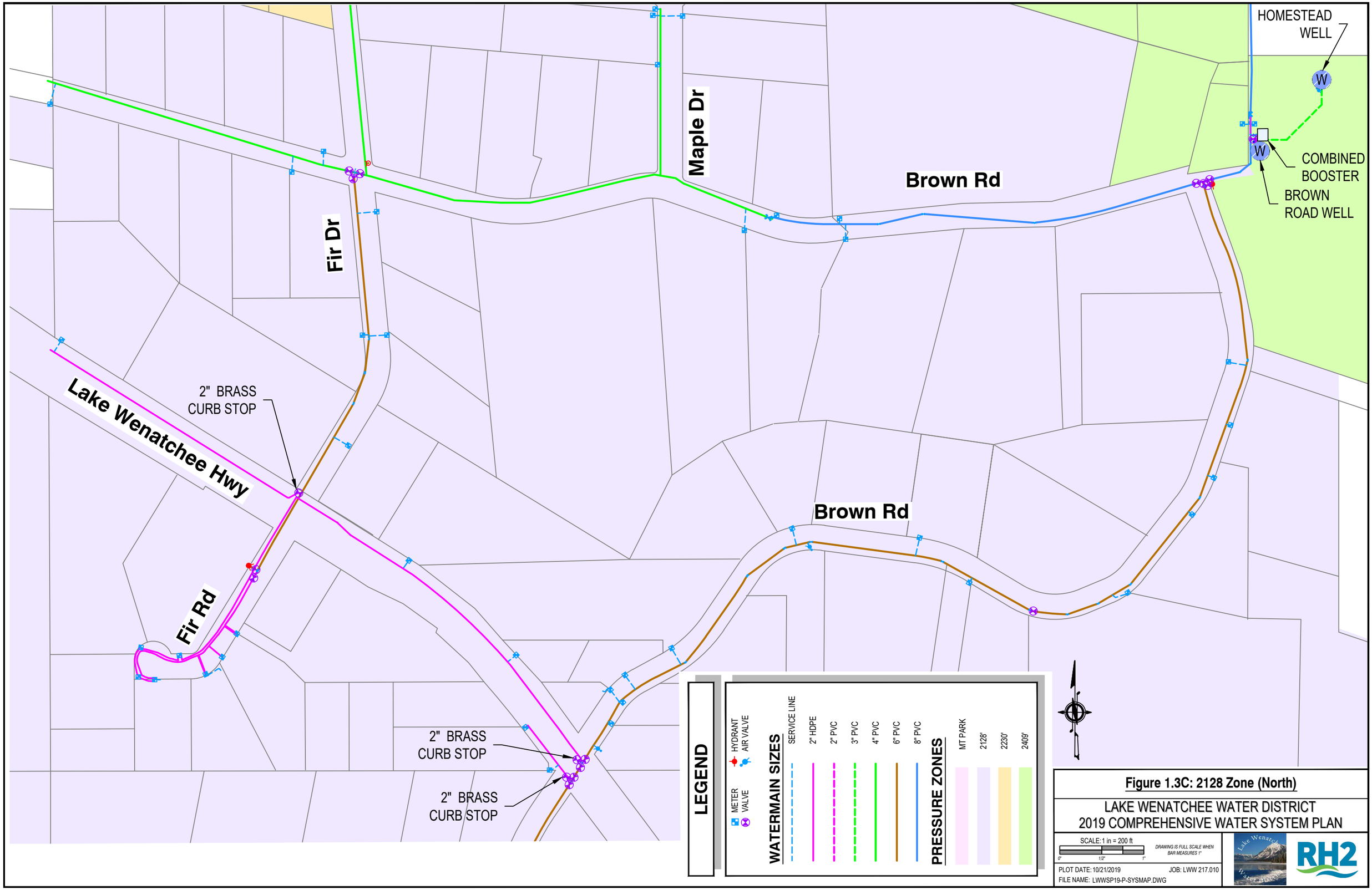


Figure 1.3C: 2128 Zone (North)

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 200 ft
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 10/21/2019 JOB: LWW 217.010
FILE NAME: LWWSP19-P-SYSMAP.DWG

RH2

Lake Wenatchee Hwy

2" BRASS
CURB STOP

TELEMETRY
REPEATER

Fir Rd

LOOPED 2" HDPE
FOR CIRCULATION

2" BRASS
CURB STOP

2" BRASS
CURB STOP

N. Shore Dr

Brown Rd

LAKE WENATCHEE

LEGEND

METER
VALVE
HYDRANT
AIR VALVE

WATERMAIN SIZES

- SERVICE LINE
- 2" HDPE
- 2" PVC
- 3" PVC
- 4" PVC
- 6" PVC
- 8" PVC

PRESSURE ZONES

- MT PARK
- 2128'
- 2230'
- 2409'

Figure 1.3D: 2128 Zone (South)

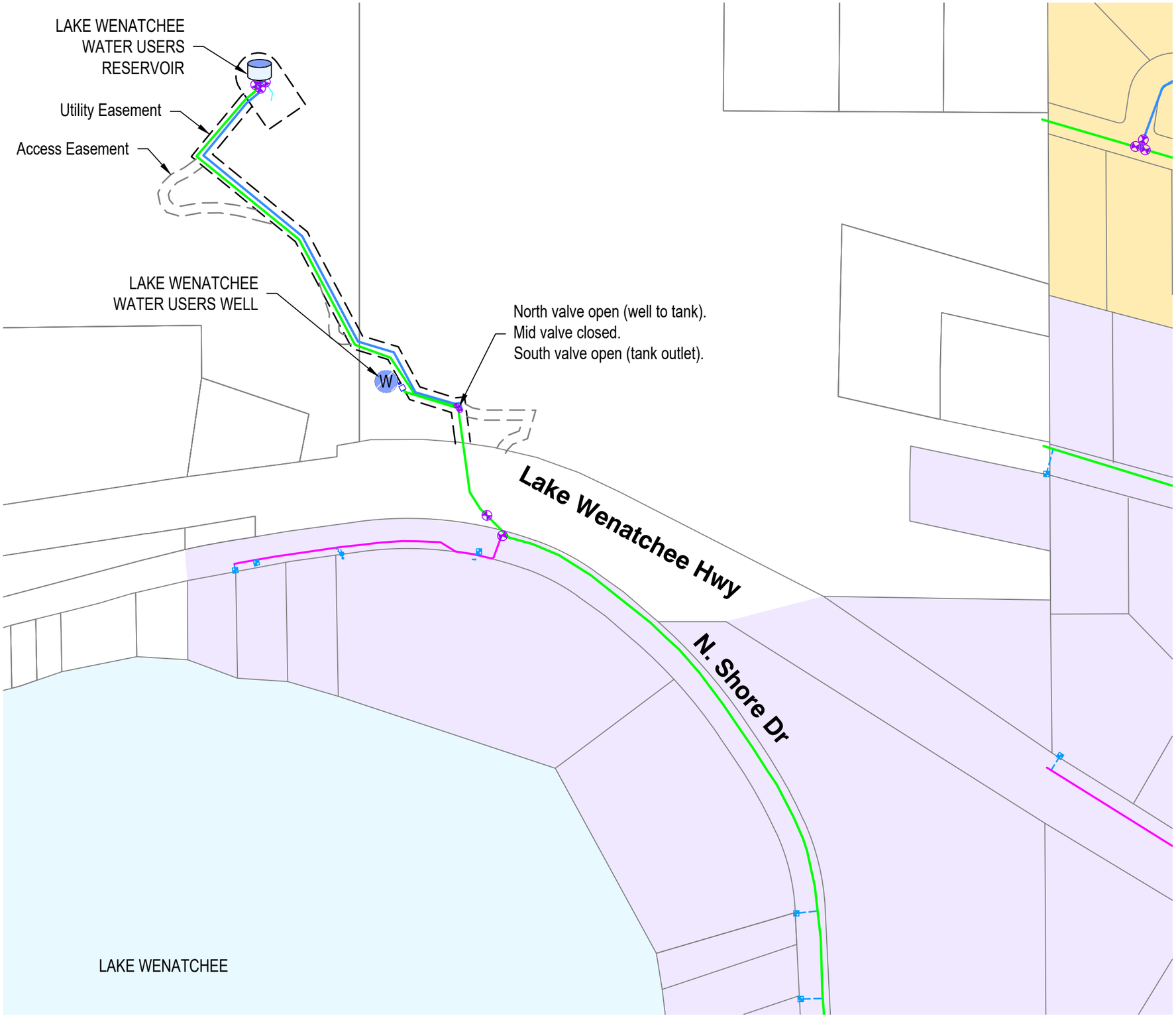
LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 200 ft
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 10/21/2019
FILE NAME: LWWSP19-P-SYSMAP.DWG

JOB: LWW 217.010

RH2



LEGEND

METER
HYDRANT
VALVE
AIR VALVE

WATERMAIN SIZES

- SERVICE LINE
- 2" HDPE
- 2" PVC
- 3" PVC
- 4" PVC
- 6" PVC
- 8" PVC

PRESSURE ZONES

- MT PARK
- 2128'
- 2230'
- 2409'

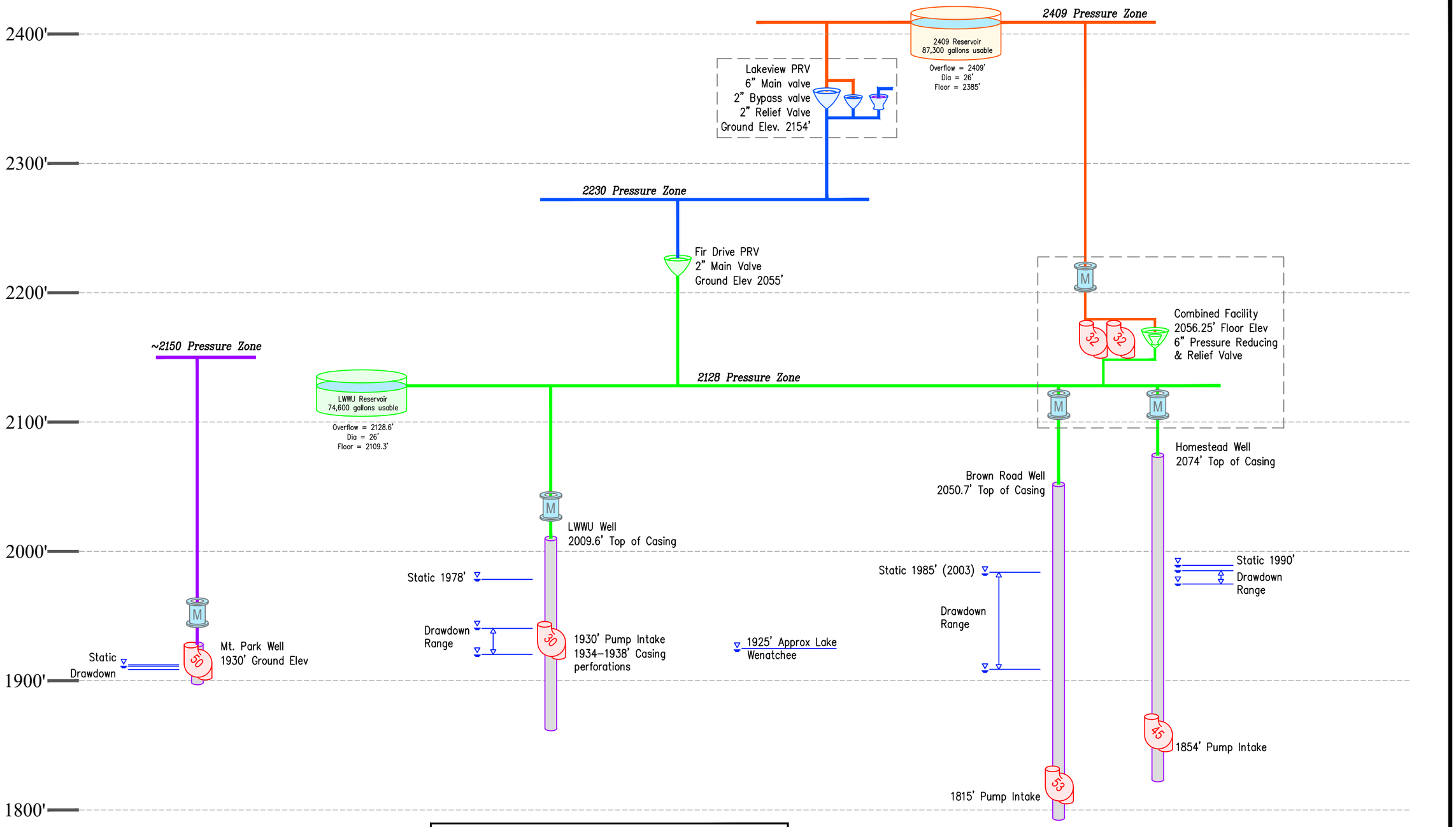
Figure 1.3E: LWWU Well and Reservoir

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 200 ft
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 10/21/2019
JOB: LWW 217.010
FILE NAME: LWWSP19-P-SYSMAP.DWG

RH2



Elevations shown are taken from the RH2 Engineering 2015 water system consolidation project, using a 2012 survey by Fitzpatrick Surveying. The 2012 survey based the vertical datum on the 2001 Erlandsen & Associates plans for the LWWU Reservoir, which show the reservoir overflow pipe at 2128.6'. The 2001 plans stated the vertical datum as "NAVD 1988 (feet) as derived by GPS observations." The resulting elevations appear to be roughly 50' higher than those implied on USGS mapping and the 1994 Whispering Pines plans prepared by IntegriTech. No reconciliation of vertical control has been performed for this hydraulic profile.

Legend

- 2409 Zone
- 2230 Zone
- 2128 Zone
- Mt Park Zone
- Flow Meter
- Pump with flow in gpm
- Pressure Reducing Station (#)=Number of stations
- Pressure Relief Valve

Figure 1.4 Hydraulic Profile

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: No Scale
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"
0" 1/2" 1"

PLOT DATE: 10/21/2019
JOB: LWW 217.010
FILE NAME: LWWSP19-F-HPRO.DWG

Whispering Pines Spring [S03]

An unnamed spring located west of Barnard Creek at approximately 2,900 feet in elevation originally provided water for Whispering Pines. The spring was isolated from the domestic water system in 2015 but still provides irrigation water, and is listed as an emergency supply source. The spring's 2-inch polyvinyl chloride (PVC) piping was installed in 1993 and flows by gravity to a 4,000 gallon reservoir.

Lake Wenatchee Water Users Well [S04]

This well was constructed in 1993 and equipped by the Lake Wenatchee Water Users in 2001. In some documents, this is also called the Dickinson Well. The 8-inch-diameter well is approximately 137 feet deep with a casing length of 81 feet and 56 feet of open boring situated in bedrock. The well casing is perforated from 72 to 76 feet with 1/8-inch by 1-inch slots, and the static water surface elevation is at 34 feet below the surface. The top of the casing is at elevation 2,009.6 feet.

The well is equipped with a 3 hp Berkley submersible well pump with a design capacity of 30 gpm. The well pump operates with a discharge capacity ranging between 20 and 37 gpm depending on the drawdown elevation of the water in the well, which varies seasonally. The pump controls and reservoir telemetry system are located in an above-grade well house. The meter was replaced in 2015, and liquid chlorination was added in 2015.

Mt. Park [S01]

Water supply for the Group B system is provided by a well located at the end of an unopened County right-of-way approximately 75 to 100 feet from the Lake Wenatchee shoreline near 17679 North Shore Drive. The well is located in a 4-foot-diameter concrete manhole and is reportedly a hand dug well that is approximately 20 feet deep. The well is equipped with an unknown pump with a reported capacity of 50 gpm. Adjacent to the well is a pump building housing three hydropneumatic tanks, a control system, and the electrical service for the well pump and pump building. The water is chlorinated. The meter and chlorination equipment were replaced in 2015 with the inclusion of 12-inch pipe to increase chlorine contact time. A riser was added to the manhole in 2015 to extend above the Lake Wenatchee ordinary high water mark.

A summary of the wells is shown in **Table 1.1**.

Table 1.1
Well Data

Source Name	Year Drilled	Well Diameter	Type	Top of Casing Elev.	Total Well Depth	Static Water Depth	Drawdown at 50 gpm (2)	Drawdown at 100 gpm (2)	Drawdown at 50 gpm + Adjacent Well (1)
Homestead [S01] (DOE tag BCF940)	2012	8 inch	Cased to 58'. Open Bottom.	2,074.0 ft	292 ft	85 ft	4 ft	14 ft	7 ft
Brown Road [S02]	1993	8 inch	Open Bottom.	2,050.7 ft	255 ft	66 ft to 117 ft	80 ft	n/a	90 ft
Whispering Pines Spring [S03] (DOE tag AGJ090)	n/a	n/a	Spring	2,120 ft (ground)	n/a	n/a	n/a	n/a	n/a
Lake Wenatchee Water Users [S04]	1993	8 inch	Perforated Casing from 72' to 76'	2,009.6 ft	137 ft	32 ft	40 to 90 ft	> 100 ft	n/a
Mt. Park / Zufall [S01]	Unknown	48 inch	Caisson	1,932 ft	20 ft	~ 5 ft	Unknown	n/a	n/a

(1) Only applicable for Homestead and Brown Road. Drawdown when both wells are running.
(2) Drawdown measured from static level.

RESERVOIRS

The District has two gravity storage reservoirs with a combined total volume of 171,900 gallons as shown in **Table 1.2**.

Table 1.2
Reservoir Data

Tank Name	Year Built	Material	Overflow Elev.	Floor Elev.	Inside Diameter	Volume (Floor to Overflow)
Lake Wenatchee Water Users	2001	Concrete	2,128.6 ft	2,109.3 ft	26.0 ft	76,600 gal
Whispering Pines	2015	Concrete	2,409.0 ft	2,385.0 ft	26.0 ft	95,300 gal

PUMPS

The only booster station is the Combined Booster which pumps from the 2128 Zone into the 2409 Zone. The building also houses the Brown Road and Homestead Wells meters and chlorinator, and the master telemetry unit. The facility was built in 2015. Data for the pumps is shown on **Table 1.3**.

Table 1.3
Well and Booster Pump Data

Pump Name	Year Installed	Brand	Model	Motor Power	Pump Elev.	Design Head	Design Flow	Actual Flow Range
Homestead Well	2015	F&W	4F55S30	5.0 hp	220 ft BG	160 ft	55 gpm	40-60 gpm
Brown Road Well	2003	Grundfos	60S75-13	7.5 hp	235 ft BG	200 ft	80 gpm	45-56 gpm
LWWU Well	2001	Berkley	Unknown	3.0 hp	80 ft BG	Unknown	30 gpm	20-37 gpm
Mt Park Well	Unknown	Unknown	Unknown	3.0 hp	~15 ft BG	Unknown	50 gpm	Unknown
Combined Booster 1	2015	Goulds	5SV-11	5.0 hp	2,060 ft	291 ft	32 gpm	31-35 gpm
Combined Booster 2	2015	Goulds	5SV-11	5.0 hp	2,060 ft	291 ft	32 gpm	31-35 gpm

BG = Below Grade

PRESSURE CONTROL VALVES

There are three pressure control stations.

The Lakeview Drive station supplies the 2230 Zone from the 2409 Zone with a 2-inch lead PRV, a 6-inch lag PRV for emergency flows, and a 2-inch pressure relief valve that will open to protect the 2230 Zone if either PRV fails open.

The Fir Drive station includes a 2-inch PRV to supplement the 2128 Zone, but is intended to be inactive except during unusually high demands or if the Whispering Pines Spring supply is temporarily reconnected to the system in an emergency.

The Combined Booster has a 6-inch PRV to supply emergency demands to the 2128 Zone from the 2409 Zone. This valve also has a pressure relief feature that will open to protect the 2409 Zone should the pumps be running, a downstream valve is closed, and the high pressure sensor fails to shut off the pumps. It also can be used to supply the system as a closed zone if the 2409 tank needs to be isolated for maintenance. Control valve data is shown in **Table 1.4**.

Table 1.4
Pressure Control Valve Data

Valve Location	Type	Diameter	Model	Valve Elev.	High Zone	Low Zone	Upstream Pressure	Pressure Setpoint
16729 Lakeview Dr. (Main)	Pressure Reducing	6 inch	Cla-Val 90G-01 BCSVYKC	2,150 ft	2,409 ft	2,230 ft	110 psi	30 psi
16729 Lakeview Dr. (Bypass)	Pressure Reducing	2 inch	Cla-Val 90G-01 ABCSVKC	2,150 ft	2,409 ft	2,230 ft	110 psi	35 psi
16729 Lakeview Dr. (Relief)	Pressure Relief	2 inch	Cla-Val 50G-01 VKC	2,150 ft	2,409 ft	n/a	110 psi	40 psi
16856 Fir Drive	Pressure Reducing	2 inch	Wilkins 600XL	2,050 ft	2,230 ft	2,128 ft	78 psi	28 psi
Combined Booster	Pressure Reducing & Relief	6 inch	Cla-Val 90G-28 BCSYKCO	2,060 ft	2,409 ft	2,128 ft	149 psi	15 psi (reduce) 160 psi (relief)

PSI = Pounds per square inch

PIPELINES

Water is distributed through 4.7 miles of pipe ranging from 2-inch to 12-inch diameter. About two thirds of the pipe was installed in 2015. The pipe data is shown in **Table 1.5**.

Table 1.5
Pipeline Data

Material & Diameter	Installation Year				
	Unknown	2001	2004	2015	Total
Ductile Iron					
8 inch				85 ft	85 ft
12 inch				66 ft	66 ft
HDPE					
2 inch CTS				586 ft	586 ft
2 inch IPS				3,770 ft	3,770 ft
PVC					
2 inch	198 ft	20 ft			219 ft
3 inch				206 ft	206 ft
4 inch	4,653 ft	1,053 ft	1,606 ft		7,312 ft
6 inch				4,939 ft	4,939 ft
8 inch		948 ft		6,611 ft	7,559 ft
Total	***4,851 ft***	***2,021 ft***	***1,606 ft***	***16,263 ft***	***24,742 ft***

DISTRICT POLICIES

District policies and procedures are discussed in this section, and **Appendix C** contains the District Administrative and Operating Directives. If there is a conflict with the text in this chapter, **Appendix C** shall govern.

DISTRICT AUTHORITY

The District shall have the power at any time, without notice, to amend, change, or modify any rule, rate, or charge, and make rates or contracts. All water service is subject to such power.

DEFINITIONS

Connection Charge: A cash payment by the customer to offset a portion of the total facilities costs necessary to provide water service.

Developer Extension: An extension of the District's water supply system constructed by a person or party other than the District, pursuant to an approved Developer Extension Application.

Developer Extension Application: A document that sets forth the agreement between the Developer and the District pertaining to an application for permission to build water facilities that will be connected to the District's water supply system. It should address the District's fees, which include connection charges, time and material charges, performance and maintenance bonds, design, format and District standards, general conditions, warranties, check lists, prints, and other fees as appropriate.

District: Lake Wenatchee Water District.

District's Cost: All costs incurred by the District including, but not limited to, labor costs, material costs, consulting fees, equipment charges, and administrative costs.

District's Water Service Line: That portion of a water line in a street, right-of-way, or easement running from a water main or corresponding stub line to the property line of the customer. It shall include saddle, corporation stop, water service line, meter setter, meter, meter box, or any combination thereof that may be required to furnish the requested water service.

Equivalent Residential Unit (ERU): A unit of measure of daily water consumption used to equate non-residential or multi-family residential water usage to a specific number of single-family residences. Monthly water service and connection charges are based on the number of ERUs each water service is assigned. An ERU will be defined as the estimated quantity of water used by a single-family residence within a medium density (1/2 to 1/6-acre per lot) development. Determination of the number of ERUs for each connection shall be assigned by the following minimum requirements:

- Water services with multiple residences shall be assigned 1 ERU per residence, except for those residences with occupancy of 6 months or less.
- Services providing water to multiple businesses will be assigned 1 ERU per business or higher as appropriate for the anticipated water use.
- Assignment of the number of ERUs may be adjusted based on actual water use records compared to District averages for single-family residential water use.
- Multiple ERU water services shall be rounded to the nearest whole number.
- New water services will be assigned ERUs based on estimated water demand using the DOH *Water System Design Manual*.

Local Facilities: The water distribution facilities located adjacent to and providing water service to a specific parcel of property.

Owner Water Service Line: That portion of a water line lying on privately owned property that runs from the water meter to the point of use.

Temporary Water Service: Water service intended to terminate prior to the end of the useful lives of the facilities used to provide the water service.

Water Meter: The device that measures the volume of water consumed by a District customer.

Water System General Facilities: Those facilities that are necessary to provide water supply, transmission, and storage to the local distribution systems serving the District's customers. Water system facilities include, but are not limited to, water storage reservoirs and standpipes, water supply sources, water supply pumping stations, water booster stations, water transmission mains, telemetry and control equipment, water system pressure regulation, operation and administrative buildings, and equipment and emergency operation facilities.

WATER SERVICE AREA POLICIES

The water system does not wholesale water. Water service will not be permitted outside of the approved water service area boundary. Extension of the system within the water service area will be allowed. Extensions must meet the design and performance standards within this WSP and be approved by the District.

Currently, water from the domestic water system is used for irrigation purposes.

SATELLITE MANAGEMENT AGENCIES

The District has no current plans to manage any satellite systems.

WATER SERVICE POLICIES

Conditions of Water Service

1. The District will provide the meter and District's water service line to serve the customer as part of the hook-up fee. For new developer extensions, the District's water service line is installed at the Developer's cost as part of the initial extension. The size of the meter is determined based on estimated peak flow rates for the water service.
2. If excessive water pressure exists at the customer's service connection, the customer shall furnish and install at his own expense, a water pressure reducing valve. Property owners assume all responsibility for damage to property and/or persons resulting from excessive water pressure. The District will notify all customers in which static pressures at the meter exceed 80 pounds per square inch (psi).
3. The customer shall hook up to the District-provided water meter service within 60 days of request by the District.
4. Prior to installation of meters by the District, inspection of the customer's plumbing is required to ensure cross connections to the irrigation system do not exist.
5. The water service line from the meter to the customer's point of use will be installed and maintained by and at the customer's expense.
6. If public water mains are extended adjacent to the customer's property after the District's request for customer hook-up, it is the practice of the District to relocate the customer's water service meter to a location abutting the customer's property. The entity or person responsible for the extension shall pay all costs and expenses in relocating the water service. The customer shall perform all work and pay all costs in relocating the customer's water service line from the point of use to the relocated water service.
7. The customer shall indemnify and hold the District harmless from any and all claims, actions, or causes of action of every kind and nature that may be asserted against the District as a result of the customer's ownership, installation, maintenance, use, or service of the water service line commencing at the District's water meter and extending to the customer's point of use. The customer shall pay all costs and/or attorney's fees incurred by the District in defending such action or actions.

Where Water Service is Provided and Service Limitations

The District will provide water service to all of the area within the approved water service area boundary where facilities are available and to other areas within the water service area boundary that may be in the best interest of the District. Water services are limited to existing customers and an established number of additional connections. Water usage and water rights will be monitored annually to determine adequacy of water rights and system performance. Water rights may limit water usage and number of connections.

Water Service Application Required

Applications for the use of water shall be made on printed forms to be furnished by the District. The applicant shall fully and truly state all purposes for which the water may be required and also agree to conform to the rules and regulations as a condition for the use of the water. In case the premises of the applicant are connected for water service as a result of his application being accepted, the application shall be considered a contract. The applicant, by his signature thereon, shall agree to abide by such rates,

rules, and regulations in effect at the time of signing the application or that may be adopted by the District and shall pay all bills promptly. An application form is provided in **Appendix C**.

Water Service Responsibility of District

The District will exercise reasonable diligence and care to furnish and deliver a continuous and sufficient supply of water meeting or exceeding regulatory requirements to the customer and avoid any shortage or interruption of delivery of the same. The District will not be liable for high or low pressure conditions, interruption, storage, or insufficiency of supply, or loss or damage occasioned thereby. The use of water upon the premises of the customer is at the risk of the customer, and the responsibility of the District shall cease at the point of delivery of the water, except as required by state guidelines for water quality. The point of delivery shall be the point where the water service line connects to the customer's line. Water will be furnished for ordinary domestic, business, and community purposes only.

Water Service Interruption

The District will exercise reasonable care to provide adequate and continuous water service but does not guarantee the same and shall not be liable for injury, loss, or damage resulting from any failure or curtailment of water service, nor shall such failure or curtailment constitute a breach of contract. The District shall have the right to temporarily suspend water service for the purpose of making repairs or improvements to its facilities. In such case, when practicable, advance public notice shall be given and every effort will be made to make interruptions as short as possible and at such times as will cause the least inconvenience to the customer.

Installation of Water Service Line

When a permit for water service has been granted, the service pipe and connections from the main to the meter will be installed and maintained by the District and kept within its exclusive control. At the District's discretion, the service pipe and connection will be installed by a licensed contractor hired and paid by the customer. Water service lines and meters will be installed within 30 days of receipt of a completed water service application.

Water Service – Size and Location

The District will furnish and install a water service of such size and at such locations as the applicant requests, provided the requests are reasonable. It is preferable that water services not be over 300 feet from the meter to the point of use to maintain adequate pressure. Water service over 300 feet in length is permitted; however, the District will not guarantee adequate pressure for these water services.

The customer's water service pipe should be at a depth of 48 inches. The water service pipe shall be installed at a location mutually agreeable to the District and the customer. The District will install the meter, meter box, and a short piece of pipe beyond the meter box, to which the customer will connect his water service.

Multiple Water Services

A single ownership parcel may serve up to three structures or dwelling units from a single meter. The property owner shall apply for and obtain permission from the District prior to connecting multiple buildings and/or dwelling units. The District shall evaluate each application on a case by case basis.

Customer Line Repair Responsibility

The customer line on the private property side of the meter must be kept in repair by the owner or occupant of the premises. The owner will be responsible for all damages resulting from breaks in said pipe or water service, along with water loss resulting from said break or leak.

If the customer's water service fails, he shall endeavor to determine if he has a broken water service line or a broken pipe inside or under the house. If a water serviceman is sent to the customer's premises at the customer's request after regular working hours, and it is determined that the problem is caused by failure of the customer's line or equipment, a charge may be made. A main shut-off valve is recommended to be installed by the customer for his use and convenience.

The District does not recommend resistance thawing (utilizing electrical energy to thaw pipes) and disavows all liability associated with its use. Damage to the customer's electrical system due to resistance thawing is the responsibility of the customer.

Water Service Line Leaks

A leak in the water service line from the meter to a point of use is the responsibility of the property owner. The District may reduce a property owner's metered water bill when a leak has occurred in the property owner's water service line or plumbing without the knowledge of or negligence of the property owner. An adjustment in the property owner's bill will be made for excess water registered by the customer's meter. The adjustment shall be based on a reduction in the metered consumption to an amount equal to 150 percent of the average of the previous 2 years metered water consumption for the same billing period. In the event the leak occurs on the water service of a new customer with no previous water consumption history, the District shall base the determination of excess consumption on the metered water consumption of adjacent properties of similar character for the same billing period of the two previous years, or if no such homes exists, postpone adjustment until a history has been established.

Water Service Meters

The District will install all the necessary meters for measuring the water service used by the customer. The meter, even though the meter charge has been paid by the customer, will remain the property of the District.

The District reserves the right to determine the size and type of meter to be installed for each specific location. The size and type of meter will depend on the rate of flow of water through the meter and the total water consumption.

All meters will be sealed by the District at the time of installation, and no seal shall be altered or broken, except by a District-authorized employee.

Permanent changes in the size of the meters and/or water service connections shall be made on request of the customer. The customer will be charged for all conversions on the basis of the actual cost to the District. If a customer increases the total water consumption on the premises served to a point where the meter is operating beyond its rated capacity or decreases the total water use to a point where the meter is too large to accurately indicate the water used, the District may, upon notification to the customer, change the size of the meter and bill the actual cost to the customer.

The meters will be maintained by the District and will be inspected from time to time and tested for accuracy.

No meter will be placed in water service or allowed to remain in service that is known to have an error in registration in excess of 2 percent under conditions of normal operation.

The District, its duly authorized agents or employees shall have the right to install meters on the customer's premises and shall, at all reasonable times, have the right to enter or leave the customer's premises for the purpose of installing, reading, repairing, testing, maintaining, or reinstalling the meter and its related appurtenances.

Customers shall take every reasonable precaution to protect meters from damage by frost or otherwise and shall be liable for injury to meters resulting from their neglect. It is unlawful for any person to disconnect or remove any meter when installed as provided in this WSP. In the case it becomes necessary to move a meter, a permit to do so must be obtained from the District.

Customers shall keep their premises adjacent to the meter free from all rubbish or material of any kind that will prevent employees of the District from having access to the meter.

Water Service Discontinuance

Water service may be temporarily discontinued because of unforeseen emergencies or other reasons beyond the control of District, or for necessary maintenance and repair of the water system. In case the supply of water shall be interrupted or fail for any such reason, accident, or any other cause, the District shall not be liable for damages for such interruption or failure, nor shall such failure or interruption for any reasonable period of time be held to constitute a breach of contract on the part of the District or in any way relieve the customer from performing its obligations to the District.

Where water is wastefully or negligently used on a customer's premises that seriously affects the general water service, the District may discontinue water service if such conditions are not corrected after due notice by the District.

Water services may be discontinued to customers having delinquent bills if action is necessary to enforce collection.

PLUMBING FACILITIES REQUIREMENTS

Customers shall install, maintain, and operate their plumbing systems using the District water supply in accordance with Washington State plumbing codes.

Swimming pools, wading pools, decorative pools, or other such devices shall be constructed so the conduit or pipes supplying water from the District system shall be at least 1 foot above the top of the overflow gutter or maximum possible surface.

In the event a customer is served by more than one water service from the District on the same premise, and the plumbing is interconnected within the premise, a check valve suitable to the District shall be installed on the customer side of each meter to prevent reverse flow through a meter.

The District will not be liable for any damage to the customer's electrical system as a result of resistance thawing of frozen pipelines.

PRESSURE AND SUPPLY

Pressure and supply will be maintained within the state requirements and guidelines, as indicated in the **Distribution System Analysis** section in **Chapter 3** of this WSP.

DISCONTINUANCE AUTHORIZED WHEN DISTRICT NOT LIABLE FOR CUSTOMER EQUIPMENT

The District shall not be liable for any loss or damage of any nature whatsoever caused by any defect in the customer's line, plumbing, or equipment. The District may, without further notice, discontinue water service to any customer when a defective condition of plumbing or equipment upon the premises of the customer results or is likely to result in interference with proper water service or contamination of water.

DAMAGE TO DISTRICT PROPERTY

Any person damaging District-owned property or facilities shall pay a tampering charge to the District as provided herein. The term damaging shall have its ordinary dictionary meaning and shall include without limitation, vandalizing, destroying, applying graffiti, or other unauthorized painting or coloring, or affecting the facilities in such a manner that operating efficiency or appearance is negatively impacted.

The person and/or persons causing and/or substantially contributing to tampering, as provided herein, shall pay an amount equal to the aggregate of the following:

1. The District's cost of repair or replacement of the tampered with item.
2. Any other District's costs.
3. A fee for using the District's tampered with facility.

INSPECTION – ACCESS AUTHORIZATION

The District will only enter the customer's premises with their permission. The District will inform the customer that the District's survey of a customer's premises, by the District or his representative, is for the sole purpose of establishing the District's minimum requirements for the protection of the public water supply system, commensurate with the District's assessment of the degree of hazard. Should the customer fail to provide permission to access the premises for inspection purposes, action as outlined under the Cross-Connection Control Program may be taken.

CROSS CONNECTIONS

Cross connections between the District's potable water system and a non-potable system shall be protected by District-approved backflow prevention devices to avoid contamination of the District's water quality. Backflow prevention assemblies, when required, shall be installed and maintained by the customer. Backflow prevention assemblies shall be inspected and tested upon installation, after any repairs, annually, and when considered necessary by the District. The District shall notify the customer not less than 60 days before due that an annual test is required. Tests must be performed by a person so certified by DOH and results delivered to the District. Backflow assemblies shall be repaired, overhauled, or replaced whenever they are found to be defective. If a customer fails to install necessary backflow prevention devices, does not comply with testing requirements, or does not repair faulty devices, the District will terminate water service.

COMPLAINTS

All complaints will be initially received by either the District's Commissioners or operator and will be addressed by the Commissioners at their next scheduled meeting. If additional investigation is required, the work will be performed by the Commissioners, District operator, or consultant, as directed by the Commission. Final resolution of the complaint will be addressed by the Commissioners, and a written response of the proposed resolution will be provided to the complainant.

DUTY TO SERVE

The District has the duty to serve all customers within the retail water service area if all of the following conditions can be met:

1. The District has sufficient capacity to serve 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 District can provide such service in a timely and reasonable manner.

In areas requiring a developer's extension, timely water service does not start until all of the provisions of the developer's extension agreement are satisfied, application forms are filled out, and applicable connection charges and fees are paid in full. If construction of a water main extension is required to provide service, the cost of such extension will be paid by the customer(s) requesting service.

Appeals to the District's policies will be addressed at regular or special meetings of the Board of Commissioners, and a record of the appeal shall be written in the meeting minutes.

LOCAL PLANNING CONSISTENCY

The Growth Management Act (GMA) requires planning consistency from two perspectives. First, it requires consistency of plans among jurisdictions. This means that city and County plans and policies must be consistent. Second, the GMA requires the implementation of the WSP be consistent with the comprehensive plans. The 2003 Municipal Water Law also requires that water system plans be consistent with local plans and regulations. The signed consistency statement checklist from the County's Planning Department included in **Appendix A** documents the determination that this WSP is consistent with their plans and regulations.

The County Board of Commissioners adopted the *Chelan County Comprehensive Plan* in 2000. Since that time, the plan has been amended several times, with the most recent amendment occurring in 2017. The County's *Comprehensive Plan* guides development in unincorporated Chelan County and designates land use in the unincorporated Urban Growth Areas.

The District's retail water service area is in a rural setting located in unincorporated Chelan County. The basic planning data used in **Chapter 2** is based on the County's *Comprehensive Plan* and projections from the Office of Financial Management. As part of the WSP approval process, the County will be asked to determine if this WSP is consistent with the land use plan for this area.

CURRENT AND FUTURE LAND USE

The largest percentages of lands within the District's retail water service area are designated as Rural Residential and Rural Waterfront. Almost all of the existing connections in the District are located on lands designated as Rural Recreation and Rural Waterfront. **Figure 1.2** shows the land use designations within the District.

ADJACENT WATER SYSTEMS

The adjacent water systems described here are shown on **Figure 1.1**.

The USFS's Lake Wenatchee Ranger Station complex is a Group A system consisting of three administration buildings, a shop, six permanent residences, and five mobile homes. The complex's water system also serves five seasonally occupied summer cabins. The number of employees served varies

depending on seasonal use. The water source for this Group A system is a well and pumping system capable of delivering 41 gpm. Reportedly, water rights exist for the well and water quality has not been a problem in the past. Static water level for the pump is 16 feet, and the pump is set at 218 feet below grade. It is unknown if the source is equipped with a meter or if the water is treated. Water from the well is pumped to a 50,000-gallon storage reservoir that provides supply to all users to maintain system pressure. The overflow elevation of this reservoir is reportedly 2,128 feet above mean sea level (AMSL). The size and extent of the distribution system is unknown. However, several municipal-style hydrants (integral valve with operating nut on bonnet) have been observed around the complex.

There are two additional water system purveyors along the north shore of Lake Wenatchee. The existing retail water service area of the Alpine Water District is approximately 1.5 miles to the east and provides water service to the Lake Wenatchee YMCA camp. There is also one other Group A water system, the North Shore Park water system, which is located along the east side of the District's corporate boundary and north of Northshore Road.

2 | POPULATION AND DEMAND PROJECTION

EXISTING POPULATION

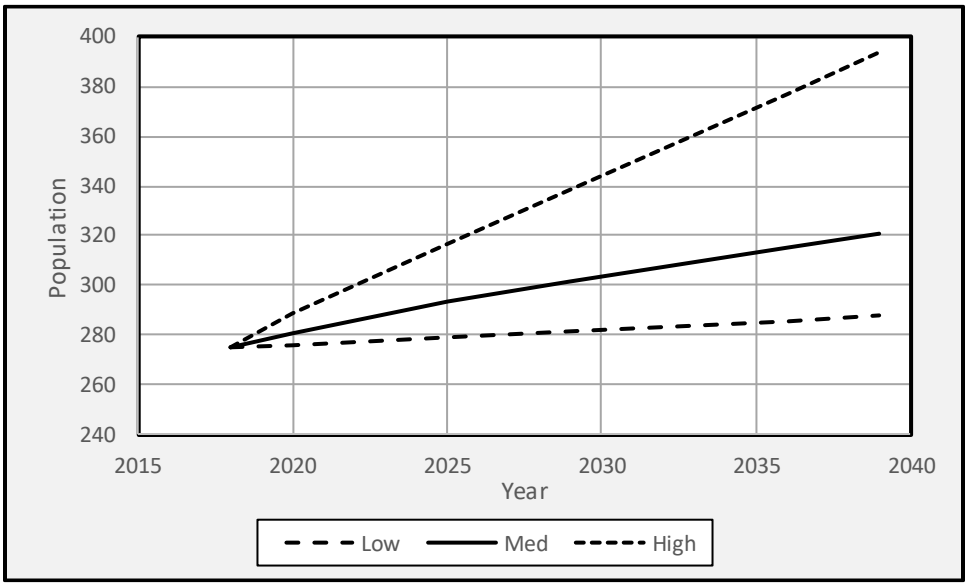
Published population estimates do not exist specifically for the Lake Wenatchee Water District's (District) service area. The District falls within Block 1 of the Leavenworth/Lake Wenatchee Census County Division (CCD) (census tract 530079602001) but occupies only about 2 percent of the tract area. Chelan County (County) estimates occupancy in this CCD using the 2014 American Community Survey (ACS) at 2.18 persons per household. With 126 active connections, this results in a population estimate of 275 persons. Note the difference between the population estimate from the 2011 Water System Plan (WSP), which used the County-wide average of 2.62 persons per household, resulting in a population estimate of 338 people.

The Office of Financial Management (OFM) estimates that population in the CCD grew from 980 in 2011 to 1,228 in 2018, a 25-percent increase. No data was found to document specifically where this growth occurred, but given no notable change in the number of water service connections during this period, it is assumed little, if any, of the population growth occurred within the District.

The Land Use Element of the County's 2017 *Comprehensive Plan* states that the County worked with the major cities to develop growth projections, which roughly followed the OFM medium range projections and were documented in County Resolution 2015-112 (**Appendix E**). The Lake Wenatchee area was not specifically identified in the projections, so it would fall into the broad "Rural" category that is projected to increase by 23 percent from 2015 to 2040, or approximately 0.8 percent per year. For comparison, the 2017 OFM projections for the County overall span from 0.2 percent annually for the low range to 2.2 percent annually for the high range.

For this WSP, the low range estimate will be used to forecast revenues, with the medium and high range estimates used to forecast consumption (**Chart 2.1**).

Chart 2.1
Population Forecasts



EXISTING WATER SYSTEM DEMANDS

It must be emphasized that the customer consumption values in this WSP are based on only one year of data, and the source of supply values are based on three years of data. The raw data has multiple errors due to registration errors of numerous meters. While all meters were installed by 2015, automated data collection of customer meters up to late 2017 was unreliable, and the accuracy of some customer and source meters has been unsatisfactory. The water demand analyses in the following sections use the data that is available and estimate what is not. The results must be read in that context.

CUSTOMER ACCOUNTS

As of 2019, the District's water system has 156 active connections. Though all connections are residential, some property owners use their land to serve temporary vacationers or gatherings. The District is aware of, but does not keep records on this practice. Many homes also are unoccupied at various times of the year. Two customers do not pay a monthly fee per a prior agreement related to transfer of water rights. Approximately 30 customers do not currently use water. The number of accounts with metered consumption ("active" columns) compared to the total number of accounts per pressure zone is shown in **Table 2.1**.

Table 2.1
Number of Customer Accounts

Zone	2017 Active	2018 Active	2018 Total
2128	86	84	106
2230	17	19	22
2409	16	15	18
Mt Park	5	6	10
Total	**124**	**124**	**156**

The total number of accounts per pressure zone by month with metered consumption are shown in **Table 2.2**. Many homes are second residences with less occupation in the winter, though some may be rented out by the homeowners.

Table 2.2
Customer Accounts with Activity by Month

Zone	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
2128	85	75	68	70	65	73	67	84	77	83	84	83	81	83	77	78
2230	17	15	16	16	16	17	16	19	19	19	18	18	17	18	16	16
2409	16	13	14	16	14	15	14	15	14	15	14	15	14	14	12	12
Mt Park	5	5	5	4	3	4	4	6	6	6	6	6	6	7	7	7
Total	**123**	**108**	**103**	**106**	**98**	**109**	**101**	**124**	**116**	**123**	**122**	**122**	**118**	**122**	**112**	**113**

CUSTOMER CONSUMPTION

Reasonably accurate reads of customer meters began in September 2017. The District has had difficulty with meter reliability, primarily with some remote transmitters either not sending data or sending erroneous data. The faulty meters and transmitters are being replaced when identified' therefore, it is assumed that data collection will improve over time.

Meters are read roughly monthly and as weather conditions permit. Reads have averaged about once every 35 days, though individual periods have ranged from 21 to 65 days. This consumption analysis has used daily averaging to estimate monthly consumption. The average day consumption per month by pressure zone is shown in **Table 2.3**.

Table 2.3
Monthly Consumption (gallons per day (gpd))

Zone	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
2128	17,681	7,150	6,770	6,665	7,230	14,989	18,757	7,786	16,397	18,681	25,239	25,580	21,737	9,566	8,533	23,694
2230	2,141	901	1,330	1,667	1,251	947	1,153	2,584	7,494	3,680	3,404	3,343	1,970	1,487	1,373	1,487
2409	4,022	842	717	953	772	472	569	756	1,268	1,718	3,103	3,175	1,298	807	738	1,079
MtPark	667	236	321	217	199	546	686	248	323	487	793	613	455	302	277	314
Total	**24,511**	**9,129**	**9,137**	**9,502**	**9,451**	**16,954**	**21,164**	**11,373**	**25,482**	**24,566**	**32,538**	**32,710**	**25,460**	**12,162**	**10,921**	**26,574**

The unusually high consumption in February, March, and December of 2018 is believed to be due to leaks in the private plumbing of five customers.

SOURCE PRODUCTION

New meters were installed on all sources in 2015. However, the reliability and accuracy of some meters has been unsatisfactory. The District continues to work with the meter supplier to resolve the issues. The data presented here uses both meter reads and pump run times to estimate production. Therefore, it should be assumed that the accuracy of pumped water totals reported herein could be plus or minus 20 percent. The total annual production by source is shown in **Table 2.4**.

Table 2.4
Annual Production by Source (gallons)

Well	2015	2016	2017	2018
Brown Rd	7,281,382	3,264,097	6,596,186	6,201,725
Homestead	1,106,762	3,473,546	764,508	1,149,591
LWWU	4,914,287	852,588	448,158	2,028,594
Mt. Park	unknown	273,900	344,350	207,570
Total	***13,304,446***	***7,866,147***	***8,155,219***	***9,589,498***

The high production in 2015 is assumed to be water used during construction of the new reservoir and water mains. Significant water was needed for testing, flushing, and dust control. It is also possible that the new source meters were not recording correctly at that time. For Mt. Park, meter reads prior to 2016 are not available.

Supply to the 2128 Zone is the total of the Brown Road, Homestead, and Lake Wenatchee Water Users Association (LWWUA) wells, less that pumped through the Combined Booster Station. The Combined

Booster Station is the sole supply to the 2409 and 2320 Zones. Graphical views of monthly supply to these pressure zones are shown on **Charts 2.2** and **2.3**.

Chart 2.2
2128 Zone Supply by Month (gallons per day (gpd))

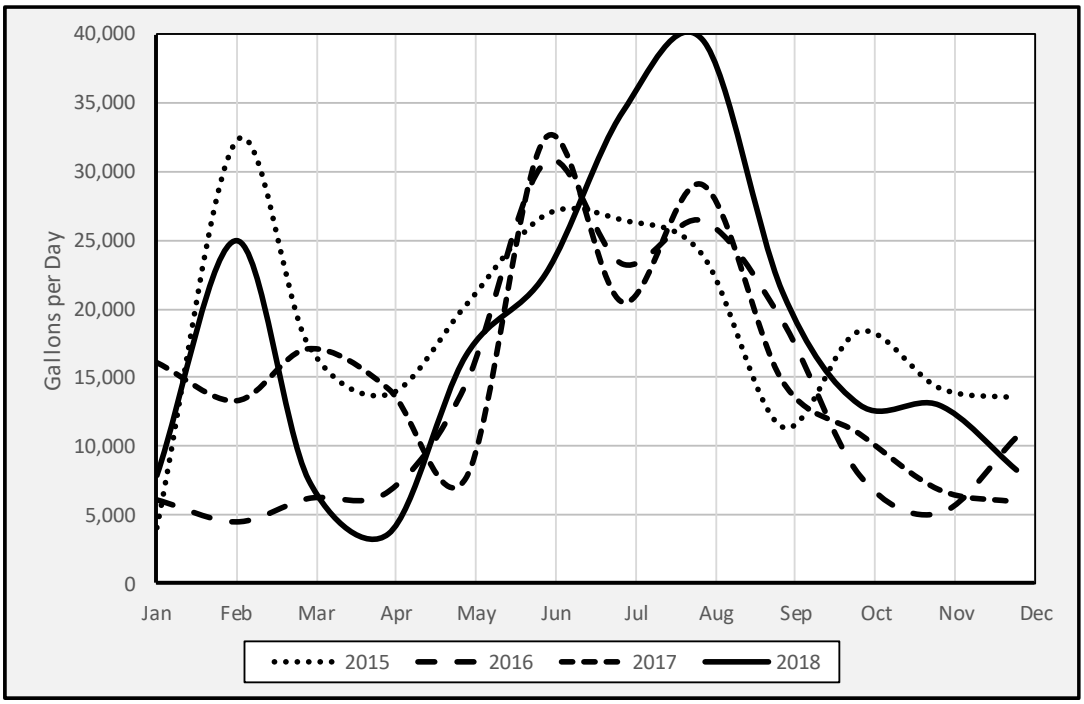
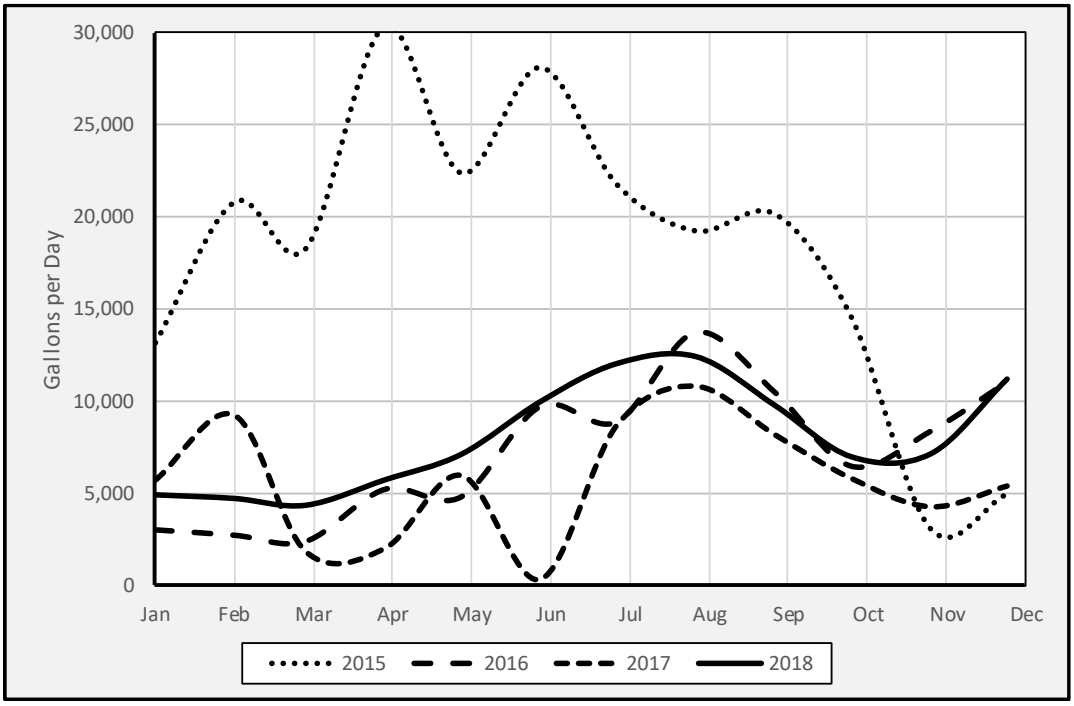


Chart 2.3
2230/2409 Zone Supply by Month (gpd)



The large supply to the 2230/2409 Zones in 2015 may be a combination of a warm year, meter error, construction water, and water being passed back to the 2128 Zone through the pressure reducing valves (PRV) before their final setpoints were established.

Supply to the 2230/2409 Zones in 2018 was more than double the customer sales. While leakage is possible, it is more likely that water is circulating back to the lower pressure zone through the PRV stations. There currently is not enough information to determine the cause of the discrepancy. The PRVs will be adjusted and meters monitored for any change.

CUSTOMER DEMANDS

Customer meter records are only available after September 2017, so 2018 is used to establish the baseline for customer demands. Demands for 2016 and 2017 are estimated by assuming the ratio of supply to sales is the same for each year. As noted earlier, 2015 is anomalous due to the construction activities.

Total metered consumption was 7,570,000 gallons in 2018, but approximately 1,500,000 gallons of this is believed to be due to leaks on five customers' properties, which have since been rectified. There is one additional customer who does not pay a monthly fee per agreement and whose meter was not read prior to 2018. The customer meter will be put on the meter reading schedule.

The following demand values are used in this evaluation.

- Winter Day Demand (WDD): Average use from November to March. Represents typical indoor use.
- Average Day Demand (ADD): Average use for the entire year.
- Maximum Month Demand (MMD): Average use for the maximum month, usually July or August. Used primarily to develop multipliers for estimating maximum day demand (MDD) since customer meters are only read monthly.
- Maximum Day Demand (MDD): The highest use day of the year or of the planning period.
- Peak Hour Demand (PHD): The maximum one hour use during the year. Usually occurs during the maximum day.

Estimates for customer consumption are shown in **Table 2.5**.

Table 2.5
Calculation for Consumption per Connection

	2015	2016	2017	2018
Winter				
Winter Average Day Supply (gpd)	16,500	12,000	16,000	17,100
Winter Average Day Consumption (gpd)	unknown	unknown	unknown	10,170
DSL Winter Average (gpd)	unknown	unknown	unknown	6,930
Number of Customers (Winter Active)	107 *	107 *	107	107
WDD per Connection (gpd)	unknown	unknown	unknown	95
Annual				
Annual Supply (gal)	13,302,431	7,864,131	8,153,202	9,587,480
ADD (gpd)	36,445	21,546	22,338	26,267
Annual Consumption (gal)	10,502,924 *	6,209,118 *	6,437,354 *	7,569,787
Annual Customer Leaks (gal)	unknown	unknown	unknown	1,475,680
Average Day Consumption (gpd)	28,775 *	17,011 *	17,637 *	20,739
DSL Annual Average (gpd)	7,670 *	4,534 *	4,701 *	5,528
Number of Customers (Annually Active)	126 *	126 *	126	126
ADD per Connection (gpd)	228 *	135 *	140 *	133
Maximum Month				
Max Month Supply Average (gpd)	54,633	44,478	43,150	53,030
Max Month Consumption (gpd)	45,599 *	26,957 *	27,948 *	32,865
DSL Max Month Average (gpd)	9,034 *	17,520 *	15,201 *	20,165
Number of Customers (Max Month)	121 *	121 *	123	123
MMD per Connection (gpd)	377 *	223 *	227 *	267
Maximum Day and Peak Hour				
MDD (gpd)	unknown	69,993	55,774	71,275
PHD (gpm)	unknown	127	121	126
MDD per Connection (gpd)	unknown	351 *	294 *	359
PHD per Connection (gpm)	unknown	0.64 *	0.64 *	0.63

* values are estimated assuming 2018 supply to sales ratios are typical.
gal = gallon
DSL = distribution system leakage

These values can be converted to consumption per person by dividing by the population, though the transient occupancy nature of the area makes this only a rough approximation. The results are shown in **Table 2.6**.

Table 2.6
Per Connection and Per Capita Consumption

2.18	People per Household			
Category	**Per Connection**	**Connections**	**Population**	**Per Capita**
Winter	95 gpd	107	233	44 gpd
Annual	136 gpd	126	275	62 gpd
Max Day	360 gpd	123	268	165 gpd
Peak Hour	0.63 gpm	123	268	0.29 gpm

The distribution of customer consumption is not uniform. While the average annual consumption per connection is 136 gpd, the median is only 82 gpd. The District's per capita consumption compared to other water systems in the area is shown in **Table 2.7**.

Table 2.7
Per Capita Consumption Comparison

Category	LWWD	Malaga	Wenatchee	Cashmere
Winter	44 gpd	64 gpd	73 gpd	59 gpd
Annual	62 gpd	107 gpd	115 gpd	119 gpd
Max Day	165 gpd	226 gpd	246 gpd	289 gpd
Peak Hour	0.29 gpm	0.33 gpm	0.24 gpm	0.30 gpm

Per capita consumption for the District appears to be much lower than the other systems, which may be due to several factors, including:

- Possible over estimation of the number of people per household in the District, since census data specific to the District service area is not available;
- Customers in the District may have, on average, less irrigated lawn than in more urban areas. Or may water lawns less because of the milder climate; and
- The calculations do not account for periods when residences are unoccupied.

EQUIVALENT RESIDENTIAL UNITS

An equivalent residential unit (ERU) is defined as the amount of water used by a typical single-family residence. Property occupancy varies widely in the District both by location and by season, so the concept of a "typical residence" does not exist. The consumption per connection values presented in **Table 2.6** could be used to represent those of an ERU. But this may under-represent the consumption characteristics of future residences if growth patterns tend more towards full-time occupancy.

The 2011 WSP established a planning value of 250 gpd per ERU, though that value included distribution system leakage (DSL). In this WSP, DSL is accounted separately with its own ERU count. Reducing 250 gpm by 20 percent DSL results in 200 gpd, which when divided by 2.18 persons per household is 92 gpd per capita, much closer to the annual values for the other water systems shown in **Table 2.7**.

For this WSP, the annual demand for 1 ERU will be set at 200 gpd. To develop the other demand conditions, the consumption ratios from **Table 2.8** are applied, with the results presented in **Table 2.9**.

Table 2.8
Consumption Ratios

Ratio	Value
WDD / ADD	0.70
MMD / ADD	1.96
MDD / ADD	2.65
MDD / MMD	1.35
PHD / MDD	2.54
PHD / ADD	6.72

Table 2.9
Equivalent Residential Units

ERU Category	Customer Consumption				ERUs				
	Per ERU	2128	2409	Mt Park	2128	2409	Mt Park	DSL	Total
ERU_{WDD}	140 gpd	7,700 gpd	2,200 gpd	270 gpd	55	16	2	50	**122**
ERU_{ADD}	200 gpd	13,043 gpd	3,218 gpd	435 gpd	65	16	2	28	**111**
ERU_{MDD}	529 gpd	34,860 gpd	7,860 gpd	4,965 gpd	66	15	9	51	**141**
ERU_{PHD}	0.93 gpm	61.5 gpm	13.9 gpm	8.8 gpm	66	15	9	51	**141**

The total ERUs are shown varying by season because the population varies seasonally, and the values for ERU_{MDD} and ERU_{PHD} are taken from a high use year (2018), not an average year. Year 2015 may have had higher consumption, but the meter data is not accurate enough to be useful.

The ERU_{ADD} value of 200 gpd is significantly lower than the 2011 WSP estimates of 390 gpd for historical use and 250 gpd for future use for the following reasons:

- Most customers were not metered at that time, so only supply meter records were used. The 2011 demands per ERU therefore included DSL, where the current values do not.
- The old distribution system was known to have significant leakage.
- The accuracy of the original source meters is unknown.

DISTRIBUTION SYSTEM LEAKAGE

The difference between the amount of water supply and water consumption is distribution system leakage (DSL). The amount of DSL in a water system is calculated as the difference between the water supply and the 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, well backwash, and reservoir overflows resulting from malfunctioning telemetry and control equipment. Several of these usage types, such as water main flushing, fire hydrant usage, and well backwash, 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 Water Use Efficiency (WUE) Rule, which became effective in 2007, establishes a DSL standard of 10 percent or less based on a rolling 3-year average. For systems with

fewer than 500 connections, such as the District, the DSL standard may be increased to 20-percent if a request with supporting data is provided to Washington State Department of Health (DOH).

There currently is insufficient data to establish an accurate DSL value. Only 2018 has customer meter records, many customer meters have malfunctioned, and some source meters have had accuracy problems. The District is actively working to correct these issues. But based on the information available for 2018, a rough estimate for DSL is presented in **Table 2.10**. The annual DSL for 2018 is estimated to be 21 percent.

Table 2.10
Distribution System Leakage Estimate (2018)

	Winter	Annual	Max Month
Supply (gpd)	17,100	26,267	53,030
Consumption (gpd)	10,170	20,739	32,865
Unmetered Authorized Use (gal)	0	0	0
DSL (gpd)	6,930	5,528	20,165
DSL Percentage	41%	21%	38%
Demand per ERU	140 gpd	200 gpd	393 gpd
DSL ERUs	50	28	51

The seasonal variability of DSL may imply a combination of meter errors and leakage, since leakage should be a relatively constant value. Two thirds of the pipelines are new and should have little to no leakage, but the older third is of unknown condition. Three leaks were repaired on customer service lines in 2018, with an estimated loss of 200,000 gallons, or about 2 percent of water supplied.

LAND USE

Figure 1.2 shows land use designations within the District. Based on the existing land use designations, there are currently 1,070 acres of land with zoning that allows residential development within the District's 1,147-acre boundary. A significant amount of this land may be undevelopable due to steep slopes, erodible soils, or wetlands. An analysis of the proportion of developable land has not been performed. There are approximately 750 parcels within the District boundary, though the developed state of these parcels has not been evaluated.

A summary of land area is shown in **Table 2.11**. Also included in the table is an estimate of potential development density based on the maximum development allowed in the land use designations. The value of 1 acre per dwelling unit (DU) for the rural recreational and residential (RRR), and rural waterfront (RW) designations is a base planning value, but smaller lots could be allowed if conditions are met pursuant to the *Chelan County Comprehensive Plan*.

Table 2.11
Land Use Designations

Description	Code	Acres	Percent	Ac/DU	DU
Rural Public Lands and Facilities	RP	15	1%	n/a	0
Rural Residenital 2.5	RR 2.5	31	3%	2.5	12
Rural Residential 5	RR 5	115	10%	5	23
Rural Residential 10	RR 10	294	26%	10	29
Rural Residential 20	RR 20	148	13%	20	7
Rural Recreational / Residential	RRR	221	19%	1	221
Rural Waterfront	RW	246	21%	1	246
Commercial Forest	FC	77	7%	n/a	0
Total		***1,147***			***539***

The land inventory within the District can support perhaps three to four times as many customers than currently served; however, the growth projections show little growth is anticipated for the current planning periods.

PROJECTED SYSTEM GROWTH AND FUTURE WATER DEMANDS

Water system growth and demand projections were prepared based on the existing water use records and the forecasted growth rates described earlier in this chapter.

Future residential demands were calculated for the 6-year, 10-year, 20-year, and build-out planning horizons. Projected residential demand was developed using the following assumptions:

- The growth rate of ERUs will be the same as the population growth rate.
- ADD for all residents at build-out was based on 200 gpd, assuming that homes may be occupied more frequently in the future.
- MDD calculations are based on MDD/ADD peaking factor of 2.7.
- PHD is calculated from actual pump and reservoir records for 2017 and 2018, and is approximately 2.6 times MDD.

The forecast summaries for each pressure zone are shown in **Tables 2.12**, **2.13**, and **2.14**.

Table 2.12
2128 Zone Demand Forecast

2128 Zone	2019	2025	2029	2039
Population Growth Rate (Resolution 2015-112)	0.00%	0.88%	0.73%	0.57%
Customer Leak ERUs	10	8	6	4
Average Day Demand				
Customer Consumption ERUs	65	69	71	75
DSL ERUs	17	16	17	18
Average Day Consumption (gpd)	15,043	15,346	15,355	15,778
DSL (gpd)	3,323	3,299	3,397	3,595
ADD (gpd)	18,365	18,645	18,752	19,373
Maximum Day Demand				
Customer ERUs	66	69	71	76
DSL ERUs	35	22	22	24
Max Day Consumption (gpd)	40,154	40,975	41,008	42,150
DSL (gpd)	18,297	11,481	11,822	12,510
MDD (gpd)	58,451	52,457	52,830	54,659
Peak Hour Demand				
Peak Hour Consumption (gpm)	61	65	67	71
DSL (gpm)	32	20	21	22
PHD (gpm)	94	85	88	93

Table 2.13
2230/2409 Zone Demand Forecast

2230 / 2409 Zones	2019	2025	2029	2039
Customer Leak ERUs	5	4	3	2
Average Day Demand				
Customer ERUs	16	17	17	18
DSL ERUs	4.1	7.0	4.2	4.4
Average Day Consumption (gpd)	4,218	4,192	4,093	4,096
DSL (gpd)	813	1,400	838	887
ADD (gpd)	5,031	5,592	4,931	4,983
Maximum Day Demand				
Customer ERUs	15	16	16	17
DSL ERUs	8	5	5	5
Max Day Consumption (gpd)	10,507	10,402	10,118	10,085
DSL (gpd)	4,125	2,589	2,666	2,821
MDD (gpd)	14,633	12,990	12,784	12,906
Peak Hour Demand				
Peak Hour Consumption (gpm)	14	15	15	16
DSL (gpm)	7	5	5	5
PHD (gpm)	21	19	20	21

Table 2.14
Mt. Park Demand Forecast

Mt. Park	2019	2025	2029	2039
Average Day Demand				
Customer ERUs	2.2	2.3	2.4	2.5
DSL ERUs	0.6	0.5	0.6	0.6
Average Day Consumption (gpd)	435	458	472	499
DSL (gpd)	111	110	113	120
ADD (gpd)	546	568	585	619
Maximum Day Demand				
Customer ERUs	9.4	9.9	10.2	10.8
DSL ERUs	2.6	2.4	2.4	2.6
Max Day Consumption (gpd)	4,965	5,232	5,388	5,701
DSL (gpd)	1,370	1,256	1,293	1,368
MDD (gpd)	6,335	6,488	6,681	7,069
Peak Hour Demand				
Peak Hour Consumption (gpm)	28.3	28.9	29.2	29.9
DSL (gpm)	6.8	6.9	7.0	7.2
PHD (gpm)	35.1	35.8	36.2	37.0

Because Mt. Park has so few customers on an isolated system, the PHD is calculated using the DOH *Water System Design Manual* Equation 3-1. The overall system demand forecast is shown in **Table 2.15**.

Table 2.15
System Demand Forecast

System Total	2019	2025	2029	2039
Average Day Demand				
Customer ERUs	98	100	100	102
DSL ERUs	21	24	22	23
Average Day Consumption (gpd)	19,696	19,997	19,919	20,373
DSL (gpd)	4,246	4,809	4,349	4,602
ADD (gpd)	23,942	24,806	24,268	24,975
ADD with No Improvement in DSL (gpd)	23,942	27,604	29,473	34,267
Maximum Day Demand				
Customer ERUs	105	107	107	109
DSL ERUs	45	29	30	32
Max Day Consumption (gpd)	55,626	56,609	56,514	57,935
DSL (gpd)	23,793	15,326	15,781	16,699
MDD (gpd)	79,418	71,935	72,295	74,634
MDD with No Improvement in DSL (gpd)	79,418	91,566	97,764	113,665
Peak Hour Demand				
Peak Hour Consumption (gpm)	104	108	111	116
DSL (gpm)	46	32	33	34
PHD (gpm)	150	140	144	151
PHD with No Improvement in DSL (gpm)	150	157	161	168

Table 2.15 includes demand forecasts both with and without improvements to DSL. These forecasts compared with the high and low range population projections are shown on **Chart 2.4** for ADD and **Chart 2.5** for MDD.

Chart 2.4
Average Day Demand Forecasts

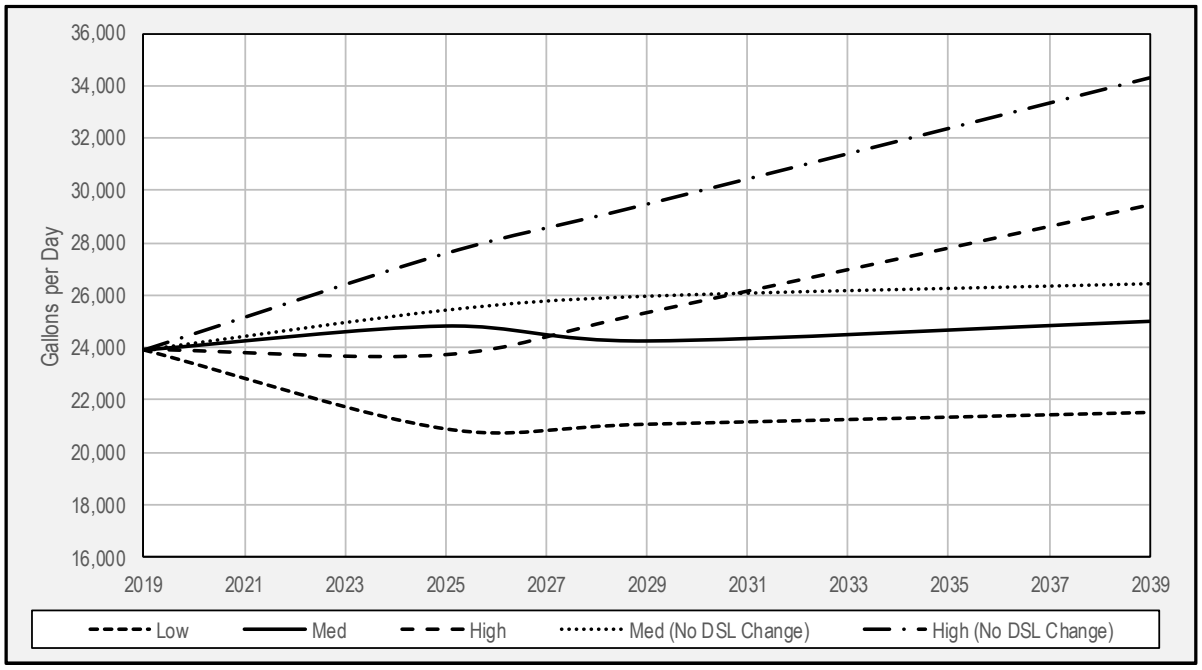
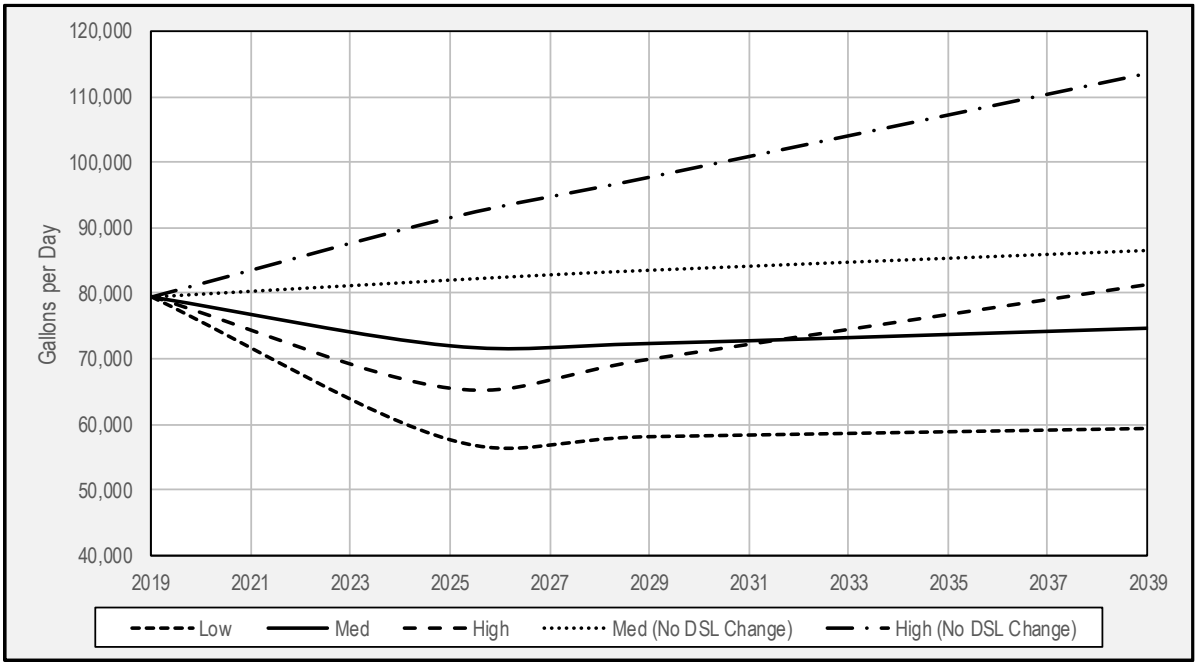


Chart 2.5
Maximum Day Demand Forecasts



The three primary forecasts (Low, Med, High) show a demand reduction for the first few years because improvements in DSL and customer leaks may exceed new demands due to growth. Two additional forecasts show the medium and high range growth assuming there is no reduction in DSL.

3 | WATER SYSTEM ANALYSIS

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 Department of Health (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 Washington 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. Lake Wenatchee Water District's (District) 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). MCLs are equal to or higher than 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. The State Reporting Limit (SRL) is the minimum value that laboratory equipment must be able to detect. 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.

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.

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).

Surface Water Treatment Rule

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 also must 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.

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 Byproducts 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.

Long Term 1 Enhanced Surface Water Treatment Rule

This is the follow-up rule to the IESWTR that became effective in December 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.

Revised 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.

On February 13, 2013, the EPA published revisions to the rule in the Federal Register, and the rule was renamed to the Revised Total Coliform Rule. This rule eliminated the coliform MCL, sets an MCL for *Escherichia coli* (*E. coli*), and specifies the frequency and timing of coliform testing based on population served, public water system type, and source water type. When total coliform is detected, this is now known as a treatment technique trigger and public notice is no longer required. Instead, the water system must conduct an assessment of their water system facilities and operations and fix any sanitary defects. For confirmed *E. coli* incidents, now known as an *E. coli* MCL violation, the water system must perform a Level 2 assessment and provide public notice within 24 hours. If a positive sample is collected on a consecutive system, the District also will need to collect source samples.

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 District's that take less than 1 sample per month, a sample that contains coliform would exceed the legal limit and trigger the follow-up sampling requirements. A copy of the District's Coliform Monitoring Plan is contained in **Appendix F**.

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 also could increase the risk of liver and kidney damage.

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, 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 6 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 pico Curies per liter (pCi/L) for combined radium-226 and radium-228; 15 pCi/L for gross alpha (excluding radon and uranium); 4 millirem per year for beta particle and photon radioactivity; and 30 micrograms per liter (µg/L) for uranium.

Wellhead Protection Program

Section 1428 of the 1986 SDWA Amendments mandates that each state develop a wellhead protection program. The Washington State mandate for wellhead protection and the required elements of a

wellhead protection 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 wellhead protection program.

A wellhead protection program is a proactive and ongoing effort of a water purveyor to protect the health of its customers by preventing contamination of the groundwater that it supplies for drinking water. All federally defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection program. All required elements of a local wellhead protection program must be documented and included in either the Comprehensive Water System Plan (applicable to the District) or a Small Water System Management Program document (not applicable to the District). The District's Wellhead Protection Program is contained in **Chapter 5**.

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 District, 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 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 latest CCR is contained in **Appendix F**.

Stage 1 Disinfectants/Disinfection Byproducts Rule

Disinfection byproducts (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 Byproducts 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 District 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 bromate; 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.

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 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 District 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 are consistent with the existing requirements for other inorganic contaminants.

Stage 2 Disinfectants/Disinfection Byproducts Rule

This rule is the second part of the Disinfectants/Disinfection Byproducts Rule, of which the Stage 1 D/DBPR became effective in February 1999. The Stage 2 Disinfectants/Disinfection Byproducts 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 that 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 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.

Long Term 2 Enhanced Surface Water Treatment Rule

Following the publishing of the IESWTR, the EPA introduced the LT1ESWTR 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 also are 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.

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 final rule was published in the Federal Register on November 8, 2006, and became effective on January 8, 2007.

The rule targets risks through an approach that relies on the four following major components:

1. Periodic sanitary surveys of groundwater systems that require the evaluation of eight critical elements and the identification of significant deficiencies (such as a well located near a leaking septic system). States must complete the initial survey for most community water systems by December 31, 2012, and for community water systems with outstanding performance and all non-community water systems by December 31, 2014. DOH conducted its most recent sanitary survey of the District's water system on September 28, 2016 under the State's existing sanitary survey program.
2. Source water monitoring to test for the presence of *E. coli*, enterococci, or coliphage in the sample. There are two monitoring provisions.
    a. Triggered monitoring for systems that do not already provide treatment that achieves at least 99.99-percent (4-log) inactivation or removal of viruses and that have a total coliform positive routine sample in the distribution system under the Total Coliform Rule.
    b. Assessment monitoring is a complement to triggered monitoring. A state has the option to require systems to conduct source water assessment monitoring at any time to help identify high risk systems.
3. Corrective actions are required for any system with a significant deficiency or source water fecal contamination. The system must implement one or more of the following corrective action options:
    a. Correct all significant deficiencies;
    b. Eliminate the source of contamination;
    c. Provide an alternate source of water; or
    d. Provide treatment that reliably achieves 99.99-percent inactivation or removal of viruses.
4. Compliance monitoring to ensure that treatment technology installed to treat drinking water reliably achieves at least 99.99-percent inactivation or removal of viruses.

The compliance date for requirements of this rule other than the sanitary survey was December 1, 2009.

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 District 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 been published yet. 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.

Unregulated Contaminant Monitoring Regulation Revisions

In accordance with the original UCMR and the SDWA, once every 5 years the EPA will issue a new list of no more than 30 unregulated contaminants to be monitored by public water systems. The fourth UCMR was proposed on December 11, 2015, and includes a list of 30 chemicals that will be monitored during the 2017 through 2021 monitoring cycle and approves several new testing methods to conduct the monitoring. For this upcoming cycle, all systems serving more than 10,000 people and a larger representative sample of smaller water systems 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 for groundwater sources and the results of recent source water quality monitoring efforts. A discussion of the water quality requirements and monitoring results for the District's distribution systems 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. Non-regulated contaminants do not have established water quality standards and generally are 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 public health. Water purveyors are required by law to monitor and comply with these standards and notify the customers if water quality does not meet these 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 that water systems are not required to comply with. 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

Group A Community water systems are required to perform water quality monitoring at their active source for IOCs and physical substances, organic chemicals, and radionuclides as specified in WAC 246-290-300. The existing monitoring schedule is shown in **Appendix F** for each system. Group B water systems are not subject to the SDWA rules; however, these systems are required to meet state and local requirements for water quality. Group B systems are required to monitor for nitrate at the source after the successful completion of an initial inorganic and physical analysis.

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 a moderate susceptibility rating for the Homestead Well (Source S01), a low susceptibility rating for the Brown Road Well (Source S02), and a high susceptibility rating for Well 1 (aka Lake Wenatchee Water Users Association (LWWUA) Well) (Source S04). DOH assigned a high susceptibility rating for the Whispering Pines Spring based on the results of the susceptibility assessment survey. This source is considered a groundwater source in hydraulic connection with surface water. Therefore, when used, the water system is required to meet a chlorine contact time (CT) of 6 using chlorination and to provide a chlorine residual of at least 0.33 mg/L. The spring is currently not supplying drinking water to the system, but is available as an emergency backup supply.

SOURCE MONITORING RESULTS

The information in this WSP is based on data obtained from the DOH Sentry Database. In the following tables "ND" means the analyte was not detected within the accuracy of the laboratory equipment.

Homestead Well [S01] (Group A)

This well was drilled in 2012 and put on line in 2015. IOCs, VOCs, SOCs, and radionuclides were sampled in 2012 and 2015. Fluoride was measured in 2012 at 2.19 mg/L, which though below the MCL of 4.0, it did exceed the SDWA's secondary standard of 2.0, prompting a requirement to test annually. All fluoride test results since 2015 have been under 2.0. Nitrates and fluoride have been sampled annually since 2015. All results have been satisfactory. The most recent test results are shown in **Table 3.1**.

Table 3.1
Homestead Well Water Quality Test Results

Monitored Analyte	No. of Samples	Period	Last Sample	Result	MCL	SRL	Units	Next Sample
Nitrate	1	1 Yr	1/8/2019	0.07	10	0.5	mg/L	Feb-19
Fluoride	1	1 Yr	10/3/2018	1.08	4	0.2	mg/L	Oct-19
Volatile Organic (VOC)	1	6 Yr	5/6/2015	ND	Varies	Varies	Varies	May-21
Complete Inorganic (IOC)	1	3 Yr	3/3/2015					Aug-19
Antimony	"	"	"	0.0001	0.006	0.003	mg/L	
Arsenic	"	"	"	0.003	0.01	0.1	mg/L	
Barium	"	"	"	0.0008	2	0.1	mg/L	
Beryllium	"	"	"	ND	0.004	0.0003	mg/L	
Cadmium	"	"	"	ND	0.005	0.001	mg/L	
Calcium	"	"	"	2.19	n/a	0.05	mg/L	
Chloride	"	"	"	3.1	250	20	mg/L	
Chromium	"	"	"	0.0001	0.1	0.007	mg/L	
Color	"	"	"	ND	15	15	CU	
Conductivity	"	"	"	220	700	70	Umhos/cm	
Copper (action level)	"	"	"	0.0034	1.3	0.02	mg/L	
Cyanide	"	"	"	ND	0.2	0.05	mg/L	
Disolved Solids	"	"	"	136	500	100	mg/L	
Hardness	"	"	"	5.47	n/a	10	mg/L	
Iron	"	"	"	0.081	0.3	0.1	mg/L	
Lead (action level)	"	"	"	0.0004	0.015	0.001	mg/L	
Magnesium	"	"	"	ND	n/a	0.1	mg/L	
Manganese	"	"	"	0.0015	0.05	0.01	mg/L	
Mercury	"	"	"	ND	0.002	0.0002	mg/L	
Nickel	"	"	"	0.0002	0.1	0.005	mg/L	
Selenium	"	"	"	0.0014	0.05	0.002	mg/L	
Silver	"	"	"	ND	0.1	0.1	mg/L	
Sodium	"	"	"	48.6	n/a	5	mg/L	
Sulfate	"	"	"	3	250	50	mg/L	
Thallium	"	"	"	0.0002	0.002	0.001	mg/L	
Turbidity	"	"	"	2.5	n/a	0.1	NTU	
Zinc	"	"	"	0.508	5	0.2	mg/L	
Synthetic Organic (SOC)								
Herbicides	1	9 Yr	2/17/2015	ND	Varies	Varies	Varies	Feb-24
Pesticides		3 Yr	2/17/2015	ND	Varies	Varies	Varies	Waiver
Radionuclides								
Gross Alpha	1	6 Yr	12/15/2015	ND	15	3	pCi/L	Dec-21
Radium 228	1	6 Yr	12/15/2015	ND	5	1	pCi/L	Dec-21

NTU = Nephelometric Turbidity Unit(s)
pCi/L = picoCuries per liter of air
Umhos/cm = micromhos

Brown Road Well [S02] (Group A)

Nitrate monitoring has been performed once per year since 2004. Radionuclide monitoring was completed in 2015. IOCs were sampled in 2019, SOCs in 2015, and VOCs in 2015. All results have been satisfactory. The most recent test results are shown in **Table 3.2**.

Table 3.2
Brown Road Well Water Quality Test Results

Monitored Analyte	No. of Samples	Period	Last Sample	Result	MCL	SRL	Units	Next Sample
Nitrate	1	1 Yr	1/8/2019	0.12	10	0.5	mg/L	Apr-19
Asbestos		n/a	10/31/2017	ND	7	0.2	MFL	
Volatile Organic (VOC)	1	6 Yr	9/23/2015	ND	Varies	Varies	Varies	Sep-21
Complete Inorganic (IOC)	1	3 Yr	3/27/2019					Apr-22
Antimony	"	"	"	ND	0.006	0.003	mg/L	
Arsenic	"	"	"	0.0001	0.01	0.1	mg/L	
Barium	"	"	"	0.0031	2	0.1	mg/L	
Beryllium	"	"	"	ND	0.004	0.0003	mg/L	
Cadmium	"	"	"	ND	0.005	0.001	mg/L	
Calcium	"	"	"	8.95	n/a	0.05	mg/L	
Chloride	"	"	"	2.3	250	20	mg/L	
Chromium	"	"	"	0.0003	0.1	0.007	mg/L	
Color	"	"	"	5	15	15	CU	
Conductivity	"	"	"	90	700	70	Umhos/cm	
Copper (action level)	"	"	"	0.0079	1.3	0.02	mg/L	
Cyanide	"	"	"	ND	0.2	0.05	mg/L	
Disolved Solids	"	"	"	68	500	100	mg/L	
Fluoride	"	"	"	0.1	4	0.2	mg/L	
Hardness	"	"	"	36.6	n/a	10	mg/L	
Iron	"	"	"	0.198	0.3	0.1	mg/L	
Lead (action level)	"	"	"	0.0021	0.015	0.001	mg/L	
Magnesium	"	"	"	3.46	n/a	0.1	mg/L	
Manganese	"	"	"	0.0108	0.05	0.01	mg/L	
Mercury	"	"	"	ND	0.002	0.0002	mg/L	
Nickel	"	"	"	0.0035	0.1	0.005	mg/L	
Selenium	"	"	"	ND	0.05	0.002	mg/L	
Silver	"	"	"	ND	0.1	0.1	mg/L	
Sodium	"	"	"	4.24	n/a	5	mg/L	
Sulfate	"	"	"	2.3	250	50	mg/L	
Thallium	"	"	"	0.0007	0.002	0.001	mg/L	
Turbidity	"	"	"	1.42	n/a	0.1	NTU	
Zinc	"	"	"	0.0993	5	0.2	mg/L	
Synthetic Organic (SOC)								
Herbicides	1	9 Yr	2/18/2015	ND	Varies	Varies	Varies	Feb-24
Pesticides		3 Yr	2/18/2015	ND	Varies	Varies	Varies	Waiver
Radionuclides								
Gross Alpha	1	6 Yr	12/15/2015	ND	15	3	pCi/L	Dec-21
Radium 228	1	6 Yr	12/15/2015	0.85	5	1	pCi/L	Dec-21

Whispering Pines Spring [S03]

This source was disconnected from the domestic water system in 2015, but could be reconnected in an emergency. Nitrate monitoring was performed once per year from 1999 to 2016, with the exception of 2001. Radionuclide monitoring was completed in 2007, 2006, and 2003. IOC monitoring was completed in 2010, VOC monitoring in 2010, and SOC monitoring in 2011. The results of the sampling that was completed were satisfactory.

Lake Wenatchee Water Users Association Well [S04] (Group A)

This source has been sampled for nitrates annually since 2003. IOCs were sampled in 2018, SOCs in 2018, VOCs in 2018, and radionuclides in 2016. All results have been satisfactory. The most recent test results are shown in **Table 3.3**.

Table 3.3
Lake Wenatchee Water Users Association Well Water Quality Test Results

Monitored Analyte	No. of Samples	Period	Last Sample	Result	MCL	SRL	Units	Next Sample
Nitrate	1	1 Yr	1/8/2019	ND	10	0.5	mg/L	Jan-20
Volatile Organic (VOC)	1	3 Yr	10/3/2018	ND	Varies	Varies	Varies	Oct-21
Complete Inorganic (IOC)	1	3 Yr	4/25/2018					May-21
Antimony	"	"	"	0.0001	0.006	0.003	mg/L	
Arsenic	"	"	"	0.0003	0.01	0.1	mg/L	
Barium	"	"	"	0.0052	2	0.1	mg/L	
Beryllium	"	"	"	ND	0.004	0.0003	mg/L	
Cadmium	"	"	"	ND	0.005	0.001	mg/L	
Calcium	"	"	"	16.8	n/a	0.05	mg/L	
Chloride	"	"	"	2.8	250	20	mg/L	
Chromium	"	"	"	0.0001	0.1	0.007	mg/L	
Color	"	"	"	ND	15	15	CU	
Conductivity	"	"	"	222	700	70	Umhos/cm	
Copper (action level)	"	"	"	0.0076	1.3	0.02	mg/L	
Cyanide	"	"	"	ND	0.2	0.05	mg/L	
Disolved Solids	"	"	"	140	500	100	mg/L	
Fluoride	"	"	"	0.22	4	0.2	mg/L	
Hardness	"	"	"	50.8	n/a	10	mg/L	
Iron	"	"	"	0.0858	0.3	0.1	mg/L	
Lead (action level)	"	"	"	0.0016	0.015	0.001	mg/L	
Magnesium	"	"	"	2.15	n/a	0.1	mg/L	
Manganese	"	"	"	0.0035	0.05	0.01	mg/L	
Mercury	"	"	"	ND	0.002	0.0002	mg/L	
Nickel	"	"	"	0.0025	0.1	0.005	mg/L	
Selenium	"	"	"	ND	0.05	0.002	mg/L	
Silver	"	"	"	ND	0.1	0.1	mg/L	
Sodium	"	"	"	30.4	n/a	5	mg/L	
Sulfate	"	"	"	2.8	250	50	mg/L	
Thallium	"	"	"	0.0002	0.002	0.001	mg/L	
Turbidity	"	"	"	0.39	n/a	0.1	NTU	
Zinc	"	"	"	0.0554	5	0.2	mg/L	
Synthetic Organic (SOC)								
Herbicides	1	9 Yr	10/3/2018	ND	Varies	Varies	Varies	Oct-27
Pesticides		3 Yr	10/3/2018	ND	Varies	Varies	Varies	Waiver
Radionuclides								
Gross Alpha	1	6 Yr	10/13/2016	ND	15	3	pCi/L	Oct-22
Radium 228	1	6 Yr	10/13/2016	ND	5	1	pCi/L	Oct-22

Mt. Park/Zufall [S01] (Group B)

This system is required to complete nitrate sampling once every 3 years. Nitrate monitoring has been completed for this source in 1995, 2002, 2006, and every year from 2012 through 2018, except 2017.

IOC monitoring was completed in 1988. The water quality sampling that was completed was satisfactory. No other water quality data is available.

The most recent test results are shown in **Table 3.4**.

Table 3.4
Mt. Park/Zufall Water Quality Test Results

Monitored Analyte	Last Sample	Result	MCL	SRL	Units	Next Sample
Nitrate	1/3/2018	0.35	10	0.5	mg/L	3 Years
Source Inorganic (IOC)	8/1/1998					
Arsenic	"	ND	0.01	0.1	mg/L	
Barium	"	ND	2	0.1	mg/L	
Cadmium	"	ND	0.005	0.001	mg/L	
Chloride	"	ND	250	20	mg/L	
Chromium	"	ND	0.1	0.007	mg/L	
Color	"	ND	15	15	CU	
Conductivity	"	160	700	70	Umhos/cm	
Fluoride	"	ND	4	0.2	mg/L	
Hardness	"	60	n/a	10	mg/L	
Iron	"	0.13	0.3	0.1	mg/L	
Lead (action level)	"	ND	0.015	0.001	mg/L	
Manganese	"	ND	0.05	0.01	mg/L	
Mercury	"	ND	0.002	0.0002	mg/L	
Selenium	"	ND	0.05	0.002	mg/L	
Silver	"	ND	0.1	0.1	mg/L	
Sodium	"	ND	n/a	5	mg/L	
Turbidity	"	0.1	n/a	0.1	NTU	
Distribution System						
Coliform	4/10/2019	ND	Presence		none	Yearly

DISTRIBUTION SYSTEM WATER QUALITY

MONITORING REQUIREMENTS AND RESULTS

All District sources are chlorinated. The water systems are required to perform water quality monitoring within the distribution system for coliform bacteria and disinfectant (chlorine) residual concentration. The District's system also is required to monitor for DBP, lead, copper, and asbestos in accordance with Chapter 246-290 WAC. A schedule of the water system water quality monitoring requirements is in **Appendix F**.

Coliform Monitoring

The District's system is required to collect a minimum of one sample per month for coliform, and the Mt. Park system is required to collect once per year from the water distribution systems. The coliform test identifies a sample as having a presence or absence of coliform.

Prior to system consolidation, coliform was detected in the Brown Road system between 2002 and 2004, in the LWWUA system between 2002 and 2015, in the Whispering Pines system in 2001, and in the Mt. Park system in 1997. Since system consolidation in late 2015, no coliform has been detected.

Disinfectant Residual Concentration Monitoring

Disinfection requirements applicable to the District are contained in WAC 246-290-310, which states that a disinfectant residual concentration shall be detectable in all active parts of the distribution system, and that the maximum residual disinfectant level shall be 4.0 mg/L for chlorine and chloramines. The District's chlorination target is to maintain a residual disinfectant concentration of at least 0.5 mg/L in the distribution system. From 2008 through 2018, free chlorine residual throughout the District ranged from 0.03 mg/L to 0.89 mg/L, and averaged 0.45 mg/L. The water samples collected by the District for coliform analysis also are tested for residual disinfectant concentration. The results of residual disinfectant concentration tests indicate that the District is in compliance with the regulations. To improve chlorine contact time for virus inactivation, 12-inch-diameter pipes were installed immediately downstream of the Mt. Park well and the Combined Booster Station.

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. Lead and copper monitoring must be conducted once every 3 years for Group A systems. Lead and copper was last tested in the District system in 2016 with satisfactory results. The Mt. Park system is not required to test for lead and copper.

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 pipe. The District's system is mostly constructed of steel and polyvinyl chloride (PVC) main. There are no records of water main being constructed of asbestos cement pipe in the system. Asbestos was last monitored in 2018 for the District system with a satisfactory result.

Disinfectants/Disinfection Byproducts Monitoring

TTHM and HAA5 are disinfection byproducts 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.

TTHM and HAA5 were last monitored in the District system in 2016 with no detection. Testing is required every 3 years. In 2015, TTHM was detected at 1.6 µg/L, which is well below the MCL of 80 µg/L. Testing for Mt. Park is not currently required.

The results of the latest District distribution system monitoring are shown in **Table 3.5**.

Table 3.5
District Distribution System Water Quality Results

Monitoring Group	No. of Samples	Test Frequency	Last Sample	Result (max)	MCL	SRL	Units	Next Sample
Coliform	1	1 Month	6/11/2019	ND	Presence		none	Monthly
Lead	5	3 Year	3/23/2016	0.0007	0.015	0.001	mg/L	Jun-19
Copper	5	3 Year	3/23/2016	0.0116	1.3	0.02	mg/L	Jun-19
TTHM	1	3 Year	8/15/2016	ND	Varies	Varies	mg/L	Aug-19
HAA5	1	3 Year	8/15/2016	ND	Varies	Varies	mg/L	Aug-19
Asbestos	0	9 Year	4/25/2018	0.123	7	0.2	MFL	TBD

MFL = Million Fibers per Liter
ND = Not Detected

SUPPLY ANALYSIS

WATER SOURCES

The current water sources connected to the domestic water system are the Homestead Well, LWWUA Well, Brown Road Well, and Mt. Park Well. All sources currently meet source standards for public water systems.

SOURCE DEFICIENCIES

The existing source deficiencies are summarized in the sections that follow.

LWWUA Well

During low precipitation periods, the water level can draw down far enough that the pump begins to pull in air, causing cavitation, reduced performance, and customer complaints of cloudy water. In addition, the air entrainment may affect the accuracy of the ultrasonic meter. Testing in 2012 resulted in 30 gallons per minute (gpm) sustainable, but 38 gpm drew the level below the casing perforations. More recent operations indicate flows below 30 gpm can cause excessive drawdown during some dry periods. To the District's knowledge, the well has never been inspected with video equipment.

Homestead Well

Shortly following activation of this well, customers complained of taste and odor. The odor is believed to be caused by ammonia. A small bench scale test was performed, indicating an increased chlorine dose of 2.0 parts per million (ppm) should improve the taste and odor, but the nearest customers may pull water before the chlorine has sufficient time to deactivate the ammonia and still experience unsatisfactory taste. The water also was found to deplete the chlorine residual faster than other sources. If this is caused by high total organic carbon, there is a risk of disinfection byproducts forming with higher chlorine doses. Distribution system water quality testing has not detected byproducts to date. In the summer of 2019, the District increased the chlorine dosing slightly to see if it would improve the quality. As of fall 2019, the odor and taste have improved. If water quality degrades in the future, follow-up work may be to perform total organic carbon testing. The results may indicate that installation of additional contact time pipe or carbon filtration may improve the odor and taste.

Brown Road Well

In 2016, DOH noted in its sanitary survey that the wellhead is in a pit and at risk of submergence. To resolve this, a drain pipe was installed in the pit to keep water below the top of casing. Recently, customers have complained about odor and taste problems, similar to those of the Homestead Well.

Mt. Park/Zufall

The well is the only source of supply to the Mt. Park system. The well is approximately 30 feet from Lake Wenatchee, which could increase the risk of contamination. There have been no quality issues identified other than a positive distribution coliform sample in 1997. A riser was added to the caisson in 2015 to extend it above the lake high water level.

WATER SUPPLY CAPACITY

For conservative planning, the supply capacity analysis uses the following assumptions:

- The DOH *Water System Design Manual* allows all sources to be considered available on the maximum day, but recommends that the supply be capable of providing the maximum day demand (MDD) in 20 hours of pumping.
- DOH also recommends derating groundwater sources by 15 percent to account for hydrogeologic and climate variations.
- For planning purposes, it is assumed the LWWUA Well has the capacity reduced to 20 gpm due to the higher drawdown it experiences in low precipitation seasons.
- MDD for Mt. Park cannot be measured; therefore, for conservative planning, it is assumed to be four times average day demand (ADD). Mt. Park peak hour demand (PHD) is calculated using DOH *Water System Design Manual* Equation 3-1.
- The high range growth projections are used.
- Distribution system leakage (DSL) is assumed to stay the same as current, without improvement.
- Mt. Park is a closed zone, so pumping capacity must meet or exceed PHD.

The results of these assumptions are shown in **Table 3.6**.

Table 3.6
Supply Capacity (gpm)

	2016	2017	2018	2025	2029	2039
2128 Zone						
MDD (Includes DSL)	36	26	38	43	46	54
Supply to 2230 / 2409 Zones	10	10	10	12	13	15
Supply Required for 24 hour pumping	47	36	48	55	59	69
Supply Required for 20 hour pumping	56	43	58	66	71	82
Supply Available	118	118	118	118	118	118
Supply Available (Derated by 15%)	100	100	100	100	100	100
Supply Surplus or (Deficit)	***44***	***57***	***43***	***34***	***30***	***18***
2230 / 2409 Zones						
MDD (Includes DSL)	10	10	10	12	13	15
Supply Required for 24 hour pumping	10	10	10	12	13	15
Supplry Required for 20 hour pumping	13	13	13	14	15	18
Supply Available	60	60	60	60	60	60
Supply Surplus or (Deficit)	***48***	***48***	***48***	***46***	***45***	***42***
Mt Park						
MDD (Includes DSL)	2.1	2.6	1.6	3.1	3.5	3.9
PHD (Includes DSL)	35	35	35	36	36	37
Supply Available (Derated by 15%)	43	43	43	43	43	43
Supply Surplus or (Deficit)	***7***	***7***	***7***	***7***	***6***	***5***

Capacity of the existing supply sources is projected to be adequate for at least the next 20 years, even if DSL stays at current levels. However, the loss of one source could result in insufficient supply.

STORAGE ANALYSIS

Water storage analysis for the existing system includes operating, equalizing, standby, and fire storage considerations. The storage requirements are based on criteria defined in the DOH *Water System Design Manual*. Storage calculations are provided for Mt. Park only for illustrative purposes. Mt. Park is currently a closed zone without gravity storage.

This section evaluates the existing water storage tanks 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 water tanks.

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 existing storage facilities within the District are provided as follows.

OPERATIONAL STORAGE

Operational storage is defined as the volume of the storage facility devoted to supplying the water system under normal operating conditions. When the system is drawing water from the operational storage volume, the source of supply is in the "off" status. The amount of operational storage utilized changes based on seasonal demands and operator judgment. Operating storage for future projections is assumed to be 3 feet deep, or about 12 to 15 percent of total storage.

DEAD STORAGE

Dead storage is the volume of the reservoir 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 may occupy the lower portion of some ground-level reservoirs. Water that is stored at or below an elevation that cannot provide a minimum pressure of 20 pounds per square inch (psi) is considered dead storage for the analyses that follow. Both reservoirs can supply water to customers at 20 psi or more when storage is depleted. Dead storage also includes the volume below the top of the outlet pipe, which is 6 inches above the floor for LWWUA and 2 feet above the floor for Whispering Pines.

The summary of reservoir dimensions, operational storage, and dead storage is in **Table 3.7**.

Table 3.7
Reservoir Dimensions, Operational, and Dead Storage

Category	Lake Wenatchee Water Users	Whispering Pines
Inside Diameter	26.0 ft	26.0 ft
Volume per Foot of Depth	3,971 gal	3,971 gal
Ceiling Elevation	2,129.6 ft	2,409.7 ft
Overflow Elevation	2,128.6 ft	2,409.0 ft
Floor Elevation	2,109.3 ft	2,385.0 ft
Wall Height	20.3 ft	24.7 ft
Operational Storage Range	3.0 ft	3.0 ft
Outlet Elevation	2,109.8 ft	2,387.0 ft
Volume (Floor to Overflow)	76,647 gal	95,312 gal
Dead Storage Below Outlet	1,986 gal	7,943 gal
Usable Storage	74,661 gal	87,370 gal
Operational Storage	11,914 gal	11,914 gal

EQUALIZING STORAGE

Equalizing storage is the volume designated to meet periodic peak demands placed on the water system. Equalizing storage is sized based on the difference between the PHD and the supply source flow rate. DOH requires that equalizing storage be stored above an elevation that will provide a minimum pressure of 30 pounds psi at all service connections throughout the system under PHD conditions. Typically, the supply sources primarily operate on a "call on demand" basis to fill the reservoirs. Therefore, the equalizing storage requirements are determined using the standard DOH formula that considers the difference between the system peak hour demand and the combined capacity of the supply sources.

ES = (PHD – Qs) x (150 minutes), but in no case less than zero

Where:

ES = equalizing storage, in gallons.

PHD = peak hour demand, in gpm.

Qs = sum of all installed and active sources, except emergency supply, in gpm.

Or to state it differently, when the PHD is greater than the supply flow rate, equalizing storage must be sized to store the difference between PHD and the supply flow rate for a duration of 2.5 hours. As shown in **Table 3.8**, and assuming DSL will be reduced in the future, the existing supply rates are projected to be very close to the system demand; therefore, equalizing storage will either not be required, or be relatively small.

Table 3.8
Equalizing Storage

	2018	2019	2025	2029	2039
2128 Zone					
Supply Available	118 gpm	118 gpm	118 gpm	118 gpm	118 gpm
PHD	70 gpm	94 gpm	85 gpm	88 gpm	93 gpm
Supply to 2409 Zone	31 gpm	31 gpm	31 gpm	31 gpm	31 gpm
Supply Excess (Deficit)	17 gpm	(7) gpm	2 gpm	(1) gpm	(6) gpm
Equalizing Storage	***0 gal***	***1,011 gal***	***0 gal***	***85 gal***	***848 gal***
2230 / 2409 Zones					
Supply Available	60 gpm	60 gpm	60 gpm	60 gpm	60 gpm
PHD	31 gpm	21 gpm	19 gpm	20 gpm	21 gpm
Supply Excess (Deficit)	29 gpm	39 gpm	41 gpm	40 gpm	39 gpm
Equalizing Storage	***0 gal***	***0 gal***	***0 gal***	***0 gal***	***0 gal***
Mt Park					
Supply Available	50 gpm	50 gpm	50 gpm	50 gpm	50 gpm
PHD	25 gpm	35 gpm	36 gpm	36 gpm	37 gpm
Supply Excess (Deficit)	25 gpm	15 gpm	14 gpm	14 gpm	13 gpm
Equalizing Storage	***0 gal***	***0 gal***	***0 gal***	***0 gal***	***0 gal***

STANDBY STORAGE

Standby storage is defined as emergency storage necessary to meet demands in the event of either a supply failure, or when unforeseen conditions require demands much higher than anticipated. This volume of storage is 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, or 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 DOH *Water System Design Manual* recommends the standby storage volume be twice the ADD or one day of MDD for systems with a single supply source. For multiple sources, the largest source is assumed to be out of service, and the remaining are de-rated to 20 hours per day. The minimum standby storage requirement per the DOH Design Manual shall not be less than 200 gallons times the number of equivalent residential units (ERUs). The standby storage summary is shown in **Table 3.9**.

Table 3.9
Standby Storage

	2018	2019	2025	2029	2039
2128 Zone					
Number of ERUs (MDD)	91	100	91	94	99
ERU_{MDD}	529 gpd	529 gpd	529 gpd	529 gpd	529 gpd
No. of Days	1 days	1 days	1 days	1 days	1 days
Supply Available (Derated)	46 gpm	46 gpm	46 gpm	46 gpm	46 gpm
Supply to 2409 Zone	31 gpm	31 gpm	31 gpm	31 gpm	31 gpm
Volume Based on Supply	0 gal	0 gal	0 gal	0 gal	0 gal
Volume Based on 200 gal/ERU	18,177 gal	20,081 gal	18,217 gal	18,758 gal	19,849 gal
Standby Storage *	***18,177 gal***	***20,081 gal***	***18,217 gal***	***18,758 gal***	***19,849 gal***
2230 / 2409 Zones					
Number of ERUs (MDD)	20	23	21	21	22
ERU_{MDD}	529 gpd	529 gpd	529 gpd	529 gpd	529 gpd
No. of Days	1 days	1 days	1 days	1 days	1 days
Supply Available (Derated)	0 gpm	0 gpm	0 gpm	0 gpm	0 gpm
Volume Based on Supply	10,849 gal	11,985 gal	10,873 gal	11,196 gal	11,847 gal
Volume Based on 200 gal/ERU	4,098 gal	4,528 gal	4,107 gal	4,229 gal	4,475 gal
Standby Storage *	***10,849 gal***	***11,985 gal***	***10,873 gal***	***11,196 gal***	***11,847 gal***
Mt Park					
Number of ERUs (MDD)	13	12	12	13	13
ERU_{MDD}	529 gpd	529 gpd	529 gpd	529 gpd	529 gpd
No. of Days	1 days	1 days	1 days	1 days	1 days
Supply Available (Derated)	0 gpm	0 gpm	0 gpm	0 gpm	0 gpm
Volume Based on Supply	6,852 gal	6,335 gal	6,488 gal	6,681 gal	7,069 gal
Volume Based on 200 gal/ERU	2,589 gal	2,393 gal	2,451 gal	2,524 gal	2,671 gal
Standby Storage *	***6,852 gal***	***6,335 gal***	***6,488 gal***	***6,681 gal***	***7,069 gal***

* Stanbdy storage required is the larger of the two calcuated volumes.

ERU_{MDD} = Maximum day demand per equivalent residential unit
Gpd = gallons per day

FIRE STORAGE

Fire storage is the volume necessary to supply the maximum required fire flow rate for the required duration. The District does not currently require fire flow because of its rural location. The future fire storage volume requirement is assumed to be 120,000 gallons (based on the fire flow requirement of

1,000 gpm for a duration of 120 minutes). Fire storage may be provided in the future if the District installs improvements sufficient for fire service.

STORAGE CAPACITY SUMMARY

The storage summary is presented in **Table 3.10**. The summary assumes fire storage will be required in 20 years. Mt. Park is a closed zone with no storage, but a summary is presented to show the storage required if it were an open zone. If Mt. Park is eventually connected to the 2128 Zone, those volumes would be incorporated into the 2128 Zone totals.

Table 3.10
Storage Summary (gallons)

	2018	2019	2025	2029	2039
2128 Zone					
Operational Storage	11,914	11,914	11,914	11,914	11,914
Equalizing Storage	0	1,011	0	85	848
Standby Storage	18,177	20,081	18,217	18,758	19,849
Dead Storage	1,986	1,986	1,986	1,986	1,986
Fire Storage	0	0	0	0	**120,000**
Storage Required	32,077	34,992	32,117	32,742	154,597
Storage Available	76,647	76,647	76,647	76,647	76,647
Storage Surplus (Deficit)	***44,570***	***41,655***	***44,530***	***43,905***	***(77,950)***
2230 / 2409 Zones					
Operational Storage	11,914	11,914	11,914	11,914	11,914
Equalizing Storage	0	0	0	0	0
Standby Storage	10,849	11,985	10,873	11,196	11,847
Dead Storage	7,943	7,943	7,943	7,943	7,943
Fire Storage	0	0	0	0	**120,000**
Storage Required	30,706	31,842	30,729	31,052	151,704
Storage Available	95,312	95,312	95,312	95,312	95,312
Storage Surplus (Deficit)	***64,607***	***63,470***	***64,583***	***64,260***	***(56,391)***
Mt Park					
Operational Storage	1,370	1,267	1,298	1,336	25,414
Equalizing Storage	0	0	0	0	0
Standby Storage	6,852	6,335	6,488	6,681	7,069
Fire Storage	0	0	0	0	**120,000**
Storage Required	***8,223***	***7,602***	***7,786***	***8,017***	***152,483***

Assuming fire flow is not mandated, there are no anticipated storage deficits for the next 20 years. If 1,000 gpm fire flow is required in the future, or the District elects to provide it, construction of additional storage may be required. There is currently approximately 63,000 gallons of excess storage in the 2230/2409 Zone, which could provide fire flow of 750 gpm for 84 minutes, or 1,000 gpm for 63 minutes. For the 2128 Zone, both tanks can supply fire flow water for a combined total of about 100,000 gallons, or approximately 750 gpm for 130 minutes, or 1,000 gpm for 100 minutes.

STORAGE DEFICIENCIES

Both reservoirs are accessed via primitive roads that can be impassible for wheeled vehicles in the winter. Neither site has security fencing, though the areas have not been prone to vandalism.

CONTROL SYSTEM ANALYSIS

The District's control systems were installed in 2015. The supervisory control and data acquisition (SCADA) server computer is nearing its recommended 5-year replacement cycle.

The Fir Road communications repeater and LWWUA Reservoir controls are solar powered. The repeater solar panel occasionally gets covered by snow, and the batteries are susceptible to cold weather damage.

The District currently has only one spare radio on hand.

New ultrasonic style flow meters were installed on all sources in 2015. The meters have had accuracy issues due, at least in part, to debris clogging the sensor ports, and reliability issues with the electronic outputs.

TREATMENT SYSTEM ANALYSIS

All sources had new liquid chlorine injection systems installed in 2015. The small diaphragm style chlorine pumps typically have a lifespan of 4 to 7 years. Tanks, piping, valves, and injectors have a typical lifespan of 7 to 10 years.

PHYSICAL CAPACITY

ANALYSIS CRITERIA

The capacity of the District's water system was determined from the limiting capacity of the water rights, transmission mains, supply, and storage facilities. The supply capacity analysis was based on the limiting capacity of the supply facilities and the system's MDD per ERU. The storage capacity analysis was based on the storage capacity available for equalizing and standby storage, and the computed storage requirement per ERU. Fire storage was excluded because it is not currently required.

The annual water rights capacity evaluation was based on the existing annual water rights, as summarized in **Chapter 4**, and the system's ADD per ERU. The instantaneous water rights capacity evaluation was based on the existing instantaneous water rights, as summarized in **Chapter 4**, and the system's MDD per ERU.

Source capacity is the Supply Available value from **Table 3.6** reduced assuming a 20 hour pumping day.

Treatment capacity (chlorination) is the same as Source capacity.

Capacity Rated Storage is obtained from **Table 3.10** by adding the storage available and subtracting the operational and dead storage values.

Water rights Qa and Qi are from **Table 4.1**.

Transmission capacity assumes no more than 5 feet per second (fps) velocity. The smallest main used for this criteria is the 4-inch main in North Shore Road, assuming all flow is coming from the LWWUA Reservoir.

Distribution system capacity is typically limited by fire flow, which is not currently provided. Refer to the **Distribution System Analysis** section for a discussion of fire flow performance.

EXISTING CAPACITY ANALYSIS RESULTS

A summary of the results of the existing system capacity analyses are shown in **Table 3.11** for District's system and **Table 3.12** for Mt. Park.

Table 3.11
District Physical Capacity Analysis

Average Day Demand	21,789 gpd
ERU_{ADD}	200 gpd
Maximum Day Demand	69,890 gpd
ERU_{MDD}	529 gpd

	Total MDD (gpd)	Total PHD (gpm)	Number of Connections	ERUs (MDD)
Single-Family	43,045	76	124	81
Multi-Family	0	0	0	0
Subtotal	43,045	76	124	81
Non-Residential	0	0	0	0
Subtotal	0	0	0	0
DSL	26,845	19	n/a	51
Total	69,900	95	124	132

Facility	Capacity Available	ERUs
Source	84 gpm	227
Treatment	84 gpm	227
Capacity Related Storage	138,203 gallons	288
Transmission (5 fps in 4-inch main)	196 gpm	533
Distribution	n/a	
Water Rights Qa	100,123 gpd	501
Water Rights Qi	904 gpm	2,458

Total System Physical Capacity (ERUs)	***227***
(Minimum of values listed above)	
Excess Capacity (ERUs)	95

The results of the system capacity analysis indicate that the limiting capacity of the District's system is the source of supply, which can support up to a maximum of approximately 227 ERUs, which is approximately 60 percent more than the existing number of ERUs.

Table 3.12
Mt. Park Physical Capacity Analysis

Average Day Demand	435 gpd
ERU_{ADD}	200 gpd
Maximum Day Demand	4,965 gpd
ERU_{MDD}	529 gpd
ERU_{PHD}	3.0 gpm

	Total MDD (gpd)	Total PHD (gpm)	Number of Connections	ERUs (MDD)
Single-Family	4,965	28.3	6	9
Multi-Family	0	0	0	0
Subtotal	**4,965**	**28.3**	**6**	**9**
Non-Residential	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**
DSL	**745**	**4.3**	**n/a**	**1**
Total	***5,700***	***33***	***6***	***11***

Facility	Capacity Available	ERUs
Source	43 gpm	14
Treatment	43 gpm	14
Capacity Related Storage	n/a	
Transmission (5 fps in 8-inch main)	783 gpm	259
Distribution	n/a	
Water Rights Qa	3,481 gpd	17
Water Rights Qi	50 gpm	17

Total System Physical Capacity (ERUs)	***14***
(Minimum of values listed above)	
Excess Capacity (ERUs)	***3***

The Mt. Park physical capacity analysis uses PHD rather than MDD because it is a closed zone. The main limitation is source capacity, with water rights close behind. Since water rights were defined based on the number of existing customers, this is understandable. Both the MDD and PHD calculations are assumed to be very conservative, but until real-time data logging of the source meter is implemented, those values can only be estimated.

DISTRIBUTION SYSTEM ANALYSIS

A hydraulic computer model of the existing water system was created and analyzed using WaterCAD by Haestad Methods. The model was used to estimate fire flow and system pressure during multiple existing and future scenarios. A summary of the modeling scenarios and results are as follows.

2018 PEAK HOUR DEMAND

Peak hour demand analyses for 2018 were performed on the existing distribution system. The reservoirs were set at the estimated bottom of operating storage, with the Brown Road Well in operation and the

LWWUA Well off. Peak hour demand flow was met, and the resulting minimum pressure was 32 psi at the downstream side of the Lakeview Pressure Reducing Valve (PRV), and 32 psi near the intake to the Combined Booster Station. All customers have at least 35 psi. The maximum pressure in the systems was 150 psi at the Combined Booster Station discharge, with the maximum pressure to a customer at approximately 140 psi just north of the Combined Booster Station. The hydraulic analysis for the Mt. Park system used an assumed pump curve and may not represent actual conditions. The modeling results are shown on **Figure 3.1**.

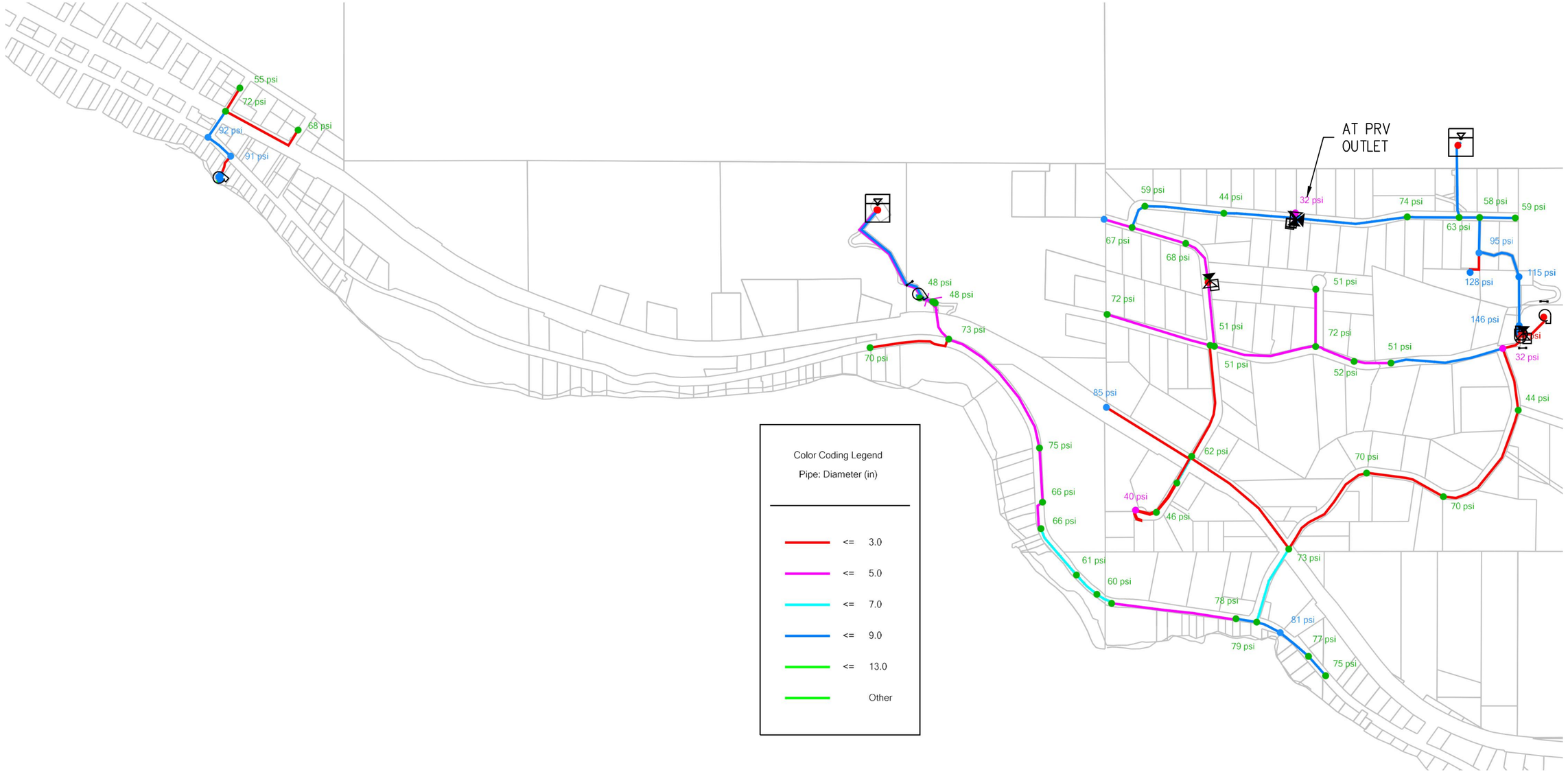
FIRE FLOW DEMAND

Fire flow scenarios were modeled under current and 2029 MDD demands for the existing system and with a 12-inch water main installed to the Mt. Park system. The LWWUA and Whispering Pines Reservoirs were lowered to just 6 feet of water to represent 120,000 gallons of fire storage depleted, and the Brown Road and LWWUA Wells were online. Available fire flow was modeled under two conditions. The first maintains 20 psi at the flow location and 20 psi to all customers. The second adds a limitation of no more than 10 fps in distribution mains. The velocity constraint was added because high velocity can result in significant water hammer and potential damage. Even with the velocity constraint, at least 1,000 gpm should be available within 6 inch and larger mains, except when fed solely by 4 inch and smaller mains, such as along Fir Drive and North Shore Road. The results are shown on **Figure 3.2** for the current system and **Figure 3.3** for the future system.

DISTRIBUTION SYSTEM LIMITATIONS

The system was not designed to provide fire protection water to existing structures, since those structures were approved for construction without fire protection. Some water mains installed in 2015 were sized to accommodate fire flow if it is required in the future. Specific pipe capacity limitations are as follows:

- An 8-inch main was installed between the LWWUA Well and Reservoir in 2001, but it was connected to the existing 4-inch main at the Lake Wenatchee Highway. The 4-inch main limits outflow from the LWWUA Reservoir to approximately 400 gpm.
- Approximately 7,000 feet of 4-inch PVC mains existing in 2015 were retained during the 2015 construction project. Most of these mains are in North Shore Drive, Fir Drive, and northern Brown Road. The small size limits fire flow to 600 gpm or less.
- There is one fire hydrant in the 2409 Zone, three hydrants in the 2128 Zone, and no hydrants in the 2230 Zone or Mt. Park Zone.
- All of the Mt. Park distribution pipe was replaced in 2015, but the system remains isolated from the main District system due to it being approximately one mile away.



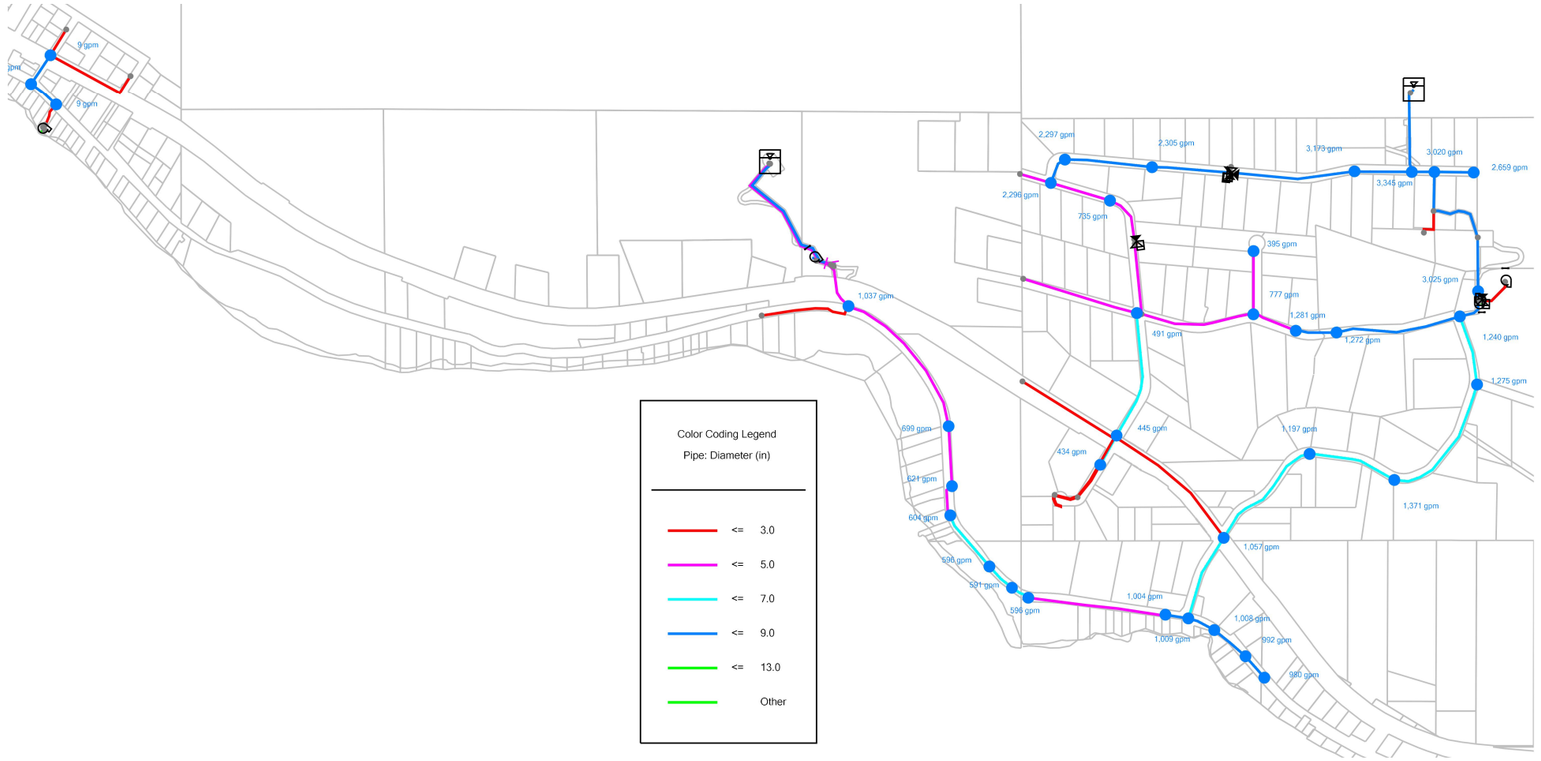
Pressures shown represent modeled pressure assuming peak hour demand and reservoirs at approximately half full.

Figure 3.1: 2018 Peak Hour Demand

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: No Scale
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/6/2019
FILE NAME: LWWSP19-P-MODEL.DWG
JOB: LWW 217.010



Flowrate shown in the upper figure represents the modeled available fire flow while maintaining both 20 psi at the flow location, and 20 psi to all customers.

Flowrate shown represents modeled fire flow available within the watermain. Not all locations shown represent actual fire hydrants, nor the flow available from a single hydrant. More than one hydrant may be needed to provide the full rated flow.

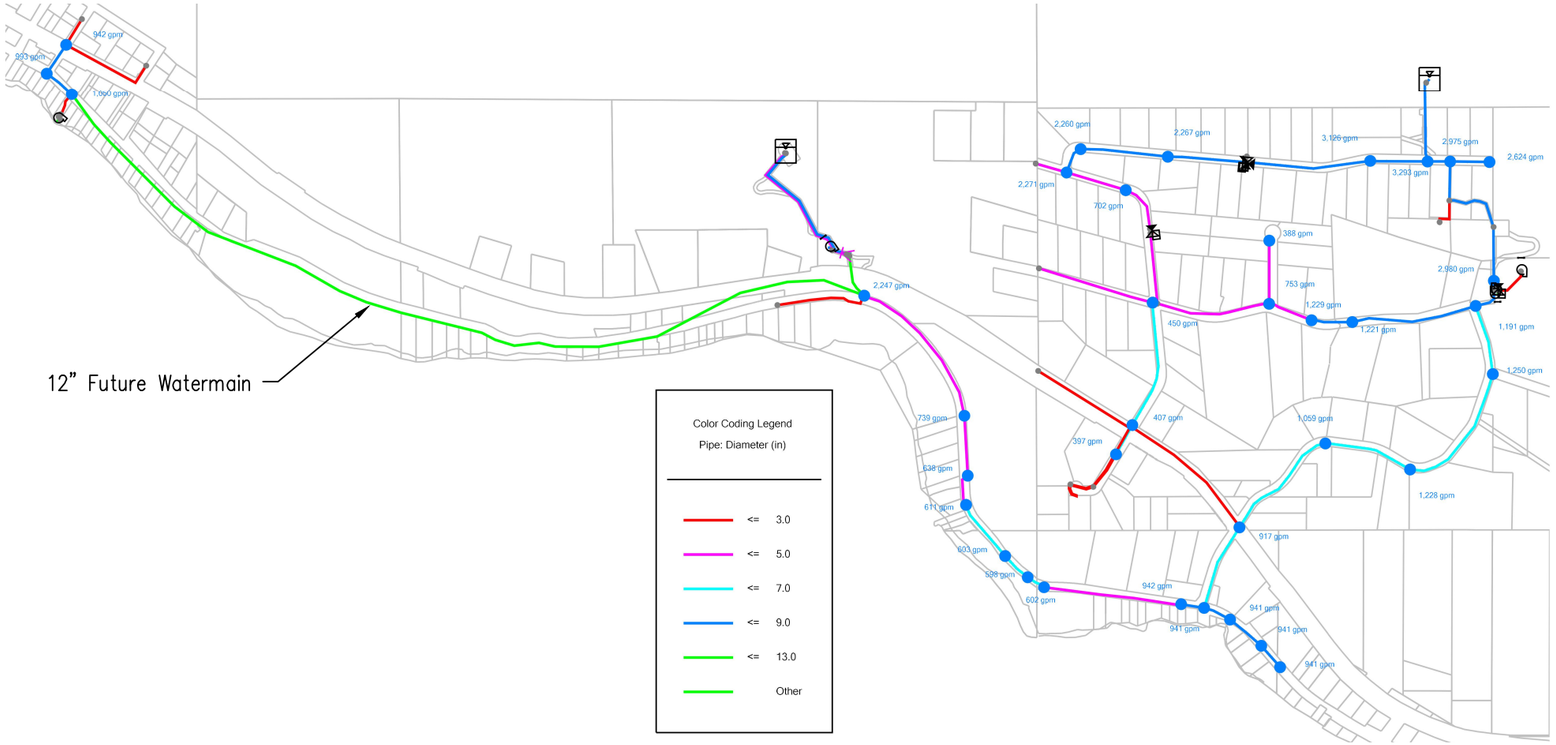
Flowrate shown in the lower figure represents the modeled available fire flow while maintaining 20 psi at the flow location, 20 psi to all customers, and limiting velocity to no more than 10 feet per second in distribution mains.

Figure 3.2: 2018 Fire Flow

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

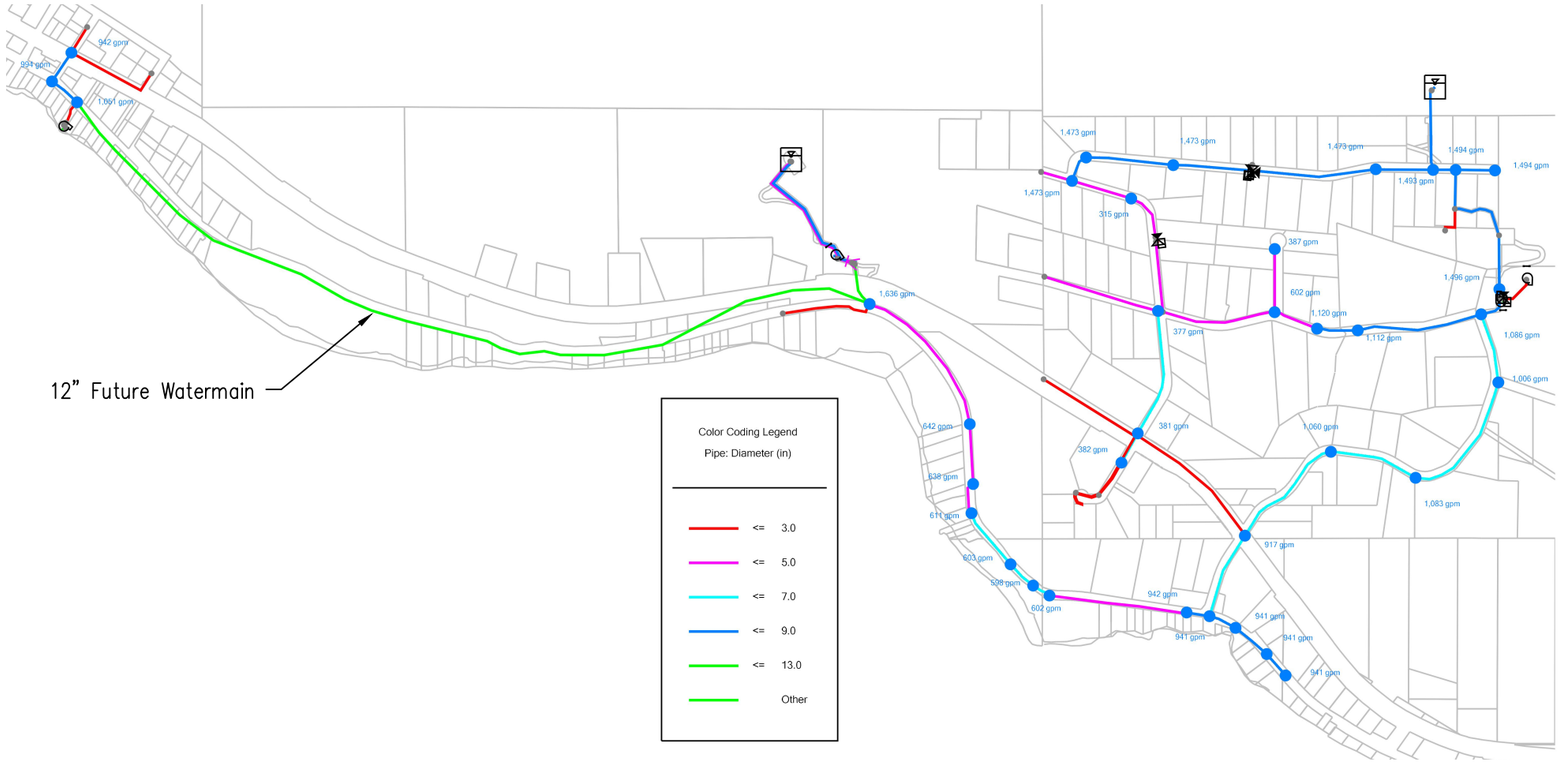
SCALE: No Scale
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/6/2019
JOB: LWW 217.010
FILE NAME: LWWSP19-P-MODEL.DWG



Flowrate shown in the upper figure represents the modeled available fire flow while maintaining both 20 psi at the flow location, and 20 psi to all customers.

Flowrate shown represents modeled fire flow available within the watermain. Not all locations shown represent actual fire hydrants, nor the flow available from a single hydrant. More than one hydrant may be needed to provide the full rated flow.



Flowrate shown in the lower figure represents the modeled available fire flow while maintaining 20 psi at the flow location, 20 psi to all customers, and limiting velocity to no more than 10 feet per second in distribution mains.

Figure 3.3: Future Fire Flow

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: No Scale
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/6/2019
FILE NAME: LWWSP19-P-MODEL.DWG
JOB: LWW 217.010

RH2

4 | WATER SOURCE AND WATER USE EFFICIENCY

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 3** discusses the Lake Wenatchee Water District's (District) ability to supply a sufficient quantity of water and identifies future source requirements. This chapter discusses the District's existing water sources, water rights, and water use efficiency.

OVERVIEW

This is a planning document only, it is not intended as a definitive statement or analysis of the full scope of all water rights held by the District, or in which the District may have an interest. Nothing herein shall be interpreted or used as a statement against the interests of, or binding upon, the District in any future proceeding or analysis concerning the scope of the water rights held by District or in which the District may have an interest.

A water right is a legal authorization to use a specified amount of public water for specific beneficial purposes. The water right is most often expressed in terms of instantaneous diversion/withdrawal rate (cubic feet per second [cfs] or gallons per minute [gpm]) and annual volume (acre-feet per year [afy]). Washington State law requires users of public water to receive approval from the Washington State Department of Ecology (Ecology) prior to use of the water. This approval is granted in the form of a water right permit or certificate. Prior to the water codes, water right claims were filed to identify water use that the claimant believed existed and therefore represented vested rights. A Report of Examination (ROE) may be prepared by the local Water Conservancy Board to propose changes to rights, which are reviewed by Ecology and formalized in a Record of Decision (ROD).

EXISTING WATER RIGHTS AND CLAIMS

The District brings together what had been five independent systems (Lake Wenatchee Water Users Association (LWWUA), Mountain Park/Zufall, Brown Road Water Users Association, Lester Addition Water Company (Lester) and Whispering Pines Water Users Association (Whispering Pines)) that held several water rights from various sources of supply. The cumulative total of the water rights held by the District is 2.12 cfs (953.76 gpm) instantaneous rate and at least 116.06 afy annual volume as shown in **Table 4.1**.

Table 4.1
Water Rights Summary

Current Point of Diversion	Number	Date	Instantaneous (Qi)		Annual (Qa)	Year of Full Use	Year of R.O.D.
			(cfs)	(gpm)	(ac ft)		
LWWD Wells	CS3-00959C@1 *	1969	0.60	270.00	* 18.00	2032	2014
LWWD Wells	CS4-26470C@1 *	1979	0.11	50.00	30.50	2032	2014
LWWD Wells	CS4-SWC8453	1961	0.20	90.00	55.00	2032	2014
LWWD Wells	CS4-WRC017516@4	1909	0.80	359.00	17.76	2032	2013
LWWD Wells	SWC 9776	1963	0.10	45.00	4.40	2032	2014
LWWD Wells	CS4-WRC028802(B)	1909	0.20	89.76	4.50	2017	2014
Zufall (Mt Park) Well	CG4-030577CL	1933	0.11	50.00	3.90	2032	2014
		Total	***2.12***	***953.76***	***116.06***		

* The 2013 ROE states the combined annual withdrawal from 00959 and 26470 shall not exceed 30.5 ac ft.

Each individual water right, organized by the system that originally held it, is listed in **Appendix G** and discussed in the following sections.

LAKE WENATCHEE WATER USERS ASSOCIATION (CS4-WRC017516@4, CS4 -WRC028802(B))

LWWUA Well also has been known as the Dickinson Well. Multiple water rights are associated with this well, which include those for the District, Dickinson, and West. Only the District rights are summarized herein.

CS4-WRC017516@4

Please note, this right is listed on some recorded documents under the number WRC107516. This appears to be a typographic error, and the correct number is WRC017516.

LWWUA held water right claim number 017516 to divert water from the Dickinson Well for community domestic residential use (0.8 cfs and 17.76 afy) with a claimed date of first use of June 14, 1909. Originally, the water right was just for diversion from Fall Creek. However, a change to this water right was processed by the Chelan County Water Conservancy Board and ultimately approved by Ecology with modifications on May 8, 2002. This change application also split the claim into a Record A, which was retained by the LWWUA and a Record B, which was retained by Don West, LLC. Only the LWWUA portion is available for use by the District and will be discussed here. The 2002 decision changed the approved point of diversion/withdrawal from Fall Creek to the Dickinson Well. However, the change approval listed the wrong legal description for the Dickinson Well. In June 2009, the LWWUA filed another change application (CS4-017516CL(A)@4) to correct this error. The point of withdraw was listed as the NW1/4, SE1/4, Section 14, T 27 N, R 16 EWM, but should be NE1/4, SE1/4, Section 13, T 27 N R 16 EWM. The error is understandable because the well is located very close to the ¼ section line. The original Claim 017516 was for municipal water supply purposes since the LWWUA system served 15 or more residential service connections and/or provided residential water to a non-residential population of 25 people for at least 60 days a year. LWWUA was a municipal water supplier.

In 2013, the Chelan County Water Conservancy Board prepared a ROE supporting the following changes under file number CS4-WRC017516@4 (CHEL-09-11):

- Correcting the point of withdrawal from the NW 1/4, SE 1/4 to the NE 1/4, SE ¼.
- Adding a point of withdrawal (parcel 271718400050 [Brown Road or Homestead Well]).

In 2013, Ecology prepared a ROD accepting the ROE proposal as submitted. The ROE also requires the right to be put to full use by the year 2032.

CS4-WRC028802(B)

The described point of withdrawal has historically served Dickinson, Don West, and LWWUA. Dickinson initially acquired the subject claim to provide domestic water and irrigation. Due to problems with the Fall Creek diversion, Dickinson transferred 0.2 cfs and 4.5 acre-feet of domestic water to the well to allow for alternative withdrawal from a well and redistribution by LWWUA. This change was approved subject to an Ecology modification letter dated May 8, 2002. Dickinson reserved the balance of the claim for diversion from Fall Creek to use for continued irrigation. However, this change incorrectly described the location of the point of withdrawal for the Dickenson Well. In June 2009, Dickinson filed change application CS4-288902@1 for the purpose of correcting this error. Since filing this application, Dickinson and LWWUA had subsequently executed a memorandum of understanding (MOU) transferring a portion of the subject claim to the District for municipal distribution. Lastly, Dickenson and the District filed a Request for Administrative Division to consummate separation of the subject claim as per the 2002 change decision that was approved by Ecology on February 28, 2014.

In 2009, the District applied for the following changes under file number CS4-WRC028802(B) (CHEL 09-13):

- Change in place of use to the District service area.
- Change in the purpose of use to continuous municipal.
- Correct the point of withdrawal.
- Add a point of withdrawal (parcel 271718400050 [Brown Road or Homestead Well]).

In 2014, the Chelan County Water Conservancy Board prepared a ROE supporting the request, with a provision that the combined maximum instantaneous quantity (Qi) for CS4-WRC028802(A) [Dickinson] and CS4-WRC0028802(B) [District] shall not exceed 1.0 cfs. In 2014, Ecology prepared a ROD accepting the ROE proposal, except for modifying the right to be put to full use by the year 2017, stating that date as 15 years since the last beneficial use of the right. This right has been associated with the Homestead Well, which became operational in 2015.

MOUNTAIN PARK/ZUFALL (CG4-030577CL)

The Mountain Park/Zufall (Mt. Park) water system held water right claim number 030577 to withdraw water from a well for domestic use with a claimed date of first use of June 20, 1933. The name on the face of the water right claim is Mr. Ralph Zufall. This document indicates that Mr. Zufall claimed 50 gpm but was only using 25 gpm when the claim was filed in 1973. It does not have any information related to the annual volume claimed or used at the time of filing. The original Water Right Claim No. 030577 was not for municipal water supply purposes since the system served less than 15 residential service connections and did not provide residential water to a non-residential population of 25 people for at least 60 days a year. Therefore, per the original claim, the Mountain Park/Zufall water system was not a municipal water supplier.

In 2012, the District applied for the following changes under file No. CG4-030577CL (CHEL-12-10):

- Change in place of use to the District service area.

- An annual right of 4.5 acre-feet (0.64 acre-feet per residence x 7 residences).
- Change in the use to continuous municipal.
- Add two points of withdrawal (parcels 271613410050 [LWWUA Well] and 271718400050 [Brown Road or Homestead Well]).

In 2013, the Chelan County Water Conservancy Board prepared a ROE supporting the request, which included a provision that "The existing authorized point of withdrawal utilized from Mt. Park shall be decommissioned upon availability of water service from the primary District municipal system." In 2014, Ecology prepared a ROD accepting the ROE proposal, except for modifying the annual right to 3.9 acre feet (390 gallons per day (gpd) per residence x 9 residences). The ROE also requires the right to be put to full use by the year 2032.

BROWN ROAD WATER USERS ASSOCIATION (SWC 8453)

The Brown Road Water Users Association (Brown Road) held surface water certificate number SWC 8453 to divert water from Barnard Creek and withdraw water from a well for domestic use (0.2 cfs and 55 afy) with a priority date of November 16, 1961. Originally, the water right was just for diversion from Barnard Creek. However, a change to this water right (CS4-SWC8453@1) was processed by the Chelan County Water Conservancy Board and ultimately approved by Ecology with modifications on June 18, 2003. This change added a well as an additional point of withdrawal/diversion while retaining the original Barnard Creek diversion. Even though the Barnard Creek diversion was retained on SWC 8453 when the well was added as an approved point of withdrawal, the water system was relying solely on the well as its source of supply since October 2003. The original SWC 8453 was for municipal water supply purposes since the Brown Road Water Association system served 15 or more residential service connections and/or provided residential water to a non-residential population of 25 people for at least 60 days a year. The Brown Road Water Association was a municipal water supplier.

In 2012, the District applied for the following changes under file No. SWC 8453 (CHEL 12-05):

- Change in place of use to the District service area.
- Change in the use to continuous municipal.
- Remove Barnard Creek as a source.
- Add a point of withdrawal (parcel 27161340050 [LWWUA Well]).

In 2013 the Chelan County Water Conservancy Board prepared a ROE supporting the request. In 2014, Ecology prepared a ROD accepting the ROE proposal as submitted. The ROE also requires the right to be put to full use by the year 2032.

LESTER ADDITION WATER COMPANY (SWC 9776)

The Lester Addition Water Company (Lester) held surface water certificate No. SWC 9776 to divert water from Barnard Creek for community domestic supply of 10 homes (0.1 cfs) with a priority date of August 15, 1963, with issuance of the certificate on October 24, 1966. As is common on older surface water rights, there is only an instantaneous rate listed with no mention of the authorized annual volume. Water Right SWC 9776 was originally not for municipal water supply purposes since the system served less than 15 residential service connections and did not provide residential water to a non-residential population of 25 people for at least 60 days a year. Therefore, the Lester Addition Water Company was not a municipal water supplier.

In 2012, the District applied for the following changes under file No. SWC 9776 (CHEL 12-07):

- Change in place of use to the District service area.
- An annual right of 6.0 acre-feet (0.6 acre-feet per residence x 10 residences).
- Change in the use to continuous municipal.
- Remove Barnard Creek as a source.
- Change the point of withdrawal (parcels 271613410050 [LWWUA Well] and 271718400050 [Brown Road or Homestead Well]).

In 2013, the Chelan County Water Conservancy Board prepared a ROE supporting the request. In 2014, Ecology prepared a ROD accepting the ROE proposal, except for modifying the annual right to 4.4 acre-feet (390 gpd) per residence x 10 residences). The ROE also requires the right to be put to full use by the year 2032.

WHISPERING PINES WATER USERS ASSOCIATION (S3-00959C, S4-26470C)

The Whispering Pines held two water rights: 1) surface water certificate No. S3-00959C to divert water from Barnard Creek for domestic use (0.6 cfs and 18 afy) with a priority date of December 18, 1969; and 2) surface water certificate No. S4-26470C to divert water from a spring that is tributary to Barnard Creek for domestic use (0.11 cfs and a total of 30.5 afy) with a priority date of October 26, 1979. In November 2001, Whispering Pines submitted a change application to Ecology (CS3-00959C) that requested to change the point of diversion from Barnard Creek to a spring that is tributary to Barnard Creek. This is the same spring that was approved as the point of diversion under S4-26470C. This change application was superseded by a 2012 application discussed below. Originally, water right S4-26470C was just for diversion from Barnard Creek. However, a change to this water right (CS4-26470C) was processed and ultimately approved by Ecology on October 21, 1992. This change made the spring that is tributary to Barnard Creek the authorized point of diversion and removed authorization to use the original Barnard Creek point of diversion.

The two water rights held by Whispering Pines contained provisional language that had been interpreted by the District as described below. The original ROE for S3-00959C contained a provision that stated, “The total annual diversion for community domestic supply use authorized under permit for this application shall not exceed 18 acre-feet less any amount diverted for this use under other rights appurtenant to the same lands." At the time the report of examination was written there was another active permit (15951) for the project that has since been cancelled. Since the right that preceded this right has been cancelled, this right should be considered primary.

For S4-26470C, the language on the original ROE and certificate indicated that "A total of 30.5 acre-feet shall be allowed for the purpose of community domestic supply, less any amount applied to these same lands under existing rights." Since both S3-00959C and S4-26470C are being used to supply water to the same lands, the total combined annual quantity that can be diverted under these two water rights is 30.5 afy. Of that 30.5 afy, up to 18 afy can be diverted under S3-00959C, or up to the full 30.5 afy can be diverted under S4-26470C. Both the original S3-00959C and S4-26470C were for municipal water supply purposes since the Whispering Pines system served 15 or more residential service connections and/or provides residential water to a non-residential population of 25 people for at least 60 days a year. Whispering Pines was a municipal water supplier.

In 2012, the District applied for the following changes under file No. S3-00959C (CHEL 12-08):

- Change in place of use to the District service area.
- Change in the use to continuous municipal.

- Change to the point of withdrawal (parcels 271613100000 [spring], 271613410050 [LWWUA Well] and 271718400050 [Brown Road and Homestead Wells]).

In 2013, the Chelan County Water Conservancy Board prepared a ROE supporting the request. In 2014, Ecology prepared a ROD accepting the ROE proposal as submitted. The ROE also requires the right to be put to full use by the year 2032.

In 2012, the District applied for the following changes under file No. S4-26470C (CHEL 12-09):

- Change in place of use to the District service area.
- Adding two points of withdrawal (parcels 271613410050 [LWWUA Well] and 271718400050 [Brown Road or Homestead Well]).

In 2013, the Chelan County Water Conservancy Board prepared a ROE supporting the request. In 2014, Ecology prepared a ROD accepting the ROE proposal as submitted. The ROE also requires the right to be put to full use by the year 2032.

WATER RIGHTS EVALUATION

Revised Code of Washington (RCW) 90.54.020(8) states that development of water systems that provide water to the public generally in regional areas within the state shall be encouraged. The formation of the District and the incorporation of the five private water systems into the District represented an opportunity to fulfill the desire of the legislature.

Based on review of the existing water rights, it appears that all are senior to the in-stream flow rule and are not subject to limitation by stream flow in the Wenatchee River or its tributaries.

An evaluation of the District's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands.

Table 4.2 compares the maximum instantaneous water right rate with the maximum day demand (MDD) of the system and the maximum annual water right volume with the average day demand (ADD) of the system. As shown in the table, the District has sufficient water rights (both instantaneous and annual rates) to meet the demands of the existing customers and for the next 20 years.

Table 4.2
Water Rights Forecast

Year	Annual (ac ft)		Instantaneous (gpm)	
	Demand	Rights	Demand	Rights
2019	26.8	116.1	55.2	953.8
2024	30.9	116.1	63.6	953.8
2028	33.0	116.1	67.9	953.8
2038	38.4	116.1	78.9	953.8

The Water Right Self-Assessment Form is contained in **Appendix G**.

FUTURE WATER RIGHT ACTIONS

The 2013 ROD for Mt. Park may state that the existing point of withdrawal shall be decommissioned upon availability of water service from the primary Lake Wenatchee Water District municipal system.

Connection to the District's municipal system is not currently scheduled, but could occur if enough customers along the proposed pipeline route request service.

If the District decides to cease using any of the sources and associated water rights, it is recommended that the District consider transferring those water rights to a new point of diversion/withdrawal or into the Trust Water Rights Program on a temporary basis to protect them from relinquishment. Relinquishment occurs when there are 5 or more consecutive years of non-use without sufficient cause.

WATER USE EFFICIENCY

INTRODUCTION

The District recognizes that water is a valuable and essential natural resource that needs to be used wisely. This Water Use Efficiency (WUE) Program provides an approach to increase water use efficiency within the District's water service area.

BACKGROUND

The Water Use Efficiency Rule

In September 2003, the Washington State Legislature passed the Municipal Water Supply – Efficiency Requirements Act, also known as the Municipal Water Law. The Municipal Water Law required the state to implement the WUE Rule. The intent of this rule is to help reduce the demand that growing communities, agriculture, and industry have placed on our state's water resources and to better manage these resources for fish and other wildlife. Municipal water suppliers are obligated under the WUE Rule to enhance the efficient use of water by the system and/or its consumers.

The WUE Rule applies to all municipal water suppliers and requires suppliers to:

1. Develop WUE goals through a public process and report annually on their performance;
2. Maintain distribution system leakage (DSL) at or below 10 percent of production;
3. Meter all existing and new service connections;
4. Collect production and consumption data, calculate DSL and forecast demands;
5. Evaluate WUE measures; and
6. Implement a WUE program.

Water Use Efficiency Program Requirements

The *Water Use Efficiency Guidebook*, originally published by the Washington State Department of Health (DOH) in July 2007, and revised most recently in January 2017, identifies the water use reporting, forecasting, and efficiency program requirements for public water systems. A WUE program meeting these requirements is a necessary element of a Water System Plan (WSP) as required by DOH and is necessary to obtain water right permits from Ecology. The *Water Use Efficiency Guidebook* defines the necessary components of a WUE program as four fundamental elements.

1. Planning requirements that include collecting data, forecasting demand, evaluating WUE measures, calculating distribution system leakage, and implementing a WUE program to meet goals.

2. A DSL standard of 10 percent or less based on a 3-year rolling average. For systems with less than 500 connections, the DSL standard may be increased to 20 percent if a request with supporting data is provided to DOH.
3. Goal setting to provide a benchmark for achievement and help define the success of the WUE program.
4. Annual performance reporting on progress towards meeting WUE goals.

WATER USE EFFICIENCY PROGRAM

As previously described, the fundamental elements of a WUE program include planning requirements and DSL standards, as well as goal setting and performance reporting. The District's water use data, demand forecasts, and other planning requirements are contained in **Chapter 2**. The District's WUE Program that follows includes a statement of its goals and objectives, the evaluation and selection of alternative efficiency measures, the schedule and budget, and the method of program monitoring.

EVALUATION AND SELECTION OF WATER USE EFFICIENCY MEASURES

The District's evaluation of WUE measures and selected levels of implementation are presented within this section. The measures fall within three categories of implementation:

1. Mandatory measures that must be implemented;
2. Measures that must be evaluated; and
3. Additional measures selected by the District that must either be evaluated or implemented.

The District serves less than 500 water service connections. Based on the number of connections, at least one WUE measure must be evaluated or implemented. Measures that are mandatory cannot be credited towards the system's WUE measures. Since the District implements the minimum number of required measures, a cost-effective evaluation is not required.

MANDATORY MEASURES

Source Meters

The volume of water produced by the system's sources must be measured using a source meter or other meter installed upstream of the distribution system (Washington Administrative Code (WAC) 246-290-496(1)). Source meters are currently installed at each of the District's sources, although the Homestead Well meter is currently faulty.

Service Meters

All public water systems that supply water for municipal purposes must install individual service meters for all water users (WAC 246-290-496(2)). Many customers were already metered prior to the 2015 system consolidation project. Meters were installed on the remaining customers by 2015. All future connections that are installed or activated will be equipped with a service meter. Service meters for residential users are read roughly monthly. The District replaces meters as soon as broken meters are identified.

Public water systems are required to report customer water use by class, such as residential, non-residential, industrial, etc. All District customers are classified as residential, though it is

acknowledged that some properties are privately rented seasonally. The District does not monitor this practice.

Meter Calibration

The District must calibrate and maintain meters based on generally accepted industry standards and manufacturer information (WAC 246-290-496(3)). Compliance will be maintained by the District by performing maintenance on the source and service meters every 5 to 10 years. Meter calibration is performed on an as-needed basis, typically when meter readings are inconsistent with customer consumption history.

DISTRIBUTION SYSTEM LEAKAGE

The collection of service meter data is a significant element in obtaining water loss information and calculating DSL. The annual WUE reports submitted to DOH contains the District's actions (if any) taken to minimize leakage in the system.

Water systems with less than 500 connections are allowed up to 20-percent DSL if the system requests a higher percentage of leakage and the system submits the following items to DOH:

1. Production volume.
2. DSL volume.
3. Leak detection survey completed in the last 6 years.
4. Repair of all leaks found.
5. No additional leaks found in the distribution system.
6. Leak minimization efforts included in the WUE program.
7. Technical, economical, or water system characteristics justifying a higher percentage level.

An evaluation of DSL is presented in **Chapter 2**. As discussed in that chapter, there is insufficient historical meter data to prepare a reasonable estimate. Only the year 2018 has both source and customer meter readings. The estimate for 2018 is 21-percent DSL, but there is missing and inaccurate customer and source data that could reduce this value. The District is working to resolve its metering issues.

CUSTOMER EDUCATION

Annual customer education regarding the importance of using water efficiency is a required element of all WUE programs. Customer education will be provided in the District's annual Consumer Confidence Report (CCR) and will include information on the system's DSL, progress towards meeting WUE goals, and tips for customers on using water more efficiently.

MEASURES THAT MUST BE EVALUATED

Rate Structure

A rate structure that encourages WUE and provides economic incentives to conserve water must be evaluated, but is not required to be implemented. The District currently bills a flat monthly rate to all customers. This was established to provide stable revenue while a few years of data could be collected on customer consumption patterns.

Since many homes in the District are only occupied part time, the main component of the rate should be a fixed monthly charge to ensure consistent revenues to operate the system. A commodity charge can be

added to encourage conservation and to distribute a portion of the operational costs proportionate to consumption. Three common commodity rate structures are described as follows:

1. Base allocation plus uniform rate: A fixed monthly charge that includes an allocation of water, often similar to that used by an equivalent residential unit (ERU) (such as 6,000 gallons per month). Water used in excess of the allocation is billed at a fixed charge per gallon.
2. Base allocation plus inclining block rate: Same as prior, but water used in excess of the allocation is charged at higher rates for higher usage.
3. No allocation plus commodity rate: A fixed monthly charge that does not include any allocation of water. All water used is billed at either a uniform or block rate.

A further discussion of rates is presented in **Chapter 9**.

MEASURES REVIEWED

Water Bill Showing Consumption History

The District's billing system cannot show consumption history. The District can provide this information to individual customers if requested.

SELECTED MEASURES

The District has chosen to implement the following WUE measures in addition to those that are mandatory or required to be evaluated.

Notifying Customers of Leaks

The District reviews bills, and when an abnormally large reading is identified, contacts the customer to warn of a possible leak. The District identified three large customer leaks in 2017 and 2018.

The customer water meters include a feature that will send an alarm code if they detect usage that may be leakage.

Outdoor Residential Conservation Measures

Irrigation water is provided through the domestic potable water system operated by the District. Customers are encouraged to reference landscape management and xeriscaping programs at http://www.chelanpud.org/conservation/water/xeriscape/index.htm, which is a website provided by the Public Utility District No. 1 of Chelan County with information on plants and landscaping native to Chelan County.

WATER USE EFFICIENCY GOALS AND THE PUBLIC PROCESS

Per WAC 246-290-830, WUE goals must be set through a public process and shall be evaluated and reestablished a minimum of every 6 years. Background on the District's proposed WUE program, water supply characteristics, water demand forecasts, and other elements will be made available two weeks prior to the public forum date. All comments received at the forum will be reviewed and considered by the District. The District's WUE goals will be subsequently adopted by the District. Following initial adoption, WUE goals will be evaluated and re-established during the water system planning process, or at minimum of every 6 years.

The District conducted a public forum on January 23, 2014, documentation of which is in **Appendix I**. The following goals were adopted by resolution.

1. Reduce total production by 3 percent from the wells by 2019.
2. Install consumption meters to all customers by December 2017.
3. Reduce the distribution system leakage to 10 percent or less by 2018.

The District has achieved Goal 2, but there is insufficient data to evaluate goals 1 and 3.

WATER USE EFFICIENCY PROGRAM EVALUATION AND REPORTING

The District will evaluate overall demand per ERU water use and the amount of DSL on an annual basis. The District will evaluate the performance of its WUE program and implemented measures by analyzing demand data and determining the long-term trend towards reducing water usage per ERU and meeting WUE goals. If the program monitoring shows that progress towards meeting the WUE goals is not being accomplished, more rigorous program implementation or additional program items will be considered, along with a cost-effective evaluation of measures.

The District will provide annual WUE performance reports to its customers in its CCR, which also will detail the results of water use monitoring and progress towards achieving the system's WUE goals. A copy of the latest CCR is included in **Appendix F**.

5 | SOURCE PROTECTION

SANITARY SURVEY

A sanitary survey was completed on Lake Wenatchee Water District's (District) system in October 2016, and is included in **Appendix J**.

Additional contingency and emergency response planning related to the water source is provided in **Chapter 6**.

WATER SUPPLY DESCRIPTION

The source of water for recharge of the groundwater supplies is primarily precipitation that occurs in the winter months. It is assumed that the primary location for the groundwater recharge area is north of the supply sources. Given that the recharge area is federally owned and will not be available for development, it does not appear that the aquifer recharge areas will be impacted by development within the District proposed retail service area. Groundwater recharge to the existing sources of supply occurs within the Wenatchee River Watershed (Water Resources Inventory Area (WRIA) 45), and these sources are beneficially used within WRIA 45. WRIA 45 is one of the 16 fish-critical basins established by the Washington State Department of Ecology (Ecology).

The Wenatchee River Watershed is home to three federally listed fish species, including endangered Upper Columbia River spring Chinook salmon, threatened Upper Columbia River steelhead, and threatened bull trout.

Environmental factors such as drought or climate change may affect recharge to the sources. Groundwater levels fluctuate seasonally but recover each spring to previous year levels. Declines in water levels during pumping are attributed to well inefficiency and reduced up-gradient flows in the summer, which are discussed in **Chapter 8**.

WELLHEAD PROTECTION PROGRAM

INTRODUCTION

A wellhead protection program is a proactive and ongoing effort of a water purveyor to protect the health of its customers by preventing contamination of the groundwater it supplies for drinking water. Sections 1428 of the 1986 Amendments to the Federal Safe Drinking Water Act (SDWA) mandate that each state develop a wellhead protection program. In Washington State, the Department of Health (DOH) is the lead agency for the development and administration of the State's wellhead protection program. All federally defined Group A public water systems that use groundwater as their source are required to implement a wellhead protection program. All required elements of a local wellhead protection program must be documented and included in either the Water System Plan (WSP) (applicable to the District) or Small Water System Management Program document (not applicable). The State mandate for wellhead protection and the required elements of a wellhead protection program are contained in Washington Administrative Code (WAC) 246-290-135, Source Protection, which became effective in July of 1994. The minimum required elements of a wellhead protection program for water systems in Washington State that rely on groundwater are as follows:

1. A completed susceptibility assessment of each water source.
2. Delineation of wellhead protection areas for each water source with the 6-month, 1-, 5-, and 10-year time of travel (TOT) boundaries marked using DOH or U.S. Environmental Protection Agency (EPA) guidance for delineation.
3. An inventory of known and potential contaminant sources located within the defined wellhead protection areas, which shall be updated every 2 years.
4. Documentation of the purveyor's notification to all owners/operators of known and potential sources of groundwater contamination within the defined wellhead protection areas.
5. Documentation of the purveyor's notification to regulatory agencies and local governments of the defined boundaries of the wellhead protection areas and the findings of the contaminant source inventory.
6. A contingency plan to ensure that customers have an adequate supply of water in the event that contamination causes a temporary or permanent loss of the system's principal source of supply.
7. Documentation of the purveyor's coordination with local emergency spill responders (including police, fire, and health departments), including notification of wellhead protection area boundaries, and results of the susceptibility assessment, inventory findings, and contingency plan.

SUSCEPTIBILITY ASSESSMENT

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.

The three susceptibility ratings DOH assigns to sources are low, moderate, and high. DOH assigned a high susceptibility rating to the Lake Wenatchee Water Users Association (LWWUA) Well and the Whispering Pines Spring (now disconnected). The Homestead Well is assigned moderate susceptibility, and the Brown Road Well has a low susceptibility rating.

DELINEATION OF WELLHEAD PROTECTION AREAS

A wellhead protection area is the surface and subsurface area surrounding a well, well field, or springs through which contaminants are likely to pass and eventually be transported into the drinking water system. This is the area around the source that must be managed to protect the water supply from contamination. Establishing or delineating the boundaries of the wellhead protection area for each source is most commonly accomplished using the estimated TOT rates of groundwater.

Wellhead Protection Area Zones

The first component of a wellhead protection area is the sanitary control area required by WAC 246-290-135. This protective area should be tightly controlled by the purveyor to minimize direct contamination at the wellhead. The minimum sanitary control area for a well shall be a radius of 100 feet around the wellhead and 200 feet around springs. The construction, storage, disposal, or application of known or potential contaminants is prohibited within this area unless permitted by DOH and the water purveyor.

Wellhead protection areas are based on six-month, 1-year, 5-year, and 10-year time of travel zones. For example, a 1-year time of travel zone represents an area around the well or well field in which contaminants could reach the well within 1 year. Each zone has different management strategies based

on the urgency of response and characteristics of risks to public health posed by contaminants within the zones. An additional zone, called the buffer zone, also may be established to provide an area of added protection outside the 10-year time of travel zone for the wellhead protection area.

Delineation Methods

There are several delineation methods that can be used to define wellhead protection areas, but the simplest approach is the Calculated Fixed Radius (CFR) method. This method requires the least technical data and is typically used for the initial delineation to identify immediate threats to water quality. Data input includes the annual volume pumped by the well, the open interval or length of the well screen, the aquifer porosity, and the travel time (typically 6-month, 1-year, 5-year, and 10-year zones). The TOT data calculated from the CFR method is used to create circular boundaries around each of the wells or well fields representing the hypothetical distance that a contaminant will travel for the given length of time.

The major drawback of the CFR method is that groundwater rarely behaves this simply; therefore, additional study of the aquifer in question is recommended to determine more accurate protection zones. Other more complex (and probably more accurate) delineation methods utilize analytical models, hydrogeologic mapping, and computer flow models. The District's wellhead protection TOT zones are based on the CFR method.

Delineation Results

The District utilized the CFR method and annual water rights quantity to establish the wellhead protection area boundaries. **Table 5.1** presents the CFR computations for each of the District's active well sources. In the District's 2011 WSP, the computations assumed each source was pumped continuously. The 2012 Homestead Well wellhead protection area delineation used a value of 8.6 million gallons per year (MGY), assuming 38 percent of the future system production estimated at that time, and assuming full contribution of the water bearing strata of 68 feet. For this WSP, the production values use the 20-year supply estimates from **Chapter 2**, assume each well supplies 100 percent of the demand to allow for operator flexibility, assume two sources may be offline, and use 10 feet of water bearing strata for open bottom casings. The wellhead protection area boundaries for the 6-month, 1-year, 5-year, and 10-year time of travel computations are presented in **Figure 5.1**.

TOWNSHIP 27 N

11 12
14 13

12 7
13 18

7 8
18 17

RANGE 16 E

RANGE 17 E

Fall Creek

Whispering Pines Spring

Barnard Creek

LWWUA Well

Mt Park Well

Lakeview Dr

Homestead Well

Brown Rd Well

Brown Rd

13 18
24 19

18 17
19 20

T

Lake Wenatchee

N Shore Dr

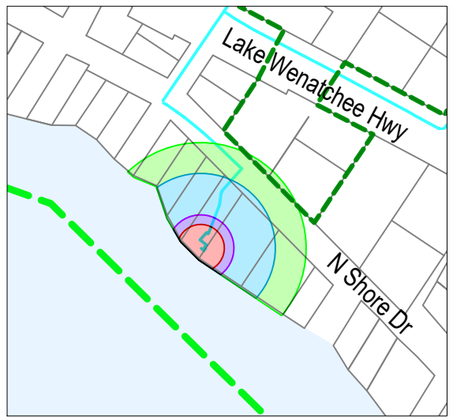
Lake Wenatchee Hwy

LEGEND

T UNDERGROUND TANK

TIME OF TRAVEL BOUNDARY

- 6 MONTH
- 1 YEAR
- 5 YEAR
- 10 YEAR



Mt. Park
1" = 300'

Figure 5.1: Wellhead Protection Areas

LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN

SCALE: 1 in = 1,000 ft
0" 1/2" 1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/6/2019
FILE NAME: LWWSP19-P-CFR.DWG

JOB: LWW 217.010

RH2

Table 5.1
Well Time of Travel

Description	Brown Rd	Homestead	LWWU	Mt Park
Source No.	S02	S01	S04	S01
Total Annual Supply (MGY)	8.89	8.89	8.89	0.23
Percent of Annual Supply this Source	100%	100%	100%	100%
Annual Volume (MGY)	8.89	8.89	8.89	0.23
Annual Volume (cf/yr)	1,188,473	1,188,473	1,188,473	30,213
Aquifer Porosity (estimated)	22%	30%	22%	22%
Screen length or aquifer thickness (ft)	10	10	4	10
Time of Travel - Calculated Fixed Radius Method				
6 Month (ft)	293	251	464	47
1 Year (ft)	415	355	656	66
5 Year (ft)	927	794	1,466	148
10 Year (ft)	1,311	1,123	2,073	209

cf/yr = cubic feet per year

Delineation Update Requirements

DOH recommends that water systems upgrade their initial delineation using a more sophisticated groundwater flow model approach within 5 years following the initial delineation. In addition, wellhead protection area boundaries should be reviewed and revised when new wells are brought online or when there is a change in the annual volume pumped from a well. DOH also recommends re-evaluation of the wellhead protection area boundaries during the update of the WSP, which occurs on a 6-year schedule.

INVENTORY OF POTENTIAL CONTAMINANT SOURCES

An essential element of wellhead protection is an inventory of all potential sources of groundwater contamination throughout the delineated wellhead protection areas. The purpose of the inventory is to identify past, present, and proposed activities that may pose a threat to the source of water supply (i.e., the aquifer).

Inventory Approach

An inventory of potential sources of groundwater contamination was conducted by searching for known and potential contaminant sources, in databases maintained by Ecology and the U.S. Environmental Protection Agency (EPA). During the 2011 WSP, the Washington State Department of Transportation (WSDOT) was contacted regarding past automobile accidents in which hazardous materials were being transported through the District service area along Lake Wenatchee Highway, a local extension of State Highway 207. The other roads in the service area are residential. The highway passes through the 6-month time of travel zones for the LWWUA Well. It may also pass through the Brown Road Well recharge area, though the CFR method does not indicate this. Aerial images of the four wellhead protection areas were reviewed during the susceptibility assessments for large yards and agricultural areas that could be sources of fertilizer, yard chemicals, and pet/farm animal waste pollution.

Inventory Findings

The inventory efforts revealed several potential sources of contamination located within the District's wellhead protection areas. Only one site is listed with Ecology, an underground tank for Chelan County Public Works, although it falls just outside of the 10-year boundary for the LWWUA well and direction of groundwater flow is likely towards the lake, not the well. Individual private wells have not been mapped as they are often identified only by the quarter-quarter corner, and the addresses have not been physically verified. The EPA Resource Conservation Recovery Act (RCRA) website revealed no additional potential contamination sources beyond those available from the Ecology databases within the wellhead TOT zones.

Other potential sources of contamination that are not specifically shown in **Figure 5.1** or listed in **Table 5.2** are discussed below.

Hazardous Spills on Highways and Roads

The Lake Wenatchee Highway passes through the six-month TOT zone for the LWWUA Well, and may pass through the 10-year TOT zone for the other wells. Vehicle accidents within this section of the highway could result in spills of gasoline or other transported hazardous materials that could threaten the aquifer that supplies water to the Brown Road, LWWUA, and Mt. Park Wells. The remainder of the roads in the wellhead protection zones are residential and traveled by local residents and visitors, although spills could still occur on these roads. The highway is not known to be a common corridor for hazardous materials since the highway ends at the west end of Lake Wenatchee. According to WSDOT during preparation of the 2011 WSP, no accidents involving hazardous materials occurred between 1999 (the earliest date of their collection data) and 2009. Although no accidents involving hazardous materials have been reported, spills could have occurred and are a concern given the wells' close proximity to the Lake Wenatchee Highway.

Pesticide and Herbicide Use Along Roads

The Chelan County (County) Roads Department applies herbicides within 2 to 3 feet of the roadway to prevent the growth of vegetation in that zone. The County Roads Department uses approved herbicides that do not travel through the soil. They do not apply the herbicides in areas that are wet or when snow is still present. There are areas along County roads that have signs that read "No Spray," where the adjacent land owner has signed a contract to control the weeds between the signs along the right-of-way. According to the Chelan County Noxious Weed Coordinator, most of these landowners prefer to use mechanical methods to remove vegetation instead of herbicides.

The U.S. Forest Service (USFS) has jurisdiction over the Wenatchee National Forest and applies herbicides and pesticides where needed. There was no available information about the history of herbicide and pesticide applications by USFS in the vicinity of the District's service area. Although the chemicals in pesticides and herbicides are a potential source of contamination to the District's water sources, the potential for contamination by USFS operations is low.

Septic Tank Effluent Pump and Septic Systems

The Public Utility District No. 1 of Chelan County owns and operates a Septic Tank Effluent Pump (S.T.E.P.) collection system along the Northshore Road within the District retail service area. It is estimated that most of the customers of the Mountain Park and LWWUA Wells are served by this wastewater collection system. There is no drainfield associated with a S.T.E.P. system. Not all residences with sewer availability are connected to the system and may continue to use traditional septic systems. The contamination risk to the District's groundwater sources is lower than if the region relied exclusively on traditional septic systems.

Home Oil Furnace Tanks

There may be some residents within the District's service area that are using oil furnaces to heat their homes. However, the number and location of these is assumed to be small given the availability of low-cost electrical power to the area. Given the location of the District's supply sources being up gradient with respect to most residences, it is assumed that contamination risk from fuel oil is low.

Hazardous Household Materials

Almost all households use hazardous materials for a variety of cleaning and maintenance. Some of these materials include cleaning solvents, paints, antifreeze, and engine oil. Improper use or disposal of these may result in contamination of the District's groundwater sources. All of the wells and springs have single-family residences located within their wellhead protection areas.

Private Wells

Poorly constructed private wells with inadequate seals and improperly abandoned wells may pose a threat to the District's groundwater sources. Poorly constructed private wells with insufficient seals provide a direct pathway for contaminants from stormwater runoff, rodents, insects, and other pollutants to enter the same aquifer used by the District's wells.

Stormwater

Stormwater runoff can potentially contaminate the District's groundwater sources. Runoff from roadways can contain high levels of metals and hydrocarbons. Runoff from residential areas is typically high in nutrients, pesticides, and metals. Stormwater is anticipated to infiltrate or generally flow towards Lake Wenatchee, resulting in a low probability of contamination to the District's supply sources.

Creeks and Lake Wenatchee

Creeks located within wellhead protection areas can carry contaminants that may pose a threat to the groundwater sources. Fall Creek is a small creek that originates on the south flank of Dirtyface Mountain and flows into Lake Wenatchee, running adjacent to the LWWUA Well. The creek flows through the LWWUA Well's 6-month TOT zone, and through the 1-year TOT zone of the Whispering Pines spring source. Fall Creek and the LWWUA Well are not hydraulically connected. Barnard Creek also originates on the south flank of Dirtyface Mountain and flows to Lake Wenatchee through the 5-year TOT zone of Whispering Pines spring and the one-year TOT zone for the LWWUA Well. Whispering Pines spring is a groundwater source in hydraulic connection with surface water (Barnard Creek). An unnamed creek flows from the south flank of Dirtyface Mountain and Pole Ridge, through a large wetland complex, and empties into Lake Wenatchee. The unnamed creek flows near the 10-year TOT zone of Brown Road well. A tributary to the unnamed creek flows near the Brown Road Well's 5-year TOT zone and into the unnamed creek near the 10-year TOT zone at their confluence.

No geotechnical information or studies as to groundwater flows or interaction with surface supplies are available for the District retail service area to determine the influence of Lake Wenatchee over the groundwater in the service area.

Lawn Care and Agricultural Practices

Farms and residences with large lawns, gardens, or cleared areas within the wellhead protection areas can be a threat to the District's groundwater sources. Inadequate cleanup of animal waste is a potential source of fecal coliform contamination. Fertilizer runoff is a potentially dangerous source of nitrates (exposure to nitrates and nitrites causes cyanosis or "Blue Baby Syndrome" in infants). Three residences are noted in **Table 5.2** as potential contamination sources because of a large lawn or cleared area.

Table 5.2
Potential Contamination Sources

Owner	Location *	Mailing Address	Mailing City / Zip	Item	Neaby Well
Chelan County Public Works	16744 N Shore Rd			Underground Tank	LWWUA
Karen Dickinson	22909 Brown Road	22909 Brown Road	Leavenworth, WA 98826	Potential fertilizer, yard	Brown, Homestead
Roy Dickinson	22750 Lake Wenatchee Hwy	17201 N Shore Dr	Leavenworth, WA 98826	Potential fertilizer, yard	LWWUA
Big Als Place	22744 Lake Wenatchee Hwy	22731 Brown Rd	Leavenworth, WA 98826	Potential fertilizer, yard	LWWUA
John Morse	17679 N Shore Dr	1206 NW Culbertson Dr	Seattle, WA 98177	Private well	Mt Park
Jim Farr	17683 N Shore Dr	514 205th Ave NE	Sammamish, WA 98074	Private well	Mt Park
Mike Nelson	17691 N Shore Dr	1600 Lake WA Blvd	Seattle, WA 98122	Private well	Mt Park
CEH Carson Trust	17215 N Shore Dr	P.O. Box 578	Peshastin, WA 98847	Private well	LWWUA
Timoth Carver	17065 N Shore Dr	1706 Howell Pl	Seattle, WA 98112	Private well	LWWUA
Dean Mastras	17325 N Shore Dr	P.O. Box 2741	Gig Harbor, WA 98335	Private well	LWWUA
Donald Belcher	NW SE S13 T27N R16E	Not found		Private well	LWWUA
Earl Landin	22945 Lake Wen Hwy	Not found		Private well	LWWUA
Rosenary	NW SE S13 T27N R16E	Not found		Private well	LWWUA
Randy Meyerson	17369 N Shore Dr	6828 52nd Ave NE	Seattle, WA 98115	Private well	LWWUA
Worley Funding	SW SE S13 T27N R16E	Not found		Private well	LWWUA
Yurily Nefedov	17356 N Shore Dr	4112 145th Pl SE	Snohomish WA, 98296	Private well	LWWUA
Bill Burgess	22745 Brown Rd	22745 Brown Rd	Leavenworth, WA 98826	Private well	Brown, Homestead
Jeff Burgess	22888 Brown Rd	22888 Brown Rd	Leavenworth, WA 98826	Private well	Brown, Homestead
Jeff Burgess	22828 Brown Rd	22828 Brown Rd	Leavenworth, WA 98826	Private well	Brown, Homestead
Jim Paris	134 Byron Lane	1052 B Ave S	Edmonds, WA 98020	Private well	Brown, Homestead
John Hashim	SW SE S18 T27N R17E	2069 Rose Point Lane	Kirkland, WA 98033	Private well	Brown, Homestead
Leslie Borgens	SE SW S18 T27N R17E	Not found		Private well	Brown, Homestead
Stevan Fredrickson	22731 Brown Rd	22731 Brown Rd	Leavenworth, WA 98826	Private well	Brown, Homestead
Two Rivers	SW SE S18 T27N R17E	7934 E Leavenworth Rd	Leavenworth, WA 98826	Private well	Brown, Homestead
Bill Burgess	22800 Brown Rd	22800 Brown Rd	Lake Wenatchee, WA 98826	Private well	Brown, Homestead

* Private well locations and owners obtained from Ecology database. Have not been verified.

Inventory Update Requirements

In accordance with WAC 246-290-135, the inventory list of actual and potential groundwater contaminant sources located within the delineated wellhead protection areas must be updated every 2 years. Inventory updates should be scheduled such that every third update is accomplished at the same time as the re-evaluation of the wellhead protection area boundaries, which is required during each six-year WSP update.

NOTIFICATION OF INVENTORY FINDINGS

Owners and operators of known and potential sources of groundwater contamination are required to be notified that they are located within the delineated wellhead protection areas. In addition, all water customers are required to be notified (via a billing insert) of the District's active water sources, its Wellhead Protection Program, and the importance of protecting the District's sources. Regulatory agencies, local governments, and emergency response agencies also will be notified of the location of the wellhead protection areas, contaminant source inventory findings, contingency plans, and emergency response procedures. **Table 5.2** lists the notification recipients. In some cases, the owner and location of private wells listed with Ecology were not readily locatable. Those locations are noted as "not found." **Table 5.3** lists the regulatory agencies and emergency services.

Table 5.3
Agency Contacts

Agency	Contact	Mailing Address	City	Zip
Regulatory Agencies				
U.S. Forest Service: Wenatchee River District		600 Sherbourne	Leavenworth, WA	98826
WA State Dept. of Health	Brenda Smits	16201 E Indiana Ave. Suite 1500	Spokane Valley, WA	99216
WA State Dept. of Ecology	Thomas Mackie	1250 W Alder St	Union Gap, WA	98903
Chelan Douglas Health District	Barry Kling	200 Valley Mall Pkwy	East Wenatchee, WA	98802
Chelan County Current Planning	Kirsten Larsen	316 Washington St, Suite 301	Wenatchee, WA	98801
Chelan County Long Range Planning	David Kuhl	316 Washington St, Suite 301	Wenatchee, WA	98801
Emergency Services				
Lake Wenatchee Fire and Rescue	Mick Lamar	21696 Lake Wenatchee Hwy	Leavenworth, WA	98826
Chelan County Sheriff	Brian Burnett	401 Washington St, Lower Level 1	Wenatchee, WA	98801

A copy of the notification letter that will be sent to owners and operators of known and potential sources of groundwater contamination located within the wellhead protection areas is found in **Appendix K**.

CONTINGENCY PLANNING

The District has developed an Emergency Response Plan for the water system. The Emergency Response Plan includes a contingency operation plan for the wells, springs, and other water system facilities. The plan is included in **Chapter 6**.

PROGRAM IMPLEMENTATION AND RECOMMENDATIONS

The District's Wellhead Protection Program is an ongoing effort that requires staffing and resources to ensure its effectiveness in protecting the source of the drinking water that is supplied to its customers. Regulations require that the District perform an inventory of all potential sources of groundwater contamination throughout the delineated wellhead protection areas every 2 years. In addition, DOH recommends that water systems upgrade their initial delineation using a more sophisticated groundwater

flow model approach within 5 years of the initial delineation. At a minimum, the District must re-evaluate the wellhead protection area boundaries during the WSP update process, which occurs every 6 years.

The following tasks will be pursued, or evaluated, as part of the District's Wellhead Protection Program:

1. The District will adopt a wellhead protection ordinance that addresses permitted uses and performance standards for properties located within designated wellhead protection areas.
2. Distribute the required notifications resulting from updated delineations and inventory findings.
3. Perform a "windshield survey" to update the inventory of potential sources of groundwater contamination.
4. Perform a more accurate delineation of the wellhead protection area boundaries utilizing analytical models, hydrogeologic mapping, and computer flow models.
    a. The wells are located generally in low risk areas, and a more sophisticated hydrogeologic evaluation may indicate the water path is more directional with the topography, which typically extends uphill into undeveloped areas. The cost to perform such evaluation does not appear warranted at this time.
5. Investigate the locations, conditions, and proper closure of abandoned private wells, especially those within 1-year time of travel zones.
6. Develop and distribute public education materials within the wellhead protection areas to address groundwater protection and household, landscape, and gardening practices that could affect groundwater quality utilizing existing information developed by DOH.
7. In coordination with Chelan County, restrict land uses in the 1-year time of travel zones that pose a high risk to groundwater, including vehicle repair shops, oil recycling, dry cleaners, fuel storage facilities, high-density animal keeping, septic systems, and golf courses.
8. Develop signage at the perimeter of and at strategic locations around the wellhead protection areas to inform people that they are entering an area that contains the District's drinking water source and is vulnerable to surface activities.

6 | OPERATIONS AND MAINTENANCE PROGRAM

WATER SYSTEM MANAGEMENT AND PERSONNEL

The water system operator is responsible for normal day to day operations, preventative maintenance, and water quality monitoring. Budgeting, billing, and accounting is currently handled by the Lake Wenatchee Water District (District) Secretary.

OPERATOR CERTIFICATION

Chapter 70.119 of the Revised Code of Washington (RCW) and Chapter 246-292 of the Washington Administrative Code (WAC) require operator certification for Group A public water systems. The District water system operator, Mr. Charles Cruickshank, has the following certifications:

- Water Distribution Manager Two (WDM2).
- Basic Treatment Operator (BTO);
- Water Treatment Plant Operator Two (WTPO2).
- Cross-Connection Control Specialist (CCS).

The water system operator for the District must meet the certification requirements of Chapter 70.119 RCW and Chapter 246-292 WAC for Group A public water systems.

SYSTEM OPERATION AND CONTROL

A water system is comprised of a series of individual components, each requiring some level of routine maintenance and/or observation. Major system components are shown on **Figures 1.2** and **1.3**. Some of the tasks are related to the physical assets of the system, such as valves, water mains, air/vacuum and blow-off valves, and fire hydrants. Other tasks are service related and driven by customer or external requests.

Periodically, emergency equipment and spare parts inventory necessary for distribution system repair, spare parts for pumps, and repair items for pumps, valves, and pipelines should be checked. A master list of minimum inventory should be developed.

The major activities comprising the recommended operation of the District's water system are summarized in the sections that follow.

WATER MAIN ACTIVITIES

Task 1 – Connect New Mains to the Distribution System

All newly installed water mains are connected to the existing distribution system by a contract service or the operator.

Task 2 – Repair Main Breaks

1. The operator is on call 24 hours a day to respond to and repair main breaks.
2. The broken or leaking section must first be isolated from the rest of the system, repaired, and then disinfected prior to being put back in service.

3. Repairs of a minor nature can be repaired under pressure by use of a clamping device, such as a full circle repair clamp.
4. All parts used in the repair (pipes, clamps, fittings, and gaskets) that come into contact with the potable water shall be disinfected with a strong solution (20 to 50 parts per million (ppm)) of hypochlorite.

Task 3 – Flush Mains

1. Water mains shall be flushed annually to remove accumulated particulates and stagnant water.
2. Flow tests shall be conducted on selected mains to evaluate fire flows and distribution system hydraulics.

VALVE ACTIVITIES

Task 1 – Valve Maintenance, Repair, and Installation

1. Each valve operated once per year in both directions (fully closed and fully opened), and the turns to do so are noted on a valve record card.
2. Repair, clean out, and maintain valve boxes.
3. Replace broken or malfunctioning valves.

Task 2 – Blow-Off Maintenance, Repair, and Installation

Inspect and operate blow-offs twice per.

Task 3 – Air and Vacuum Release Valves

Check air valves annually for proper operation.

Task 4 – Pressure Reducing and Pressure Relief Valves

1. Annually check that each valve is functional.
2. Read and record inlet and outlet pressure.
3. Every 5 years hire a specialized service company to inspect and rebuild the wear parts.

SERVICE-RELATED ACTIVITIES

Task 1 – New Services

New services are installed as required. Installation includes the connection to the water main and service line placement up to the property line.

Task 2 – Service Exchanges

Substandard water services that have been identified are exchanged for new services. This includes a regular effort to exchange galvanized piping services when found.

Task 3 – Service Repair

1. Repairs are usually for leaking services.
2. Water services damaged by contractors and customers require immediate repair.
3. This task includes repair of curb stops and meter boxes.

4. About 10 percent of the system's meter boxes are inspected each year; this occurs as part of water turn on, shut off, and leak detection activities.

Task 4 – Abandoned Services

Water services that are considered abandoned and not reusable are disconnected and removed from the distribution system.

METER-RELATED ACTIVITIES

Task 1 – New Meter Installation

Meters for new services will be installed as required. Installation includes a meter box.

Task 2 – Meter Exchange, Repair, Replacement, and Relocation

During meter testing and meter reading activities, damaged, leaking, or inaccurate meters are identified for repair or replacement.

Task 3 – Meter Testing – Meters are Not Routinely Tested

Meters are spot tested and replaced at a frequency that depends on the make and model of the meter.

Task 4 – Meter Reading

Meters are read on a routine basis. Large consumption accounts are generally read and billed on a monthly basis, and all other account meters are read once every 2 months.

HYDRANT RELATED ACTIVITIES

Task 1 – Hydrant Maintenance, Repair, and Installation

1. Hydrants are painted approximately every 5 years.
2. A portion of the hydrants require annual cleaning (vegetation removal) to keep them accessible.
3. All hydrants and hydrant valves are operated and inspected annually as part of the main flushing program.
4. Repairs are generally minor, with the exception of those that result from vehicle accidents.
5. Hydrants that cannot be repaired or have been determined to be substandard are replaced. This can also include new hydrant installation as part of the maintenance program.

CUSTOMER SERVICES

Task 1 – Complaint Investigation and Resolution

1. The most common complaints are for "dirty" water, poor taste or odor, low or no pressure, or evidence of a broken or leaking main or service line.
2. The complaint is investigated and the customer is notified of the action to be taken.
3. A Customer Service Report (CSR) is filled out for each complaint.

Task 2 – Shut Offs (S/O) and Turn Ons (T/O)

1. This task includes S/O requests for delinquent, abandoned, or vacant accounts.

2. These tasks also are conducted so that maintenance can be done on private plumbing per customer request.
3. This task includes T/O requests upon installation of water service lines.

Task 3 – Utility Locates

1. The District participates in the Utility Underground Location Center ("call before you dig") service. Water main and water service lines are marked to prevent damage during excavation activities.

Task 4 – Delinquents/Vacants/Pending

1. Pending and vacant lists are checked to ensure that water services are not being used illegally.
    a. Pending checks are done quarterly and vacant checks are done semi-annually.

OTHER ACTIVITIES

Task 1 – Administration

1. Water bills are routinely sent to customers and the payments received and credited to the account.
2. Regular District meetings are conducted.

Task 2 – Source of Supply Inspection

1. Visit and perform a visual inspection of each water source in the system.
2. Lubrication and maintenance instructions specified by the manufacturer should be followed closely, if applicable.
3. The water source site should have detailed start up, shut down, and safety procedures posted.
4. Well water level is checked. Static and operating water levels must be checked and recorded seasonally (Washington Administrative Code (WAC) 246-290-415(10)).
5. Control systems equipment and unexplained changes in reservoir or well water levels are checked.

Task 3 – Booster Pump Station Inspection

1. Visit and perform a visual inspection of each booster pump station (BPS) site in the system.
2. Check and record flow rate and discharge pressure. If substantially different than prior readings, investigate cause.
3. Lubrication and maintenance instructions specified by the manufacturer should be followed closely.
4. Each BPS site should have detailed start up, shut down, and safety procedures posted.
5. Check control systems equipment.

Task 4 – Reservoir/Site Inspection

1. Visit and perform a visual inspection of each reservoir in the system.
2. Check control system equipment. Physically measure water level and compare to transmitter.

Task 5 – Water Quality Testing

1. Collect and deliver samples to the laboratory for the required water quality tests as necessary.

Task 6 – Backflow Device Inspection and Testing

1. Ensure that all backflow devices in the water system are inspected and tested on an annual basis by a certified tester. Keep a log of all devices and testing.

Task 7 – Leak Detection

1. Special listening devices can be rented to locate leaks in water main and services. Older services and sections of pipe are particularly susceptible to leaks.

Task 8 – Flow Tests

1. Flow tests are set up by request to check the condition of certain sections of water main and fire hydrant capacity.

Task 9 – Records and Files

1. This task includes updating and managing the maintenance management information, map files, and other records.

Task 10 – Education/Training

1. State certification as a Water Distribution Specialist with Cross-Connection Control (CCC) training is required for the operator of the water system.
    a. Three continuing education units (CEUs) are required every 3 years (this is equivalent to 30 hours of instruction every 3 years) to maintain State certification.
2. Approximately 40 hours per employee per year is currently planned for education and training needs.

Task 11 – Operational Response

1. Respond to control system alarms and notifications.

Task 12 – Equipment Maintenance

1. This task includes minor maintenance to vehicles, tools, and shop equipment.

Task 13 – Other General Maintenance

1. These are miscellaneous tasks that do not fall under any of the listed tasks.

STAFFING

A water system is a complex assortment of equipment and parts that require operation and maintenance. The available hours of a person during a year are not the total hours worked. There are hours spent on training, non-work status, and other activities that deduct from the 2,080 hours in pay status during the year. The total available hours are typically reduced to 1,575, as shown in **Table 6.1**.

Table 6.1
Annual Available Hours 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 10 days per year	-80
Less average small tasks other than above of 1 hour per day	-225
Net Available Hours Per Year Per Person	***1,575***

Table 6.2 summarizes the estimated maintenance and operation staffing needs for the District. The District has three part-time employees: the operator; bookkeeper; and clerk.

Table 6.2
Staffing Time Estimate

Work Item	Count	Units	Times / year	Hours	Total Hours
Watermains					
Connect New Mains	1	Each	1	8	8
Repair Main Breaks	4	Each	1	8	32
Flush Mains	5	Miles	1	4	20
Valves					
Valve Maintenance	60	Each	1	0.33	20
Blowoff Maintenance	4	Each	1	0.33	1
Air Valve Maintenance	8	Each	1	1	8
Services					
New Service Installation	1	Each	1	8	8
Service Exchanges	1	Each	0.5	8	4
Service Repair	4	Each	1	6	24
Abandon Services	1	Each	0.25	8	2
Meters					
New Meter Installation	1	Each	1	6	6
Meter Exchange, Repair	5	Each	1	1	5
Meter Testing	5	Each	1	2	10
Meter Reading	126	Each	12	0.1	151
Hydrants					
Hydrant Maintenance	4	Each	1	2	8
Customer Service					
Complaint Response	12	Each	1	2	24
Shut Off / Turn On	2	Each	1	1	2
Utility Locates	12	Calls	1	3	36
Other					
Administration / Billing	1		52	12	624
Well Inspection	4	Each	52	1	208
Booster Station Inspection	1	Each	52	1	52
Reservoir Inspection	2	Each	52	1	104
Water Quality Testing	1	Each	12	3	36
Backflow Device Inspection	0	Each	1	1	0
Leak Detection	1	Each	1	4	4
Flow Tests	1	Each	1	2	2
Recordkeeping	1	Each	12	4	48
Education / Training	1	Each	1	40	40
Operational Response	1	Each	26	4	104
Equipment Maintenance	1	Service	2	4	8
General Maintenance	1	Service	2	4	8
Total Estimated Hours					***1,607***
Total Full Time Staff Estimated (1,575 hrs per year basis)					***1.02***

WATER QUALITY AND COLIFORM MONITORING PLAN

The Water Quality Monitoring Plan contains the requirements for both source and distribution system water quality monitoring in accordance with the drinking water regulations contained in WAC 246-290-300. This plan also provides a summary of the existing water system facilities and operation based on incorporation of the separate water systems. These plans are found in **Appendix F**.

EMERGENCY RESPONSE

All water systems are subject to damage, contamination, or interruption from unusual emergency events. The degree of damage and capacity to respond to that damage or interruption is determined by the vulnerability to or contamination of the system.

Many emergency plans call for notification of the public, Washington State Department of Health (DOH), and emergency response agencies regarding the emergency condition and required demand curtailment measures.

The following is a sample emergency announcement:

> *The water system has experienced a major loss of its water production capacity (booster pump failure, power outage, or major main break). Customers are directed to stop all non-essential water use and make every effort to conserve for sanitary and potable use only. Everything is being done to restore the water system to normal operation. You will be notified of any changes in the situation.*

A list of organizations that may be contacted in an emergency is provided in **Table 6.3**. Following this table is a summary of the procedures for notification during an emergency event.

Table 6.3
Emergency Contact List

Service	Agency/Company	Main Phone	After Hours
District Office	Lake Wenatchee Water District	(509) 679-1353	(509) 429-0424
Fire / Police / Medical	Chelan County services	911	911
Water Quality Assistance	WA Dept. of Health	(509) 329-2100	
Environmental Health	Chelan / Douglas Health District	(509) 886-6450	(509) 886-6499
Spill Response	Dept. of Ecology (must call both numbers)	(800) 258-5990 (800) 424-8802	
Electrical Utility	Chelan County PUD	(509) 548-7761	(877) 783-8123
Pump Service	Tumwater Drilling	(509) 548-5361	
Pipe Supplies	HD Fowler	(509) 886-8804	
Electrician	Beaver Valley Electric	(509) 763-4344	
DOH Regional Engineer	Jeff Johnson	(509) 329-2110	(877) 481-4901
Media	KPQ Radio	(509) 665-6565	(509) 888-8446
Call Before You Dig	Alternate phone (800) 424-5555	811	811
Engineering Consultant (mechanical systems)	RH2 Engineering / Ryan Peterson	(509) 886-2900	(509) 679-9144
Engineering Consultant (control systems)	RH2 Engineering / Clayton Anderson	(509) 886-2900	(509) 881-9872

CUSTOMERS

Customers and the general public will be notified in the event of an emergency that affects either the quantity or quality of water supply. Customers will be notified through door to door direct contact of the emergency and how it affects them. If the emergency affects water quality, customers may be asked to boil water prior to drinking or cooking. If the emergency affects water quantity, customers may be asked to conserve water to prevent depletion of a potentially limited quantity of emergency supply.

PRIORITY CUSTOMERS

Priority customers that require uninterrupted water service will be notified directly. These customers could include home care kidney dialysis patients, medical facilities, and commercial customers who are especially vulnerable to loss of water service. Currently, the District's water system does not have any customers who require an uninterrupted supply of water.

HEALTH DEPARTMENTS

The local health departments, the Chelan-Douglas Health District, and the DOH will be contacted directly if there are water quality problems, water shortage concerns, or any other emergency situations in which public health is threatened.

POLICE AND FIRE

Police or fire personnel will be notified in the event of a fire or human safety emergency. The emergency phone number for these types of emergency situations is 911.

CONTINGENCY OPERATION PLAN

The following sections contain contingency operation plans for responding to potential emergency conditions for each of the major system components.

WELLS

Emergency Condition: Aquifer Contamination

Impact on System: Potentially major impact. The water is not suitable for potable water use – major loss of supply.

Emergency Response

1. Shut down the well(s).
2. Notify DOH of the aquifer contamination.
3. Notify all customers of the problem and instruct them to boil all water to be used for consumption and cooking.
4. Analyze the water quality within reservoirs and dispose of properly if contaminated.
5. Disinfect reservoirs and water mains as necessary to remove contaminated residuals.
6. Adjust control of system facilities as necessary to provide supply from storage facilities if water within them is not contaminated.
7. Monitor water quality at the source and investigate the cause of contamination.
8. Implement water use reduction measures as necessary to ensure an adequate supply of water.

Emergency Condition: Power Outage

Impact on System: Moderate impact depending on the length of the outage, the area affected by the outage, and the level of system demand.

Emergency Response

1. Contact the power company to restore power.
2. If necessary, bring portable generator to affected site and connect to facility.
3. Supply water demand from reservoirs.
4. Implement water use reduction measures as necessary to ensure an adequate supply of water.

RESERVOIRS

Emergency Condition: Structural Damage

Impact on System: Potentially major impact depending on reservoir (or reservoirs) damaged. Impacts could include loss of storage capacity and reduced fire flow.

Emergency Response

1. Isolate reservoir(s) from water system.
2. Notify police and nearby residents of potential danger.
3. Notify local fire departments of reduced firefighting capabilities in areas served by the reservoir(s).

4. Drain reservoir(s) as necessary to reduce level of damage and threat to local residents.
5. Determine the extent of damage.
6. Adjust control of other system facilities to operate system without the damaged reservoir(s).
7. Implement water use reduction measures as necessary to ensure an adequate supply of water.
8. Contact consulting engineer for assistance.

Emergency Condition: Power Outage

Impact on System: Loss of automatic pump control.

Emergency Response:

1. Manually operate pump(s).
2. Contact the power company to restore power.

TRANSMISSION AND DISTRIBUTION MAINS

Emergency Condition: Water Main Break

Impact on System: Depending on the size and location of the water main and size of the break, impacts range from minor to major. Loss of water from reservoirs, reduction or loss of fire protection capability, disruption of water service to customers, and potential damage to adjacent property are all possible impacts.

Emergency Response

1. Notify affected customers.
2. Isolate, shut down, and repair damaged water main.
3. If one of the major transmission mains must be shut down, adjustments to the control and operation of other facilities may be necessary.

Emergency Condition: Water System Contamination Due to a Backflow Incident

Impact on System: Potentially major impact. Water not suitable for potable use means a loss of supply.

Emergency Response

1. Notify the CCS of the incident.
2. Shut down the affected mains, if possible, to contain the affected contaminants.
3. Notify DOH of the backflow incident.
4. Notify all customers of the problem and instruct them to boil all water to be used for consumption and cooking and/or issue a no drinking warning.
5. Flush affected water mains to remove contaminants.
6. Disinfect reservoirs and water mains as necessary to remove contaminated residuals.
7. Analyze water quality in other parts of the distribution system to ensure that all contaminants were contained.

CONTROL SYSTEM

Emergency Condition: Control Equipment Failure

Impact on System: Minor to moderate impact depending on the extent of loss to control equipment at the affected facilities. If the control equipment fails, pumps will have no automatic control. This would result in non-stop pump operation and reservoir overflow if the control equipment failed during pump operation. If the control equipment failed while the pump was in the "off" mode, the results would be failure to activate the pump and excessive drawdown in tanks.

Emergency Response

1. Shut down and/or hand operate pumps as needed to maintain reservoir levels.
2. Make necessary adjustments to or manually operate the facility with the failed control equipment.
3. Call necessary personnel to repair or replace the failed equipment.

COMPREHENSIVE MONITORING

Copies of the most recent water quality monitoring schedule, Coliform Monitoring Plan, and Consumer Confidence Report are provided in **Appendix F**.

VULNERABLE FACILITIES

The water system consists of vulnerable facilities; malfunction or contamination would impact the system's capability to provide service, as shown below.

District Well

- Supply is limited to the two remaining wells and water stored in the reservoirs.

Mt. Park Well

- The well is the sole supply source. Loss of the well will terminate water supply. There is no storage.

Combined Booster Station

- A significant failure could result in loss of supply to the upper pressure zones, limiting water to that in storage.

LWWUA Reservoir

- Reservoir offline will reduce emergency storage and disable automatic well control. Supply from wells must be matched to booster pump rate, requiring manual throttling or operational spills with a temporary pressure relief valve.

Whispering Pines Reservoir

- Reservoir offline will eliminate all upper zone storage and disable automatic booster pump control. Supply can be provided with booster pumps running in recirculation mode.

SAFETY PROCEDURES AND EQUIPMENT

Safety is the concern and responsibility of all water operations and maintenance staff. 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 identifies procedures to be followed for operations and maintenance tasks that involve the most common potential work place hazards in the water system.

USE OF CHLORINE OR CHLORINE PRODUCTS

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.

WORKING ON OR AROUND WATER RESERVOIRS

Standard Procedure – Follow proper safety harness procedures for working on tall structures.

WORKING IN OR AROUND PUMP STATIONS

Standard Procedure – Obtain proper training and follow all safety procedures for working on pumps and electrical equipment. Use noise protection equipment.

CROSS-CONNECTION CONTROL

The District's CCC Ordinance and program are contained in **Appendix C**. The program description is within Section 17 of the District's Administrative and Operating Directives.

REQUIREMENTS FOR PROGRAM

The District has the responsibility to protect the public water system from contamination due to cross connections. A cross connection may be defined as:

> Any actual or potential physical connection between a potable water line and any pipe, vessel, or machine that contains or has a probability of containing a non-potable gas or liquid, such that it is possible for a non-potable gas or liquid to enter the potable water system by backflow.

All public water systems are required to develop and implement CCC programs. The requirements are contained in WAC 246-290-490 of the Drinking Water Regulations. The elements of a CCC program are as follows:

1. Establishment of legal authority and program policies.
2. Evaluation of premises for cross-connection hazards.
3. Elimination and/or control of cross connections.
4. Provision of qualified personnel.
5. Inspection and testing of backflow preventers.
6. Quality control of testing process.
7. Response to backflow incidents.
8. Public education for consumers.
9. Recordkeeping for CCC program.
10. Special requirements for reclaimed water use.

Other requirements of a CCC program include:

1. Coordination with the Local Administrative Authority (local building or plumbing official) regarding CCC activities;
2. Prohibition of the return of used water into the distribution system; and
3. Inclusion of a written CCC program in a WSP or a Small Water System Management Program (SWSMP).

PROGRAM OBJECTIVES

The objectives of the cross-connection control program are to:

1. Reasonably reduce the risk of contamination of the public water distribution system;
2. Reasonably reduce the District's exposure to legal liability arising from the backflow of any contaminant originating from the customer's plumbing system and then supplied to other customers; and
3. Cooperate with the local plumbing authority by exchanging information.

ELEMENTS OF PROGRAM

The DOH requires that a CCC program include certain elements. The elements are listed in WAC 246-290-490(3). These elements are summarized in this section with a description of how the District intends to comply with each program element. As of the writing of this WSP, no properties have a CCC device installed.

Element 1: Authorizing a CCC Program

1. The District adopted a resolution in 2016 that authorizes the water system to implement a CCC program.
    a. The policy will authorize the system to terminate water service to consumers who do not comply with the policy or resolution. However, the primary method for protection of the distribution system shall be the installation of a backflow prevention device by the water system customer, and the cost thereof will be paid by the customer.

Element 2: Procedures and Schedules for Evaluating New and Existing Service Connections to Assess the Degree of Hazard

1. The District surveyed all customers' premises within 1 year of the assumption of the first water system.
2. The survey was completed commensurate with the District's assessment of the degree of hazard by a representative of the District or through the evaluation of a questionnaire completed by the customer for the sole purpose of establishing the District's minimum requirements for the protection of the public water supply system.
3. New residential services will be surveyed at the time of beginning service.
4. Commercial services will be surveyed annually to ensure the required backflow assembly device has been tested by a certified backflow assembly tester (BAT).
5. The District will inform the customer or any regulatory agencies of the District's requirements for the installation of backflow prevention assemblies.
6. Existing services will be monitored for new hazards and continued use of approved backflow devices during meter reading cycles.

Element 3: Procedures and Schedules for Elimination and/or Control of Cross Connections

1. Backflow Preventer Requirements: The following service policy shall apply to all new and existing customers.
    a. The District will require that water service to all non-residential customers be isolated at the service isolation valve, corporation stop, or meter by a District-approved double check valve assembly (DCVA) or reduced pressure backflow prevention assembly (RPBPA). Water service to all residential customers will be isolated at the service line isolation valve or meter by a District-installed meter check valve (single or dual), except where the customer has special plumbing that increases the risk to the District's distribution system. "Special plumbing" includes, but is not limited to, the following:
        i. Lawn irrigation systems.
        ii. Solar heating systems.
        iii. An auxiliary source of supply, e.g., a well or creek.
        iv. Piping for livestock watering, hobby farming, etc.
        v. Residential fire sprinkler system (not including pass-through systems).
        vi. Property containing a small boat moorage.
    b. For all District customers, the premises isolation DCVA or RPBPA required above shall be:
        i. Purchased and installed by the customer (at the customer's expense) immediately downstream of the water meter in accordance with the District's standards described hereinafter; and
        ii. Maintained, tested at least annually, and inspected in accordance with the District's standards described hereinafter.
    c. For new customers, the District will not turn on water (except for testing purposes) at the meter until the customer complies with the above requirements.
    d. Failure of the customer to comply with the above installation and maintenance requirements shall be cause for the discontinuation of water service.

2. Approved Backflow Preventers and Installation: All backflow preventers relied upon by the District to protect the public water system shall meet the definition of "approved backflow preventer" as contained in WAC 246-290-010. The District will obtain and maintain a current list of assemblies approved for installation in Washington State by DOH.
    a. All backflow preventers must be installed:
        i. In the orientation for which they are approved;
        ii. In a manner and location that facilitates their proper operation, maintenance, and testing or inspection (installation standards contained in the Pacific Northwest Section-American Water Works Association Manual or the *Manual of Cross-Connection Control* published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (USC Manual) shall be followed unless the manufacturer's requirements are more stringent);
        iii. In a manner that will protect them from weather-related conditions such as flooding and freezing; and
        iv. In compliance with applicable safety regulations.
    b. The District has no regulatory responsibility or authority over the installation and operation of the customer's plumbing system. The customer is solely responsible for compliance with all applicable regulations and for prevention of contamination of their plumbing system from sources within their premises. Any action taken by the District to survey plumbing, inspect or test backflow prevention assemblies, or to require premises isolation (installation of DCVA or RPBPA on service) is solely for the purposes of reducing the risk of contamination of the District's distribution system.
    c. The District will inform the customer that any action taken shall not be construed by the customer to provide guidance on the safety or reliability of the plumbing system. The District will not provide advice to the customer on the design and installation of plumbing other than the general public education program discussed in Element 8.
    d. Except for easements containing the District's distribution system, the District will not undertake work on the customer's premises.

Element 4: Personnel

Program Administration

1. The responsibility for administration rests with the District, either as a body, or to an individual manager or employee, hereinafter referred to as the Manager.
2. The District will employ or have on staff at least one person certified by DOH as a CCS to implement the CCC program. As an alternative, or when no staff or employees are properly qualified, the District may retain a properly certified CCS on contract to provide the necessary expertise and services.
3. The following cross-connection related tasks will be performed by or under the direction of the certified CCS:
    a. Preparation and recommendation of changes to the CCC program.
    b. Performance of and/or review of CCC hazard evaluations.
    c. Recommendation of the type of backflow preventer to be installed.

d. Recommendation of schedules for retrofitting backflow preventers.
e. Inspection of backflow preventers for proper application and installation.
f. Review of backflow preventer inspection and test reports.
g. Review of backflow testing quality control information.
h. Recommendation and/or the granting of exceptions to mandatory premises isolation.
i. Participation in or cooperation with other water utility staff in the investigation of backflow incidents and other water quality problems.
j. Completion of CCC Activity and Program Summary Reports when required by DOH.

4. Other CCC program activities may be delegated, as necessary, to other personnel, including clerical support staff. These activities include:
    a. Administration of paperwork associated with service agreements;
    b. Mailing, collecting, and screening of hazard evaluation questionnaires;
    c. Mailing of assembly testing notices;
    d. Receiving and screening of assembly test reports;
    e. Database administration and recordkeeping of CCC program information;
    f. Disseminating public education material; and
    g. Assisting in tasks associated with coordinating with the local administrative authority.
5. The District will retain on contract a current CCS.

Element 5: Backflow Preventer Inspection and Testing

1. Inspection and Testing of Backflow Preventers
    a. All backflow preventers that the District relies upon for protection of the water system will be subject to inspection and, if applicable, testing.
    b. Inspection of backflow preventers for proper application will be performed by the District's CCS.
    c. Inspection of backflow preventers for correct installation will be performed by either a CCS or a DOH-certified BAT.
    d. Testing of assemblies will be performed by a DOH-certified BAT.
2. Frequency of Inspection and Testing
    a. Inspection and testing of backflow preventers will be conducted:
        i. At the time of installation;
        ii. Annually, after installation;
        iii. After a backflow incident; and
        iv. After a repair, reinstallation, relocation, or replumbing.
    b. The District may require a backflow preventer to be inspected or tested more frequently than once a year when it protects against a high health hazard or repeatedly fails tests or inspections.
3. Responsibility for Inspection and Testing
    a. The District will be responsible for inspecting and testing all District-owned backflow preventers.

b. The District requires the customer be responsible for inspection and testing of backflow preventers owned by the customer. The customer shall employ, at customer expense, a DOH-certified BAT to conduct the inspection and test within the time period specified in a testing notice sent by the District. The test report shall be completed and signed by the BAT, then countersigned and returned by the customer to the District before the due date specified by the District.

4. Approved Test Procedures
    a. The District requires that all assemblies relied upon to protect the water system be tested in accordance with DOH approved test procedures as specified in WAC 246-290-490(7) (d). Any proposal to use alternate test procedures must be approved by the District's CCS.
5. Notification of Testing
    a. The District will notify all customers who own backflow preventers that are relied upon to protect the water system to have their backflow preventer(s) inspected and/or tested.
6. Enforcement
    a. A customer who fails to send in the inspection/test report by the due date specified may be subject to water discontinuation.

Element 6: Backflow Device Testing Quality Control Assurance Program

1. The District will maintain a list of pre-approved, local certified CCSs and BATs.

Element 7: Backflow Incident Response

1. Backflow Incident Response Plan
    a. The District's CCS will participate in developing a backflow incident response plan that will be part of the water system's emergency response program as required by WAC 246-290-415(2). The incident response plan will include, but will not be limited to:
        i. Notification of affected population;
        ii. Notification and coordination with other agencies, such as DOH, the local administrative authority, and the local health jurisdiction;
        iii. Identification of the source of contamination;
        iv. Isolation of the source of contamination and the affected area(s);
        v. Cleaning, flushing, and other measures to mitigate and correct the problem; and
        vi. Application of corrective action to prevent future backflow occurrences.
2. Technical Resource
    a. The District will use the *Backflow Incident Investigation Procedures*, First Edition, 1996, published by the Pacific Northwest Section – American Water Works Association (PNWS-AWWA) as a supplement.

Element 8: Public Education Program

1. The District will educate customers about cross connections through newsletters or brochures regarding the following possible subjects:
    a. Cross-connection hazards in general.

b. Irrigation system hazards and corrective actions.
c. Fire sprinkler cross-connection hazards.
d. Importance of annual inspection or testing of backflow preventers.
e. Thermal expansion in hot water systems when backflow preventers are installed.

2. The District shall distribute informational brochures to all customers every 2 to 3 years.

Element 9: Cross-Connection Control Records

1. Types of records and data to be maintained:
    a. Service connections/customer premises information, including assessed degree of hazard and required backflow preventer to protect the public water system;
    b. Backflow preventer inventory and information, including:
        i. Air gap location, installation, and inspection dates, inspection results, and person conducting the inspection;
        ii. Backflow assembly location, assembly description (type, manufacturer, make, model, size, and serial number), installation, inspection and test dates, test results, and person performing the test; and
        iii. Information on Atmospheric Vacuum Breakers (AVBs) used for irrigation system applications, including manufacturer, make, model, size, dates of installation, and inspections and person performing inspections.
2. Reports to be Prepared and Submitted:
    a. The District will prepare the following reports as required by DOH. The District's CCS will prepare or review the report for correctness.
        i. CCC program activities for the calendar year to be sent to DOH when requested.
        ii. CCC program summary information, when required, or when there are significant policy changes.
        iii. Backflow incident reports to DOH.
        iv. Documentation when exceptions to mandatory premises isolation are granted.

Element 10: Reclaimed Water

1. At this time, the District does not receive or distribute reclaimed water. In the event that reclaimed water use is proposed within the system service area, all CCC requirements mandated by the permitting authority in accordance with Chapter 90.46 RCW will be complied with and made part of the CCC program.

OTHER PROVISIONS

Coordination with Local Administrative Authority

1. A copy of the District's CCC program is provided to the Chelan County Building Official (plumbing authority) via a copy of the WSP or in a separate document.
    a. The District will inform the plumbing authority of any changes in policy or procedure that may impact the plumbing authority.

Unapproved Auxiliary Supplies

1. All water supplies other than those owned by the District are considered unapproved auxiliary supplies as defined in WAC 246-290-010.
    a. The District will require the installation of an RPBPA for premises isolation at the service connection of any customer having an unapproved auxiliary supply on the premises, whether or not there is a physical connection between the auxiliary supply and the District's system.

Tanker Trucks

1. The District may allow tanker trucks to obtain water from the water system under the following conditions:
    a. The tanker truck is equipped with an approved air gap or an approved RPBPA with a current satisfactory inspection or test report.
    b. The tanker truck shall obtain water from District-designated watering points only through a metered connection.

Temporary Water Connections

1. The District will not supply water through temporary connections, such as those used for construction projects or main disinfection, except through a backflow preventer arrangement approved by the District.
    a. The applicant for the temporary connection shall document that the backflow preventer is of an approved model and has passed an inspection or test within the past 12 months.

Interties and Wholesale Water Customers

1. The District will require that interties with other public water systems be isolated at the point of delivery by:
    a. A minimum of a DCVA; or
    b. A minimum of an RPBPA if the District considers the customer to be a high health hazard.
2. The District may waive or reduce the level of protection if the customer:
    a. Is a Group A public water system not exempt from DOH regulation as per WAC 246-290-020(2);
    b. Has a CCC program that complies with WAC 246-290-490 and has been approved by DOH; and
    c. Implements the CCC program at a level satisfactory to the District.

Relationship to Other Programs

1. The District will consider the requirements and consequences of the CCC program upon the planning and operations requirements of the water utility. Such considerations include, but are not limited to:
    a. Ensuring and promoting adequate communication between CCC program personnel and other water utility staff;
    b. Ensuring that adequate training is provided to all staff to recognize potential CCC problems;

c. Ensuring that cross-connection issues are considered in water quality investigations;
d. Ensuring that the design of the water distribution system makes adequate provisions for expected head losses experienced by backflow assemblies;
e. Ensuring that the CCC program personnel be consulted in the design of water and wastewater treatment facilities and when proposals are made to receive or distribute reclaimed water;
f. Ensuring that operations under normal and abnormal conditions do not result in excessive pressure losses; and
g. Providing for adequate financial and administrative resources to carry out the CCC program.

Operations and Maintenance Improvements

Other proposed improvements not mentioned above are addressed in **Chapter 8** and included in the District's Capital Improvement Program.

DEVELOPER EXTENSION REVIEW

If a party ("developer") requests service that, in the District's opinion, requires construction of a watermain extension, the following procedure shall be followed.

1. Developer obtains a determination from the Fire District of fire flow requirements.
2. Developer and District meet to discuss the requirements for constructing improvements to the water system.
3. Developer contracts with a professional engineer to develop plans. Optionally, developer may request if the District's engineer may prepare the plans.
4. District's engineer reviews the developer's plans and provides comments.
5. After all review comments have been addressed, developer submits plans for District signature.
6. Developer constructs improvements.
7. District inspector observes and approves the installation methods, pressure testing, and purity testing.
8. District accepts the extension as complete. Developer transfers ownership to the District.
9. Engineer of record prepares a DOH Construction Completion Report.

7 | DESIGN AND CONSTRUCTION STANDARDS

GENERAL WATER SYSTEM STANDARDS AND DETAILS

Design standards to be used for replacement or extensions to the water system are (in no particular order):

- Public Utility District No. 1 of Chelan County Water Standard Details (**Appendix L**);
- Applicable Chelan County ordinance(s), codes, or standards;
- *Standard Specifications for Road, Bridge, and Municipal Construction*, Washington State Department of Transportation (WSDOT), latest version;
- Standards of the American Water Works Association (AWWA), latest revision; and
- *Water System Design Manual*, Washington State Department of Health (DOH), latest revision.

All future improvements to the water system must be designed by a professional engineer licensed in the State of Washington. Lake Wenatchee Water District (District) requests eligibility for the submittal exception process for distribution system improvements. Water system improvement plans for wells, pump stations, and reservoirs must be submitted to DOH for review and approval prior to making any improvements. Upon completion of improvements, a construction completion report for Public Water Systems Projects (DOH Form), per Washington Administrative Code (WAC) 246-290-040, shall be provided to the District.

DESIGN STANDARDS

PURPOSE

The purpose of this chapter is to provide information regarding the standards for design and construction of water system improvements to the District's domestic water system. Information in this document is partially obtained from the following sources:

- 2011 District *Comprehensive Water System Plan*.
- 2018 WSDOT Standard Specifications.
- AWWA Standards.
- DOH *Water System Design Manual*.

Where any signed agreement exists between the District and the party providing the infrastructure, any such standards or requirements outlined in said agreement shall take precedence over this document.

The following standards are to be followed in the design of extensions to the District's water system of and in the preparation of plans and specifications for the construction of these extensions. These standards are to be followed except where specific deviations are approved by the District. A copy of the District's standard construction details is located in **Appendix L**.

CONSTRUCTION DRAWING FORMAT

Sheet size: 24-inch by 36-inch.

Plat Map: The final plat map shall be to the scale of 1-inch equals 100 feet. The contour map shall have a standard engineering scale and contour intervals of 5 feet or less. The remaining sheets may be to any suitable scale as selected by the Developer.

The District desires to maintain a consistent format to its construction drawings; therefore, it requires that all construction drawings conform to the following format unless exceptions are approved in advance by the District and/or the District 's Engineer.

The following format and requirements are a minimum for typical system extensions. Unusual or special facilities or construction requirements may dictate additional drawings and drawing requirements.

Water Plan: A separate construction plan is required at a scale of 1-inch equals 20 feet, 30 feet, or 40 feet, showing all existing or proposed utilities, existing or proposed street surfacing and improvements, street centerline and stationing, street right-of-way margins, street names, legal identifications of properties, such as lot number or tax lot number, section subdivision lines, all property lines, and all water or other utility easements and rights-of-way.

All water plans shall show the following information:

- Size, material, location, and length of each water main. Length measured between fittings or appurtenances.
- Station and offset to all fittings and valves, and listing of each fitting and the type of connection (i.e., flanges (FL), mechanical joint (MJ), etc.).
- Station and offset to all appurtenances such as fire hydrants, blow-off, and air valve assemblies.
- Details showing how the connection to the existing water system is to be made and how the new mains are to be tested and sampled for bacteriological analysis prior to connection.
- Location and size of all water services and whether the service is a double or single.
- Lot numbers and phasing, if applicable.

Water Profile: A drawing showing the vertical profile will be required for water lines. The scale of these drawings shall be a standard engineering scale with an appropriate vertical exaggeration. Other utilities (sanitary sewer, storm drain, etc.) also shall be shown on the profile.

As Built: After construction, the Developer shall submit to the District a revised Plan showing all field changes in Mylar, Adobe™ PDF format, and an electronic file in AutoCAD format. Water service will not be provided until an as-built record has been received.

WATER SYSTEM DESIGN

The design of water extensions shall be consistent with the District's approved Water System Plan, Standard Details, the regulations and standards of the Washington State Department of Ecology (Ecology), DOH, Department of Social and Health Services (DSHS), Chelan County Fire Marshal, and all other applicable State, county, and local agency standard regulations. Specific standards established by the District are as follows.

Transmission and Distribution Mains

1. Minimum size for all water mains shall be 6 inches except at the discretion of the District.
2. Any existing steel and/or undersized pipes that are adjacent to properties under development shall be replaced to current standards by the Developer to the farthest property boundary in all directions. Any existing water services along the existing main(s) shall be reconnected to the new main(s).
3. Water lines shall be extended to the boundaries of the property being served, providing access to all adjacent properties for looping and/or that may require future service.
4. Water mains shall be located at a uniform 6 to 9 feet north and east of centerline, roughly centered in the driving lane, unless otherwise approved by the District. Bends shall be used when necessary to maintain, as closely as possible, a uniform offset from centerline.
5. Water mains shall not be located under permanent concrete structures unless cased.
6. All new water mains shall be polyvinyl chloride (PVC) or ductile iron (DI) pipe. The DI pipe shall be class 50, except where trench, backfill, and loading dictate a stronger class pipe. PVC pipe shall be C-900 DR 18 (235 pounds per square inch (psi)) minimum.
7. Tracing wire and locating tape shall be installed on all mains, laterals, and service lines.
8. In areas of corrosive soils, polyethylene tubing wrap shall be used for DI pipe or the District may review the use of C900 PVC as an option.
9. Water mains shall be looped and dead-end lines avoided if possible.
10. Water mains shall be located in public Rights-of-Way whenever possible.
11. The bury for all waterlines shall be 48 inches minimum and 54 inches maximum as measured from the top of the pipe to the top of the subgrade. Whenever excavation or fill changes the cover over an existing waterline then, at the discretion of the District, the water main may be required to be replaced to the specified grade.
12. Water and sanitary sewer (or irrigation) mains separation shall conform to Ecology and DOH Standards. For all other utilities, the water main shall have a minimum horizontal separation of 36 inches, unless waived by the District.
13. Vertical separation from utilities other than sanitary sewer or irrigation shall be 6 inches minimum. If this is not possible, the District may allow closer separation with the addition of "blueboard" insulation to prevent utilities from bearing directly on each other.
14. A blow-off or fire hydrant shall be installed at all dead-end cul-de-sacs to improve water quality and facilitate testing.

Valves and Hydrants

1. Valves shall be clustered at the tee or crosses of connecting intersecting water lines. Full valve clusters are required.
2. All buried valves and valve clusters shall be pressure tested outside the trench prior to installation.
3. Zone valves shall be located at all pressure zone interfaces to allow future pressure zone re-alignment without the need for additional pipe construction.
4. Isolation valves shall be located wherever necessary to allow individual pipelines to be shut down for repair or installing services. In general, four valves shall be provided per cross and three valves per tee.

5. Typically, valves shall be placed at a maximum of 1,000-foot intervals.
6. Combination air/vacuum release valves shall be placed at all high points or "crowns" in all pipelines.
7. Hydrants shall be located where required by Chelan County (County) or State Code.

Water Services

1. Service lines shall only be connected to public distribution mains. Connection to hydrant runs, private mains, or dedicated supply mains will not be allowed. The District may reconsider this standard at its discretion if there is a public health benefit.
2. All water service lines shall be 1 inch or larger. Dual services are allowed.
3. All water service lines are to be located along the street and address side of the lot and installed perpendicular to the water main and street centerline.
4. Meter boxes shall be located within, and adjacent to, the right-of-way whenever possible.
5. If water service line lengths greater than 250 feet are required, the customer shall sign a special water service agreement with the District.
6. Standard District practice is to serve properties no more than two deep from the water main.
7. Meter boxes shall be installed with sufficient clearance from side sewers, transformers, pedestals, and other utility service equipment to provide for safe maintenance access and maintain water quality. Generally, clearance is required 10 feet from side sewers and 3 feet from dry utilities.
8. Where existing mains are being replaced, all existing water services shall be connected to the new main. For newer services with full size meter boxes and poly service lines, the service lines need only be reconnected at the main. For older, small meter chambers, the chambers shall be replaced to current standards and located as close to the right-of-way as possible. For any existing services with a copper or steel service pipe, the pipe shall be replaced with poly. Service reconstructions shall be reconnected to the customer side line.
9. For a site served by a master meter and/or private on-site domestic distribution, a cross-connection device commensurate with the degree of hazard shall be installed. Installation will be at the point of delivery, which is the downstream side of the water service (Premises Isolation), unless in-premises backflow preventers are providing a level of protection commensurate with the District's assessment. The Owner's Engineer shall size the device to pass all anticipated flows, which may include domestic, irrigation, and fire sprinkler demands. Per WAC 246-290-490(1)e, purveyors are not responsible for eliminating or controlling cross-connections within the consumer's water system. Under Chapter 19.27 Revised Code of Washington (RCW), the responsibility for cross-connection control within the consumer's water system, i.e., within the property lines of the consumer's premises, falls under the jurisdiction of the local administrative authority (Local Building Department). Owner's engineer/architect shall verify if premise isolation will be required at each structure.

Pressure Reducing Stations

1. The District's Standard Detail for pressure reducing valves (PRV) stations shall be used for design. Prepackaged stations may be allowed at the discretion of the District.
2. Vaults are to be sized to provide adequate working space, including clear head room and sufficient clearance to service and remove all equipment.

3. Vaults shall include drywell drains, daylight drains, or sump pumps.
4. Pressure relief valves may be required by the District for closed pressure zones to prevent over-pressurization if a PRV fails in the open position.
5. Stations shall include a large valve for emergency flow and a small bypass valve for domestic flows. The District will determine the valve sizes.
6. Hydraulic control valves 2 inches and larger shall be manufactured by Cla-Val, no substitutions.

Easements

1. Whenever water mains are located outside of public streets, the right-of-way or easement shall be of sufficient width to allow for future replacement of the facility without damage to permanent adjacent improvements.
2. In general, the minimum easement width shall be 20 feet. Special circumstances may require additional easement widths.
3. A graveled vehicular access road shall be provided over the easement, unless waived by the District.
4. Easements must be shown on the water plan and recorded on the plat.

Fire Flow

1. Fire flow delivery may be possible where hydrants exist, and for whatever duration is possible with the storage in the reservoirs and pumps functional at such time. However, the water system is not currently rated or guaranteed for any level of fire flow delivery.
2. The long-range planning-level fire flow requirement for the design of storage and distribution facilities for the District is 1,000 gallons per minute (gpm) for a 2-hour duration. This value exceeds the minimum Chelan County fire flow requirement for residential buildings of less than 3,600 square feet, which is 750 gpm (Chelan County Code 15.40.040, Fire-flow requirements for buildings).

8 | WATER SYSTEM IMPROVEMENTS

INTRODUCTION

This chapter presents proposed improvements to the Lake Wenatchee Water District's (District) water system that are necessary to resolve existing system deficiencies, improve reliability, 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 3**. The water system improvements were sized to meet both the existing and future demand conditions of the system.

A Capital Improvement Program (CIP) number has been assigned to each improvement, and illustrated on **Figure 8.1**. The improvements are organized and presented in this chapter according to the following categories:

- Six-Year System Improvements
- Future System Improvements
- Non-Project Improvements

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

SIX-YEAR SYSTEM IMPROVEMENTS

SOURCE METERS

Deficiency

The existing source flow meter at the Homestead well has been unreliable.

Improvement

(A1). Replace the source flow meter at the Homestead Well.

SCADA SERVER REPLACEMENT

Deficiency

The supervisory control and data acquisition (SCADA) server hardware is 4 years old and nearing its recommended replacement cycle. The District has only a single spare radio on hand.

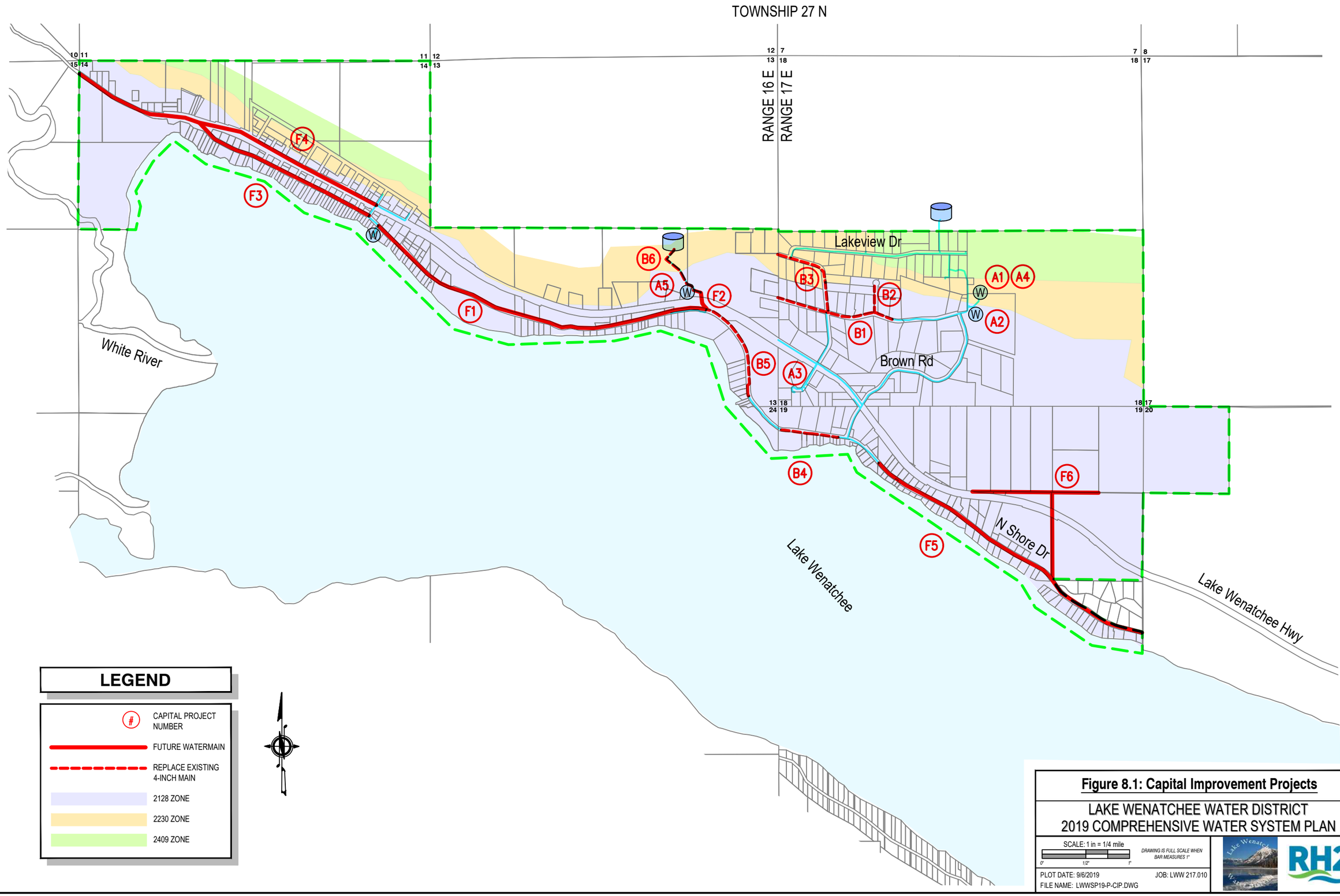
Improvement

(A2). Install a new SCADA server machine. Purchase a second spare radio.

FIR ROAD REPEATER POWER

Deficiency

The existing repeater is solar powered, resulting in inconsistent winter performance.


TOWNSHIP 27 N
RANGE 16 E
RANGE 17 E
10 11
15 14
11 12
14 13
12 7
13 18
7 8
18 17
13 18
24 19
18 17
19 20
F1
F2
F3
F4
F5
F6
B1
B2
B3
B4
B5
B6
A1
A2
A3
A4
A5
W
Lakeview Dr
Brown Rd
N Shore Dr
White River
Lake Wenatchee
Lake Wenatchee Hwy
LEGEND
CAPITAL PROJECT NUMBER
FUTURE WATERMAIN
REPLACE EXISTING 4-INCH MAIN
2128 ZONE
2230 ZONE
2409 ZONE
Figure 8.1: Capital Improvement Projects
LAKE WENATCHEE WATER DISTRICT
2019 COMPREHENSIVE WATER SYSTEM PLAN
SCALE: 1 in = 1/4 mile
0"
1/2"
1"
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"
PLOT DATE: 9/6/2019
JOB: LWW 217.010
FILE NAME: LWWSP19-P-CIP.DWG
RH2

Improvement

(A3). Install permanent power for the repeater.

HOMESTEAD WELL AND BROWN ROAD WELL WATER QUALITY

Deficiency

Customers have complained about odor and taste from the Homestead Well since shortly after its installation, and recently have had similar complaints about the Brown Road Well water. Increasing the chlorine dosage has improved the quality, but complaints still occur.

Improvement

(A4). Adjust the chlorine levels. If results are still unsatisfactory, test for total organic carbon and perform a bench test to evaluate if carbon filtration may improve water quality.

LAKE WENATCHEE WATER USERS ASSOCIATION WELL CONTROLLER

Deficiency

The existing pump can overdraw the well during dry periods. This reduces capacity and pulls air into the system, resulting in customer complaints and possibly reducing the pump life from cavitation.

Improvement

(A5). Perform a video inspection of the well to check the condition of the casing perforations. Depending on the results of the inspection, the following projects should be considered:

- Redevelop the well to recover some lost capacity,
- Install a variable frequency drive (VFD) and water level transducer. Control pump speed to prevent excessive water level drawdown in dry periods.

CUSTOMER METER REPLACEMENT

Deficiency

Approximately one third of the customer meters were in place prior to the system consolidation project, with the remainder installed in 2015. Customer meters have an average life expectancy of 15 years.

Improvement

(A6). A reserve fund could be established now, with annual contributions to build reserves for replacement by about the year 2030. It is most efficient to replace all meters over no more than a 3-year window so they are all on the same remote read technology. In today's dollars, full replacement would be $50,000, or $3,400 contributed to the fund for 15 years. Optionally, the District could defer contributions in the hope of obtaining funding assistance at that time. For this planning period, it is assumed the District will contribute 50-percent, or $1,700 per year, to the fund.

PORTABLE GENERATOR

Deficiency

The District does not own backup power generation equipment. In an extended power outage, the District would be reliant on available rental equipment.

Improvements

(A7). Lake Wenatchee Fire and Rescue has made a Federal Emergency Management Agency grant application for a District generator. It is hoped the grant will fully fund the purchase; therefore, no costs have been included in the CIP. Should the grant not be obtained, the District may budget for a generator in the future.

CONTROL VALVE SERVICE

Improvements

(A8). Contract with a control valve service company to inspect and service all pressure control valves every 5 years.

FUTURE SYSTEM IMPROVEMENTS

MOUNTAIN PARK CONNECTION

Deficiency

The Mountain Park/Zuffal system is a standalone Group B system with no backup source facilities. Consolidation of this system into the 2128 Zone will improve the long-term reliability and expand water service into currently unserved areas along the North Shore Road west of the existing District system. This project also could provide an additional source of water to the United State Forest Service (USFS) facilities located in the SW¼ of Section 13 and assumption of this Group A water system. It is assumed that this project would be initiated by either the currently unserved residences along the North Shore Road or the USFS. Following the connection of the Mountain Park system to the 2128 Zone, the existing well pump might be used as a secondary supply to the 2128 pressure zone, if conditions on the water rights allow.

Improvement

(F1 and F2). Connect the Mountain Park water system to the 2128 Zone by installing 5,500 feet of water main along North Shore Drive from the west end of the 2128 Zone to the Mountain Park system. To provide fire flow, the 300 feet of existing 4-inch main from North Shore Drive to the Lake Wenatchee Water Users Association (LWWUA) Well also would need to be replaced. The water main sizes in **Table 8.1** would be needed to supply the flows noted.

Table 8.1
Mountain Park Water Main Extension Sizing

Flow Available to Mt Park	New Main along N. Shore Dr.	New main from N. Shore Dr. to LWWUA Well.
200 gpm	6-inch	4-inch (existing)
350 gpm	8-inch	4-inch (existing)
450 gpm	8-inch	8-inch
750 gpm	10-inch	10-inch
1,000 gpm	12-inch	12-inch

gpm = gallons per minute

FUTURE WATER MAIN EXPANSION AND REPLACEMENT PROJECTS

(B1-B6). There is over 7,000 feet of mostly 4-inch polyvinyl chloride pipe that predates the 2015 project and is in unknown condition. It appears there may still be leakage in the system, and these older pipes and customer service lines are highly probable sources. No schedule is currently associated with replacement of these mains since leakage is not quantified or proven.

(F3-F6). Four general water main extension projects have been shown to provide future service within the District's retail service area. These projects are identified to assist the District regarding future service requests for currently unserved areas. The alignments of the proposed extensions are conceptual, and it is assumed that a review of possible alignment options will be undertaken to determine the least cost alternative for providing water service within these areas. It is assumed that the cost for the design and extension of water service into these areas will be borne by the land owners benefited by these projects.

NON-PROJECT IMPROVEMENTS

WELLHEAD PROTECTION PROGRAM

Deficiency

The District does not have a wellhead protection ordinance and program that meets current State requirements.

Improvement

(C1). Develop and adopt a wellhead protection ordinance that addresses permitted uses and performance standards for properties located within designated wellhead protection areas. Conduct a detailed inventory of potential sources of groundwater contamination. In addition, evaluate if performing a more detailed delineation of the wellhead protection area boundaries utilizing analytical models, hydrogeologic mapping, and computer flow models would be beneficial. Carry out other wellhead protection program requirements as outlined in **Chapter 5**. No cost is included in the CIP as it assumes work will be performed by District staff.

WATER SYSTEM PLAN UPDATE

Deficiency

WAC 246-290-100 requires that the District's Water System Plan (WSP) be updated every 6 to 10 years and be submitted to the Washington State Department of Health for review and approval.

Improvement

(C2). Update and submit a WSP every 6 to 10 years to comply with state requirements. For budgeting purposes, a 6-year cycle is assumed.

WATER RATE STUDY

Deficiency

The District's water rates should be evaluated to establish costs for providing water service to customers. A flat-rate structure was implemented during system consolidation, with the goal of providing a stable revenue stream. However, customer use records indicate a wide imbalance of consumption.

Improvement

(C3). Conduct a water rate study. The study should consider a block rate structure to encourage efficient use of the District's water supply, and fair allocation of costs.

WATER USE EFFICIENCY PROGRAM

Deficiency

There is insufficient historical data to accurately evaluate or monitor past efficiency performance.

Improvement

(C4). Implement the Water Use Efficiency Program, focusing on meter accuracy issues for the next few years. No cost is included in the CIP as it assumes work will be performed by District staff.

SUMMARY OF CAPITAL IMPROVEMENT PROJECTS

A summary of the CIPs is listed in **Table 8.2**. The project costs listed in this table are based on historical construction costs for the Chelan County area and include indirect costs of 35 percent to cover engineering, surveying, contingencies, inspection, and administration. The projects identified as necessary to meet the District's goal to provide a minimum level of service to all customers within the District are shown for completion within the first 6 years. No specific projects beyond 2026 have been identified, as growth projections do not indicate any system capacity limitations for the planning period.

Table 8.2
Capital Improvement Projects

CIP No.	Description	2019 Cost Estimate	3.0% Assumed Inflation Rate								
			2019	2020	2021	2022	2023	2024	2025	2026	No Date
	Inflation Multiplier		*1.00*	*1.03*	*1.06*	*1.09*	*1.13*	*1.16*	*1.19*	*1.23*	Set
A1	Homestead Well Source Meter	$3,000		$3,100							
A2	SCADA Server Replacement	$10,000		$10,300							
A3	Fir Drive Repeater Power	$5,000		$5,200							
A4	Homestead Well Water Quality	$10,000			$10,700						
A5	LWWU Well Controller	$15,000					$16,900				
A6	Meter Replacement Fund			$1,700	$1,700	$1,700	$1,700	$1,700	$1,700	$1,700	
A7	Portable Generator (FEMA grant)										
A8	Control Valve Service	$5,000				$5,000					
C1	Wellhead Protection Program										
C2	Water System Plan Update		$30,000						$45,000		
C3	Water Rate Study	$10,000									$10,000
C4	Water Use Efficiency Program										
Total			***$30,000***	***$20,300***	***$12,400***	***$6,700***	***$18,600***	***$1,700***	***$46,700***	***$1,700***	***$10,000***

Table 8.3 shows cost estimates for the future pipeline projects for reference. These projects are not currently scheduled as they will be driven by development or replacement due to leakage. The cost of these projects is not feasible with current revenue. The costs are separated into construction and pre-construction portions. Pre-construction includes survey, design, and permitting.

Table 8.3
Future Pipeline Projects

CIP No.	Description	Physical		Location			2019 Cost Estimate		
		Size	Length	Along	From	To	Constr.	Preconst.	Total
F1	Mt Park Connection	12 in	5,500 ft	N. Shore Dr.	17201 N Shore Dr	17691 N Shore Dr	$1,473,523	$179,026	$1,652,549
F2	4-Inch Main Replacement	12 in	300 ft	Lk Wen Hwy	17201 N Shore Dr	LWWU Well	$128,251	$15,582	$143,833
B1	4-Inch Main Replacement	6 in	750 ft	Brown Rd (North)	16896 Brown Rd.	16604 Brown Rd.	$177,581	$21,575	$199,156
B2	4-Inch Main Replacement	6 in	500 ft	Maple Dr.	Brown Rd (North)	North End	$100,081	$12,159	$112,240
B3	4-Inch Main Replacement	8 in	1,400 ft	Fir Dr.	Brown Rd (North)	Lakeview Dr.	$293,449	$35,653	$329,101
B4	4-Inch Main Replacement	6 in	900 ft	N. Shore Dr.	16699 N Shore Dr	16887 N Shore Dr.	$180,206	$21,894	$202,100
B5	4-Inch Main Replacement	6 in	1,100 ft	N. Shore Dr.	16995 N Shore Dr	17201 N Shore Dr	$217,545	$26,431	$243,976
B6	4-Inch Main Replacement	4 in	1,000 ft	Easement	LWWU Well	LWWU Tank	$110,142	$13,382	$123,523
F3	NW Service Area (N Shore Dr)	12 in	3,400 ft	N. Shore Dr.	17695 N Shore Dr	18149 N Shore Dr	$1,058,994	$128,663	$1,187,657
F4	NW Service Area (Hwy)	8 in	5,000 ft	Lk Wen Hwy	23140 Lk Wen Hwy	23410 Lk Wen Hwy	$1,341,670	$163,007	$1,504,677
F5	SE Service Area	8 in	4,800 ft	N. Shore Dr.	16508 N Shore Dr	15491 N Shore Dr	$1,170,285	$142,184	$1,312,469
F6	E Service Area	8 in	3,300 ft	USFS 271719140000	16231 N Shore Dr	22625 Lk Wen Hwy	$692,879	$84,182	$777,060

9 | FINANCIAL PROGRAM

WATER RATES AND PAST FINANCIAL RECORDS

The District uses a flat monthly rate structure. The rate was $38 in 2017, and $39 for 2018 and 2019. There is no commodity charge. The flat rate was established to provide a consistent revenue stream, and to simplify the billing system during the startup years of Lake Wenatchee Water District (District) operation. Because of the small number of accounts, the District does not currently have an option to seasonally discontinue billing when homes are not occupied. Doing so would require a substantial increase in the monthly rate to offset the vacancies, resulting in inconsistent and unpredictable revenue.

A brief summary of revenues and expenses is shown in **Table 9.1**. This summary only shows normal bills for revenue, it does not include less predictable sources, such as late fees or interest. More detailed past financial statements are in **Appendix M**.

Table 9.1
Historical Revenue and Expenses

	2013	2014	2015	2016	2017	2018
Revenue	$ 63,489	$ 65,417	$ 64,496	$ 72,361	$ 73,004	$ 73,275
Expenses	$ 52,490	$ 53,655	$ 77,787	$ 66,185	$ 58,946	$ 62,700
Net Income	***$ 10,999***	***$ 11,762***	***$ (13,291)***	***$ 6,176***	***$ 14,058***	***$ 10,575***

Customers also are assessed for repayment of the Local Improvement District (LID) for the 2015 system consolidation project. Those collections are managed by the Chelan County Treasurer and are essentially a zero sum (collections of equal loan payments); therefore, a more detailed discussion is not presented here.

The connection fee for a new service is $13,000 plus installation. Because the population projections show few, if any, new connections anticipated during this planning period, no re-evaluation of the connection fee has been performed.

RESERVE FUNDS

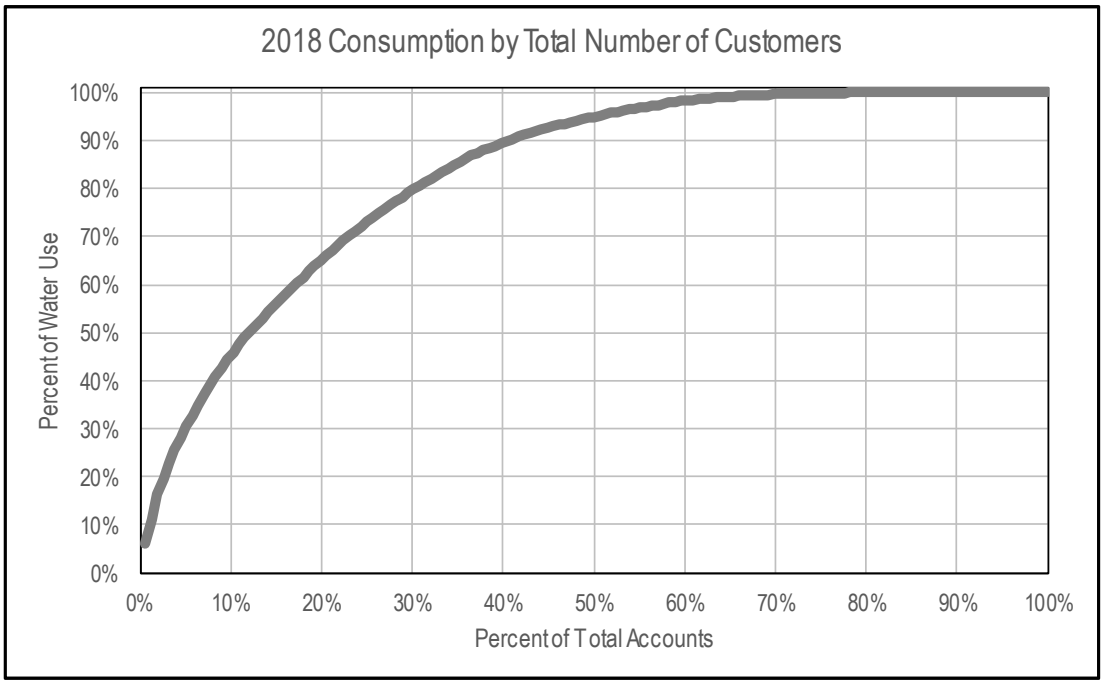
Currently, the District has only one reserve fund. It is recommended that this fund include the following minimum amounts:

- One-eighth of annual costs to cover periods where revenues may lag expenses. Approximately $10,000, but varies.
- Cost to replace the single largest mechanical component, which would be a well pump. Estimated cost of $20,000.
- Cost to fund the upcoming year capital projects, if not being funded otherwise through debt service. Varies, but average may be approximately $20,000 per year.

PROPOSED WATER RATES

One year of complete customer meter records (2018) shows customer consumption varies widely; many customers average annually less than 10 gallons per day (gpd) (seasonal occupancy), and a few average over 500 gpd. The distribution of annual use is shown on **Chart 9.1**. For example, approximately 12 percent of the customers use 50 percent of the water.

Chart 9.1



Because of this imbalance, and because the current rate structure does not discourage excessive water use, or encourage quick repairs of private leaks, a commodity charge should be implemented. A modest charge is proposed, as revenue stability from the base rate is still critical. A detailed rate evaluation is out of the scope of this planning effort, but a review of multiple Central Washington water utilities shows a common range of $2.00 to $3.00 per 1,000 gallons of usage.

To fully fund the normal operation of the water system and the capital projects identified in **Chapter 8**, a 6.5-percent annual rate increase is required for the next 6 years, in addition to the proposed commodity charge. This is based on the following assumptions:

- 2.5-percent annual inflation for operational expenses.
- 3.0-percent annual inflation for capital projects.
- No new service connections and no loss of existing service connections.
- Quantity of water sold will reduce annually due to water use efficiency measures.
- No new debt service.
- Maintaining a reserve no less than one-eighth of operating costs plus $20,000 emergency reserve.

The estimated monthly bill for a customer using an average of 150 gpd is shown on **Table 9.2**. One method of checking affordability is to compare the rate against 1.5 percent of the median income. This comparison also is shown on **Table 9.2**.

Table 9.2
Estimated Average Customer Monthly Bill

	2018	2019	2020	2021	2022	2023	2024
Average Monthly Use (gal)	4,563	4,563	4,563	4,563	4,563	4,563	4,563
Base Rate	$ 39.00	$ 39.00	$ 41.54	$ 44.23	$ 47.11	$ 50.17	$ 53.43
Block Rate ($ / 1,000 gal)	$ -	$ -	$ 1.00	$ 2.00	$ 2.50	$ 3.00	$ 3.00
Average Montly Bill	$ 39.00	$ 39.00	$ 46.10	$ 53.36	$ 58.52	$ 63.86	$ 67.12
Comparison to Chelan County Median Income							
Median Income	$ 4,440	$ 4,542	$ 4,646	$ 4,753	$ 4,863	$ 4,974	$ 5,089
1.5% of Median Income	$ 66.60	$ 68.13	$ 69.70	$ 71.30	$ 72.94	$ 74.62	$ 76.33

The proposed rates and revenues are show in **Table 9.3**. The commodity charge is proposed to start at $1 per 1,000 gallons in 2020 and increase to $3 per 1,000 gallons by 2023.

Table 9.3
Historical and Proposed Rates and Revenues

	2017	2018	2019	2020	2021	2022	2023	2024	2025
Number of Connections									
LWWD	144	146	147	147	147	148	148	148	149
Mt Park	10	10	11	11	11	11	11	11	11
Total Connections	**154**	**156**	**158**	**158**	**158**	**159**	**159**	**159**	**160**
Base Meter Charge									
LWWD	$38.00	$39.00	$39.00	$41.54	$44.23	$47.11	$50.17	$53.43	$56.91
Mt Park	$38.00	$39.00	$39.00	$41.54	$44.23	$47.11	$50.17	$53.43	$56.91
LWWD Base Revenue	$65,664	$68,328	$68,796	$73,268	$78,030	$83,667	$89,106	$94,898	$101,749
Mt Park Base Revenue	$4,560	$4,680	$5,148	$5,483	$5,839	$6,219	$6,623	$7,053	$7,512
Total Base Meter Charge	**$70,224**	**$73,008**	**$73,944**	**$78,750**	**$83,869**	**$89,886**	**$95,729**	**$101,951**	**$109,261**
Water Sales (gallons x 1,000)									
LWWD	5,953	5,953	5,936	5,919	5,902	5,884	5,867	5,849	5,831
Mt Park	141	141	140	140	140	139	139	138	138
Total Water Sales	**6,094**	**6,094**	**6,077**	**6,059**	**6,041**	**6,023**	**6,006**	**5,988**	**5,969**
Commodity Charge									
$ / 1,000 gal	$0.00	$0.00	$0.00	$1.00	$2.00	$2.50	$3.00	$3.00	$3.00
Total Commodity Charge	**$0**	**$0**	**$0**	**$6,059**	**$12,083**	**$15,059**	**$18,017**	**$17,963**	**$17,908**
Total Projected Revenue	**$70,224**	**$73,008**	**$73,944**	**$84,809**	**$95,952**	**$104,945**	**$113,745**	**$119,913**	**$127,169**
Average Revenue per Connection	**$456**	**$468**	**$468**	**$537**	**$607**	**$660**	**$715**	**$754**	**$795**

A 6-year forecast of revenues and expenses is shown on **Table 9.4**.

Table 9.4
Revenue and Expense Forecast

		2018	2019	2020	2021	2022	2023	2024	2025
INCOME									
Operating Revenue									
	Water Sales	$73,008	$73,944	$84,809	$95,952	$104,945	$113,745	$119,913	$127,169
	USFS ULID	$2,304	$2,304	$2,304	$2,304	$2,304	$2,304	$2,304	$2,304
	Connection Charges	$0	$0	$0	$0	$0	$0	$0	$0
	Other Miscellaneous	$1,000	$500	$513	$525	$538	$552	$566	$580
Total Operating Revenue		**$76,312**	**$76,748**	**$87,626**	**$98,781**	**$107,787**	**$116,601**	**$122,783**	**$130,053**
Capital Sources									
	Loans/Bonds	$0	$0	$0	$0	$0	$0	$0	$0
	Withdrawal from Operating Reserves	$0	$25,000	$20,300	$12,400	$6,700	$18,600	$1,700	$46,700
Total from Capital Sources		**$0**	**$25,000**	**$20,300**	**$12,400**	**$6,700**	**$18,600**	**$1,700**	**$46,700**
TOTAL INCOME		**$76,312**	**$101,748**	**$107,926**	**$111,181**	**$114,487**	**$135,201**	**$124,483**	**$176,753**
EXPENSES									
Operating Expenses									
Payroll & Taxes									
	Wages	$35,504	$36,000	$36,900	$37,823	$39,013	$39,989	$40,988	$42,277
	Benefits and Taxes	$750	$1,000	$1,025	$1,051	$1,084	$1,111	$1,139	$1,174
	Total Payroll	**$36,254**	**$37,000**	**$37,925**	**$38,873**	**$40,097**	**$41,100**	**$42,127**	**$43,452**
Operation and Maintenance									
	Maintenane, Repairs, Snow Removal	$17,500	$18,000	$18,450	$18,911	$19,507	$19,994	$20,494	$21,139
	Utilities & fuel	$3,500	$4,000	$4,100	$4,203	$4,335	$4,443	$4,554	$4,697
	Total Operation & Maintenance	**$21,000**	**$22,000**	**$22,550**	**$23,114**	**$23,842**	**$24,438**	**$25,049**	**$25,836**
General and Administrative									
	Testing	$2,500	$3,000	$3,075	$3,152	$3,251	$3,332	$3,416	$3,523
	Insurance	$4,000	$4,500	$4,613	$4,728	$4,877	$4,999	$5,124	$5,285
	Legal Services	$1,500	$1,000	$1,025	$1,051	$1,084	$1,111	$1,139	$1,174
	Engineering Services	$3,000	$3,000	$3,000	$3,075	$3,172	$3,251	$3,332	$3,437
	Dues/Training/Licenses/Mileage/Audit/NSF	$1,825	$2,000	$2,050	$2,101	$2,167	$2,222	$2,277	$2,349
	Office Expenses	$2,050	$2,000	$2,050	$2,101	$2,167	$2,222	$2,277	$2,349
	Total General & Administrative	**$14,875**	**$15,500**	**$15,813**	**$16,208**	**$16,718**	**$17,136**	**$17,565**	**$18,117**
State and Local Taxes (assumes 5.5% of retail sales)		**$0**	**$4,067**	**$4,665**	**$5,277**	**$5,772**	**$6,256**	**$6,595**	**$6,994**
Total Operating Expenses		**$72,129**	**$78,567**	**$80,952**	**$83,472**	**$86,429**	**$88,929**	**$91,335**	**$94,399**
Capital Improvement Program Expenditures									
	Capital Improvements	$0	$30,000	$20,300	$12,400	$6,700	$18,600	$1,700	$46,700
Total Capital Expenditures		**$0**	**$30,000**	**$20,300**	**$12,400**	**$6,700**	**$18,600**	**$1,700**	**$46,700**
TOTAL EXPENSES		**$72,129**	**$108,567**	**$101,252**	**$95,872**	**$93,129**	**$107,529**	**$93,035**	**$141,099**
OPERATING RESERVE FUNDS									
Recommended Minimum Balance									
	O&M Rerserve = 1/8 O&M+G&A	$9,016	$9,821	$10,119	$10,434	$10,804	$11,116	$11,417	$11,800
	Emergency Rerserve = Biggest Asset	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
	Capital Reserve = CIP	$0	$30,000	$20,300	$12,400	$6,700	$18,600	$1,700	$46,700
	Reserve Amount Recommended	$29,016	$59,821	$50,419	$42,834	$37,504	$49,716	$33,117	$78,500
Reserves									
	Beginning Balance	$66,943	$77,518	$45,699	$32,073	$34,982	$49,640	$58,712	$88,460
	(Withdraws) for CIP		($25,000)	($20,300)	($12,400)	($6,700)	($18,600)	($1,700)	($46,700)
	Balance Additions (Withdraws)	$10,575	($6,819)	$6,674	$15,309	$21,358	$27,672	$31,448	$35,653
	Ending Balance	$77,518	$45,699	$32,073	$34,982	$49,640	$58,712	$88,460	$77,413

Reserves are expected to diminish through 2021, then slowly rebuild in following years. Preventing any loss of reserves would require a substantial initial rate increase of 25 percent, although annual increases after that could be reduced to 3 percent. A deferral of capital projects would lessen the impact on reserves. A formal rate study could be performed to more precisely evaluate the District finances, but an additional rate increase may be required just to fund the study itself.