



East Wenatchee Water District 2014 Comprehensive Water System Plan



**Final
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EXECUTIVE SUMMARY

1. OVERVIEW

The East Wenatchee Water District (District) Comprehensive Water System Plan (Plan) represents an engineering evaluation of all components of the District's water system. The public water system planning in Washington State is becoming increasingly complex as population growth and competing water uses increase the demands on limited water resources. The more stringent environmental and water quality regulations place new conservation, monitoring and financial requirements on water systems. Given these conditions, efficient use of the available water supply is one of the District's highest priorities.

2. PURPOSE

This Plan identifies system improvements necessary to provide safe, adequate water to current and future customers and to meet all local, state, and federal policies. The Plan follows the format and content outlined in the Washington State Department of Health's (DOH) 1997 *Comprehensive Planning Manual*. More specifically, the Plan answers the following questions.

- Does the District have enough water to meet existing and future demands?
- Is water system supply and storage adequate to meet water demand on the maximum water use day of the year?
- Can the distribution and transmission system adequately convey demands for fighting fires concurrent with customer demands?
- Does the water quality meet all current standards?
- Is the District using its available water supply efficiently?
- Is the system financially viable? That is, is the District able to fund capital improvements, its operation and maintenance program, and meet water quality standards without decreasing the existing level of service?

This Plan provides an evaluation to determine system improvements that are necessary to meet the current and future water system demands of the District's service area. The improvements will ensure the system will provide the level of service required as identified in the *Greater East Wenatchee Area Comprehensive Plan* and will meet the state's mandate that municipal water systems supply adequate, safe and reliable water to their customers. The evaluation has the five broad objectives.

- **Supply:** Adequacy of water supply to meet existing and future demands.
- **Storage:** Adequacy of storage to meet the maximum day demand and to provide emergency volume with the largest source of supply out of service.
- **Distribution:** Adequacy of transmission and distribution water mains to convey peak hour demand at minimum pressure standards to any location in the system.

- **Water Quality:** Adequacy of source to meet all water quality standards and maintain such standards within the system.
- **Operations and Maintenance:** Adequacy of system operation and policy to meet normal and emergency operating conditions and to ensure best use of available water resources.

This Plan updates the District's *2006 Comprehensive Water System Plan*. Since completion of the 2006 Plan, many laws and policies have been adopted at the state and federal levels that significantly impact water supply and distribution planning. Specifically, this plan evaluates the ability of the District's water system to meet the regulations and objectives of the DOH Public Water Supply Regulations (WAC 246-290), the *Greater East Wenatchee Area Comprehensive Plan*, and the State Municipal Water Law.

3. OVERVIEW OF EXISTING WATER SYSTEM

Planning and Service Areas

The District is located in central Washington, adjacent to the Columbia River in Douglas County (County). The planning area is the current and future service area boundaries of the District's water system, as established through annexation since formation of the District in 1940. The planning area is located along the east side of the Columbia River, rising from an elevation of approximately 600 feet above sea level to a maximum elevation of 1,580 feet above seal level along the District's eastern boundary.

System Facilities

All of the existing water supply is produced from the Wenatchee Regional Water System (Regional Water System) located north of the District adjacent to the Rocky Reach Dam. The system is owned jointly by the City of Wenatchee, Chelan County Public Utility District No. 1 (PUD), and the District. The Regional Water System source consists of four groundwater wells with installed capacity of approximately 7.2, 11.7, 14.0 and 14.0, million gallons per day (MGD). The City of Wenatchee operates the Regional Water System wells and manages all source water quality requirements.

Prior to the last plan, the District abandoned Well Nos. 2A, 2B, 2C, 3, and 6. Well Nos. 4, 5, and 7's ownership were transferred to the Regional Water System and are intended only for backup emergency supply. The District obtains all of its water through the Regional Supply Station built in 2001.

The Regional Supply Station pumps directly into the 965 Pressure Zone. The upper zones (1292, 1494, 1594, and 1768) are supplied by 5 booster stations and 11 reservoirs. The Reservoirs contain approximate usable storage capacity of 7.6 million gallons. There are also two large pressure reduced zones (1170 and 1350) served by numerous pressure reducing

stations. The distribution system contains 190 miles of pipelines with approximately 55 percent being ductile iron and 43 percent being steel. Approximately 40 percent of the piping is more than 40 years old.

4. METHODOLOGY – SYSTEM EVALUATION

The evaluation of a water distribution system is based on providing a level of service consistent with the DOH regulations, the Federal Safe Drinking Water Act, and local District resolutions and policies. The system is evaluated based on its ability to meet current demands of the existing land use and future demands based on the City of East Wenatchee and Douglas County (County) Land Use Plans, prepared in accordance with the requirements of the Growth Management Act. Forecast of future demands is based on current demand characteristics. Level of service is identified based on DOH regulations and the County's ordinances setting requirements for fire flow in each land use classification as well as specific requirements for fire flow to existing buildings. Evaluation of the system was conducted using computer simulations to identify the ability to meet the level of service based on both current and future system demands.

To evaluate the water system, the current *Comprehensive Land Use Plans* and population data was used to calculate future water demand. A computer model of the District's water system was used to simulate future demands to evaluate whether the system could handle future conditions. The computer analysis was used to assist in identifying issues within the system and recommending improvements to address them. The following sections discuss this evaluation in more detail.

Current Water Use

The District currently serves approximately 9,400 customers, over 90 percent of which are residential. Other uses include commercial, institutional and industrial. Current water use is approximately 3.3 MGD for average day demand and 5.8 MGD for maximum day demand. Unaccounted-for water, which may include leaks, under-recording meters and possible illegal connections, totals approximately 9 percent of system demand.

Land Use and Water Planning

Land use affects water system planning in the following ways:

1. Water consumption and demand varies with the type of development;
2. Population density or extent of development must be known to project accurate future water demands;
3. Sizing and routing of facilities depends on location of development; and
4. Timing of growth affects design, scheduling, and financing of water system improvements.

Water System Demand

Water system supply records and population data is used to calculate existing water system demands. The three basic consumptive demands (water consumed by system users) and their use in water system planning are as follows.

Average Day Demand: The total amount of water delivered to a system in a year divided by the number of days in the year. Average day demand is used for obtaining water rights and for general planning purposes.

Maximum Day Demand: The amount of water delivered to the system on the year's maximum water use day, usually one of the hottest days of the year. Maximum day demand is used for sizing supply and storage facilities.

Peak Hour Demand: The maximum rate of water use, excluding emergency use, experienced or expected within a defined service area at any hour in time. Peak hour demand is used for sizing storage facilities and distribution mains.

In addition, non-consumptive demand includes water required for fire protection. Fire protection demand is based on the land use classification or a specific building configuration and is generally identified as a continuous rate of flow in gallons per minute for a specified duration in hours.

Future Demand

Future and buildout demand is calculated for all three consumptive demand categories. Buildout is a time in the future when the land within the service area has been fully developed according to the land use designation. The first step in calculating future demand is to determine the existing demand from recent water use data. The amount of water used per customer type is identified. Each of the three demands is then calculated based on current demand per customer applied to the future population.

Land Use Planning

The service area of the District is comprised of both rural and urban areas. The service area extends outside the Urban Growth Area (UGA). For those areas outside of the UGA, the District has adopted a rural service standard which is to provide domestic water service without fire flow capability. Within the UGA, the District has adopted service policies consistent with the type and character of the land use. However, there are areas within the UGA that the District cannot currently meet the desired service levels for both the existing and planned land uses without construction of additional water system improvements. For those areas, the District has identified the required capital improvements necessary to provide the level of service and has prioritized these improvements within its financial capabilities. The *Greater East Wenatchee Area Plan* anticipates a development of larger portions of the vacant

(agricultural) lands over the next 20 years. It is anticipated that the service population will increase from a 2012 population of 32,500 to 41,800 by the year 2030, or roughly 1.3 percent per year. The expected time frame for the full development of the service area is beyond the 20-year planning horizon.

Aerial photographs have been used to identify location and extent of vacant land and its potential development for distribution of the additional demands on the water system. Lists of proposed upcoming developments within the County and City of East Wenatchee were also used.

There is a significant amount of land in the District that has very little domestic water use. Undeveloped or underdeveloped land accounts for 5,600 acres, or almost 40 percent of the total land area within the current service area. Much of this land is currently used for commercial agriculture, or is vacant. The future service area is set by contract with the Regional Water System and encompasses another 4,000 acres.

5. SYSTEM ISSUES

The District is a growing system with recent increases in service connections of approximately 1 percent per year. This is a significant drop from prior growth rates of 3 to 4 percent, but growth is expected to increase slightly as the economy improves. Because of this growth, it is inevitable that portions of the District's system will reach their maximum capacity within the 6-and 20-year planning periods.

The evaluation of the water system has identified four classifications of issues relating to transmission, storage, pumping capacity and distribution system capacity. Many of these issues are the result of land use changes to older areas of the District as the areas have converted from rural to urban service. Other issues result from rapid growth in outlying areas and the need to serve those new customers. The District has aggressively constructed new pumping capacity to supply those needs, but only two new reservoirs have been built in the last 25 years. The projected growth in demand of approximately 30 percent within the service area over the next 20 years will impact the ability of the system to supply its customers. As a result of the evaluation of the water system to meet both current and future demands, the following issues have been identified.

Transmission

During high usage periods, transmission from the Regional Supply Station to the Pearcot Reservoirs is limited. The Pearcot Reservoirs water level lags behind the 15th Street Reservoirs. The 24-inch transmission main extends only part way into the District, resulting in high pressure in the north and somewhat restricted pump capacity.

Storage

The 1170/1292 Zones are lacking in emergency storage, though construction of the planned 10th Street Reservoir in 2016 will resolve this issue. Storage in the 1594 and 1768 Zones are currently fully allocated and only a few more lots may be built. Emergency storage in the 965S Zone is insufficient only due to the District's conservative policy regarding nesting of emergency storage volumes.

Pumping Capacity

Pumping capacity to the 1594 and 1768 Zones are fully allocated, there is no excess capacity. Capacity to the entire District at the Regional Supply Station is expected to be sufficient until the year 2030.

Distribution System Capacity

Approximately 31 percent (59 miles) of the distribution mains are 6 inches or smaller in diameter and older than 40 years of age. Given the average life expectancy of 40 to 60 years for steel mains, a significant amount of these mains will need to be replaced within the next 20 years. Of this total, approximately 47 miles are 4 inches or smaller in diameter.

6. RECOMMENDED IMPROVEMENTS – 6 YEAR

Transmission Improvements

Extend the 24-inch transmission main from 19th Street NE to 9th Street NE to provide adequate hydraulic balance between the 15th Street and Pearcot Reservoir sites, improve supply capacity and reduce north-end pressure. Improve transmission along South Nile Avenue if the City of East Wenatchee adopts the proposed UGA expansion.

Storage Improvements

Adjust the District's storage nesting policy to show adequate storage in the 965S Zone. Construct a 2.0 million-gallon (MG) reservoir in the 1292 Zone. Construct storage in the 1592 and/or 1768 Zones to allow future growth, though these projects may require developer funding.

Pumping Improvements

Construct a new pump station to supply the 1592 and 1768. Preferred location would be adjacent to the 10th Street Reservoirs to maximize hydraulic balance and promote redundancy. It is expected that this station will be paid for by local development. Depending on development in the 1494 zone, it may be necessary to provide pumping capacity for fire supply, which is expected to be paid for by local development.

Distribution Main Improvements

Continue the District’s current policy of replacing old and failing mains to the amount of \$150,000 per year. Construction of distribution in conjunction with road improvement projects, when possible, saves on restoration costs. The Plan also identifies a series of main improvements necessary to serve the anticipated new growth within the service area. These unfunded improvements are anticipated to be constructed as developer funded extensions, as part of providing service to currently un-served areas.

Estimated Capital Improvement Plan Costs

The 6-year Capital Improvement Plan (CIP) includes all of the improvements recommended within the initial 6-year plan. These improvements were prioritized by the District to correct existing issues and correspond with other infrastructure projects to make best use of cost sharing and minimize impact to the public. The estimated costs based on 2013 construction estimates for the following 6 years are as follows.

	Cost Estimate
2014	\$ 1,500,000
2015	\$ 4,000,000
2016	\$ 4,200,000
2017	\$ 2,200,000
2018	\$ 5,100,000
2019	\$ 7,000,000
Developer	\$ 11,000,000

There is also potentially another \$10,000,000 in projects that would be driven by road construction projects that currently have no funding, or localized growth that is difficult to predict. The District will coordinate closely with the City of East Wenatchee and County to anticipate road construction projects.

7. CAPITAL IMPROVEMENT PLAN FINANCING

The Financing Plan for the 6-year CIP anticipates that construction costs will increase due to inflation by 3 percent per year and projects a total CIP cost of nearly \$24,000,000. The funding of the CIP is proposed to be accomplished from four sources: 1) existing capital reserves; 2) future water sales revenues; 3) revenue bonds; and 4) Public Works Trust Fund loans.

To fund the financing plan, revenues of the water system will be required to increase by approximately 30 percent over 6 years. This increase includes an allowance for increase in operating costs due to inflation and anticipated increases in debt service, which will increase the cost of water.

The initial element of the improvement program will be initiated in 2014 from existing capital reserves and Public Work Trust Fund loans. Future financing of the improvements will require issuing of new revenue bonds and yearly increases in water revenues of about 4.3 percent.

CHAPTER 1

DESCRIPTION OF WATER SYSTEM

This chapter describes the existing water system, its ownership, history, facilities, existing and future service area, and service policies.

AUTHORIZATION OF THIS PLAN

The East Wenatchee Water District (District) is a Group A Community water system as defined in Washington Administrative Code (WAC) 246-290-020 and authorized by Revised Code of Washington (RCW) 57.04. This plan is written to comply with planning requirements of WAC 246-290-100.

1. OWNERSHIP AND MANAGEMENT

The East Wenatchee Water District is a municipal corporation established in accordance with the laws of the State of Washington, RCW Chapter 57. The Washington State Department of Health (DOH) water system identification number is 21800. The functions of the District are governed by a three-member Board of Commissioners, elected by voters within the District. The Commissioners act on behalf of the public ownership to provide for the operation and maintenance, improvement, and extension of water service within the boundaries and service area of the District. A District Manager handles the day-to-day decision making and provides direct oversight of District personnel. A copy of the current Water Facilities Inventory can be found in **Appendix E**.

2. SYSTEM BACKGROUND

History of Water System Development and Growth

Domestic water service became available east of the Columbia River, within the District service area, when the Wenatchee Canal Company brought irrigation water across the Columbia River in 1908. Circa 1926, a private water company began a water system for domestic use north of what is now downtown East Wenatchee. Shortly after, the East Wenatchee Domestic Water Association was incorporated.

Water supply was provided by five wells dug at the foot of 15th Street, with storage in a cement-lined earth reservoir on 15th Street above Eastmont Avenue. Water quality was frequently a problem, as the dug wells were subject to flooding by the Columbia River.

In 1940, the District was formed and assumed ownership of the Water Association, its assets and its liabilities. In 1943, a new well was drilled at 19th Street and Cascade Avenue and in 1949 the initial reservoir was filled in and replaced with a cylindrical reinforced concrete reservoir. In 1952 a second well was drilled on Kentucky Avenue just north of the old Rock Island Road and a second reservoir was built above the intersection of 10th Street and Kentucky Avenue. The District's water system has continued to expand since these initial beginnings with both water supply and storage facilities added as customer demands and service areas expanded.

In 1976, the City of Rock Island's water system was transferred to the District. The system was returned to Rock Island 1 year later in 1977.

During the late 1990s, reliability and capacity concerns of the District's wells, and increasing requirements for water treatment, made it prudent to investigate a new water source. In 2001, the District officially joined the Greater Wenatchee Regional Water System (Regional Water System) as an equal partner with the City of Wenatchee and Chelan County Public Utility District No. 1 (PUD). This required construction of a new supply pumping station and transmission main to connect to the existing Regional Water System 30-inch mainline. The Witte Wells Nos. 4 and 5 and Cascade Well No. 7 were placed in standby mode, and ownership of said wells transferred to the Regional Water System. All other District wells were decommissioned.

The District's Water System has grown from the initial 200 members, who participated in the incorporation of the original water association, to 9,384 accounts by 2013. Annual water supply reached 1,270 million gallons in 2013. Growth since the *2006 Comprehensive Water System Plan* has totaled 1,014 metered accounts, an average annual increase of 1.4 percent.

Service Area Geography and Constraints

Topography

Throughout the District's service area, the topography slopes toward the Columbia River at an average of 5 to 6 percent. Slopes of approximately 50 percent exist in the northeastern portion of the District (west of Fancher Heights) and in the southern portion south of Pangborn Airport. Altitudes range from 1,760 feet above Mean Sea Level (MSL) in the Fancher Heights area to 605 feet above MSL at the shore of the Columbia River. In the northern part of the District, the steep slopes east of the Sunset Highway have caused growth to occur within 1 mile of the river where flatter slopes prevail. The urban growth boundary (UGB) in the northern part of the District follows the steep slope east of the Sunset Highway, which forms a natural boundary to development. The southeastern portion of the District contains the greatest amount of gently sloping land conducive to development. Much of this land, however, is currently zoned Agricultural-Resource for orchard use. Therefore, the UGB ends at approximately Nile Avenue.

Geology

The geology of the East Wenatchee area, like most areas surrounding large river systems, is characterized by sandy loams typical of alluvial fans. In general, the geology of the study area will not significantly limit development. Regions of landslide and erosion susceptibility exist along the steep

slopes which form the UGB. Within the UGB and the District service area, topography and subsurface conditions do not create adverse conditions for development.

Climate

East Wenatchee's weather is typically arid, with less than 10 inches of annual rainfall. Summers are hot and dry, with high temperatures averaging 85 degrees Fahrenheit (°F) to 90°F, while the winters are colder, with low temperatures averaging 25°F to 35°F.

Flood Zones

Flooding along the Columbia River is an unheard of phenomenon due to the control provided by the Rocky Reach and Rock Island Dams. East Wenatchee's greatest problem with flooding occurs as flash floods. Given that the typical annual rainfall is 9 inches, it is not uncommon to have larger portions of that annual rainfall fall within a short duration. The flash floods are used as design criteria for storm conveyance to ensure property and facilities are not flooded.

Although the following requirements may not specifically apply to the District, they are provided for reference. The Growth Management Act (GMA) requires cities and counties to classify frequently flooded areas based on the 100-year floodplain designations of the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP). Two types of floodplains were designated. They are:

- Floodway: The channel of a stream and adjacent land areas that are required to carry and discharge the flood water or flood flows of any river or stream associated with a regulatory flood.
- Flood Fringe: The land area which is outside a stream's floodway, but is subject to periodic inundation due to flooding associated with a regulatory flood.
- Designating the floodplains had the following two purposes:
 - Limit or prohibit, as appropriate, encroachment in floodplains.
 - Preserve the natural functions of floodplains to store, carry and control waters.

Any structures permitted in the designated areas are subject to strict flood-proofing regulations. In the District's service area, these regions are limited and do not significantly affect development.

Adjacent Water Purveyors

The only adjacent Group A purveyor on the east side of the Columbia River is the City of Rock Island, whose boundary is coincident with the District's southeast service area boundary. The City of Wenatchee and Chelan County PUD are separated from the District by the Columbia River (**Figure 1.1**). A number of Group B systems that may be within or adjacent to the District's service area were shown in state water system records and are listed below. No research has been performed to determine the location or status of these systems.

- Daisy Hill Water System
- Corning Water System No. 2
- Sanford Shores

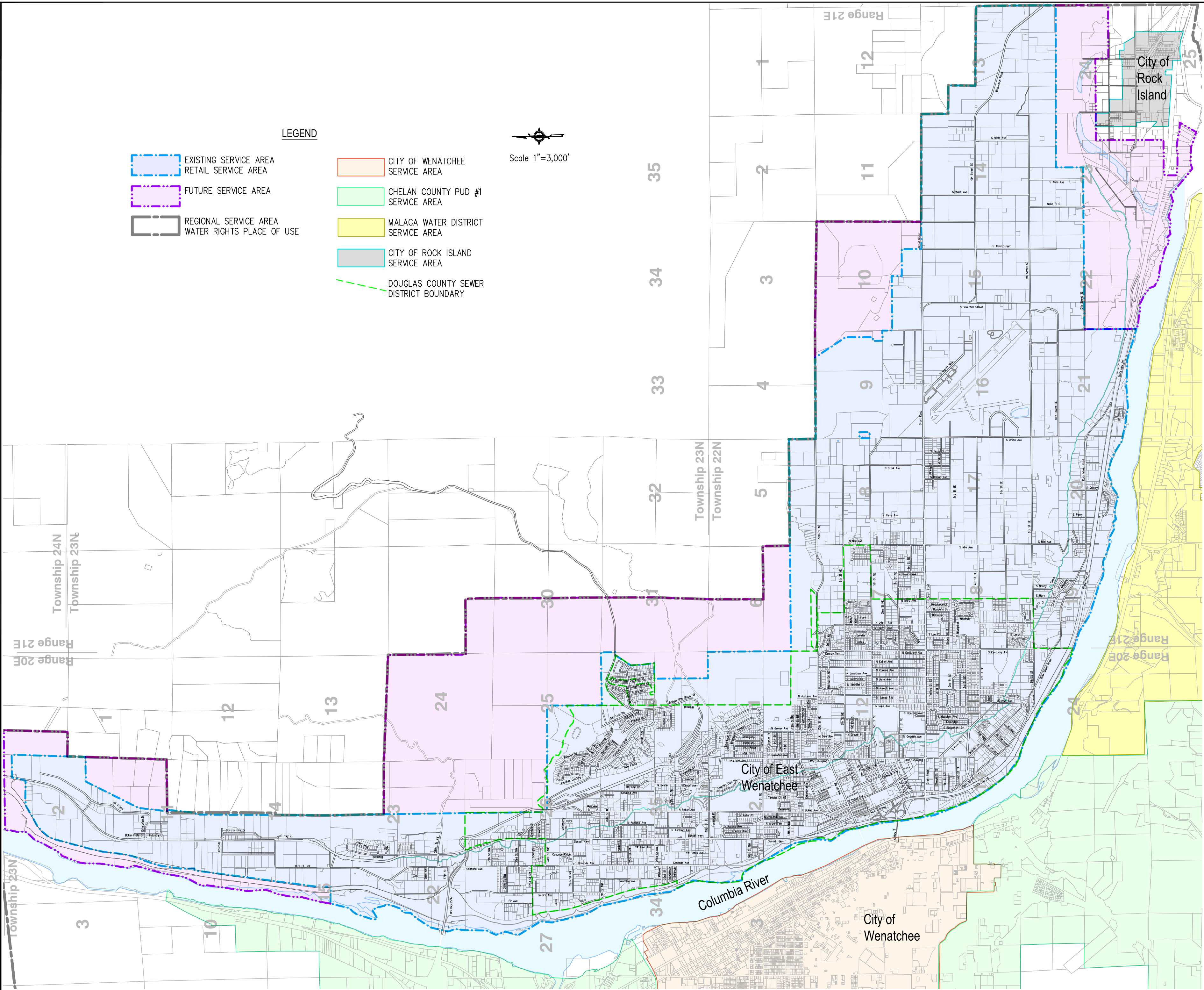
- Talbot Water Works
- Jenne Water System
- TR Miller Orchards
- Hall S Water System
- Douglas Simon
- L&J Orchard
- Leray No. 1
- Sand Canyon
- Piepel Water System
- Columbia View Estates

Regulatory Constraints

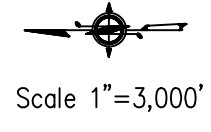
The District must work in cooperation with Douglas County (County) and the City of East Wenatchee urban area planning efforts. The District endeavors to provide a level of service commensurate with land use zoning and anticipated growth. More detail on these efforts can be found later in this chapter and in **Chapter 2**.

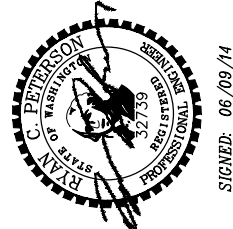
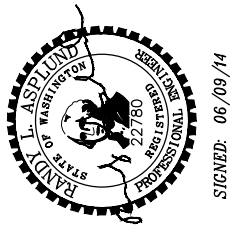

3. INVENTORY OF EXISTING FACILITIES

The District's distribution system is comprised of seven main pressure zones. The topographical extent of the pressure zones and the existing distribution system facilities are shown in **Figure 1.2 Existing Water System**. Water storage is provided in five pressure zones which are supplied by the District's Regional Supply Station and inter-zone booster pumps. Intermediate pressure zones without storage are supplied from the higher zone above by pressure regulation. The relationship between water supply, storage, pressure regulating facilities, and pressure zones is shown schematically in **Figure 1.3 Existing Hydraulic Profile**. Booster pumps are controlled by reservoir level. Individual pumps are turned on and off based on the rise and fall of the reservoir's water level. **Table 1.1** shows the controlling reservoir for each pump in the system and the level below full at which the pump is turned on and off.



- LEGEND**
- EXISTING SERVICE AREA RETAIL SERVICE AREA
 - FUTURE SERVICE AREA
 - REGIONAL SERVICE AREA WATER RIGHTS PLACE OF USE
 - CITY OF WENATCHEE SERVICE AREA
 - CHELAN COUNTY PUD #1 SERVICE AREA
 - MALAGA WATER DISTRICT SERVICE AREA
 - CITY OF ROCK ISLAND SERVICE AREA
 - DOUGLAS COUNTY SEWER DISTRICT BOUNDARY



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**East Wenatchee Water District
2014 Comprehensive Water System Plan**

**FIGURE 1.1
ADJACENT WATER SYSTEMS**

NO.	DATE	DESCRIPTION	BY	REVIEW
1	9/4/14	City of Rock Island service area updated		

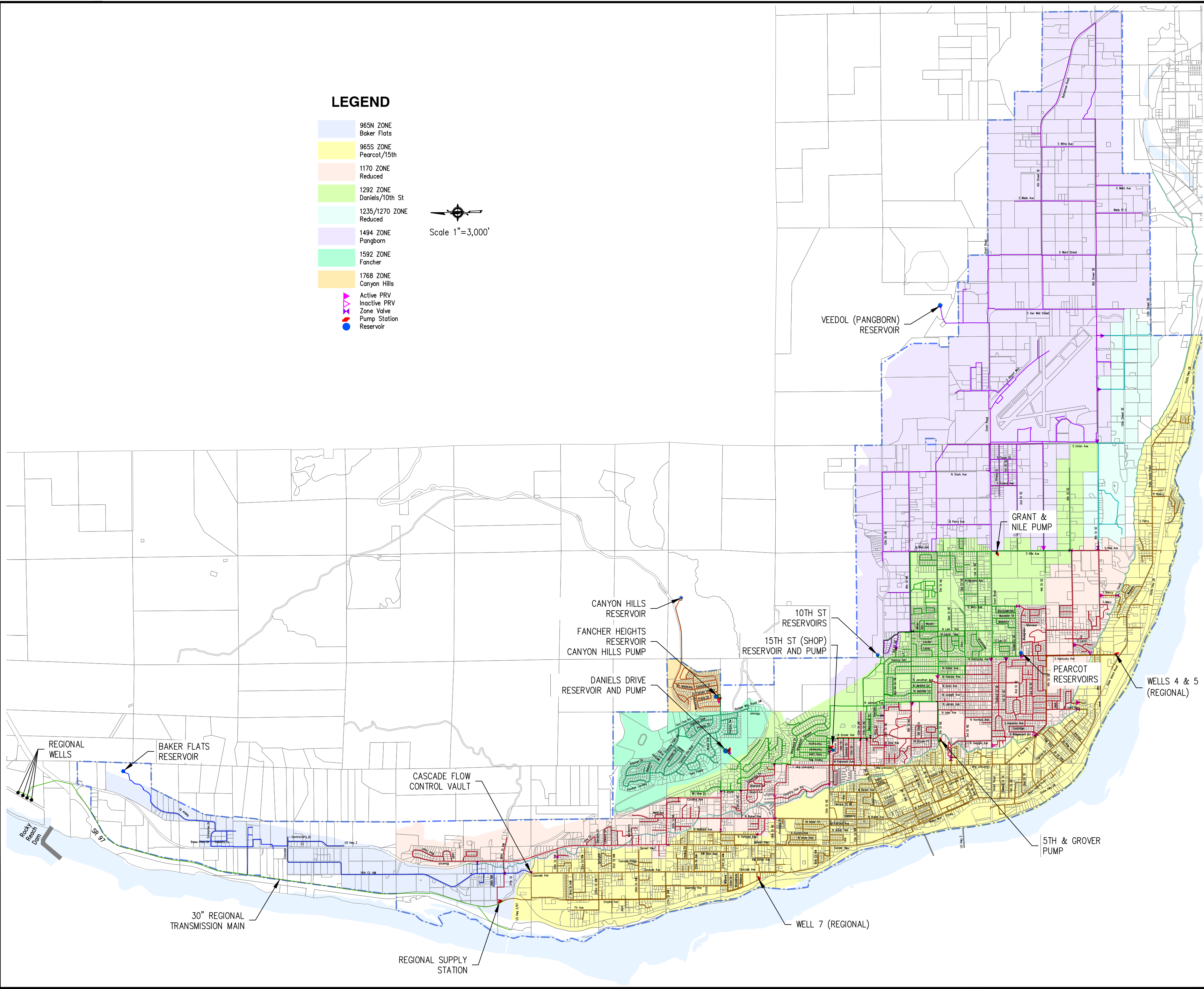
ENGINEER: RCP	SCALE: SHOWN	JOB NO.: 213.121	DATE: 9/4/14
REVISIONS			
FILENAME: E:\MCP14-F-SAD\WG			
CLIENT: EWW			
DATE: Sep 5, 2014			
PROJECT DATE: Sep 8, 2014			

LEGEND

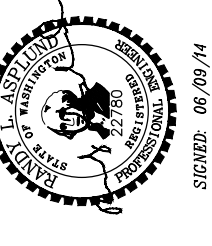
- 965N ZONE
Baker Flats
- 965S ZONE
Pearcot/15th
- 1170 ZONE
Reduced
- 1292 ZONE
Daniels/10th St
- 1235/1270 ZONE
Reduced
- 1494 ZONE
Pangborn
- 1592 ZONE
Fancher
- 1768 ZONE
Canyon Hills
- Active PRV
- Inactive PRV
- Zone Valve
- Pump Station
- Reservoir



Scale 1"=3,000'



SIGNED: 06/09/14



SIGNED: 06/09/14



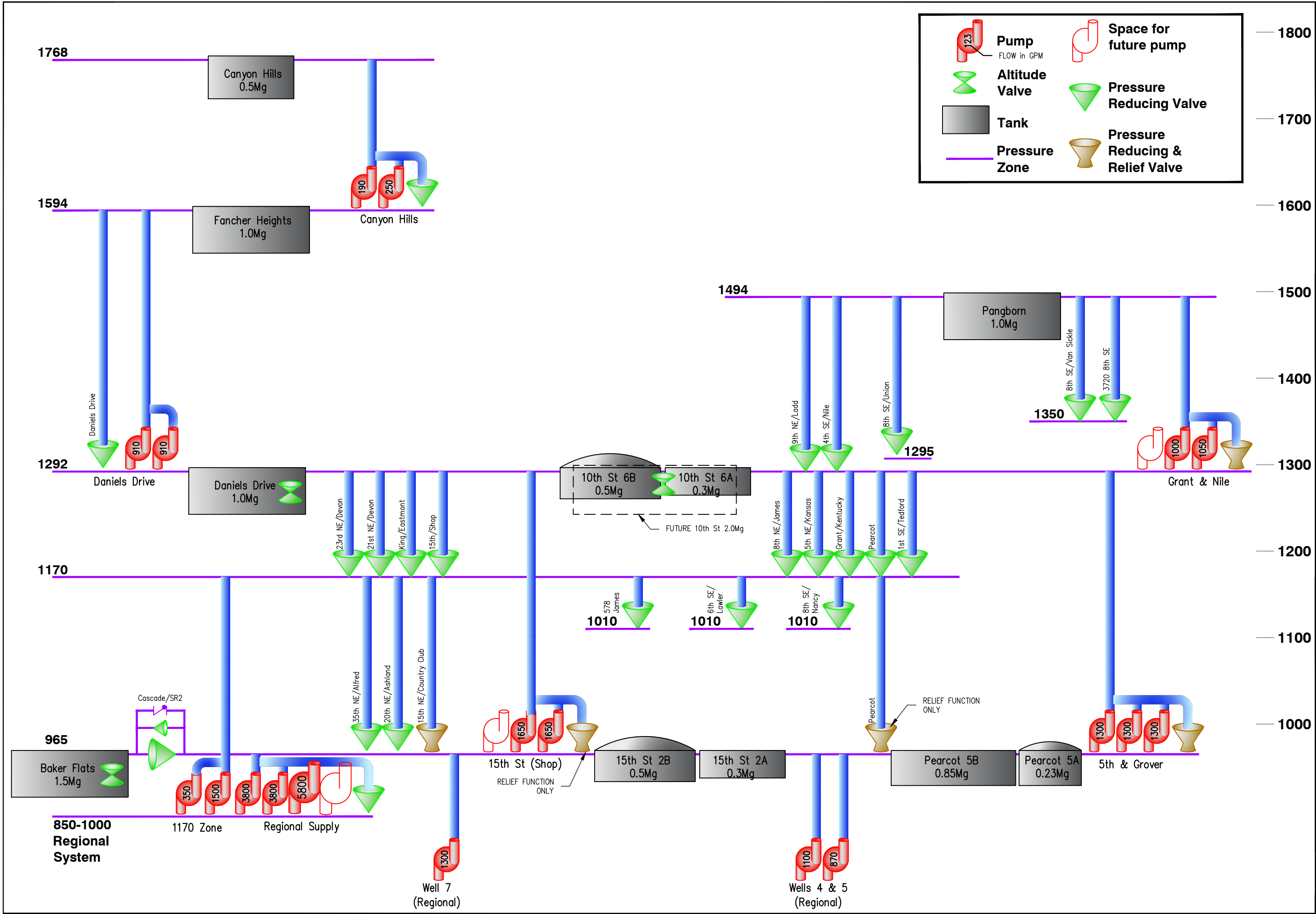
**East Wenatchee Water District
2014 Comprehensive Water System Plan**

**FIGURE 1.2
EXISTING WATER SYSTEM**



NO.	DATE	DESCRIPTION	BY	REVIEW

REVISIONS	
NO.	DESCRIPTION



Legend:

- Pump (FLOW in GPM)
- Altitude Valve
- Tank
- Pressure Zone
- Space for future pump
- Pressure Reducing Valve
- Pressure Reducing & Relief Valve

Professional Seals:

- C. PETERSON, P.E., 27335
- L. ASBULLO, P.E., 27335

REVISIONS:

ENGINEER: EWM
 REVIEWED: RCP
 DATE: JUN 9, 2014
 FILENAME: EWCP14-HYDRO.DWG

SCALE: NONE

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: 1.3 **SHEET NO.:** 1.3

East Wenatchee Water District
2014 Comprehensive Water System Plan

FIGURE 1.3
HYDRAULIC PROFILE

NO.	DATE	DESCRIPTION	BY	REVIEW

Table 1.1 Supply Pumps and Controls

Station	No.	Power (hp)	Capacity (gpm) *	Date Installed	Brand & Model	Speed (rpm)	Controlling Reservoir	Level Setpoint***	
								On	Off
Standby Emergency Supply (Regionally Owned)									
Witte Wells	4	125	1,100	1952	12MS	1760	Pearcot 5B	7	9
	5	100	870	1956	Fairbanks 11M7000	1770	Pearcot 5B	7	9
Cascade Well	7	200	1,300	1993	Peerless 12LD	1760	15th St (Shop) 2A	7	9
Booster Stations									
Regional Supply	2	400	5,800	2001	Goulds 18DHC	1770 **	15th St (Shop) 2A	Alternate	
	3	200	3,800	2001	Goulds 14FHC	1770 **	15th St (Shop) 2A	14	16.7
	4	200	3,800	2001	Goulds 14FHC	1770 **	15th St (Shop) 2A	13	16.7
1170 Zone	5	75	1,500	2013	Goulds 14RJLC	1775 **	local control	188 psi	120 gpm
	6	25	350	2013	Goulds 66SV20NE37	3530 **	local control	184 psi	400 gpm
5th and Grover	1	150	1,320	1999	Somarakis ST12H1250	1790	10th St 6B	17	18.5
	2	150	1,320	1999	Somarakis ST12H1250	1790	10th St 6B	16	17.5
	3	150	1,320	1999	Somarakis ST12H1250	1790	10th St 6B	Alternate	
15th St (Shop)	1	200	1,670	2005	Simflo SV12C-7	1785 **	Daniels Drive	27	28.5
	2	200	1,670	2005	Simflo SV12C-7	1785 **	Daniels Drive	26	27.5
Grant and Nile	1	100	1,000	1999	Somarakis ST12M900	1790	Veedol	27	29
	2	100	1,050	1999	Somarakis ST12M900	1790	Veedol	24	26
Daniels Drive	5	100	910	2001	Goulds 10RJLO	3500	Fancher Heights	27.5	29
	6	100	910	2001	Goulds 10RJLO	3500	Fancher Heights	25.5	27
Canyon Hills	1	25	190	2010	American Turbine 10L20	1760	Canyon Hills	25	27
	2	25	255	2010	American Turbine 10L20	1760	Canyon Hills	25	27
Recirculation Pump									
Baker Flats	1	5	400	2010	Paco 10-40707	1750 **	timer / chlorine monitor		

* Measured maximum capacity with one pump running.

** Variable Speed Pump, maximum speed indicated.

*** Depth of water in feet measured from floor up. Setpoints may change with seasonal demands and operational issues.

Water Supply

The District's system is supplied from a single booster supply station containing three primary supply pumps. Well Nos. 4, 5, and 7 are available as emergency supplies. **Table 1.2** provides an inventory of these supply pumps, their installed capacity (measured capacity while operating independent of other pumps), and their measured capacity under average conditions. The Regional Supply Station pump rates can vary by plus or minus 500 gallons per minute (gpm) depending on the hydraulic grade line of the Regional Water System.

Table 1.2. Supply Pump Capacity

Station	No.	Rated Flow *		Combined Flow **		Combined Flow **	
		(gpm)	(Mgd)	(gpm)	(Mgd)	(gpm)	(Mgd)
Standby Emergency Supply (Regionally Owned)							
Witte Wells	4	1,100	2.5	920	2.05		
	5	870	1.9	860	1.92		
Cascade Well	7	1,300	2.9	1,300	2.90		
Total				3,080	6.9		
Primary Supply							
Regional Supply	2	5,800	12.9			4,900	10.92
	3	3,800	8.5	3,000	6.68	2,100	4.68
	4	3,800	8.5	3,000	6.68		
Total				6,000	13.4	7,000	15.6

* Rated nominal flow with one pump running.

** Combined flow is with pumps operating in parallel



Regional Supply Station



Cascade Well 7

Water Storage

The District’s water storage reservoirs are located within pressure zones having hydraulic elevations of 961, 1,286, 1,490, 1,592 and 1,768 feet. The locations of the reservoirs are shown in **Figure 1.2**. The reservoir’s name and nominal capacity is shown in **Table 1.3**. A more detailed description of reservoir type and effective capacity can be found in **Chapter 3**.

Table 1.3 - Storage

Reservoir Name	No.	Overflow Elevation	Nominal Capacity (Gal)	Altitude Valve
15th St (Shop)	2A	965	300,000	No
15th St (Shop)	2B	965	500,000	No
Pearcot	5A	965	200,000	No
Pearcot	5B	965	860,000	No
Baker Flats	11	965	1,500,000	Yes
10th Street	6A	1291	300,000	Yes
10th Street	6B	1293	500,000	Yes
Daniels Drive	7	1292	1,000,000	Inactive
Veedol	8	1494	1,000,000	No
Fancher Heights	9	1594	1,000,000	No
Canyon Hills	10	1768	500,000	No
System Total			7,660,000	

Prior to this Comprehensive Water System Plan (Plan), elevations in the District for older facilities and pressure zones were still named per the 1929 vertical datum. For this Plan, all elevations have been updated to the 1988 datum, which is approximately 4 feet higher. For example, the 965 Zone was previously called the 961 Zone.

Distribution and Transmission Mains

The distribution and transmission system includes pipe materials of steel, ductile iron, galvanized iron, and a small amount of PVC and HDPE. The total length by pipe material is shown in **Table 1.4**. The length and age by pipe diameter is shown for each pipe material in **Table 1.5**.

Table 1.4 Pipe Length by Material

Pipe Material	Length		Percent
Ductile Iron	546,442 ft	103.5 miles	55%
Steel	349,023 ft	66.1 miles	35%
Galv Iron *	88,906 ft	16.8 miles	9%
PVC	8,836 ft	1.7 miles	1%
HDPE	9,357 ft	1.8 miles	1%
System Total	1,002,564 feet	190 miles	

* Assumes all steel pipe 2" and smaller is galvanized iron

Table 1.5 Pipe Inventory

Age	Material	Length of Pipe in Feet												Total	% of All Pipe
		1 in	1.5 in	2 in	4 in	6 in	8 in	10 in	12 in	14 in	16 in	18 in	24 in		
0-10 yrs	Ductile Iron				237	378	102,433	97	62,655		7,444	563		173,807	17%
	HDPE		809	5,862			139	189	822		644			8,465	1%
0-10 yrs Total			809	5,862	237	378	102,572	286	63,477		8,088	563		182,272	18%
11-20 yrs	Ductile Iron				721	13,848	107,545	9,821	85,951		771	6,844	14,982	240,483	24%
	HDPE			892										892	0%
	PVC						132							132	0%
11-20 yrs Total				892	721	13,848	107,677	9,821	85,951		771	6,844	14,982	241,507	24%
21-30 yrs	Ductile Iron				848	41,343	44,875	18,459	15,176	1,550	5,468			127,719	13%
	Galvanized iron	1,035	553	3,416										5,004	0%
	Steel					711	1,248							1,959	0%
21-30 yrs Total		1,035	553	3,416	848	42,054	46,123	18,459	15,176	1,550	5,468			134,682	13%
31-40 yrs	Ductile Iron					1,906	655	1,872						4,433	0%
	Galvanized iron			1,043										1,043	0%
	PVC						1,196	7,508						8,704	1%
	Steel				6,942	11,874	2,284	17,081	8,324		3,038			49,543	5%
31-40 yrs Total				1,043	6,942	13,780	4,135	26,461	8,324		3,038			63,723	6%
41-50 yrs	Galvanized iron			25,936										25,936	3%
	Steel			2,145	72,755	19,774	4,934	2,740	3,168					105,516	11%
41-50 yrs Total				28,081	72,755	19,774	4,934	2,740	3,168					131,452	13%
51-60 yrs	Galvanized iron			779										779	0%
	Steel				13,469	8,476	27,440	4,311	25					53,721	5%
51-60 yrs Total				779	13,469	8,476	27,440	4,311	25					54,500	5%
Over 60 or unknown	Galvanized iron	649	5,659	49,836										56,144	6%
	Steel				77,457	34,327	15,797	7,485	3,218					138,284	14%
Over 60 or Unknown Total		649	5,659	49,836	77,457	34,327	15,797	7,485	3,218					194,428	19%
Grand Total		1,684	7,021	89,909	172,429	132,637	308,678	69,563	179,339	1,550	17,365	7,407	14,982	1,002,564	100%

Figures 3.1 and 3.2 in Chapter 3 show graphically the age and material of pipes in the system, respectively.

Pressure-Regulating Stations

The distribution system contains active pressure regulating stations that supply closed pressure zones with hydraulic elevations of 1,170 and 1,350 feet. There are two additional smaller stations whose main purpose is to maintain water quality by providing minimum flows. One other station provides pressure relief protection to the 1170 Zone. Lastly are several control valves which are inside or adjacent to booster stations, some of which also provide pressure relief protection. **Table 1.6** presents a summary of these pressure regulating valves, their location, ground elevation, downstream pressure and hydraulic grade setting.

Table 1.6 Pressure Control Valve Inventory

Location	Ground Elevation	Year Installed	Valve Size (in)	Setting HGL (ft)	Setting (psi)	Upstream psi	Supply Zone	Service Zone	Type
Active (operational) Valves									
Cascade and SR2	818	2009	4	n/a		64	965	965	Flow control
			10	940	53				Reducing
35th Street NW	845	1997	2	926	35	141	1170	965	Reducing
			6	917	31				Reducing
15th NE & Country Club	879	1997	8 RP	941	27	126	1170	965	Relief/Reducing
20th NE and Ashland	776	1990	0.75	955	78	171	1170	965	Reducing (recirc)
578 James, near Juno	850	2006	2	1,012	70	139	1170	965	Reducing
			6	1,000	65				Reducing
8th SE and Nancy	933	1993	2	1,008	32	103	1170	1010	Reducing
6th SE and Lawler	930	1996	2	1,010	35	104	1170	1010	Reducing
			6	1,000	30				Reducing
King and Eastmont	981	1997 moved '06	2	1,150	73	135	1292	1170	Reducing
			6	1,127	63				Reducing
21st NE and Devon	930	2002	2	1,150	95	157	1292	1170	Reducing
			4	1,127	85				Reducing
23rd NE and Devon	987	1993	2	1,150	71	132	1292	1170	Reducing
			6	1,127	61				Reducing
8th NE and James	973	1999	6	1,142	73	138	1292	1170	Reducing
15th St Shop	967	1997	3	1,150	79	141	1292	1170	Reducing
			8	1,127	69				Reducing
1st SE and Tedford	957	2003	2	1,170	92	145	1292	1170	Reducing
			6	1,145	81				Reducing
5th NE and Kansas	987	1997	2	1,170	79	132	1292	1170	Reducing
			6	1,145	68				Reducing
Grant and Kentucky	975	1997	3	1,170	84	137	1292	1170	Reducing
			8	1,145	74				Reducing
Kentucky and Soden (Pearcot)	945	2001	2	1,170	97	150	1292	1170	Reducing
			8	1,157	92				Reducing
4th SE and Nile	1,100	2003	0.75	1,280	78	171	1494	1292	Reducing (recirc)
9th NE and Ladd	1,170	2001	0.75	1,270	43	140	1494	1292	Reducing (recirc)
3720 8th SE (near Ute)	1,178	1993	2	1,342	71	137	1494	1350	Reducing
8th SE and VanSickle	1,223	1993	2	1,342	52	117	1494	1350	Reducing
8th SE and Union	1,160	2002	2	1,276	50	145	1494	1292	Reducing
			6	1,265	45				Reducing
Inactive (wide open) Valves									
Grant and BiMart	865	1991	8					1170	Reducing
10th NE and Gale	907		1					1170	Reducing
Grant and Iowa	897		6					1170	Reducing
Grant and Gilmore	875		4					1170	Reducing
Grant and June	935		6					1170	Reducing
Closed Valves									
4th SE and Pace	856	1995	8					1170	Reducing
Cascade & 38th	830	2009	1	950	52	147	1170	965	Reducing (recirc)
Lawler and S. Kentucky	860	1996	2	955	41	134	1170	965	Reducing
Valves Located Inside of Pump Stations				Low Set		High Set			
				ft	psi	psi			
Regional Supply	715	2001	8	875	69	250	965	880	Relief/Reducing
1170 at Regional	715	2013	4			201	1170	965	Relief
5th & Grover	861	1999	6 RP	930	30	240	1292	965	Relief/Reducing
15th St (Shop)	966	2005	6	1,173	90	180	1292	965	Relief/Relief
Daniels Drive	1,255	2004	8	1,265	4	n/a	1594	1292	Reducing
Well 7	648	1993	12	n/a		220	965	965	Relief
Grant & Nile	1,136	1999	6 RP	1,250	49	240	1494	1292	Relief/Reducing
Canyon Hills	1,552	1998	8	1,570	8	n/a	1768	1594	Reducing

The pressure reducing valve (PRV) stations at King/Eastmont, 21st/Devon, 23rd/Devon, and 15th Street Shop were adjusted down by 5 pounds per square inch (psi) in 2013 in conjunction with the activation

of the 1170 Zone booster pumps. By lowering the PRV settings, this allows Pump No. 6 to run as primary supply to the north 1170 Zone, improving pressure stability and reducing electrical costs.



Pearcot PRV Station

Pressure Zones

The water supply, storage, and pressure regulating stations, together with the distribution transmission system, controls the service pressures within each of the seven pressure zones in the District’s system. The base pressure zone is established at a hydraulic grade of 965 feet based on the overflow of that zone’s reservoirs. The upper pressure zones are supplied by booster pumps and/or pressure reducing stations as shown in **Table 1.7**.

Table 1.7 Pressure Zone Supply and Storage

Pressure Zone Hydraulic Grade (ft)	Supply Source	Reservoir	Volume (Mgal)
965N	Regional Supply	Baker Flats	1.50
965S	Regional Supply	15th St (Shop) 2A	0.30
		15th St (Shop) 2B	0.50
		Pearcot 5	0.20
		Pearcot 5A	0.86
1170	pressure reduced & 1170 Zone Pumps	n/a	
1292	5th and Grover 15th St (Shop)	10th St 6	0.30
		10th St 6A	0.50
		Daniels Drive	1.00
1350	pressure reduced	n/a	
1494	Grant and Nile	Veedol	1.00
1594	Daniels Drive	Fancher Heights	1.00
1768	Canyon Hills	Canyon Hills	0.50

Operation and Control

The water system incorporates a telemetry and control system that monitors the condition of the system facilities, accumulates and records system data, and provides for remote and automatic control of the operation of supply pumps. The operating status of each pump and reservoir is monitored and

indicated, as well as recorded at the administrative offices. Controlled setpoints can be remotely adjusted and pumps manually controlled from this headquarters location. Data is logged in computer drive storage for all monitored data, including reservoir level, pump rate, alarms, pressure, and daily demand summaries.

Services and Meters

All customers of the District are metered. Service lines are sized commensurate with meter and service requirements. Prior to about 1980, all service lines were constructed of steel. Between about 1980 and 1994, service material installed was copper; since 1994, service lines have been constructed of polyethylene tubing. Almost 5,000 services were originally constructed of steel. Where water mains have recently been replaced, steel services have also been replaced with polyethylene.

A summary of meter counts is given in **Table 1.8**. A more detailed review of customer counts and demands is presented in **Chapter 2**.

Table 1.8 Meter Counts

Meter Size (in)	Meter Count	
	2005	2013
5/8 x 3/4	6,831	7,780
1	1,088	1,417
1-1/2	78	105
2	53	60
3	22	15
4	3	7
Total	8,075	9,384

Interties

The District is intertied at only one location. There is a hydraulic control valve in the Regional Supply Station that allows back-feed out of the District's system and into the Regional Water System. This valve is normally locked out and must be manually energized to operate. This intertie is for emergency purposes only and, to date, has not been used.

4. RELATED PLANS

This Plan is written to conform, where possible, with other regional planning efforts. Coordination has occurred with the following agencies and reports during preparation of this plan.

- Douglas County Transportation and Land Services
 - 2012 Greater East Wenatchee Area Comprehensive Plan (City of East Wenatchee) (GEWACP)
 - 2014 Draft UGA Expansion, City of East Wenatchee
 - 2012 Douglas County Countywide Comprehensive Plan (DCCCP)
 - 2013 Draft Amendment to the DCCCP (dated September 26, 2013)
 - 2009 Douglas County Regional Policy Plan (DCRPP)

- City of Wenatchee
 - *2012 Comprehensive Water System Plan Volume 2 – Regional Service Area and Facilities*
- Douglas County Sewer District
 - *2006 General Sewer Plan Update*
- Douglas County Watershed Planning Association
 - *2004 Watershed Management Plan – WRLA 44/50 (WMP)*

The County's population growth projections in the *2013 Draft Amendment* and land use designations have been used to project future District service needs.

Land use affects water system planning in the following ways: 1) water consumption and demand varies with the type of development; 2) population density or extent of development must be known to project accurate future water demands; 3) sizing and routing of facilities depends on location of development; and 4) timing of growth affects design, scheduling, and financing of water system improvements.

2012 Greater East Wenatchee Area Comprehensive Plan (GEWACP)

The County's City of East Wenatchee and Pangborn Industrial Service Urban Growth Areas (UGA) are located entirely within the District's service area boundary. The UGA includes the incorporated City of East Wenatchee and much of the urbanized unincorporated growth of County. The boundary is intended to cover 20 years of growth, which matches the planning period for this Plan. Infrastructure within the UGA must be sufficient to meet urban standards, or be capable of being provided to urban standards. The following excerpts from the GEWACP are related to water system infrastructure.

UG-7 Ensure that the location of proposed easements and road dedications, structures, stormwater drainage facilities, and the extension of a full range of urban utilities (water, sewer, power, etc.) are consistent with the orderly future development of the property to achieve urban densities.

UG-8 The development of residential and commercial property within the urban growth area shall only occur when all necessary urban public facilities and services are provided prior to or concurrent with development.

UG-9 If the property is located outside of the service district boundary of a utility, annexation into the service district or the execution of a "no-protest" annexation agreement must occur prior to development of the property.

County UG-13 states that "development of long-range capital facilities plans shall anticipate the provision of full public services out to the UGA within the next twenty years."

County Commercial Policy 14: Promote the extension of support facilities and services to commercial areas. Support interagency cooperation in the extension and upgrading of infrastructure and support facilities to commercial areas.

County Industrial Policy 7: Encourage, whenever possible, the extension of support facilities and services for industrial activity.

One of the principle criteria for identifying needed capital improvements are standards for Levels of Service (LOS). The Capital Facilities Plan (CFP) contains LOS standards for each public facility and requires that new development be

served by adequate facilities (i.e., the "concurrency" requirement). The CFP also contains goals, policies, and rationales that guide and implement the provision of adequate facilities.

County CFP Policy 7: The phasing of growth & development within the UGB should be consistent with the priorities and capital improvement budgets contained within the comprehensive water and sewer plans.

RATIONALE: As new development within the UGA is dependent on being served by a full range of urban services, it would be beneficial to establish a development phasing plan tied directly to identified improvements contained in the water and sewer district plans. As both the District and the Douglas County Sewer District have not yet finalized their comprehensive plan updates based on the GEWACP, the development of a phasing plan will be addressed in the future as an amendment to this Plan.

Utility Policy 4: Ensure that development takes into account the timely provision of adequate and efficient utility systems.

RATIONALE: Utility systems meeting the needs of development should be available when development takes place.

Utility Policy 5: The cost of on-site utility improvements or site preparation for developments, such as surface drainage, utilities and water and sewer systems should be the responsibility of private enterprise.

RATIONALE: The cost of infrastructure to support the development should be the responsibility of those directly benefiting from the services provided. If not, the community as a whole must pay for these improvements, which benefit those improving the value of the land for resale.

Utility Policy 6: Identify service boundaries within which utility services will be provided consistent with the UGA and the Capital Improvement Program.

RATIONALE: Establishing such boundaries will assist the community in identifying where future growth will occur and the quantity, extent and location of service needs.

Utility Policy 7: Promote utility extensions to those areas needing services within the UGA.

RATIONALE: This policy promotes extension based on need and is not limited to new projects. Older areas deficient in utility systems or areas that might be environmentally sensitive should be served as soon as possible.

Utility Policy 8: Future water system planning should be coordinated with the comprehensive plan of the City of East Wenatchee, County, and other planning efforts pertaining to land use, other utilities and other community facilities.

Utility Policy 9: Promote the planned development and phasing of utility and public facility construction consistent with capital improvement programs.

RATIONALE: Implement capital improvement programs to ensure utilities and public facilities are provided in a timely, coordinated, and cost-efficient fashion. Capital improvement programs also have a citizen participation element which aids in the predictability and expectations for the utility user.

Utility Policy 10: Promote multi-jurisdictional cooperation for utility planning and implementation.

RATIONALE: Provide a coordinated and comprehensive approach to utility planning.

Utility Policy 11: Utility installations and system upgrades should be done in a manner sensitive to the surrounding land uses.

RATIONALE: Sensitivity in utility locations should be given for environmental considerations, hazard area considerations, and other features which will promote the vision of the comprehensive plan. For example: A utility should not be installed if it would increase dangers in a flood hazard area.

Utility Policy 12: Require the under-grounding of utility wires where feasible, especially within a view corridor and/or around the Columbia River.

Utility Policy 14: Ensure that capital improvement planning and programs are consistent with the GEWACP.

RATIONALE: Urban service delivery and construction of capital facilities is directly related to the growth and development of the study area. Therefore, since the comprehensive plan puts into motion the community vision developed by its citizens, consistency with the comprehensive plan is vitally important.

Utility Policy 15: Ensure the adequate sizing of utility trunk lines and mainlines consistent with the Capital Improvement Program of that agency recommendations and that development bear its share of the cost of such construction.

RATIONALE: Development pays its own way. Costs incurred by development are not borne by all rate payers but rather by those who benefit from development. Where utility extensions are made consistent with utility plan recommendations and the cost of installation is borne solely by the developer, a system should be established to allow cost recovery by the developer through the transfer of connection fees paid over a period of time for use of the utility extension.

Utility Policy 16: Promote the coordinated development, review, update and implementation of City of East Wenatchee, County, and PUD capital improvement programs consistent with the GEWACP.

RATIONALE: Capital improvement planning and coordination of such plans allows for the coordination of scheduling and location of utilities, which can result in savings, such as planning utility line construction, to coincide with street improvements. This policy stresses coordination among the various entities involved in such planning.

Utility Policy 17: Include in utility system planning activities an on-going analysis of the systems overall physical condition.

RATIONALE: This policy promotes maintenance of older infrastructure to ensure proper long-term function and to avoid unanticipated replacement costs.

The District has always taken a proactive approach to addressing those issues from the GEWACP identified above. Previous system improvements, and those proposed in this plan, are intended to provide the major infrastructure necessary to serve the areas within and outside of the UGB to a normal expected level of service. However, individual developers are responsible for providing their own infrastructure within their project limits and are occasionally required to construct off-site improvements. These off-site improvements are required when a development has service requirements (usually fire flow) higher than those reasonably anticipated for the land use area. Where such development requires significant facility construction, such as a pump station or reservoir, the District works closely with the developer to ensure that such facilities meet appropriate design standards and are compatible with District operations.

2012 Douglas County Countywide Comprehensive Plan

The DCCCP describes the UGA growth areas, but mostly focuses on rural areas outside the UGA. The DCCCP's main purpose is to describe land use planning and future growth and only briefly discusses water supply issues. The relevant sections of the DCCCP are as follows.

G-9. Rural development should only occur where adequate access to transportation systems, rural levels of utilities and facilities are available. Appropriate facilities/services may include domestic water, sewage disposal, fire and police protection, schools, power, etc., depending on the scale and impact of the development.

RD-6. The costs associated with implementing a rural development and providing the necessary utilities, facilities, and/or services will be borne by the developer.

U-5. Provide utilities at service levels that are appropriate for the specific land uses and areas, thereby avoiding excess capacities that may encourage growth beyond the desired densities of an area.

U-6. Promote multi-jurisdictional cooperation between cities, the County, special purpose purveyors, and other private utilities for utility planning and implementation.

U-7. Encourage the coordinated development, review, update, and implementation of capital facility plans and plans consistent with adopted comprehensive plans.

U-8. Utility planning activities should include an ongoing analysis of the system's overall physical condition.

U-9. The cost of on-site utility improvements or site preparation for developments will be the responsibility of the development benefiting from the improvement.

U-10. Promote the continued use, maintenance, development, and revitalization of existing utilities whenever possible.

The District's operations and policies are in conformance with the above principals.

The DCCCP also covers the City of Rock Island. As shown on **Figure 1.1**, the service area of Rock Island does not overlap the District's service area. The two water systems are not intertied. Therefore, the planning efforts for Rock Island do not currently impact those of the District.

The City of Rock Island's water system service area is essentially constrained within the geographic bowl of six large ponds and roughly corresponds with the Rock Island UGA. If Rock Island's water quality drops, or regulations require more stringent standards, it may become necessary for Rock Island to develop new sources, construct treatment facilities, or obtain water from the District. The possibility of an intertie with the District is discussed in prior Rock Island comprehensive plans, but is not currently recommended nor planned for due to the high cost of infrastructure needed to transmit adequate supply between the purveyors. The City of Rock Island does not currently have plans to extend its service boundary toward the District.

2009 Douglas County Regional Policy Plan

The Douglas County Regional Policy Plan (DCRPP) basically identifies the processes by which local jurisdictions cooperate to develop long-range planning and reiterates the way an UGA is established. This plan also states that urban growth planning will typically follow the available infrastructure and not the other way around. The DCRPP states that urban services shall not be provided outside of the UGB except where necessary to support public health and safety for specific projects. This becomes something of a difficult situation for a water system; in order to provide adequate water supply for public health and fire protection, it is often necessary to extend infrastructure that has the ability to

provide a higher level of service than abutting land use requires outside the UGA. Where such seeming conflicts occur, the District will always err to the side of public health and safety. This approach was challenged once by the City of East Wenatchee to a proposed District annexation. The issue was eventually dropped when the annexation effort was abandoned.

Chelan-Douglas Health District

When an individual or a developer applies for a building permit, the Chelan-Douglas Health District contacts the District to check if there is domestic water service available. The Chelan-Douglas Health District may also be involved in the County's pre-application meeting where service conditions for new projects are identified.

2012 City of Wenatchee Comprehensive Water System Plan Volume 2 – Regional Facilities

The District worked jointly with the City of Wenatchee and the PUD No. 1 to develop this Plan for the water supply system to all three purveyors. The Regional Water System provides all water supply to the District through the Regional Supply Station and backup emergency wells. The District's operations, policies, and future service area comply with this Plan.

2004 Douglas County Watershed Planning Association Watershed Management Plan – WRIA 44 and 50

The WMP contains recommended actions to promote best use of water and to maintain water quality. It does not contain requirements or regulations and, as such, is voluntary. The relevant sections are as follows.

- Action 7. Promote xeriscaping, low-water use landscaping. Assess feasibility to incorporate xeriscaping into Douglas County land use code as a landscaping standard.
- Action 8. Continue municipal conservation programs to: 1) encourage the individual water consumer to conserve; and 2) promote operational efficiency measures for public water systems that minimize losses of water during routine flushing of mains and conserve water by detecting and repairing leaks and testing and repairing meters.
- Action 9. Ensure that the watershed plan is consistent with planned future use of existing water rights for municipal water supplies.
- Action 13. Research alternative ways to supply water. Assess feasibility to create new water systems or extend public water systems. Coordinate actions with the Chelan-Douglas Health District and the DOH.
- Action 15. Promote greywater segregation. Wastewater segregation involves the in-house separation of domestic sewage stream into two fractions: 1) toilet wastes and kitchen sink wastes, referred to as blackwater; and 2) dishwasher, clothes washer, and bath/shower wastes, referred to as greywater. Treated greywater can be used for landscape irrigation and toilet flushing to conserve potable water supplies. Treatment of greywater is achieved through the installation and operation of specialized on-site sewage system. Provide information on system design to homebuilders, real estate companies and homeowners.
- Action 16. Encourage industrial conservation measures and modifications to the following types of practices as appropriate: 1) heating and cooling; 2) product washing and processing; 3) cleaning and maintenance; 4) wastewater disposal; and 5) landscaping.

Encourage industries to participate in conservation programs such as the Washington State Department of Ecology's Technical Resources for Engineering Efficiency (TREE) Program.

The District's support of these recommendations are included in **Chapter 4 – Conservation Program**.

Douglas County Sewer District 2006 General Sewer Plan

The District's service area extends well beyond the Douglas County Sewer District's (DCSD) service area in all directions. Therefore, the DCSD does not drive any water infrastructure planning. The DCSD Sewer District's Plan does not place any conditions or constraints upon domestic water service and mentions the District only in the context of overlapping service areas and wellhead protection zones.

The DCSD service area extends far beyond the current sewer infrastructure. Therefore, development density in areas past the sewer infrastructure is generally limited by the need for on-site sewage disposal (septic) systems. For this Plan, it has been assumed that sewer will eventually extend throughout the UGB and development density will be consistent with the currently designated land use. The Sewer District service area is shown on **Figure 1.1**.

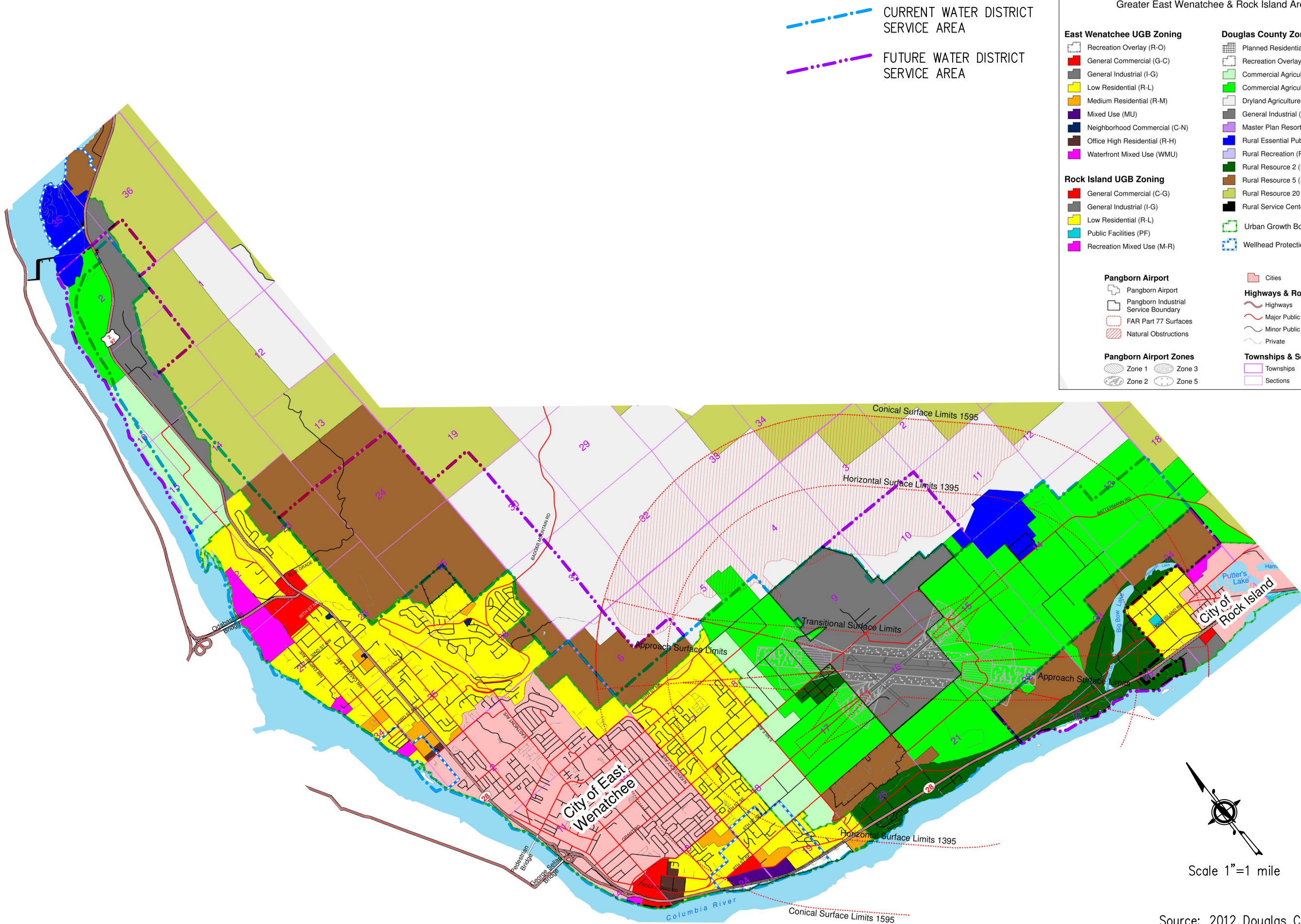
5. EXISTING SERVICE AREA CHARACTERISTICS

The District serves 23 square miles of Douglas County on the east side of the Columbia River adjacent to the City of Wenatchee in central Washington. The service area extends north and south adjacent to the Columbia River from the Baker Flats Industrial area (approximately 3 miles north of the Odabashian Bridge on U.S. Highway 2 crossing the Columbia River) to the City of Rock Island. The District's boundaries encompass the City of East Wenatchee and the UGB as defined in the GEWACP. East of the UGB the District provides service to the rural agricultural lands as well as the Pangborn Airport and Industrial Area.

The boundary of the District's existing service area, including major facilities is shown in **Figure 1.2**. The service area in relation to land use is shown in **Figure 1.4** and **Figure 1.5**. The service area is encompassed by the District's current boundaries. The District's existing service area encompasses the current boundaries of the City of East Wenatchee and the Greater East Wenatchee UGB.

Over two dozen separate land use designations within the service area (County and City of East Wenatchee independent) have been defined by the County and the City of East Wenatchee. The District has adopted these land uses unchanged, for the purposes of growth and water demand projections. Detailed descriptions for each land use (zoning) can be found in the *Douglas County Code Title 18 – Zoning* and the *City of East Wenatchee Title 17 – Zoning*. These descriptions are extensive and therefore will not be repeated here. In **Chapter 2**, more information is given regarding land use designations related to water demands.

The general land use areas within the existing service area are shown in **Table 1.9** and **Chart 1.1**.

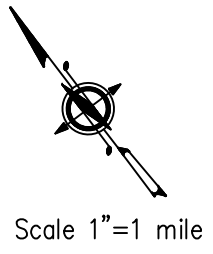


--- CURRENT WATER DISTRICT SERVICE AREA
 --- FUTURE WATER DISTRICT SERVICE AREA

Douglas County Zoning for the Greater East Wenatchee & Rock Island Areas

<p>East Wenatchee UGB Zoning</p> <ul style="list-style-type: none"> Recreation Overlay (R-O) General Commercial (G-C) General Industrial (I-G) Low Residential (R-L) Medium Residential (R-M) Mixed Use (MU) Neighborhood Commercial (C-N) Office High Residential (R-H) Waterfront Mixed Use (WMU) <p>Rock Island UGB Zoning</p> <ul style="list-style-type: none"> General Commercial (C-G) General Industrial (I-G) Low Residential (R-L) Public Facilities (PF) Recreation Mixed Use (M-R) 	<p>Douglas County Zoning</p> <ul style="list-style-type: none"> Planned Residential Development (PRD) Recreation Overlay (R-O) Commercial Agriculture 5 (AC-5) Commercial Agriculture 10 (AC-10) Dryland Agriculture (A-D) General Industrial (I-G) Master Plan Resort (MPR) Rural Essential Public Facilities (R-EPF) Rural Recreation (R-REC) Rural Resource 2 (RR-2) Rural Resource 5 (RR-5) Rural Resource 20 (RR-20) Rural Service Center (RSC) Urban Growth Boundary Wellhead Protection Zones
--	--

<p>Pangborn Airport</p> <ul style="list-style-type: none"> Pangborn Airport Pangborn Industrial Service Boundary FAR Part 77 Surfaces Natural Obstructions <p>Pangborn Airport Zones</p> <ul style="list-style-type: none"> Zone 1 Zone 2 Zone 3 Zone 5 	<p>Cities</p> <ul style="list-style-type: none"> Cities <p>Highways & Roads</p> <ul style="list-style-type: none"> Highways Major Public Road Minor Public Road Private <p>Townships & Sections</p> <ul style="list-style-type: none"> Townships Sections
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Source: 2012 Douglas County Countywide Comprehensive Plan

RH2 ENGINEERS, INC.
 1000 20th St.
 EAST WENATCHEE, WA
 300 Simon Street, Suite 5

**East Wenatchee Water District
 2014 Comprehensive Water System Plan**

**FIGURE 1.4
 COUNTY LAND USE**

NO.	DATE	DESCRIPTION	BY	REVISION

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: 1.4	SHEET NO.: 1.4
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CURRENT WATER DISTRICT SERVICE AREA



Scale
1"=1/2 mile



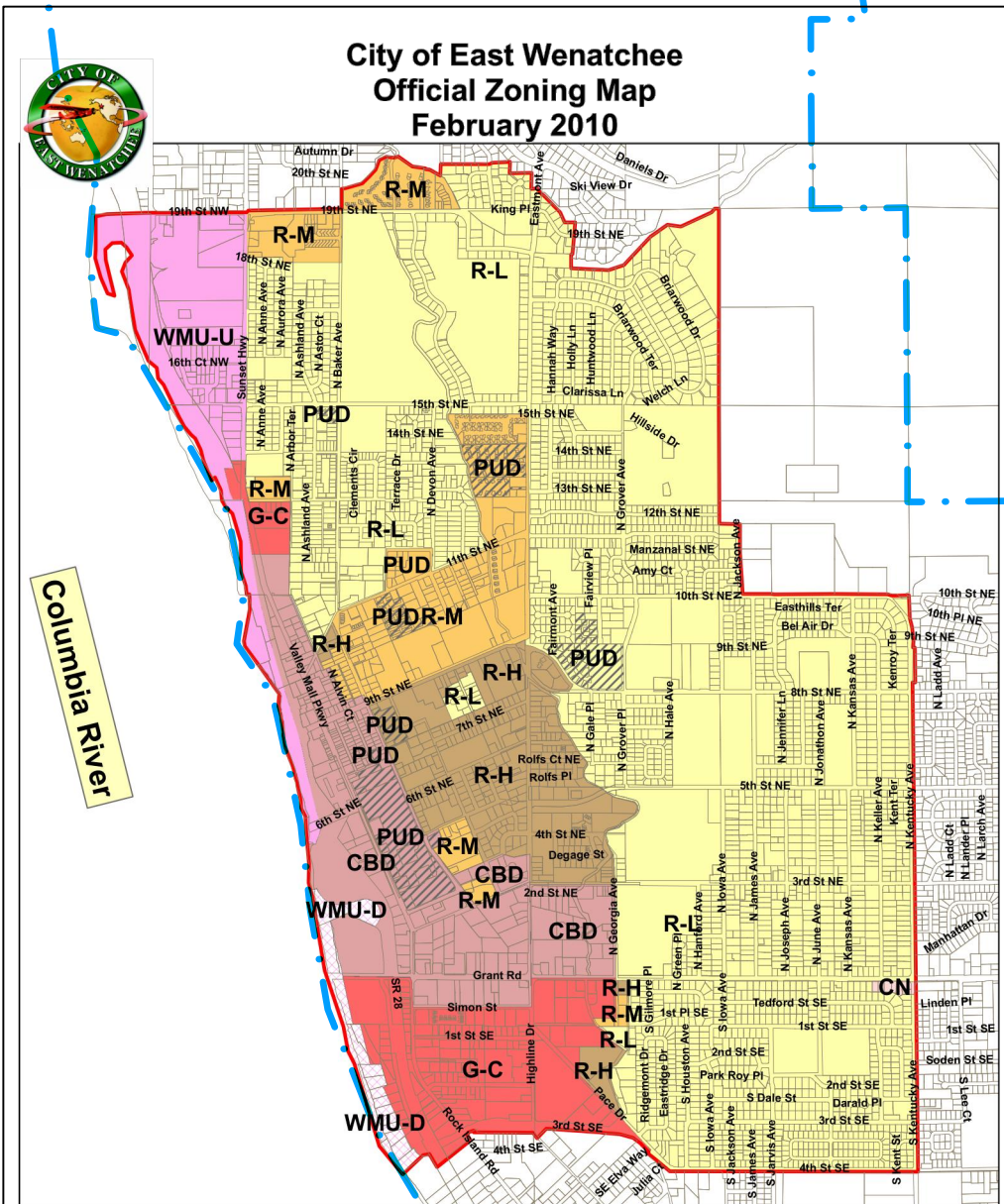
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SIGNED: 06/09/14



City of East Wenatchee Official Zoning Map February 2010

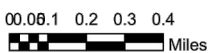


Columbia River

Legend

- Parcels
- City Limits
- Central Business District (CBD)
- Neighborhood Commercial (C-N)
- General Commercial District (G-C)
- Planned Unit Development (PUD)
- Low Residential (R-L)
- Medium Residential (R-M)
- Office High Residential (R-H)
- Waterfront Mixed Use-Downtown (WMU-D)
- Waterfront Mixed Use-Uptown (WMU-U)

Please note: This map is intended for general information purposes only. The City of East Wenatchee makes no claim as to the accuracy or current condition of the data shown on this map.



**East Wenatchee Water District
2014 Comprehensive Water System Plan**

**FIGURE 1.5
CITY LAND USE**



ENGINEER	REVISIONS	NO.	DATE	DESCRIPTION	BY	REVIEW
RCP						
RCP						

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

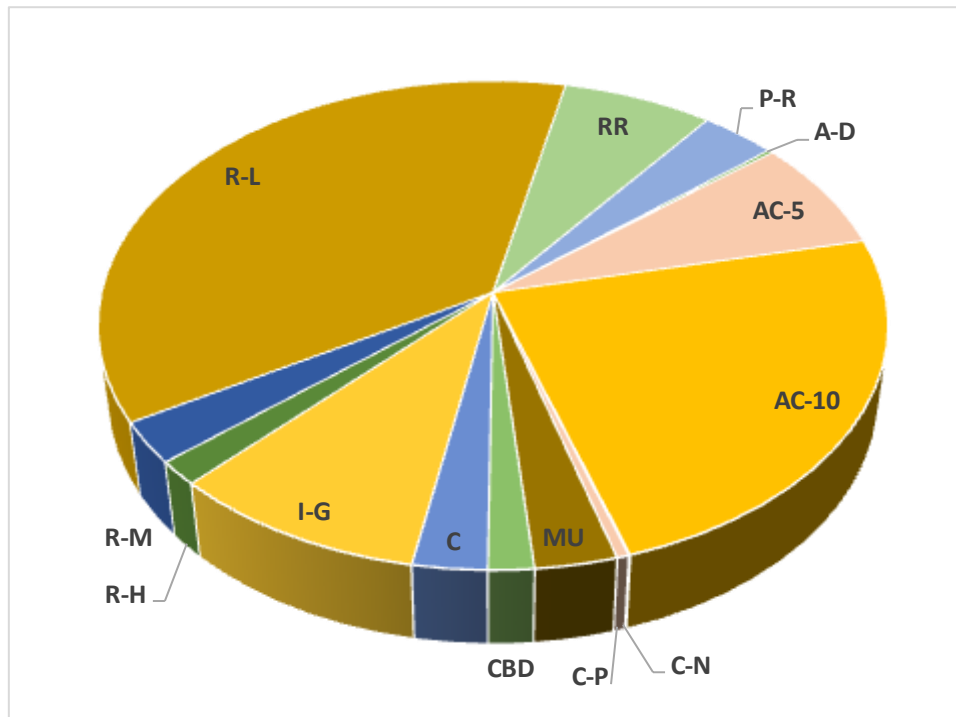
DWG NO: 1.5 SHEET NO: 1.5

Source: City of East Wenatchee Website

Table 1.9 Existing Land Use

Abbrev	Description	Area	
A-D	Dryland Agriculture	30 ac	0.2%
AC-5	Commercial Agriculture 5	1,079 ac	7.4%
AC-10	Commercial Agriculture 10	3,458 ac	23.6%
C-N	Neighborhood Commercial	8 ac	0.1%
C-P	Planned Development	64 ac	0.4%
MU	Mixed Use	437 ac	3.0%
CBD	Central Business District	242 ac	1.7%
C	General Commercial	396 ac	2.7%
I-G	General Industrial	1,370 ac	9.3%
R-H	High Density Residential	233 ac	1.6%
R-M	Medium Density Residential	400 ac	2.7%
R-L	Low Density Residential	5,395 ac	36.8%
RR	Rural Resource	1,025 ac	7.0%
P-R	Public / Recreation	516 ac	3.5%
System Total		14,653 ac	100%


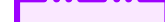


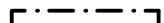


Chart 1.1 Land Use Proportion

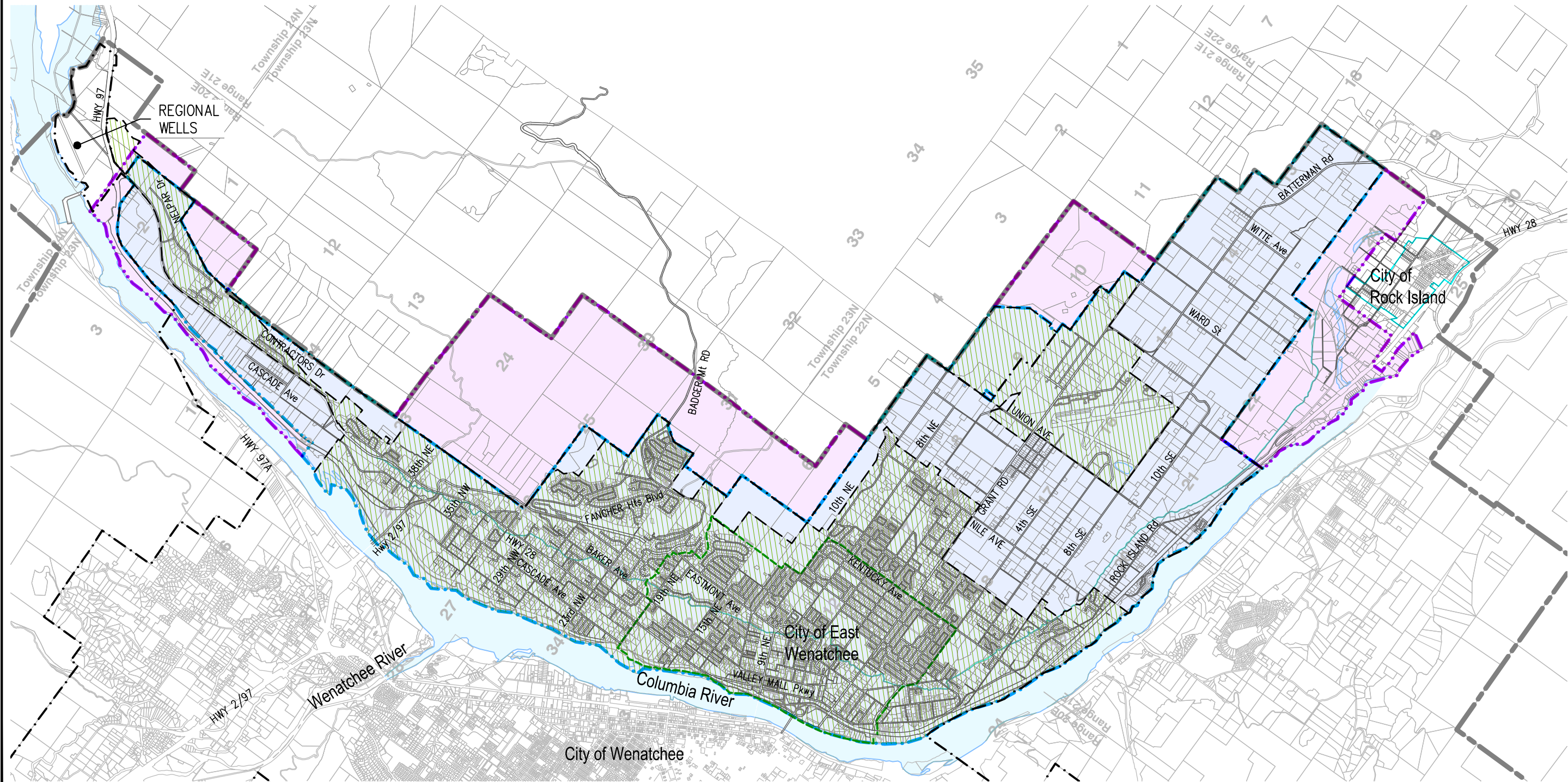
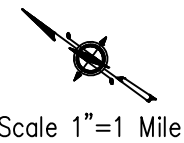


6. FUTURE SERVICE AREA

The District’s existing service area encompasses all properties that it anticipates will require water service within the horizon of this planning effort. Areas planned for urban growth based on the adopted GEWACP are encompassed within the boundary of the current service area. **Figure 1.6** shows the following areas that may be added to the District’s service area in the future. These areas

LEGEND

-  EXISTING SERVICE AREA
-  FUTURE SERVICE AREA
-  URBAN GROWTH AREA
-  CITY OF EAST WENATCHEE
-  EXISTING REGIONAL WATER SERVICE AREA
-  FUTURE REGIONAL WATER SERVICE AREA
-  WATER RIGHTS PLACE OF USE



**East Wenatchee Water District
2014 Comprehensive Water System Plan**



REVISIONS

NO.	DATE	DESCRIPTION	BY	REVIEW

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO. 1.6	SHEET NO. 1.6
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**FIGURE 1.6
SERVICE AREA**

STICKED: 06/09/14

were also identified in Volume 2 of the *Wenatchee Comprehensive Plan* and are consistent with the Regional Water System Agreement.

Baker Flats

The industrially zoned area was previously served by special agreement and was annexed into the District's service area in 2010.

South and West Halves of Section 6

The land north of 10th Street NE, between Kentucky and Nile Avenues, is well suited topologically for residential development. Multiple developers have been looking at this land over the last decade, but none has advanced due to the airport overlay zones and lack of water system infrastructure adjacent to the area. A water supply analysis was prepared in March 2005 addressing this area and is included in **Appendix N**. To adequately serve this area, new pumping and storage facilities will likely be required. It appears the Veedol 1494 Pressure Zone is well suited for service, because most land higher than 1,400 feet is not buildable due to the Pangborn Airport Overlay Zone restrictions. However, service from the Fancher Heights 1594 zone is also feasible. The area is currently zoned as Rural Resource 5 (one lot per 5 acres). However, the County does have the ability to permit denser construction via Planned Residential Development procedures. Any infrastructure required to provide service to this area will be the responsibility of the developer(s). The District may elect to participate financially if it is deemed that there is system-wide benefit to increasing the pumping or storage capacity of the proposed facilities.

Fancher Heights Plateau North and East

Currently, residential development within Fancher Heights has terminated approximately at the east-west quarter section line of sections 25 and 26, coincident with Canyon B and the UGB. Land north of Canyon B is gently sloped at 4 percent to 10 percent, and development interest has increased. Land to the east is gently rolling and easily accessible. Storage in the Fancher Heights and Canyon Hills Reservoirs and pumping capacity from Daniels Drive is already fully allocated, so additional pumping and storage facilities will be required to serve this area.

Sections 9 and 10

Interest over the years has increased and decreased for Sections 4, 5, 9, and 10 in Range 21, north of the Veedol Pressure Zone. The District is not currently aware of any proposals for development. Substantial infrastructure may be required to serve any large developments, including pumping, transmission, and storage. Expansion of the service area to these sections is not proposed at this time and should any development proposals arise during this planning period, they will be addressed on a case-by-case basis.

Approximately 315 acres within Section 9 were annexed in 2012 and zoned for industrial development.

Adjacent Systems

The District's service area nears, but does not touch, the City of Rock Island's water system on the north and east. The Regional Water Supply System traverses through the north portion of the District's service area from the Rocky Reach Dam well field to the Odabashian Bridge on U.S. Highway 2 crossing the Columbia River. Local service from this main is limited to the PUD

facilities at the Rocky Reach Dam, State Fish Hatchery, Lincoln Rock State Park, and Bonneville Power Administration, all of which are outside of the District service area. Service is provided through the Chelan County PUD, a joint participant with the City of Wenatchee in this supply system.

The City of Wenatchee and Chelan County PUD service areas are separated from the District by the Columbia River.

There are no other known Group A public water systems near the District's service area. A number of individual systems likely still exist in the rural portions of the service area, particularly adjacent the Columbia River where individual well systems can be easily developed. The District has not attempted to inventory these individual systems.

7. SERVICE AREA AGREEMENTS

The service area boundaries of the District and City of Rock Island have been established mutually, although no written agreement is in place.

The City of Wenatchee *Water System Comprehensive Plan Volume 2*, Chapter 3 describes the service areas for the District, City of Wenatchee, and Chelan County PUD. These service areas are identified in the "*Water Contract – Regional Water System*" amended November 1998, and included as **Appendix F**.

8. SERVICE AREA POLICIES

This section describes the District's policies for providing water service throughout the service area.

Duty to Serve

The District has a 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 service request is consistent with adopted local plans and development regulations.
3. The District has sufficient water rights to provide service.
4. The District can provide service in a timely and reasonable manner.

The District's approach to each item is as follows:

1. The District's growth projections are shown in **Table 2.16**, with an estimate of 14,850 equivalent residential units (ERUs) by the year 2035. The 20-year water supply estimate is shown in **Table 2.17** as 4.6 million gallons per day (MGD) (3,200 gpm) for the annual average and 8.1 MGD (5,600 gpm) for maximum day demand. The existing source pumping capacity is 8.8 MGD (6,100 gpm). Physical supply capacity is more than sufficient for the 20-year projection.

2. Development requests are handled by Douglas County or the City of East Wenatchee, which will make a determination if the proposed project is consistent with existing land use. Conditions of service are described later in this chapter and in the Developer Extension Agreement (DEA). Once a customer makes a service request, the District will review their policies and any County or City of East Wenatchee conditions to determine consistency and provide response via a Water Availability Letter.
3. Water Rights are held and managed by the Regional Water System. The existing water rights are projected to be sufficient beyond the year 2050 for both instantaneous and annual use.
4. Duty to serve is immediate within the retail service area and timely service shall be defined as 120 days after payment of the applicable hookup fees in the retail service area. In areas requiring a DEA, timely service does not start until after all of the provisions of the DEA are satisfied, application forms are filled out and hookup fees are paid.

Wholesaling Water

The District does not provide wholesale water to other purveyors, nor does it have any current plans to do so.

Wheeling Water

The District does not “wheel” water through its system to other purveyors, nor does it have any current plans to do so. If water to another purveyor becomes necessary, a special agreement must be developed.

Annexations

Areas annexed within the District’s water service area shall comply with District standards for the construction of water system extensions. For the District to assume control of an existing water system, the system to be annexed must be upgraded to District standards. Areas outside of the current service area will either need to be annexed before service is provided or have a special service agreement developed.

Direct Connection and Satellite/Remote Systems

New developments within the service area must be directly connected to the District’s water system in order to be owned and operated by the District. Such developments must meet the District’s design and construction standards.

The District is not an authorized agency for satellite management of lands outside of and adjacent to the District’s future service area.

Design and Performance Standards

The District provides a DEA for all new developments which includes a comprehensive description of the District’s design standards. The DEA is included as **Appendix G**. The District also provides hard or electronic copies of its Standard Details for water system construction in **Appendix I**.

Surcharge for Outside Customers

There currently are no customers served outside of the District service area.

Utility Local Improvement District (ULID) Formation

The District will work with property owners who request to be included in the District service area or whose infrastructure needs exceed those of the existing facilities.

UGA Service

The District endeavors to provide an appropriate LOS within the UGA based on typical domestic and fire flow requirements. A new development that has requirements higher than typical standards, or are currently available, are required to fund and construct system improvements necessary to meet their own requirements. The County has not established any fixed (numerical) performance standards to be met within the UGA.

Late-Comer Agreements (Reimbursement Agreements)

The District allows Reimbursement Agreements for water system improvements constructed by developers that provide benefit to other properties. The policies for reimbursement are outlined in Section 20 of the DEA in **Appendix G**.

Oversizing

The District may provide additional funding for infrastructure to maximize its potential for service of future growth. An example of this is District funding to provide additional standby storage in the proposed Baker Flats reservoir. The District also occasionally pays the difference in cost to up-size distribution mains installed by developers, if the size increase is of overall system benefit. Determination of such participation will be on a case-by-case basis.

Cross-connection Control Program

The District's Cross-connection Control Program (CCC) is identified in **Chapter 6** of this Plan.

Service Extension

If a customer requests service for a property currently fronted by existing infrastructure, the District will make a determination if said infrastructure has sufficient capacity to serve the proposed request. If the request is for a single existing "lot of record" fronted by an existing main, the typical action is for the customer to fill out a service request at the office. The customer is responsible for constructing the water service (if not already existing) and the District will install the meter once all charges have been settled.

If a request for service of a residential subdivision, commercial, industrial or public facility development is received, a DEA will be prepared by the District to be signed by the developer. The

developer must deposit funds in the amount estimated in the DEA to cover administrative, engineering and construction services. If not all deposited funds are used, the remainder will be returned to the developer.

If it is deemed that the system does not have sufficient capacity to meet the needs of the proposed service, the developer will be required to fund and construct the infrastructure necessary to serve their property. Said improvements will either be privately owned and maintained, or deeded to the District via a Bill of Sale, (see **Appendix G**). Privately owned infrastructure must be isolated from the District's system by an approved backflow prevention device, unless such private system is deemed by the District to be of low or no risk to District customers.

Additional Policies

Temporary Services: Compliance with standards may be deferred for temporary water service. Water quality standards will be maintained.

Emergency Service: Water quality standards will not be compromised in any situation; however, other standards and policies may be deferred for emergency water service.

Land Use: The District will not provide nor propose to provide water service to any proposed development that is not permitted under the zoning or land use regulations of the City of East Wenatchee or Douglas County.

Irrigation Water Sources: Where domestic water service is to be provided to property which has rights to a separate source of water for irrigation, the District will endeavor to require the continued use of the separate water source for irrigation.

9. SATELLITE MANAGEMENT AGENCIES

The District is not currently, nor has any plans to become, a satellite management agency.

10. CONDITIONS OF SERVICE

Developer Extension Agreement

The District has a DEA document that has a checklist of what a developer must do in order to be approved for a waterline extension within the District's service area. It covers the fees, as well as District and contractor requirements. Some, though not all, of the items covered are performance bond; easements; permits; grading of roads; drawing requirements; insurance; materials; connection to the existing water system; acceptance of improvements, and reimbursement agreement (**Appendix G**).

Domestic Water Service

The District's general policy for providing water service to an existing lot of record (recorded prior to 1986) is that the meter may be installed within the District's boundary if the property is no farther

away than two lots deep from fronting a water main and, if it is a long service line, the owner must sign a special service agreement (**Appendix H**).

Cross-connection Control Program

The District's CCC Program is identified in **Chapter 6** of this Plan and requires water users to protect the domestic water system from any outside source of contamination, as outlined by the DOH statutes and the District's resolution for CCC.

Connection Fee Schedule

The District's current fee schedule is included in **Chapter 9**.

Meter and Material Specifications

The District provides and installs all water meters used in the District. The District installs the new water meter into a vault and meter setter assembly that has already been installed by the developer/owner. The District currently uses Sensus water meters and radio read equipment. The District has Standard Details that are used on all projects done by the District or developers (**Appendix I**). The District also has Contract Special Provisions that modify the Washington State Department of Transportation (WSDOT) standard specifications that are included on District project bid documents (**Appendix J**).

Planning Boundaries

The District will use the existing water service boundary as its planning boundary.

11. COMPLAINTS

The District logs all complaints that come into the office so a permanent record may be reviewed in case the customer calls back at a later date. The logging of complaints is also used to see if there is a pattern developing with a particular complaint, such as dirty water. This form is also used to track a complaint about District policies so staff can report to the commissioners any special situations or provide this information to the District's insurance company in case a future claim is filed.

BASIC PLANNING DATA and WATER DEMAND FORECASTING

This chapter presents the planning basis for forecasting water demands to be met by the East Wenatchee Water District (District) water system for the next 20 years. This chapter includes a discussion of existing land use and the adopted future land use plan as compiled by the Douglas County (County) Department of Transportation and Land Services 2012 *Countywide Comprehensive Plan*, and the City of East Wenatchee 2012 *Greater East Wenatchee Area Comprehensive Plan*. The County 2013 *Draft Countywide Comprehensive Plan Amendment* was also reviewed for applicability. Existing and forecasted population, existing water consumption, and customer characteristics, are used as the basis to forecast water system demands for the planning period.

1. CURRENT POPULATION

Existing Land Use

The District service area is located within the Greater East Wenatchee planning area. The service area encompasses a land area of more than 14,600 acres. Over 4,500 acres are designated as irrigated agricultural resource lands of long-term commercial significance. Almost 9,400 acres of the service area are located within the urban growth area.

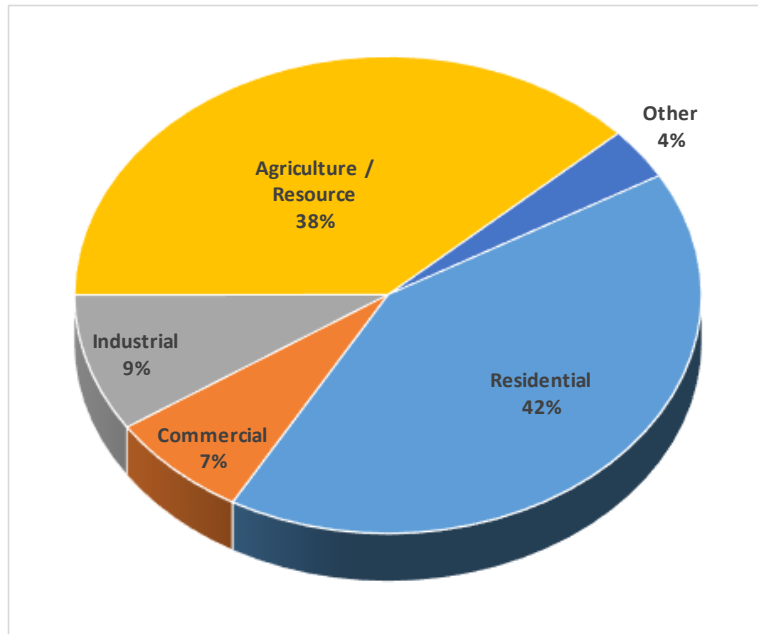
The service area of the District encompasses the urban area as well as portions of the rural area and irrigated agricultural resource lands. While some changes will occur within both the rural area and the irrigated agricultural resource lands, the adopted land use plan will preclude development with a significant impact on the service requirements of the District or its water demands. Therefore, this plan focuses its planning on the water service demands of the current and proposed urban areas of the Greater East Wenatchee planning area. **Table 2.1** details the existing land use area within the District's service area.

Table 2.1 Existing Land Use Area

County Land Use	Acres in Pressure Zone							Total
	965	1170	1292	1350	1494	1594	1768	
Commercial Ag-5	503	189	194		193			1,079
Commercial Ag-10	15	11	178	347	2,907			3,458
Dryland Ag					30			30
Residential - Low	1,204	951	835		263	503	133	3,889
Residential - Med	170	36	3			7		216
Residential - High / Office	61							61
General Commercial	203	32						235
Mixed Use	60							60
Commercial-Neighborhood	1	3				3		7
Planned Development	24							24
Recreation Overlay	60			165	20	116		361
General Industrial	239				1,131			1,370
Rural Essential Public					155			155
Rural Resource - 2	363				71			434
Rural Resource - 5		62	3	198	159	151		573
Rural Resource - 20	18							18
Waterfront Mixed Use	220							220
City Land Use								
Central Business	229	13						242
General Commercial	155	6						161
Residential - Low	233	886	387					1,506
Residential - Med	146	38						184
Commercial-Neighborhood		1						1
Planned Development	19	21						40
Residential / Office	150	22						172
Waterfront Mixed Use	157							157
Total	4,230	2,271	1,600	710	4,929	780	133	14,653

The proportion of land use area can be seen in **Chart 2.1**.

Chart 2.1 Land Use Proportion



2. WATER DEMANDS

Water demands for the District are forecast based on past water supply and consumption patterns, forecasts of population and metered connections, and fire flows required by the density of development expected within the service area.

Service Connections

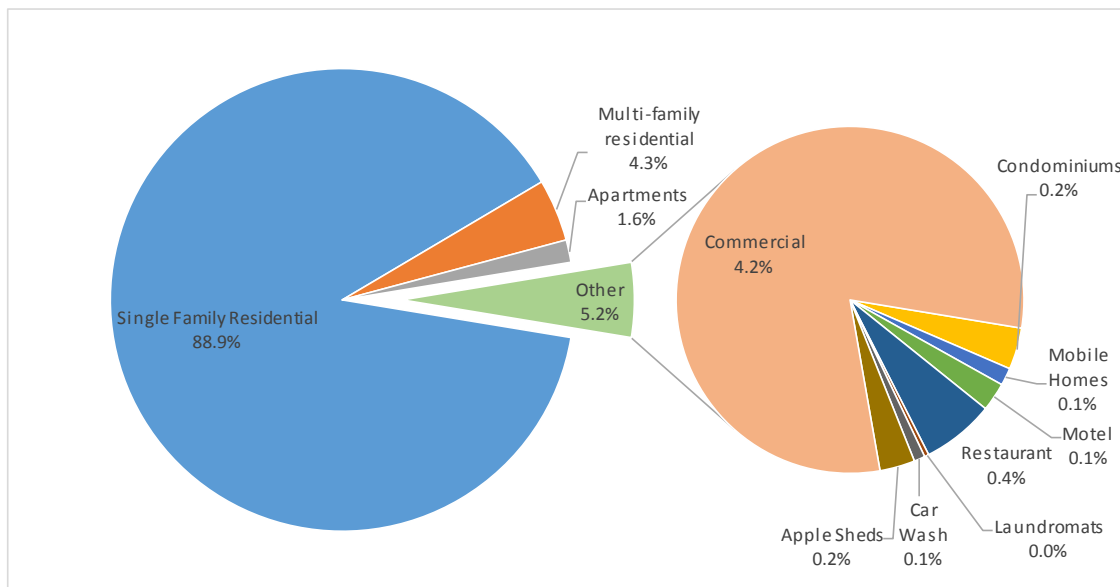
Table 2.2 shows the total number of service connections per each customer class. Approximately 89 percent of all services are single-family residences, while all classes of residential use account for 95 percent of connections.

Table 2.2 Customer Classes

Class Code	Description	Number of Services (2013)						Total
		3/4"	1"	1.5"	2"	3"	4"	
100	Single Family Residential	7,242	1,081	17	-	-	-	8,340
101	Multi-family residential	234	171	3	-	-	-	408
102	Apartments	56	40	29	14	7	1	147
103	Condominiums	6	2	2	5	3	1	19
104	Mobile Homes	3	1	1	2	1	-	8
105	Motel	-	13	-	-	-	-	13
106	Restaurant	18	13	2	-	-	-	33
107	Laundromats	1	-	1	-	-	-	2
108	Car Wash	3	1	1	-	-	-	5
109	Apple Sheds	11	3	-	2	-	-	16
110	Commercial	206	92	49	37	4	5	393
Total		7,780	1,417	105	60	15	7	9,384

The proportion of services per customer class can be seen graphically in Chart 2.2.

Chart 2.2 Proportion of Customer Classes



The total service count since 1981 is shown in Table 2.3. Growth in service connections was less than 1 percent per year from 2008 to 2013.

Table 2.3 Meter Totals by Year

Year End of	Meter Size						Total	Added per year	Growth per year
	3/4"	1"	1-1/2"	2"	3"	4"			
1981	4,635	338	33	23	6	1	5,036		
1982	4,673	344	34	25	6	1	5,083	47	0.93%
1983	4,732	351	35	25	6	1	5,150	67	1.32%
1984	4,800	360	35	26	7	1	5,229	79	1.53%
1985	4,875	378	35	27	8	3	5,326	97	1.86%
1986	4,977	406	37	27	9	3	5,459	133	2.50%
1987	5,056	418	38	28	10	3	5,553	94	1.72%
1988	5,133	434	39	31	11	3	5,651	98	1.76%
1989	5,183	443	41	31	11	3	5,712	61	1.08%
1990	5,267	459	43	31	11	3	5,814	102	1.79%
1991	5,371	492	44	32	13	3	5,955	141	2.43%
1992	5,486	520	44	34	13	3	6,100	145	2.43%
1993	5,590	546	45	35	14	3	6,233	133	2.18%
1994	5,677	575	47	37	14	3	6,353	120	1.93%
1995	5,772	617	48	38	17	3	6,495	142	2.24%
1996	5,916	652	52	40	17	3	6,680	185	2.85%
1997	6,017	706	56	43	19	3	6,844	164	2.46%
1998	6,148	748	64	46	20	3	7,029	185	2.70%
1999	6,281	786	66	46	20	3	7,202	173	2.46%
2000	6,384	831	70	47	20	3	7,355	153	2.12%
2001	6,471	873	73	50	20	3	7,490	135	1.84%
2002	6,575	939	75	52	21	3	7,665	175	2.34%
2003	6,687	1,025	77	52	21	3	7,865	200	2.61%
2004	6,831	1,088	78	53	22	3	8,075	210	2.67%
2005	7,035	1,184	80	55	13	3	8,370	295	3.65%
2006	7,237	1,323	80	55	13	3	8,711	341	4.07%
2007	7,400	1,346	88	56	13	5	8,908	197	2.26%
2008	7,494	1,369	92	58	14	6	9,033	125	1.40%
2009	7,564	1,371	103	58	15	6	9,117	84	0.93%
2010	7,609	1,383	103	60	15	6	9,176	59	0.65%
2011	7,670	1,386	103	60	15	6	9,240	64	0.70%
2012	7,724	1,397	104	60	15	6	9,306	66	0.71%
2013	7,780	1,417	105	60	15	7	9,384	78	0.84%
								2000-2013	1.91%
								2008-2013	0.87%

Current Water Supply and Consumption

The District's geographic information system (GIS) data was used in conjunction with the billing records to determine which accounts were in each pressure zone. **Table 2.4** shows the breakdown of meter sizes by pressure zone.

Table 2.4 Meter Size by Pressure Zone

Zone	Meter Size (2012)						
	3/4"	1" SFR	1"	1.5"	2"	3"	4"
965 N	75	3	26	5	3	1	0
965 S	2,420	94	155	70	35	9	3
1170	2,618	103	71	8	12	3	3
1292	2,067	43	8	6	3	1	0
1350	84	2	2	0	1	0	0
1494	451	39	24	15	4	1	0
1594	6	528	13	0	2	0	0
1768	3	285	1	0	0	0	0
Total	7,724	1,097	300	104	60	15	6
9,306 Total meters							

Note: SFR indicates meters installed for single-family residences. Most 1-inch meters have been installed for homes using residential fire sprinkler systems. The standard 5/8 by 3/4-inch meters are typically too small to provide adequate flow for sprinklers. Throughout this Comprehensive Water System Plan (Plan), the 1-inch meters will be segregated between those used for sprinklers (SFR) and those used because the normal customer demand requires the 1-inch size, which typically are non-residential customers.

Meters are read every 2 months based on meter routes, which are staggered throughout the billing period. To develop maximum day and peak hour demands, multipliers were developed using the supervisory control and data acquisition (SCADA) pump station records for daily, monthly and seasonal totals. Average daily demand (ADD) is calculated by dividing the year's total sales by 365 days. Demands during the winter are almost exclusively indoor use and categorized as Minimum day demand (MinDD). MinDD is calculated by using the minimum demand billing period for the year. Between December and February there is very little change in usage, so monthly, weekly, and daily demands during this period are essentially identical. Not all meter reading routes and pressure zones will have the maximum sales during the same 2-month period. To ensure that the District is planning conservatively and that pumping and storage capacity is sufficient to meet demands, the maximum billing periods during the year have been used to develop maximum demands.

Pump station and reservoir performance data is available minute by minute from the telemetry system. This information was extracted on 1 minute intervals for the minimum, average, and maximum weeks for 2012. Using this data, peak demands were calculated and the relationship between system-wide monthly, weekly, and daily usage water determined as shown in **Table 2.5**.

Table 2.5 System-Wide Demand Multipliers

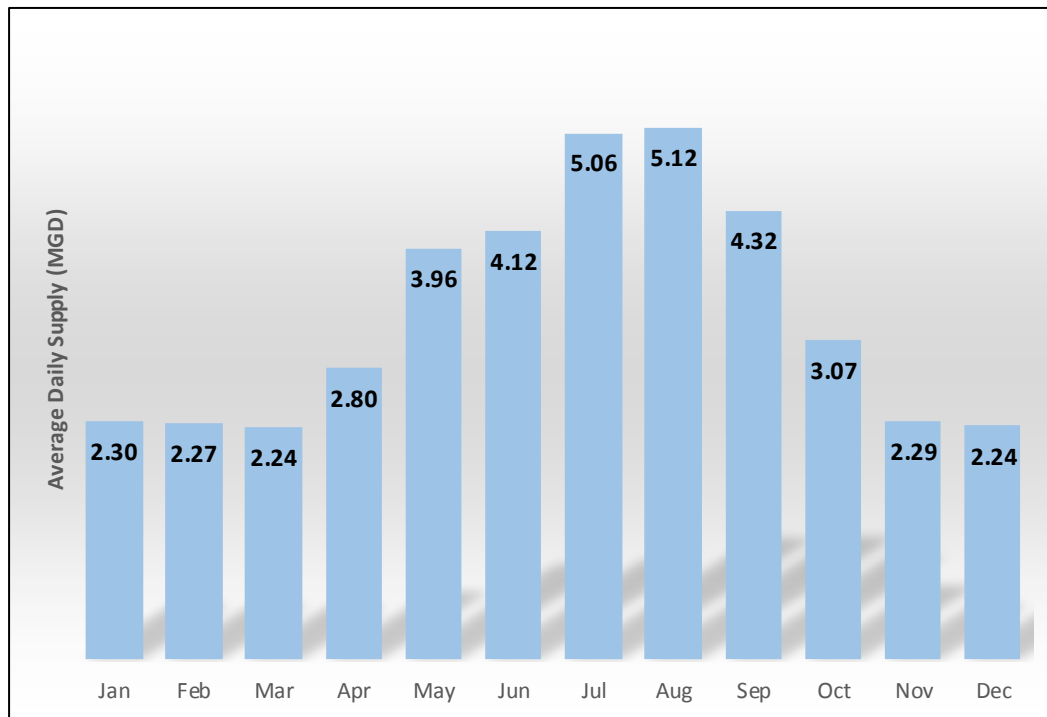
	2009	2010	2011	2012	2013	Avg	Max
Daily Supply							
MDD (mgd)	5.8	5.8	5.8	5.7	5.9	5.8	5.9
date	7/22/09	7/21/10	7/11/11	8/16/12	7/24/13		
ADD (mgd)	3.46	3.23	3.21	3.31	3.46	3.33	3.46
MinDD (mgd)	2.10	2.20	2.10	2.00	1.90	2.06	n/a
Weekly Supply							
MWD (mgd)	5.58	5.50	5.26	5.38	5.75	5.49	5.75
date	July	July	July	July	July		
MinWD (mgd)	2.20	2.18	2.18	2.10	2.20	2.17	n/a
date	Dec	Dec	Dec	Dec	Jan		
AWD (mgd)	3.46	3.23	3.21	3.31	3.46	3.33	n/a
date	April	April	April	April	April		
Max 2 Month Supply (corresponds to billing cycle)							
M2MD (mgd)	5.16	5.08	4.81	5.10	5.10	5.05	5.16
date	Jul/Aug	Jul/Aug	Jul/Aug	Jul/Aug	Jul/Aug		
Supply Factors - System Wide							
MDD/ADD	1.68	1.80	1.81	1.72	1.71	1.74	
MinDD/ADD	0.61	0.68	0.65	0.60	0.55	0.62	
MDD/MWD	1.04	1.05	1.10	1.06	1.03	1.06	
MDD/M2MD	1.12	1.14	1.21	1.12	1.16	1.15	
MWD/M2MD	1.08	1.08	1.09	1.05	1.13	1.09	

MWD = maximum weekly demand
 MinWD = minimum weekly demand
 AWD = average weekly demand
 M2MD = maximum 2-month demand

Attached in **Appendix O** are the diurnal curves developed for each pressure zone during each demand period. As can be seen from these curves, pressure zones which are primarily residential, such as the 1594 and 1768 zones, have dramatic peak demands. This is because most customers leave during the day for work and demand drops accordingly. Zones with many commercial and industrial customers, such as 965 and 1170, have flatter demand patterns since there is a mixed use of water throughout the day.

Seasonal supply to the entire system for 2012 is shown in **Chart 2.3**.

Chart 2.3 Seasonal Supply 2012



Distribution System Leakage

Unbilled water must be accounted for in demand planning. There are multiple sources of unbilled water in the District water system.

- Construction Meters: Fire hydrant meters used primarily by contractors during construction.
- Public Works: Water used by the City of East Wenatchee and County primarily for street cleaning.
- Sewer Department: Water used by the Douglas County Sewer District primarily to clean sewer lines.
- Flushing: Water used by the District to flush new mains and dead end pipes to maintain water quality.
- District Meters: Water used by the District primarily for irrigation of facility sites.
- Leaks: Leaks within the system.
- Under-recording Meters: Older meters may record less flow than actually passes through the meter. Oversized meters may also not accurately record low flows.
- Fire Fighting: Water used by the Fire Department for fire suppression.

While some of these sources of unbilled water can be accurately determined, others cannot. For example, flushing and leaks can only be estimated, while under-recording meters are virtually impossible to assess. **Table 2.6** shows the best estimates for unbilled water from 2007 through 2012.

Table 2.6 Unbilled Water (Gallons)

	2007	2008	2009	2010	2011	2012	Avg 10-12
Hydrant meters	18,679,000	19,907,000	7,858,000	12,497,000	6,168,000	11,276,000	
Public Works/Flushing	458,000	485,000	426,000	13,960,000	9,114,000	6,752,000	
Sewer Dept.	262,000		236,000				
Repaired leak estimate	3,084,000	32,334,000	2,626,000	4,877,000	635,000	1,109,900	
District meters	2,526,000						
Total Unbilled	25,009,000	52,726,000	11,146,000	31,334,000	15,917,000	19,137,900	25,878,317
Yearly Avg/day	68,518	144,455	30,537	85,847	43,608	52,433	70,899
Total Pumped	1,177,000,000	1,235,900,000	1,261,900,000	1,177,900,000	1,170,200,000	1,210,200,000	
Total Sales	1,089,505,000	1,082,822,000	1,110,233,212	1,043,750,000	1,072,412,000	1,046,581,000	
Unaccounted for Water (DSL)	62,486,000	100,352,000	140,520,788	102,816,000	81,871,000	144,481,100	114,008,178
	5.3%	8.1%	11.1%	8.7%	7.0%	11.9%	9.2%

Unaccounted for water is calculated by taking the total water pumped for the year then subtracting sales and metered unbilled water. The District has implemented an aggressive program to locate and repair leaks and replace older mains and service lines with the goal of reducing distribution system leakage (DSL) to below 10 percent.

3. EQUIVALENT RESIDENTIAL UNITS

The concept of equivalent residential unit (ERU) as a standard single-family residence is not entirely appropriate for the District. The use of separate irrigation water by many residents, highly variable irrigation patterns, and differences in family sizes can result in wide variations of demand from one family to the next. In the District, each pressure zone or meter route has a different ERU capacity value due to the variations in residence styles. Because of this, a simplified method of determining ERUs has been established. A single ERU has been defined as a customer served by a 3/4-inch meter. Larger meters are assigned an ERU value that equates to the meter capacity ratio to a 3/4-inch meter. For example, a 2-inch meter has a rated capacity of 8 times that of a 3/4-inch meter, so a customer with a 2-inch meter is counted as eight ERUs. This rationale has been used so that system facilities may be designed to serve the potential demands of the total installed meter capacity. The one exception is for 1-inch meters serving residential fire sprinkler systems; since the meter size is only to fulfill the fire sprinkler needs, those meters (1-inch SFR) are assigned one ERU.

Table 2.7 ERU Sizing

Meter Size	Rated Flow (gpm)	ERU Equivalent
3/4"	20	1
1" SFR	40	1
1"	40	2
1.5"	100	5
2"	160	8
3"	320	16
4"	500	25

The ultimate goal is to obtain ERUs and demands by pressure zone so that the pumping capacity and storage requirements per pressure zone can be established. The next step towards this goal is taking the current meter counts and multiplying by the ERU equivalents. The estimated count of meters by pressure zone are shown in **Table 2.8**.

Table 2.8 Meters per Pressure Zone

Zone	Meter Size (2012)						
	3/4"	1" SFR	1"	1.5"	2"	3"	4"
965 N	75	3	26	5	3	1	0
965 S	2,420	94	155	70	35	9	3
1170	2,618	103	71	8	12	3	3
1292	2,067	43	8	6	3	1	0
1350	84	2	2	0	1	0	0
1494	451	39	24	15	4	1	0
1594	6	528	13	0	2	0	0
1768	3	285	1	0	0	0	0
Total	7,724	1,097	300	104	60	15	6
9,306 Total meters							

Multiplying the number of meters by the allocation per ERU results in the number of ERUs per pressure zone, as shown in **Table 2.9**.

Table 2.9 ERU per Pressure Zone

Zone	ERU Counts (2012)							Total
	3/4"	1" SFR	1"	1.5"	2"	3"	4"	
965 N	75	3	52	25	24	16	0	195
965 S	2,420	94	310	350	280	144	75	3,673
1170	2,618	103	142	40	96	48	75	3,122
1292	2,067	43	16	30	24	16	0	2,196
1350	84	2	4	0	8	0	0	98
1494	451	39	48	75	32	16	0	661
1594	6	528	26	0	16	0	0	576
1768	3	285	2	0	0	0	0	290
Total	7,724	1,097	600	520	480	240	150	10,811

Water Use Patterns

Water use patterns were developed using actual billing records and the multipliers in previous tables. Peak hour demands (PHD) are critical to the evaluation of the water system since storage must make up any difference between supply rate and peak demand. Each pressure zone has its own usage characteristics and therefore its own unique PHD. The following table shows the relationship between supply patterns per pressure zone. PHD and peaking factors are obtained from the diurnal curves found in **Appendix O**.

Table 2.10 Daily Supply Patterns (2012)

Pressure Zone	MinDD		ADD		MDD		PHD	Multiplier
	gpd	gpm	gpd	gpm	gpd	gpm	gpm	
965 N	28,800	20	51,457	36	111,789	78	200	2.58
965 S	849,600	590	1,166,963	810	1,863,158	1,294	1,980	1.53
1170	698,586	485	962,416	668	1,580,084	1,097	1,765	1.61
1292	424,614	295	520,629	362	774,948	538	865	1.61
1350	12,223	8	14,789	10	28,357	20	55	2.78
1494	174,977	122	209,800	146	344,275	239	665	2.78
1594	82,800	58	356,186	247	977,040	679	1,990	2.93
1768	33,120	23	101,385	70	274,257	190	580	3.05
Total	2,304,700	1,601	3,383,600	2,350	5,953,900	4,135	8,100	1.96

There is a wide range of demand per ERU by pressure zone, as shown in **Table 2.11**. This is due to the differing character of the zones. For example, pressure zones 1594 and 1768 are primarily middle- to high-end residential without separate irrigation water, which results in very high summer demands and low winter usage. Pressure zones 965 and 1292 have mixed use resulting in less fluctuation over the year. The values in **Table 2.11** include both customer consumption and DSL.

Table 2.11 ERU Demand by Pressure Zone

Zone	Gallons per day per ERU		
	MinDD	ADD	MDD
965 N	148	264	573
965 S	231	318	507
1170	224	308	506
1292	193	237	353
1350	125	151	289
1494	265	317	521
1594	144	618	1,696
1768	114	350	946

From this table, using the average winter day demand for the pressure zones that are primarily residential, average indoor residential use is approximately 150 gallons per day (gpd) per ERU.

Taking the entire water system as a whole results in average demand per ERU, shown in **Table 2.12** (consumption and DSL).

Table 2.12 System Wide Average Demand per ERU

	Gallons per Day	
	Total	per ERU
WinDD	2,304,700	213
ADD	3,383,600	313
MDD	5,953,900	551

WinDD – winter day demand average

4. PROJECTED GROWTH AND DEMANDS

Based on the land use plan, the District believe that the relative proportion of residential to nonresidential users will continue to be similar to that which now exists, and that metered connections will grow in proportion to the population being served. Future metered connections have been projected based on the proportion that the current metered connections conveys to the Greater East Wenatchee urban area population. **Table 2.13** summarizes the population projections from the current County and city comprehensive plans. There are no planning agency estimates for population of the District’s service area. To estimate the population, it is assumed that the rural to urban population distribution within the service area is the same as that for all of Douglas County (82-percent urban, 18-percent rural).

Table 2.13 Population Projections

	1970	1980	1990	2000	2010	2015	2020	2025	2030	2035
Douglas County (entire county)	16,787	22,144	26,205	32,603	38,431	40,603	43,619	46,662	49,583	52,256
Rock Island UGA				1,065	1,143	1,197	1,273	1,349	1,422	1,489
East Wenatchee UGA	9,034	14,778	16,660	21,304	26,221	27,785	29,956	32,147	34,250	36,175
City of East Wentachee	913	1,640	2,701	5,757	13,190	data not available				
District Service Area Estimate	11,017	18,022	20,317	25,980	31,977	33,884	36,532	39,204	41,768	44,116
Rate of Growth		5.0%	1.2%	2.5%	0.5%	1.17%	1.34%	1.37%	1.34%	1.30%
District Metered Connections **	3,220	4,980	5,712	7,202	9,117	9,661	10,326	11,052	11,815	12,600

* Populations taken from 2012 County and City Comprehensive Plans and Draft 2013 County Ammenment.

** Actual connection counts through 2013. 2015-2035 projected using County growth rates.

2010 is Census data

As can be seen from **Table 2.13**, the County’s growth projections of approximately 1.3 percent exceed the District’s recent growth of less than 1 percent (**Table 2.3**). In order to plan conservatively, the County’s growth rates were used for the projected data. **Table 2.13** illustrates how the projected growth will occur throughout the District. **Table 2.14** lists estimated land areas that are currently developed and undeveloped, and also includes areas that may be annexed into the District in the future. The annexation areas correspond to the future service areas identified in the *City of Wenatchee Comprehensive Water System Plan Volume 2 – Regional Facilities*.

Table 2.14 Land Area (acres) per Pressure Zone (acres)

Pressure Zone	Total Area	Undeveloped Area *	Developed Area	Future Annex	Buildout Total
965 N	1,300	600	700	350	1,650
965 S	2,930	650	2,280	0	2,930
1170	2,271	500	1,771	0	2,271
1292	1,600	500	1,100	0	1,600
1350	520	300	220	400	920
1494	4,929	2,800	2,129	1,000	5,929
1594	780	250	530	1,000	1,780
1768	133	29	104	1,200	1,333
Total	14,463	5,629	8,834	3,950	18,413

* Includes only that area that is reasonably developable.

Table 2.15 shows currently developed land density and estimated future developed density based on historical development and current land use planning. The City of Rock Island is not included in these areas. Should future conditions warrant supply to Rock Island from the District, it will be re-evaluated at that time. Likely the rate of supply to Rock Island would need to be constrained to the average rate of the maximum day demand (MDD) and not allow peaking off of the District.

Table 2.15 Development Density

Pressure Zone	No. ERUs 2012	Developed Area (ac)	Existing ERU/acre	* Fill-in ERU/acre
965 N	195	700	0.28	1.0
965 S	3,673	2,280	1.61	3.4
1170	3,122	1,771	1.76	3.4
1292	2,196	1,100	2.00	3.4
1350	98	220	0.45	1.0
1494	661	2,129	0.31	1.0
1594	576	530	1.09	3.4
1768	290	104	2.79	3.4

* Assumed future developed density for currently undeveloped land

The estimated fill-in density of 3.4 ERUs per acre is obtained from the City of East Wenatchee’s 2012 land use capacity analysis.

Growth pattern estimates for the District are based on County projections, knowledge of undeveloped areas that are currently in the planning stages, planning within the Urban Growth Area, and review of buildable lands not currently in the planning stages. Full buildout development is defined as all land built out to logical densities. Buildout density might be unrealistically high, but provides a reference point for estimating long-term service needs. **Table 2.16** shows ADD ERU projections totals through the 5-, 10-, 20-, and 40-year and fall buildout development periods.

Table 2.16 ERU Growth Projections

Pressure Zone	2012	2015	2025	2030	2035	Buildout
Overall growth/year *		1.17%	1.37%	1.34%	1.30%	n/a
Population	32,740	33,884	39,204	41,768	44,116	
965 N	195	202	233	248	287	1,145
965 S	3,673	3,803	4,382	4,671	4,910	5,883
1170	3,122	3,232	3,725	3,970	4,071	4,822
1292	2,196	2,274	2,620	2,793	2,935	3,896
1350	98	101	117	125	131	798
1494	661	684	789	841	965	4,461
1594	576	596	687	733	849	4,826
1768	290	300	346	369	388	4,469
Total ERUs	10,811	11,193	12,899	13,749	14,536	30,300

* County Population Growth projection

For these projections, it is assumed that the proposed annexation areas of **Table 2.14** will not be incorporated into the service area until after 2035. The City of Rock Island is also not included in these tables.

Table 2.17 takes the ERU projections from the previous table and multiplies them by the demands per ERU found in Table 2.11. Table 2.17 shows the anticipated growth in water demand for the District by pressure zone. These demands assume the same rate of DSL seen today and do not account for conservation.

Table 2.17 Supply Projections

Pressure Zone	Average Day Demand (gpd)					
	2012	2015	2025	2030	2035	Buildout
965 N	51,457	53,277	61,395	65,441	75,864	302,142
965 S	1,166,963	1,208,242	1,392,353	1,484,114	1,559,819	1,869,111
1170	962,416	996,459	1,148,299	1,223,976	1,254,883	1,486,473
1292	520,629	539,045	621,185	662,123	695,898	923,666
1350	14,789	15,313	17,646	18,809	19,768	120,428
1494	209,800	217,222	250,322	266,819	306,325	1,415,915
1594	356,186	368,786	424,981	452,989	525,138	2,984,298
1768	101,385	104,971	120,967	128,939	135,516	1,562,237
Total	3,384,000	3,503,000	4,037,000	4,303,000	4,573,000	10,664,000

Pressure Zone	Maximum Day Demand (gpd)					
	2012	2015	2025	2030	2035	Buildout
965 N	111,789	115,744	133,381	142,171	164,815	656,405
965 S	1,863,158	1,929,063	2,223,013	2,369,517	2,490,386	2,984,198
1170	1,580,084	1,635,975	1,885,265	2,009,510	2,060,253	2,440,475
1292	774,948	802,360	924,624	985,559	1,035,833	1,374,862
1350	28,357	29,360	33,834	36,064	37,903	230,907
1494	344,275	356,452	410,769	437,840	502,667	2,323,463
1594	977,040	1,011,600	1,165,748	1,242,575	1,440,485	8,186,103
1768	274,257	283,958	327,228	348,793	366,585	4,226,014
Total	5,954,000	6,165,000	7,104,000	7,572,000	8,099,000	22,422,000

Pressure Zone	Peak Hour Demand (gpm)					
	2012	2015	2025	2030	2035	Buildout
965 N	200	207	239	254	295	1,174
965 S	1,980	2,050	2,362	2,518	2,647	3,171
1170	1,765	1,827	2,105	2,244	2,301	2,725
1292	865	896	1,033	1,101	1,157	1,535
1350	55	57	65	70	73	446
1494	665	689	794	846	971	4,489
1594	1,990	2,060	2,374	2,531	2,934	16,673
1768	580	601	692	738	775	8,937

ERU demand calculations are only valid for ADD and system-wide supply, since that is how they have been derived. ERUs can be used to project yearly total system supply, but are not useful for determining intra-zone supply and storage requirements as the demand per ERU per zone and land use varies throughout the District. It is also not practical to use a single ERU demand value for MDD because of the widely differing irrigation use patterns. For example, MDD per ERU for the 1594 zone is 1,700 gpd, while an ERU in the 1350 zone is 290 gpd. For this reason, current demands multiplied by growth projections for Table 2.17 have been used.

The District has established six-year conservation goals as outlined in **Chapter 4**. The forecast water system demands based on the conservation goals in **Chapter 4** are presented in **Table 2.18**.

Table 2.18 Conservation Supply Projections

Pressure Zone	Average Day Demand (gpd)					
	2012	2015	2025	2030	2035	Buildout
965 N	51,457	53,170	60,474	64,132	74,195	294,588
965 S	1,166,963	1,205,825	1,371,468	1,454,432	1,525,503	1,822,383
1170	962,416	994,466	1,131,075	1,199,497	1,227,276	1,449,311
1292	520,629	537,967	611,867	648,880	680,588	900,574
1350	14,789	15,282	17,381	18,433	19,333	117,417
1494	209,800	216,787	246,567	261,483	299,586	1,380,517
1594	356,186	368,048	418,606	443,929	513,585	2,909,690
1768	101,385	104,761	119,152	126,360	132,535	1,523,181
Total	3,384,000	3,496,000	3,977,000	4,217,000	4,473,000	10,398,000

Pressure Zone	Maximum Day Demand (gpd)					
	2012	2015	2025	2030	2035	Buildout
965 N	111,789	115,512	131,380	139,328	161,189	639,995
965 S	1,863,158	1,925,205	2,189,668	2,322,127	2,435,598	2,909,593
1170	1,580,084	1,632,703	1,856,986	1,969,320	2,014,927	2,379,463
1292	774,948	800,755	910,754	965,848	1,013,044	1,340,491
1350	28,357	29,301	33,326	35,342	37,070	225,135
1494	344,275	355,740	404,607	429,083	491,609	2,265,376
1594	977,040	1,009,577	1,148,262	1,217,723	1,408,794	7,981,450
1768	274,257	283,390	322,319	341,817	358,520	4,120,364
Total	5,954,000	6,152,000	6,997,000	7,421,000	7,921,000	21,862,000

Pressure Zone	Peak Hour Demand (gpm)					
	2012	2015	2025	2030	2035	Buildout
965 N	200	207	235	249	288	1,145
965 S	1,980	2,046	2,327	2,468	2,588	3,092
1170	1,765	1,823	2,074	2,199	2,250	2,657
1292	865	894	1,017	1,079	1,131	1,497
1350	55	57	64	68	72	435
1494	665	687	782	829	950	4,377
1594	1,990	2,056	2,339	2,480	2,869	16,256
1768	580	599	682	723	758	8,714

Demands are forecast to increase after allowances for conservation by 18 percent in the year 2025. Water supply may be required to provide nearly 7 million gpd on a maximum day in 2025. The water system must have the capability to hydraulically distribute and transmit more than 9,000 gallons per minute (gpm) to meet peak hour demands plus fire flow of as much as 4,000 gpm minute.

SYSTEM ANALYSIS

INTRODUCTION

This chapter presents East Wenatchee Water District (District) performance standards for infrastructure, as well as the evaluation of the performance of the water system facilities to meet current and future water demands based on adopted design standards, which are included at the beginning of this chapter. This evaluation addresses facilities, including source of supply, water treatment, storage, transmission, and the distribution system. A summary of system deficiencies is presented as well as alternatives to correct the deficiencies.

1. SYSTEM DESIGN AND PERFORMANCE STANDARDS

The District has adopted design and construction standards for all new construction. All District and developer constructed projects are required to be designed and constructed to these standards. The District adopts the most current versions of the following agency and organizational standards for minimum requirements.

- Washington State Department of Health (DOH) – *Water System Design Manual* (DOH Design Manual)
- Washington Administrative Code (WAC) – Chapter 246-290
- Revised Code of Washington (RCW)
- American Public Works Association (APWA) Standards
- Washington State Department of Transportation Standard Specifications for Road, Bridge and Municipal Construction and APWA Supplement
- American Water Works Association (AWWA) Standards
- International Building Code (IBC) and International Plumbing Code (IPC)

The following sections describe District standards of performance that may either not be addressed or exceed those listed in the above standards.

Water Quality

1. Protection of the well fields of Well Nos. 4, 5, and 7 shall be per the Douglas County (County) Wellhead Protection Plan and WAC 246-290-135.
2. Water quality criteria shall meet at a minimum, the requirements of WAC 246-290-300, 246-290-310, 246-290-320, 246-290-451, and 246-290-480.
3. Coatings and additives in contact with drinking water shall be compliant with National Sanitation Foundation International (NSF) 61.

4. The quality of the water source supplied to the District's system shall continuously meet the primary and secondary drinking water standards of the State of Washington and Safe Drinking Water Act.

Average and Maximum Daily Demands

1. Demand sizing shall comply with WAC 246-290-221.
2. The system shall provide for a maximum day demand (MDD) of approximately 1.8 times the average day demand (ADD).
3. The capacity of the source of supply, booster pump stations, and transmission mains shall be sufficient to meet MDD and to replenish storage used during a fire within 72 hours after a fire or other emergency. The supply system should be capable of meeting these criteria with the largest supply source out of service, or any other combination of failure that is considered reasonable that has an effect on supply sizing, locating or planning.

Peak Hour Demand

1. Demand sizing shall comply with WAC 246-290-221.
2. Each pressure zone shall be capable of providing, through supply and storage, the peak hour demand (PHD) of that pressure zone, without need for outside or emergency supply.

Storage

1. Storage sizing shall comply with WAC 246-290-222 and 246-290-250.
2. Storage within the distribution system must be of sufficient capacity to supplement transmission supply when peaking demands are greater than the supply rate (equalizing storage) and still maintain sufficient storage for a fire or other emergency condition.
3. Under normal operating conditions, equalizing storage should be replenished within 24-hour cycle.
4. Equalizing storage must be stored above the elevation which yields a 30 pounds per square inch (psi) pressure to any customer meter.
5. Fire flow storage must be stored above the elevation which yields a 20 psi pressure to any customer meter.
6. Standby storage is in reserve to meet demands during an emergency such as supply failure due to pipeline breakage. Standby requirements are based on delivering the average day demand to each connection for 2 days less supply capacity, or 200 gallons per equivalent residential unit (ERU), whichever is greater.
7. Standby storage volume must be replenished in 72 hours while continuing to deliver MDD per service connection.
8. Nesting of standby and fire flow storage may be allowed in existing reservoirs pending approval of the District Commissioners but will not be allowed in new reservoirs.
9. Sizing of new reservoirs will consider, though not require, current fire flow standards for "grandfathered" facilities.
10. Sufficient emergency storage must be provided so that should a fire occur, the supply capacity from the reservoirs will be sufficient to fight the fire while meeting the average rate of the maximum day demand.

Fire Flow Rate and Duration

1. Fire flow rate and duration as established by the Douglas County Fire Marshal shall be the design basis for sizing system improvements including supply storage and distribution.
2. The following documents are used to establish minimum standards: *AWWA Distribution System Requirements for Fire Protection*; Insurance Services Office *Fire Suppression Rating Schedule*; Washington State DOH *Group A Public Water Systems*.
3. Facilities will be designed to provide fire flow while maintaining at least 20 psi in the distribution system and positive pressure in dedicated transmission mains.
4. Facilities will be designed to provide fire flow while the system is experiencing the average rate of the maximum day demand.

Fire flow shall be provided through the domestic water system to meet Washington State and Douglas County Fire District minimum standards. **Table 3.1** indicates minimum fire flow capacity by land use area as obtained from Douglas County Fire District No. 2. These values are intended to be used as planning values for typical types of construction within these land uses, but may not be requirements that must be currently met. The District is not required to provide the fire flows calculated by the Washington Survey and Rating Bureau. However, meeting these fire flows will improve the insurance rating of a building as well as the overall rating of the water system.

Table 3.1 Fire Flow Goal by Land Use

Land Use Description	Flow (gpm)	Duration (min)	Storage Req'd (gal)
Dryland Agriculture	0	0	0
Commercial Agriculture 5	0	0	0
Commercial Agriculture 10	0	0	0
Neighborhood Commercial	1,500	120	180,000
Planned Commercial	2,500	120	300,000
Tourist Recreation Commercial	2,500	120	300,000
Central Business District	4,000	240	960,000
General Industrial	4,000	240	960,000
High Density Residential	2,500	120	300,000
Medium Density Residential	2,500	120	300,000
Low Density Residential	1,000	120	120,000
Rural Resource 2	0	0	0
Rural Resource 5	0	0	0
Rural Resource 20	0	0	0

The District will endeavor to provide this capacity in the appropriate land use area. However, there may be individual buildings or developments that exceed the typical requirements of the local land use. In these cases, the District will usually require that those developments provide the infrastructure improvements necessary to meet their additional fire flow needs. When such improvements provide benefit to the District as a whole, the District may elect to share the costs of the improvements.

Table 3.2 shows the seven existing buildings with the highest fire flow requirements by current standards. It is important to note that most of these buildings were constructed when standards are lower than today's and the current fire flow standards listed may not be available through the existing water system. These facilities are typically grandfathered under the fire code, but provide a reference point for system capacity needs.

Table 3.2 Fire Flow for Existing Facilities

Building	Flow (gpm)	Duration (hrs)	Storage Req'd (gal)	Zone
Eastmont High School	2,500	3.0	450,000	1170
Old Eastmont Junior High School	4,000	4.0	960,000	965
Inn on the River	4,000	4.0	960,000	965
Kenroy Elementary School	3,500	3.0	630,000	1292
Valley Mall	4,000	4.0	960,000	965
CMI at Pangborn Airport	4,000	2.0	480,000	1494
R. E. Lee Elementary School	3,500	3.0	630,000	965

Pressure

1. Pressure design criteria shall comply with WAC 246-290-222, 246-290-230, 246-290-420.
2. The District shall endeavor to provide a minimum of 35 psi at customer meters during normal demand conditions and 30 psi during PHD, not including a fire or emergency.
3. The District shall endeavor to provide a maximum of 150 psi at system meters during normal demand conditions, not including pressure surges. Individual customers are responsible for providing pressure reducing valves at their service when pressure exceeds 80 psi.
4. During a failure of any part of the system, the maximum pressure shall not exceed the normal pressure rating of the weakest components, generally 200 psi.

Pipe Size

1. Pipe size criteria shall comply with WAC 246-290-230.
2. The desired velocity of water in transmission and distribution mains should be less than 5 feet per second (fps) during peak demand periods.
3. Under emergency conditions, such as a fire, the desired velocity in the water mains shall be less than 8 fps. On a case-by-case basis, reviewed by the District Manager, velocity of up to 10 fps may be allowed in short lengths of new ductile iron (DI) mains.
4. Headloss per 1,000 feet of pipeline in zones supplied by pumps should not exceed 10 feet.
5. Where practical, distribution mains shall be looped to increase reliability and decrease head losses.
6. Minimum size for all water mains shall be 8 inches except, at the discretion of the District, where the water main is permanently dead ended with no future potential for extension, is less than 300 feet in length, and does not include a fire hydrant.
7. Minimum size for mains in commercial and industrially zoned areas shall be 12 inches. The District may reduce this to 8 inches depending on potential for growth, type of structures, and general character of the area.

8. Ten 10-inch and 14-inch-diameter DI pipe is not allowed as these are not common sizes and repair and replacement materials are expensive and often not readily available.
9. In the Urban Growth Area (UGA), 12-inch or larger mains should be used on the principal streets and for all lines that are not connected to other mains at intervals close enough for proper mutual support.

Telemetry System

1. Control must be capable of optimizing the operation of the water system's components in response to reservoir levels, system pressures, abnormal system conditions, electrical power rate structure, and water costs.
2. The Master Telemetry Unit (MTU) shall record and save all incoming data for future review and analysis.
3. Pump stations and reservoirs shall each have a Remote Telemetry Unit (RTU) that monitors and displays local sensor and device status data and communicates with the MTU.
4. RTUs shall include backup power, surge and lightening protection, and be easily capable of expansion for additional input and output signals.
5. RTUs shall be programmed by an integrator of the District's choice. Preprogrammed "package" control units are not allowed.

Backup Power Requirements

1. Given the historical reliability of power supply to the service area, permanent backup power at open-zone facilities is typically not required.
2. Reliability standards per WAC 246-293-660 shall be followed.
3. Closed zone pump stations shall have permanent backup power installed on site with an automatic transfer switch.
4. All new pump stations shall include provisions for connecting a portable engine generator to run the facility in the event of a power failure. Equipment shall meet the District's standards.
5. All RTUs shall include an automatic battery backup.

Valve and Hydrant Spacing

1. Zone valves shall be located at all pressure zone interfaces to allow future pressure zone re-alignment without the need for additional pipe construction.
2. 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.
3. Typically, valves shall be placed at a maximum of 1,000-foot intervals.
4. Combination air/vacuum release valves shall be placed at all high points or "crowns" in all pipelines.
5. Hydrant spacing shall be approved by the Fire District. Typical spacing shall be 600 feet for residential areas and within 250 feet of the building envelope for light commercial and multi-family.
6. Hydrant spacing for other facilities shall be determined by the Fire District.
7. Hydrants shall be located at street intersections whenever possible.

8. Length of hydrant runs from the mainline to the hydrant shall not exceed 80 feet.

2. WATER QUALITY

Source Quality

The District's water source is the Wenatchee Regional Water System (Regional Water System). Since all source water supply is under the ownership of the Regional Water System, all source water quality testing is performed by the City of Wenatchee. Operations and monitoring of the source's water quality is described in the *City of Wenatchee Comprehensive 2012 Water System Plan Volume 2 – Regional Facilities* (2012 Regional Plan).

Distribution System Water Quality

The District is required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, disinfection by-products (DBPs), and lead and copper in accordance with Chapter 245-290 WAC. These requirements and procedures are summarized in the following.

The District has been in compliance with all monitoring requirements since 2006. A summary of the results of the distribution system water quality monitoring within the system is presented in the following sections.

Coliform Monitoring

Water samples collected within the distribution system have not tested positive for coliform since 2006. The District maintains a permanent disinfecting residual to ensure the absence of coliform bacteria at all times. The District collects 30 coliform samples per month from different locations throughout the system.

Disinfectant Residual Concentration Monitoring

Disinfection requirements applicable to the District are contained in WAC 245-290-310, which state 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 milligrams per liter (mg/L) for chlorine and chloramines. In 2012, the District's free chlorine residual throughout the distribution system averaged 0.32 mg/L.

Disinfectants/Disinfection By-products Monitoring

Trihalomethanes (THMs) and five 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 THM and HAA5 are dependent on such factors as amount and type of chlorine used,

water temperature, concentration of precursors, pH, and chlorine contact time. THMs have been found to cause cancer in laboratory animals and are suspected to be human carcinogens. The most recent samples for THM and HAA5 were taken in 2011 and comply with this regulation.

Lead and Copper Monitoring

The U.S. Environmental Protection Agency (EPA) Lead and Copper Rule identifies the action level for lead as being greater than 0.015 mg/L and the action level for copper as being greater than 1.3 mg/L. The results of the tests from September 2011, which included 30 sample sites, indicated a range of less than 0.0005 mg/L to 0.0029 mg/L for lead and a range of 0.0163 mg/L to 0.959 mg/L for copper in the District's system. Results have all been satisfactory, since the 90th percentile concentration of either lead or copper from each group of samples has not exceeded the action levels.

3. WATER SYSTEM FACILITY EVALUATION

This section presents the result of the analysis and evaluation of the system facility components to meet the current and future demands as forecasted by the City of East Wenatchee and County comprehensive plans. The analysis focuses on providing consistency and concurrency with the adopted comprehensive plans. The analysis of each component of the system is discussed as follows.

Source of Supply

Regional Supply

Water supply is from the Regional Water System. Capacity of that well field is sufficient to supply the projected needs of the District for the current planning period and beyond.

The current regional agreement states that the District may utilize any unused capacity of the 30-inch regional transmission main until such time that the City of Wenatchee and Chelan County Public Utility District (PUD) No. 1 require the full capacity to meet their demands. When this occurs, additional transmission must be constructed to provide the District's supply. Per the 2012 Regional Plan, it is projected that the existing pumps and pipeline from the Regional Well field will not reach capacity until sometime after 2030. Options for increasing long-term Regional supply are currently being evaluated in a separate study under contract with the City of Wenatchee.

The Regional Supply Station was built in 2001 and is in excellent operating condition. This facility can be expected to perform without significant maintenance for at least another 25 years. The station contains three 965 zone pumps all controlled with variable speed drives. The pump data is shown in **Table 3.3**. There is space to add a second 400 horsepower (hp) pump. The current installed capacity is 6,100 gpm (8.8 million gallons per day (MGD)) maximum, though capacity could increase if transmission limitations are resolved. The 400 hp pump could potentially produce more than 7,500 gpm (10.8 MGD) if future system conditions reduced total dynamic head (TDH) by a sufficient amount. This pump should be constrained to produce no more than 7,000 gpm to protect against motor overload and cavitation. This can be accomplished relatively easily in the variable frequency drive (VFD) control panel and telemetry system. For the same reasons, the 200 hp pumps should be constrained to never produce more than 4,300 gpm.

Capacity available from the Regional Supply Station is essentially limited by transmission capacity. The 24-inch main built in 2001 connects the Regional System to the District's distribution system at 19th Street and Cascade Avenue. From there, the water passes through the distribution system to the reservoirs at 15th Street nearly 2 miles away and to the Pearcot Reservoir over 4 miles away. The 24-inch main can convey up to 7,500 gpm (10.8 MGD) at 5 fps velocity. However, high supply rates create unacceptably high pressure in the distribution system, essentially limiting current flow to around 5,500 gpm (7.9 MGD).

In 2013, two new pumps were installed to supply the 1170 Zone. This is a closed pressure zone currently supplied by PRVs. The Carmichaels Reservoir and Booster Pump Station were removed for construction of the extension of Eastmont Avenue, requiring a replacement pump station to meet fire flow requirements. A 75 hp, 1,500 gpm fire pump was installed. Also, a 30 hp, 350 gpm jockey pump was included to increase system efficiency by reducing reliance on the PRV stations.



Regional Supply Station 965 Zone Pumps



Regional Supply Station 1170 Zone Pumps

Wells

The only wells remaining in service are Well Nos. 4, 5, and 7. Ownership of the wells was transferred to the Regional Water System after the Regional Supply Station was put online.

Wells Nos. 4 and 5 electrical systems and piping were upgraded in 1995. The flow meters failed in 2003 due to moisture in the electronics and were replaced in 2004. The transmission mains between these wells and 4th Street SE are steel and well over 50 years old. Although no significant problems with these mains have yet occurred, they may be near the end of their life expectancy.



Wells 4 and 5

Well No. 7 was constructed in 1993 and is in good condition. This facility is expected to operate without significant maintenance for at least another 20 years. Well 7 discharges into a 40-year-old steel main in Cascade Avenue, which has performed adequately to the time of this writing.

Baker Flats

Water supply to the Baker Flats Industrial water system used to operate independently of the remainder of the District's system and was supplied directly from the Regional Water System. Baker Flats was integrated into the District's system in 2010. A 1.5 million (MG) concrete reservoir, a control valve station and 3 miles of pipeline were installed. The system was design to provide between 2,500 gpm and 4,000 gpm fire flow.

Booster Pump Station Supply

Pump capacity for the booster pump stations are shown in **Table 3.3**.

Table 3.3 Existing Pump Station Capacity

Pump Station	Pump No.	Capacity		Date Installed	Age (yrs)	Power hp
		Rated gpm	Actual gpm			
Regional Supply ***	1	5,200	future			400
	2	5,200	5,800	2001	13	400
	3	3,500	3,800	2001	13	200
	4	3,500	3,800	2001	13	200
	2 & 3	6,100	7,000	combined pumps		
	3 & 4	5,800	6,000	combined pumps		
		6,100	7,000	System Supply Total		
1170 (at Regional)	5	1,500	1,500	2013	1	75
	6	350	350	2013	1	25
5th & Grover	1	1,250	1,320	1999	15	150
	2	1,250	1,320	1999	15	150
	3	1,250	1,320	1999	15	150
	1 & 2	2,150	2,300	combined pumps		
	1,2,3	2,700	2,950	combined pumps		
15th Street (Shop)	1	1,700	1,670	2005	9	200*
	2	1,700	1,670	2005	9	200*
	3	1,700	future			200*
	1 & 2	3,000	3,100	combined pumps		
		5,500	4,770	1170/1286 Supply Total		
Grant & Nile	1	1,000	1,000	1999	15	100
	2	1,000	1,050	1999	15	100
	3	1,000	future			100
	1 & 2	1,900	1,970	combined pumps		
		1,900	1,970	1490 Supply Total		
Daniels Drive	1	950	910	2010 **	4	100
	2	950	910	2010 **	4	100
	1 & 2	1,800	1,740	combined pumps		
		1,800	1,740	1592 Supply Total		
Canyon Hills	1	320	190	1998	16	25
	2	320	255	1998	16	25
	1 & 2	600	430	combined pumps		
		600	430	1768 Supply Total		

* Can be upgraded to 250 hp in the future

** The station was built in 1987, the pumps were replaced in 2001 and 2010

*** Capacity is variable depending on the Regional Wellfield status and can be ±500gpm per pump

1170 / 1292 Zones

The 1292 zone is fed directly from the 5th and Grover and the 15th Street booster pump stations. The 1170 zone is pressure reduced from 1292 and supplied by the 1170 Zone pumps. The 5th and Grover station was built in 1999 with three identical pumps for a maximum capacity of 2,900 gpm (4.2 MGD). Space has been provided for installation of a small chlorinator if it becomes necessary. Transmission is through a 12-inch DI main feeding the distribution system and the 10th Street reservoirs.



5th and Grover Booster Pump Station

The original 15th Street booster pump station was built in 1949 and is located on top and within the Shop Reservoir 2A. The station was decommissioned in 2006 and replaced with the new 15th Street BPS.

The new 15th Street booster pump station completed in 2006 has two variable speed pumps installed and room for a future third. This station was designed to accept higher capacity 250 hp pumps in the future. Installed capacity is 3,000 gpm (4.3 MGD) with potential capacity of approximately 5,000 gpm (7.2 MGD). Maximum capacity will likely be transmission limited. Space has been provided for installation of a small chlorinator if it becomes necessary. Transmission is through a 12-inch DI main, which quickly branches into the distribution system ultimately feeding the Daniels Drive and 10th Street reservoirs. Both the 15th Street and 5th and Grover stations are new and expected to be in service for at least 25 years.



New 15th Street Booster Pump Station

The Carmichaels Booster Pump Station was constructed in 1997 with a 7.5 hp domestic variable speed pump and 100 hp diesel driven fire pump. This station and reservoir (overflow 1014) were connected to the 1170 Zone with the reservoir fed through an altitude valve. The pump station was decommissioned in 2013 in conjunction when Eastmont Avenue was constructed through the site.

The Pearcot Booster Pump Station, built in the 1950s, was removed in 2013.

1494 / 1350 Zones

The Grant and Nile Booster Pump Station pumps out of the 1292 Zone into the Veedol 1494 reservoir. The 1350 zone is pressure reduced from the 1494 reservoir. The Grant and Nile Booster Pump Station was built in 1999 with two 1,000 gpm pumps and room for a third in the future. Current capacity is 1,900 gpm (2.7 MGD), with potential for 2,500 gpm (3.6 MGD), though it is not expected that this maximum capacity will be needed for the foreseeable future, if ever. A small chlorinator was installed in 2009. The station pumps directly into the distribution system. The station is in excellent condition and expected to operate reliably for at least 25 years.



Grant and Nile Booster Pump Station

The Daniels Drive Booster Pump Station was built in 1987. The original capacity was approximately 600 gpm total, but was upgraded with new 3,600 rotations per minute (rpm) pumps in 2001 to 1,700 gpm (2.4 MGD). The pumps wore out and were replaced again in 2010 with an estimated capacity of 900 gpm each, or 1,700 gpm combined. It may not be economically practical to increase capacity of this booster pump station further, as it would require all new electrical systems and piping, including replacement of piping beneath the floor. The entire facility is in reasonably good structural and operating condition. There are no discharge pressure gauges or transmitters. The flow meter is located in a buried vault outside of the station.



Daniels Drive Booster Pump Station

1768 Zone

The Canyon Hills Booster Pump Stations, built in 1998, pumps out of the Fancher Heights 1594 reservoir and into the Canyon Hills 1768 reservoir. The station was originally built for closed zone operation but was converted to open zone after the addition of the Canyon Hills reservoir in 2001. The closed zone control logic was abandoned along with the small jockey pumps and the station now runs solely on reservoir setpoints controlling the two 25 hp pumps. Capacity for each pump is rated at 320 gpm, but currently recorded as 190 gpm and 255 gpm, though the pumps are identical models. The pumps have not been removed for inspection to determine why they are underperforming, though it is likely the impellers are worn. The combined capacity is 430 gpm (0.6 MGD). The station is otherwise in satisfactory condition and expected to operate reliably for at least 25 years. There is sufficient space inside the station and the transmission piping is sized such that station capacity could be increased in the future by installing larger pumps. However, such expansion would require significant plumbing modifications within the station and a new electrical system.



Canyon Hills Booster Pump Station

Water Treatment

The District currently obtains its water from the Regional Water System, which has chlorination facilities installed at the source. The 2012 Regional Plan contains further discussion of source treatment. If an unusual situations occurred during some high demand periods, the District can contact City of Wenatchee to operate the standby wells to supplement supply.

On May 28, 1996, the District entered into a bilateral compliance agreement with DOH to provide for chlorination of its water system. Negative coliform testing during 1995 dictated that a chlorine residual be maintained at all times in the water system. Hypochlorite injection systems have been installed at Wells Nos. 4, 5, and 7. Since these wells are on standby, the chlorination systems are mothballed until the wells are needed.

A permanent operational chlorination facility is located at the Baker Flats reservoir. The reservoir is relatively remote from the system and large compared to the local demands, which can result in a reduction of chlorine residual. A chlorine monitor constantly checks chlorine levels. Injection and circulation pumps add and mix chlorine when needed.

Water Storage Facilities

Useable storage is that volume of water above the outlet pipe and below the lead pump stop point. Given the short height of the District's tanks (30 feet and less) dead storage due to ground elevation and minimum service pressure is not relevant. Useable storage is available for operational, equalizing, fire flow, and standby components.

Table 3.4 Existing Storage Capacity

Reservoir Name	No.	Overflow Elev	Year Built	Age (yrs)	Type	Inside Dia (ft)	Floor Elev (ft)	Min Wtr Elev (ft)*	Pump Start (ft)	Pump Stop (ft)	Useable Volume (gal)
15th St (Shop)	2A	964.9	1949	65	Conc	54	947.5	947.7	961.2	963.9	278,320
15th St (Shop)	2B	964.9	1963	51	Conc	66	945.3	945.3	961.2	963.9	475,985
Pearcot	5A	963.3	1952	62	Conc	42	940.3	942	961.2	962.3	210,372
Pearcot	5B	963.3	1979	35	Conc	80	940.3	942	961.2	962.3	763,253
Baker Flats	11	965.0	2010	4	Conc	95.5	930	932	961.0	964.0	1,714,546
965 Zone Storage Total											3,442,476
10th Street	6A	1291	1949	65	Conc	54	1273.6	1273.8	1288.3	1291.3	300,590
10th Street	6B	1292.5	1959	55	Conc	66	1273	1273	1288.3	1291.3	468,308
Daniels Drive	7	1292.3	1984	30	Steel	75	1261.3	1262.3	1288.3	1291.3	958,325
1170/1292 Zone Storage Total											1,727,223
Veedol	8	1494	1980	34	Steel	75	1463.0	1464	1489.5	1493.5	974,848
1494 Zone Storage Total											974,848
Fancher Heights	9	1594	1987	27	Steel	75	1563	1564	1591.5	1593.5	974,848
1594 Zone Storage Total											974,848
Canyon Hills	10	1768.0	2001	13	Steel	55	1740	1741	1764.5	1767.5	470,938
1768 Zone Storage Total											470,938

* Refers to floor elevation or outlet pipe elevation, whichever is higher.

965 Zone

The District's lowest gravity storage comes from the two 15th Street, two Pearcot reservoirs, and the Baker Flats reservoir. Physical data on these tanks can be found in **Table 3.4**. Total useful storage in the zone is 3.4 MG. There may be room on the east end of the District's 15th Street site for construction of new storage in the future. There is not room on the Pearcot site for construction of new storage without demolition of the existing tank(s). A visual evaluation of each tank was performed for the prior District's Comprehensive Water System Plan (Plan) with the following results.

15th Street 2A Reservoir: The internal concrete structure appears sound. No cracking or spalling of the concrete is visible. A new stainless steel ladder was installed in 2005. The original floor joint seals had deteriorated and were replaced in 2005. The tank is entirely buried so no external structure evaluation can be performed. The overflow is badly corroded and should be replaced. The supply piping was completely replaced in 2005.

15th Street 2B Reservoir: Internal and external structure (where visible) appears sound. No cracking in the concrete is apparent and the floor joints appear in good shape. There is no overflow for this tank as the overflow for 2A serves both tanks. The supply piping was completely replaced in 2005. It is expected that this tank's useful life will extend beyond this planning period.



15th Street 2B Reservoir: Exposed during 2005 Pipe Replacement

Pearcot 5A Reservoir: An internal inspection has not been performed. The external structure appears in good condition. All external supply and drain piping was replaced in 2000. It is expected that this tank's useful life will extend beyond this planning period.



Pearcot 5A Reservoir

Pearcot 5B Reservoir: An internal inspection has not been performed. The structure has a significant number of external circumferential cracks, but they are not leaking. A number of small leaks have occurred and been repaired in the last 15 years. One small weep has recently surfaced on the top of the foundation and should be fixed. The external supply and drain piping was replaced in 2000. The remaining useful life of this tank is somewhat suspect and a more detailed evaluation of the internal structure may be warranted.



Pearcot 5B

1014 Zone

Carmichaels Reservoir: The reservoir was decommissioned in 2013, though it is still in place. The site was sold to Douglas County. The 1014 Zone no longer exists.



Carmichael's Reservoir Site

1170/1292 Zone

Storage for these zones is held at the 1292 elevation from the Daniels Drive and 10th Street reservoirs. Total useful storage is 1.7 MG. There is sufficient land on the 10th Street site to build additional storage in the future, however significant excavation would need to occur because of the moderately steep grade across the site. It is unlikely that additional storage could be cost effectively built adjacent to Daniels Drive due to the steep slopes. Construction of a new 10th Street reservoir is expected to begin in 2015.

Daniels Drive Reservoir: The 30-year-old steel structure appears sound. However the exterior paint is chalking and past its useful life and should be scheduled for repainting. An interior inspection was not performed. The useful life of this tank is expected to extend beyond this planning period if it is properly maintained.



Daniel's Drive Reservoir

10th Street 6A Reservoir: The 65-year-old roof had significant weather damage and was repaired in 2001 by applying a foam covering. An internal inspection has not been performed. The supply, drain, and overflow piping were replaced in 1999. The exterior coating is peeling near the ground line, but appears to be only an aesthetic problem. Given problems with the District's older concrete tank floors, the long-term useful life of this tank is unknown. The tank will be replaced in 2015 to 2016.



10th Street 6A Reservoir

10th Street 6B Reservoir: A portion of the floor of this tank cracked and dropped approximately 4 inches sometime prior to 2002, resulting in leakage beyond what is acceptable for a concrete tank. The ringwall was rebuilt to stabilize the tank. An interior spray-applied flexible polyurea coating was applied in 2008 to prevent further leakage. A new stainless steel ladder was installed with the liner to replace the old corroded steel ladder. The feed and overflow piping were replaced in 1999. Given the leakage

problems with this tank and proximity to residences, either a new repair method is recommended or replacement of this tank within 10 years should be considered. The tank will be replaced in 2015 to 2016.



10th Street Tank 6B Reservoir Internal Coating

1494 Zone

Veedol (Pangborn) Reservoir: The Veedol Reservoir is the sole storage for the 1494 zone and contains useful storage of 0.97 MG. No internal inspection was performed. The steel structure appears sound, through the paint is in need of touch up in numerous places. The joint between the ringwall and floor plate and the space under the floor plate are common locations for corrosion or collection of debris and should be inspected regularly. The expected useful life of this tank is beyond this planning period, if it is well maintained. The unreliable solar power equipment was removed in 2013 and replaced with utility power.



Veedol Reservoir

1594 Zone

Fancher Heights Reservoir: The Fancher Heights Reservoir is the sole storage for the 1594 Zone and contains useful storage of 0.97 MG. No internal inspection was performed. The steel structure appears sound, through the paint is in need of touch ups in numerous places. The joint between the ringwall and floor sheet and the space under the floor plate are common locations for corrosion or collection of debris and should be inspected regularly. A new drainage pond was constructed in 2004. The expected useful life of this tank is beyond this planning period if it is well maintained.



Fancher Heights Reservoir

1768 Zone

Canyon Hills Reservoir: The Canyon Hills Reservoir is the sole storage for the 1768 zone and contains useful storage of 0.47 MG. The site was designed for installation of a second equal or slightly larger sized tank in the future. The tank was built in 2001 and is in excellent condition. The paint system should last at least another 10 years before needing recoating.



Canyon Hills Tank

Reservoir Water Turnover

Water turnover is important to maintain adequate chlorine residual and mitigate temperature variations. Water turnover in the reservoirs can be very roughly estimated by taking the total zone storage and dividing by the zone demand plus the wheeling supply. Estimated turnover rates are shown in **Table 3.5**.

Table 3.5 Reservoir Water Turnover

Pressure Zone	Storage (gal)	Winter Day Demand			Average Day Demand			Maximum Day Demand		
		Zone demand (gpd)	Wheeling (gpd)	Turnover Rate (days)	Zone demand (gpd)	Wheeling (gpd)	Turnover Rate (days)	Zone demand (gpd)	Wheeling (gpd)	Turnover Rate (days)
965 N	1,714,546	28,800	0	59.5	51,457	0	33.3	111,789	0	15.3
965 S	1,727,930	849,600	1,426,320	0.8	1,166,963	2,165,206	0.5	1,863,158	3,978,960	0.3
1292	1,727,223	1,123,200	303,120	1.2	1,483,045	682,161	0.8	2,355,032	1,623,928	0.4
1494	974,848	187,200	0	5.2	224,590	0	4.3	372,632	0	2.6
1594	974,848	82,800	33,120	8.4	356,186	101,385	2.1	977,040	274,257	0.8
1768	470,938	33,120	0	14.2	101,385	0	4.6	274,257	0	1.7

The Baker Flats, Canyon Hills and Veedol Reservoirs have a very long turnover period due to the low customer demands. A rechlorination facility was built with the Baker Flats Reservoir, and the water level is periodically drawn down to refresh the water.

If water quality becomes a problem, chlorination facilities can easily be added to the booster pump stations. The District can also enact a flushing program, if necessary. As growth progresses, the turnover rates in these tanks should improve. Water turnover can be more accurately predicted using hydraulic modeling, though this has not been performed except on the Baker Flats reservoir.

Distribution System

The District’s system generally combines transmission and distribution in the same pipelines. The one notable exception is the 24-inch main from the Regional Water System to 19th Street. Though currently connected to the distribution system at three locations, it behaves essentially as dedicated transmission. A detailed breakdown of the type, length, diameter, and age of the pipes in the District can be found in **Chapter 1**. **Charts 3.1** and **3.2** show system-wide percentages of pipe length by material and by age.

Chart 3.1 Pipe Length by Material

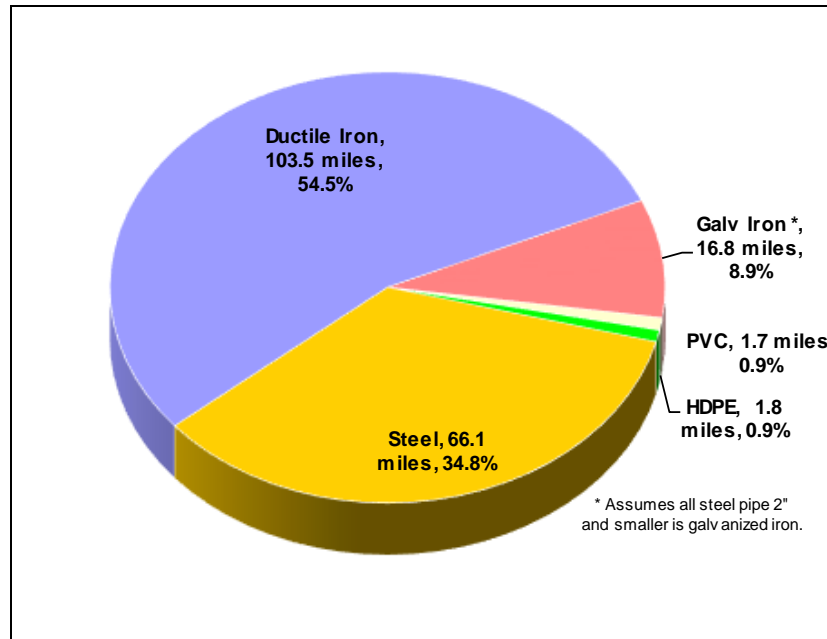
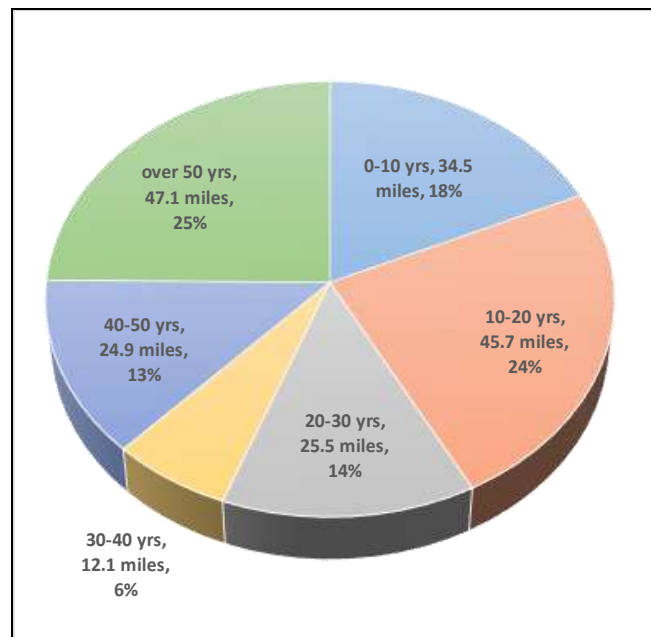


Chart 3.2 Pipe Length by Age



Roughly one third of the distribution system is steel and more than 40 years old. The life of steel pipe in the District Water System is dependent on many factors, including:

- Care during installation to protect material and coating;
- Whether or not there is an exterior and/or interior coating;
- Soil moisture and type;
- Coarseness of the bedding material; and
- Thickness of the steel.

It is virtually impossible to classify any of the older distribution system by these factors, as records from original installation are limited or, more commonly, non-existent. Some old mains exposed during construction have not shown any significant aging and appear nearly new, while others are badly corroded and leaking. The District switched from steel to ductile iron pipe in 1984.

The majority of the original service lines were built of galvanized iron. Due to the high rate of leakage of these lines, the District eventually changed to copper. Since the early 1990s, all new services are polyethylene pipe. As distribution pipelines are replaced, the old service lines are also replaced with polyethylene.

Leak Characteristics

Leaks may come from many sources; corroded pipe and fittings, unrevealed damage during construction, seismic (rare), illegal connections, and aged gaskets are typical culprits. In the District, the most common leak sources are corroded pipe and service lines. A single leak event is typically repaired in place with a note to the condition of the existing pipe. If multiple leaks occur in the same area, the pipeline is scheduled for replacement.

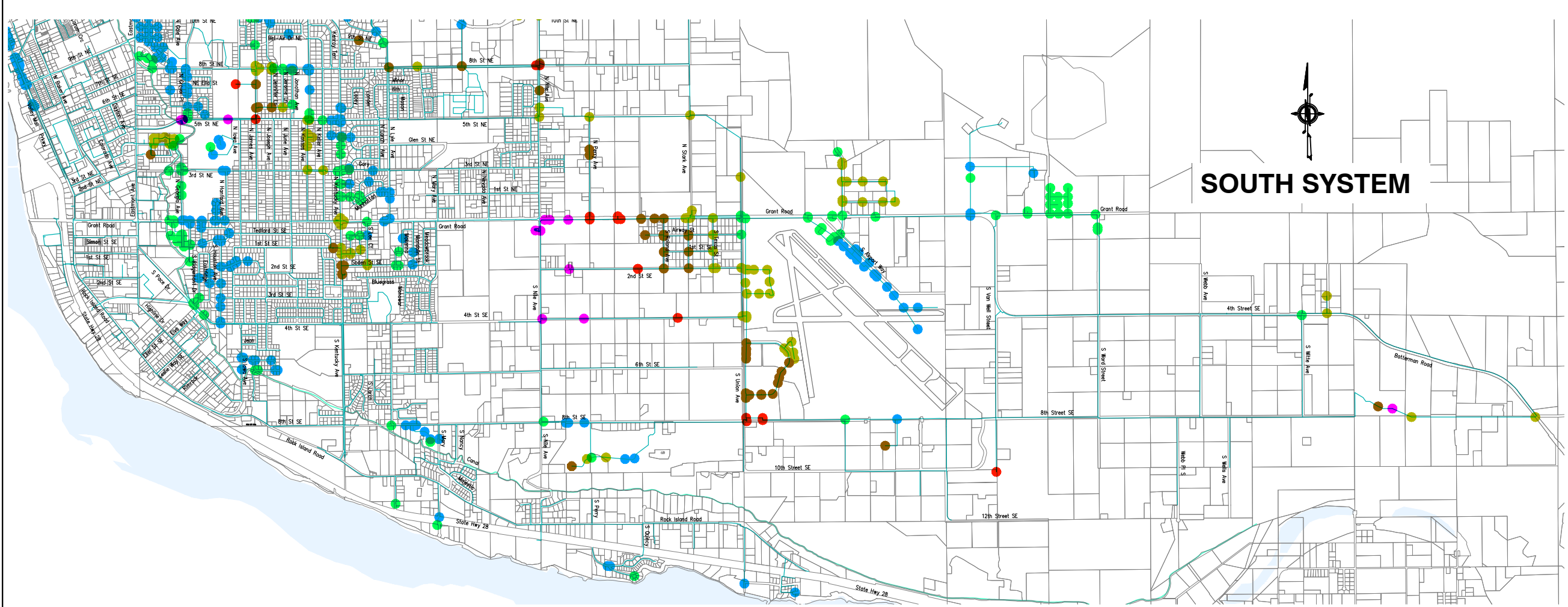
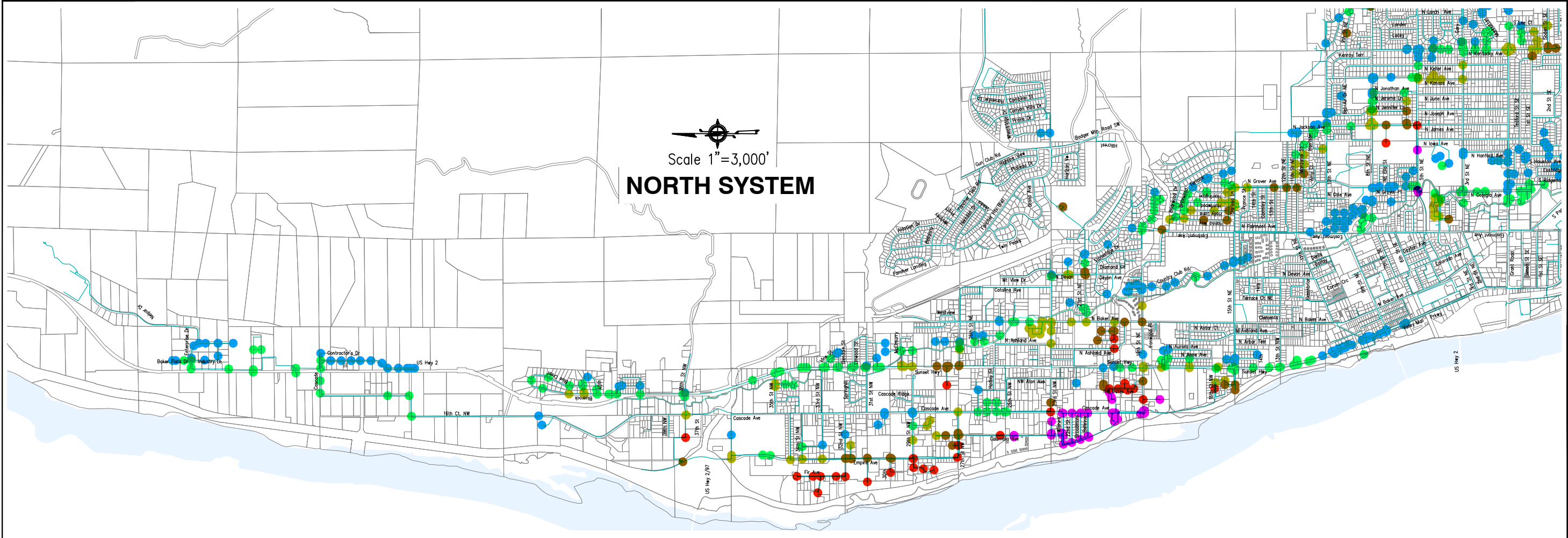
Pressure Zones

The District’s pressure zones have been established to maintain reasonable pressure ranges throughout the distribution system. The 965 Zone is bounded by the Columbia River and Wenatchee Reclamation District canal. The 1170 Zone was established as recommended in an earlier comprehensive plan to alleviate the low pressure areas of 965 and high pressure areas of 1292. The 1292 Zone is bounded on all sides by other pressure zones. The 1494, 1594, and 1768 zones are essentially constrained to the current service area boundary, though topological constraints are also relevant. There is one small pressure reduced zone at 1350. **Table 3.6** shows the pressure zones with the elevation and service pressure ranges.

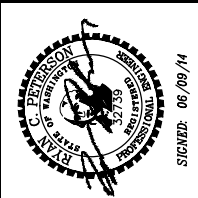
Table 3.6 Service Pressure Range

Zone	Elevation (ft)		Static (psi)	
	Max	Min	Min	Max
965 N	834	647	57	138
965 S	890	635	32	143
1170	1,087	715	36	197
1292	1,230	860	27	187
1350	1,156	988	84	157
1494	1,316	1,050	77	192
1594	1,472	1,261	53	144
1768	1,585	1,470	79	129

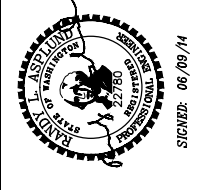
Many areas of the District have very high pressure, between 150 and 200 psi. These areas can be seen graphically on **Figure 3-1**. There is only one location where service pressure is below 30 psi. This is on the east end of Daniels Drive (**Figure 3-2**). Three customer meters experience between 25 and 30 psi. This will be discussed later in this chapter.



- Pressure
- 120–130 psi
 - 131–140 psi
 - 141–150 psi
 - 151–160 psi
 - 161–170 psi
 - > 170 psi



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**East Wenatchee Water District
2014 Comprehensive Water System Plan**

**FIGURE 3.1
HIGH PRESSURE AREAS**



ENGINEER RCP	DATE	DESCRIPTION	BY	REVIEW
REVIEWED RCP				
SCALE: SHOWN				
DRAWING IS FULL SCALE WHEN BAR MEASURES 2"				
DWG NO.	SHEET NO.			
3.1	3.1			

2013.121

CLIENT: EWWD

DATE: Jun 3, 2014

ENGINEER RCP

REVIEWED RCP

DWG NO.

213.121

CLIENT: EWWD

DATE: Jun 9, 2014

ENGINEER RCP

REVIEWED RCP

DWG NO.

213.121

CLIENT: EWWD

DATE: Jun 9, 2014

ENGINEER RCP

REVIEWED RCP

DWG NO.

213.121

CLIENT: EWWD

DATE: Jun 9, 2014

ENGINEER RCP

REVIEWED RCP

DWG NO.

213.121

CLIENT: EWWD

DATE: Jun 9, 2014

ENGINEER RCP

REVIEWED RCP

DWG NO.

213.121

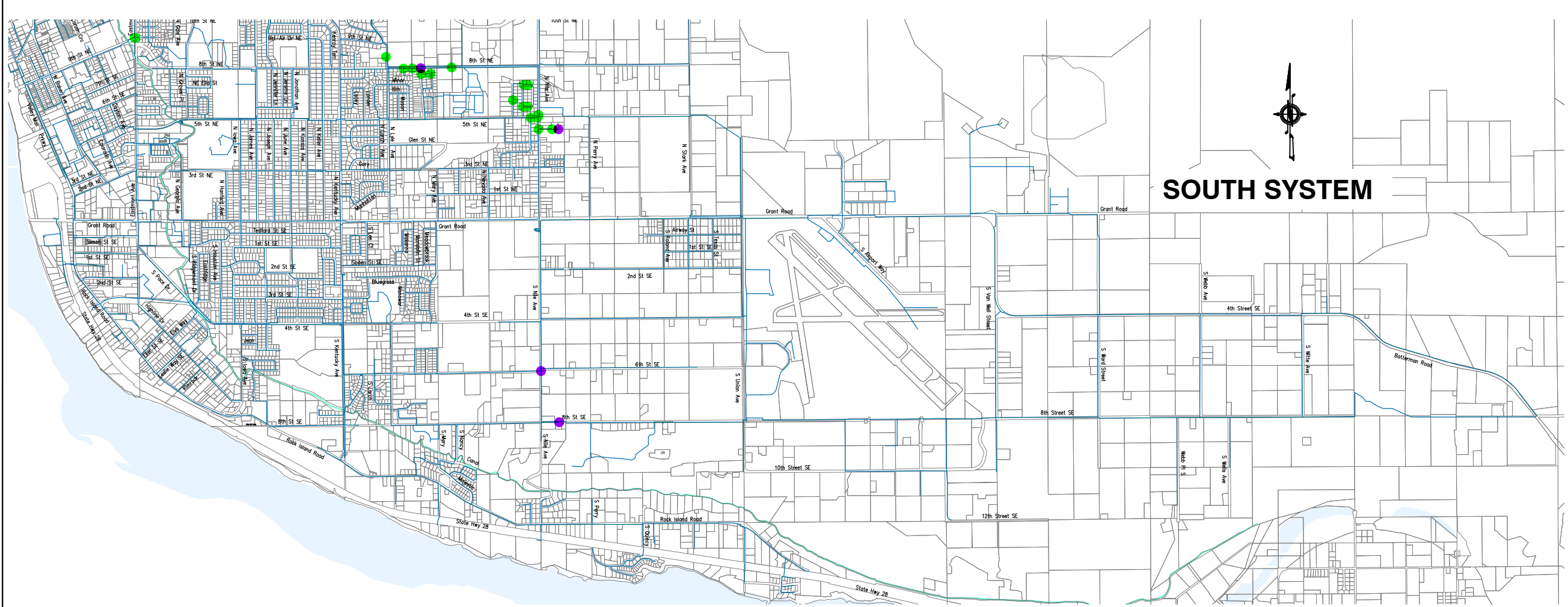
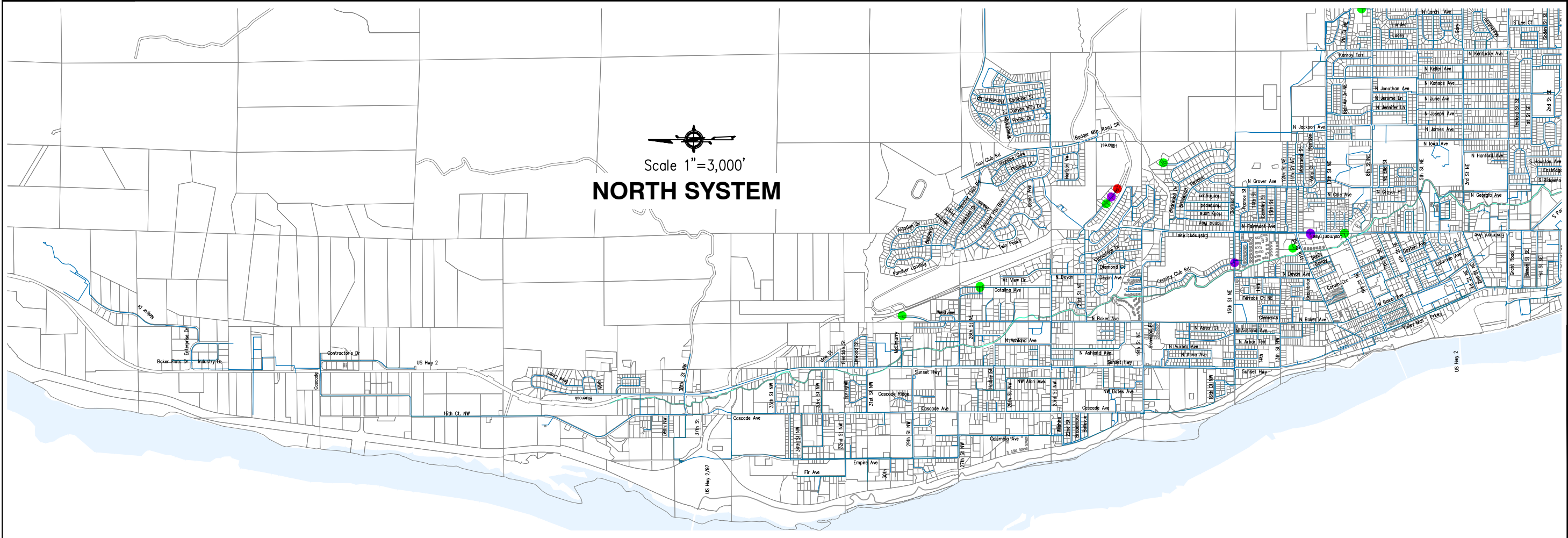
CLIENT: EWWD

DATE: Jun 9, 2014


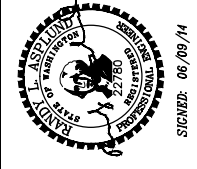

ENGINEER RCP


REVIEWED RCP

DWG NO.



- Pressure
- < 30 psi
 - 31-35 psi
 - 36-40 psi

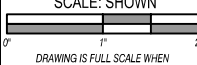


East Wenatchee Water District
2014 Comprehensive Water System Plan

FIGURE 3.2
LOW PRESSURE AREAS

ENGINEER	DATE	REVISION	DESCRIPTION	BY	DATE

SCALE: SHOWN



DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO. 3.2 SHEET NO. 3.2

Dead End Mains

In any water system that has been in existence for decades there are going to be numerous dead end mains. Topological and political boundaries also result in unavoidable dead end mains. The District’s policy is to require that all new mains be looped, unless it is physically impractical. For mains that will remain dead end indefinitely, a fire hydrant or permanent blow off is required at the end of the main. Because some dead end mains have very low customer demands, some hydrants and blow offs are placed on the District’s regular maintenance schedule for flushing. Where water quality concerns (taste, color, etc.) occur, mains will either be looped or a blow off installed and added to the flushing schedule.

Pipeline Replacement Program

The District actively pursues replacement of old distribution mains. Mains will be replaced when concurrent with other projects, such as road reconstruction, transmission for a pump station, and also when repeated leakage in an area warrants replacement. When pipelines are replaced, so are the connecting service lines, meter boxes, and setters. The District has averaged more than 6,000 feet of pipe replacement per year since 2006. **Table 3.7** shows pipe installation projects funded by the District. Developer projects are not included.

Table 3.7 Pipe Installation by Year

	Location	Diameter inch	Length feet		Location	Diameter inch	Length feet	
2006	Badger Mt Rd, Valley View to North	8	1,500		2010	Grant, Eastmont to Valley Mall	12	1,700
	Eastmont, 15th to 19th	8	2,100			31st, SR28 to Vine	8	1,000
	Baker, 5th NE to Standerfer	12	1,000			Westview, Baker to Baker	8	700
	Total		4,600			Total		2,700
2007	SR28 Hadley to 27th	8	1,400	2011	Bluegrade, east of SR28	2	900	
	SR28 27th to McElmurry	12	1,700		11th, Alfred to Baker	12	600	
Total		3,100	5th NE, Kentucky to Lyle		8	1,200		
2008	Rock Island Rd, McGee to 3rd SE	12	1,200		Keller, Kansas to 8th NE	8	1,000	
	Kansas, 5th NE to 8th NE	8	1,200		Kent, Keller to 2nd SE	8	1,000	
	Gilmore, Grant to 1st SE	8	600	Total		4,700		
	1st SE, Gilmore to Houston	8	500	2012	Easement, RSS to 38th	12	1,900	
Total		3,500	Glendale, SR28 to Vine		8	700		
2009	Nelpar Drive to Reservoir	12 & 16	2,200		1st SE, Houston to Iowa	8	700	
	Cascade, Empire to Baker Flats	12	14,500		Nevada, Grant to 1st NE	8	300	
	N. Baker, 23rd to 27th	12	2,700		Fairview, 10th NE to north	8	400	
	35th NE, Cascade to Alfred	8	900	Total		4,000		
	38th St, SR28 to Cascade	12	500	2013	Eastmont, 1st to 9th	12, 16, 18	4,200	
Total		20,800	5th NE, Nile to Perry		8	1,500		
			Total			5,700		

Table 3.8 shows an estimated length of pipe installed by developers per year.

Table 3.8 Developer Installed Pipe

Year	Length ft
2006	30,800
2007	14,900
2008	7,500
2009	3,600
2010	5,600
2011	3,100
2012	4,300
2013	11,100

Pressure Monitoring

The District monitors system pressure in real-time at each modern pump station. All but one station include pressure transmitters on the suction and discharge side of the pumps. These transmitters give an indication of zone pressure. Reservoir levels are also monitored and logged in the telemetry system. When the District receives a complaint, or is concerned about pressure in an area, they are able to install a battery operated pressure recorder anywhere in the system to log data for review.

System Mapping

The District maintains an ESRI ArcInfo graphical information system (GIS) form of its water system. Visible structures are located using the global positioning system (GPS). The District's hydraulic model is regularly kept up to date as system improvements are built. The model contains relevant physical data for all system components, but is not intended for locating facilities in the field.

4. WATER SYSTEM ANALYSIS

Source Capacity Analysis

System supply consists of the Regional Supply Station and inter-zone booster pump stations. **Table 3.9** shows the existing supply rate available compared to the MDD for this planning period. The term "wheeling" refers to water that is transmitted through the pressure zone to serve upper pressure zones. Supply to each pressure zone must be sufficient to meet the needs of its zone plus those supplied, or "wheeled," through the zone. Also included in the supply evaluation is the capacity needed to refill the zone storage used in an emergency event over the course of 3 days.

Table 3.9 Supply Capacity (gpm)

	2012	2015	2025	2030	2035	Buildout
1768 Zone MDD	190	197	227	242	255	2,935
FF Storage Refill	21	21	21	21	21	21
Canyon Hills Supply	190	190	190	190	190	190
1768 Surplus	(21)	(28)	(58)	(73)	(85)	(2,766)
1594 Zone MDD	679	703	810	863	1,000	5,685
FF Storage Refill	21	69	69	69	69	69
Wheeling MDD	190	197	227	242	255	2,935
Daniels Drive Supply	910	910	910	910	910	910
1594 Surplus	20	(59)	(196)	(265)	(414)	(7,779)
1350/1494 Zone MDD	259	268	309	329	375	1,774
FF Storage Refill	111	222	222	222	222	222
Grant & Nile Supply	1,000	1,000	1,000	1,000	1,000	1,000
1494 Surplus	630	510	469	449	402	(996)
1170/1292 Zone MDD	1,635	1,693	1,951	2,080	2,150	2,650
FF Storage Refill	146	146	146	146	146	146
Wheeling MDD	1,128	1,168	1,346	1,434	1,630	10,393
Grover/Shop/1170 Supply	4,320	4,320	4,320	4,320	4,320	4,320
1170/1292 Surplus	1,411	1,313	877	660	394	(8,869)
965S Zone MDD	1,294	1,340	1,544	1,645	1,729	2,072
FF Storage Refill	222	222	222	222	222	222
Wheeling MDD	2,841	2,941	3,389	3,613	3,895	13,499
Regional Supply	5,800	5,800	5,800	5,800	5,800	5,800
965S Surplus	1,443	1,297	645	319	(46)	(9,993)
965N Zone MDD	78	80	93	99	114	456
FF Storage Refill	222	222	222	222	222	222
Cascade FCV Supply	300	300	300	300	300	300
965N Surplus	0	(3)	(15)	(21)	(37)	(378)

The supply rate available assumes the largest individual pump supplying any pressure zone is out of service. The current District source capacity is expected to be sufficient to supply the needs through roughly 2030. Sometime after 2030, additional capacity may be required at the Regional Supply Station, or a secondary source provided. The additional supply may consist of adding another 400 hp pump in the spare space in the existing station. Regional supply is partially limited where the 24-inch transmission main connects to the distribution system at 19th Street. By extending the transmission main further south into the District, more water may be supplied by the Regional Supply Station due to a reduction in friction loss.

According to the City of Wenatchee 2012 Regional Plan, the capacity in the 30-inch Regional main may be reached near the year 2020, though more recent demand forecasts imply a later date. When this capacity is reached, a supplemental source of water for the District will be required. A number of options are currently being reviewed by the Regional Water System partners. Some of those options include:

- Adding a second parallel Regional transmission main.
- Adding a fifth well at the Regional well field.
- Supplying Regional water directly to Baker Flats.
- Upgrading the existing backup wells to be used for normal operations.

- Constructing a new Regional source at a new location.

A final decision on long-term supplemental supply is expected in late 2014 or 2015.

Additional supply may also be necessary for the 1594 and 1768 Zone within 4 years. Until additional supply to 1594 is constructed, any new development in Fancher Heights beyond currently approved developments may not occur. For the 1594 Zone, it is likely that a new booster pump station will be required, as the Daniels Drive Booster Pump Station might not be able to be upgraded cost effectively. The Canyon Hills Booster Pump Station could be upgraded with larger or rebuilt pumps.

An apparent supply surplus refers only to the ability to move enough water to supply the pressure zone as a whole. Given the expected continued expansion of the District, it is likely that some new developments cannot be practically served with existing pumping facilities due to transmission or topological constraints. An example of this is the land northeast of 10th Street NE and Kentucky Avenue. Even though the 1494 Zone as a whole has sufficient supply capacity, supply to this currently unimproved area is limited by transmission capacity and a new booster pump station may be the most economical method of providing supply.

Storage Capacity Analysis

Water storage facilities provide a source of supply to meet demands in excess of the MDDs and to provide operational storage and an emergency source of supply for situations such as fire or failure of a supply source. In this section, all components of storage are evaluated for each pressure zone. These storage components are operational, equalizing, fire flow, and stand-by storage. The demands shown in the following tables have assumed the 6-year conservation goals outlined in **Chapter 4** have been achieved.

Operational Storage is the volume required to operate the supplying pump station. The volume is defined between the lag pump start and lead pump stop reservoir levels. **Table 3.10** shows the operational storage requirements for the District. The District uses between 10 and 20 percent of storage for operations depending on reservoir height and time of year.

Table 3.10 Operational Storage

Reservoir Name	No.	Inside Dia (ft)	Gal per ft depth	Operating Range (ft)	Operational Storage (gal)
15th St (Shop)	2A	54	17,131	3.5	59,958
15th St (Shop)	2B	66	25,591	3.5	89,567
Pearcot	5A	42	10,363	3.5	36,271
Pearcot	5B	80	37,599	3.5	131,595
Baker Flats	11	95.5	53,579	3.5	187,528
961 Zone Storage Total					504,918
10th Street	6A	54	17,131	3.0	51,393
10th Street	6B	66	25,591	3.0	76,772
Daniels Drive	7	75	33,046	3.0	99,137
1170/1286 Zone Storage Total					227,301
Veedol	8	75	33,046	4.0	132,182
1490 Zone Storage Total					132,182
Fancher Heights	9	75	33,046	3.5	115,660
1592 Zone Storage Total					115,660
Canyon Hills	10	55	17,771	3.0	53,314
1768 Zone Storage Total					53,314

Standby Storage is the volume of storage required to supply demands if a portion of the supply is off line. It is calculated to be two times the average day demand less the supply rate with the largest source of supply (or pump) inoperative, but shall be no less than 200 gallons per ERU. **Table 3.11** shows the District's current and future standby storage needs.

Table 3.11 Standby Storage

	2012	2015	2025	2030	2035	Buildout
1768 Zone ADD (gpd)	101,385	104,971	120,967	128,939	135,516	1,562,237
Supply available (gpd)	273,600	283,958	327,228	348,793	366,585	4,226,014
530 gal/ERU minimum	153,700	159,137	183,386	195,472	205,443	2,368,358
1768 Standby (gal)	153,700	159,137	183,386	195,472	205,443	2,368,358
1594 Zone ADD (gpd)	356,186	368,786	424,981	452,989	525,138	2,984,298
Supply available (gpd)	1,310,400	1,310,400	1,492,976	1,591,368	1,807,070	12,412,117
Wheeling supply (gpd)	274,257	283,958	327,228	348,793	366,585	4,226,014
530 gal/ERU minimum	305,280	316,079	364,243	388,247	450,085	2,557,780
1594 Standby (gal)	305,280	316,079	364,243	388,247	450,085	2,557,780
1494 Zone ADD (gpd)	209,800	217,222	250,322	266,819	306,325	1,415,915
1350 Zone ADD (gpd)	14,789	15,313	17,646	18,809	19,768	120,428
Supply available (gpd)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	2,554,370
200 gal/ERU minimum	151,800	157,170	181,119	193,055	219,220	1,051,800
1350/1494 Standby (gal)	151,800	157,170	181,119	193,055	219,220	1,051,800
1292 Zone ADD (gpd)	520,629	539,045	621,185	662,123	695,898	923,666
1170 Zone ADD (gpd)	962,416	996,459	1,148,299	1,223,976	1,254,883	1,486,473
Supply available (gpd)	6,868,800	6,868,800	6,868,800	6,868,800	6,868,800	18,781,824
Wheeling supply (gpd)	1,623,928	1,681,371	1,937,578	2,065,271	2,347,640	14,966,487
200 gal/ERU minimum	1,063,600	1,101,222	1,269,027	1,352,660	1,401,204	1,743,600
1170/1292 Standby (gal)	1,063,600	1,101,222	1,269,027	1,352,660	1,401,204	1,743,600
965S Zone ADD (gpd)	1,166,963	1,208,242	1,392,353	1,484,114	1,559,819	1,869,111
Supply available (gpd)	8,352,000	8,352,000	8,352,000	8,352,000	8,352,000	22,422,426
Wheeling supply (gpd)	4,090,749	4,235,450	4,880,848	5,202,512	5,608,541	19,438,229
200 gal/ERU minimum	734,600	760,585	876,483	934,246	981,902	1,176,600
965S Standby (gal)	734,600	760,585	876,483	934,246	981,902	1,176,600
965N Zone ADD (gpd)	51,457	53,277	61,395	65,441	75,864	302,142
Supply available (gpd)	432,000	432,000	432,000	432,000	432,000	656,405
200 gal/ERU minimum	39,000	40,380	46,533	49,599	57,499	229,000
965N Standby (gal)	39,000	40,380	46,533	49,599	57,499	229,000

The minimum standby storage requirement for the 1594 and 1768 zones has been set at 530 gallons per ERU. This higher value is justified for three reasons: 1) high historical water use in these zones; 2) no separate irrigation system; and 3) the area is currently served by only a single pump station, Daniels Drive. Were this station to be rendered temporarily inoperable for any reason, all domestic service would have to come from storage. Five hundred and thirty gallons per ERU is the current average daily use of the 1594 and 1768 zones. Since standby storage is directly tied to supply capacity, **Table 3.11** assumes that supply (as shown in the *Supply available* rows) will at least match MDD for each time period.

Equalizing Storage is the volume required to make up the difference between PHD and supply capacity with all installed supply capacity operational, not counting emergency supply sources. Equalizing storage is calculated by taking the difference between PHD and supply in gpm and multiplying by 150 minutes, per the DOH Design Manual. Also included is the wheeling (outbound) pump capacity that would be expected during PHD, which in some cases includes all installed pumping capacity (**Table 3.12**).

Table 3.12 Equalizing Storage

	2012	2015	2025	2030	2035	Buildout
1768 Zone PHD (gpm)	580	601	692	738	775	8,937
Supply available (gpm)	430	430	430	430	430	2,935
1768 Equalizing (gal)	22,500	25,577	39,303	46,144	51,788	900,370
1594 Zone PHD (gpm)	1,990	2,060	2,374	2,531	2,934	16,673
Wheeling supply (gpm)	430	430	430	430	430	2,935
Supply available (gpm)	1,740	1,740	1,740	1,740	1,740	8,620
1594 Equalizing (gal)	102,000	112,559	159,653	183,125	243,589	1,648,255
1494 Zone PHD (gpm)	665	689	794	846	971	4,489
1350 Zone PHD (gpm)	55	55	55	55	55	55
Supply available (gpm)	1,970	1,970	1,970	1,970	1,970	1,970
1350/1494 Equalizing (gal)	0	0	0	0	0	386,129
1292 Zone PHD (gpm)	865	896	1,033	1,101	1,157	1,535
1170 Zone PHD (gpm)	1,765	1,827	2,105	2,244	2,301	2,725
Wheeling supply (gpm)	2,740	2,861	3,297	3,514	3,780	13,043
Supply available (gpm)	4,770	4,770	5,661	5,790	5,860	13,239
1170/1292 Equalizing (gal)	90,000	122,091	116,026	160,348	206,683	609,701
965 S Zone PHD (gpm)	1,980	2,050	2,362	2,518	2,647	3,171
Wheeling supply (gpm)	4,770	4,770	4,933	5,258	5,624	15,571
Supply available (gpm)	7,000	7,000	7,205	7,435	7,589	15,311
965 S Equalizing (gal)	0	0	13,588	51,159	102,199	514,657
965 N Zone PHD (gpm)	200	207	239	254	295	1,174
Supply available (gpm)	300	300	300	300	300	300
965 N Equalizing (gal)	0	0	0	0	0	131,154

The DOH method of using all installed pumping capacity during PHD assumes a perfectly balanced system where all pumps can be active simultaneously. From computer modeling, it has been found that this is not the case for the 1292 Zone. The 5th and Grover Booster Pump Station will likely only run one pump during MDD and PHD for the foreseeable future. Because of this, supply available to the 1292 Zone for calculating equalizing storage (4,770 gpm) is less than all installed capacity (5,700 gpm). As can be seen in **Table 3.12**, the 1286, 1592, and 1768 Zones currently require equalizing storage because installed supply capacity is less than PHD. Since equalizing storage is directly tied to supply capacity, it has been assumed that supply (as shown in the *Supply* rows) will at least match MDD for each time period.

Fire Flow Storage is based on the maximum fire flow within the pressure zones served by the storage facility. Fire flow requirements are found in **Table 3.1** earlier in this chapter. It has been assumed that fire flow requirements for the 1494 Zone will increase by 2015 to ensure that sufficient storage is available to meet potential industrial development. Fire flow storage in the 1594 Zone is also increased in 2015 to 2,500 gpm for 2 hours under the assumption that a new elementary school will be built in Fancher Heights.

The total required storage capacity in each pressure zone is summarized in **Table 3.13**. The column labeled *Surplus (Deficit)* indicates the storage excess or shortfall in that pressure zone assuming that all storage required for a zone is only available within that zone.

Table 3.13 Storage Requirements

	Pressure Zone	Existing Capacity	Required Capacity (gal)				Surplus (Deficit)	Upper Zone Credited	
			Op/Dead	Fire	Standby	Equal			Total
2012	965N	1,714,546	187,528	960,000	39,000	0	1,186,528	528,018	768,018
	965S	1,727,930	317,391	960,000	734,600	0	2,011,991	(284,061)	(44,061)
	1170 / 1292	1,727,223	227,301	630,000	1,063,600	90,000	2,010,901	(283,677)	28,323
	1494	974,848	132,182	480,000	151,800	0	763,982	210,866	210,866
	1594	974,848	115,660	90,000	305,280	102,000	612,940	361,909	601,909
	1768	470,938	53,314	90,000	153,700	22,500	319,514	151,424	151,424
Total							684,479	1,716,479	
2015	965N	1,714,546	187,528	960,000	40,380	0	1,187,907	526,639	766,639
	965S	1,727,930	317,391	960,000	760,585	0	2,037,975	(310,046)	(70,046)
	1170 / 1292	1,727,223	227,301	630,000	1,101,222	122,091	2,080,614	(353,390)	(41,390)
	1494	974,848	132,182	960,000	157,170	0	1,249,352	(274,504)	(274,504)
	1594	974,848	115,660	300,000	316,079	112,559	844,297	130,551	363,462
	1768	470,938	53,314	90,000	159,137	25,577	328,028	142,910	142,910
Total							(137,839)	887,071	
2025	965N	1,714,546	187,528	960,000	46,533	0	1,194,060	520,486	760,486
	965S	1,727,930	317,391	960,000	876,483	13,588	2,167,461	(439,532)	(199,532)
	1170 / 1292	2,958,325	227,301	630,000	1,269,027	116,026	2,242,353	715,972	1,027,972
	1494	974,848	132,182	960,000	181,119	0	1,273,301	(298,453)	(298,453)
	1594	974,848	115,660	300,000	364,243	159,653	939,555	35,293	230,228
	1768	470,938	53,314	90,000	183,386	39,303	366,003	104,935	104,935
Total							638,701	1,625,636	
2030	965N	1,714,546	187,528	960,000	49,599	0	1,197,127	517,419	757,419
	965S	1,727,930	317,391	960,000	934,246	51,159	2,262,795	(534,866)	(294,866)
	1170 / 1292	2,958,325	227,301	630,000	1,352,660	160,348	2,370,308	588,017	900,017
	1494	974,848	132,182	960,000	193,055	0	1,285,238	(310,390)	(310,390)
	1594	974,848	115,660	300,000	388,247	183,125	987,032	(12,183)	163,825
	1768	470,938	53,314	90,000	195,472	46,144	384,930	86,008	86,008
Total							334,006	1,302,015	
2035	965N	1,714,546	187,528	960,000	57,499	0	1,205,027	509,519	749,519
	965S	1,727,930	317,391	960,000	981,902	102,199	2,361,491	(633,561)	(393,561)
	1170 / 1292	2,958,325	227,301	630,000	1,401,204	206,683	2,465,187	493,138	805,138
	1494	974,848	132,182	960,000	219,220	0	1,311,403	(336,555)	(336,555)
	1594	974,848	115,660	300,000	450,085	243,589	1,109,334	(134,486)	25,908
	1768	470,938	53,314	90,000	205,443	51,788	400,545	70,393	70,393
Total							(31,551)	920,843	
Buildout	965N	1,714,546	187,528	960,000	229,000	131,154	1,507,682	206,865	446,865
	965S	1,727,930	317,391	960,000	1,176,600	514,657	2,968,648	(1,240,718)	(1,000,718)
	1170 / 1292	2,958,325	227,301	630,000	1,743,600	609,701	3,210,602	(252,277)	(252,277)
	1494	974,848	132,182	960,000	1,051,800	386,129	2,530,111	(1,555,263)	(1,555,263)
	1594	974,848	115,660	300,000	2,557,780	1,648,255	4,621,695	(3,646,846)	(3,646,846)
	1768	470,938	53,314	90,000	2,368,358	900,370	3,412,042	(2,941,104)	(2,941,104)
Total							(9,429,343)	(8,949,343)	

The District has pressure reducing stations between all pressure zones which allow movement of water from upper zones to lower ones. As a result, it is practical to assume that storage in upper zones can be used to compensate for a shortfall in a lower zone for fire flow volume. Standby storage is assumed to be required in the zone it will be used and not available from upper zones. This is justified because an

emergency requiring the use of standby, such as a pump station failure, would likely require turning off upper zone pump stations to prevent robbing of water from the affected pressure zone. Under this scenario, all standby storage for a zone must be available within that zone. These assumptions are reflected in the last column of the above table labeled *Upper Zone Credited* where upper zone storage is used to supplement a deficit in the next lower zone. The supplemental storage available is calculated by taking the total storage and subtracting operational, standby and equalizing components. Hydraulic modeling was performed to determine how much flow could actually be transmitted through the PRVs during an emergency. The upper zone credited amount was reduced, when appropriate, to coincide with that modeled flowrate.

By 2015, the 1494 zone is shown as short of capacity only because the District intends to plan for industrial fire flow requirements that do not currently exist. This is also the case for the 1594 Zone, where a proposed school may increase fire flow requirements. Also by 2015, the 965 Zone storage becomes insufficient due to growth and the related standby and equalizing storage increases.

Physical Capacity Analysis

Overall system physical capacity can be evaluated looking at each individual system component and taking the most limiting factor. **Table 3.14** summarizes this analysis, which was performed on the system as a whole.

Table 3.14 Physical Capacity Analysis

Average Day Demand / ERU	313 gpd
Maximum Day Demand / ERU	551 gpd

Number of Service Connections (2012)

	Total MDD (gpd)	Total PHD (gpm)	Number of Connections	ERUs
Single Family	4,525,302	6,197	8,340	8,335
Multi-Family	709,886	972	582	1,289
Subtotal	5,235,188	7,169	8,922	9,624
Indus/Comm	606,886	632	462	1,220
Government	0	0	0	0
Agricultural	0	0	0	0
Other (irrig)	130,000	178	48	119
Unbilled	52,433	55	n/a	0
Subtotal	789,318	865	510	1,339
Total	6,024,507	8,251	9,432	10,963
DSL in ERUs	312,351	217	n/a	998

Specific Physical Capacity

Facility	Capacity Available	ERUs
Source	7,000 gpm	18,303
Treatment	7,000 gpm	18,303
Standby & Equalizing Storage	3,346,959 gal	13,784
Distribution	not applicable	
Transmission (5 fps in 24" main)	7,467 gpm	19,524
Total System Physical Capacity (minimum of values listed above)		13,784

This analysis is consistent with the previous text which shows the system can provide an adequate level of service to the current customers with the facilities that are in place. Distribution capacity is not considered relevant for this analysis. This is because any restrictions in the distribution system that are identified when new developments are proposed are required to be corrected prior to any such developments being approved. Capacity Rated Storage is the amount of storage available for both standby and equalizing. Available storage will be the first component that restricts the amount of new customers that can be added. This was also shown in **Table 3.13**, where a storage shortfall may occur by 2015 in some pressure zones. In the capital improvement plan, facilities or administrative practices are proposed that will ensure that system physical capacity will keep pace with anticipated growth.

Hydraulic Model Development

The entire water distribution, storage, and supply system was simulated in a single computer model to evaluate the hydraulic conditions within the system under a variety of demands. The model allowed the identification of system performance issues and the evaluation of alternative improvements to address these issues. A description of the development of the hydraulic model is discussed in the following paragraphs.

The computer model of the water system was created in Bentley Systems WaterCAD (Version V8i). The model includes all known existing pipelines (not service lines), regardless of size, in the District's system. Also modeled are pressure control valves, true pump curves, tank dimensions and operational controls. For the purpose of assuring accurate model results, sites that have two adjacent reservoirs are modeled as a single reservoir of equivalent volume because adjacent reservoirs typically cause modeling problems when the numerical engine tries to balance the two tanks.

Demands were allocated to each junction node of the model in proportion to the metered water consumption based on the demand analysis of **Chapter 2** for ADD and MDD. Uniformed demand factors are then applied to this metered consumption to simulate the distribution of demands at PHD. Demands are also modeled with 24-hour diurnal curves for use in Extended Period Simulations (EPS). Future demand increases were distributed based on assumed geographic distribution of future population increases.

Pipe lengths were entered into the model by overlaying an accurate street base map. Pipe diameter, material and age were taken from construction records and District maps. Where pipe material was unknown, it was assumed to be steel. When the age of the pipe was unknown the date of the map on which it first was shown was used. Hazen-Williams roughness coefficients were assigned to pipes based on common engineering values such as Table 5.2 of the 1995 CYBERNET User's Manual and 2002 Cameron Hydraulic Data. The range of Hazen-Williams "C" Factors used for the system are shown in **Table 3.15**.

Table 3.15 Modeling Friction Factors

Hazen-Williams Coefficient "C"		
Material	Older	Newer
Steel	60	110
Galvanized Iron	60	120
PVC	150	
HDPE	150	
Ductile Iron	130	140

Most pipes include a minor loss coefficient of approximately 0.1 to represent an open gate valve. Pipes containing significant valves or fittings, such as those within pump stations or pressure reducing stations, have minor losses added to represent the headloss of those items.

The model was recently updated using LIDAR elevation data on the NAVD 88 vertical datum. This reflects a change of approximately 4 feet from prior elevations, which were based on the NGVD 29 datum. These elevations are assumed to be accurate to within 5 feet.

Steady State Analyses (SSA) are used to determine system performance at a single point in time. Common uses for these analyses are to determine PHD pressure and perform fire flow analyses. EPS are used to investigate system performance over time. Such EPS may include evaluation of overall system response during MDD to review tank drawdown, pump runtimes, water velocity, and system restrictions that may not show up in a SSA.

To determine the validity of the model, runs were made to simulate field fire flow tests performed by the District staff and the local fire district. In the tests shown below, the margin of error ranged from 0 to 4 percent. Also, the performance of all new pumping facilities since 1995 have been compared with the predicted model results and have been found to be within the accuracy of the installed meters and gauges. However, the model has not been rigorously calibrated. For the purposes of this water system plan, this accuracy is considered adequate and no further calibration is proposed.

Table 3.16 – Past Model Comparisons

Location and date	Field test	Model test	Difference
Hind Bldg/Union Ave. March 17, 1997	134 psi static 1251 gpm @ 108 psi residual	136 psi static 1251 gpm @ 108 psi residual	1.5% 0.0%
Sr28/31 st St NE October 14, 2004	140 psi static 793 gpm @ 65 psi * 1045 gpm @ 110 psi **	135 psi static 793 gpm @ 65 psi * 1020 gpm @ 110 psi **	3.7% 0.0% 2.5%
SR28 south of Bluerock August 9, 2005	128 psi static 1874 gpm @ 20 psi	131 psi static 1880 gpm @ 20 psi	2.3% 0.3 %

* Carmichaels fire pump off.

** Carmichaels fire pump running.

A series of hydraulic analyses were performed to determine the available fire flow at each relevant node in the model under MDD conditions with the largest pump in each zone out of service and all fire flow storage depleted to represent the system near the end of the fire event. Minimum residual pressure during the fire flow analyses was set at 20 psi and minimum zone pressure established at 20 psi.

Hydraulic Analysis Results

Figure 3.3 represents the modeled fire flow currently available within the pipeline at each model node location while meeting minimum residual and system pressure constraints. These sites do not necessarily represent actual fire hydrant locations. The actual fire flow available to a site will depend on the number and location of hydrants installed. More than one hydrant is often required to maximize use of the fire flow available within the pipeline.

Figure 3.4 represents flow available while meeting the same constraints, but also including the District’s standard of 8.0 fps maximum velocity in the pipelines during a fire event. Velocity within pump stations and PRV stations is disregarded.

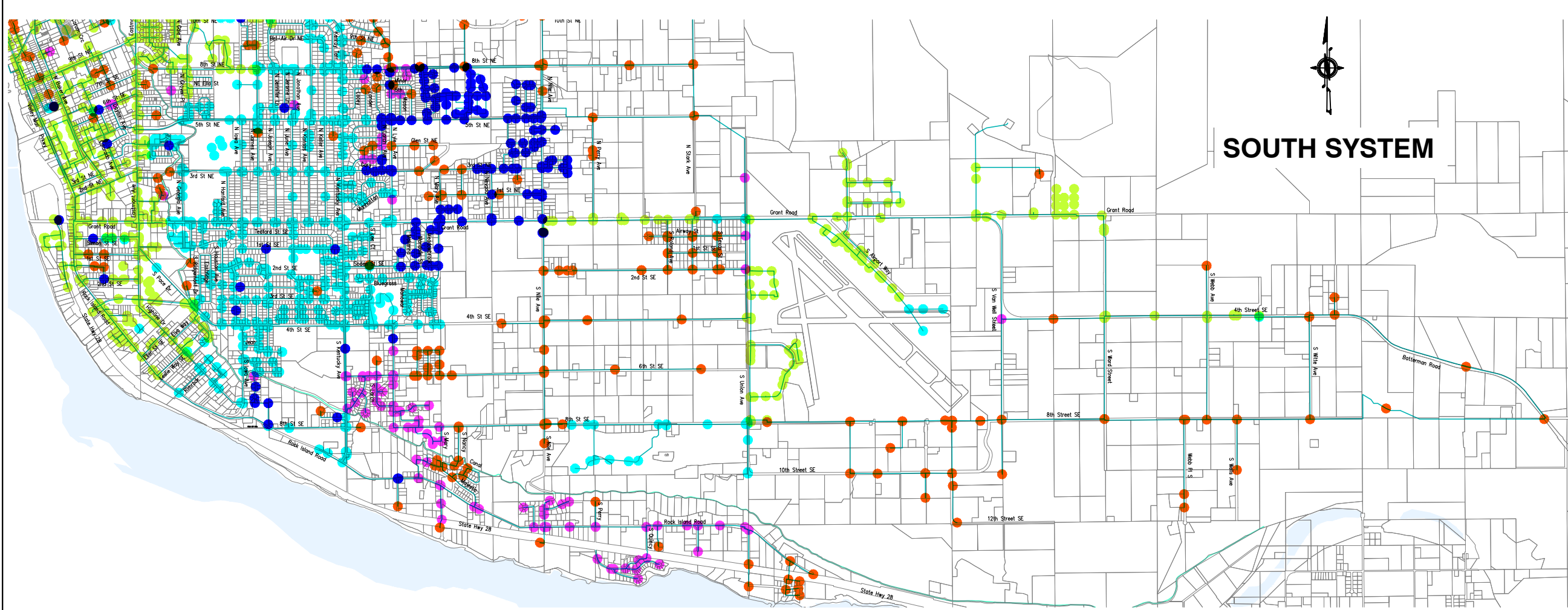
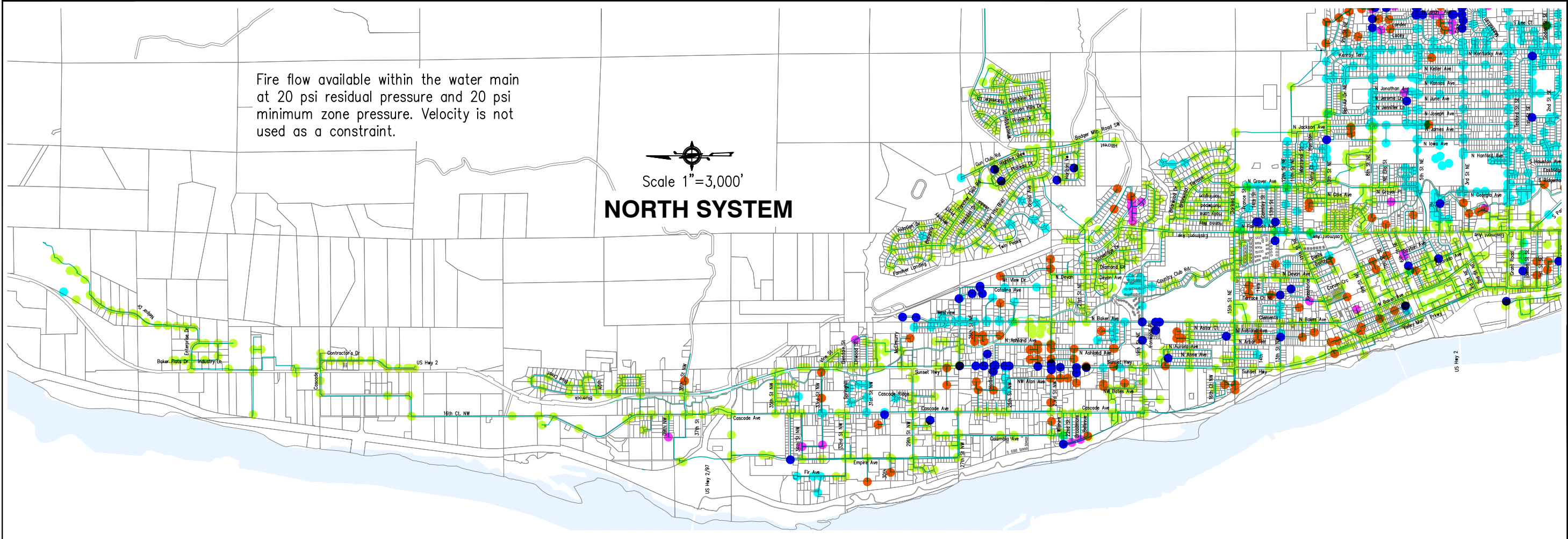
5. SYSTEM ISSUES

This section summarizes where the system may lack capacity as identified previously, provides alternatives, and evaluate those alternatives. Selection of preferred alternatives, prioritizing, and scheduling can be found in **Chapter 8**. Issues are classified in the following sections:

- Source and Supply
- Storage
- Transmission
- Pressure
- Fire Flow

Fire flow available within the water main at 20 psi residual pressure and 20 psi minimum zone pressure. Velocity is not used as a constraint.

Scale 1"=3,000'
NORTH SYSTEM



SOUTH SYSTEM

- Available Fire Flow
- < 750 gpm
 - 750–1,000 gpm
 - 1,001–1,500 gpm
 - 1,501–2,500 gpm
 - > 2,501 gpm

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**East Wenatchee Water District
 2014 Comprehensive Water System Plan**

**FIGURE 3.3
 EXISTING FIRE FLOW
 PRESSURE CONSTRAINED**

Professional Engineer Seal: State of Washington, Mechanical.

NO.	DATE	DESCRIPTION	BY	REVIEW

REVISIONS

ENGINEER: RCP SHEET DATE: Jun 9, 2014 CLIENT: EWWD JOB NO.: 213.721
 REVIEWED: RCP PLOT DATE: Jun 9, 2014 FILENAME: EWCP14-F-F-DWG

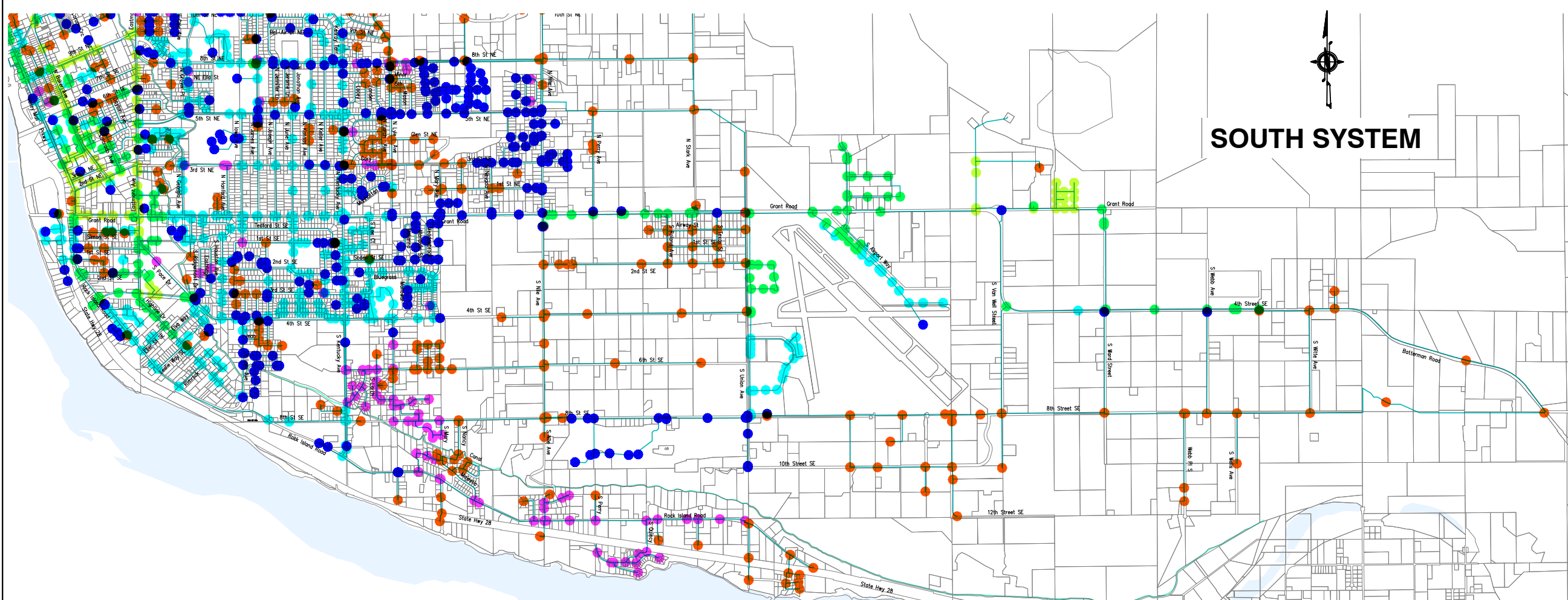
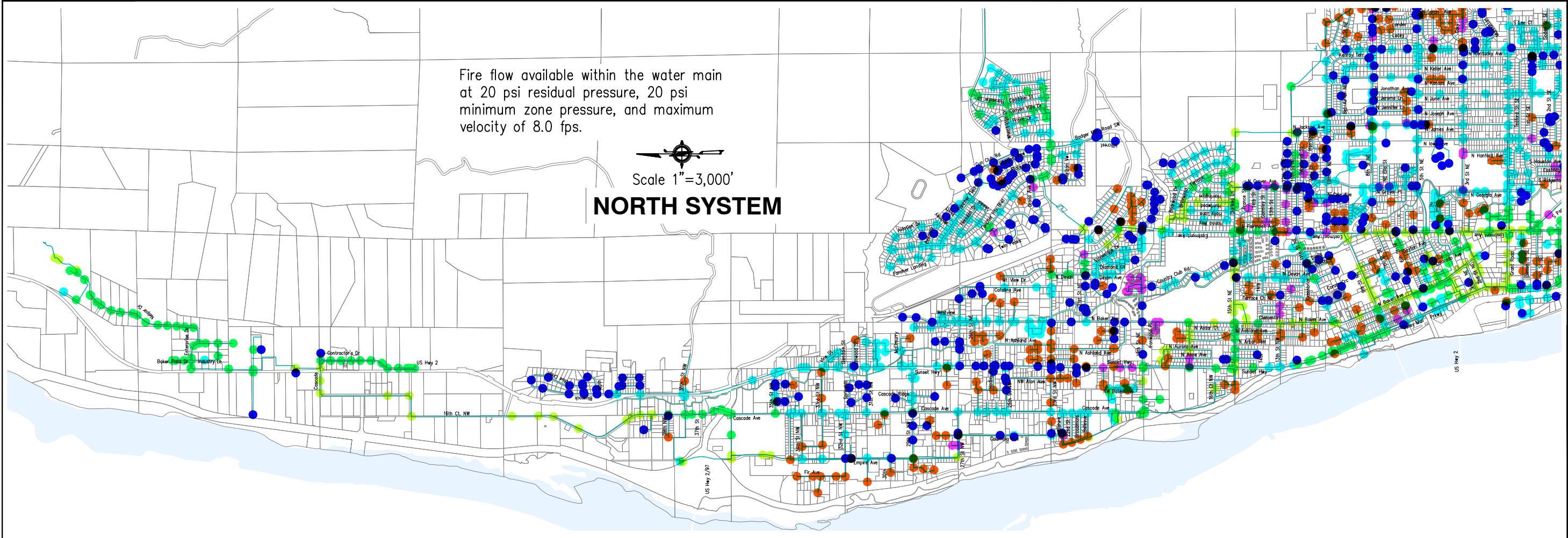
SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO. 3.3 SHEET NO. 3.3

Fire flow available within the water main at 20 psi residual pressure, 20 psi minimum zone pressure, and maximum velocity of 8.0 fps.

Scale 1"=3,000'
NORTH SYSTEM



- Available Fire Flow
- < 750 gpm
 - 750–1,000 gpm
 - 1,001–1,500 gpm
 - 1,501–2,500 gpm
 - 2,501–4,000 gpm
 - > 4,000 gpm

Scale 1"=3,000'
SOUTH SYSTEM

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East Wenatchee Water District
2014 Comprehensive Water System Plan

FIGURE 3.4
EXISTING FIRE FLOW
VELOCITY CONSTRAINED

Professional Engineer Seal: RUS ENGINEERING, INC., No. 27780, State of Washington

NO.	DATE	DESCRIPTION	BY	REVIEW

REVISIONS

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO. 3.4 SHEET NO. 3.4

- Water Quality
- Operations and Maintenance

Source and Supply

Issue A1: The Regional Water System is expected to reach capacity sometime around 2030, limited by the size of the existing 30-inch transmission main from the Regional Well Field.

Evaluation: The Regional Water System partners began a study in 2013 to review options for improving both reliability and capacity. The preliminary study is expected to be complete by the end of 2014, which will recommend a number of alternate approaches to be further explored.

Issue A2: The 1592 Zone supply is limited. The current District policy is to not allow any additional new lot development until additional capacity is added.

Evaluation: The District may reevaluate the storage requirements of this zone based on more recent water use calculations. This would be performed in a separate study.

Alternative 1: Construct a second booster pump station, leaving the existing station in service. The proposed site would be near 27th Street and Baker and requires approximately 5,000 feet of new pipeline fed from the 1286 Zone.

Alternative 2: Construct a second booster pump station, leaving the existing Daniels Drive station in service. Proposed site would be near the 10th Street Reservoir and require approximately 8,000 feet of new 12-inch pipeline.

Evaluation: This will provide two pump stations supplying the zone for redundancy; allow a reduction in run times at the existing station to extend its life; minimize the single-point demand on the lower zone; and provide maximum flexibility as growth extends in the upper pressure zones. A new site must be purchased and transmission main built to connect the two zones.. Much of the cost of this location could be borne by developers needing water in the 10th Street area. An additional benefit has been shown from hydraulic modeling making maximum use of the 5th and Grover Booster Pump Station, which will help balance both the 965 and 1292 Reservoirs. Suggested pump size is 1,000 gpm per pump controlled with VFDs to give the most flexibility in operations. Total project cost is estimated to be \$2,000,000, plus land.

Alternative 3: Construct a booster pump station to replace Daniels Drive Station.

Evaluation: A new station could be constructed adjacent to the existing station thereby abandoning the existing station. Although feasible, a significant amount of earthwork may be required to create a new building pad and continue the single supply point to the upper zones. The project does not improve reliability. Cost is estimated to be \$900,000.

Alternative 4: Increase capacity at Daniels Drive Booster Pump Station.

Evaluation: Increasing capacity at the existing Daniel's Drive Booster Pump Station would be economically impractical. The pumps have already been replaced with the highest capacity pumps that could make use of the existing plumbing while minimizing power supply improvements. The pumps wore out relatively quickly and have already been replaced. Cost of upsizing these pumps, piping, and electrical systems would likely approach the cost of constructing an entirely new pump station. Increasing capacity at the Daniels Drive Booster Pump Station creates hydraulic problems farther down in the system by requiring disproportionately high flow from 15th Street and reducing 5th and Grover Booster Pump Station

operation to almost nothing. The project does not improve reliability. Cost is estimated at \$600,000.

Issue A3: The 1768 Zone supply currently insufficient due to the underperforming pumps. This has not yet been a problem because both pumps have continuously been available. If the better pump should fail, the remaining pump may not meet MDD.

Alternative 1: Replace the most underperforming pump.

Evaluation: A new pump could be installed in the existing barrel, it may be possible to reuse the existing motor. Cost is estimated to be \$40,000

Alternative 2: Add a third pump to Canyon Hills Booster Pump Station.

Evaluation: The existing plumbing would need significant modification for a third pump, but there is sufficient space. Cost is estimated to be \$100,000.

Storage

Issue B1: The 965S Zone will have insufficient storage by 2015. This only occurs if the District uses a very conservative approach of not nesting the fire and standby storage volumes.

Alternative 1: Allow a portion of the standby storage and fire flow storage to be nested, rather than occupying separate volumes.

Evaluation: Partial nesting would eliminate all forecasted storage deficiencies for the foreseeable future, at the cost of reduced reliability should a fire event and a water system failure occur at the same time (a very low probability occurrence). Only a partial nesting of 20% of fire storage is currently required. By 2035, nesting of 60 percent of fire storage would accommodate storage needs.

Alternative 2: Place the backup Well Nos. 4, 5, and 7 on continuous standby, available for use should reservoir elevations drop to abnormally low levels.

Evaluation: Regular maintenance and testing will be required to assure the wells and chlorination systems are at full functionality. An agreement with the Regional Water System partners will be needed, because the wells are Regional Water System resources.

Alternative 3: Increase distribution capacity to utilize more storage from the 1292 Zone to supplement an emergency condition.

Evaluation: Additional PRV stations and pipelines will be needed. Hydraulic modeling must be performed to determine the feasibility and improvements required.

Alternative 4: Redefine the minimum District standard for standby storage.

Evaluation: The projected storage deficiency is based on a minimum requirement of 200 gallons per ERU. Reducing this to 130 gallons per ERU, which is similar to the average ERU daily indoor use, would eliminate the shortfall through approximately 2035. Agreement from the District Commissioners and DOH would be required. Reducing to 130 gallons per ERU would assume that a system failure could be repaired within 24 hours.

Issue B2: This item is related to Issue B1. Three of the four existing 965S Reservoirs are older than 50 years of age, and the fourth tank (Pearcot 5B) has a history of leaks. These four tanks total 1.7 MG of usable storage and replacement within the next 20 years may be prudent for reliability, though may not be immediately necessary for additional capacity.

Alternative 1: Replace existing tanks with new tanks within 20 years.

Evaluation: There is very little land left at the 930 to 940 elevation in the District to construct new storage. The Shop site has sufficient land, but will require a partially buried reservoir(s). There may be space at 8th Street NE and James Avenue, which is currently a school parking lot, but would again necessitate a buried tank. The Pearcot site is relatively small, and addition of storage would be expensive due to the need to demolish the existing tanks. Location of storage south of Pearcot is not prudent due to hydraulic remoteness. It is assumed that a new tank will be built where sufficient transmission already exists, other than that necessary on-site.

For future tanks, consideration should be made for matching the existing floor elevations at 15th Street (947 feet), which would also require raising the site at Pearcot by 7 feet. This would reduce the amount of excavation necessary at 15th Street. The existing Regional Water System pumps could easily accommodate the increase in additional head and it may help to keep the pumps operating close to their best efficiency. This may also improve the usability of all storage due to a few isolated high elevations in the zone.

Issue B3: The 1494 Zone will need storage when fire flow requirements approach 700,000 gallons (approximately 4,000 gpm for 3 hours, or 3,000 gpm for 4 hours). Long-term needs are not expected to exceed 400,000 gallons unless land use designations change significantly.

Alternative 1: Provide reliable pumping capacity sufficient to supplement storage.

Evaluation: Pumping capacity will be of benefit only to fire flow storage, since existing supply rate already exceeds MDD and PHD. This can come in one of two forms; either a dedicated engine-driven fire pump or installation of a permanent engine generator to power the existing Grant and Nile facility. In order to provide 4,000 gpm, two Nile pumps would need to be operated during a fire. It may also be necessary to install a third pump to insure that full capacity is available if one pump is out of service. A standalone engine generator (EG) set, third pump and motor control center (MCC) may cost \$300,000.

Alternative 2: Construct 0.5 MG of additional storage.

Evaluation: Additional storage provides the most reliable source of emergency water. Additional transmission main may be necessary to make effective use of this storage. Additional storage may be a detriment to water quality due to extended turnover times. Cost is estimated to be \$1,200,000 for tank plus \$500,000 for transmission plus cost of land.

For alternative 2, the storage could be built in at either the 1494 or 1594 elevation. If built at 1594, multiple use of the storage is possible, though extension of transmission between the 1494 and 1594 Zones would be required. At the 1594 elevation, this project also assists Issue B6.

Issue B4: The Daniels Drive Reservoir exterior paint is chalking and beginning to peel. Condition of interior coating is unknown.

Alternative 1: Spot repair the paint.

Evaluation: Spot repairs may delay recoating by a few years, but full recoat is still necessary. Cost is estimated to be \$5,000 (if District personnel performed the work).

Alternative 2: Full recoat.

Evaluation: Twenty years is a normal life for paint installed in the 1980s. Given the intense wind and sun exposure location of this tank, a full recoat is warranted. Cost is estimated to be \$50,000 (for materials only and District staff labor), or \$120,000 for a contractor.

Issue B5: The Fancher Heights Reservoir paint is chalking and spot damaged. Most spot damage is due to vandalism.

Alternative 1: Spot repair the paint.

Evaluation: Spot repairs should delay recoating by a few years. Cost is estimated to be \$2,000 (if completed by District personnel).

Alternative 2: Full recoat.

Evaluation: Twenty years is a normal life for paint installed in the 1980s. However, the paint on this reservoir has held up slightly better than at the Daniels Drive Reservoir. Cost is estimated at \$120,000 (as a bid project).

Issue B6: Growth in Fancher Heights is limited by existing storage and supply capacity. Without improvements, no more water system connections will be allowed beyond currently approved developments.

Alternative 1: Construct approximately 0.5 MG of additional storage in the 1594 Zone.

Evaluation: Storage may benefit both the 1594 and 1292 Zones. Land for a tank would likely have to be outside of the urban growth boundary (UGB) in order to obtain sufficient elevation. Depending on the site, hydraulic balance of the tanks could be difficult. Cost is estimated to be \$1,200,000, plus site and transmission main.

Alternative 2: Construct approximately 0.5 MG of additional storage in the 1768 Zone.

Evaluation: Storage may benefit both the 1768 and 1594 Zones. Sufficient existing land and pipeline should be available at the existing Canyon Hills site. A new emergency PRV station between the zones may be necessary for reliability. Cost is estimated to be \$1,000,000.

Alternative 3: Construct approximately 1,000-gpm pumping capacity in lieu of storage.

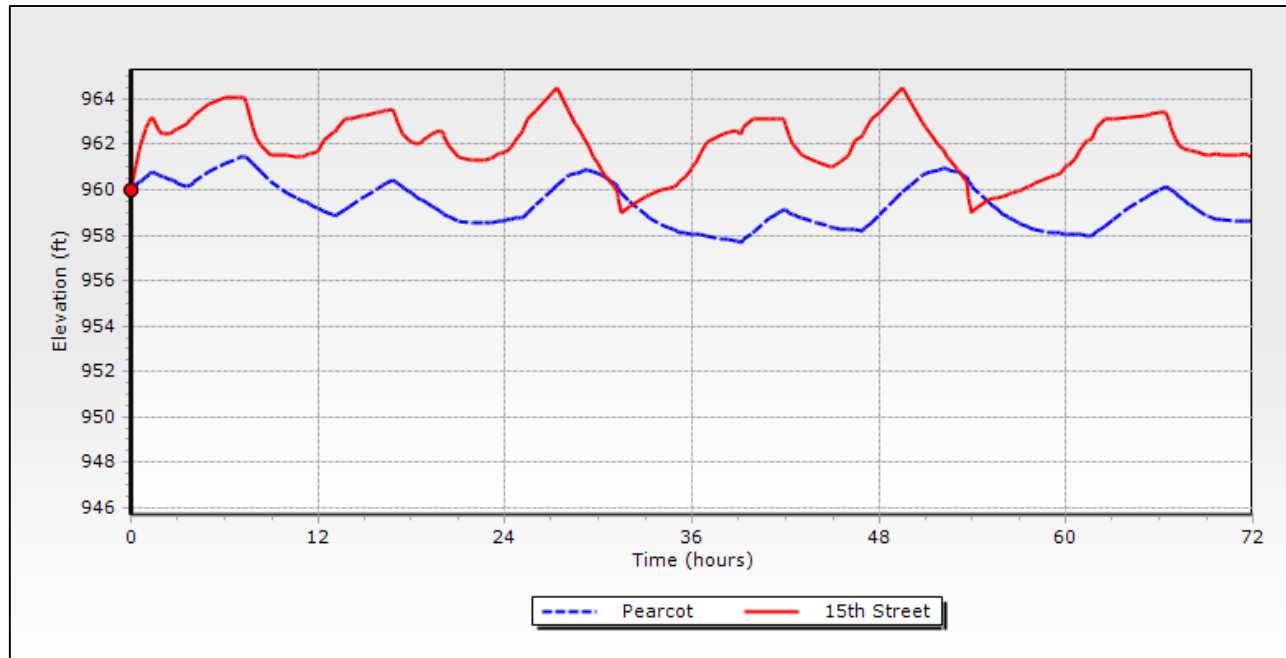
Evaluation: Such pumping capacity must meet emergency reliability standards. Emergency pumps are typically high maintenance items. Locating the pump at the Daniels Drive Booster Pump Station would keep costs down by using existing site and transmission. A study would be needed to determine exact pump sizing. Cost is estimated to be \$150,000.

Alternative 4: Construct approximately 1,000-gpm of pumping capacity near the 10th Street Reservoirs. Approximately 1.5 miles of transmission main would also be necessary to reach Fancher Heights. This alternative complements Issue A2, Alternative 2. This capacity may be considered as a temporary solution with additional storage eventually required.

Transmission

Issue C1: The Pearcot Reservoir levels appear to lag behind the 15th Street Reservoirs by approximately 3 feet. This can reduce the available storage. This occurs because the 15th Street tanks are physically and hydraulically closer to the Regional Water System. There may also be a slight overflow elevation difference between the reservoir sites, which is currently being researched. Frictional losses between the 15th Street and Pearcot Reservoirs cause the drawdown differential. **Chart 3.3** shows the results of an EPS in the hydraulic model.

Chart 3.3 965 S Zone Reservoir Levels



Alternative 1: Construct additional transmission extending the 24-inch main to a point hydraulically equidistant from both reservoir sites.

Evaluation: By passively balancing the system, the most flexibility in operations can be provided to the District. Approximately 10,000 feet of 24-inch transmission main plus 2,000 feet or more of additional distribution main replacement would be required, though improvements may be phased over time. Cost is estimated to be \$6,000,000. Prior to proceeding with design, a predesign study should be performed to determine the preferred route.

Alternative 2: Use Well Nos. 4 and 5 during high demand periods.

Evaluation: Use of Well Nos. 4 and 5, which are Regional Water System resources, to meet normal demands is not currently approved by the Regional Water System agreement. Water quality of these wells is also a concern.

Alternative 3: Construct additional transmission between the 15th Street and Pearcot Reservoir sites.

Evaluation: Construction of pure transmission between the two tank sites is not practical. In order to ensure reasonable minimum tank differential, 3 miles of at least 30-inch-diameter pipe would be required. This would have to be constructed through improved areas and would be cost prohibitive compared to the other alternatives. The 24-inch main in Alternative 1 of this issue would still eventually need to be constructed. Cost is estimated to be \$5,000,000 for a 30-inch main.

Issue C2: Land in Sections 17 and 18 is currently the top candidate by the City of East Wenatchee for annexing in the UGA. There are very few existing mains in this area, and they are undersized for potential land use.

Alternative 1: Construct 12-inch mains along S Nile from Grant Road to 8th Street SE. Parallel mains may be required because there are three pressure zone breaks along this route.

Evaluation: Given the distance from the nearest reservoir, an 8-inch main may have too much headloss. These mains will provide the backbone for future adjacent development. A

reimbursement area could be set up for benefitted properties to pay back the District. Cost is estimated to be \$3,000,000.

Alternative 2: Make any improvements the responsibility of developers.

Evaluation: It may be difficult to get an orderly set of system improvements if timing is dependent on development.

Issue C3: Transmission to the industrial areas west of the Airport are served by a single main in Union Avenue, backed up by a very small main in 8th Street SE. This limits capacity to approximately 2,000 gpm, and results in poor reliability.

Alternative 1: Construct either an 8-inch or 12-inch main from 4th SE and Van Well to 8th SE and Union Avenue.

Evaluation: This will provide improved fire flow to the industrial area and greatly increased reliability. Cost is estimated to be \$3,000,000.

Alternative 2: Make any improvements the responsibility of developers.

Evaluation: It may be difficult to get an orderly set of system improvements if timing is dependent on development.

Pressure

Distribution pressures do not drop significantly during peak hour demand. More often than not, the pressure rises due to operation of more booster pumps to keep up with demands.

A number of areas exceed the District's desired maximum 150 psi service pressure. The majority of these areas are north of 19th Street along the Columbia River, just west of the Airport, and along the 1170/1292 pressure zone boundary. All pressures are still within the pressure rating of the water system materials, so lowering pressure below 150 psi is not mandatory, but older equipment will be more prone to failure.

Issue D1: Pressure to the last two customer meters at the east end of Daniels Drive ranges from 25 to 30 psi.

Evaluation: This is the same pressure that these lots experienced when they were first developed decades ago. Water system standards at that time did not require a minimum pressure of 30 psi. The topography between this area and the nearest higher pressure infrastructure is steep with loose soils and would be costly to traverse (estimated cost of \$500,000) with little benefit. Since this condition has existed for decades and the customers are accustomed to the level of service, no changes are proposed.

Issue D2: High pressure along Cascade Avenue, Columbia Avenue and Empire Avenue north of 19th Street. Pressure can fluctuate 40 psi when the Regional Supply Station turns on and off.

Alternative 1: Take no action.

Evaluation: The existing system seems to be withstanding the high pressure without incident. As old steel pipes are slowly replaced with ductile iron, the strength of the system will continue to improve. Cost is estimated to be \$0.

Alternative 2: Disconnect the 24-inch transmission from the distribution grid north of 19th Street.

Evaluation: This will eliminate the pressure fluctuations and overall pressure in the area drops below 150 psi. However, fire flow availability in the north 961 Zone is reduced due to disconnection from the 24-inch main, and a number of dead end mains may also result. Cost is estimated to be \$0. Correcting the dead end mains would add cost, but an evaluation of the

required improvements has not yet been performed. For planning purposes, an estimated cost of \$500,000 is presented to correct dead end mains and recover some fire flow capacity.

Alternative 3: Extend the 24-inch transmission to the south, terminating approximately at 9th Street NE

Evaluation: Extending the transmission main will reduce headloss and lower pressure. This also addresses Issue C1 mentioned earlier. A predesign study should be conducted to determine what pipeline improvements may be needed to preserve adequate fire flow performance.

Issue D3: High pressure along Grant Road between Nile and Union.

Alternative 1: Take no action.

Evaluation: The existing system seems to be withstanding the high pressure without incident. As old steel pipes are slowly replaced with ductile iron, the strength of the system will continue to improve. Cost is estimated to be \$0.

Alternative 2: Realign the 1292/1494 Zone boundary approximately along the 1,190-foot contour.

Evaluation: Realigning the pressure zone would require construction of at least 1 mile of new pipeline, since the Nile Booster Pump Station transmission main must be left in the 1494 Zone. Moving customers from the 1494 to the 1292 Zone would negatively impact the already low turnover rate in the 1494 Reservoir. Cost is estimated to be \$1,300,000. The industrial properties on the east side of Union Avenue may have to stay in the 1494 Zone to have adequate fire flow, unless significant pipelines are added. A possible location of the future zone boundary is shown on **Figure 8.3** in **Chapter 8**.

Fire Flow and Distribution

Issue F1: The north 1170 Zone is bottlenecked at 27th Street, with a single 6-inch main connecting the north and south halves. The 1170 Booster Pump Station was constructed in 2013, which greatly improved reliability on the north end. However, additional piping would improve reliability and capacity further.

Alternative 1: Install a new 12-inch main along an easement from the Breckenridge Development to 31st Street NE.

Evaluation: This provides a parallel main to 27th Street, greatly improving both capacity and reliability. Cost is estimated to be \$240,000. It is currently assumed that the project will be funded and constructed by a developer.

Alternative 2: Replace the 6-inch main in 27th Street with 12-inch.

Evaluation: This provides an adequate improvement in capacity, but does not improve reliability since there is still only a single pipe through this area. Cost is estimated to be \$250,000.

Issue F2: Rock Island Road east of Kentucky Avenue has a single dead end main, approximately 3 miles long. Reliability is low because of the single main. Fire flow is restricted to less than 1,000 gpm due to the length, friction in old steel pipe, and high elevation services near the irrigation canal. There is not a convenient place to install a parallel water main except along the State Route 28 (SR 28), which may be cost prohibitive due to the extreme length.

Alternative 1: Install 1,500 feet of 8-inch main from 8th Street SE to Kentucky Avenue.

Evaluation: This will slightly improve reliability west of Kentucky Avenue, but will have only minor benefit east of Kentucky Avenue. Cost is estimated to be \$350,000.

Alternative 2: Replace 6,000 feet of 10-inch steel main with 12-inch DI from Kentucky Avenue to Nile Avenue.

Evaluation: Fire flow will increase by approximately 20 percent, with available fire flow along Rock Island Road between 1,000 and 1,500 gpm. The project improves fire flow, but does not improve reliability. Cost is estimated to be \$1,400,000.

Alternative 3: Provide a secondary feed from the pressure zones above the canal.

Evaluation: Three routes were reviewed.

The easiest project is to reset the Nancy Avenue & 8th Street SE PRV and open the zone valve at the canal at Nancy Avenue. This may improve fire flow along Rock Island Road to just over 1,000 gpm by preventing low pressure along Canal Street. However this project has limited reliability benefit due to its westerly location.

Nancy Avenue is an existing street, but there is no water main between 8th Street SE and the canal. Install 3,000 feet of 8-inch main. The project has limited benefit due to its westerly location, but provides better reliability than the Nancy Avenue route. A PRV station and canal crossing will be required. Cost is estimated to be \$700,000.

Union Avenue would be the best route hydraulically, however no road exists and the topography is extremely steep with loose soil. Install 1,500 feet of 8-inch or 12-inch main. A PRV station and canal crossing will be required. Cost is estimated to be \$450,000.

As described earlier in this report, approximately one third of the District's water system consists of 6-inch and smaller diameter steel water mains with an average age of over 50 years. Although the 50-year mark does not necessarily mean a pipe is beyond its useful life, upgrading the pipe infrastructure as part of fire flow or pressure zone improvements is recommended. Pipeline diameters of 4 inches or less do not meet current state standards and are generally incapable of providing minimum fire flow requirements.

The District proposes to budget \$150,000 per year toward replacement of small mains. The cost to replace all steel mains in the District is roughly estimated to be over \$100,000,000. For areas currently undeveloped, it is the District's policy to require developers to replace existing mains or extend mains of adequate size necessary to provide the required fire flow for the various land uses. These improvements would be paid for as part of a developer extension process for connection to the District's water system.

The District is technically not deficient in fire flow anywhere in the system. Even though some structures may not meet today's standards of fire flow protection, at the time they were constructed the standards were lower. All such facilities, therefore, are grandfathered under the current fire codes. However, as new structures are built, or existing ones remodeled or sold, fire protection must be brought up to current standards. It is typically the responsibility of the property owner to construct whatever improvements are necessary to provide adequate fire flow. Because of this, the District has not identified any specific distribution improvements related to fire flow capacity. **Figures 3.3** and **3.4** show an overview of current available fire flow throughout the District based on District pressure and velocity standards. **Figure 3.3** shows available fire flow in the water main while maintaining the greater of either 20 psi at the fire site, or 20 psi within the pressure zone. **Figure 3.4** shows available fire flow while maintaining the 20 psi limit, while also limiting the water velocity through distribution mains to no more than 8.0 fps.

For the purposes of discussion, the following areas are identified where fire flow availability does not currently meet land use expectations shown in **Table 3.1**.

Central Business District

Most locations in the Central Business District (CBD) are well served by fire flow. The few areas that do not are small residential areas. There are still a few old steel mains in major high traffic volume roads with substantial existing interfering utilities, such as Valley Mall Parkway. Any watermain replacement work should be done in conjunction with road improvement projects, as cost is prohibitive for the District to replace the water mains alone.

Pangborn Airport and Industrial Sites

Fire flows around Pangborn Airport are limited mainly by pipe size, with 10-inch mains in Grant Road and in Union Avenue. Pangborn Airport is unable to provide more than 2,000 gpm fire flow in some areas with the 10-inch-diameter mains on South Airport Way and the 10-inch main on Grant Road. Replacement of the 10-inch-diameter mains on South Airport Way and Grant Road or additional water main looping along the south side of the Airport would improve these fire flows (also relates to Issue C3). The industrial areas along Union Avenue west of the airport are similarly limited by 10-inch and 12-inch dead-end mains.

Residential Areas

Most residential areas within the UGB that are served by a 4-inch-diameter or smaller mains have substandard or no fire flow. The locations are too numerous to address individually. The small diameter steel mains in the urban areas should be replaced on a prioritized basis. Prioritization typically is led by the history of leaks and if a road construction project is planned.

Replacement of small water mains to accommodate new development is the responsibility of the developers. However, some areas in the District will still have substandard fire flow even if the small diameter mains fronting the improved properties are replaced. These areas are as follows.

Along Sunset Highway between 19th Street and 25th Street – Undersized mains and increasing elevation diminish fire flows in this area. When the State WSDOT rebuilds the highway, the existing mains should be replaced. The cost for the District to do the project alone may be prohibitive.

Along Lyle Avenue, between 8th Street NE and 10th Street NE – Elevations in excess of 1,275 feet preclude service by the 1292 Zone in this area. Currently, supply comes from the Veedol 1494 Reservoir (3 ½ miles to the east). Transmission from the Veedol Reservoir is inadequate; particularly the 4-inch-diameter steel main on 8th Street NE between Nile Avenue and Lyle Street. Fire flow in excess of 1,000 gpm could be achieved by installing a booster pump station at the 10th Street reservoir site. The 4-inch-diameter steel mains between the booster pump station and the properties desiring fire flow will require replacement to provide distribution capacity for the fire flow. The booster pump station could include an engine-driven fire pump for increased reliability. The cost of this improvement should be borne by the property owners benefiting from the improvement.

Between Grant Road, N Nile Avenue, 5th Street NE and N Kentucky Avenue – Most of this system was built in the 1960s or earlier and consists primarily of 4-inch steel mains. In order to provide at least 1,000 gpm fire flow, virtually all of these mains must be replaced with 8-inch to achieve current fire flow standards.

Operations and Maintenance

Issue G1: Future system conditions could result in Regional Supply Station pumps operating at unacceptably high flow rates. Potentially overloading the motors and/or cavitating and damaging the impellers.

Alternative 1: Take no action.

Evaluation: The risk of this occurring is low due to high transmission main head loss. As future transmission improvements are made and the Regional Water System hydraulic grade line stays high for longer periods of time, the risk increases. Estimated cost would be \$0, unless pumps are damaged.

Alternative 2: Program the VFD interface and telemetry system to not allow the pumps to exceed a preset flow rate.

Evaluation: A relatively simple method of pump constraint, but may not be effective over the full operational range. Cost estimated to be \$5,000.

Alternative 3: Install backpressure sustaining or TDH control valves on discharge of pumps.

Evaluation: Functionally workable solution, but adds hydraulic valves which require long-term maintenance and increases electrical costs. Cost estimated to be \$50,000.

Issue G2: The Daniels Drive Booster Pump Station does not have pressure gauges or transmitters.

Alternative 1: Install gauges, transmitters and replace the flow meter.

Evaluation: Equipment will assist in operations and troubleshooting. Cost estimated to be \$15,000.

Alternative 2: Take no action.

Evaluation: Early identification of problems and troubleshooting may take more time than would otherwise be necessary. Cost estimated to be \$0.

CHAPTER 4

EFFICIENCY PROGRAM AND SOURCE OF SUPPLY

INTRODUCTION

The 2003 Municipal Water Law (HB-1338) directed the Washington State Department of Health (DOH) to develop a new rule for Municipal Water Supply – Efficiency Requirements Act, Chapter 5, Laws of 2003 First Special Session, memorialized in Washington Administrative Code (WAC) 246-290-800. The following discussion represents the East Wenatchee Water District’s (District) effort to follow those requirements. DOH has published a guidance document titled the Water Use Efficiency (WUE) Guidebook. The Washington Water Utilities Council sets forth the “guidelines and requirements for public water systems regarding water use reporting, demand forecasting methodology and conservation programs.” These requirements are based on statutes directing DOH and the Washington State Department of Ecology (Ecology) to encourage WUE. Ecology will also consider the implementation of an approved conservation plan in all water right permits issued by Ecology for public water systems.

1. CURRENT CONSERVATION PROGRAM

Public Education

The District has developed a promotional program, which will publicize the needs and methods for achieving water conservation in the community. The District has used radio to inform its customers of the importance of water conservation and has also given out free indoor water conservation kits to its customers.

Radio news, newspaper articles, and other publications have been used to quickly inform a wide audience of impending or current water resource shortages or system failures.

The conservation program seeks to publicize the need for promoting efficient indoor and outdoor water usage through distribution of informational brochures or other printed materials that address methods of conservation. Pre-printed brochures are available from a number of sources, including Ecology, DOH and American Water Works Association (AWWA). These are reviewed for their content, approach, and cost. Displays and informational packets are used as a method of disseminating conservation information throughout the community.

Promotion and public education are ongoing. Staff has given presentations at civic groups such as Rotary and Kiwanis, as well as at local schools and college.

Water conservation tips are provided in the District’s annual Water Quality Report sent to all customers.

Program Promotion

This conservation measure is a required element of all water conservation programs. The Conservation Planning Requirements provides the following definition for this measure.

Publicize the need for water conservation through television and radio public service announcements, news articles, public water systems' bill inserts, or other means. This includes promoting efficient indoor and outdoor water usage, distribution of Ecology/Health conservation brochures of other printed material, informing customers, builders and contractors of new plumbing code regulations requiring efficient plumbing fixtures and other efforts.

The District includes conservation information in its annual report during the summer in an attempt to educate customers about the methods and reasons for conserving water. Water conservation information can also be accessed by District customers via informational material located on the District and Chelan County Public Utility District No. 1 (PUD) websites. Other promotional alternatives include newspaper articles, radio public service announcements, displays at local fairs and mall shows, water-related conferences and seminars, community presentations, newsletters, conservation education courses for adults, and various conservation programs for the elementary, middle, and high schools.

The District has used the local media on numerous occasions to promote water conservation and will continue this effort in the future. The District will support the regional conservation promotion activities of both the Chelan County PUD and the City of Wenatchee.

Theme Shows and Fairs

The District hosts a booth at local home shows to promote water use efficiency and answer customer questions.

Technical Assistance**Purveyor Assistance**

The District continues to work with the Chelan County PUD and City of Wenatchee to discuss water conservation methods and programs. The District will promote discussions regarding cooperative planning, program development and purchasing.

Customer Assistance

The District provides assistance and information to customers, which facilitates water conservation.

Customer assistance publications on water conservation practices are available at the District. The District currently has brochures available at the District's main office on the WUE standards for plumbing fixtures.

The District will commit the necessary budgetary resources to provide information to the customer, which facilitates water conservation. This element will be ongoing as long as it is shown to be cost effective.

Customer assistance is practiced regularly in the District. Most assistance revolves around troubleshooting unexpected or unusually high excess water use. Users who are interested in landscape management and xeriscape programs are directed to Chelan County PUD's website <http://www.chelanpud.org/xeriscape.html>, which provides information on plants and landscaping native to the area. This information is particularly valuable to residential homes that are built on lands without an irrigation water right.

System Measures

Source Meters

A source master meter was installed when the District joined the Wenatchee Regional Water System in 2001. Each Regional backup well also has its own meter.

Metering Program

The District's policy is to require that "all use and services for water shall be furnished and measured by meter." The District implemented this policy many years ago by metering all water consumption that the District is aware of. District personnel periodically test installed meters and replace them if there is a problem. The District currently has a meter replacement program that replaces all meters on a 15-year cycle. Source water is metered at the Regional Supply Station.

Leak Detection

The amount of distribution system leakage (DSL) in the District system has averaged below 10 percent over the last several years. **Chapter 2** contains DSL tabulations. The District has leak detection equipment, which is used as needed to detect leaks in suspected areas. Leaks are repaired on an "as-discovered basis." The District has also used an outside company to evaluate areas of the system that they suspect may be leaking. The District replaces steel mains where leaks have been recorded as part of its Capital Improvement Plan (CIP). The District will commit the necessary budgetary resources through user fees to support any adopted CIP. The CIP will be ongoing with reviews of the proposed projects on an annual basis.

The District also has a data logger which it has used on customer service meters that records water use and time of day. If a customer has unusual water consumption, water use data can be recorded for a week and give the customer a printout and plot of water use for that period of time. It usually provides insight into when the consumption occurs and points to the problem, such as like a soft water machine that back flushes too long, an irrigation system running longer than assumed, a fire sprinkler system leaking, etc.

Billing Measures

Conservation Pricing

The District allows 600 cubic feet of water in the base monthly water rate and is billed bi-monthly. Water use in excess of the base allocation is billed on a uniform block rate per gallon. In past rate studies, the District has evaluated changing the base water allowance but the Commissioners have chosen to leave the water allowance intact and increased the monthly base rate to include a fee for the included water. The excess block rate billing encourages the use of separate irrigation water and xeriscaping.

Conservation Goals and Public Process

WUE goals must be set through a public process and be evaluated and reestablished a minimum of every 6 years. Public hearings are typically scheduled with the District's Commissioner meetings, with the most recent held on September 4, 2014. The meeting minutes are in **Appendix M**.

The District supports water conservation as a wise and efficient use of natural resources. The program presented here will include elements that improve source management and increase public awareness with the intent of reducing per capita water consumption. The objectives of this conservation program over the next 6-year period are:

1. To reduce the DSL by 0.5 percent;
2. To reduce per capita water use by 1 percent to 2 percent; and
3. To promote public education and awareness of water conservation issues.

Results of Past Conservation Efforts

Table 4.1 shows system usage since 1994. Total pumped water is compared to the number of water service connections and equivalent residential unit (ERUs) to obtain an average water supply per each. As can be seen, water usage per connection has dropped dramatically from 428 gallons per day (gpd) per ERU in 1994, to 306 gpd in 2012, or an average consumption reduction of 1.8 percent per year. Water consumption per ERU has reduced by 6 percent since the previous Comprehensive Water System Plan (Plan), exceeding prior goals by a significant margin.

Table 4- 1 Past Conservation Performance

Year	No. of Services	Yearly Supply (gal)	Avg per Service (gpd)	Avg per ERU (gpd)	Gallons * Saved (gpd)	Change /ERU/yr **
1994	6,353	1,153,570,000	497	428	0	
1995	6,495	1,144,547,000	483	414	95,362	-2.9%
1996	6,680	1,173,656,000	481	413	107,645	-0.2%
1997	6,844	1,174,199,000	470	401	187,743	-2.4%
1998	7,029	1,217,774,000	475	403	160,392	0.5%
1999	7,202	1,230,116,000	468	398	212,642	-1.0%
2000	7,355	1,153,162,000	430	366	499,589	-7.0%
2001	7,490	1,145,310,000	419	356	588,260	-2.2%
2002	7,665	1,145,872,000	410	348	673,779	-2.0%
2003	7,865	1,140,539,000	397	339	787,885	-2.3%
2004	8,075	1,144,111,000	388	331	882,569	-1.9%
2005	8,370	1,172,514,000	384	333	951,508	0.5%
2006	8,711	1,194,903,000	376	328	1,059,808	-1.4%
2007	8,908	1,177,065,000	362	314	1,206,682	-3.7%
2008	9,033	1,235,899,000	375	324	1,107,677	2.6%
2009	9,117	1,262,900,000	380	326	1,075,490	0.7%
2010	9,176	1,178,950,000	352	303	1,334,841	-6.3%
2011	9,240	1,171,650,000	347	299	1,386,679	-1.0%
2012	9,306	1,208,150,000	356	306	1,319,513	2.1%

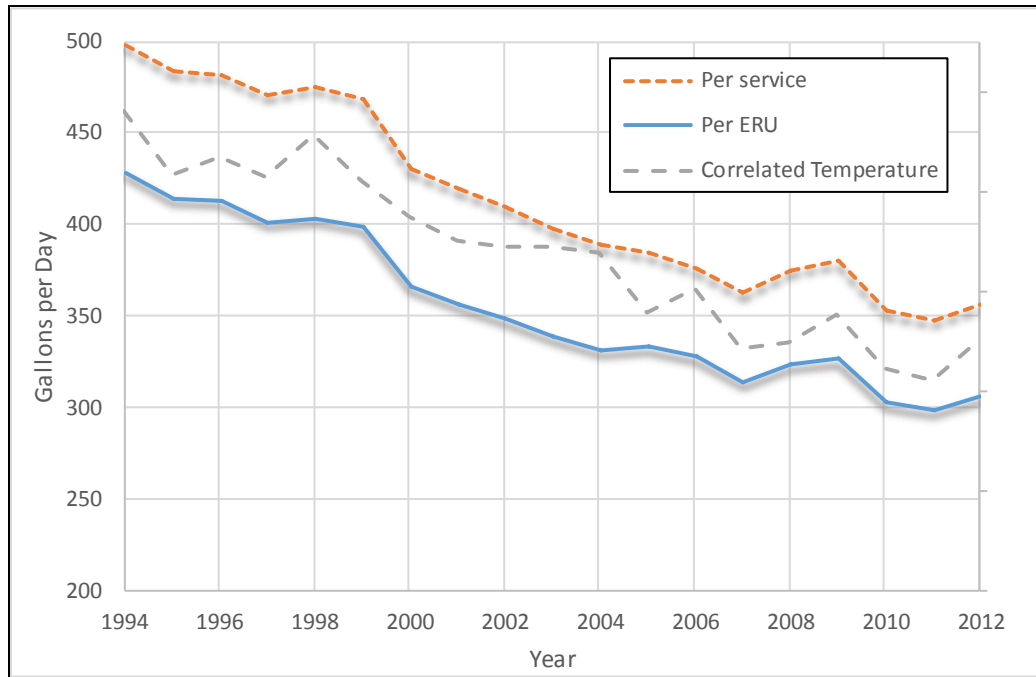
* Using 1994 as a baseline

** Positive number indicates increase in usage, negative indicates decrease in usage

The column labeled *Gallons Saved* is derived by comparing each year’s average supply per connection to 1994 and calculating the difference in system demand if there were no efficiency achievements. Compared to 1994, the demands per ERU in 2012 represent a 30-percent reduction in supply required per ERU. This is a significant accomplishment and speaks well of the District’s efforts to consistently improve the system infrastructure and educate on efficient use of water. To date, the District has exceeded its prior conservation goals.

This reduction in water use is shown graphically on **Chart 4.1**. Also included is a modified representation of average summer temperature (Correlated Temperature). The average temperature has been adjusted by the same proportion of per ERU water use reduction for the purpose of observing if there is a direct correlation between summer temperature and water use. It is clear from this chart that customer use directly tracks with annual summer temperature variations.

Chart 4.1 Annual Water Use Reductions



Mandatory Measures

The water use data collection requirements vary, depending on the size of the water system. The water use data for the District is presented in **Chapter 2**. The following conservation measures are mandatory, and do not count towards the District’s quota of other conservation measures.

1. Source of Supply Meter Readings

Requirement: Read meters daily. Record monthly and annual totals.

Compliance Status: Water supply to the District is currently provided by one metered supply point. Flow is recorded in real time, with daily totals archived.

2. Customer Service Meters

Requirement:

- a. Record monthly totals. Monthly totals may be estimated if water usage is billed less frequently.
- b. Record usage for the following classes: single-family, multi-family, commercial, industrial, and public.

Compliance Status: Customer meters are read every other month. The District has grouped customers into several classes that meet the requirements stated above.

3. Meter Calibration

Requirement: Verify meter accuracy and repair or replace on a regular schedule.

Compliance Status: The source meter (full bore mag-meter style) was installed in 2001. The District has no current reason to question the meter accuracy. A 15-year or shorter recalibration schedule for source meters is recommended.

Customer meters are replaced when water use records become suspect. A 15-year replacement program for customer meters is in place. The District reviews water use on the large (4-inch to 6-inch) customer meters and will replace with modern high accuracy meters when water use appears suspect.

4. Leak Detection

Requirement: Conduct a leak detection survey at least every 6 years until DSL is reduced to below 10 percent.

Compliance Status: The District regularly uses its own leak detection equipment. Current DSL averages less than 10 percent (**Table 2.6**).

5. Customer Education

Requirement: Provide yearly customer education.

Compliance Status: Current customer education is described under the “Public Education,” and “Customer Assistance” paragraphs of the Current WUE Program Section. Formal forums have not been held.

6. Determine DSL Rate

Requirement: Record annual totals.

Compliance Status: Source and customer meters are totaled yearly, and authorized unmetered uses (firefighting, construction flushing, etc.) are estimated.

Measures to be Evaluated or Implemented

Because the District has more than 9,000 but less than 9,999 connections, at least 6 additional measures must be evaluated for applicability and cost-effectiveness. The WFI in Appendix C shows over 11,000 service connections, but this is incorrect. The number entered by DOH is a tally of dwelling units, not service connections. Most multi-family dwelling units are clustered where multiple units are served by a single connection. See Chapter 2, Table 2.2 for a count of actual service connections. However, to account for future growth in the District which will eventually exceed 9,999 connections, at least 9 conservation measures are discussed herein.

The following measures are presented and evaluated for practicality and benefit. If a measure will not be implemented, it is evaluated on three bases: 1) the cost-effectiveness to the District; 2) the cost-effectiveness if costs are shared with other entities; and 3) the cost-effectiveness on a societal view. Measures that will be, or are currently, implemented do not include any further cost evaluation.

Except where specifically noted otherwise, cost sharing with other entities is considered ineffective. Education efforts typically have very low costs, and other measures are so geographically localized that coordinating with other entities would not increase efficiency or reduce costs. The District stays

in constant contact with the City of Wenatchee and Chelan County PUD to discuss how each purveyors' approach to water use efficiency has fared.

The societal cost benefits of water use efficiency would be the same for any measure that reduces water use, and as such are not repeated in each section below. The efficient use of water can reduce electrical needs for pumping, improve instream flows (though for the capacious Regional Aquifer and Columbia River, this would not be measurable), and support both the perception and the reality that our resources are being used wisely.

1) Ongoing Public Education as discussed on page 4-1 for Single Family customers.

a) Irrigation Water Use – New Construction

The District reviews development and subdivision proposals for compliance with District standards. When land being developed is within an existing irrigation service area, the District will inform the proponent and encourage the use of separate irrigation water.

Status: Implemented.

b) Landscape Management

Promote low water demand landscaping in all retail customer classes and work with local nurseries.

Status: The District has promoted low water use landscaping (xeriscape) by utilizing xeriscape techniques during modifications to the District's office and other District reservoir and booster pump station projects. However, other than the information in the proposed brochures regarding low water use landscaping, the District does not plan to actively pursue a formal program of promotion of this type of landscaping. The District directs customers to the Chelan County PUD website, which provides information about xeriscaping.

2) Ongoing Public Education as discussed on page 4-1 for Multi Family customers. See also item 1a and 1b.

3) Ongoing Public Education as discussed on page 4-1 for Commercial/Industrial customers. See also item 1a and 1b.

4) Bill Showing Consumption History for Single Family customers:

Billings show water use over the same period from the previous year.

Status: This program was implemented in 2009.

5) Bill Showing Consumption History for Multi Family customers:

See description under item 4.

6) Bill Showing Consumption History for Commercial/Industrial customers:

See description under item 4.

7) Excess Water Rates

The District's current rate schedule and past evaluation of other rate schedules is described in prior sections. A change to another rate structure would require approval of the District Commissioners and a modification of the billing system.

Status: A uniform block rate structure was implemented some time ago, prior to any current memory. Consideration of rate increases is made yearly. The District believes the uniform block rate structure has shown to be an effective conservation measure. The conservation effectiveness of any rate system is determined by the amount of the rate itself, not the structure of the system. The District's current excess rate is \$1.45 per 100 cubic feet (cf).

8) Irrigation Water Use – Existing Unserved Areas

The Regional Water System purchased a large amount of irrigation water shares from the Pioneer Water Users Association in 2013. Some of these shares will be used for municipal water, but some are available for irrigation. The District has been in discussion with the Greater Wenatchee Irrigation District to evaluate if irrigation water can be supplied to the Fancher Heights area, which currently has no irrigation water. A significant amount of infrastructure will be required, but the water savings could be substantial, potentially well over 0.5 million gallons (MG) per day.

Status: Not implemented, but discussions are ongoing.

Cost: At least 5 miles of transmission main may be required at an estimated cost of \$2,000,000 to \$3,000,000. A distribution system within the improved areas is much harder to estimate, but may cost between \$1,000,000 and \$3,000,000.

9) Review Bills for Abnormal Use for Single Family customers

The District reviews billing trends and identify individual customers whose usage increases dramatically. This can indicate a leak in a customer's private service.

Status: Implemented.

10) Review Bills for Abnormal Use for Multi Family customers.

See description under item 9.

11) Review Bills for Abnormal Use for Commercial/Industrial customers.

See description under item 9.

12) Supply Fixture Efficiency Kits to Customers on an Individual Basis

Status: Implemented. The District has both indoor and outdoor kits on hand. Documentation contained in the indoor kit states potential water savings of up to 130 gpd (47,000 gallons per year) per home.

13) Supply Fixture Efficiency Kits to All Existing Homes

New and remodeled residences in the District already need to comply with the water efficiency standards for plumbing fixtures.

Status: Not implemented.

Cost Evaluation: To purchase and distribute kits to retrofit fixtures of all older homes not meeting these standards would be cost prohibitive for the District. It appears that more can be accomplished in the program promotion measure by educating the public about ways to conserve water, including the new WUE standards for plumbing fixtures and devices they can install to improve the efficiency of their existing fixtures.

14) Install Real-time Customer Meter Monitoring

The District is evaluating new technology which would allow a customer to borrow a remote reader to monitor the use in real-time. The District is also evaluating a much larger system which can monitor all customers in real-time with data available to the District and to each customer via a website. The customer meters the District is currently installing have the ability to report real-time data, but receiving equipment has not been purchased yet. A study is currently underway to determine the number and cost of antennae sites required for data collection.

Status: Being evaluated. Expected to be complete this winter.

Cost: It is still too early to know the cost of a real-time reading system until the number of antennae sites has been determined. Once the District has completed its initial evaluation of the equipment, a cost estimate will be prepared.

Cost sharing: The technology is not expected to be more cost efficient with multiple agencies due to the limited coverage of antennae. Other agencies would require a proportional quantity of equivalent antennae sites and recording equipment to integrate with their unique billing systems.

15) Nurseries/Agriculture

Encourage and/or require the application of current technology to water use practices of large agriculture/irrigation operations. Currently, the only agriculture-related water uses relate to the filling of spray tanks prior to the irrigation water being turned on in the valley.

Status: Not implemented.

Cost Evaluation: There are no large nurseries and agricultural areas within the District service area which use District water for irrigation. Promoting or requiring specific water use practices for these operations would not be cost effective since no substantial water savings would be gained.

Inventory of Sources for Reclaimed Water

Following is a list of potential sources of reclaimed water.

Treated Sanitary Sewage Outflow

The District has had conversations with the Douglas County Sewer District about using its discharge water as a potential source for reclaimed water. The thought is to obtain funding to install pumps and new piping from the wastewater plant up to the golf course at 15th Street NE for irrigation. Currently, the wastewater plant does not provide tertiary treatment, which, by itself, could stop this project financially if grant monies are not found. There is approximately 1 mile of new pipe that would need to be installed which includes crossing a major local highway and then traveling up local city roads. This possible project will be looked at more closely in the future with the Douglas County Sewer District.

Excerpt from the 2004 Water Resource Inventory Area (WRIA) 44 and 50 Watershed Management Plan:

1.2 Reclaimed Water Feasibility Assessment

The Douglas County Sewer District Treatment Plant discharges about 3 million gallons per day of treated wastewater. This water could potentially be used for landscape irrigation for

parks, cemeteries and golf courses. Currently, the District does not have the facilities to treat the wastewater to the tertiary level, as required to protect public health and safety, and the tertiary treatment is cost prohibitive at this time compared to the benefits obtained. In the future, however, when the treatment plant is upgraded or a new plant is built, reclaimed water may become feasible.

Fish Hatcheries

There are no fish hatcheries within the District water service area, but there is one at Rock Reach Dam, which is adjacent to the service area. Currently, the water is taken from wells adjacent to the Columbia River and then passed directly back into the Columbia River after going through the hatchery. Using the water as reclaimed water could potentially be difficult to gain acceptance from the Ecology.

Storm Water Impoundments

There are several storm-water impoundments within the District service area that are managed by the City of East Wenatchee and Douglas County. In this area, the rainfall is scarce, and the majority occurs in the winter and spring months when irrigation water is not needed. The water that reaches these impoundments perk into the sandy/loam soils of the ponds. For the cost of adding infrastructure improvements to these small, sparsely located ponds for irrigation uses does not seem to be a financially viable nor prudent measure to pursue.

Potential Uses for Reclaimed Water

Industrial and Commercial

The industrial users have been informed that, if the water lost in their operations is supplied through their water meter, many are paying sewer charges on that water even though it may not be discharged to the sanitary sewer system because sewer charges are based on the water meter readings. These businesses have been encouraged to utilize their non-contact cooling water in some other aspect of their operation. Floor cleaning and non-treated float tanks are potential recycling uses for the non-contact cooling water.

Landscape Irrigation

This could include public parks, nurseries and golf courses. The effluent from the Douglas County Sewer District wastewater treatment plant is the only source of sufficient volumes to be used for irrigation. However, in order to protect public health and safety, treatment of the wastewater used for irrigation would need to be improved to the tertiary level. Tertiary treatment is estimated to be cost prohibitive at this time compared to the benefits obtained.

The closest park to the wastewater treatment plant is a very small City of East Wenatchee park at the north end of Valley Mall Parkway, approximately 2,000 feet north of the plant. This is estimated to be cost prohibitive for the benefits obtained.

Note: The above mentioned golf course, schools, and large landscape areas are currently served via irrigation water from either Greater Wenatchee Reclamation District or the Wenatchee Reclamation District. So, converting them to a water reclamation source does not provide any water conservation savings through the District's water system.

Conservation Program Monitoring

The District will continue to monitor overall water use, per-capita water use and the amount of DSL on an annual basis. The District will monitor the success or failure of its water conservation program by analyzing this data and determining the long-term trend in per-capita water usage. If the results of the program monitoring show that the water savings’ goals for per-capita water use are not being met, more rigorous program implementation or additional program items will be considered.

Evaluation of the implemented measures will be made based on the criteria in **Table 4.2**.

Table 4.2 – Conservation Efforts and Monitoring

Category and Measure Implemented	Economic Incentive Promoted	Monitoring Technique	Impact Water Supply (S) or Customer Demand (D)	Impact on Customer C=commercial R=residential I=industrial	Measure Reduces Peak Demand (P) or Overall Demand (O)
Public Education					
Public Outreach	N/A	Track number of brochures, presentations & school / civic group visits	D	R	P & O
Program Promotion	N/A	Track number of brochures, presentations & school / civic group visits	D	C, R, I	P & O
Technical Assistance					
Purveyor Assistance	N/A	Review impacts with other utilities & monitor customer feedback	D	C, R, I	O & P
Customer Assistance	N/A	Track number of customers, material delivered	D	C, R, I	O & P
System Measures					
Source Meters	N/A	Monitor meter accuracy	S	N/A	O
Service Meters	No	Measure % of customers measured	S	N/A	O
Unaccounted for Water/Leak Detection	No	Measure decrease in the amount of unaccounted for water	S	C, R, I	O

2. SOURCE OF SUPPLY ANALYSIS

The District currently obtains all of its water from the Regional Water System, with emergency supply from Well Nos. 4, 5, and 7. The Regional Water System source is the East Bank Aquifer near Rocky Reach Dam. The capacity of that aquifer is sufficient to supply the Regional service area for at least the next 20 years. *Volume 2 of the City of Wenatchee Comprehensive Water System Plan* contains further information regarding the Regional Water System. **Appendix C** contains the Water Facilities Inventory (WFI) form and water rights evaluation.

The District owns and shares its water rights as a one-third tenant in common with the City of Wenatchee and Chelan County PUD. Water rights are held through the Regional Contract for

common use by the three partners. Therefore, a water rights self-assessment for just the District is not applicable.

A water rights and source capacity analysis was performed in the 2012 Regional Water System Plan. The analysis in that plan concluded adequate physical source capacity through 2020 and water rights to serve through 2030. A study is currently in process to review other future water sources. The Regional partners recently purchased water rights that have been put into the State Water Trust Account until needed to meet system demands.

The possibility of developing other sources of water within the District has been reviewed, but none are deemed to be prudent at this time. A discussion of the alternatives follows.

Water Right Changes

Previous District well water rights have either already been transferred or are in the process of being transferred to the Regional Water System. No other water rights changes are currently proposed.

Interties

The District is intertied to the Regional Water System in one location, the Regional Supply Station. There are no other water systems of sufficient size adjacent to the District to warrant construction of more interties.

Artificial Recharge

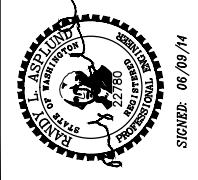
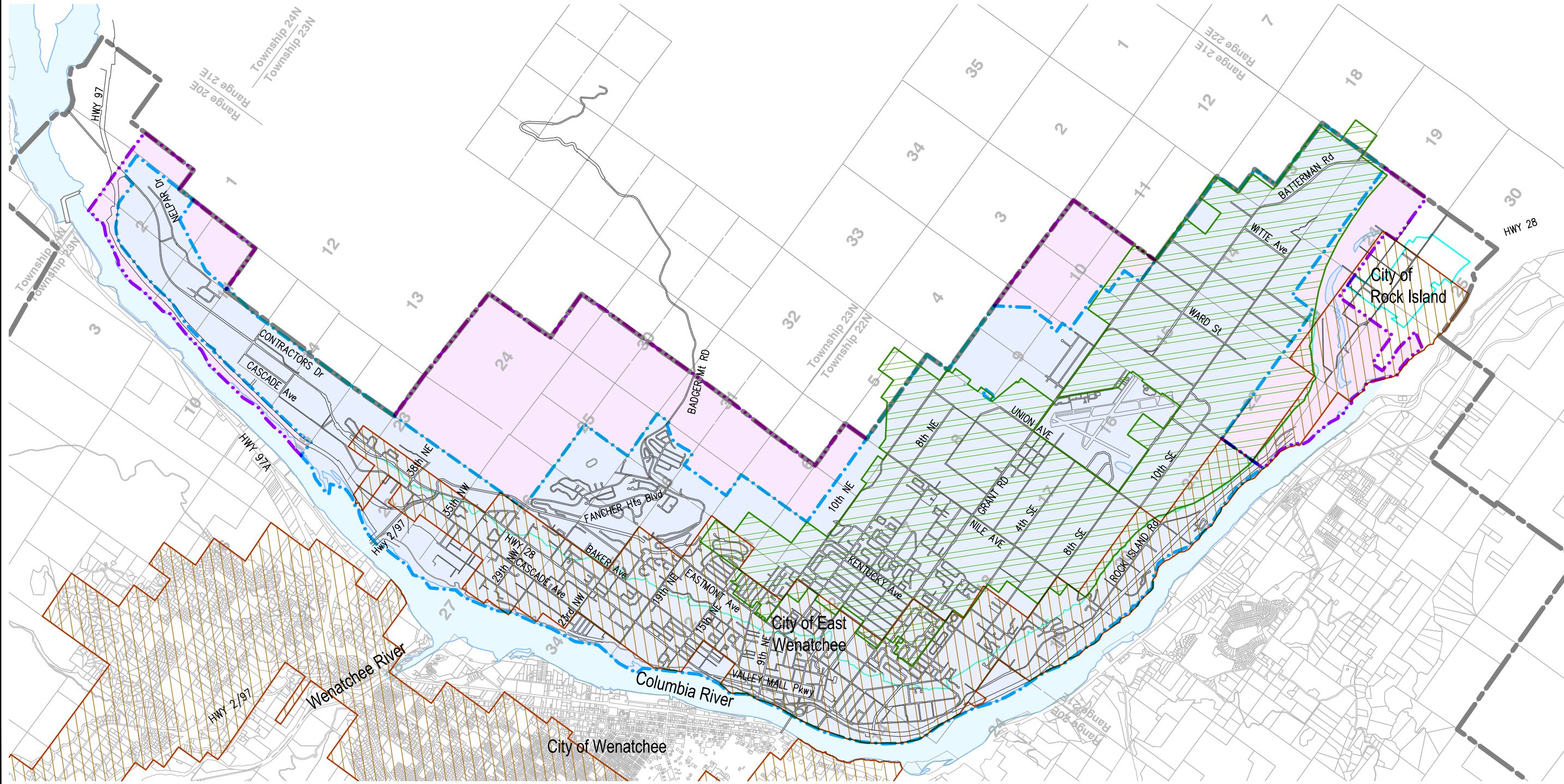
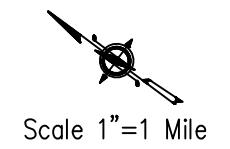
The Wenatchee Valley has an arid climate and does not receive significant rainfall. Most rights to surface water in the area (not counting the Columbia River) are already spoken for, being used for both domestic and irrigation purposes. The East Bank Aquifer is an extremely large source and artificial recharge would provide insignificant benefit.

Use of Reclaimed Water and Non-potable Sources

Refer to the Reclaimed Water Evaluation section earlier in this chapter. The District has been growing at less than 1-percent added connections per year since 2008. Therefore, only minor benefit to supply can be expected from conservation and reuse. **Figure 4.1** shows the District service area in relation to the irrigation service areas of the Wenatchee Reclamation District and Greater Wenatchee Irrigation District. These irrigation service areas cover approximately 80 percent of the District service area. Encouraging use of irrigation water, where available, for landscape watering will help to keep demand on the domestic water system as low as possible.

LEGEND

- EXISTING SERVICE AREA
- FUTURE SERVICE AREA
- WATER RIGHTS PLACE OF USE
- WENATCHEE RECLAMATION DISTRICT
- GREATER WENATCHEE IRRIGATION DISTRICT



**East Wenatchee Water District
2014 Comprehensive Water System Plan**

**FIGURE 4.1
IRRIGATION SERVICE AREAS**



ENGINEER RCP	DATE	BY	DESCRIPTION	NO.	DATE	BY	REVIEW

SCALE: SHOWN	
DRAWING IS FULL SCALE WHEN BAR MEASURES 2"	SHEET NO. 4.1

DRAWN: 06/09/14
CHECKED: 06/09/14

SOURCE PROTECTION

1. WELLHEAD PROTECTION PROGRAM

The East Wenatchee Water District (District) receives all of its water from the Wenatchee Regional Water System (Regional Water System), and no longer owns or maintains any of its own wells. The remaining active wells within the District's service area are Well Nos. 4, 5, and 7. Ownership of these wells have been transferred to the Regional Water System.

Protection of the Regional Well Field and the local wells is identified in the following two documents.

- Douglas County Wellhead Protection Program, January 1998.
- City of Wenatchee *Comprehensive Water System Plan Volume 2 – Regional Facilities*, May 2012.
- City of Wenatchee Regional Water Wellhead Protection Program – updated October 2012.

The District participated in development of these plans and is active in their implementation. These reports contain information regarding source water protection.

2. Regional Facilities

The following text in italics are excerpts from Chapter 5 of the City of Wenatchee *Comprehensive Water System Plan Volume 2 – Regional Service Facilities*, dated 2012, which relates to the Regional Water System's wells located within the District's service area.

Source of Supply

The Rocky Reach well field (Source) includes four wells. The well field is located in the Eastbank Aquifer just north of Rocky Reach Dam on the east side of the Columbia River. The aquifer wells have a tested capacity of 43 million gallons per day (MGD) with a current hydraulic capacity based on the transmission system of about 23 MGD. The current Contract (amended in 1998 to add the District) is based on a total transmission capacity of 19.5 MGD with allocation of 15.5 MGD to the City and 4.0 MGD to the Public Utility District No. 1 (PUD). Any excess transmission capacity in the supply pipeline is used by the District. All three purveyors share an equal undivided interest as tenants in common in the Regional facilities and water rights as identified in the Contract, Exhibits C and E, for the purpose of supplying the Regional Supply needs.

The District contributed Wells Nos. 4, 5 and 7, now Regional Facilities along with the Water District Regional Intertie, as part of the consideration for the District becoming a participant in the Regional Contract in 1998. The original Regional Contract was entered by the City and PUD in 1979. These wells are located within the District water distribution system and are currently used to provide standby supply to the Regional system. The pumping capacity of

these wells is approximately 2,600 gallons per minute (gpm). The North Bank and Hawley standby wells in Chelan County also provide an additional 1,945 gpm of pumping capacity.

The Source and backup wells are chlorinated at the point of withdrawal. The Regional transmission line is connected to the City's retail distribution system through a 30-inch transmission main between the well field and the connection point to the City's transmission system at 5th Street. The supply system serves the City of Wenatchee, PUD and District, including individual users of the PUD near the Rocky Reach Dam.

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 Regional or in which Regional may have an interest. Nothing herein shall be interpreted or used as a statement against the interests of or binding upon the Regional Water System in any future proceeding or analysis concerning the scope of the water rights held by Regional or in which Regional may have an interest.

Contaminant Sources (Wells 4, 5 and 7)

Description

Wells 4/5 - The Kentucky Avenue wellfield taps a deeper aquifer than the 19th Street wellfield and is located about one-half mile north of the Columbia River on a bench about 150 feet above the River. This wellfield is surrounded by suburban residential and agricultural land uses that are potential contamination sources. This aquifer is located in sands and gravels covered with semi-impermeable materials, making it less susceptible to contamination from septic systems and orchard operations than Well 7. Potential contamination sources include pesticides/herbicides from the extensive active orchard operations within the probable zone of contribution for these wells. In addition, all of the homes within the probable contribution zone for the aquifer were constructed over the last 40 years using onsite sewage disposal systems. This wellfield is also located adjacent to a former orchard dumpsite that could be potential source of chemical contamination. The Kentucky Avenue wells are also located adjacent to the Wenatchee Irrigation District's canal overflow points that could be a source of contaminated water. To reduce the potential of contamination from these two sources, the Irrigation District and the District have jointly constructed a diversion system to pipe the irrigation water through the old dumpsite. State Route 28 (SR28) lies within the CFR Boundary, which could also be a major source of contamination due to a hazardous chemical spill.

Well No. 7 - The 19th Street wellfield is located in a shallow unconfined aquifer at about 50 feet in depth. The wellfield is located about 200 feet east of the Columbia River in the vicinity of 19th Street NW. The aquifer is located on top of the sandstone bedrock in alluvial sands and gravels. The close proximity of this aquifer to the Columbia River and the surface makes it susceptible to contamination from numerous sources. These potential contamination sources include pesticides/herbicides from the former orchard operations within the probable zone of contributions for this wellfield. In addition, virtually all of the homes within the probable zone of contribution for the aquifer use onsite sewage disposal systems. A large percentage of these onsite sewage disposal systems were constructed prior to regulations that recognized the excessively permeable soils in the area as ineffective for wastewater treatment. Also, Sunset Highway (SR28), which is a major transportation corridor, is located east of the probable zone of contribution. Much of the truck traffic includes the transportation of hazardous chemicals.

On-site Wastewater Disposal Systems

Existing and planned residential development using on-site wastewater disposal systems constitute one of the major potential contamination sources for the District system. Most of the homes within the final Wellhead Protection Boundaries were constructed with on-site systems that would not meet current regulatory standards. This is because, at the time that most of the existing septic tank and drainfields were installed, state and local health regulations did not recognize the inadequate

treatment provided by what are now classified as “excessively permeable” soils. That is, prior to current health regulations, it was felt that the more quickly water infiltrated into the ground, the better. Now, however, it is recognized that septic effluent needs minimum amounts of time in the upper soil profiles in order for the naturally occurring microbes in the soil to adequately treat the septic effluent.

One probable result from the existing drainfields near District wells is elevated nitrate levels (nitrates are an indicator of septic contamination) in some of District’s wells. Water quality monitoring results show elevated nitrate in water quality monitoring results for Well Nos. 4/5. Correcting this problem and preventing increases in nitrate levels will require extension of sanitary sewer service within the wellhead protection boundary. Implementation of Douglas County’s adopted Growth Management Plan will require adequate water supply and, in order to protect water supply, it will be necessary to also provide sewer service in the Wellhead Protection Areas.

Stormwater Runoff

Stormwater runoff from development can be another source of groundwater contamination. Impervious surfaces related to development increase the amount of runoff and significantly alter the pattern of infiltration. In addition, stormwater typically contains hydrocarbons, phosphorus and other harmful contaminants that can contaminate groundwater.

While stormwater runoff in the Wellhead Protection Area is a risk and should be monitored, several factors reduce the possibility of contamination of the ground water system in the area. The first factor is the location of the Regional well field and Well No. 7. Recharge areas for both of these well fields lie upstream from the majority of development in the area. In addition, the Washington State Department of Ecology issued the Eastern Washington Phase II Municipal Stormwater Permit in 2007. The permit covers the City of East Wenatchee and the City of Wenatchee as well as the surrounding urban areas in Chelan and Douglas Counties. Under this permit the cities and counties have adopted requirements to prevent stormwater pollution and a regional stormwater management program. The program will be fully implemented by August 2011.

A second factor is the character of development within the Wellhead Protection Boundaries. This is particularly relevant for the Regional well field as park and other publicly-owned property. As proposed in the implementation program, the City will be working with Washington State Parks, PUD, and BPA to implement programs to protect the wellheads. Low-density residential and agricultural activities dominate the land use around the District well fields. As conversion from these activities occurs over time, the opportunity to control and manage stormwater to protect groundwater quality exists. As this conversion through development occurs, the opportunity exists to implement best management practices for stormwater control. These practices will be developed and adopted as part of the implementation program by Douglas County. Standards have been developed and adopted to meet both the requirements of the Wellhead Protection Program and relevant State and Federal requirements.

A third factor mitigating the threat of stormwater in the Final Wellhead Protection areas is hydraulics and dilution. As the well fields appear to be in good communication with the Columbia River, runoff that enters the river will be transported downstream. Further, the total volume of stormwater runoff in the area is minute compared to the volume of the Columbia River at any given time.

Orchards

Orchards have been the foundation of the greater Wenatchee economy for decades. However, associated with orchards is the application of chemicals that can contaminate groundwater. Historic orchard operations used arsenic and other chemicals. Current orchardists apply a range of Synthetic Organic Compounds (SOCs) to achieve quality production. Some of these SOC’s have been detected at low levels in District wells. The results of a Washington State Department of

Health Area-Wide Groundwater Monitoring Project, that included District's Well Nos. 2A/B, 3, and 5, showed trace amounts of SOC's in the test results. While these results do not present any known health risks, they are indicative of the potential for contamination from orchard activities. A current review and research of Federal and State databases conducted in the preparation of this plan has not revealed any additional potential contaminate sources in the capture areas of the Wells 4/5 and 7.

Approximately 10 years ago, sanitary sewer service was extended into the area around Well No. 7. As a result of this activity, all new residences and existing residences with failing septic systems are required to connect to the sanitary sewer system. For Well Nos. 4 and 5, much of the area adjacent to the wells is undergoing a conversion from commercial orchards to residential development. Sewer service has been extended into areas north of the well field and it is contemplated that sewer service to the west of the well will be extended in the near future as a result of this conversion. A windshield review of the activities and land uses within the capture zones for these two well fields, indicate no other changes.

3. WATERSHED CONTROL PROGRAM

The District does not obtain water from any surface water sources. The District's service area is located within the boundary of the Moses Coulee Water Resource Inventory Area (WRIA) 44 as identified in the District's *Watershed Management Plan – Moses Coulee and Foster Creek Watersheds – WRIA 44 and 50*, September 2004. The District was directly involved in preparation of this plan which outlines recommendations and goals for management of the watershed area. The WRIA plan identified education and conservation practices as the greatest emphasis to preservation of the watershed. The relevant sections of this report can be found in **Chapter 1**. The District anticipates continued involvement in implementation and updates to the WRIA plan.

CHAPTER 6

OPERATIONS AND MAINTENANCE

1. WATER SYSTEM MANAGEMENT AND PERSONNEL

General Policies

East Wenatchee Water District (District) general policies are established by a three-member Board of Commissioners based on the priorities of the protection of the public health and welfare, regulatory compliance and sound fiscal management of the utility.

Structure

The District is operated as an enterprise utility (financially self-supporting). The District consists of four basic divisions. These include administration, operations, maintenance, and customer service.

The General Manager reports directly to the three-member Board of Commissioners and manages the functions of approximately 19 full-time employees. Duties of the General Manager include operation, maintenance, and budget administration.

Administration is the responsibility of the General Manager. These responsibilities include budget preparation and fiscal management during the operating year, personnel management, scheduling of engineering services, and development of capital improvement projects.

Engineering Operation and Maintenance

Operations

Routine daily operations are supervised by the Superintendent with the assistance of a Lead Man. Operations encompasses the operation of the District's Regional Supply Station, reservoir sites, booster pump stations and pressure reducing valve (PRV) stations.

Figure 6.1
Water Resource Department
Organizational Chart

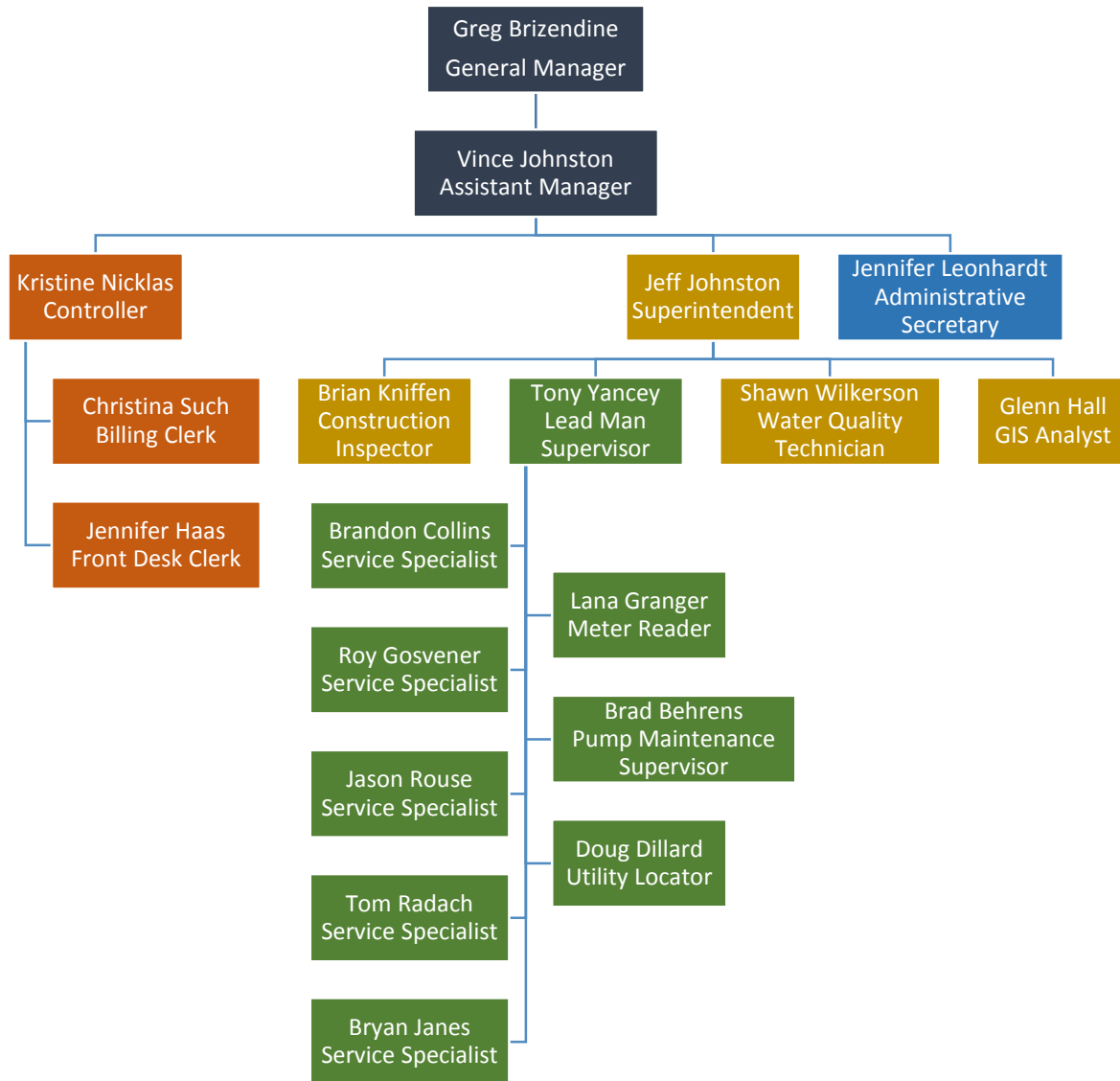


Table 6.1 - Water Utility Personnel, Certificates, Licenses and Responsibilities			
Personnel	Position	Certification	Responsibilities
Greg Brizendine	General Manager	Water Distribution Manager 3	Chief Executive Officer for the District, directly accountable to three member Board of Commissioners. Overall Personnel/Operations, Fiscal Management.
Vince Johnston	Assistant Manager	Water Distribution Manager 3 Cross-Connection Control Specialist 1 CDL	Under the direction of the Manager. To assist in Supervision, Administration, Maintenance and Operations.
Jeff Johnston	Superintendent	Water Distribution Manager 2 Cross-Connection Control Specialist 1 CDL	Supervises operation and maintenance of the distribution system.
Tony Yancey	Lead Man Supervisor	Water Distribution Manager 2 Cross-Connection Control Specialist 1 CDL	Assists Superintendent, utility work on the water system. Install new meters, service lines, taps, general work on the distribution system.
Shawn Wilkerson	Water Quality Technician	Water Distribution Manager 2 Cross-Connection Control Specialist 1 Backflow Assembly Tester, CDL	Administers cross connection control program. Tracks inventory and prepares monthly plan reports. Administers water quality reporting and testing.
Glenn Hall	GIS Analyst	Water Distribution Manager 1	Develop and maintain GIS of water system. Duties are performed in accordance with federal, state, and local regulations.
Lana Granger	Meter Reader	Water Distribution Manager 2	Full time meter reader. Provides Meter Maintenance information. Other work as required.
Brad Behrens	Pump Maintenance and Safety Supervisor	Water Distribution Specialist 2 Cross-Connection Control Specialist 1 CDL	Maintenance of all water related production equipment. Prepares weekly and annual safety meetings as Safety Officer.
Doug Dillard	Utility Locator	Water Distribution Manager 1 Cross-Connection Control Specialist 1 CDL	Locates District's water lines and underground facilities.
Brian Kniffen	Construction Inspector	Water Distribution Manager 3 Cross-Connection Control Specialist 1 CDL	Provides all supervision and inspection of District construction projects and oversees developer extensions. Other work as assigned.
Bryan Janes	Service Specialist	Water Distribution Manager 2 Cross-Connection Control Specialist 1 Backflow Assembly Tester, CDL	Equipment Operator, utility work on the water system. Install new water meters, service lines, taps, general work on the distribution system.
Brandon Collins	Service Specialist	Water Distribution Manager 1 Cross-Connection Control Specialist 1 CDL	Equipment Operator, utility work on the water system. Install new water meters, service lines, taps, general work on the distribution system.
Roy Gosvener	Service Specialist	Water Distribution Manager 1 Cross-Connection Control Specialist 1 CDL	Equipment Operator, utility work on the water system. Install new water meters, service lines, taps, general work on the distribution system.
Jason Rouse	Service Specialist	Water Distribution Manager 1 Cross-Connection Control Specialist 1 CDL	Equipment Operator, utility work on the water system. Install new water meters, service lines, taps, general work on the distribution system.
Tom Radach	Service Specialist	Water Distribution Manager 1 Cross-Connection Control Specialist 1 CDL	Equipment Operator, utility work on the water system. Install new water meters, service lines, taps, general work on the distribution system.

Maintenance

Routine daily maintenance of the distribution system is supervised by the Superintendent with the assistance of the Lead Man. Maintenance includes all the tasks necessary to insure the integrity of the distribution system remains sound and in good working condition. These tasks include the following:

- Meter maintenance, both new installations and replacements.
- Mainline installations.
- Mainline tapping for new services and fire lines.
- Service line repair within the public right-of-way.
- Fire hydrant installations and repair.
- Inventory monitoring.
- 24-hour emergency response.
- Valve installation and maintenance.
- Well pump, booster pump and reservoir storage maintenance.
- General plant maintenance.
- Developer extension inspections.
- Disinfection system operation.
- Mainline flushing.
- Leak detection and repair.
- Miscellaneous tasks as needed.

Customer Service

Routine customer service tasks are supervised by the District office staff and customer contact is directed to specific personnel according to the task. These tasks include the following:

- Radio read meters are installed in all areas both commercial and residential. All meters are read every 2 months.
- Installation of metered fire hydrant valves with a double-check valve for construction water.
- "Turn-offs" for nonpayment.
- New account "turn-ons."
- Response to customer requests.
- Meter records. All meters have a record kept which includes all pertinent information.
- Utility locations for construction excavations.
- Various work order reports regarding information such as needed repairs and meters, vaults and service line repair.
- Miscellaneous tasks as needed.

2. OPERATOR CERTIFICATION AND PROFESSIONAL GROWTH

Currently, under Washington Administrative Code (WAC) 256-292-040 the District distribution system is classified as a Group 3 requiring the District to have at least one Water Distribution Manager classified at a level equal to or higher than the water system's classification. The District system is also required to have a Cross-Connection Control Specialist (CCS) responsible for the cross-connection control program and a certified backflow assembly tester (BAT) for inspecting, testing and monitoring backflow prevention assemblies. Private assemblies are the responsibility of the owner to have tested and to supply a copy of the successful test to the District. The District sends out notices annually to each assembly owner, on their anniversary date of installation, to remind them of their annual test.

Professional growth requirements are met by scheduling all utility workers and operators for enough training to acquire a minimum of 30 hours of contact training time, qualifying for 3 continuous education unit (CEUs) over a period of 3 years at seminars, online classes, short training courses and college level classes that relate directly to job duties and tasks. The number of contact hours of each of the training sessions is documented and reported to the appropriate Water Works Certification Program representatives.

3. SYSTEM OPERATION AND CONTROL

Major System Components

The major components of the District consists of a Regional Supply Station, backup emergency/standby well sources, reservoirs, intra-zone booster pumps, PRV, mainline valves, and distribution grid system.

Preventative Maintenance

Preventative maintenance is based on regular and frequent visits to the various facilities with scheduled routine inspections and tasks performed as part of the maintenance program. Information is recorded and any necessary work is noted and scheduled accordingly.

Table 6.2 lists the maintenance performed for the various components at the source facilities. The following sections include tables and lists of the major components of the distribution system with the frequency and descriptions of the maintenance performed.

Table 6.2 - Source Maintenance Requirements		
Frequency	Facility/Component	Existing Maintenance
Daily	Pump motor	Visual Inspection
	Pump packing	Visual and Adjust
	Pump control Valve	Visual Inspection
	Electrical Panels	Visual Inspection
	Chlorine Injection Equipment	Visual, Testing, Replenish Hypochlorite day tank
	Telemetry Panels	Visual Inspection
	Read & Record Meters and Gauges	Read and Record
	Perform Checklist Tasks	Visual Inspection
	Minor House Cleaning	As Needed
	Heaters	Visual Inspection
	Exhaust Fans	Visual Inspection
	Windows/Doors	Visual Inspection
	Vent Filters	Visual Inspection
Pump/Reservoir Setpoints	Adjust if Needed	
Weekly	Read & Record Flow Meters	Visual Inspection
	Major House Cleaning	Sweep, Vacuum, Dust, Wash
Semi-Annually	Telemetry Emergency Shutdown	Test Standby Batteries
	Telemetry System	Test and Calibrate
Annually	Inventory	Balance Inventory
	Telemetry System	Test and Calibrate
	Pump, Motors and Motor Controls	Inspection

Facility/Storage Zone	Location	Frequency	Existing Maintenance
Well 4 -Zone 2	901 S. Kentucky	Daily or Monthly. By City of Wenatchee since they are now Regional assets	Visual inspection, pump control valve, overboard valve, surge valves, packing, motor oil, electrical panel and general area condition.
Well 5 -Zone 2	(SAME AS WELL 4)		
Well 7 -Zone 2&1	1930 NW Cascade	Monthly (standby facility) By City of Wenatchee since it is a Regional facility.	Visual inspection, pump control valve, overboard valve, packing, motor oil, electrical panel and general area condition.

PRVs

PRVs are used to reduce pressure due to changes in topography. Generally, the 4-inch and larger valves are designed to provide fire flows and the 3-inch and smaller valves primary purpose is to provide domestic demand pressures. The District has approximately four PRVs installed to eliminate dead end mains and provide circulation. **Table 6.3** summarizes the pressure reducing stations maintenance requirements and set points.

Table 6.3 – Pressure Reducing Valves	
Maintenance Requirements	
Frequency	Existing Maintenance
Monthly	Inspect valve and chamber
Semi-annually	Inspect valve and chamber. Also check pressure.
Annually	Inspect, clean, operate and check pressures.
Every 5 years	Rebuild, disassemble, clean, test and check pressures.
As needed	Rebuild and/or replace.

Mainline Valve Maintenance Program

The District maintains an electronic geographic information systems (GIS) map of the distribution system which can be accessed by the District’s employees. Locating the mainline valves is accomplished visually by using the global positioning system (GPS) unit or by using a metal detector.

The District has a formal valve exercising program. Valves have been operated and repaired on an as-needed basis.

The District’s goal is to operate, through their full range of travel, all valves on an annual basis. Valve type, location, depth, and the number of turns will be recorded. Other pertinent information will also be noted such as any special conditions that must be met before operation, needed repairs, ease or difficulty of operation and any other observations that may be useful to future operation and maintenance.

The distribution system is divided into nine different valve zones and these valves will operated annually.

Reservoir Maintenance Program

The District has a formal reservoir inspection program. A walk-through is performed at the reservoir sites once per week where the general conditions of the facility, such as security fencing, hatch covers, road access, ladders, vents, overflows and general condition of the grounds will be checked. Altitude valves, control valves and vaults will be inspected once per month. Level probe accuracy and hatch seals are checked annually. Conditions will be recorded and necessary repairs and maintenance will be scheduled by the Superintendent. All reservoirs and booster pump stations are electronically monitored as an outcome of the District’s vulnerability study. **Table 6.4** summarizes the District’s reservoirs and their maintenance schedules.

Table 6.4 - Reservoir Maintenance				
Facility	Storage	Location	Frequency	Existing Maintenance
2A 15 th Shop	300,00	718 NE 15 St.	Weekly	Visual inspection-vents, overflow line, security and general condition.
2B 15 th Shop	500,000	(AS ABOVE)		
Baker Flats	1,500,000	13200 US 2/97	Weekly	Visual inspection-vents, overflow line, security and general condition.
5A Pearcot	200,000	145 S. Kentucky	Weekly	Visual inspection-vents, overflow line, security and general condition.
5B Pearcot	860,000	(AS ABOVE)		
6A 10 th St.	300,000	1707 NE 10 PL	Weekly	Visual inspection-vents, overflow line, security and general condition.
6B 10 th St.	500,000	(AS ABOVE)		
Danials Drive	1,000,000	2300 Badger Mt. Rd.	Weekly	Visual inspection-vents overflow line, security and general condition.
Veedol	1,000,000	4400 Grant Rd.	Weekly	Visual inspection-vents overflow line, security and general condition.
Fancher	1,000,000	Fancher/Badger Mt. Rd.	Weekly	Visual inspection-vents overflow line, security and general condition.
Canyon Hills	500,000	Badger Mtg. Rd. (1 mile above Fancher Res.)	Weekly	Visual inspection-vents overflow line, security and general condition.

Distribution System

The distribution system consists of a variety of pipe sizes, types and ages. The size of mainlines ranges from 2 to 24 inches. Types of pipe include galvanized steel, steel, C900 PVC, high-density polyethylene (HDPE) and ductile iron. See **Table 1.5** containing more detailed information on the District’s distribution system.

Maintenance of the grid system is performed on an as needed basis. Protection of the system is provided through active participation in the Northwest Utility Notification Center-DIG number which requires a 48-hour lead time call for a locate of utilities for all scheduled work requiring excavation. The utility council meets monthly to discuss the number of locates performed, and damages that may have occurred, and tries to determine if there is anything which can be improved to avoid future damages.

The booster pumps are assigned reservoir level set points according to demand requirements throughout the year. During high/low demand times, various pumps are adjusted by set points to allow maintenance and operational rest. At this time, the Assistant Manager and Superintendent

coordinate the operation of the telemetry system for booster pump station and reservoir level set points.

Water Utility Equipment

The District is well equipped for a variety of tasks, including emergency response and regular operations and maintenance (O&M) activities. **Table 6.5A** and **Table 6.5B** list the large and small equipment available to the distribution system, respectively.

Table 6.5A – Vehicles and Large Equipment			
Vehicle	Description	Year	Prime Operator
# 1	GMC Pickup –Quad door	2004	Assistant Manager/ Office
# 2	Toyota Tundra	2001	Utility Crew
# 2-A	Ford 4X4 F 250/ with Plow	2006	Utility Crew
# 3	Chevrolet 4X4 2500	2003	Utility Crew/ On Call 24 Hr.
# 4	Chevrolet 4X4 2500	2010	Superintendent
# 6	Toyota Tacoma 4X4	2013	Utility Locator
# 7	Toyota Tacoma 4X4	2013	Pump Maintenance
# 7-A	Jeep Wrangler 4X4	2004	Meter Reading RH Steering
# 8	Ford 4X4 F 350	2009	Utility Service Vehicle
# 16	Ford 4X4 F 350	2011	Utility Service Vehicle
# 19	Ford 4X4 F 350	1997	Utility Service Vehicle
# 19-A	Ford 4X4 F 350	2001	Utility Service Vehicle
# 9	International Dump Truck	1980	Utility Crew
# 9-A	Kenworth Dump Truck	2005	Utility Crew
# 10	JD 410 Backhoe	1992	Utility Crew
# 11	JD 410 Backhoe	1996	Utility Crew
# 15	JD 410 Backhoe	2004	Utility Crew
# 12	Asphalt Roller		Utility Crew
# 13	Case Sweeper	1952	Utility Crew
# 14	Ingersall Rand Air Comp.	2002	Utility Crew
# 15	Asphalt Saw		Utility Crew
# 17	Travel-Vac-300		Utility Crew
# 21	P&H Arc Welder	1963	Utility Crew, Gasoline (425 amps)
	Toyota Tacoma	2013	Utility Service Vehicle
	Toyota Tacoma	2014	Utility Service Vehicle
	Toyota Tacoma	2014	Utility Service Vehicle

Table 6.5B - Small Equipment
Description
Motorola Portable Radios - 4
Jackhammer and Concrete Drill
Lift Forks for Backhoe Bucket
Snow Blade
Emergency Light Unit
Steam/Pressure Washer, 115VAC
ICE BREAKER #450, 115VAC, 20AMP (Pipe thawer)
Well Level Probe/Sensor - 2
Data Logger & Lap Top Computer
Rigid Pipe Threader - 2
Rigid Power Head Drill
Cut-Off Saws 4@18"
Rotohammers - 3
Hand Grinders - 4
Homelite 2" Diaphragm Pump - 2
Honda 1" Pump - 4
Metro Tech Pipe Locators - 3
Various Metal Locators - 4
Tapmate Too Tapping Machine, 3/4" to 2"
Tapmate Tapping Machine, 4" to 8"
Portable Honda 2500 Generator - 5
Wire Feed Welder
OX/AC Welding Set
Arco Arc Welder, Gasoline
Hand Compactors - 3
Pressure Test Pump, gasoline
Transit Unit
Electronic Data Loger – Flow and pressure
Pavement Breaker, Asphalt saw
Various Street Flagging, Barricades, Cones, PVC fencing etc.
Propane Torch, Weed Burner, Thawer- 2@10 gal.
Chain Saw, 18"
Misc. small hand tools
Rigid band saw
Plasma cutter
Craftsman drill press
Stihl combination tool

4. WATER QUALITY MONITORING

The District is required to perform water quality monitoring within its distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, lead and copper, and disinfection by-products in accordance with WAC 246-290.

Routine Procedures

Coliform Monitoring

Currently, 30 routine coliform samples are collected each month in the distribution system at locations specified in the written Coliform Monitoring Plan. If the sample tested by the laboratory is unsatisfactory (positive, coliforms present), the lab will contact the District and the District will collect repeat samples at the same location as well as upstream and downstream samples as specified in the monitoring plan. The coliform monitoring site map is shown in **Appendix L**. These repeat samples shall be taken by the end of the next business day after receiving the unsatisfactory results. If the results conclude that a maximum contaminant level (MCL) is exceeded (i.e., coliform are present in two or more samples for the month, including repeat samples), the District shall proceed with public notification in accordance with WAC 246-290-495.

Disinfectant Residual Concentration Monitoring

The District must comply with disinfectant residual concentration requirements for treated groundwater. Disinfection requirements applicable to the District are contained in WAC 246-290-451, which states that a disinfectant residual concentration shall be detectable in all active parts of the distribution system. The City's chlorination target is to maintain a residual disinfectant concentration of at least 0.2 milligrams per liter (mg/L) throughout the distribution system. In 2012, the average free chlorine residual throughout the distribution system was 0.32 mg/L.

Samples collected and submitted for coliform testing shall also be tested for disinfectant residual concentration to ensure the disinfectant residual meets the regulatory requirements and achieves the target levels set by the District.

Lead and Copper Monitoring

Specific requirements are contained in Title 40, Parts 141.86, 141.87, and 141.88 of the Code of Federal Regulations (40 CFR). The District was required to collect one set of 30 samples in 2011 and has an ongoing sampling schedule of every 3 years. All lead and copper monitoring completed indicated lead and copper levels were below the action levels at the 90th percentile. Sample sites shall be selected based on the known existence of lead pipes, copper pipes and copper pipes with lead solder in accordance with 40 CFR 141.86(a). All samples, except for lead service line samples, shall be "first draw tap samples" taken at a cold water tap in which water has not been drawn from the tap for at least 6 hours, but no more than 12 hours. Sample faucets shall be flushed with cold water the evening prior to collecting the sample. Lead service line samples shall be collected with one of three methods in accordance with 40 CFR 141.86(b). The locations of future sample sites shall be the same as past sample sites, unless unavoidable conditions prevent sampling at the same locations.

Stage 2 Disinfection Byproduct Monitoring

Disinfectants are an essential element of drinking water treatment because of the barrier they provide against waterborne disease causing microorganisms. However, disinfection byproducts (DPBs) form when disinfectants used to treat drinking water react with naturally occurring materials in the water (e.g., decomposing plant material).

Total trihalomethanes (TTHM – chloroform, bromoform, bromodichloromethane, and dibromochloromethane) and haloacetic acids (HAA5 – monochloro-, dichloro-, trichloro-, monobromo-, and dibromo-) are widely occurring classes of DBPs formed during disinfection with chlorine and chloramine. The amount of trihalomethanes and haloacetic acids in drinking water from one water system can change from day to day, depending on the season, water temperature, amount of chlorine added, the amount of plant material in the water, and a variety of other factors.

At this time, the environmental protection agency (EPA) believes that the best way to control DBPs is both to regulate known byproducts and to limit the quantity of disinfection byproduct precursors (e.g., decomposing plant material) allowed to react with disinfectants. TTHM and HAA5 are useful indicators for measuring DBPs in chlorinated drinking water because they commonly occur at natural levels that can be easily measured.

The District collects four samples every quarter from various points throughout the distribution system based on data collected from previous Stage 1 monitoring for TTHM and HAAS acids. All samples to date have been well under the MCLs set forth by the EPA and the specific requires found in WAC 246-290-300.

Violation Procedures

MCLS are given in WAC 246-290-310. If an MCL is exceeded, the District will take follow-up action in accordance with WAC 246-290-320. Follow-up action for coliform monitoring involves notification to the Washington State Department of Health (DOH) in accordance with WAC 246-290-480, identifying the cause of the coliform presence and correcting it, and conducting public notification as required.

There also are no MCLs established for lead and copper. If the 90th percentile results exceed the action levels, the District would follow the lead and copper rule for requirements to obtain optimal corrosion control.

Violation of MCLs, and failure to comply with monitoring requirements, primary standards, or treatment technique requirements will be reported to the DOH in accordance with the record keeping and reporting requirements of WAC 246-290-480.

5. EMERGENCY RESPONSE PROGRAM

Vulnerability

A vulnerability analysis is an estimation of the degree or extent the system is affected by an emergency condition in relation to how it must then continue to perform. The analysis helps in understanding and determining the strengths and weaknesses of the system in relation to certain anticipated or

simulated conditions or emergencies. The District evaluated both the criticality of all assets to the mission and the vulnerability of those assets to a set of 14 threats that management considered important. The District has completed the formal vulnerability assessment and has forwarded a copy of that study and certification to the EPA.

Partial List of Causes of Emergencies

Natural Disasters

The most probable natural disasters that could be expected in the East Wenatchee area are mainly weather related. These include high winds such as the 1962 Columbus Day storm, heavy snow fall, flooding from heavy rains or snow melt conditions, wild fires, and electrical storms. The possible results of these disasters are power outages, blocked access, and possible direct damage to major components. Other natural disasters are possible, but less probable. These may include volcanic eruptions causing ash fall and earthquakes.

Vandalism, Civil Disorders, Strikes, Multivalent Acts (Man-Made)

Vandalism and civil disorders, although unlikely, could have a significant impact on the District's water system. Rampant disregard for private and public facilities could result in the destruction of key components such as power lines, pumping facilities, and control facilities. Damage to facilities by means of arson or other physically destructive means could cause power outages, blocked access and damage to components or facilities. It is extremely difficult to guard against such activities, therefore, the primary response will to repair the damage or utilize backup system.

Sanctioned union strikes causing blocked access to facilities is unlikely due to anti-strike clauses in the Union contracts and binding arbitration. However, if strikes did occur, trained management staff could fill in until the disagreements are resolved.

Intrusion alarms have been installed at all well, pump station and reservoir sites.

Equipment Failure

Equipment failure can be caused by a number of factors. Certainly the age of components can be a cause, but in many cases faulty maintenance is the cause. It is imperative that sound maintenance programs be followed. Both preventative and corrective maintenance programs are important. Following suggested manufacturer preventative maintenance programs for equipment will minimize equipment failure and extend the longevity of the equipment. Corrective maintenance, whether it is simply replacing aging inefficient components or prompt repair of failed equipment, can prevent a bad situation from becoming a major emergency.

Negligent Operations

All operations require that certain procedures be followed for satisfactory performance. If sound procedures, whether established "in house" by a regulatory agency or local government for the operation of a system are not followed, then the omission constitutes negligent operations.

Accidents

Accidents generally result in either personal injury or property damage, and in the worst cases, both. Accidents can be avoided by following standard operating procedures and using safety equipment properly. A frequent accident which generally causes a functional loss of at least a portion of the system is damage to pipe lines by excavation. Usually the damage is a result of poor excavation techniques, lack of care or failure to call for a utility locate before beginning excavation.

Power Failure

Power failure at the supply facilities would result in loss of supply to District reservoirs. The failure can be caused by a number of factors as discussed earlier. A power failure situation has the potential to have a tremendous impact on the distribution system depending on the duration of the outage because there is no backup power supply. Portable power generation would need to be leased and put into service if the situation continued for more than 1 day. The District has storage of 6.4 million gallons, which would provide emergency supply to the District customers for approximately 4 days with conservation measures initiated.

Power failure with the District distribution system would constitute more of a concern for the higher zones because none of the booster pump stations would operate and portable power generators would need to be put into service if the outage continued.

Table 6.6 - Effects of Emergency Conditions		
Condition	Effect	Possible Result
Natural Disasters Severe Weather Earthquake	Flooding High Winds Blocked Access Power Outage Fire	Personnel cannot access facilities Equipment & controls offline Loss of ability to supply water Pipe line damage
Vandalism, Civil Disorder, Strike	Sabotage Fire Personnel Absent	Loss of controls Equipment off line Blocked access Equipment damaged
Faulty Maintenance	Equipment Failure	Loss of redundant systems Loss of ability to supply water Equipment damaged
Negligent Operation	Loss of Operation Damaged Equipment	Loss of ability to supply water Damaged equipment Loss of disinfection capabilities
Accidents	Personal Injury Property Damage Power Outage Blocked Access	Loss of personnel Damaged facilities Loss of ability to supply water
Power Failure	Loss of Control Equipment Offline	Loss of ability to supply water

For all conditions and effects listed above, the District would respond with the following response procedures.

Emergency Response Procedure

Distribution System

The distribution crew of the District is responsible for responding to emergencies within the distribution system service area. The emergency response plan is designed to provide a response and preliminary assessment of any report of a potential problem or emergency within 20 minutes of receiving the report.

During regular working hours, a report of a potential emergency can be received from virtually any citizen or employee by phoning the District. All phone numbers are listed in the blue pages of the phone directory.

Upon receiving the report, the Superintendent or appropriate crew member is notified and given the location of the potential problem. The report is immediately investigated, given an initial appraisal and a preliminary report is radioed back to the District office. A detailed action plan is formulated to determine the exact cause and repairs are scheduled. If excavation is required to complete the repairs a phone call is placed to the Northwest Utility Notification Center-DIG number and emergency utility locates are requested of all the appropriate utilities. The locations are usually completed within the following hour.

Between 5:00 pm and 8:00 am on weekdays, and 24 hours per day on weekends and holidays, emergencies can be reported by dialing the listed District Office numbers. This connects the caller with the answering service who then contacts the District's on-call person. The answering service is provided a yearly list of employees' names and phone numbers who are assigned the on-call duty. On-call employees carry a pager and cell phone which the answering service can activate and can call anywhere in the valley. Each employee is assigned 7 consecutive days of on-call duty. If the answering service cannot contact the individual on-call, the answering service then attempts to contact alternate members of the District, beginning with the Assistant Manager, then the Superintendent, then other members of the on-call list until they contact a representative of the District.

If there is a concern regarding a possible damage claim being filed due to private property damage caused by the emergency condition or as a result of the repairs being made, the Manager, Assistance Manager, or Superintendent is notified.

Following is a list of the emergency response members of the District.

**Emergency Response Phone Numbers
For the East Wenatchee Water District
District Office Phone Number (509) 884-3569**

Home Phone Numbers of Employees on On-call List

Brandon Collins	(509) 664-1039	Roy Gosvener	(509) 630-2040
Shawn Wilkerson	(509) 387-6428	Doug Dillard	(509) 663-3343
Tony Yancey	(509) 669-8444	Brian Kniffen	(509) 470-5237
Lana Granger	(509) 884-1998	Jason Rouse	(360) 510-7427
Brad Behrens	(509) 663-9515	Tom Radach	(509) 888-4473
Glen Hall	(509) 630-4758	Bryan Janes	(509) 886-0852

On-call Cell Number..... (509) 630-4758

Manager	Greg Brizendine	(509)884-7871 (h) (509) 630-0357 (c)
Assistant Manager	Vince Johnston	(509) 664-4080 (h) (509 630-4754 (c)
Superintendent	Jeff Johnston	(509)630-9741 (c)

Other Useful Phone Numbers

City of Wenatchee Water Shop	(509) 664-3380
Chelan County Public Utility District Water Dept	(509) 663-8121
City of East Wenatchee Public Works Department	(509) 884-1829
Douglas County Public Works	(509) 884-7173
Northwest Utility Notification Center-DIG Number	811
Chelan / Douglas Health District	(509) 886-6400
Greater Wenatchee Irrigation District	(509) 884-4042
Wenatchee Reclamation District	(509) 663-0002
Douglas County Public Utility District	(509) 884-7191
DaVita East Wenatchee (dialysis center)	(509) 886-4950
See letter in Appendix S	

6. RELIABILITY ANALYSIS - EMERGENCY SCENARIOS

Loss of Regional Booster Pump Station

The District’s primary source of water comes from the Regional Well Field at Rocky Reach Dam. This aquifer and pumping facility is shared by the City of Wenatchee, Chelan County PUD, and the District. The District pulls off the 30-inch regional pipeline before it crosses the Columbia River Bridge. If the District loses this source of water, it can turn on the old wells and supply water to its customers. The District has the ability to backflow water from its system to the other regional partners across the river via a PRV located in the District’s Regional Supply Station facility.

Loss of Well Pumps

The District well sites, which now Wenatchee Regional Water System (Regional Water System) assets, offer various levels of demand and redundancy. Well Nos. 4, 5, and 7 all pump into Zone 1. Well Nos. 4 and 5 are more than three miles away from Well No. 7 and are supplied by a different power grid.

Loss of Telemetry

If the telemetry system is offline for an extended period due to extreme causes such as natural disaster, etc., the system can be operated manually if needed until the telemetry and automatic controls can be restored.

Loss of Disinfecting Capabilities

If disinfection capabilities were lost, repairs would be initiated immediately. The disinfection injection system is composed of a 60- gallon poly tanks with an injector that adds a 12.5 percent chlorine solution into the system based on the stations pumping rate. If a unit is out of service, the temporarily District may use another chlorinator unit from another station, based on the type of outage or emergency. The District does have a backup chlorinator unit.

Diminished Ability to Deliver Water

In such an emergency situation, local media such as the local radio stations and newspapers will be contacted for public notification of mandatory water conservation measures. Neighboring water utilities will also be notified. All non-essential uses of water will be discontinued. Water users will be encouraged not to hoard water by filling bath tubs and other large containers but rather to conserve. The message will include a general description of the problem and give a preliminary time table for the completion of repairs with scheduled informational updates to keep the water customers informed as to the progress of the repairs and the effects of the conservation measures.

Distribution**Leaks and Pipe Line Failures**

Problems regarding leaks or failures are discovered and reported through a variety of means and sources are responded to on a 24-hour per day basis as described earlier. The District also has emergency response equipment available in the form of portable pumps, small generators, work lights, metal cut-off saws, backhoes, dump trucks and all necessary small tools to perform repairs. The District does have the ability to borrow large trailer mounted generators from local contractors and neighboring utilities if an emergency required that level of response.

Booster Pump Failure

Each booster pump station has at least two pumps. The 1286 Zone is supplied by two separate booster pump stations. If an entire station becomes non-functional, the other station has the capacity to supply water.

If the Daniels Drive, Canyon Hills, or Grant/Nile booster are no longer operating, the reservoirs can provide water to their respective zones for several days if an emergency arose and water conservation measures were enforced. The water from every reservoir can be moved downhill to the adjacent lower zone in the case of an emergency.

If a reservoir is lost due to structural failure, the tank structure will be repaired in the most expedient manner available to the District. The most effective way to avoid a structure failure of any of the components is to diligently follow a good preventative maintenance program of inspection, maintenance, and operation and make every effort to keep the reservoir in sound structural condition.

Emergency Disinfection

The District has the capability to perform emergency disinfection of water lines through the use of a portable pressure pump. This pump can be used to pump liquid potable hypochlorite solution. The pressure pump draws the solution from a portable tank which can be replenished as needed.

Emergency Power

Currently, the District does not own an emergency power generator large enough to power a booster pump station. However, if a situation develops wherein the need for a large portable power source is needed, large generators can be leased and brought on line within 48 hours or less. All booster pump stations built since 1997 include receptacles for quick connection of a portable generator.

Material Inventory

The District maintains an extensive inventory of pipe, fittings, valves, fire hydrants and repair materials for all types of sizes of pipes and appurtenances within the distribution system. A complete up-to-date list of all the materials and quantities can be obtained upon request. The inventory system is currently being balanced month by month.

Potential Work Place Hazard and Responses Accident Prevention Plan (APP)

The purpose of this policy is to develop a high standard of safety throughout all operations of the District and to ensure that no employee is required to work under any conditions which are hazardous or unsanitary. This document is in its own binder located in the District office. It meets all of the necessary requirements and has been approved by the local Labor and Industries (L&I) office. This document is available for review at the District's Office if so desired.

7. CROSS-CONNECTION CONTROL PROGRAM

The District has updated its existing Cross-Connection Control (CCC) Program and is actively and continuously pursuing to review its entire service area to ensure all private services and fire service lines are in compliance with the District's CCC program. As a result of this review, the District currently has approximately 950 residential service connections that are equipped with an approved backflow assembly as either premise isolation or in-premise protection. There is a total of 1,259 documented and approved backflow assemblies installed within the District. All 1,259 assemblies are inspected and tested annually as required by law.

As part of the District's review of its existing CCC program, an updated cross-connection resolution was adopted by the District's Board of Commissioners in March 1999. A copy of Resolution No. 462 can be found in **Appendix Q**.

Mr. Shawn Wilkerson is the District’s designated cross-connection control specialist and is responsible for implementation of the update CCC program as documented in this chapter. As part of the updated CCC program process, the District has coordinated with the Douglas County Fire Marshall which identifies new buildings and an email is generated to track the new device and verify that it has had an acceptable test and tagged into service prior to occupancy. The District has also coordinated with our local building officials at the City of East Wenatchee and Douglas County to help assure that devices are being installed and tested prior to occupancy.

The District’s updated CCC program is presented in this section. It addresses who is responsible for the program and procedures for identification and elimination of cross-connections within the District’s water service area. This program also includes the Backflow Incident Response Plan as required in WAC 246-290-415(2).

A. Purpose

The District has the responsibility to protect the public water systems 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.*” The objectives of the CCC program are to reasonably reduce the risk of contamination of the public water distribution system, and 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.

B. Program and Policy Overview

All public water systems are required to develop and implement CCC programs. DOH requires that a CCC program include certain elements, as listed in WAC 246-290-490(3) of the Drinking Water Regulations. **Table 6.7** summarizes the major policy and program decisions adopted for the District’s water system.

Table 6.7

1. Type of Program [General, WAC 246-290-490(2)(e)]
Premises Isolation and In-premises protection (Combination Program)
2. Extent of Coordination with Local Administrative Authority [WAC 246-290-290(2)(d)]
Interaction
3. Relationship with Customer [Element 1]
Ordinance/Resolution; implied service agreement
4. Enforcement of Corrective Action [Element 1]
Rely upon shut-off of water service
5. Assessment and Re-assessment of Hazard [Element 2]
By District’s staff or equivalent
6. Location and Ownership of Premises Isolation Assembly [Element 3]
On customer’s service line

7. CCS Option – District’s Program Management [Element 4]
District’s staff member certified
8. Testing of Assemblies [Element 5]
By customer employed (contractor) BAT
9. Cost Recovery [WAC 246-290-100 (4)(h) and –105(4)(p)]
Borne by all customers (general water rates)

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 his plumbing system from sources within his/her premises. Any action taken by the District to survey plumbing, inspect or test backflow prevention assemblies, or to require premises isolation is solely for the purposes of reducing the risk of contamination of the District’s distribution system.

C. Program Elements

Element 1: Establishment of Legal Authority and Program Policies

The District has adopted Resolution No. 462 reproduced as **Appendix Q**, which authorizes the District to implement a CCC program. The ordinance authorizes the system to discontinue water supply within 72 hours of giving notice, or a lesser period of time if required to protect the public health, if the customer fails to cooperate in the installation, maintenance, repair, inspection, or testing of backflow prevention assemblies or air gaps required by the District.

Element 2: Evaluation of Premises for Cross-connection Hazard

Cross-connection Hazard Surveys: The procedures for evaluating the backflow prevention requirements for new and existing customers are as follows:

1. For all new services, and changes in account owner or name, the customer is required to sign an application for service form, which also acknowledges the District’s CCC requirements as a condition of service.
2. For all existing services that have been identified as potential cross connection hazards in the water system, including but not limited to, premises listed in Table 9 of WAC 246-290-490, an initial inspection will be performed by a DOH certified cross-connection control specialist (CCS) employed by the District. The following inspection procedure will be followed:
 - A. Based upon the known information of the customer’s activities on the premise and/or information received from the customer, an inspection date and time will be scheduled.
 - B. On the scheduled inspection date, a CCS will inspect the premises for all actual and potential cross connections. Immediately upon completion of the inspection, the CCS will brief the customer or representative on the findings.
 - C. The CCS will then prepare a written report, which will include the following information:
 1. Location of premise and contact information.

2. All cross-connections found, their locations, and locations of all existing backflow preventers.
 3. All industrial fluids, chemicals or other contaminating liquids discovered and/or pumped under pressure and their use and probability of cross-connection.
 4. Any applicable drawings, sketches, blue prints or other documents used in support of the inspection.
 5. A summary of findings.
 6. Specific recommendations.
 7. A copy of the written report shall be placed in the master CCC file.
- D. After creating the written report, the CCS or authorized representative will write a letter to the customer outlining the results of the inspection and any required corrective actions along with a date by which the work must be completed.
- E. On the date that the required corrective actions are to be completed, a CCS employed by the District shall re-inspect the corrected areas. The CCS will document the findings of the re-inspection and if it meets the CCS requirements it will be filed in the control file. If the customer has not completed the required corrective actions enforcement action will be taken in accordance with the **Appendix Q**.

Re-evaluation of Cross-connection Hazards:

The recommended frequency of the re-evaluation for backflow preventers is as shown in **Table 6.8**.

Table 6.8

Type of Service	Recommended Frequency of Re-evaluation
Any services with a RPBA installed for premises isolation.	None required as long as RPBA passes tests and inspections.
Commercial services with a DCVA installed for premises isolation.	Every 2 years and upon change in use or ownership.
Residential services with special plumbing where District relies upon compliance with Uniform Plumbing Code.	Every 2-3 years (questionnaire/survey).
Residential services with DCVA installed for premises isolation.	Every 4-5 years (questionnaire/survey).
Residential services with no known special plumbing.	Every 4-5 years and upon change in use, ownership, or plumbing system (questionnaire/survey).

Element 3: Elimination and/or Control of Cross-connectionsService Policy to Apply to All New and Existing Customers:

1. The District will require that water service to all non-residential customers, wherein exists a condition or situation that increases the risk to the District's distribution system, to be isolated at the meter by a District-approved double-check valve assembly (DCVA) or reduced pressure backflow assembly (RPBA). All customers described in Table 9 of WAC 246-290-490 shall be isolated with a RPBA.
2. Water service to all residential customers, wherein exists a condition or situation that increases the risk to the District's distribution system, such as, but not limited to, the following:
 - a) A lawn irrigation system.
 - b) A solar heating system.
 - c) An auxiliary source of supply, e.g., a well or creek, or separate irrigation source.
 - d) Piping for livestock watering, hobby farming, etc.
 - e) Residential fire sprinkler system.
 - f) Property containing a small boat moorage.

The District will require all residential customers with special plumbing described in Table 9 of WAC 246-290-490 be isolated with a RPBA. All other residential customers with special plumbing shall be isolated with a DCVA.

3. For all customers that are required by the District to install premises isolation, the backflow preventer shall be:
 - Purchased and installed by the customer (at the customer's expense) in accordance with the District's standards described hereinafter; and
 - Maintained, tested and inspected in accordance with the District's standards described hereinafter;

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. The failure of the customer to comply with the above installation and maintenance requirements shall constitute the customer's breach of contract. The District may then proceed with corrective action provisions stipulated in the ordinance.

4. 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 249-290-010. The District will obtain and maintain a current list of backflow preventers approved for installation in Washington State from DOH. All backflow preventers must be installed:
 - In the orientation for which they are approved.
 - 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 (PNWS-AWWA) Manual or the USC Manual shall be followed unless the manufacturer's requirements are more stringent.

- In a manner that will protect them from weather-related conditions such as flooding and freezing.
- In compliance with applicable safety regulations.

Element 4: Provision of qualified personnel

The responsibility for administration rests with the Manager; any representative authorized by the Manager and his or her authorized representatives may take action as required. The District will employ or have on staff at least one person certified by the DOH as a CCS to implement the CCC program. There are currently 12 certified CCCs employed by the District.

Element 5: Inspection and testing of backflow preventers

All backflow preventers that the District relies upon for protection of the water system will be subject to inspection and, if applicable, testing. Inspection of backflow preventers for proper application will be performed by the District's CCS. Inspection of backflow preventers for correct installation will be performed by either a CCS or a DOH-certified BAT. Testing of assemblies will be performed by a DOH-certified BAT.

1. Frequency of Inspection and Testing

Inspection and testing of backflow preventers will be conducted:

- At the time of installation;
- Annually, after installation;
- After a backflow incident; and
- After a repair, reinstallation, relocation, or a re-plumbing.

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 when it repeatedly fails tests or inspections.

2. Responsibility for Inspection and Testing

The District will be responsible for inspection and testing of all District-owned backflow preventers.

The District requires the customer to be responsible for inspection and testing of backflow preventers owned by the customer. The customer shall employ, at his or her expense, a DOH certified BAT to conduct the inspection; the customer must return the test report to the District before the due date specified by the District. A request for an extension of the completion time for the return of a test report may be made in writing by the customer to the District. One extension of up to 30 days may be granted at the discretion of the CCS Manager.

3. Approved Test Procedures

The District will require 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).

4. Notification of Inspection and/or Testing

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) tested. Notices are sent out at the first of the month for all tests due that given month. The notice will also specify the date by which the inspection/test report must be received by the District (approximately 30 days). If a customer fails to send in the inspection/test report within 15 days after the due date specified, and the CCS manager has not approved an extension, enforcement action will be taken in accordance with Ordinance 2003-03.

Element 6: Quality Control of Testing Process**1. List of Pre-approved Certified BATs**

The District will maintain a list of local certified BATs to perform the following activities:

- Backflow preventer inspection for proper installation.
- Backflow assembly testing.

The list shall be revised annually or more frequently if necessary.

2. Pre-approval Qualifications

BATs who wish to be included on the pre-approved list must apply to the District and furnish the following information:

- Evidence of current DOH certification (BAT card) in good standing and if applicable a current L&I Specialty Plumber certification card.
- Make and model of the testing equipment.
- Evidence of test equipment calibration or verification of accuracy within the past 12 months.
- Pass a hands-on competency test witnessed by the District CCS manager or other District employed CCS.

The District may consider the inclusion of the applicant on a current list of pre-approved BATs issued by another public water system with more than 1,000 connections having a similar quality assurance requirement as sufficient evidence of qualification to be included on the District's pre-approved list.

3. Quality Assurance

The District's CCS will review the inspection/test report forms submitted by the customer within 10 days of receipt. District's CCS may accept reports that are signed by a CCS or BAT not on the pre-approved CCS and BAT list provided that the same information as listed in "Pre-approval Qualifications" are also submitted. District's CCS will follow up on reports that are deficient in any way. District's CCS will also make random verification checks to ensure the quality of testing being provided.

Element 7: Procedures for Responding to Backflow Incidents.**1. Backflow Incident Response Plan**

The District's CCS will participate in administering the backflow incident response plan that is part of the water system's emergency response program as required by WAC 246-290-415(2). The incident response plan includes, but is not limited to:

- Notification of affected population;
- Notification and coordination with other agencies, such as DOH and Chelan-Douglas Health District;
- Identification of the source of contamination;
- Isolation of the source of contamination and affected area(s);
- Cleaning, flushing, and other measures to mitigate and correct the problem; and
- Apply corrective action to prevent future backflow occurrences.

2. Technical Resources

The District will use the manual *Backflow Incident Investigation Procedures*, First Edition, 1996, published by the PNWS-AWWA as a supplement.

Element 8: Public Education Program.

1. Public Education

The District will regularly distribute information via mailings and in the District’s annual Water Quality Report describing the cross connection hazards in homes and the recommended assemblies that should be installed by the homeowner to reduce the hazard. Brochures will also be available to the public at District office. The education program will emphasize the responsibility of the customer in preventing the contamination of his/her water supply. The information brochures may be obtained from: PNWS-AWWA, Spokane Regional Cross-Connection Control Committee (SRC4), other backflow prevention associations, and other water utilities. Information distributed will include, but not limited to, the following subjects: Cross-connection hazards in general, irrigation system hazards and corrective actions, fire sprinkler cross-connection hazards, importance of annual testing of backflow preventers, thermal expansion in hot water systems when backflow preventers are installed. The District will distribute information brochures to all customers every 2 or 3 years and to every new customer at the time of signing of a service agreement.

2. Public Outreach

In cooperation with other water utilities, the District will participate in an outreach program, which may consist of:

- Distribution of cross-connection information to hardware and plumbing stores serving the area as well as local landscaping companies; and
- Participation in fairs, exhibits and other events.

Element 9: Record Keeping

1. Types of Records and Data to be maintained

The District will maintain records of the following types of information:

Service connections/customer premises information, including:

- Assessed degree of hazard; and

- Required backflow preventer to protect the public water system.

Backflow preventer inventory and information including:

- Air gap location, installation and inspection dates, inspection results and person conducting inspection; and
- Backflow assembly location, assembly description (type, manufacturer, make, model, size and serial number), installation, inspection and test dates, test results, and the person performing test.

2. Reports to be Prepared and Submitted.

The District will prepare the following reports as required by DOH:

- CCC program activities for the calendar year, to be sent to DOH when requested;
- CCC Annual Summary Report information, as required, or when there are significant policy changes; and
- Backflow incident reports to DOH and PNWS-AWWA CCC committee.

The District does not grant exceptions to mandatory premise isolation conditions.

Element 10: Reclaimed Water

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 the Revised Code of Washington (RCW) will be complied with and made part of the CCC program.

D. Other Provisions

1. Coordination between the water District and the local administrative authority in matters pertaining to CCC is required by both WAC 246-290-490 and the Uniform Plumbing Code. The City of East Wenatchee and the Douglas County Building Department are the local administrative authority.

2. Prohibition of the Return of Used Water

Used water is defined as water that has left the control of the District. This includes water used for heating and cooling purposes, and water that may flow back from customers with multiple connections. Therefore, it is the policy of the water system to require that all customers with multiple connections, where the hydraulics permit the potential return of used water, to install a backflow preventer (DCVA or RPBA) commensurate with the degree of hazard at each point of connection.

3. Unapproved Auxiliary Supplies

All water supplies other than those owned by the District are considered unapproved auxiliary supplies as defined in WAC 246-290-010. The District will require the installation of an RPBA for premises isolation at the service connection of any customer having an unapproved auxiliary supply on the premises, regardless of whether or not there is a physical connection between the auxiliary supply and the District's system. If the customer can demonstrate to the District's satisfaction that there are no cross-connections with the

auxiliary water supply and there are no other health hazards present, the customer may be granted exemption from the cross-connection requirements.

4. Tanker Trucks and Jurisdictional Uses

The District may allow tanker trucks and other local governmental uses (such as fire tanker trucks, street sweeping, flushing and sewer cleaning) to obtain water from the water system only if the vehicle is equipped with an approved AG or an approved RPBA, with a current satisfactory inspection or test report. The District has a fill station with an approved RPBA that customers may use to fill with once they have signed a work order and provided all pertinent information at the District Office.

5. Temporary Water Connections

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. The applicant for the temporary connection shall provide a completed test report showing that the backflow preventer has successfully passed testing after being installed on the hydrant to be used for temporary service.

8. RECORD KEEPING AND REPORTING

Maps

Maps of the distribution system including main lines, valves, fire hydrants, reservoirs, PRV stations and pump stations are kept current by the GIS Specialist. The maps are continuously updated as system changes occur. The files are made available electronically through computer GIS viewers and staff have laptop computers for field and office viewing. The District makes the files available to local agencies upon request.

Time Cards and Work Orders

Work is generally scheduled and monitored by the Superintendent and Lead Man. At the end of each work day, employees complete a detailed time sheet outlining the department and/or work order number.

Work orders can be generated from the office and/or the superintendent or Lead man. The work order is a detailed time and materials record. The work order is used for inventory, time cross reference, equipment usage used to perform cost accounting and to calculate the amount of labor and materials used for the various tasks.

Fire Hydrants

Fire hydrants records are maintained by the Douglas County Fire District No. 2. The Fire District measures pressures and flows of most of the hydrants and performs annual inspections for operation. Any problems are reported to the District and the repairs are scheduled and performed by the District.

Meter Records

The District billing system retains several years of use history on every meter account. The billing system software is very elaborate and can track and manage work orders for each meter in the system.

DISTRIBUTION FACILITIES DESIGN AND CONSTRUCTION STANDARDS

1. PROJECT REVIEW PROCEDURES

This section describes the process used for review of projects initiated by the East Wenatchee Water District (District) for system improvements.

Water system improvement designs are commonly performed by the District's contract engineer. For simple aged water main replacement projects, the design may be performed in-house under the direction of the licensed staff engineer, currently the District Manager. For projects other than distribution and maintenance replacement, a project report per Washington Administrative Code (WAC) 246-290-110 will be prepared prior to design by the engineer and submitted to the Washington State Department of Health (DOH) for review.

The designer coordinates locations of fire hydrants with the Fire Department. A hydraulic analysis will usually be performed to verify fire flow performance of the proposed improvements. The designer will coordinate with the transportation department of either the City of East Wenatchee or Douglas County (County) to ensure that the proposed water system improvements are compatible with current road standards and plans.

Final review of designs is performed by the District Manager, District Operator, Engineer and Field Inspector. Approval of the design is given when the District Manager signs the plans. For projects other than distribution and maintenance replacement, the construction documents are submitted to DOH for review prior to construction per WAC 246-290-125.

When appropriate, the District will coordinate with other utility agencies when developing designs to minimize potential conflicts and to present the opportunity to share cost on joint projects. These agencies may include the following:

- Douglas County PUD;
- Douglas County Sewer District;
- Frontier;
- Sprint;
- Cascade Natural Gas;
- Greater Wenatchee Irrigation District; and
- Wenatchee Reclamation District.

The District uses the DOH's submittal exception process for distribution water main projects. The District has not yet utilized DOH's submittal exception process for reservoirs and booster pump stations because the District has appreciated the review comments received from DOH on past projects. However, the District does desire to leave open the option to exercise submittal exception on future projects.

2. POLICIES AND REQUIREMENTS FOR OUTSIDE PARTIES

Water system improvement designs are commonly performed by outside agencies for private developments. Outside parties may design distribution and maintenance replacement projects, but all other infrastructure projects (pump stations, reservoirs, etc.) are designed by the District Engineer. Occasionally, outside party design work is incorporated into larger regional projects such as road construction. The District requires that design work be performed by or directly supervised and reviewed by licensed Professional Engineers.

A pre-application (Pre-App) meeting between the proponent, County, District, and relevant agencies occurs prior to any design work so that the proponent is familiar with agency requirements. The District encourages, but does not require a separate pre-design meeting with the proponent and designer.

The District provides the designer with the Developer Extension Agreement (DEA) and Standard Water System Details. The District's Comprehensive Plan is available for the designer to review for system design criteria.

If applicable, the District's engineer will perform a hydraulic analysis to determine the available domestic and fire flow capability of the system to the proponent's site. If service is deemed deficient for the proponent's needs, recommendations will be provided for system improvements.

The designer is required to coordinate locations of fire hydrants with the Fire District. The Fire Marshal may verify available fire flows in the area prior to construction of critical facilities and typically checks that fire hydrants are operational after improvements have been completed. The District requires the designer to coordinate with outside planning, transportation, and utility agencies when developing designs.

Review and approval of plans are performed by the District Manager, Operator, and Engineer. Signature on the plans by the District Manager constitutes final plan acceptance.

Since 1991, the District has required all developer related constructed projects to enter into a water system extension agreement with the District for the purpose of guaranteeing that all privately constructed extensions to the District's water system meet the design and construction requirements of the District. A copy of the DEA is included in **Appendix G**.

3. DESIGN STANDARDS

This section presents the design standards and planning criteria to be used to establish an optimum behavior level and a standard of quality for the water system. A copy of the District's design standards

and requirements for all new extensions is incorporated into the DEA. The design standard sections within the DEA are as follows.

- Design and format standards for preparation of DEA construction plans and specifications.
- General conditions for extensions constructed by developers.

District Standard Details for water system construction can be found in **Appendix I**, and are posted on the District's website

The following additional standards are used by the District for design of new and replacement facilities.

Source of Supply

1. Source of supply shall be from the Wenatchee Regional Water System.
2. The source pumping capacity shall be capable of meeting, at a minimum, the average rate of the maximum day demand.

Storage

1. Storage design shall comply with American Water Works Association (AWWA) D100, D102, or D110 where applicable.
2. The minimum size for any new reservoir shall be 500,000 gallons.
3. New reservoir sites shall provide plumbing and land for a future equal sized tank, if topography and costs are reasonable.
4. Two tank sites should be considered per pressure zone for reliability and to improve hydraulic balance.
5. At a minimum, the following shall be recorded and transmitted to the master telemetry unit (MTU): water level, high water, low water, intrusion.
6. Tanks may be welded steel or reinforced concrete.
7. Coating for the interior of welded steel tanks shall include a corrosion inhibiting agent, such as a zinc-rich primer.
8. Permanent ladders shall be provided on the interior and exterior of the tank. Vandal protection shall be provided for exterior ladders. Interior ladders shall be stainless steel or fiberglass. Landings and cages for fall protection shall be incorporated in lieu of hoist or cable systems, unless waived by the District.
9. Water circulation systems shall be incorporated into new storage, unless waived by the District. Passive or mechanical systems will be reviewed.

Transmission and Distribution

1. Minimum size for all water mains shall be 8 inches except, at the discretion of the District, where the water main is permanently dead ended with no future potential for extension, is less than 300 feet in length and does not include a fire hydrant. Water mains in Commercial and Industrial zoned areas shall be a minimum 12 inches in diameter, unless waived by the District.
2. 10-inch and 14-inch mains are not commonly stocked sizes and, as such, are not allowed for new construction.

3. Where practical, mains shall be looped to increase reliability and water quality.
4. 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). Mains within said properties shall be extended to the property boundary for future extension and looping when appropriate.
5. Water mains shall be located at a uniform distance north and east of centerline, as shown on the District's standard detail, unless otherwise approved by the District. Fittings will be used when necessary to maintain, as closely as possible, the uniform offset from centerline.
6. Water mains shall be located no closer than 7 feet from the face of curb. The District may elect to reduce this to 5 feet under special circumstances.
7. Water mains shall not be located under permanent concrete structures unless cased.
8. Where ever possible, valves shall be clustered at the tee or crosses of connecting intersecting water lines. Full valve clusters are required.
9. Waterlines shall be located in public right-of-way whenever possible.
10. The bury for all waterlines shall be 48 inches minimum and 54 inches maximum as measured from the top of the pipe to top of the finished grade. 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.
11. Water and sanitary sewer mains separation shall conform to DOH and Washington State Department of Ecology (Ecology) Standards. For all other utilities, the water main shall have a minimum horizontal separation of 36 inches, unless waived by the District.
12. Vertical separation from utilities other than sanitary sewer 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.
13. A fire hydrant shall be installed at all dead-end cul-de-sacs to improve water quality and facilitate testing.
14. Extensions which are not to the benefit of the District shall be private and isolated from the system with a double check detector assembly.
15. Water mains shall be located within public rights-of-way whenever possible. If the District allows a main on private property, the property owner shall provide a 20-foot-wide easement centered on the pipeline to the District per the District's easement document found in the DEA.

Water Services

1. Service lines shall only be connected to public distribution mains. Connection to hydrant runs, fire lines, private mains, or dedicated transmission mains will not be allowed. The District may reconsider this standard at their discretion if there is public health benefit.
2. All water service lines and meter boxes are to be located along the street address side of the lot and installed perpendicularly to the water main and street centerline.
3. Meter boxes shall be located within right-of-way and within sidewalks whenever possible. Where sidewalks do not exist, the boxes shall be adjacent to the right-of-way line whenever possible.
4. If water service line lengths greater than 200 feet are required, the customer shall sign a special water service agreement with the District (**Appendix H**).
5. Standard District practice is to serve properties no more than two deep from the water main.

6. 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 required is 10 feet from side sewers and 3 feet clear from dry utilities.

Pump Stations

1. Structures shall be non-combustible and vandal proof, where practical.
2. Structures shall have adequate heating, cooling, ventilation, insulation, lighting and work space necessary for safe and efficient operations and maintenance.
3. Underground vaults shall be avoided if possible.
4. Sites shall be fenced to reduce vandalism and District liability.
5. Stations shall be fully equipped with all instrumentation and alarms as necessary to assist personnel in operations and troubleshooting.
6. At a minimum, the following shall be recorded in real-time and transmitted to the MTU: flow rate, flow total, discharge pressure, suction pressure, room temperature, check valve status, and control valve status.
7. At a minimum, the following shall be alarmed: intrusion, low flow, high discharge, low discharge, low suction, pump fail, flood.
8. A connection for emergency power shall be provided in all new pump stations.
9. The standard generator connection shall be a Posi-Lok system as manufactured by Crouse-Hinds. Plugs with cords shall be stored at each facility.
10. Two pump stations supplying a pressure zone shall be considered to improve reliability and hydraulic balance.
11. Closed zone booster pump stations will only be allowed on a temporary basis. The period shall be 3 years or until 40 lots are connected, whichever comes first.
12. Fire pumps are discouraged and allowed only if construction of storage is impractical, delayed, or, if in the opinion of the District, it is detrimental to water quality.
13. Stations shall be constructed with the ability to increase capacity in the future. This shall be accomplished by adding space for additional pumps and/or by over-sizing the facility to install larger pumps in place of the original pumps.
14. Stations shall include a control valve to pass water from the upper zone to the lower. Control valve shall include pressure relief functionality to permit operation of the station if the receiving reservoir is out of service.

Pressure Reducing Stations

1. District Standard Detail for pressure reducing valve (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 shall be considered 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 small bypass valve for domestic flows.

4. CONSTRUCTION STANDARDS

The District follows the most current version of the AWWA Standards for materials and Washington State Department of Transportation (WSDOT) Standard Specifications for construction except as shown otherwise on the District Standard Details, Supplemental Provisions and specifically modified herein.

1. All water mains 3 inches and larger shall be ductile iron pipe per American National Standards Institute (ANSI)/AWWA C-151/A21.51. The ductile iron pipe shall be Class 50 except where trench, backfill and loading dictate a stronger class pipe. Class 52 shall be used in areas where pressures are 150 pounds per square inch (psi) and greater.
2. In areas of corrosive soils, polyethylene tubing wrap shall be used or the District may review the use of C900 PVC or HDPE as an option.
3. All mainline fittings 4 inches and larger shall be cast from ductile iron in accordance with ANSI/AWWA C-153/A21.53 with mechanical joint bells. Glands, bolts, nuts, and gaskets are to be in accordance with ANSI/AWWA C-153/A21.53 requirements and listed by an approved certifying agency as conforming to the requirements of ANSI/NSF61. Working pressure rating is to be 350 psi. Fittings shall be cement-lined and seal-coated with ANSI/AWWA C-104/A21.4.
4. Valves 3-inch through 12-inch shall be resilient seated gates per AWWA C509 or C515. Larger valves may be butterfly type per C504 at the discretion of the District.
5. Booster pump station meters shall be electromagnetic type (Mag-meter) with no internal moving parts.
6. Hydraulic control valves 2 inches and larger shall be manufactured by Cla-Val, no substitutions.
7. Service lines shall be C901 200 psi CTS high-density polyethylene, 1 inch diameter minimum.
8. Tracer wire shall be installed with all non-metallic pipe.
9. All buried valves and valve clusters shall be pressure tested outside the trench prior to installation.
10. A preconstruction conference is required prior to construction and 48 hours advance notification of the Douglas County Department of Transportation and Land Services or City of East Wenatchee, the District, and all affected utility companies prior to the actual start of work.
11. Water main trench section and all excavated areas shall be backfilled and compacted in accordance with the Standard Details and with sections 7-10.3(10) and 7-10.3(11) of the Standard Specifications. Compaction testing shall be required during backfilling operations at the discretion of the District. If trench backfill does not meet compaction requirements, contractor shall excavate, recompact and retest material at contractor's expense.
12. Restoration of damaged road surfacing shall be in accordance with the Standard Specifications and Douglas County or City of East Wenatchee requirements. All other areas shall be restored to original condition or as directed by the District. This includes shoulders, landscaping, walls, fences and all other improvements.
13. All services, fire hydrants and thrust blocking shall be installed per District standard details and shall be inspected by the District before bury.
14. A sanitary gap must be provided between the existing and new water systems. Connection to the existing water system shall be performed by the contractor only after:
 - Completion of an acceptable hydrostatic pressure test at a minimum of 250 psi; and
 - The pipeline is disinfected and receipt of approval of water quality test results from the Chelan-Douglas Health District.
15. A pipe plug shall be used on each joint during installation to protect the pipe from inadvertent contamination.

16. All valves shall be supplied with valve box, lid and debris cap. Lid shall have recessed handle. Valve box riser ears to be installed with the ears parallel to the direction of water flow.
17. No other utilities shall be installed within 36 inches horizontally of any active waterline unless otherwise pre-approved by the District.
18. Contractor shall pothole a sufficient distance ahead to verify depth of all existing water mains and crossing utilities prior to construction and connections and to anticipate any necessary changes in fittings or alignment.
19. All metal products (valve boxes excluded) and fitting components (e.g. bolts, gaskets, etc) are to be of domestic fabrication and construction. Only Ford, McDonald, and Mueller products are approved for use as service brass.
20. Gaskets for all flanged fittings shall be ring type only, full faced gaskets are not acceptable.
21. An as-built record must be submitted to the District before water service will be provided.
22. Deflection at pipe and fitting joints will be allowed up to 3.0 degrees or as recommended by manufacturer, whichever is less. 3 degrees in an 18-foot length equals 11 inches of deflection.

5. CONSTRUCTION CERTIFICATION and FOLLOW-UP PROCEDURES

Once plans have been approved by the District, a pre-construction Conference (precon) is held. Typical attendees includes District Engineer, District Inspector, District Operator, project designer, contractor superintendent, contractor foreman, project owner, County or city representative and any affected utility representatives.

The District Inspector provides periodic inspection. The level of inspection depends on the complexity of the work and the experience of the contractor.

Pressure testing and disinfection are performed by the contractor to WSDOT/AWWA standards. The District Inspector verifies the results and performs the purity testing.

After construction, as-built drawings in hard copy and electronic format are required by the District. Once received, the District transfers this information to the master maps and files the as-builts at the office.

Formal acceptance of a project is accomplished by resolution at a District Commissioner's meeting. Acceptance also begins the warranty period. Once the final project is accepted by the District as complete, ownership of the facilities are transferred to the District via Bill of Sale. For applicable projects, a DOH Construction Completion Report is filled out and filed with DOH and the District.

If a Latecomer's Agreement (aka Reimbursement Agreement) is desired, the proponent has 12 months after formal acceptance to prepare and submit an acceptable version of said agreement to the District. Additional requirements for preparation of said agreement can be found in the DEA document in **Appendix G**.

CAPITAL IMPROVEMENT PLAN

INTRODUCTION

This chapter summarizes the issues of the East Wenatchee Water District's (District) distribution system as discussed in the previous chapters. It then presents the improvements necessary to address the existing issues and to accommodate planned growth. This six-year capital improvement plan (CIP) is designed along with the entire *Comprehensive Water System Plan* (Plan) to be used as a guideline during each yearly budget process. The list of issues which forms the basis for the proposed Capital Improvement Projects are summarized by the following major water system components.

- Water Quality.
- Source and Supply.
- Transmission.
- Storage.
- Distribution.
- Operations and Maintenance.

The issues, alternatives and evaluations were presented in **Chapter 3**. In this chapter, the recommended improvement, justification, schedule and an estimated project cost are provided.

Several projects listed in the prior Plan were not constructed, for varying reasons. The project numbers below are from Table 8.8 of the prior Plan.

- 3, 4, 12, 17: The 965S zone transmission issue was reviewed a number of times, with inconclusive results. Until a final determination of reservoir unbalance is made, it would not be prudent to proceed with infrastructure work.
- 10, 23: Extension of the 24-inch main has been delayed because growth in the District has not occurred as fast as was projected in prior planning efforts. The project has been rescheduled in this Plan.
- 16, 28, 29, 30, 31: Projects were intended to be done in conjunction with City or County road reconstruction. The road projects did not happen.
- 21, 22: The District determined that installing water mains in these new roads did not provide benefit due to the lack of adjacent developable land.

1. PROPOSED SUPPLY AND STORAGE

Supply and storage issues were identified in **Chapter 3**. Those tables are herein revised with capacities necessary to correct those issues. The specific projects necessary to provide these capacities are identified in the *Recommended Improvements* section.

Table 8.1 Proposed Storage Capacity

Reservoir Location	No.	Overflow Elev (ft)	Inside Dia (ft)	Floor Elev (ft)	Min Wtr Elev (ft)*	Pump Start (ft)	Pump Stop (ft)	Effective Volume (gal)
15th St (Shop)	2A	964.9	54	947.5	947.7	961.2	963.9	278,320
15th St (Shop)	2B	964.9	66	945.3	945.3	961.2	963.9	475,985
Pearcot	5A	963.3	42	940.3	942	961.2	962.3	210,372
Pearcot	5B	963.3	80	940.3	942	961.2	962.3	763,253
Baker Flats	11	965.0	95.5	930	932	961.0	964.0	1,714,546
965 Zone Storage Total								3,442,476
10th St (2016)	6	1292.0	109	1261	1262	1288.3	1291.3	2,045,093
Daniels Drive	7	1292.3	75	1261.3	1262.3	1288.3	1291.3	958,325
1170/1292 Zone Storage Total								3,003,419
Veedol	8	1494.0	75	1463	1464	1490.0	1493.5	974,848
1494 Zone Storage Total								974,848
Fancher Heights	9	1594.0	75	1563	1564	1591.5	1593.5	974,848
1594 Zone Storage Total								974,848
Future		1768.0	55	1740	1741	1765.5	1767.5	470,938
Canyon Hills	10	1768.0	55	1740	1741	1765.5	1767.5	470,938
1768 Zone Storage Total								941,876

* Refers to floor elevation or outlet pipe elevation, whichever is higher.

Table 8.1 above takes the existing storage capacity table and adds future storage capacity to each applicable pressure zone. The capacity added is selected so that the available storage essentially matches the storage requirement in 20 years. The future tank dimensions shown are only approximations, and the configuration of this storage could be via a single new tank, multiple tanks or a larger tank incorporating storage of older tanks that may be decommissioned.

Table 8.2 Proposed Supply Capacity (gpm)

	2012	2015	2025	2030	2035	Buildout
1768 Zone MDD	190	197	227	242	255	2,935
FF Storage Refill	21	21	21	21	21	21
Future Supply	0	50	50	100	100	2,800
Canyon Hills Supply	190	190	190	190	190	190
1768 Surplus	(21)	22	(8)	27	15	34
1594 Zone MDD	679	703	810	863	1,000	5,685
FF Storage Refill	21	69	69	69	69	69
Wheeling MDD	190	197	227	242	255	2,935
Future Supply	0	0	1,000	1,000	1,000	8,000
Daniels Drive Supply	910	910	910	910	910	910
1594 Surplus	20	(59)	804	735	586	221
1350/1494 Zone MDD	259	268	309	329	375	1,774
FF Storage Refill	111	222	222	222	222	222
Future Supply	0	0	0	0	0	1,000
Grant & Nile Supply	1,000	1,000	1,000	1,000	1,000	1,000
1350/1494 Surplus	630	510	469	449	402	4
1170/1292 Zone MDD	1,635	1,693	1,951	2,080	2,150	2,650
FF Storage Refill	146	146	146	146	146	146
Wheeling MDD	1,128	1,168	1,346	1,434	1,630	10,393
Future Supply	0	0	0	0	0	9,000
Grover/Shop/1170 Supply	4,320	4,320	4,320	4,320	4,320	4,320
1170/1292 Surplus	1,411	1,313	877	660	394	131
965S Zone MDD	1,294	1,340	1,544	1,645	1,729	2,072
FF Storage Refill	222	222	222	222	222	222
Wheeling MDD	2,841	2,941	3,389	3,613	3,895	13,499
Future Supply	0	0	0	0	0	10,000
Regional Supply	5,800	5,800	5,800	5,800	5,800	5,800
965S Surplus	1,443	1,297	645	319	(46)	7
965N Zone MDD	78	80	93	99	114	456
FF Storage Refill	222	222	222	222	222	222
Future Supply	0	0	0	0	0	400
Cascade FCV Supply	300	300	300	300	300	300
965N Surplus	0	(3)	(15)	(21)	(37)	22

Table 8.2 above shows supply capacity with the inclusion of proposed supply improvements. Pumping capacity is added such that supply always at least equals maximum daily demand (MDD). An advantage of large supply capacity is that it can often offset potential standby and/or equalizing storage requirements, thereby lessening the size of future storage needed. There are infinite combinations of supply/storage offsets which, for obvious reasons, are not reflected herein. When the time comes to construct either type of facility, a cost/benefit analysis should be produced to determine the most efficient size.

Table 8.3 Proposed Operational Storage

Reservoir Name	No.	Inside Dia (ft)	Gal per ft depth	Operating Range (ft)	Operational Storage (gal)
15th St (Shop)	2A	54	17,131	4.0	68,523
15th St (Shop)	2B	66	25,591	4.0	102,362
Pearcot	5A	42	10,363	4.0	41,452
Pearcot	5B	80	37,599	4.0	150,394
Baker Flats	11	95.5	53,579	3.5	187,528
965 Zone Storage Total					550,260
Future		109	69,798	4.0	279,193
Daniels Drive	7	75	33,046	4.0	132,182
1170/1292 Zone Storage Total					411,375
Veedol	8	75	33,046	4.0	132,182
1494 Zone Storage Total					132,182
Fancher Heights	9	75	33,046	4.0	132,182
1594 Zone Storage Total					132,182
Future		55	17,771	3.0	53,314
Canyon Hills	10	55	17,771	3.0	53,314
1768 Zone Storage Total					106,627

Table 8.3 above shows proposed operational storage, which has been increased from Chapter 3 to represent additional storage needed due to increased pumping capacity and to improve reservoir turnover for water quality.

Table 8.4 Proposed Standby Storage

	2012	2015	2025	2030	2035	Buildout
1768 Zone ADD (gpd)	101,385	104,971	120,967	128,939	135,516	1,562,237
Supply available (gpd)	273,600	345,600	345,600	417,600	417,600	4,305,600
530 gal/ERU minimum	153,700	159,137	183,386	195,472	205,443	2,368,358
1768 Standby (gal)	153,700	159,137	183,386	195,472	205,443	2,368,358
1594 Zone ADD (gpd)	356,186	368,786	424,981	452,989	525,138	2,984,298
Supply available (gpd)	1,310,400	1,310,400	2,750,400	2,750,400	2,750,400	12,830,400
Wheeling supply (gpd)	274,257	283,958	327,228	348,793	366,585	4,226,014
530 gal/ERU minimum	305,280	316,079	364,243	388,247	450,085	2,557,780
1594 Standby (gal)	305,280	316,079	364,243	388,247	450,085	2,557,780
1494 Zone ADD (gpd)	209,800	217,222	250,322	266,819	306,325	1,415,915
1350 Zone ADD (gpd)	14,789	15,313	17,646	18,809	19,768	120,428
Supply available (gpd)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	2,880,000
200 gal/ERU minimum	151,800	157,170	181,119	193,055	219,220	1,051,800
1494 Standby (gal)	151,800	157,170	181,119	193,055	219,220	1,051,800
1292 Zone ADD (gpd)	520,629	539,045	621,185	662,123	695,898	923,666
1170 Zone ADD (gpd)	962,416	996,459	1,148,299	1,223,976	1,254,883	1,486,473
Supply available (gpd)	6,220,800	6,220,800	6,220,800	6,220,800	6,220,800	19,180,800
Wheeling supply (gpd)	1,623,928	1,681,371	1,937,578	2,065,271	2,347,640	14,966,487
200 gal/ERU minimum	1,063,600	1,101,222	1,269,027	1,352,660	1,401,204	1,743,600
1170/1292 Standby (gal)	1,063,600	1,101,222	1,269,027	1,352,660	1,401,204	1,743,600
965S Zone ADD (gpd)	1,166,963	1,208,242	1,392,353	1,484,114	1,559,819	1,869,111
Supply available (gpd)	8,352,000	8,352,000	8,352,000	8,352,000	8,352,000	22,752,000
Wheeling supply (gpd)	4,090,749	4,235,450	4,880,848	5,202,512	5,608,541	19,438,229
200 gal/ERU minimum	734,600	760,585	876,483	934,246	981,902	1,176,600
965S Standby (gal)	734,600	760,585	876,483	934,246	981,902	1,176,600
965N Zone ADD (gpd)	51,457	53,277	61,395	65,441	75,864	302,142
Supply available (gpd)	432,000	432,000	432,000	432,000	432,000	1,008,000
200 gal/ERU minimum	39,000	40,380	46,533	49,599	57,499	229,000
965N Standby (gal)	39,000	40,380	46,533	49,599	57,499	229,000

Wheeling supply is water that is pumped out of the zone to meet upper zone MDD.

Tables 8.4 and 8.5 show the revised standby and equalizing storage requirements based on the supply improvements shown in the Table 8.2. Increased supply can often reduce the standby and equalizing storage required.

Table 8.5 Proposed Equalizing Storage

	2012	2015	2025	2030	2035	Buildout
1768 Zone PHD (gpm)	580	601	692	738	775	8,937
Supply (gpm)	430	480	480	530	530	3,230
1768 Equalizing (gal)	22,500	18,077	31,803	31,144	36,788	856,080
1594 Zone PHD (gpm)	1,990	2,060	2,374	2,531	2,934	16,673
Wheeling supply (gpm)	430	480	480	530	530	3,230
Supply (gpm)	1,740	1,740	2,740	2,740	2,740	9,740
1594 Equalizing (gal)	102,000	120,059	17,153	48,125	108,589	1,524,474
1494 Zone PHD (gpm)	665	689	794	846	971	4,489
1350 Zone PHD (gpm)	55	55	55	55	55	55
Supply (gpm)	1,970	1,970	1,970	1,970	1,970	2,970
1350/1494 Equalizing (gal)	0	0	0	0	0	236,129
1292 Zone PHD (gpm)	865	896	1,033	1,101	1,157	1,535
1170 Zone PHD (gpm)	1,765	1,827	2,105	2,244	2,301	2,725
Wheeling supply (gpm)	2,740	2,740	3,740	3,740	3,740	11,740
Supply (gpm)	4,770	4,770	4,770	4,770	4,770	13,770
1170/1292 Equalizing (gal)	90,000	103,955	316,195	347,215	364,137	334,621
965 S Zone PHD (gpm)	1,980	2,050	2,362	2,518	2,647	3,171
Wheeling supply (gpm)	4,320	4,320	5,750	5,750	5,750	15,150
Supply (gpm)	7,000	7,000	7,000	7,000	7,000	17,000
965S Equalizing (gal)	0	0	166,863	190,217	209,484	198,201
965 N Zone PHD (gpm)	200	207	239	254	295	1,174
Supply (gpm)	300	300	300	300	300	700
965N Equalizing (gal)	0	0	0	0	0	71,154

Wheeling supply is the typical outbound booster capacity used during upper zone PHD.

Table 8.6 summarizes the proposed storage improvements. The goal is to ensure there are no storage deficits in any future time period. The column labeled *Additional Capacity* would be the size of a new tank if all existing tanks are left in service. If any existing tanks are to be demolished, then that storage lost must be added to the proposed new storage.

Table 8.6 Proposed Storage Requirements

	Pressure Zone	Existing Capacity (gal)	Additional Capacity (gal)	Fire Pump gpm	Required Capacity (gal)				Surplus (gal) (Deficit)	Upper Zone Credited (gal)	
					Op/Dead	Fire	Standby	Equalize			Total
2012	965N	1,714,546	0	0	187,528	960,000	39,000	0	1,186,528	528,018	768,018
	965S	1,727,930	0	0	317,391	960,000	734,600	0	2,011,991	(284,061)	(44,061)
	1170/1292	1,727,223	0	0	227,301	630,000	1,063,600	90,000	2,010,901	(283,677)	28,323
	1494	974,848	0	0	132,182	480,000	151,800	0	763,982	210,866	210,866
	1594	974,848	0	0	115,660	90,000	305,280	102,000	612,940	361,909	601,909
	1768	470,938	0	0	53,314	90,000	153,700	22,500	319,514	151,424	151,424
Total										684,479	1,716,479
2015	965N	1,714,546	0	0	187,528	960,000	40,380	0	1,187,907	526,639	766,639
	965S	1,727,930	200,000	0	362,732	960,000	760,585	0	2,083,317	(155,387)	84,613
	1170/1292	1,727,223	0	0	227,301	630,000	1,101,222	103,955	2,062,478	(335,254)	(23,254)
	1494	974,848	0	1,500	132,182	960,000	157,170	0	1,249,352	85,496	85,496
	1594	974,848	0	0	132,182	300,000	316,079	120,059	868,320	106,529	293,625
	1768	470,938	0	0	106,627	90,000	159,137	18,077	373,841	97,097	97,097
Total										325,119	1,304,216
2025	965N	1,714,546	0	0	187,528	960,000	46,533	0	1,194,060	520,486	760,486
	965S	1,727,930	400,000	0	362,732	960,000	876,483	166,863	2,366,078	(238,148)	1,852
	1170/1292	958,325	2,000,000	0	411,375	630,000	1,269,027	316,195	2,626,596	331,729	643,729
	1494	974,848	0	1,500	132,182	960,000	181,119	0	1,273,301	61,547	61,547
	1594	974,848	0	0	132,182	300,000	364,243	17,153	813,578	161,270	401,270
	1768	470,938	500,000	0	106,627	180,000	183,386	31,803	501,817	469,121	469,121
Total										1,306,005	2,338,005
2030	965N	1,714,546	0	0	187,528	960,000	49,599	0	1,197,127	517,419	757,419
	965S	1,727,930	500,000	0	362,732	960,000	934,246	190,217	2,447,195	(219,265)	20,735
	1170/1292	958,325	2,000,000	0	411,375	630,000	1,352,660	347,215	2,741,250	217,076	529,076
	1494	974,848	0	1,500	132,182	960,000	193,055	0	1,285,238	49,610	49,610
	1594	974,848	0	0	132,182	300,000	388,247	48,125	868,555	106,294	346,294
	1768	470,938	500,000	0	106,627	180,000	195,472	31,144	513,243	457,695	457,695
Total										1,128,828	2,160,828
2035	965N	1,714,546	0	0	187,528	960,000	57,499	0	1,205,027	509,519	749,519
	965S	1,727,930	600,000	0	362,732	960,000	981,902	209,484	2,514,118	(186,189)	53,811
	1170/1292	958,325	2,000,000	0	411,375	630,000	1,401,204	364,137	2,806,716	151,610	463,610
	1494	974,848	0	1,500	132,182	960,000	219,220	0	1,311,403	23,445	23,445
	1594	974,848	0	0	132,182	300,000	450,085	108,589	990,857	(16,008)	223,992
	1768	470,938	500,000	0	106,627	180,000	205,443	36,788	528,858	442,080	442,080
Total										924,457	1,956,457
Buildout	965N	1,714,546	0	0	187,528	960,000	229,000	71,154	1,447,682	266,865	506,865
	965S	1,727,930	800,000	0	362,732	960,000	1,176,600	198,201	2,697,533	(169,604)	70,396
	1170/1292	958,325	2,000,000	0	411,375	630,000	1,743,600	334,621	3,119,596	(161,271)	150,729
	1494	974,848	1,500,000	0	132,182	960,000	1,051,800	236,129	2,380,111	94,737	94,737
	1594	974,848	5,000,000	0	132,182	300,000	2,557,780	1,524,474	4,514,436	1,460,412	1,700,412
	1768	470,938	4,000,000	0	106,627	180,000	2,368,358	856,080	3,511,065	959,873	959,873
Total										2,451,012	3,483,012

* Assumes partial nesting of existing standby and fire storage equates to the volume shown.

The proposed 2.0 million gallons (Mg) 10th Street Reservoir is expected to be online in 2016. The column labeled “Fire Pump gpm” is a proposed size for a fire pump to supply that pressure zone. This capacity could come in the form of a dedicated engine-driven pump, or by adding an engine generator to an existing pump station. The addition of a reliable fire pump will reduce the fire flow storage requirement and free up reservoir storage for other purposes. We have assumed increases in fire flow requirements in 2015 for the 1494 and 1594 zones, and in 2025 for the 1768 zone and reservoir sizing is set accordingly. If these fire flow standards are not needed, the additional capacity may not be required.

The 965S zone is short of emergency storage for the foreseeable future. We have accommodated this issue by allowing partial nesting of standby and fire storage in the 965S reservoirs through 2030 as shown in the “Additional Capacity” column. When the reservoirs are beyond their useful age, they can be replaced with larger reservoirs sized to include un-nested volumes.

2. RECOMMENDED IMPROVEMENTS

Projects or policies to address the issues discussed in Chapter 3 are presented in this section, including a brief description of the issue and the recommended method of addressing the issue.

Source and Supply

Issue A1: Regional supply is expected to reach capacity sometime around 2030, limited by the size of the existing 30-inch transmission main from the Regional Wellfield.

Recommendation: The Regional partners are currently studying this issue. No separate District effort is proposed.

Issue A2: 1594 Zone supply is expected to be insufficient to meet demands beyond 2015.

Recommendation: Alternative 2: Construct a second booster station, leaving the existing station in service. Proposed site would be near the 10th Street Reservoirs and require approximately 8,000 feet of new 12-inch pipeline.

Justification: A second pump station remote from Daniels meets the District's reliability requirements and improves overall system hydraulic balance. Costs should be shared or borne by developers depending on timing and weighting of the benefit gained. It may also be necessary to construct storage in conjunction with this project, with size and timing dependent on future level of development in the area.

Issue A3: The 1768 Zone supply is currently insufficient due to one underperforming pump.

Recommendation: Alternative 1: Replace or rebuild the underperforming pump.

Justification: This is the least cost alternative and the easiest to implement.

Storage

Issue B1: The 965S Zone will have insufficient emergency storage by 2015.

Recommendation: Alternative 1: Adjust the District's nesting standard to allow fire flow and standby storage to occupy the same volume.

Justification: The District's standards are already conservative, especially with the ability to move water from upper to lower pressure zones. Power is historically very reliable at the Regional Supply Station.

Issue B2: Three of the four existing 965S Reservoirs are older than 50 years of age, and the fourth tank has a history of leaks.

Recommendation: Alternative 1: Replace all existing tanks with new tanks within 20 years.

Justification: Eventually, all tanks will need to be replaced. Typically, providing replacement storage in the zone where such storage is needed is the most prudent approach. The actual date of replacement is unknown and will depend on how the tank structures perform in the future.

Issue B3: The 1494 Zone will have insufficient storage when fire flow requirements approach 700,000 gallons.

Recommendation: Alternative 1: Provide reliable pumping capacity sufficient to supplement storage. This could be via either a permanent engine generator at the Grant and Nile Station

(sized to simultaneously run two 100 (horsepower) hp pumps plus miscellaneous station equipment) or installation of a new engine driven fire pump. At this time, we are assuming that a portable EG set will be provided and a third 100 hp pump installed for reliability.

Justification: Additional storage at 1494 exacerbates water turnover problems due to low customer demands. The amount of transmission main required to make use of new storage near 10th Street could likely cost more than the storage itself. Although the District standards do not typically allow permanent use of engine driven pumps, the tradeoff of added maintenance for improved water quality justifies the use in this application.

Issue B4: Daniels Drive tank paint is chalking and beginning to peel.

Recommendation: Alternative 2: Full recoat.

Justification: Recoat will be required within a short period regardless of temporary patching efforts.

Issue B5: Fancher Heights tank paint is chalking and spot damaged.

Recommendation: Alternative 1: Spot repair.

Justification: An annual inspection of the tank should be performed to determine when a coating is warranted.

Issue B6: Growth in Fancher Heights is limited by existing storage and supply capacity.

Recommendation: Alternatives 4 and 2: Construct approximately 1,000 gpm pumping capacity near the 10th Street Reservoirs. This alternative mirrors Issue A2. This capacity may be considered as a temporary solution with additional storage (Alternative 2) eventually required.

Justification: This may be an effective temporary solution to allow a reasonable cost burden to small development. However, as growth progresses, construction of permanent storage will be required. The timing will follow growth. The majority, if not all costs for these improvements should be borne by development since the benefit area is directly tied to the improvements.

Transmission

Issue C1: The Pearcot Reservoir levels lag behind the 15th Street Reservoirs.

Recommendation: Alternative 1: Construct additional transmission extending the 24-inch transmission main to a point hydraulically equidistant from both reservoir sites. Additional distribution improvements will also be required to remove current bottlenecks.

Justification: Construction of new supply transmission would provide long-term hydraulic balance between the tank sites and reduce pressure in the north 965 Zone. Improving transmission between 15th Street and Pearcot expands the District's operational flexibility.

Issue C2: Land in Sections 17 and 18 is currently the top candidate by the City of East Wenatchee for annexing in the UGA. There are very few existing mains in this area, and they are undersized for potential land use.

Recommendation: Alternative 1: Construct 12-inch mains along S. Nile from Grant Road to 8th St SE. Parallel mains may be required because there are three pressure zone breaks along this route.

Justification: The area is current short on pipe capacity, and the existing mains are mostly steel. A determination has not yet been made if the District or developers will pay for the work.

Issue C3: Transmission to the industrial areas west of the Airport are served by a single main in Union, backed up by a very small main in 8th SE. This limits capacity to approximately 2,000 gallons per minute (gpm), and results in poor reliability.

Recommendation: Alternative 1: Construct either an 8-inch or 12-inch main from 4th SE and Van Well to 8th SE and Union.

Justification: The area is current short on pipe capacity, and the existing mains are mostly steel. A determination has not yet been made if the District or developers will pay for the work.

Pressure

Issue D2: High pressure along Cascade, Columbia and Empire north of 19th Street. Pressure can fluctuate 40 pounds per square inch (psi) when the Regional Supply Station turns on and off.

Recommendation: Alternative 3: Extend 24-inch transmission to the south, thereby reducing headloss and lowering system pressure.

Justification: This work is already recommended in Issue C1 to correct other issues.

Issue D3: High pressure along Grant Road between Nile and Union.

Recommendation: Alternative 1: Do nothing.

Justification: The cost to realign the pressure zone does not warrant the benefit gained.

Issue D3: High pressure near Lyle Ave between 6th Street SE and 10th Street SE.

Recommendation: Alternative 2: Extend the 1170 Pressure Zone to the southeast.

Justification: This improvement was identified in previous Comprehensive Plan. Potential development in the near future warrants completion of this project.

Fire Flow and Distribution

As part of the Greater East Wenatchee Growth Management planning, the City and County planning departments have identified areas for urban development for the next five years. Some offsite water system improvements necessary for providing that required level of service to these future development areas within the District's boundary are included in the CIP but would be financed through developer extension agreements by the developer.

The Plan identifies a series of main improvements necessary to serve the anticipated new growth within the District's service area. These unfunded improvements are anticipated to be constructed as developer funded extensions as part of providing service too currently under served or unserved areas. These capital improvements are identified in the Plan as Developer related projects. As part of the plan to replace 4-inch and smaller distribution mains, the Plan identifies \$150,000 per year toward these main improvements.

A number of projects shown on **Table 8.8** are water main replacements driven by street projects. When the City or County rebuild a street where there is an existing old or undersized main, the District will typically replace that main either prior to, or in conjunction with the street project. This is the most cost effective way to perform the work, and also reduces the chance that an old main and appurtenances could be damaged during construction. Several of the street projects on the County and City 6 year plans

currently have no funding source and may not be constructed. The District does not anticipate replacing mains in these streets unless the street improvement projects happen.

Issue F1: The North 1170 Zone is bottlenecked at 27th Street with a single 6-inch main connecting the north and south halves. The 1170 booster was constructed in 2013 which greatly improved reliability on the north end. However, additional piping would improve reliability and capacity further.

Recommendation: Alternative 1: Install a new 12-inch main along an easement from Breckenridge to 31st Street NE.

Justification: This alternative provides the best redundancy and capacity improvements.

Issue F2: Rock Island Road east of Kentucky Avenue has a single dead end main, approximately 3 miles long. Reliability is low because of the single main. Fire flow is restricted to less than 1,000 gpm due to the length, friction in old steel pipe, and high elevation services near the irrigation canal. There is not a convenient place to install a parallel water main except along the State Highway, which has limited benefit for the cost.

Recommendation: Alternative 3: Provide a secondary main along Union Avenue. Work will also need a canal crossing, PRV station, and private easement as there currently is no dedicated right-of-way between 10th Street SE and Rock Island Road.

Justification: This alternative provides the best redundancy and hydraulic capacity. However, the project will likely not be constructed until there is significant interest in development or a degradation of the local infrastructure.

Operations and Maintenance

Issue G1: Future system conditions could result in Regional Supply Station pumps operating at unacceptably high flow rates.

Recommendation: Alternative 2: Program the VFD interface and telemetry system to not allow the pumps to exceed a preset flow rate.

Justification: Low cost and simple to implement. No new physical components are required, only programming. However, prior to implementation a hydraulic study must be performed to determine the effectiveness of the approach.

Issue G2: Daniels Drive Pump Station lacks accurate pressure and flow monitoring equipment.

Recommendation: Alternative 1: Install monitoring equipment.

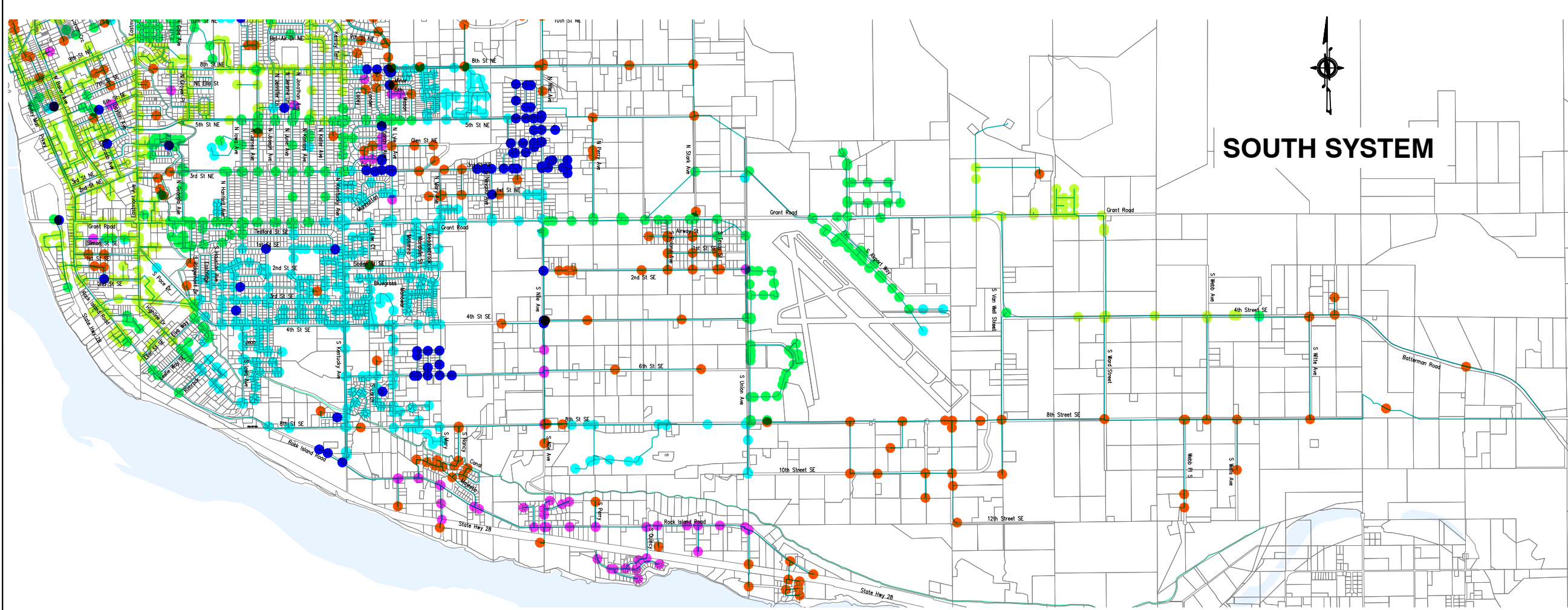
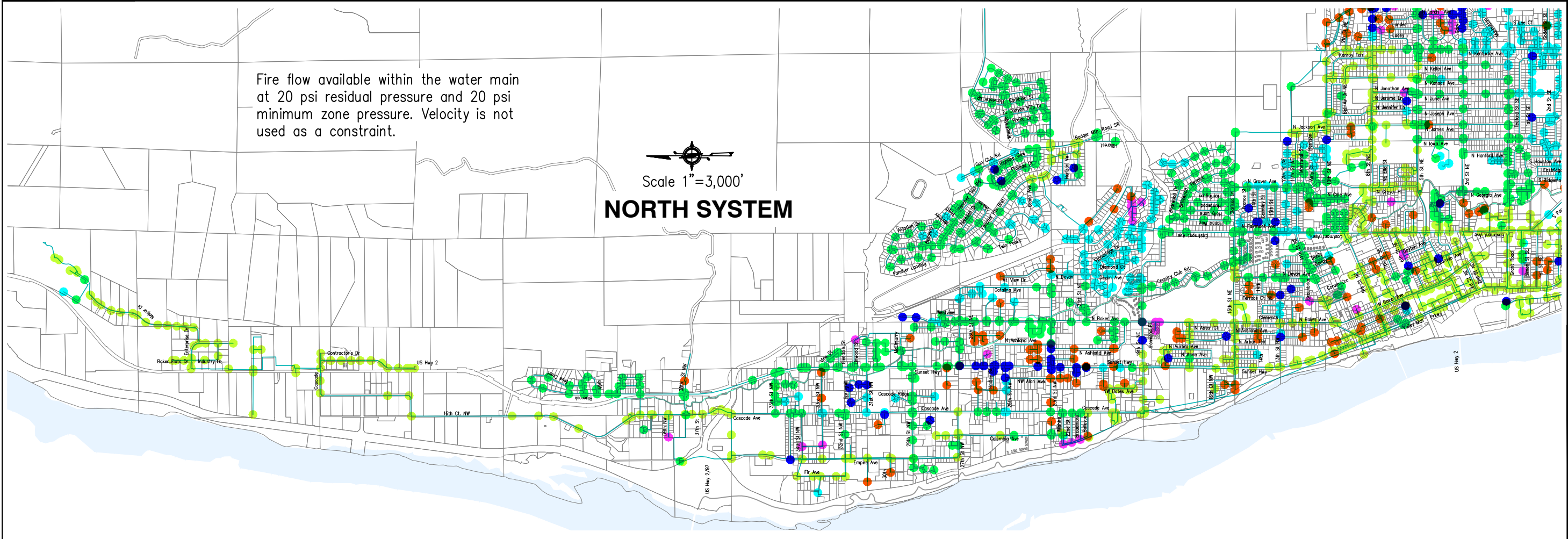
Justification: Gauging is inexpensive operation and maintenance equipment.

CIP Analysis Results

Fire flow analyses and EPS analyses were run with the proposed 6-year CIP improvements in order to determine future system response. **Figures 8.1** and **8.2** represent the available fire flow under the pressure constrained and velocity constrained conditions the same as identified in the *Hydraulic Analysis Results* section of **Chapter 3**.

Fire flow available within the water main at 20 psi residual pressure and 20 psi minimum zone pressure. Velocity is not used as a constraint.

Scale 1"=3,000'
NORTH SYSTEM



SOUTH SYSTEM

- Available Fire Flow
- < 750 gpm
 - 750–1,000 gpm
 - 1,001–1,500 gpm
 - 1,501–2,500 gpm
 - 2,501–4,000 gpm
 - > 4,000 gpm

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**East Wenatchee Water District
 2014 Comprehensive Water System Plan**

**FIGURE 8.1 FIRE FLOW WITH CIP
 PRESSURE CONSTRAINED**

NO.	DATE	DESCRIPTION	BY	REVIEW

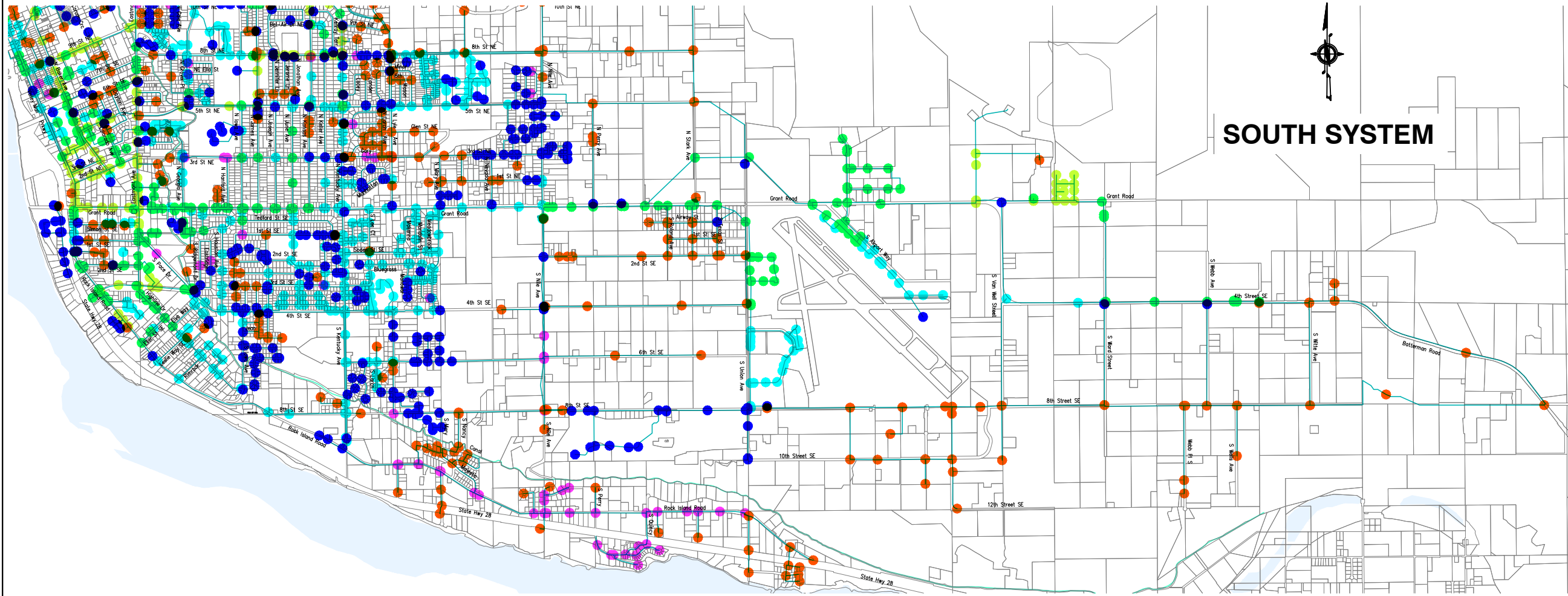
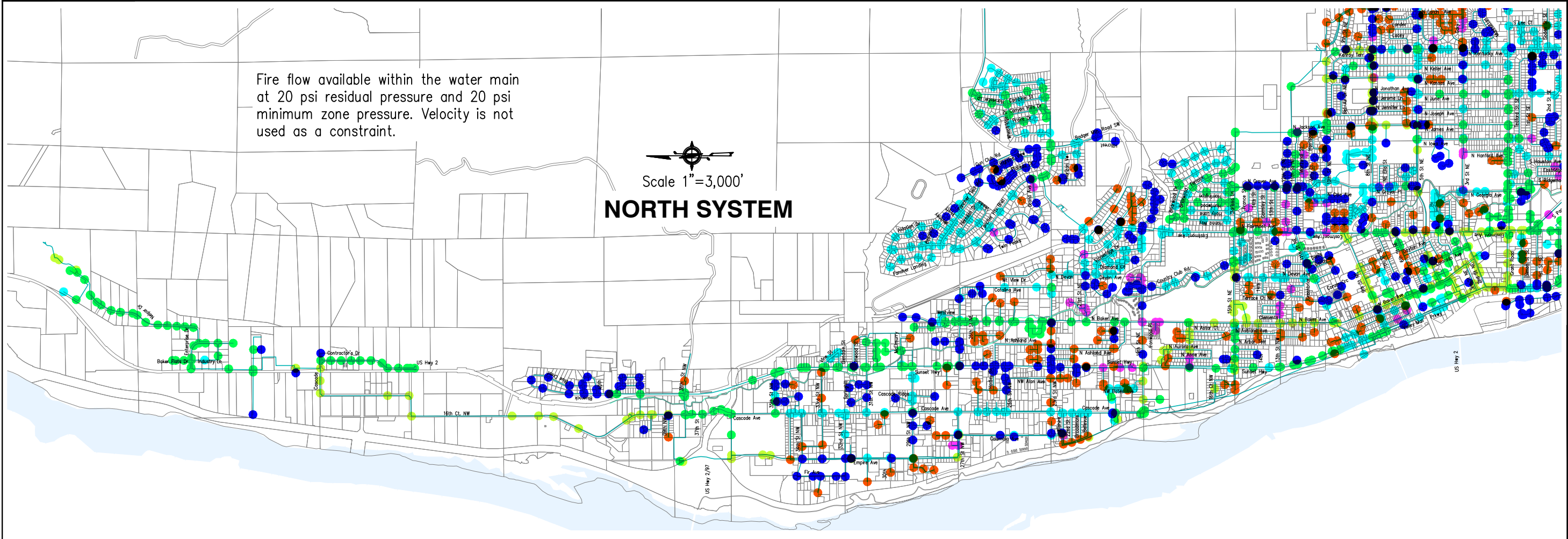
SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO. 8.1 SHEET NO. 8.1

Fire flow available within the water main at 20 psi residual pressure and 20 psi minimum zone pressure. Velocity is not used as a constraint.

Scale 1"=3,000'
NORTH SYSTEM



SOUTH SYSTEM

- Available Fire Flow
- < 750 gpm
 - 750–1,000 gpm
 - 1,001–1,500 gpm
 - 1,501–2,500 gpm
 - 2,501–4,000 gpm
 - > 4,000 gpm

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SIGNED: 06/09/14

East Wenatchee Water District
2014 Comprehensive Water System Plan

FIGURE 8.2 FIRE FLOW WITH CIP VELOCITY CONSTRAINED

Professional Engineer Seal: [Seal]

NO.	DATE	DESCRIPTION	BY	REVIEW

REVISIONS

ENGINEER RCP: DATE: Jun 9, 2014
 REVIEWED RCP: DATE: Jun 9, 2014
 CLIENT: EWW
 FILENAME: EWCP14-F-FDWG
 DSB NO.: 213.721

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: 8.2
 SHEET NO.: 8.2

3. IMPROVEMENT SCHEDULE AND PRIORITIES

The proposed improvements have been prioritized based on a number of factors. For each improvement, the following items (in order of importance) were considered when asking the question, “Does the improvement improve an issue with:”

1. Water Quality;
2. Fire Protection;
3. Source and Supply;
4. Storage;
5. Transmission;
6. Distribution (old, failing and/or undersized pipes); and
7. Operations and Maintenance.

Also considered were proposed street improvement projects by Douglas County and the City of East Wenatchee. Whenever possible, water mains are replaced in conjunction with street reconstruction projects. This is done to minimize costs for surface restoration, traffic control and project administration; the costs of which can easily exceed 1/4 of total project costs.

The project cost estimates presented in the following CIP tables are based on costs for recently constructed public works projects in North Central Washington area and assumed typical construction conditions. Included in each project cost estimate is an indirect cost factor to account for the following costs.

Table 8.7 Indirect Costs

Description	% of Construction	
	Pipeline	Facility
Surveying	3%	2%
Design Engineering	12%	15%
Permitting	1%	4%
Construction Administration	4%	7%
Inspection	2%	5%
Contingency	20%	20%
Total	42%	53%

All planning level cost estimates were based on 2013 dollars and will need to be revised annually. **Figure 8.3** illustrates the Capital Improvement Projects proposed for the District’s water system. The schedule of recommended Capital Improvements is presented in **Table 8.8**. The initial six-year plan provides for the correction of existing issues, improved transmission capacity within the District’s service area, and the initiation of distribution system improvements to correct substandard mains and sizes. Estimated costs of the improvements in years 2014-2019 ranges between \$20 and \$33 million. The range of costs reflects road projects that are currently unfunded and may not happen, and optional projects that may become necessary if rapid local growth occurs in the proposed urban group area (UGA) expansion.

Table 8.8 6 Year Capital Improvement Plan

CIP No.	Description	Purpose	Physical		Location			Assumed inflation rate of 3.0%						Funded By Others
			Size	Length	Along	From	To	2014	2015	2016	2017	2018	2019	
Pipeline Projects								1.00	1.03	1.06	1.09	1.13	1.16	1.0
1	Yearly old main replacement	O&M						\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	
2	23rd NE reconstruction	County widening 2014	8 in	750 ft	23rd NE	SR28	Baker	\$245,000						
3	15th St Overlay	City overlay			15th NE	Baker	Eastmont	2014 No watermain work known						
4	French St	City reconstruction	8 in	800 ft	French St	9th NE	Standerfer	\$40,000	\$236,000					
5	Hamilton St	City reconstruction (replace meters only)			Hamilton	9th NE	Standerfer	\$52,000						
6a	Airport Runway Extension 2014	Grant Rd Realignment	12 in	5,200 ft	Grant Rd	Stark	Airport Way	*						\$767,000
6b	Airport Runway Extension 2014	Grant Rd Realignment	12 in	1,800 ft	Grant Rd	Stark	Union	*						\$266,000
6c	Airport Runway Extension 2014	Grant Rd Realignment	8 in	500 ft	Misc extensions to existing mains			*						\$53,000
7a	10th St Tank transmission	Remove high point in main	12 in	1,050 ft	10th PI NE	10th NE	N Lyle		\$59,000	\$344,000				
7b	10th St Tank transmission	Replace 4" in conjunction with 12"	8 in	1,050 ft	10th PI NE	10th NE	N Lyle		\$53,000	\$310,000				
8a	10th NE Reconstruction Ph 1	City reconstruction in 2019	8 in	1,700 ft	10th NE	Grover	James	\$113,000	\$666,000					
8b	10th NE Reconstruction Ph 2	City reconstruction in 2019	12 in	1,700 ft	10th NE	James	Kansas		\$125,000	\$739,000				
8c	10th NE Reconstruction Ph 3	City reconstruction in 2019	8 in	1,700 ft	10th NE	Eastmont	Grover			\$120,000	\$707,000			
9	Rock Island Road	County widening 2017	12 in	1,800 ft	Rock Isl. Rd	3rd SE	Eller			\$104,000	\$612,000			
10a	Baker Ave Reconstruction (965 Zone)	County rebuild (est 2018)	8 in	1,000 ft	Baker	20th	23rd				\$40,000	\$236,000		
10b	Baker Ave Reconstruction (1170 Zone)	County rebuild (est 2018)	12 in	2,300 ft	Baker	20th	23rd				\$136,000	\$804,000		
11a	Baker Ave Reconstruction	City reconstruction 15th NE to 20th NE	8 in	1,000 ft	Baker	17th NE	Ironwood					\$55,000	\$322,000	
11b	Baker Ave Reconstruction	City reconstruction 15th NE to 20th NE	12 in	600 ft	Baker	19th NE	20th NE					\$37,000	\$217,000	
12	Valley Mall Pkwy widening/sidewalks	City 2019 (replace meters only)		2,400 ft	Valley Mall	6th NE	9th NE							\$129,000
13	Valley Mall Pkwy widening/sidewalks	City 2019 (replace meters only)		2,100 ft	Valley Mall	9th NE	SR28							\$100,000
14	27th to 30th 1170 transmission	Fire flow / Capacity / Reliability	12 in	1,600 ft	easement	Breckenridge	31st NE							\$236,000
15	Enhanced Distribution	Capacity / fire flow	8 in	2,600 ft	Webb	4th SE	8th SE							\$872,000
16	Rock Island Road	Fire flow / O&M	12 in	6,000 ft	Rock Isl. Rd	Kentucky	Nile							\$2,167,000
17	Rock Island Road	Fire flow / O&M	12 in	2,200 ft	Rock Isl. Rd	Union	SR28							\$796,000
18	10th SE transmission	Capacity	8 in	5,000 ft	10th SE	8th SE	Van Sickle & 12th							\$1,676,000
19	12th SE transmission	Capacity	8 in	7,000 ft	New ROW	12th / Van Well								\$723,000
Pipe projects Subtotal								\$600,000	\$1,289,000	\$1,767,000	\$1,645,000	\$1,282,000	\$918,000	\$7,556,000
Pipeline Projects Contingent on Road Projects that are currently unfunded														
101	South 965 transmission	City sidewalks and storm	12 in	400 ft	Highline	Simon	1st SE		\$199,820					
102	Empire Ave replacement	County reconstruction 2016	8 in	2,500 ft	Empire	27th NE	35th NE		\$94,000	\$554,000				
103	SR28 Paving, 15th to Pearcot transmission	DOT project; Capacity / O&M	12 in	700 ft	SR28	13th NE	14th NE				\$32,000	\$185,000		
104	SR28 Paving	DOT project	12 in	800 ft	SR28	16th NE	17th NE				\$48,000	\$280,000		
105	SR28 Paving	DOT project	12 in	3,000 ft	SR28	19th NE	23rd NE				\$177,000	\$1,048,000		
106	SR28 Paving	DOT project	8 in	1,300 ft	SR28	23rd NE	25th NE				\$69,000	\$407,000		
107	North 965 transmission	County widening coincident with DOT project	12 in	1,800 ft	Cascade	19th NE	Wilshire				\$80,000	\$473,000		
108	24" Transmission Relocation	DOT 2/97/Cascade reconfiguration	24 in	600 ft	DOT ROW	Hwy 2/97						\$384,000		
109	19th St Realignment	City reconstruction	8 in	3,300 ft	19th NE	Baker	Eastmont					\$135,000	\$798,000	
Pipe projects with Unfunded Road Project Subtotal								\$0	\$293,820	\$554,000	\$406,000	\$2,912,000	\$798,000	\$0
Supply and Storage Projects														
201	965 transmission, procure easements									\$25,000	\$25,000			
202	965 transmission extension Ph 1	Capacity	24 in	2,500 ft	easement	19th NW	16th/Webster					\$128,000	\$755,000	
203	965 transmission extension Ph 2A	Capacity	24 in	1,700 ft	16th/Avon/15th	Webster	SR28					\$142,000	\$840,000	
204	965 transmission extension Ph 2B	Capacity	8 in	1,700 ft	16th/Avon/15th	Webster	SR28					\$96,000	\$563,000	
205	965 transmission extension Ph 3	Capacity	24 in	2,700 ft	SR28	15th NW	Valley Mall					\$188,000	\$1,112,000	
206	965 transmission extension Ph 4	Capacity	24 in	2,000 ft	Valley Mall	SR28	9th NE					\$222,000	\$1,314,000	
207	965 transmission extension Ph 5	Capacity	24 in	700 ft	9th NE	Valley Mall Pkwy	Baker Ave					\$78,000	\$461,000	
208	1292 storage, 2MG	Capacity / O&M	2.0 MG		10th Street Reservoir			\$500,000	\$2,487,600	\$1,658,400				
209	1494 engine generator & 3rd pump	Capacity / Fire flow	250kW	EG + 100 hp pump	Grant & Nile Booster									\$306,000
210	1594 secondary transmission	Procure easements for future			DNR land	10th St Tanks	Badger Mt Rd		\$25,000	\$25,000				\$50,000
211	1594 secondary transmission	Capacity	12 in	8,000 ft	DNR land	10th St Tanks	Badger Mt Rd							\$1,179,000
212	1594 pump station	Capacity		1000 gpm (x2)										\$918,000
213	1594/1768 storage	Capacity	0.5 MG											\$1,224,000
Supply and Storage projects Subtotal								\$500,000	\$2,512,600	\$1,708,400	\$25,000	\$854,000	\$5,045,000	\$3,677,000
O&M Projects and Studies														
301	Annual meter replacement							\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	
302	Daniels Drive tank painting								\$57,000					
303	965 Transmission Predesign									\$54,000				
304	2020 Comprehensive Plan													\$100,000
O&M Project and Studies Subtotal								\$100,000	\$157,000	\$154,000	\$100,000	\$100,000	\$200,000	\$0
Total Costs								\$1,200,000	\$4,252,420	\$4,183,400	\$2,176,000	\$5,148,000	\$6,961,000	\$11,233,000
Optional Projects														
401	Valley Mall Pkwy overlay	City overlay 2015	12 in	2,300 ft	Valley Mall	4th NE	9th NE	\$124,000	\$736,000					
402	Eastmont overlay	City overlay	16 in	3,500 ft	Eastmont	9th NE	15th NE					\$257,000	\$1,520,000	
403	Eastmont overlay	City overlay	12 in	700 ft	Eastmont	9th NE	15th NE					\$43,000	\$253,000	
404	Airport perimeter watermain	Capacity / Fire flow / Redundancy	8 in	2,800 ft	Van Well	4th SE	8th SE					\$157,000	\$928,000	
405	Airport perimeter watermain	Capacity / Fire flow / Redundancy	8 in	6,000 ft	8th SE	Old Cherry Camp	Van Well					\$335,000	\$1,987,000	
406	S Nile Ave (1170 Zone)	Capacity	12 in	1,500 ft	Nile	6th SE	8th SE				\$88,000	\$521,000		
407	S Nile Ave (1292 Zone)	Capacity	12 in	4,000 ft	Nile	Booster Station	6th SE			\$234,000	\$1,387,000			
408	S Nile Ave (1494 Zone)	Capacity	12 in	2,500 ft	Nile	Booster Station	4th SE			\$147,000	\$867,000			
409	Rock Island Road Reliability	Capacity / Fire flow / Redundancy	8 in	1,500 ft	Union	10th SE	Rock Island Rd			\$103,000	\$605,000			
Optional Project Subtotal								\$124,000	\$736,000	\$0	\$572,000	\$4,172,000	\$4,688,000	\$0

FINANCIAL PROGRAM

INTRODUCTION

This Chapter will review the recent financial history of the District's water system, present a plan for financing the six-year Capital Improvement Plan (CIP) and identify the revenue sources to implement to financing plan.

1. FINANCIAL HISTORY

Table 9.1 presents the water system financial results for the past five years (2008 through 2013). The estimated results, based on the District's adopted 2014 Budget, are presented along with estimated results for the six-year financial plan, 2014-2019, later in this Chapter. In 2014, the District refunded the 2004 water revenue bonds by issuing its Water Revenue Refunding Bonds, 2014. The Bond Reserve fund set aside to guarantee the repayment of the prior water revenue bonds were used in the refunding.

In 2010, the District sold revenue bonds for the financing of ULID No. 2 which required the establishment of a \$1.0 million dollar rate stabilization fund which is to be used in the event the District's future net revenues are not sufficient to meet the debt coverage requirement. This fund is included along with the bond reserve fund in the total amount of restricted funds shown in the District's financial plan.

Table 9.1 Financial Results 2008-2013
(in thousands of dollars)

	2008	2009	2010	2011	2012	2013
Operating Statement						
Customer Accounts						
Metered Accounts	9,033	9,117	9,176	9,240	9,306	9,385
Meter Equivalents (ERU's)	10,785	10,897	10,972	11,039	11,135	11,222
Statement of Income						
Operating Income	\$3,910	\$4,072	\$3,989	\$4,021	\$4,139	\$4,195
Operating Income Per ERU	\$362	\$374	\$364	\$364	\$372	\$374
Operating Expense	\$2,526	\$2,631	\$2,378	\$2,648	\$2,664	\$3,030
Operating Expense Per ERU	\$234	\$241	\$217	\$240	\$239	\$270
Net Operating Income	\$1,384	\$1,441	\$1,612	\$1,373	\$1,475	\$1,165
Net Operating Income Per ERU	\$128	\$132	\$147	\$124	\$132	\$104
Other Income/Deductions	\$189	\$197	\$863	\$663	\$1,029	\$673
Interest Charges	(\$495)	(\$281)	(\$337)	(\$378)	(\$362)	(\$345)
Net Income	\$1,078	\$1,358	\$2,137	\$1,657	\$2,142	\$1,494
Balance Sheet						
Assets						
Utility Plant in Service	\$16,854	\$19,721	\$21,362	\$21,142	\$22,576	\$23,519
Other Property and Investments	\$4,953	\$2,063	\$1,081	\$1,096	\$976	\$671
Current and Accrued Assets	\$2,298	\$4,027	\$3,550	\$3,726	\$4,148	\$3,462
Deferred Debits	\$299	\$273	\$257	\$259	\$240	\$876
Total Assets and Other Debits	\$24,404	\$26,083	\$26,250	\$26,222	\$27,940	\$28,530
Liabilities						
Long Term Debt	\$8,194	\$11,200	\$13,332	\$12,614	\$11,881	\$11,986
Current and Accrued Liabilities	\$690	\$505	\$306	\$179	\$569	\$677
Deferred Credits	\$32	\$11	\$25	\$28	\$34	(\$22)
Total Liabilities and Deferred Credits	\$8,916	\$11,716	\$13,662	\$12,822	\$12,484	\$12,640
Equity						
Retained Earnings	\$3,031	\$3,304	\$3,581	\$3,443	\$3,383	\$3,346
Contributions in Aid of Construction	\$10,951	\$12,525	\$12,878	\$13,337	\$15,199	\$16,061
Total Equity	\$13,982	\$15,828	\$16,459	\$16,780	\$18,582	\$19,407
Total Liabilities and Equity	\$22,899	\$27,544	\$30,122	\$29,602	\$31,065	\$32,047
Long Term Debt Per ERU (\$)	\$760	\$1,028	\$1,215	\$1,143	\$1,067	\$1,068
Equity Per ERU (\$)	\$1,296	\$1,453	\$1,500	\$1,520	\$1,669	\$1,729

Between 2008 and 2013, the District increased its customer accounts by 352 and its meter equivalents (ERU) by 437, an increase of approximately 3.8 percent in accounts and 3.9 percent in ERU's. The Utility Plant in Service increased by more than 10 percent in the same time period. The majority of this increase in the value of the Utility Plant in Service was accomplished by the formation of ULID No. 2 (Baker Flats reservoir and transmission main improvements) and the subsequent sale of approximately \$2.23 million in revenue bonds which funded over 40 percent of the Project. The remaining increase in value was funded through a combination of PWTIF loans and use of rates and charges revenue of the District.

Operating revenue per ERU increased by approximately 3.2 percent to accommodate this growth and the increases in operating costs over the prior six year period. The District had accumulated invested cash reserves of approximately \$4.1 million in its operating and construction funds by the end of 2013.

The District also collected from each new customer a connection charge. The connection charge includes the District’s cost of providing and installing the service and meter and a Plant Investment Fee (PIF). PIF recovers from each new customer an equitable share of the cost of existing facilities and planned capital improvements necessary to provide service to the new customer. The District’s current connection charges are present in **Table 9.2**. The financial plan will examine the ability of the adopted rates and charges to provide sufficient revenue for water system operation and maintenance, repayment of long-term debt and financing of the six-year capital improvements.

Table 9.2 System Connection Charges

Part A. Residential Connection Charges				
Number of Dwellings	Required Meter Size	Plant Investment Fee (PIF)	Meter Installation Charge	Total connection Charge
1	5/8" x 3/4"	\$2,000	\$500	\$2,500
1	1"	\$3,600	\$700	\$4,300
2	1"	\$5,200	\$700	\$5,900
3	1"	\$6,800	\$700	\$7,500
4	1"	\$8,400	\$700	\$9,100
5 (2)				
(1) Single Family connections where 1" meters are required shall be considered the same as two multifamily dwelling units (2) The P.I.F. Charge for multi-family service connections with greater than (4) dwelling units shall be based on the meter size shown in Part B. below . (3) The P.I.F. for each additional multi-family unit shall be computed at 80% of the base charge up to a total of 4 dwelling units				
Part B. 1-1/2" and Larger Meter Connections				
Required Meter Size	Meter Capacity (1)	Flow Factor (2)	Plant Investment Fee (PIF)	Meter Installation Charge
1-1/2"	200 gpm	10	\$20,000	Cost plus 20%
2" & 3"	320 gpm	16	\$32,000	Cost plus 20%
4"	500 gpm	25	\$50,000	Cost plus 20%
6"	1,000 gpm	50	\$100,000	Cost plus 20%
(1) Meter capacity based on AWWA standard for max rated continuous capacity of compound meters (2) Flow factor based on the maximum rated continuous capacity for a 5/8" x 3/4" meter of 20 gpm				

2. CIP FINANCING PLAN

The initial six years of the CIP presented in **Table 8.8** is summarized by year and by improvement types; Pipelines, Supply and Storage; and O & M and Studies in **Table 9.3**. Capital improvements included in the District’s adopted 2014 Budget are also summarized by improvement type. The financing plan anticipates an annual increase in construction costs of approximately 2 percent per year. The project costs presented in **Table 8.8** are adjusted to reflect this cost adjustment. The Plan only includes those projects identified as District funded and does not include any CIP projects that are anticipated to be funded by developers. The CIP will be funded through a combination of rates, fees and long-term financing.

As previously described in **Chapter 8**, approximately 20 percent of the total six year CIP is associated with City and County road projects. Presently, the City and County do not have funding for these projects, yet they are included on their six year road plans. If and when these projects are constructed could have significant impacts on the District to fund its own projects. The District keeps in close communication with the City and County in order to track any changes as to when these road project might be considered for construction.

In order to prepare the District’s financial plan, it is assumed specific road projects will be constructed as shown in **Chapter 8** and as summarized in **Table 9.3**.

**Table 9.3 Summary of Six Year Capital Improvement Plan
(in thousands of dollars)**

Project Description	2014	2015	2016	2017	2018	2019	
Pipelines	\$829	\$1,053	\$1,767	\$1,645	\$1,282	\$918	
Pipelines contingent on County/City Road Project Funding	\$0	\$294	\$554	\$406	\$2,912	\$798	
Storage and Supply	\$500	\$2,513	\$1,708	\$25	\$854	\$5,045	
O & M and Studies	\$100	\$157	\$154	\$100	\$100	\$200	
District Funding Total	\$1,429	\$4,016	\$4,183	\$2,176	\$5,148	\$6,961	
Unfunded Projects							Developer
Optional Pipelines	\$124	\$736	\$0	\$469	\$3,567	\$4,688	\$3,677
Unfunded/Other Developer	\$124	\$736	\$0	\$469	\$3,567	\$4,688	\$3,677

The financing plan is based on the District using two existing Public Works Trust Fund (PWTF) loans for the system replacement projects scheduled for construction in 2015 and again in 2016. The loans will be equal to 85 percent of the project cost with repayment over 20-year at an interest rate of 0.5 percent. The PWTF loans are \$407,000 and \$3,949,000 which will be drawn over 2014 through 2016. It is anticipate that the balance of the proposed six year CIP costs of \$23.9 million dollars will be funded from current rates, existing accumulated reserves in the Operation and Maintenance Fund and Capital Improvement Fund and a proposed revenue bond sale in 2018.

The financing of the District’s revenue requirements includes an allowance for the adjustment of water service rates of approximately 3.6 percent per year beginning in 2015. The revenue from water service rates will increase by a total of approximately 22 percent over 2014 rates based on the annual increases proposed from 2015 through 2019. The average monthly revenue per ERU will increase from \$32.58 in 2014 to \$39.42 in 2019, or \$6.83 per month. The proposed water rates for 2014 through 2019 are shown in **Table 9.4**.

Table 9.4 Proposed Water Service Rates

Meter Size	Proposed Bi-Monthly Charge Rate Structure						Avg. Ann. Increase
	2014	2015	2016	2017	2018	2019	
5/8 & 3/4 inch	\$47.00	\$49.00	\$51.00	\$53.00	\$55.00	\$57.00	4.3%
1 inch	\$52.25	\$54.50	\$56.70	\$58.90	\$61.20	\$63.40	4.3%
1-1/2 inch	\$58.75	\$61.10	\$63.60	\$66.10	\$68.60	\$71.10	4.2%
2 inch	\$75.50	\$78.70	\$81.90	\$85.10	\$88.30	\$91.50	4.2%
3 inch	\$202.00	\$211.20	\$219.80	\$228.40	\$237.00	\$245.60	4.3%
4 inch	\$250.50	\$260.20	\$270.80	\$281.40	\$292.00	\$302.60	4.2%
Additional Business or Dwelling Unit	\$38.50	\$39.20	\$40.80	\$42.40	\$44.00	\$45.60	3.7%
Water Consumption	2014	2015	2016	2017	2018	2019	
Charge per 100 CF in excess of 1200 CF	\$1.45	\$1.55	\$1.65	\$1.75	\$1.85	\$1.95	6.9%
Low Income/Senior Bi-Monthly Discount							
	2014	2015	2016	2017	2018	2019	
Discount Class 1	(\$5.00)	(\$6.00)	(\$7.00)	(\$8.00)	(\$9.00)	(\$10.00)	
Discount Class 2	(\$9.00)	(\$11.00)	(\$12.00)	(\$13.00)	(\$14.00)	(\$15.00)	
Discount Class 3	(\$13.00)	(\$15.00)	(\$17.00)	(\$18.00)	(\$19.00)	(\$20.00)	

3. WATER SYSTEM FINANCIAL POLICIES

The District has established the following financial policies and priorities for maintaining sound fiscal operations:

1. The utility will fully meet its obligations to the holders of the District's water revenue bonds as they are established by the covenants adopted in the resolution issuing such bonds.
2. The District will fully meet contractual obligations incurred to acquire assets and property, as well as short-term and long-term debt incurred including Public Works Trust Fund Loans.
3. To the extent that there are excess accumulated reserves resulting from past years operations, these excess funds will be allocated to capital improvements to the system as identified in the District's adopted CIP (CIP).
4. In the Operating Fund, the District shall maintain a cash balance equal to 45 days working capital based on the annual operation and maintenance expenses excluding depreciation.
5. The District shall fund, from operating revenues, an annual amount for capital improvements equal to the allowance for depreciation and amortization less the annual charges for repayment of the principal amount of all debt obligations. These funds may be used for replacing or repairing existing assets or acquiring new assets.

6. The rate structure shall, as closely as possible, recover from each customer the cost of providing service while maintaining a uniformed set of water rates based on meter size.
7. Each new connection to the water system shall pay a connection charge that recovers an equitable proportion of the investment in water system facilities and planned system additions and replacements for the following 10 years.
8. The Construction and Capital Improvement Fund will have the following revenue sources.
 - a) Connection charge.
 - b) Net-proceeds of any revenue bonds issued or loans secured for the purpose of constructing additions to the water system.
 - c) Revenue set aside for capital improvements from water service rates and charges.
 - d) Operating Fund reserves allocated to capital improvements.

4. FINANCIAL FORECASTS

Table 9.5 presents a forecast of the water system operating results for 2014 through 2019, based on the current adopted rates and connection charges and the proposed water service charge rate increases. The forecast includes an allowance for increases in operating expenses of 2 percent per year, plus increases associated with the increase in meter equivalents (ERU's) and water consumption. Interest income on accumulated reserves is computed at 0.5 percent per annum.

Table 9.5 Forecast of Operating Results 2014-2019
(in thousands of dollars)

	2014	2015	2016	2017	2018	2019
Customer Accounts						
Metered Accounts	9,478	9,589	9,704	9,825	9,949	10,080
Meter Equivalents (ERU's)	11,353	11,478	11,608	11,745	11,886	12,033
Operating Statement						
Operating Income	\$4,438	\$4,682	\$4,929	\$5,180	\$5,437	\$5,697
Operating Income Per ERU	\$391	\$408	\$425	\$441	\$457	\$473
Operating Expense	\$2,975	\$3,063	\$3,154	\$3,249	\$3,346	\$3,447
Operating Expense Per ERU	\$262	\$267	\$272	\$277	\$282	\$286
Net Operating Income	\$1,463	\$1,619	\$1,775	\$1,932	\$2,091	\$2,250
Net Operating Income Per ERU	\$129	\$141	\$153	\$164	\$176	\$187
Other Income/Deductions	\$552	\$620	\$638	\$621	\$639	\$720
Interest Charges	(\$236)	(\$291)	(\$255)	(\$241)	(\$522)	(\$501)
Net Income	\$1,779	\$1,949	\$2,158	\$2,312	\$2,208	\$2,470
Net Income per ERU	\$157	\$170	\$186	\$197	\$186	\$205

A cash flow forecast for the District's; Operating Fund, Capital and Construction Fund and Revenue Bond Fund is presented in **Table 9.6**. The cash flow is forecast for 2014 through

2019. Cash reserves in the Operation and Maintenance fund and Construction and Capital Improvement Fund begin at \$4,162,000 in 2014 and is projected to increase to \$5,967,000 by the end of 2019. The funding of future capital improvements beyond 2019, will be limited to the annual transfer of depreciation and amortization less the principal long-term debt payments and the income from connection charges. Increases in operating costs beyond 2019 or funding of capital improvements in an amount beyond that available from rates and charges on an annual basis will require an additional increase in water service rates and connection charges.

The six-year CIP will provide facilities to serve the anticipated growth through 2019 and beyond. While the financing plan illustrates the District's ability to finance these improvements and meet all of the costs of operation and maintenance an evaluation of the appropriate amount to be charged to a new connection as a Plant Investment Fee is warranted. The District's policy is to recover from new connection to the system a proportionate amount of the equity in the current facilities as well as the planned improvements through the Plant Investment Fee. While this report does not provide a specific recommendation it is readily apparent that the current PIF does not accomplish the intent of the District objective. We recommend that the District re-evaluate the charge required to accomplish their objective and consider adopting a new charge consistent with the evaluation. A PIF that recovers the District's cost of facilities required to provide service to each new customer will reduce the District's reliance on water service rates to fund future capital improvements.

Table 9.6 Forecast of District Cash Flow 2014-2019
(in thousands of dollars)

	2014	2015	2016	2017	2018	2019
Operation and Maintenance Fund						
Beginning Fund Balance	\$5,576	\$6,456	\$5,910	\$4,608	\$3,888	\$4,554
Net Income From Operations	\$1,463	\$1,619	\$1,775	\$1,932	\$2,091	\$2,250
Other Income (Expense)	\$552	\$620	\$638	\$621	\$639	\$720
Total Available Cash	\$7,591	\$8,696	\$8,323	\$7,161	\$6,618	\$7,525
Less Loan Payments						
PWTF Loans	\$338	\$332	\$308	\$307	\$513	\$510
Installment Debt	\$16	\$0	\$0	\$0	\$0	\$0
Net Available Cash	\$7,237	\$8,363	\$8,015	\$6,854	\$6,105	\$7,015
Cash Transfers						
Revenue Bond Fund	\$309	\$807	\$803	\$790	\$1,074	\$1,070
Capital Fund includes Capitalized Exp's	\$366	\$438	\$450	\$452	\$477	\$530
Capital Funding from Reserves	\$106	\$1,209	\$2,154	\$1,724	\$0	\$4,095
Total Transfers	\$781	\$2,454	\$3,407	\$2,966	\$1,551	\$5,695
Ending Fund Balance	\$6,456	\$5,910	\$4,608	\$3,888	\$4,554	\$1,321
Desired Minimum Balance (60 days Cash Flow)	\$496	\$511	\$526	\$541	\$558	\$575
Construction and Capital Improvement Fund						
Beginning Fund Balance	\$407	\$0	\$0	\$0	\$0	\$2,329
Transfers in						
From Operation and Maintenance Fund	\$472	\$1,647	\$2,604	\$2,176	\$477	\$4,625
Proceeds of Revenue Bond Sale	\$550	\$0	\$0	\$0	\$7,000	\$0
Proceeds of PWTF Loan	\$0	\$2,369	\$1,580	\$0	\$0	\$0
Developer Funding	\$0	\$0	\$0	\$0	\$0	\$0
Total Transfers In	\$1,022	\$4,016	\$4,183	\$2,176	\$7,477	\$4,625
Cost of Capital Improvements	\$1,429	\$4,016	\$4,183	\$2,176	\$5,148	\$6,954
Ending Fund Balance	\$0	\$0	\$0	\$0	\$2,329	\$0
Desired Minimum Balance (1% of Assets)	\$245	\$262	\$282	\$372	\$389	\$407
Bond Redemption Fund						
Beginning Fund Balance	\$1,413	\$1,413	\$1,413	\$1,413	\$1,413	\$1,413
Transfers In						
From Operation and Maintenance Fund	\$309	\$807	\$803	\$790	\$1,074	\$1,070
From Sale of Revenue Bonds	\$0	\$0	\$0	\$0	\$0	\$0
Total Transfers In	\$309	\$807	\$803	\$790	\$1,074	\$1,070
Transfers Out						
Revenue Bond Principal	\$125	\$565	\$575	\$575	\$595	\$610
Revenue Bond Interest	\$184	\$242	\$228	\$215	\$479	\$460
Total Transfers Out	\$309	\$807	\$803	\$790	\$1,074	\$1,070
Ending Fund Balance	\$1,413	\$1,413	\$1,413	\$1,413	\$1,413	\$1,413
Minimum Reserve Balance Required	\$1,413	\$1,413	\$1,413	\$1,413	\$1,413	\$1,413
Cash Balance All Funds						
Total Beginning Cash Balance All Funds	\$7,395	\$7,869	\$7,322	\$6,021	\$5,301	\$8,296
Total Ending Cash Balance All Funds	\$7,869	\$7,322	\$6,021	\$5,301	\$8,296	\$2,733
Minimum Desired Ending Cash Balance	\$2,154	\$2,185	\$2,220	\$2,326	\$2,360	\$2,395
Long Term Debt						
Total Long Term Debt	\$11,530	\$8,711	\$13,536	\$12,948	\$12,345	\$11,737
Long Term Debt per ERU	\$1,016	\$759	\$1,166	\$1,102	\$1,039	\$975

Table 9.7 provides an evaluation of the ability of proposed rates and current connection charge to meet the District's revenue requirement. The revenue requirement is based on two tests. First is annual income sufficient to meet the annual cash out-flow, and second is the income sufficient after deducting operating expenses but before depreciation to meet the coverage required by the District's revenue bond covenants. The revenue bond covenants require this net income to at least equal to 1.4-times the annual revenue bond principal and

interest payments. The proposed rates and current connection charge as shown in **Table 9.4** will provide sufficient revenues to meet the district revenue requirements while financing the six-year Capital Improvement Plan. Future capital improvements (beyond 2019) will probably require additional long-term debt and adjustments in rates and charges.

Table 9.7 Estimated Revenue Requirement
(in thousands of dollars)

	2014	2015	2016	2017	2018	2019
Revenue Requirement Based On Cash Flow						
Cash Operating Expenses	\$2,975	\$3,063	\$3,154	\$3,249	\$3,346	\$3,447
Debt Service	\$309	\$807	\$803	\$790	\$1,074	\$1,070
PWTF Loan P & I	\$338	\$332	\$308	\$307	\$513	\$510
Other Loan Payments	\$16	\$0	\$0	\$0	\$0	\$0
Capital Funding	\$106	\$1,209	\$2,154	\$1,724	\$0	\$4,095
Total Cash Expenditures	\$3,744	\$5,411	\$6,419	\$6,069	\$4,932	\$9,121
Water Service Income	\$4,438	\$4,682	\$4,929	\$5,180	\$5,437	\$5,697
Other Cash Revenues (Expenses)	\$552	\$620	\$638	\$621	\$639	\$720
Total Revenues	\$4,991	\$5,303	\$5,567	\$5,802	\$6,076	\$6,418
Revenue Deficiency (Surplus)	(\$1,246)	\$109	\$852	\$268	(\$1,144)	\$2,704
Revenue Requirement Based on Water Revenue Bond Covenants						
Cash Operating Expenses	\$2,975	\$3,063	\$3,154	\$3,249	\$3,346	\$3,447
Total Debt Service	\$309	\$807	\$803	\$790	\$1,074	\$1,070
Bond Coverage Requirement 1.4 x Debt Service	\$123	\$323	\$321	\$316	\$429	\$428
Total Revenue Requirement	\$3,407	\$4,193	\$4,279	\$4,354	\$4,849	\$4,945
Water Service Income	\$4,438	\$4,682	\$4,929	\$5,180	\$5,437	\$5,697
Other Cash Revenues (Expenses)	\$552	\$620	\$638	\$621	\$639	\$720
Total Revenues	\$4,991	\$5,303	\$5,567	\$5,802	\$6,076	\$6,418
Net Revenue Required for Coverage	\$0	\$0	\$0	\$0	\$0	\$0
Coverage Realized	6.53	2.78	3	3.23	2.54	2.78
Revenue Deficiency (Surplus)	(\$1,583)	(\$1,110)	(\$1,288)	(\$1,447)	(\$1,227)	(\$1,473)
Total Revenue Deficiency	\$0	\$0	\$0	\$0	\$0	\$0