Population and Demand Projection

2

EXISTING WATER SYSTEM CUSTOMERS

Currently, the District's water system has 129 connections comprised entirely of residential services. Brown Road has 16 connections, Lake Wenatchee Users has 40 connections, Whispering Pines has 52 connections, Mountain Park has 9 connections and Lester has 12 connections. The existing population of the District was estimated by applying the average household size within Chelan County from the 2000 Census survey (2.62 residents per household) to the number of residential connections served by the District. The 2009 population for the District is estimated to be 338 residents.

The Land Use Element of the *Chelan County 2000 Comprehensive Plan* (amended January 2010) states that the County chose to plan for the high population projections released by the Office of Financial Management (OFM) as this growth scenario best matched the high rates of growth being experienced within the County and would provide sufficient room for growth in the twenty year planning period without artificially inflating development costs. The OFM conducts annual population forecasts at the county level for the State of Washington. The most current projections were released in 2007 and extend to the year 2030. The District's future growth rate for connections to the system was estimated using the OFM high forecast growth rates for Chelan County from the 2007 forecast. Future population for the District was then estimated by applying the average household size to the estimated number of residential connections served by the District. The 2029 population for the District is estimated to be 457 residents.

EXISTING WATER SYSTEM DEMANDS

Historical Water Use

The available water source production records for each system from January 2001 to December 2009 are shown in **Table 2-1**. The Lester and Mountain Park sources do not have meters installed, therefore use records in those systems are not available. The period of record was used to establish the historical pattern of water use for the residents in the District.

Table 2-1
Historical Water Use

Year	Total Supply: Annual (gal)	Total Supply: Average Monthly (gal/month)	Total Supply: Average Daily (gpd)	Connections: Full Time	Connections: Seasonal	Connections: Total	Supply per Connection (gpd)
Brown Road Water Users							
2007	7,357,879	613,157	20,159	7	9	16	1,260
2008	2,191,460	182,622	6,004	7	9	16	375
2009	4,922,894	410,241	13,487	7	9	16	843
Lake Wenatchee Water Users							
2004	4,181,400	348,450	11,456	6	34	40	286
2005	4,170,300	347,525	11,425	6	34	40	286
2006	4,629,900	385,825	12,685	6	34	40	317
2007	Not Available			6	34	40	---
2008	Not Available			6	34	40	---
2009	Not Available			6	34	40	---
Whispering Pines Water Users							
2001	6,465,300	538,775	17,713	19	33	52	341
2002	6,433,350	536,113	17,626	19	33	52	339
2003	6,685,630	557,136	18,317	19	33	52	352
2004	6,215,760	517,980	17,029	19	33	52	327
2005	6,920,190	576,683	18,959	19	33	52	365
2006	8,686,840	723,903	23,800	19	33	52	458
2007	6,906,235	575,520	18,921	19	33	52	364
2008	Not Available			19	33	52	---
2009	Not Available			19	33	52	---
Mountain Park Water Users							
2009	Not Available			---	---	9	---
Lester Addition Water Users							
2009	Not Available			---	---	12	---

Because water supply records were not available from all systems in 2009, the existing water use was estimated based on the average supply per connection from all available system data shown in **Table 2-1**. This average supply per connection of 390 gallons per day was used as the systems' demand per equivalent residential unit (ERU) and includes irrigation and system leakage. The existing estimated supply for all systems, shown in **Table 2-2**, is calculated based on the demand per ERU and the total number of ERUs in the system.

Table 2-2
Estimated Current Water Use

Demand per ERU (gpd/ERU)	Total ERUs	Estimated Supply		
		Daily (gpm)	Daily (gpd)	Annual (gal)
Total All Water Users				
390	129	35	50,310	18,363,150

The estimated demand per ERU for the water system is much greater than the minimum planning level water consumption as recommended by the WSDOH planning handbook. The reasons for the high estimated water consumption include high levels of leaking in the systems, domestic water being used for irrigation, and low fees for water use. To conservatively plan for future demands within the 20-year planning period, this demand per ERU will be used to account for similar usage patterns and character of future residential developments within the District. However, a decrease in the demand per ERU will be used for the projected build-out demands to account for planned water use efficiency and system leakage improvements. A build-out demand of 250 gallons per day per ERU was based on an analysis of the adjacent Alpine Water District and other systems with similar characteristics.

Since only monthly meter records were available, it is not possible to derive Maximum Day Demand (MDD) and Peak Hour Demand (PHD) from the existing water system data. MDD and PHD have been estimated using typical peaking factors from the DOH Design Manual and data from other Central Washington water systems. System demand data and peaking factors are displayed in **Table 2-3**.

Table 2-3
Current Demand Data and Peaking Factors

Demand Data

Demand Type	Demand/ERU	Estimated System Demand
Average Day Demand (ADD)	390 gpd/ERU	35 gpm
Maximum Day Demand (MDD)	780 gpd/ERU	70 gpm
Peak Hour Demand (PHD)	2,214 gpd/ERU	198 gpm

Peaking Factors

Description	Factor
Maximum Day Demand/Average Day Demand (MDD/ADD)[1]	2.00
Peak Hour Demand/Maximum Day Demand (PHD/MDD)[2]	2.84
Peak Hour Demand/Average Day Demand (PHD/ADD)	5.68

1 - Assumed Maximum Day Demand / Average Day Demand = 2.00 based on comparison to similar Central Washington systems.
2 - Peaking factor derived from Equation 5-1 of the DOH Water System Design Manual.

Fire Flow Demands

The planning-level fire flow requirement for the design of storage and transmission 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 gallons per minute (*Chelan County Code 15.40.040 Fire-flow requirements for buildings*).

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 three-year average. For systems with fewer than 500 connections, the DSL standard may be increased to 20 percent if a request with supporting data is provided to DOH.

Although the existing DSL cannot currently be calculated, it is estimated that leakage in the District's existing system is high due to old service and distribution lines currently in use. The District intends to determine the DSL in the system by installing meters for all customers once the District is established. The District will also record the volume of water used for flushing the distribution system and construction purposes. The District intends to reduce the amount of DSL in the system to meet the DSL standard by replacing old service and distribution lines. The District will also implement the Water Use Efficiency Program contained in **Chapter 4.**

PROJECTED SYSTEM GROWTH AND FUTURE WATER DEMANDS

Water system growth and demand projections were prepared based on a number of sources including existing water use records, forecasted growth rates for Chelan County, land use designations, and development anticipated in the area. **Figure 1-6** shows land use designations within the District. Based on the existing land use designations, there are currently 784 acres of residential area within the District's water service area boundary.

Future residential demands were calculated for the 6-year, 20-year, and build-out planning horizons and are shown in **Table 2-4**. Projected residential demand was developed using the following assumptions:

- The demand for the existing and future population will remain the same as in recent years. This assumes that existing users will continue to use water at the rate estimated in **Table 2-2** of 390 gpd/connection.

- Maximum Day Demand calculations are based on an MDD/ADD peaking factor of 2.0.
- Peak Hour Demand calculations for each year are based on Equation 5.1 in the DOH Water System Design Manual.
- Although the current, 6-year, and 20-year average day demand is assumed to be 390 gpd/connection, average day demand for all residents at build-out was based on 250 gpd/ERU to account for increased water use efficiency and decreased leakage.

Forecasted population growth rates for the District were obtained from the Office of Financial Management's 2007 County Population Projections. The high projection for the growth rate was utilized because it is consistent with the growth rate established in the *Chelan County 2000 Comprehensive Plan* and provides for a more conservative design.

Table 2-4
Future Water Demand Projections

Description	Existing	Projected							
	2009	2010	2011	2012	2013	2014	2015 (+6 yrs)	2029 (+20 yrs)	Build-out
Residential ERU's	129	131	133	136	138	140	142	174	777
Demand per ERU (gpd)	390	390	390	390	390	390	390	390	250
System Average Day Demand (gpm)	35	36	36	37	37	38	39	47	135
System Maximum Day Demand (gpm)	70	71	72	74	75	76	77	94	270
System Peak Hour Demand (gpm)	**198**	**201**	**203**	**206**	**208**	**211**	**213**	**247**	**528**

Water System Analysis

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DRINKING WATER REGULATIONS

Overview

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, the DOH is the agency responsible for implementing and enforcing the drinking water regulations. For the State of Washington to maintain primacy (delegated authority to implement requirements) under the SDWA, the state must adopt drinking water regulations that are at least as stringent as the federal regulations. In meeting these requirements, the State, in cooperation with the EPA, has published drinking water regulations that are contained in Chapter 246-290 WAC.

Existing Regulations

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

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

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

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

- Organic Chemicals – Animal or plant produced substances containing carbon and other elements such as hydrogen and oxygen.
- Synthetic Organic Chemicals (SOCs) – Manmade organic substances, including herbicides, pesticides, and various industrial chemicals and solvents.
- Volatile Organic Chemicals (VOCs) – Chemicals, as liquid, that evaporate easily into the air.
- Inorganic Chemicals (IOCs) – Chemicals of mineral origin that are naturally occurring elements. These include metals such as lead and cadmium.

Phase I Rule

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

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

The 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 must also be filtered, unless a filtration waiver is granted. A filtration waiver may be granted to systems with pristine sources that continuously meet stringent source water quality and protection requirements.

Interim Enhanced Surface Water Treatment Rule

The EPA proposed the Interim Enhanced Surface Water Treatment Rule (IESWTR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became effective on February 16, 1999, concurrent with the Stage 1 Disinfectants/Disinfection By-products Rule. The rule primarily applies to public water systems that serve 10,000 or more people and use surface water or GWI sources. The rule also requires primacy agencies (i.e., DOH) to conduct sanitary surveys of all surface water and GWI systems, regardless of size. The rule is the first to directly regulate the protozoan *Cryptosporidium* and has set the MCLG for *Cryptosporidium* at zero. Water systems affected by this rule needed to comply with it by December 16, 2001.

Long Term 1 Enhanced Surface Water Treatment Rule

This is the follow-up rule to the IESWTR that became effective in December of 1998. The final Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was published on January 14, 2002, and became effective February 13, 2002. The rule addresses water systems using surface water or groundwater under the direct influence of surface water serving fewer than 10,000 people. The rule extends protections against *Cryptosporidium* for smaller water systems.

Total Coliform Rule

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

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

The rule established the MCLG for total coliform at zero. To comply with the legal limit, systems must not find coliform in more than 5 percent of the samples taken each month. For smaller systems like the 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 K**.

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

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

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

Radionuclides Rule

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

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

The final rule was published in the Federal Register on December 7, 2000, and became effective on December 8, 2003. The rule established an MCLG of zero for the four regulated contaminates and MCLs of 5 pCi/L for combined radium-226 and radium-228; 15 pCi/L for gross alpha (excluding radon and uranium); 4 mrem/year for beta particle and photon radioactivity; and 30 ug/L for uranium.

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). A copy of 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 1^{st} of each year thereafter.

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

Stage 1 Disinfectants/Disinfection By-products Rule

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

The EPA proposed the Stage 1 Disinfectants/Disinfection By-products Rule (D/DBPR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became effective on February 16, 1999. The rule applies to the District and most other water systems which add a chemical disinfectant to the drinking water during any part of the treatment process. The rule reduced the MCL for total trihalomethanes, which are a composite measure of four individual trihalomethanes, from the previous interim level of 0.10 mg/L to 0.08 mg/L. The rule established MCLs and requires monitoring of three additional categories of DBPs: 1) 0.06 mg/L for five haloacetic acids; 2) 0.01 mg/L for bromated; and 3) 1.0 mg/L for chlorite. The rule also established maximum residual disinfectant levels (MRDLs) for chlorine (4.0 mg/L), chloramines (4.0 mg/L) and chlorine dioxide (0.8 mg/L). The rule requires systems using surface water or groundwater directly influenced by surface water to implement enhanced coagulation or softening to remove DBP precursors, unless alternative criteria are met. Compliance with this rule must have been satisfied by December 16, 2001 for large surface water systems (those serving over 10,000 people) and by December 16, 2003 for smaller surface water systems and all groundwater systems.

Unregulated Contaminant Monitoring Regulation

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

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

Arsenic

The EPA established interim drinking water regulations for arsenic in 1976 under the SDWA. Arsenic is highly toxic, affects the skin and nervous system, and may cause cancer. The 1986 SDWA amendments require the EPA to conduct research to assess health risks associated with exposure to low levels of arsenic. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90 day public review period. The final rule, which was published in the Federal Register on January 22, 2001, was to become effective on March 23, 2001, except for certain amendments to several sections of the rule. However, because of the national debate regarding the science and costs related to the rule, the EPA announced on May 22, 2001 that it was delaying the effective date for the rule to allow time to reassess the rule and afford the public a full opportunity to provide further input. On October 31, 2001, the EPA reaffirmed the final rule as published on January 22, 2001. The Arsenic Rule subsequently became effective on February 22, 2002.

The rule sets the MCLG of arsenic at zero and reduces the MCL from the previous standard of 0.05 mg/L to 0.01 mg/L. Arsenic's monitoring requirements is consistent with the existing requirements for other inorganic contaminants.

Stage 2 Disinfectants/Disinfection By-products Rule

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

Similar to the Stage 1 D/DBPR, this rule applies to most water systems that add a disinfectant to the drinking water other than ultraviolet light or those systems which deliver such water. The Stage 2 D/DBPR changes the calculation procedure requirement of the MCLs for two groups of DBPs (TTHM and 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 LTIESWTR to supplement the preceding regulations. The second part of the regulations of the LT1ESWTR, which became effective in February 2002, are mandated in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The final rule was published in the Federal Register on January 5, 2006, and became effective on March 6, 2006. The final rule was implemented simultaneously with the Stage 2 D/DBPR described in the previous section. This rule applies to all systems that use surface water or GWI sources.

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

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

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 October 4, 2007 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.
   - 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.
   - 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: 1) correct all significant deficiencies; 2) eliminate the source of contamination; 3) provide an alternate source of water; or 4) 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 are delayed until 2008 but have not yet been published. The rule proposes a 300 pCi/L MCL for community water systems that use groundwater or an alternative, less stringent MCL of 4,000 pCi/L for water systems where their state implements an EPA-approved program to reduce radon risks in household indoor air and tap water. It is not currently known when or what a radon regulation may require as adopted by the EPA or what will be the rule's implementation schedule.

Unregulated Contaminant Monitoring Regulation Revisions

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

SOURCE WATER QUALITY

This section presents the current water quality standards 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 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 are generally monitored at the discretion of the water purveyor and in the interest of customers.

The regulated contaminants are grouped into two categories of standards: primary and secondary. Primary standards are drinking water standards for contaminants that could affect 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 which 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 Transient Non-Community (TNC) water systems are only required to monitor for nitrates after their source has been approved. Group A Community water systems are required to perform water quality monitoring at their active source for inorganic chemical (IOC) and physical substances, organic chemicals and radionuclides. The existing monitoring schedule is shown on the Water Facilities Inventory (WFI) forms which are included in **Appendix B** for each individual 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.

Currently, the District's retail service area contains one Group A Community (Community) public water system, Whispering Pines. The monitoring requirements that the District must comply with are specified in WAC 246-290-300. A description of the Whispering Pines source water quality monitoring requirements and procedures for each group of substances is contained in the Whispering Pines Water Quality Monitoring Report that is included in **Appendix H**.

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 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, the water system is required to meet a CT of 6 using chlorination and to provide a chlorine residual of at least 0.33 mg/L.

The District will be required to coordinate with DOH to define the water quality constituents to be monitored as part of the revised water quality monitoring plan following the incorporation of the water systems.

Source Monitoring Results

It is important to note that the information below is based on data obtained from the Department of Health Sentry Database. Additional water quality data may exist but the data was not available during the completion of the Plan.

Brown Road (Group A – TNC)

Nitrate monitoring has been performed once per year since 2004. Radionuclide monitoring was completed in 1981. The nitrate and radionuclide results were satisfactory. IOC, SOC and VOC lab results were not available.

Lake Wenatchee Users (Group A – TNC)

This source was sampled for VOC's in 1999 and was satisfactory. No other water quality results were available for this source.

Whispering Pines (Group A-Community)

Nitrate monitoring has been performed once per year since 1999 with the exception of 2001. Radionuclide monitoring was completed in 2007, 2006 and 2003. IOC monitoring was completed in 2007, VOC monitoring was completed in 2006 and arsenic sampling was completed in 2002. The result of the sampling that was completed was satisfactory. No data exists for SOC's.

Mountain Park (Group B)

This system is required to complete nitrate sampling once every three years. Nitrate monitoring has been completed for this source in 1995, 2002 and 2006. IOC monitoring was completed in 1988. The water quality sampling that was completed was satisfactory. No other water quality data was available.

Lester (Group B)

No water quality data is available for this system.

DISTRIBUTION SYSTEM WATER QUALITY

Monitoring Requirements and Results

The Brown Road, Whispering Pines and Mountain Park systems chlorinate their water. In general, the water systems are required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, DBP, lead and copper, and asbestos in accordance with Chapter 246-290 WAC. Since the Lake Wenatchee Users system does not chlorinate, the system is not required to monitor DBPs or disinfectant residual concentrations. A schedule of all water systems' water quality monitoring requirements is contained in the Water Facilities Inventory (WFI) in **Appendix B**. The Lake Wenatchee User's Water Quality Monitoring Plan is included in **Appendix H**.

A summary of the results of each water systems water quality monitoring within the District's retail service area are presented below.

Coliform Monitoring

Generally, the systems are required to collect a minimum of one sample per month from the water distribution system. The coliform test identifies a sample as having a presence or absence of coliform.

The Brown Road water system currently conducts quarterly coliform monitoring in the months of January, April, July and October. This system has not detected the presence of coliform in the distribution system since 2004. Coliform was detected in 2002, 2003 and 2004. Follow up sampling did not detect the presence of E-coli.

The Lake Wenatchee Users currently conduct monthly coliform monitoring of their system excluding the month of February. The system detected the presence of coliform in 2009, three times in 2008, once each in 2007 and 2006, eleven times in 2003 and once in 2002. Follow up sampling yielded the detection of E-coli twice in 2003.

Whispering Pines currently conduct monthly coliform monitoring of their system. The system has not detected the presence of coliform since 2001.

Mountain Park water system currently collects one coliform sample per year. The system has not detected the presence of coliform since 1997.

No water quality data is available for Lester.

Disinfectant Residual Concentration Monitoring

The Whispering Pines system receives its water from a spring source. This source is designated as a groundwater source in hydraulic connection with surface water. Chlorine is used to achieve a CT of 6. The system is required to maintain a chlorine residual of at least 0.33 mg/L prior to the first customer's service meter. No data was available of the chlorine residual for the distribution system. Whispering Pines is required to submit monthly chlorination reports to the DOH and is in compliance with this requirement.

No other data was available regarding disinfectant residual monitoring for the Brown Road, Mountain Park and the Lester systems. Disinfectant residual monitoring is not required of the Lake Wenatchee Users.

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 three years.

Brown Road completed the monitoring in 2006 and Whispering Pines is in compliance with this rule, with the last samples being taken in 2009. No lead and copper data exists on the other water systems.

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 PVC main. There are no records of watermain being constructed of AC pipe in the system.

Disinfectants/Disinfection By-products Monitoring

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

Brown Road completed this monitoring in 2005 through 2007. Whispering Pines completed this monitoring in 2006, 2007 and 2009. Both of these systems are in compliance with the monitoring requirements.

This monitoring is not required for the Lake Wenatchee Users. No other data exists for the Lester or Mountain Parker water systems.

SUPPLY ANALYSIS

Water Sources

The current water sources for inclusion into the District are the Lake Wenatchee Users Well, Brown Road Well, Whispering Pines Spring, Lester Intake, and Mountain Park Well. Of these five supply sources, the Lake Wenatchee Users Well and the Brown Road Well currently meet source standards for public water systems. The other three supply sources have either existing deficiencies in the physical condition of the source facilities or do not presently meet current federal and state standards for source water requirements.

Existing Source Deficiencies

A summary of the existing source deficiencies are summarized below:

- Whispering Pines Spring
  Based on a site sanitary survey inspection by the DOH in July 2008, the spring's collection system boxes do not appear to be adequately protecting the springs from contamination by surface water runoff from the adjacent creek during the spring. The DOH has directed the Whispering Pines Water Association to either improve the collection boxes to protect than from surface contamination or to develop another source of supply.

- Lester Intake
  This source collects untreated water from Bainard Creek and is therefore classified as a surface supply. If continued use of this supply is contemplated, surface water treatment will be required.

- Mountain Park/Zufall
  This is a hand-dug well estimated to be approximately 20 feet in depth and as such it does not meet public source water standards and requirements. DOH generally does not consider hand-dug wells as a protected groundwater source. This well may need to be replaced if this system expands or if this well is incorporated into an expanded water system.

In addition to the above-identified deficiencies, none of these supplies has a source meter as is required for all public water supplies.

Water Supply Capacity

Currently, the District has a total of 129 ERUs and the estimated MDD is 780 gpd/ERU. The Washington State Department of Health (DOH) Water System Design Manual states that a water supply system should be capable of providing the MDD in 18 hours of pumping. Therefore, a 93 gpm source flow rate is needed to meet the current demand. Since the existing available water sources have a total capacity of 250 gpm, the current water supply capacity is adequate for current demand. For the remainder of this chapter, an 18 hour pumping day for supply capacity has been used.

Table 3-1 shows existing and future water supply demands and capacity.

Table 3-1
Water Supply Capacity

Description	Existing 2009	Future Projections 2015	2029
Required Source Capacity			
Maximum Day Demand (gpm)	70	77	94
Maximum Day Demand (gpd)	100,620	111,120	135,370
Available Source Capacity			
Lake Wenatchee Water Users Well (gpd)	32,400	32,400	32,400
Brown Road Well (gpd)	70,200	70,200	70,200
Whispering Pines Spring (gpd)	54,000	54,000	54,000
Lester Intake (gpd)	48,492	48,492	48,492
Mountain Park Water Users Well (gpd)	54,000	54,000	54,000
Total (gpd)	259,092	259,092	259,092
Surplus or Deficient Source Capacity			
Surplus or Deficient Amount (gpd)	158,472	147,972	123,722
Surplus or Deficient Amount (gpm)	110	103	86

1 = Available source capacity is based on the existing sources providing supply for 18 hours per day.

The Available Source Capacity represents the resultant gallons supplied per day assuming an 18 hour supply period. No additional sources are needed to supply projected growth if the existing available sources are maintained with their current capacities.

BOOSTER PUMP STATION ANALYSIS

Of the five water systems, only the Whispering Pines System has multiple pressure zones requiring booster pump stations to supply water from the lower zones into the two upper zones.

Booster Pump Station 1 is located at the site of the lower reservoirs and pumps water into the two mid-zone reservoirs. The pump station consists of a single pump controlled by a timer and pressure transducer, which is used to measure water pressure at the pump discharge for pump control. Since this one pump is the only supply to the mid-zone reservoirs, the Whispering Pines Water Association has purchased a second spare pump and motor that can be swapped out with the current pump in case of failure. The control system for this pump is unique in that pressure is measured at the discharge of the pump which requires the pump to be off in order to determine reservoir level. This method of control is not ideal in that the pump must be shut down by a timer so that the system can stabilize before reading the pressure to determine the water level in the mid-zone tanks. Using this method of control can cause the tanks to run out of water during periods of high demand. Given the number of service connections served by this zone, if this station is to remain as part of the larger water system, it is recommended that additional reliability be provided by installing a second pump that could alternate with the existing pump to provide continued supply in the event of an emergency. Additionally, telemetry improvements are recommended where pump control is based on actual tank level measured at the tanks and not at the discharge of the pump.

Booster Pump Station 2 is a single-pump station controlled in a similar manner as Booster Pump Station 1. This pump station has similar reliability issues as those identified with Booster Pump Station 1. If Booster Pump Station 2 is to be incorporated into a larger water system, it is recommended that similar reliability improvements as proposed for Booster Pump Station 1 be incorporated into this station.

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.

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 below.

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. Operating storage is approximately 39,400 gallons for all reservoirs, which has been established to ensure adequate turnover in the reservoirs to maintain water quality. The amount of operational storage utilized changes based on seasonal demands and operator judgment. Operating storage for future projections is assumed to be 15 to 20 percent of total storage.

Equalizing Storage

Equalizing storage is the volume of storage 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 psi at all service connections throughout the system under peak hour demand 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 – Q_S)(150 minutes), but in no case less than zero

Where:

ES = equalizing storage, in gallons.

PHD = peak hour demand, in gpm.

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

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. Since the District's supply flow rate is greater than the PHD in all the zones except the 2128 Zone, equalization storage is currently necessary only in the 2128 Zone.

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, and loss of supply, transmission main breaks, and any other situation that disrupts the supply source. DOH requires that standby storage be stored above an elevation that will provide a minimum pressure of 20 psi at all service connections throughout the system.

The DOH Water System Design Manual recommends the standby storage volume to be two times the average day demand of the system for systems with a single supply source. For the purposes of calculating this standby storage, the average day demand is based on 390 gallons per day as determined from the current water system demands data shown in **Table 2-3.** Using 129 ERU's and 780 gallons per ERU (2x390 gallons), the current total standby storage volume required is approximately 99,000 gallons. Since standby storage is calculated based on demand, as the system demand increases, the standby storage requirement also increases. The minimum standby storage requirement per DOH design manual shall not be less than 200 gallons times the number of ERUs served by the system or 28,800 gallons. Fire Storage

Fire storage is the volume of storage necessary to supply the maximum required fire flow rate for the required duration. The District's fire storage volume requirement will be 120,000 gallons (based on the fire flow requirement of 1,000 gpm for duration of 120 minutes). Fire storage will be provided in the future, when the District installs improvements to make fire flow available in the system. The District does not currently provide fire flow to the service area because it is located in a rural area.

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 occupies the lower portion of most ground-level reservoirs. Water that is stored at or below an elevation that cannot provide a minimum pressure of 20 psi is considered dead storage for the analyses that follow.

Current Water Storage Capacity

Based on existing conditions, the District has a storage deficiency of approximately 46,000 gallons, shown in **Table 3-2**.

Table 3-2
Existing Storage Evaluation

Description	Mountain Park	Brown Road	Lester	Whispering Pines 2085 Zone	Lake Wenatchee Users	Whispering Pines 2272 Zone	Whispering Pines 2335 Zone	Totals
	Supply Area							
Available/Usable Storage (gallons)								
Maximum Storage Capacity	0	13,000	0	15,000	80,000	22,000	10,000	140,000
Dead (Non-usable Storage)	0	-13,000	0	-15,000	0	0	-2,538	-30,538
Total Available Storage	0	0	0	0	80,000	22,000	7,462	109,462
Required Storage (gallons)								
Operational Storage	0	5,417	0	3,288	15,092	15,228	3,525	42,550
Equalizing Storage	0	0	0	0	4,727	3,341	4,495	12,563
Standby Storage	7,020	12,480	9,360	21,060	31,200	15,600	3,900	100,620
Fire Flow Storage	0	0	0	0	0	0	0	0
Totals	7,020	17,897	9,360	24,348	51,019	34,170	11,920	155,733
Surplus or Deficient Storage (gallons)								
Surplus or Deficient Amt.	-7,020	-17,897	-9,360	-24,348	28,981	-12,170	-4,458	-46,271

Future Water Storage Capacity

Additional storage capacity will be required to serve more ERUs in the future. **Table 3.3** shows future storage capacity requirements.

Table 3-3
Future Storage Projections

Description	2015 Supply Area				2029 Supply Area			
	2128 Zone	2272 Zone	2335 Zone	Totals	2128 Zone	2272 Zone	2380 Zone	Totals
Available/Usable Storage (gallons)								
Maximum Storage Capacity	80,000	22,000	10,000	112,000	80,000	0	180,000	260,000
Dead (Non-usable Storage)	0	0	-2,538	-2,538	0	0	0	0
Total Available Storage	80,000	22,000	7,462	109,462	80,000	0	180,000	260,000
Required Storage (gallons)								
Operational Storage	15,092	15,228	3,525	33,846	15,092	0	28,788	43,880
Equalizing Storage	0	0	0	0	0	0	1,019	1,019
Standby Storage	22,800	17,160	4,680	44,640	27,961	21,027	5,735	54,722
Fire Flow Storage	0	0	0	0	0	0	120,000	120,000
Totals	37,892	32,388	8,205	78,486	43,053	21,027	155,542	219,622
Surplus or Deficient Storage (gallons)								
Surplus or Deficient Amt.	42,108	-10,388	-743	30,976	36,947	-21,027	24,458	40,378

The future storage projections shown in **Table 3-4** are based on pressure zone other system improvements, including a new 180,000 gallon 2380 Zone reservoir, as presented in the Capital Improvement Program in **Chapter 8**. The fire flow storage calculation assumes that a flow of 1,000 gpm for 2 hours will be required by 2029 and that the fire storage in the proposed 2380 Zone reservoir will be available to other pressure zones through proposed pressure reducing valve systems.

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 peak day demand per ERU. The storage capacity analysis was based on the storage capacity for equalizing and standby storage and the computed storage requirement per ERU. Operational and fire flow storage capacity was excluded from the storage analysis because these components are not directly determined by water demands or ERUs. For the analyses, a reserve amount equivalent to the existing operational and fire flow storage requirement was deducted from the total available storage capacity to determine the storage capacity available for equalizing and standby storage. This storage capacity available for equalizing and standby storage was divided by the existing number of ERUs presented in **Chapter 2** to determine the storage requirement per ERU. The ERU-based demand data was derived from the average day demand of the system and demand peaking factors from **Chapter 2.** The annual water rights capacity evaluation was based on the existing annual water rights, as summarized in **Chapter 4**, and the system's average day demand 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 peak day demand per ERU.

Existing Capacity Analysis Results

A summary of the results of the existing system capacity analysis is shown in **Table 3-4**. The results of the system capacity analysis indicate that the limiting capacity of the system is storage, which can support up to a maximum of approximately 76 ERUs. The existing water system has a deficient capacity of approximately 53 ERUs.

Table 3-4
Existing System Capacity Analysis

Demands Per ERU Basis

Average Day Demand Per ERU (gal/day)	390
Peak Day Demand Per ERU (gal/day)	780
Peak Hour Demand Per ERU (gal/day)	2,214

Source Capacity - Well and Spring Supply

Well and Spring Supply Capacity (gal/day)	259,092
Peak Day Demand Per ERU (gal/day)	780
Maximum Supply Capacity (ERU's)	332

Source Capacity - Annual Water Rights

Annual Water Right Capacity (gal/day)	101,558
Average Day Demand Per ERU (gal/day)	390
Maximum Annual Water Right Capacity (ERUs)	260

Source Capacity - Instantaneous Water Rights

Instantaneous Water Right Capacity (gal/day)	1,242,000
Peak Day Demand Per ERU (gal/day)	780
Maximum Instantaneous Capacity (ERUs)	1,592

Storage Capacity

Maximum Equalizing & Standby Storage Capacity (gal)	66,912
Equalizing & Standby Storage Requirement Per ERU (gal)	877
Maximum Storage Capacity (ERU's)	76

Transmission Capacity

Transmission Capacity (gal/day)	493,514
Peak Day Demand Per ERU (gal/day)	780
Maximum Transmission Capacity (ERU's)	633

Maximum System Capacity

Based on Limiting Facility - Storage	76

Unused Available System Capacity

Maximum System Capacity (ERU's)	76
Existing (2009) ERU's	129
Surplus (Deficient) Capacity (ERU's)	(53)

Future Capacity Analysis Results

A summary of the results of the 6-year projected system capacity analysis is shown in **Table 3-5**. The system capacity analysis shown in the table accounts for the proposed improvements that are planned within the 6-year planning period, as described in **Chapter 8**. These improvements include converting the Whispering Pines' 2085 Zone and the Brown Road and Lester systems into the existing 2128 Zone and removal of the Brown Road Reservoir. The results of the 2015 system capacity analysis indicate that, with improvements which increase the supply capacity of the system to 214 ERUs, the system will have a surplus system capacity of approximately 72 ERUs.

Table 3-5
Year 2015 System Capacity Analysis with Proposed 2015 System Improvements Completed

Demands Per ERU Basis	
Average Day Demand Per ERU (gal/day)	390
Peak Day Demand Per ERU (gal/day)	780
Peak Hour Demand Per ERU (gal/day)	2,161
Source Capacity - Well and Spring Supply	
Well and Spring Supply Capacity (gal/day)	259,092
Peak Day Demand Per ERU (gal/day)	780
Maximum Supply Capacity (ERU's)	332
Source Capacity - Annual Water Rights	
Annual Water Right Capacity (gal/day)	101,558
Average Day Demand Per ERU (gal/day)	390
Maximum Annual Water Right Capacity (ERUs)	260
Source Capacity - Instantaneous Water Rights	
Instantaneous Water Right Capacity (gal/day)	1,242,000
Peak Day Demand Per ERU (gal/day)	780
Maximum Instantaneous Capacity (ERUs)	1,592
Storage Capacity	
Maximum Equalizing & Standby Storage Capacity (gal)	75,616
Equalizing & Standby Storage Requirement Per ERU (gal)	354
Maximum Storage Capacity (ERU's)	214
Transmission Capacity	
Transmission Capacity (gal/day)	493,514
Peak Day Demand Per ERU (gal/day)	780
Maximum Transmission Capacity (ERU's)	633
Maximum System Capacity	
Based on Limiting Facility - Storage	214
Available System Capacity	
Maximum System Capacity (ERU's)	214
Projected 2015 ERU's	142
Surplus (Deficient) Capacity (ERU's)	72

The total system capacity for the existing and proposed 2015 system with improvements is limited by the District's storage capacity. Maximum equalizing and standby storage capacity has been calculated as that available in the reservoirs for equalizing and standby purposes. Equalizing storage capacity increases with the 2015 proposed improvements because of planned pressure zone improvements.

The District needs additional storage capacity for fire storage and to achieve adequate equalizing and standby storage in the system.

DISTRIBUTION SYSTEM ANALYSIS

The existing distribution system consists of the following amount of pipe:

Table 3-6
Pipe Inventory

Nominal Diameter	Length	
	Steel	PVC
2"	8,330 ft	5,310 ft
4"		12,210 ft
6"		60 ft
8"		935 ft

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

2009 Peak Hour Demand

Peak hour demand analysis for 2009 were performed on the existing system with the existing reservoirs at the estimated bottom of their operating and equalizing storage levels and all booster pumps and well pumps off. The resulting minimum system pressure was 16 psi in the 2052 Zone near the Brown Road well. A summary of pressure deficiencies identified from the results of these analyses and how those pressures change with the proposed improvements in **Chapter 8** is contained in **Table 3-7**. The resulting maximum pressure in the systems was 104 psi at 17210 N Shore Dr. Hydraulic analyses were not performed on the Mountain Park system because there is insufficient data regarding the system's existing facilities.

Table 3-7
Pressure Analysis Summary

Description	Approx. Location	Existing Pressure Zone	Proposed Pressure Zone	Node Number	Pressure (psi)		
					Existing System	Future 2015	Future 2029
Low Pressure Areas							
Rural Residential	16925 Brown Rd	2052	2128	J-138	16	53	53
Rural Residential	22909 Brown Rd	2052	2128	J-45	16	52	54
Rural Residential	16925 Brown Rd	2085	2128	J-139	24	101	106
Rural Residential	16925 Brown Rd	2085	2272	J-31	24	101	106
Rural Residential	22909 Brown Rd	2052	2128	J-44	26	62	65
Rural Residential	1654 Lakeview Dr	2335	2380	J-131	27	29	48
Rural Residential	Cul-de Sac on Maple Dr	2085	2128	J-39	28	44	46
Rural Residential	16438 Lakeview Dr	2272	2380	J-42	31	31	35
Rural Residential	16464 Lakeview Dr	2272	2380	J-130	31	31	35
Rural Residential	16438 Lakeview Dr	2272	2380	J-128	31	31	35
Rural Residential	16464 Lakeview Dr	2272	2380	J-49	31	32	36
Rural Residential	16438 Lakeview Dr	2335	2380	J-132	34	36	55
High Pressure Areas							
Rural Residential	18485 Beaver Valley Rd	2128	2128	J-84	103	103	104
Rural Residential	17210 N Shore Dr	2128	2128	J-85	104	104	105
Rural Residential	850 ft West of Cul-de-Sac on Fir Rd	2128	2128	J-87	102	102	102

2009 Fire Flow Demand

No fire flow scenarios were modeled for 2009 since the existing systems do not currently provide fire suppression.

2015 Peak Hour Demand

Peak hour demand analyses for 2015 were performed on the existing distribution system with the proposed 2015 improvements as discussed in **Chapter 8** completed including the addition of a telemetry system to turn on the Brown Road Well under low pressure conditions. The reservoirs were set at the estimated bottom of operating storage, with the Brown Road Well in operation and the Lake Wenatchee Water Users well off. Peak hour demand flow was met, and the resulting minimum pressure at the highest service point was 35 psi which was in the 2380 Zone near the end of Lakeview Drive. The resulting maximum pressure in the systems was 102 psi at 17210 N Shore Dr. Hydraulic analysis was not performed on the Mountain Park system because there is insufficient data regarding the system's existing facilities and it is unlikely the Mountain Park system will be connected to the rest of the District's system by 2015.

2015 Fire Flow Demand

No fire flow scenarios were modeled for 2015 since the system improvements will not be capable of providing fire suppression.

2029 Peak Hour Demand

Peak hour demand for 2029 was simulated on the existing system with the 2029 proposed improvements completed. The Lake Wenatchee Users Reservoir was at a level of 2125 feet (estimated bottom of operating storage), the 2380 Zone Reservoir was at a level of 2376 feet (estimated bottom of operating storage), PRV #2 was closed, and all pumps except the Mountain Park well pump were turned off. Peak hour demand flow was met, and the resulting minimum pressure at the highest service point was 5 psi which was in the 2272 Zone near PRV #1. The resulting maximum pressure in the systems was 105 psi at 17210 N Shore Dr.

2029 Fire Flow Demand

Several fire flow scenarios were modeled under 2029 MDD demands for the existing system with the 2029 proposed improvements completed. The Lake Wenatchee Users Reservoir was at a level of 2125 feet (estimated bottom of operating storage), the 2380 Zone Reservoir was at a level of 2376 feet (estimated bottom of operating storage), PRV #2 was allowed to open, and all pumps except the Mountain Park well pump were turned off. The entire system was modeled under a fire flow scenario to ensure a minimum 1,000 gpm flow rate could be met, and a minimum residual pressure of 20 psi could be reached throughout. All fire flow scenarios met all required criteria. Fire flow availability for the system is shown in the fire flow map, **Figure 3-1**. A summary of the results of the analyses for representative system nodes is presented in **Table 3-8**. The proposed improvements for the system are displayed in **Figure 8-1**.

Table 3-8
Peak Day Demand Fire Flow Analysis Summary

Description	Approx. Location	Existing Pressure Zone	Proposed Pressure Zone	Node Number	Available Fire Flow (gpm) Year 2029	Target Fire Flow (gpm)
Rural Residential	900 Front St C147	2085	2128	J-39	1,251	1,000
Rural Residential	16609 North Shore Dr	2128	2128	J-102	1,249	1,000
Rural Residential	17201 N Shore Dr	2128	2128	J-82	1,500	1,000
Rural Residential	19960 Gill Creek Rd	Mountain Park	2128	J-105	1,006	1,000
Rural Residential	17225 N Shore Dr	Mountain Park	2128	J-110	1,163	1,000
Rural Residential	100 ft East of Intersection of Fir Dr and Brown Road	2085	2128	J-40	1,356	1,000
Rural Residential	16925 Brown Rd	2085	2272	J-31	1,231	1,000
Rural Residential	23000 Brown Rd	2272	2272	J-129	1,231	1,000
Rural Residential	16438 Lakeview Dr	2335	2380	J-132	1,231	1,000
Rural Residential	22909 Brown Rd	2052	2128	J-138	1,251	1,000
Rural Residential	16916 Brown Rd	2085	2128	J-41	1,500	1,000
Rural Residential	300 ft Southwest of Cul-de-Sac on Fir Dr	2128	2128	J-94	1,093	1,000
Rural Residential	650 ft West of Cul-de-Sac on Fir Dr	2128	2128	J-88	1,059	1,000
Rural Residential	850 ft West of Cul-de-Sac on Fir Dr	2128	2128	J-87	1,248	1,000
Rural Residential	16609 N Shore Dr	2128	2128	J-98	1,500	1,000
Rural Residential	Intersection of Lake Wenatchee Highway and Brown Rd	2052	2128	J-48	1,114	1,000

The existing system node map is shown in **Figure K-1,** and the proposed system node map is shown in **Figure K-2.** The water modeling results are provided in **Appendix K**.

SUMMARY OF EXISTING SYSTEM DEFICIENCIES

There are currently known existing system deficiencies. Some projects are recommended to improve existing sources, system capacity and operating pressures, and some projects are recommended to improve system reliability. The 6-year improvements recommended to accomplish this include abandoning the Lester Intake and transferring the water rights associated with this point of deversion to other supply sources, improvements to the Whispering Pines collection boxes and replacing the Moutain Park Well.

Pressure zone improvements include merging the 2085 Zone of the Whispering Pines system and the Brown Road, Lake Wenatchee, and Lester systems so they will all be served by the 2128 Zone. In order to accomplish this, the Brown Road Reservoir will need to be removed as well. These projects are described in more detail in **Chapter 8**. A number of system extension projects are anticipated to accommodate growth.