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CHAPTER 1

WATER SYSTEM DESCRIPTION

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WATER SYSTEM DESCRIPTION

1.1 introduction

The purpose of this Plan is to provide an update to the 1996 *City of Ridgefield Water System Plan* for the City of Ridgefield, Washington. In accordance with Washington Administrative Code (WAC) 246-290-100 and the Washington State Department of Health (DOH), water system plans need to be updated every six years. This Plan is prepared in accordance with WAC 246-290-100, the DOH *Water System Planning Handbook*, dated April 1997, and the DOH *Water System Design Manual* (DOH Design Manual) dated August 2001.

The Plan that follows evaluates the existing Group A water system and its ability to meet the current and anticipated State and Federal requirements for water source, quality, transmission, distribution, and storage. Recommended system improvements and operational modifications are developed to meet the demands of regulatory impacts and infrastructure repair and replacement. Emergency operation, water quality monitoring, system maintenance, record keeping and reporting, cross-connection control, and wellhead protection are also addressed in this Plan.

A vicinity map showing the location of the City of Ridgefield is shown as Figure 1-1. An aerial photograph displaying the current city limits along with the urban growth area for the City of Ridgefield is shown as Figure 1-2.

1.1.1 authorization and contract

The City of Ridgefield has authorized the preparation of this plan by General Engineering Services Amendment No. 4.

1.1.2 WATER SYSTEM OWNERSHIP AND MANAGEMENT

The City of Ridgefield operates a Group A community water system that provides potable water to the community. The estimated 2004 population of the City of Ridgefield is approximately 2,195. In 2004, it is estimated that the City's water system provided potable water to approximately 1,697 residents. The remainder were served by private wells. The water system is owned and managed as a municipal water system by the City of Ridgefield. The DOH system identification number for the Ridgefield Water System is 72400V. Justin Clary, P.E., is the Public Works Director who oversees the existing management structure and decision making process for the water system. The contact information is as follows:

City of Ridgefield
230 Pioneer Avenue
P.O. Box 608
Ridgefield, Washington 98642
(360) 887-3557 fax 887-0861

1.2 System Background

1.2.1 History Of Ridgefield

The City was originally situated along the shoreline of Lake River. The primary employer for the community was Pacific Wood Treating, a riverside industry that provided treated wood products to various national and international markets. Pacific Wood Treating ceased operations in the 1970's. After a decade of low growth, the City of Ridgefield has become a rapidly growing community with residential, commercial and industrial development. The City also has an elementary school, middle school and high school. Much of the recent growth has derived from the housing and commercial markets that have reached the capacity limits in the Urban Growth Areas (UGAs) for the larger communities of Portland and Vancouver. These markets have now moved north to the City of Ridgefield.

1.2.2 History of System Development and Growth

In 1917, a reservoir was constructed with a storage volume of 200,000 gallons in what is now the Low Zone. Most of the downtown area distribution system was constructed in 1935. Through various development contracts the distribution system has been maintained and replaced. Various wells have been installed throughout the downtown area prior to 1945 through the late 1970's. Wells No. 1-6 were among the wells installed in the downtown area. None of these wells are currently in service due to various reasons.

The area just east of the I-5 and SR 501 interchange is referred to as the Junction area. The Junction area, well, distribution system, booster station, and 100,000 gallon reservoir was constructed in 1985 in order to serve the Port of Ridgefield industrial park. The Junction area system is discussed further in section 1.3.1. The Junction area water system was connected to the downtown area system in 1996 with the completion of a 12-inch water main from the downtown area to the Junction area. At this time the Junction Well was taken out of service due to high iron and manganese concentrations.

In 1986, Well No.'s 7, 8, and 9 were constructed in Abrams Park. These wells are now the primary wells serving the water system. Most of the Hillhurst Road area facilities were also constructed in 1986. The Hillhurst Road facilities consist of approximately 10,000 feet of distribution main along Hillhurst Road and a 600,000-gallon standpipe located on the High School's property. This standpipe provides storage for the High Zone.

1.2.3 PROJECTS COMPLETED SINCE THE 1996 pLAN

The 1996 Plan made many recommendations for system improvements. Table 1-1 summarizes the 1996 six-year improvement recommendations and the status of each recommended improvement.

TABLE 1-1

1996 Recommended Improvements and Status

Item No.	Improvement	Status
Source Improvement		
S1	Source Study to Increase Supply	Preliminary evaluation completed as part of this Plan. Detailed study to be completed in 2005.
S2	Modifications to Well No. 9 to pump directly to High Zone	Completed
Storage Improvement		
R1	300,000 gallon Low Zone reservoir	400,000 gallon reservoir constructed
R2	1,000,000 gallon High Zone elevated reservoir in northwest service area	Emergency intertie with Clark Public Utilities (CPU) used to meet interim need. Reservoir planned for 2007.
Distribution / Transmission System Improvements		
D1	10,300' of 12" main to intertie City with Junction	Completed
D2	2,000' of 12" main from 269th to Hillhurst Road	Completed
D3	2,400' of 8" main from Abrams Park to proposed Low Zone reservoir	Completed
D4	3,200' of 8" main from Main St. to proposed Low Zone reservoir	Completed
D5	Replace 15 undersized hydrants	Not completed
D6	2,000' of 12" main from Abrams Park to north High School Reservoir	Completed as part of Bellwood Heights development.
D19	3,200' of 6" mains to replace existing 4" mains	Not completed
Miscellaneous		
M1	Rate Study	System development charge study completed in 2005. Rate study not done.

1.2.4 Geography

The City of Ridgefield is located in southwestern Washington approximately two miles east of the Columbia River and 25 miles north of Portland, Oregon. Rolling hills and ravines surround the City. Lake River borders Ridgefield to the west and the existing city limits extend past I-5 to the east. Gee Creek is the primary surface water body through the City's service area. Elevations range from a maximum of approximately 300' Mean Sea Level (MSL) on the east side of I-5 to a minimum of 0' MSL at Lake River, A topographic map of the City is shown in Figure 1-3.

1.2.5 Adjacent Purveyors

The only adjacent purveyor is Clark Public Utilities (CPU). The City's water system has an intertie with CPU east of I-5 on South 5th Street, which was constructed in 2003. The intertie can provide an alternative source of supply during an emergency within Ridgefield's water system. The City has an agreement with CPU regarding usage of the intertie. A copy of the interlocal agreement is included in Appendix B. Figure 1-4 displays the purveyors near the City of Ridgefield.

1.3 Inventory of existing facilities

1.3.1 source of supply

The City currently obtains water from three wells (identified as Wells No. 7, 8, and 9) located in Abrams Park, as shown in Figure 1-5. All three wells draw from the Troutdale formation, which is the primary source of water for many Clark County water systems. These wells were constructed in 1986 and can each yield approximately 400 gallons per minute. Presently, Well No.'s 7 and 8 produce an average of 300 gpm each, while Well No. 9 produces an average of 400 gpm. The well water is chlorinated using a sodium hypochlorite injection system located at the well field. The water quality is excellent and meets all present and anticipated drinking water standards.

Two additional wells (Well No. 2 drilled in 1955 and Well No. 3 drilled in 1965) are also located within Abrams Park and have been inactive since 1991. Well No. 2 is out of service due to two breaks in its casing pipe. Well No. 3 is off line but could potentially be restored to service. Originally each well could produce 150 gpm.

The Ridgefield Junction Area was formerly served by a well developed for the Port of Ridgefield Industrial Park. The existing well pump is rated at 100 gpm, and the well has a capacity of 300 gpm. However, due to high iron and manganese levels from this source the well has not been used since 1999. The Junction Area is currently provided with water drawn from the Abrams Park well field through the Junction Transmission Main.

Water service to the existing residences in the rural areas of Ridgefield UGA is supplied by private wells. As water mains are extended throughout the City, it is expected that most of these residences will connect to the City's water system. Table 1-2 lists the sources of supply and notes the current status of each well.

TABLE 1-2

Sources of Supply

Source	DOH Source Number	Year Completed	Total Well Depth (feet)	Current Pumping Production (gpm)
Well No. 2	S10	1955	165	0
Well No. 3	S03	1965	167	0
Well No. 5	-	1966	138	0

Well No. 6	-	1971	131	0
Well No. 7	S11	1986	145	300
Well No. 8	S08	1986	153	300
Well No. 9	S09	1986	162	400
Junction Well	S12	1986	460	0

1.3.2 Water Rights

According to the Washington State Department of Ecology, the City currently holds water rights for 962 acre-ft of annual withdrawal and 1,875 gpm of instantaneous withdrawal. These water rights are attached to various well sources. As the City's water demands increase, rights associated with well sources not currently in use will likely need to be transferred to productive well sources. Table 1-3 summarizes the water rights held by the City.

TABLE 1-3

Water Rights

Source	Water Rights Claim Number	Type	Instantaneous Withdrawal (gpm)	Annual Withdrawal (acre-ft)
Well No. 1	018511	Domestic	200	323
Well No. 2	G2-20381	Domestic	300	240
Well No. 3	2449	Domestic	150	180
Well No. 5	G2-20379	Domestic	200	161(1)
Well No. 6	G2-20380	Domestic	125	100
Well No. 7	G2-27103	Domestic	300	241(2)
Well No. 8	G2-27104	Domestic	300	241(2)
Well No. 9	G2-27105	Domestic	300	241(2)
Junction Well		Domestic		
		Total	1,875(3)	962(3)

(1) Of this total, 119 acre-ft are primary rights and 42 acre-ft are supplemental rights
(2) Supplemental to existing rights.
(3) Total provided is an interpretation of the City's water rights as determined through discussions with the Department of Ecology.

1.3.3 Storage

The storage facilities serving the City consist of a Low Zone 400,000-gallon reservoir located near the cemetery and a 616,000-gallon standpipe reservoir located near Ridgefield High School that serves the High Zone. The High Zone also has a 100,000-gallon reservoir at Ridgefield Junction, which in conjunction with booster pumps, can supplement fire flow to the High Zone. A schematic showing the pressure Zones and related storage facilities are shown on Figure 1-6. Table 1-4 summarizes the storage facilities used by the City.

Cemetery Reservoir. The Cemetery Reservoir is a 400,000-gallon, at-grade bolted steel tank constructed in 1999. The water supply is from Wells No. 7 & 8 in Abrams Park with a combined capacity of 600 gpm. The wells pump directly into the Low Zone distribution system and supply the Cemetery Reservoir.

High School Reservoir: The High School Reservoir serves the High Zone. It is a welded steel reservoir that was constructed in 1986 and has a capacity of approximately 616,000-gallons. Approximately 372,000-gallons are available for fire protection and standby use. The remaining volumes cannot be delivered at system pressures but would still be useful in an emergency. The reservoir is supplied by Abrams Park Well No. 9, with a capacity of 400 gpm, that feeds directly into the High Zone.

Junction Reservoir: A 100,000-gallon ground level concrete reservoir is located at the Ridgefield Junction. The overflow elevation for this reservoir lower than the High School Reservoir, so the Junction Booster Station must be used to supply water from this reservoir to the High Zone.

Hydropneumatic Tanks: The Ridgefield water system also has two hydropneumatic tanks that can operate in conjunction with the booster stations. One hydropneumatic tank, located by the Cemetery Reservoir, has a capacity of 3,000-gallons. It was built to serve the area along the ridge in the southeast part of the City before the High School Reservoir was constructed. Currently, it can operate in conjunction with the cemetery booster pumps to supply the High Zone when the High School Reservoir is out of service. An air compressor, activated by pressure switches in the 3,000-gallon tank, maintains the tank pressure between 50 and 70 psi.

The second hydropneumatic tank has a capacity of approximately 500-gallons and is located next to the Junction Booster Station. It is currently off-line, but could be used with the Junction Booster Station to supply demands in the High Zone if the High School Reservoir is off-line.

TABLE 1-4

Storage Facilities

Storage Facility	Construction		Diameter	Base Elevation	Overflow Elevation	Capacity
	Type	Date	(feet)	(feet)	(feet)	(gallons)
High School Reservoir	Welded Steel	1986	28	273.75	407.75	617,000
Cemetery Reservoir	Bolted Steel	1999	62	236.5	262.0	400,000
Junction	Concrete	1985	26	258(1)	282.0	100,000

(1) Base elevation was taken from topographic data obtained from Clark County GIS.

1.3.4 Booster Stations

The City currently has two booster stations. Table 1-5 provides a summary of the booster stations operated by the City.

TABLE 1-5

Booster Stations

Booster Station	Type of Pumps	Number of Pumps	Capacity (gpm)	Function
Cemetery Booster Station	End Suction Centrifugal	2	80 gpm (each)	Pumps water from Low Zone to High Zone
Junction Booster Station	End Suction Centrifugal (3), Vertical Multi-Stage(1)	4	Pump 1-3: 1,000 gpm (each) Pump 4: 10 gpm	Pumps water from the Junction Reservoir to the High Zone

<u>Cemetery Booster Station:</u> The Cemetery Booster Station was constructed in the 1950's. It consists of two 80 gpm end suction centrifugal pumps and is used to transfer water from the Low Zone to the High Zone.

<u>Junction Booster Station:</u> The Junction Booster Station was constructed in 1986. It consists of three 1,000 gpm end suction centrifugal pumps and one 10 gpm vertical multi-stage pump. The Junction Booster Station provides water to the High Zone from the Junction Reservori during emergencies.

1.3.6 PRV Stations

The Ridgefield water system currently has three pressure reducing valve (PRV) stations. The first is located in Abrams Park on the south side of Gee Creek. The second PRV is located near the Cemetery Reservoir. Both PRV's that can be used to supply water from the High Zone to the Low Zone. A third PRV is located at the entrance to the Gee Creek Meadows Mobile Home Park. This PRV reduces pressure from the High Zone to acceptable levels within the Mobile Home Park. A fourth PRV is planned to be installed in the Heron Ridge Development when the Low Zone water main is connected to the High Zone water main.

1.3.7 Pressure Zones

The Low Zone comprises most of the City's main system and over 70% of the connections. It includes the well field located in Abrams Park, a 400,000-gallon reservoir and a network of distribution main that was mostly constructed in 1935. The well field serving the Low Zone includes several older wells no longer in active use, and two newer wells (Well No.'s 7 and 8).

The High Zone is located south and east of the city along Pioneer Street and Hillhurst Road. Most of the High Zone has been constructed since 1986. It consists of approximately 10,000 lineal feet of water main along Hillhurst Road and 14,500 lineal feet of water main on Pioneer Street. A 616,000-gallon standpipe located on High School property provides storage for the High Zone. Abrams Park Well No. 9 delivers water to the High Zone. In emergencies, water may also be delivered to the High Zone from the Cemetery Reservoir by two 80 gpm booster pumps.

Another historical remote system, the Junction system, was connected to the High Zone through a distribution main project in 1996. The Junction system was constructed in 1986 to serve the Port of Ridgefield industrial park located at the junction of Pioneer Street and I-5. The Junction system still utilizes a 100,000-gallon ground level reservoir and booster pump station.

1.3.8 Transmission and Distribution System

The City's water transmission system consists of 8-inch, 10-inch, and 12-inch ductile iron and PVC water mains that connect the Abrams Park Wells No.7, 8, and 9 to the Cemetery and High School Reservoirs. The City's distribution system consists of approximately 68,000 feet of water main ranging in size from 2-inch to 16-inch (including steel, PVC, and ductile iron mains). Figure 1-7 shows the City's existing water distribution system along with the pressure Zone delineation line. Table 1-6 summarizes the length and type of pipe in the City's water system.

TABLE 1-6

Approximate Length and Type of Pipe in the System
(2-inch and larger)

Pipe Size (inches)	Pipe Material and Length (Linear feet)		TOTAL
	DI	PVC	
2	-	1,200	1,200
4	3,200	-	3,200
6	4,850	900	5,750
8	15,150	-	15,150
10	3,600	14,300	17,900
12	19,400	-	19,400
14	700	-	700
16	5,000	-	5,000
Total	**51,900**	**16,400**	**68,300**

1.3.9 Telemetry and controls

The City recently upgraded their Supervisory Control and Data Acquisition (SCADA) system to include controls over several of the water system components as well as monitoring capabilities. The SCADA operating system is housed at the Wastewater Treatment Plant and is combined with the treatment plant's control program. The SCADA system displays the levels of both the High School Reservoir and the Cemetery Reservoir as well as the status of the pumps in Abrams Park and the booster pump at the Cemetery Reservoir. The system sends alarms when low or high levels occur in either of these reservoirs. The operator can remotely change the on/off settings for the well pumps at Abrams Park as well as the booster pump at the Cemetery Reservoir. The controls presently regulate well production based on storage levels in the Cemetery Reservoir and the High School Reservoir. At this time, the SCADA system does not have control or monitoring capabilities for the booster pumps and the reservoir located at the Junction Area.

1.3.10 number of service connections

In 2003, the City of Ridgefield had a total of 807 water service connections. Service connections are discussed in Chapter 2. A breakdown of service connections is shown in Table 2-2.

1.3.11 existing interties

The City's water system is intertied with Clark Public Utilities east of I-5 near the intersection of South 5th Street and South 10th Avenue. Additional interties are currently plannded for the intersection of N. 65th Avenue and 279th Street and N. 65th Avenue and 289th Street. The interties can provide an alternative source of supply during an emergency within Ridgefield's water system. The City has an interlocal agreement with CPU regarding usage of the intertie. A copy of this agreement is included in Appendix B.

1.4 Related Planning documents

The following plans and reports were used in the preparation of this document.

- *Clark County Coordinated Water System Plan*, 1999
- *Clark Public Utilities Water System Plan, 2001*
- *City of Ridgefield Comprehensive Plan, 2004*
- *City of Ridgefield Capital Facilities Plan, 2004*
- *City of Ridgefield General Sewer Plan, 1997*

1.5 existing water service area characteristics

1.5.1 land use

In 2004, the City of Ridgefield comprised of approximately 4,300 acres. Land use throughout the City is broken up into 5 major land use categories; urban residential, urban employment, urban mixed use, urban public, and urban holding. The City of Ridgefield land use categories, along with the governing Municipal Code Chapter, total acreage for each land use category, and percentage of the total acreage is listed in Table 1-7. Figure 1-8 shows the land use designations within the current city limits, the urban growth area, and the urban reserve area for the City of Ridgefield. Figure 1-9 shows the zoning designations within the current city limits, the urban growth area, and the urban reserve area for the City of Ridgefield.

1.5.1.1 Land Use Designations

The following bulleted list briefly describes each of the land use categories. For more information regarding land use categories, see Chapter 18 of the City's Municipal Code.

- Low Density Residential – 5, New development is limited to 5,000 sf per lot
- Low Density Residential – 7.5, New development is limited to 7,500 sf per lot
- Low Density Residential – 8.5, New development is limited to 8,500 sf per lot
- Medium Density Residential – 16, New development must have a minimum of eight buildings per buildable acre with a minimum of two acres developed

TABLE 1-7

Existing Land Use

Land Use Category	Governing City Code Chapter	Acreage(1)	Percent of Total Acreage
Urban Residential			
Low Density Residential - 5	18.210	90.37	2.1%
Low Density Residential - 6	18.210	39.88	0.9%
Low Density Residential - 7.5	18.210	632.77	14.8%
Low Density Residential - 8.5	18.210	1045.07	24.4%
Low Density Residential - 10	18.210	47.63	1.1%
Medium Density Residential - 16	18.220	204.13	4.8%
Urban Commercial / Industrial			
Planned Commercial	18.230	114.42	2.7%
Neighborhood Commercial	18.230	10.34	0.2%
Master Planned Business Park	18.240	853.87	20.0%
Industrial Park	18.240	858.42	20.1%
Mixed Use			
Water Front Mixed Use	18.230	55.23	1.3%
Downtown Mixed Use	18.230	22.8	0.5%
Urban Public			
Public Park / Wildlife Refuge	18.260 / 18.280	208.53	4.9%
Public Facility	18.260 / 18.280	93.05	2.2%
TOTAL		4276.51	100.0%

(1) Acreages calculated based on land use mapping.

1.6 future water service area characteristics

As noted in Chapter 2 of the Capital Facilities Plan, most of the projected growth will occur in the High Zone. The City is also expecting substantial commercial and industrial growth to occur within the planning window of six and twenty years.

1.7 service area policies and conditions of service

The City recently completed an update to its comprehensive land use plan per the requirements of the Growth Management Act. The comprehensive plan addressed a number of general water system policy issues. The City and the city engineer have reviewed these policies as part of its capital facilities planning and during the preparation of this water system plan. Current policies are summarized as follows:

1) Encourage concentric growth from either the City proper, or the Junction.

2) Be the sole provider of water service within the City's water service area.

3) Be the sole provider of water services within the UGA and the urban reserve areas. As the City expands, the UGA will likely expand into areas currently identified as served area for Clark Public Utilities. In areas where Clark Public Utilities has existing infrastructure, the City will work with CPU to provide water to customers in an efficient manner.

4) Extend water service outside the City Limits only if the customer agrees to annex and also agrees to connect to City sewer at such time as it becomes available. Although not a requirement, the City encourages water service in conjunction with sewer service.

5) Discourage satellite systems within the City's water service area.

6) Have growth pay the cost of infrastructure needed to accommodate that growth.

7) Charge water utility customers located outside of the City a 50% surcharge to encourage annexation and to account for the added cost of operating services outside of City limits.

8) Set service charges at a rate which will pay for the cost of operation and accumulate funds to pay for the cost of maintenance upgrades including replacement of undersized mains serving existing developed areas.

9) Impose water system design and construction standards upon new development that will result in the lowest long-term cost of water service to the public.

The City of Ridgefield has been a member of the Clark County Water Utility Coordinating Committee (CCWUCC). The City was involved in the development of the original Coordinated Water System Plan (CWSP) and entered into the resulting Interlocal Agreement in 1982. The City has also adopted the 1991 CWSP update which included substantial revisions to the construction standards. The City is currently involved with other members of the CCWUCC to address a wide variety of water system policies. The following specific details of the City's policies provide details for service area policies:

Wholesale Water	The City would consider a request for wholesale water sales but at present there are no connections to other systems that require it.
Wheeling of Water	The City would consider a request for wheeling of water through their distribution system but at present there are no connections to other systems besides CPU. Important considerations include monitoring and control, water quality, and water rights.
Annexation	The City presently requires either annexation or a "no contest" agreement as a

condition of service.

Direct Connection or Remote System	The City requires direct service from its water system or use of private wells. New private wells within the City limits will only be allowed if the residence is further than 500' from the closest service line. Remote systems will only be considered under extreme conditions precluding this option and remote systems must meet the City's engineering and construction standards.
Design and Performance Standards	The City has prepared a comprehensive set of engineering and construction standards for public works construction. All new water system improvements must meet these criteria. (Copy of water standards included in Appendix C - Engineering Standards.)
Surcharge for Outside Customers	Connections outside the city limits pay a 50% surcharge on monthly rates.
LID Formation outside City	The City would assist with formation of an LID outside the city limits but within its water service area.
UGA Responsibilities	The City has a strong policy of concentric growth based on its UGA planning. New developments are expected to pay for distribution extensions and pay system development charges to enable the City to construct additional source, storage, and transmission facilities.
Late-Comer Agreements	The City would allow the creation of late-comer agreements to facilitate efficient construction of water system facilities.
Oversizing Policy	The City will provide financial assistance for over-sizing of water facilities when the needs of the system exceed the development's requirements.
Cross-Connection Control Policy	The City strictly regulates potential cross-connections and requires customers to implement appropriate prevention measures. When cross-connections are identified the City will provide limited assistance to correct the problem but will ultimately terminate service if uncorrected. (See Cross Connection Control Program in Chapter 8 for additional information.)
System Extension	All extension to the City's water systems must meet City engineering standards. Where necessary to meet long-term system needs, the City will pay for over-sizing as appropriate.
Timeliness	The City defines 240 days as a timely response to a request for water service. This time frame begins with the receipt of a written request for water service and ends with the approval of plans for the service. The City has a policy of responding to plan submittals within 30 days. Since construction of system extensions is the responsibility of the developer, the City cannot guarantee when actual service can be provided.

The following conditions of service cover the responsibilities of the City and the prospective customer:

Purveyor Responsibilities	The City is responsible for providing water that meets quality and quantity standards of the state of Washington and the City's design standards. The City will attempt to minimize service interruptions during maintenance, repair, and construction activities.
Customer Responsibilities	The customer is responsible for payment of all charges incurred from their water service and to respond to the City's requests for water conservation during

	emergencies.
Connection Fees	The current system development charge is $3,950/EDU with a 50% surcharge on connections outside the city limits.
Meter and Materials Requirements	The City will provide and install all residential meters. Larger meters must be installed by a contractor. Water system materials must meet the engineering and construction standards.
Consent	The customer must consent to access by the City for inspection, maintenance, and repair of water facilities. All new facilities must be located within either the public right-of-way or within a utility easement.
Cross-Connection	The customer is responsible for selection and installation of cross-connection control devices that meet the city's standards. The customer is also responsible for annual testing where appropriate.
Late-Comers	Where a new connection will be served by connection to facilities covered by a late-comer agreement, the City will not permit service until the appropriate fee has been paid and clearly documented.
Service Connection Responsibility	Service taps on new mains will be completed by the developer following notification of the City. All service taps on existing mains will be made by the City. All connections to existing facilities require 48-hour notification.
Developer Extension Requirements	All developer extensions must meet the City's engineering and construction standards including design by a professional engineer. Financing of extensions is the developer's responsibility with the possible addition of utility oversizing by the City.
Design Standards Compliance	Exceptions to the design standards will be considered by the City in extreme situations and when a reasonable alternative is suggested.

1.8 Satellite System Management

In special cases the City may consider becoming a satellite system manager but only within its designated water service area for Group A or B water systems. The City would not own these systems but would be willing to operate and maintain. Given the City's strong policy against remote systems, desire to promote concentric growth and an efficient water utility, and the large minimum lot size for rural areas it is not anticipated that a significant demand will exist for satellite system management within the water service area.

1.9 CUSTOMER COMPLAINTS

Customer complaints are directed to the City Hall at (360) 887-3557. The customer is asked to complete a complaint form, which is submitted to the City Clerk. The Clerk then fills out a complaint log and notifies public works personnel to resolve the issue. After the issue is resolved, the complaint log is completed and filed and the customer is notified.

CHAPTER 2

BASIC PLANNING DATA

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CHAPTER 2

BASIC PLANNING DATA

2.1 Introduction

Basic planning data essential for the assessment of the City of Ridgefield water production and consumption requirements are presented in this chapter. Information is included regarding historical growth and water production, equivalent residential units, population projections, and water production requirement projections. Information presented is used to evaluate the condition of the existing system and determine future needs based on foreseeable demographic trends for the next twenty years.

2.2 EXISTING POPULATION, SERVICES, AND WATER PRODUCTION

2.2.1 Population History

2.2.1.1 Population Estimates

Population history for the City of Ridgefield was obtained from the Washington State Office of Financial Management (OFM). The historical population data is summarized in Table 2-1.

TABLE 2-1

City of Ridgefield Population History

	1997	1998	1999	2000	2001	2002	2003	2004
Total Population	1,732	1,808	2,132	2,147	2,175	2,145	2,185	2,195

2.2.1.2 Service Connections

The City of Ridgefield began tracking water consumption by customer class in 2003. As shown in Table 2-2, the City of Ridgefield served a total of 807 service connections, including 628 residential, and 179 non-residential connections in 2003.

TABLE 2-2

City of Ridgefield Service Connections for the Year 2003

Description	2003 Connections
Total Number of Service Connections	807
High Reservoir Meters	264
Low Reservoir Meters	543
Single Family	489
Part Time Single Family	1
Apartment, Condo, Duplexes	103
Full Time Apartment Units	35
Total Residential Connections	**628**
Recreation	20
Commercial Industrial, Institutional	159
Total Non-Residential Connections	**179**

2.2.2 Water Production History

The City of Ridgefield tabulates monthly water production records. Water production records from January 1999 through December 2004 have been reviewed. Table 2-3 shows metered water production for the six year period, 1999-2004.

TABLE 2-3

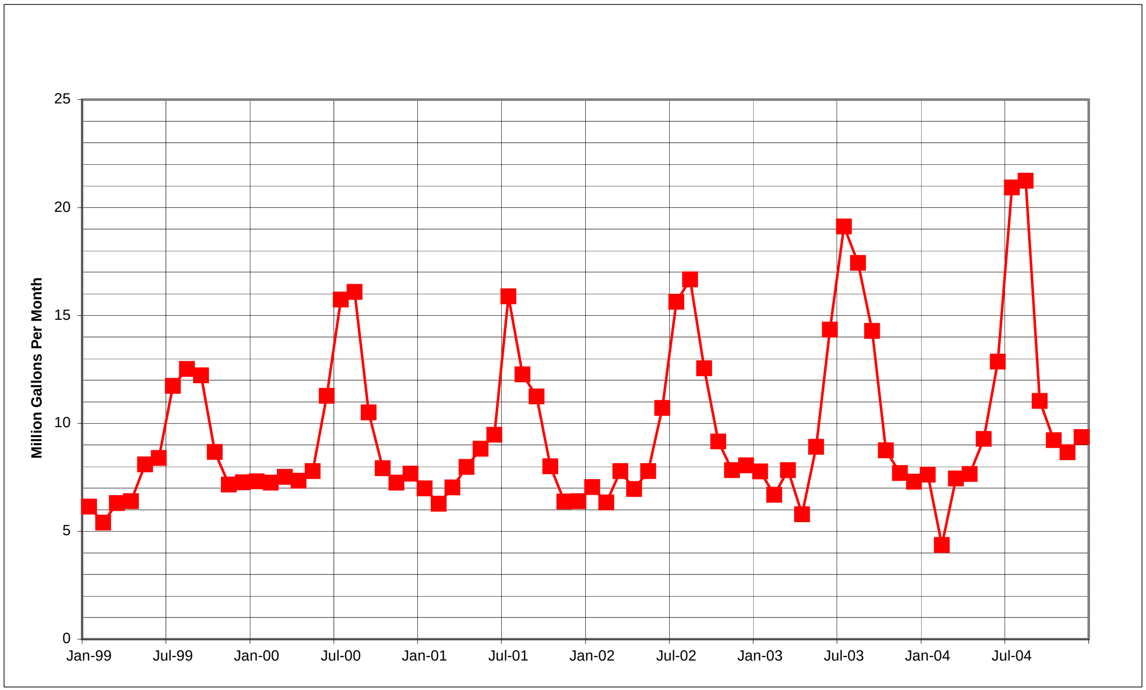
Metered Water Production

Year	Volume (Million Gallons)			
	No. 7	No. 8	No. 9	Total
1999	47.0	4.1	49.1	100.3
2000	6.0	58.6	49.1	113.7
2001	40.7	25.9	40.2	106.7
2002	35.3	34.2	47.0	116.5
2003	40.1	33.1	52.7	125.9
2004	32.3	42.6	54.9	129.7

As can be seen from Table 2-3 the total water production has increased by about eight million gallons annually for the past 4 years. Net monthly water production history is shown graphically in Figure 2-1.

FIGURE 2-1

Total Monthly Water Production History



2.2.2.1 Per Capita Water Production

Historical connection data for the City of Ridgefield is unavailable. Water production per capita and per connection for 2003 for the City of Ridgefield is estimated in Table 2-4. Because water production includes water use by all users, as well as unaccounted-for water, the water use per capita based on permanent population includes water use by seasonal and transient users of the system, as well as other water uses such as construction water, park watering, line flushing and fire fighting.

TABLE 2-4

Water Production Per Capita

Year	Average Daily Production, gpd (1)	Service Area Population (2)	Estimated Connected Population (3)	Per Capita Production, gpcd (4)	Estimated Service Area Connections (5)	Estimated Production Per Connection, gpd/con (6)
2003	344,890	2,185	1,690	204	807	427

(1) Average Daily Production is the Total value from Table 2-3 times one million gallons and divided by 365 days per year .
(2) Service Area Population is from Table 2-1.
(3) Connected population is estimated to be the total number of residential connections in 2003 (628) multiplied by 2.69 people per connection.
(4) Per Capita Production is Average Daily Production divided by the Estimated Connected Population.
(5) Estimated Service Area Connections is the 2003 total connections from Table 2-2.
(6) Estimated Per Connection Production is Average Daily Production divided by Estimated Service Area Connections.

2.2.2.2 Maximum Day Production

Maximum daily water production records for 1999 - 2004 are summarized in Table 2-5.

TABLE 2-5

Maximum Day to Average Day Ratio Average

Year	Maximum Day Date	Maximum Daily Production, gpd (1)	Average Daily Production, gpd (2)	Peaking Factor (3)
1999	Sept. 19	591,000	274,863	2.15
2000	August 21	815,000	310,604	2.62
2001	July 17	759,000	292,442	2.60
2002	July 24	703,000	319,182	2.20
2003	July 27	821,000	344,890	2.38
2004	August 12	999,000	354,399	2.82
			Six Year Average	2.46
			Average Last Three Years	2.47

(1) Maximum Daily Production was used from City production data.
(2) Average Daily Production is the Total value from Table 2-3 times one million gallons and divided by 365 days per year (366 days for leap years).
(3) Peaking Factor is calculated by dividing the Maximum Daily Production by the Average Daily Production.

2.2.3 Water Consumption

Billing records for the City of Ridgefield have been tabulated for 2003 in Table 2-6. Residential water use averaged 232 gpd per connection, and the overall average water use was 293 gpd per connection in 2003. 61% of water use was residential and 39% of water use was non-residential.

TABLE 2-6

2003 Average Day Consumption by Customer Class

Customer Class	2003 Water Sales, Gallons	Number of Connections	Average Water Sales, gpd (1)	Average Daily Water Sales, gpd/Con (2)	2003 ERU Total
Residential	53,118,255	628	145,529	232	628
Commercial / Institutional	33,286,688	179	91,196	509	394
Total	86,404,943	807	236,726	293	1022

(1) Average Water Sales is the 2003 Water Sales divided by 365 days per year.
(2) Average Daily Water Sales is the value for Average Water Sales divided by the number of connections..

Detailed breakdowns of water consumption by customer class in other years are not readily available.

2.2.3.1 Equivalent Residential Units

Use of Equivalent Residential Units (ERUs) is a way to express water use by multi-family and non-residential customers as an equivalent number of residential customers. One ERU is defined as the average day water consumption by a single-family residence. When metered data is available, the average day use for all single-family residential units is divided by the number of housing units to obtain an ERU. Average water use per residence in 2003 is shown in Table 2-6 as 232 gpd per residential connection. **An annual average consumption of 232 gpd will be used to represent one ERU.**

2.2.3.1 Lost and Unaccounted for Water

Lost and unaccounted for water (L/UW) is defined as the difference between metered source production and metered consumption. "Lost" water includes any water loss due to leaks or unauthorized uses such as illegal service connections. "Unaccounted-for water" results from accounting errors, inaccurate source and customer meters, and water leaving the system for unmetered usage such as flushing of mains, fire flows, and use by unmetered services.

Table 2-7 indicates the L/UW for 1999 through 2003 steadily increased from 18% to 31%, then dropped to 20.1% in 2004. The reduction in 2004 was primarily due to better accounting of construction water and hydrant usage. DOH recommends that L/UW should be maintained below 10%. If L/UW is above 20% DOH requires that the Water System Plan identify actions be taken to reduce it. Recommended actions include leak detection and repair, replacement of service meters, and improved accounting of unmetered water use.

As reflected in Table 2-7, the City's L/UW is higher than recommended by DOH. A reduction to achieve a L/UW value of 10% overall by 2009 should be attainable.

The City is continuing to search for and repair water main leaks as they appear and to upgrade water mains in problem areas. It is estimated that the bulk of the remainder of the lost and unaccounted for water is due to under-reading service meters, fire hydrant use, illegal connections, construction use, and errors and omissions in estimating unmetered water usage.

TABLE 2-7

Estimated Lost and Unaccounted for Water

	1999	2000	2001	2002	2003	2004
Production, MG	100.30	113.70	106.74	116.50	125.89	129.71
Consumption, MG (1)	81.50	89.25	82.85	87.50	87.16	103.62 (2)
Lost and Unaccounted For Percentage	18.3%	21.6%	22.4%	24.9%	30.8%	20.1%

(1) Consumption includes an estimated 760,000 gallons annually for Abrams Park irrigation and potable water use for picnic facilities.
(2) 2004 consumption includes an additional 3.66 million gallons which were used for construction water and fire district training exercises.

2.3 FUTURE POPULATION AND WATER REQUIREMENTS

2.3.1 Projected population growth

Population history is discussed in previous sections and shown in Table 2-1. Population has been estimated in both the Capital Facilities Plan and the Comprehensive Land-use Plan. These documents were used in projecting future population growth as shown in Table 2-8.

2.3.2 Water Consumption Projections

Tables 2-8 through 2-10 display the estimated water consumption for the City of Ridgefield through 2024. The six and twenty year values are shown in bold.

2.3.2.1 Residential Water Projections

The residential projected water consumption is shown in Table 2-8. The projected UGA population was taken from the Capital Facilities Plan (2004), and linearly interpolated between the given population values for 2008, 2013, 2018, and 2023. Currently, not all residents within the UGA are connected to the City water system. It is estimated that in 2003, 1,690 residents were connected to the water system based on knowing the City had 628 connections and using assumptions from the 2005 Comprehensive Plan of 2.69 people per connection. Due to the pace of growth that is occurring in the City, it was assumed that the all residents within the City limits would be connected to the City's water system by 2010. The average day consumption was calculated by dividing the projected service area population by the number of people per connection, which is 2.69, then multiplied by the consumption per connection value of 232 gpd/connection. The projected total ERU's is the average day consumption divided by the consumption per connection value of 232 gpd/connection.

TABLE 2-8

Residential Projected Water Consumption

Year	Projected UGA Population (1)	Projected Connected Population (2)	Average Day Consumption, gpd (3)	Projected Total ERU's (4)
2005	2,495	2,094	180,600	778
2006	2,795	2,498	215,400	928
2007	3,095	2,902	250,300	1,079
2008	3,395	3,306	285,100	1,229
2009	3,755	3,710	320,000	1,379
2010	**4,115**	**4,115**	**354,900**	**1,530**
2011	4,475	4,475	385,900	1,663
2012	4,835	4,835	417,000	1,797
2013	5,195	5,195	448,000	1,931
2014	5,755	5,755	496,300	2,139
2015	6,315	6,315	544,600	2,347
2016	6,875	6,875	592,900	2,556
2017	7,435	7,435	641,200	2,764
2018	7,995	7,995	689,500	2,972
2019	8,795	8,795	758,500	3,269
2020	9,595	9,595	827,500	3,567
2021	10,395	10,395	896,500	3,864
2022	11,195	11,195	965,500	4,162
2023	11,995	11,995	1,034,500	4,459
2024	**12,000**	**12,000**	**1,034,900**	**4,461**

(1) Projected UGA Population was taken from the City's 2004 Capital Facilities Plan.
(2) It is estimated that all residents within the City's UGA will be connected to City water by 2010.
(3) Average Day Consumption is the Projected Service Area Population divided by 2.69 (people per connection) then multiplied by 232 (Consumption per Connection, gpd/connection), rounded to the nearest hundred.
(4) Projected Total ERU's is the Average Day Consumption divided by 232 (Consumption per Connection, gpd/connection).

2.3.2.2 Commercial/Industrial Water Projections

The projected commercial/industrial water consumption is shown in Table 2-9. The new non-residential acreage was taken from the Capital Facilities Plan (2004), and linearly interpolated between the given acreage values for 2008, 2013, 2018, and 2023. The average day consumption is the 2004 non-residential consumption (133,100 gpd) plus the product of the new non-residential acreage multiplied by 1,000 gpd/acre. The projected total ERU's is the average day consumption divided by the consumption per connection value of 232 gpd/ERU.

TABLE 2-9

Industrial / Commercial / Institutional Projected Water Consumption

Year	New Non- Residential Acreage (1)	Average Day Consumption, gpd (2)	Projected Total ERU's (3)
2005	38	171,100	738
2006	76	209,100	901
2007	114	247,100	1,065
2008	151	284,100	1,225
2009	215	348,100	1,500
2010	**279**	**412,100**	**1,776**
2011	343	476,100	2,052
2012	407	540,100	2,328
2013	471	604,100	2,604
2014	516	649,100	2,798
2015	561	694,100	2,992
2016	606	739,100	3,186
2017	651	784,100	3,380
2018	696	829,100	3,574
2019	794	927,100	3,996
2020	892	1,025,100	4,419
2021	990	1,123,100	4,841
2022	1,088	1,221,100	5,263
2023	1,186	1,319,100	5,686
2024	**1,186**	**1,319,100**	**5,686**

(1) New Non-Residential Acreage was taken from the City's Capital Facilities Plan.
(2) Average Day Consumption is the 2004 non-residential consumption plus the product of the New Non-Residential Acreage multiplied by 1000 gpd/acre, rounded to the nearest hundred.
(3) Projected Total ERU's is the Average Day Consumption divided by 232 (Consumption per Connection, gpd/connection).

2.3.2.3 Combined Residential and Commercial/Industrial Water Projections

The total projected water production requirements are shown in Table 2-10. The total average day consumption is the sum of the average day consumption from Table's 2-8 and 2-9. The total average day production, including lost and unaccounted for water, was calculated by multiplying the total average day consumption by one plus the lost and unaccounted for water percentage. The maximum day consumption is the total average day production multiplied by the peaking factor of 2.47 from Table 2-5. The projected total ERU's was calculated by dividing the total production by the ADD of 232 gpd/ERU. Peak hour demand was calculated based on Equation 5-3 from the DOH Water System Design Manual, using the average day demand per ERU of 232 gpd multiplied by the peaking factor of 2.47 for "MDD" and the projected total number of ERUs for "N".

TABLE 2-10

Projected Water Production Requirements

Year	Total Average Day Consumption, gpd (1)	Total Average Day Production Including L/UW, gpd (2)	Maximum Day Production, gpd (3)	Projected Total ERU's (4)	Peak Hour Demand, gpm (5)
2005	351,700	416,500	1,028,800	1,795	1,250
2006	424,500	495,500	1,223,900	2,136	1,470
2007	497,400	572,300	1,413,600	2,467	1,680
2008	569,200	645,300	1,593,900	2,781	1,880
2009	668,100	734,900	1,815,200	3,168	2,120
2010	**767,000**	**843,700**	**2,083,900**	**3,637**	**2,420**
2011	862,000	948,200	2,342,100	4,087	2,710
2012	957,100	1,052,800	2,600,400	4,538	3,000
2013	1,052,100	1,157,300	2,858,500	4,988	3,280
2014	1,145,400	1,259,900	3,112,000	5,431	3,570
2015	1,238,700	1,362,600	3,365,600	5,873	3,850
2016	1,332,000	1,465,200	3,619,000	6,316	4,130
2017	1,425,300	1,567,800	3,872,500	6,758	4,410
2018	1,518,600	1,670,500	4,126,100	7,200	4,690
2019	1,685,600	1,854,200	4,579,900	7,992	5,200
2020	1,852,600	2,037,900	5,033,600	8,784	5,700
2021	2,019,600	2,221,600	5,487,400	9,576	6,200
2022	2,186,600	2,405,300	5,941,100	10,368	6,710
2023	2,353,600	2,589,000	6,394,800	11,159	7,210
2024	**2,354,000**	**2,589,400**	**6,395,800**	**11,161**	**7,210**

(1) Total Average Day Consumption is the Residential Average Day Consumption (from Table 2-8) added to the Commercial / Industrial Average Day Consumption (from Table 2-9).

(2) Total Average Day Production Including L/UW is the Total Average Day Consumption multiplied by one plus the lost and unaccounted for water percentage. In 2004 L/UW was equal to 20.1%. A goal of 10% L/UW is expected to be achieved by 2009. These values were linearized to achieve a linear L/UW rate.

(3) Maximum Day Consumption is the Total Average Day Production Including L/UW multiplied by the peaking factor of 2.47 from Table 2-5.

(4) Projected Total ERU's is the Total Average Day Production divided by 232 gpd/ERU.

(5) Peak Hour Demand is calculated based on Equation 5-3 from the Washington State Department of Health Water System Design Manual, using the average day production per ERU of 232 gpd times the peaking factor of 2.47 for "MDD" and the Projected Total Number of ERUs for "N".

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Chapter 3 – Water System Analysis

CHAPTER 3

WATER SYSTEM ANALYSIS

3.1 objective

Water system planning includes a careful analysis of a water utility's ability to meet minimum level of service standards for existing and future customers. In this chapter, design standards are presented which identify criteria that are applicable to the City of Ridgefield water system. A water quality and facility analysis then compares existing water quality and system facilities to these design standards. Based on this comparison, water system deficiencies are identified and recommendations to improve compliance with the required standards are developed.

3.2 System design Standards

3.2.1 DESIGN STANDARDS

Performance and design criteria typically address the sizing and reliability requirements for source, storage, distribution, and fire flow. WAC 246-290 contains general criteria and standards that must be followed in development of public water systems in Washington State. In addition, the Washington State Department of Health (DOH) 2001 Water System Design Manual provides more specific guidance for water system design.

3.2.2 General Facility Standards

The Water System Planning Handbook, published by DOH, provides a list of specific design standards to be discussed in the Water System Plan, which can be seen be seen below.

- Average and Maximum Day Demand
- Peak Hour Demand
- Source Capacity
- Storage Requirements
- Minimum System Pressure
- Fire Flow Rate and Duration
- Minimum Pipe Size
- Reliability Recommendations
- Valve and Hydrant Spacing
- Water Quality Standards

DOH also relies on various publications, agencies and the utility itself to establish design criteria. The following gives a brief description of three of the most widely recognized performance and design standards.

- **WAC 246-290, Group A Public Water Systems, Washington State Department of Health (July 2004).**
  This is the primary drinking water regulation utilized by DOH to assess capacity, water quality, and overall compliance with drinking water standards.

- **Water System Design Manual (WSDM), Washington State Department of Health (August 2001).**
  Significant revisions to the former DOH Sizing Guidelines have recently been adopted. These standards will serve as guidance for the preparation of plans and specifications for Group A public water systems in compliance with WAC 246-290.

- **Recommended Standards for Water Works (RSWW), A Committee Report of the Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers (1997).**
  Commonly known as the Ten States Standards, this document formalizes the design standards recommended by a water supply committee representing ten Midwestern and upper Great Lake States and the Province of Ontario. The report of the Water Supply Committee was first published in 1953, and subsequently revised and published in 1962, 1968, 1976, 1982, 1992, and 1997. The report presents recommendations for both design and construction standards; however, the construction standards are somewhat general in nature with minor emphasis on materials specifications. Since surface water treatment is quite common in the Midwest and Upper Great Lakes, the Committee report tends to concentrate on water treatment plant design and operation.

Table 3-1 lists the suggested DOH Water System Design Manual guidance and the City of Ridgefield's policies with regard to each standard.

TABLE 3-1

General Facility Requirements

Standard	DOH *Water System Design Manual* (August 2001)	City of Ridgefield Standard
Average Day and Maximum Day Demand	Average Day Demand (ADD) should be determined from metered water use data. Maximum Day Demand (MDD) is estimated at approximately 2.0 times the average day demand if metered data is not available.	ADD and MDD are based on metered water use data. ADD = 232 gpd/ERU MDD = ADD times the peaking factor of 2.47 = 573 gpd/ERU
Peak Hour Demand	Peak hour demand is determined using the following equation: PHD = (MDD/1440)[(C)(N) + F] + 18 C = Coefficient from DOH Table 5-1 N = Number of connections, ERUs F = Factor of range from Table 5-1	Same as DOH *Water System Design Manual*.
Source Capacity	Capacity must be sufficient to meet MDD and replenish fire suppression storage in 72 hours. (Chapter 7)	Same as DOH *Water System Design Manual*.
Storage Capacity	The sum of: <u>Operational Storage</u> Volume sufficient to prevent pump recycling. <u>Equalizing Storage</u> $V_{ES} = (Q_{PH} – Q_S) * 150$ <u>Standby Storage</u> $V_{SB} = (2 * ADD * N) – t_m * (Q_S – Q_L)$ <u>Fire Suppression Storage</u> V_{FSS} = NFF * T ADD = average day demand, gpd/ERU N = number of ERU's Q_{PH} = peak hour demand, gpm Q_S = capacity of all sources, excluding emergency sources, gpm Q_L = capacity of largest source, gpm t_m = daily pump source run time, min (1440) NFF = needed fire flow, gpm T = fire flow duration, min (Chapter 9)	Same as DOH *Water System Design Manual*.
Minimum System Pressure	The system should be designed to maintain a minimum of 30 psi in the distribution system under peak hour demand and 20 psi under fire flow conditions during MDD. (Chapter 8)	Same as DOH *Water System Design Manual*.
Fire Flow Standards	The minimum fire flow shall be determined by the local fire authority or WAC 246-293 for systems within a Critical Water Supply Service Area (CWSSA), whichever is greater.	The City's fire flow requirements are based on City Ordinances and the Clark County Coordinated Water System Plan. See Table 3-17 of this Plan. Residential: 1,000 gpm/120 min. Commercial: 1,500 gpm/120 min. Industrial: 2,000 gpm/120 min.

TABLE 3-1—(CONTINUED)

General Facility Requirements

Standard	DOH *Water System Design Manual* (August 2001)	City of Ridgefield Standard
Minimum Pipe Sizes	The diameter of a transmission line shall be determined by hydraulic analysis. The minimum size distribution system line shall not be less than 6-inches in diameter. (Chapter 8)	Same as DOH *Water System Design Manual*.
Reliability Recommen-dations	• Sources capable of supplying MDD within an 18-hour period • Sources meet ADD with largest source out of service • Back-up power equipment for pump stations unless there are two independent public power sources • Provision of multiple storage tanks • Standby storage equivalent to ADD x 2, with a minimum of 200 gpd/ERU • Low and high level storage alarms • Looping of distribution mains when feasible • Pipeline velocities not greater than 8 fps at PHD • Flushing velocities of 2.5 fps for all pipelines (Chapter 5)	Same as DOH *Water System* *Design Manual*.
Valve and Hydrant Spacing	Sufficient valving should be placed to keep a minimum of customers out of service when water is turned off for maintenance or repair. Fire hydrants on lateral should be provided with their own auxiliary gate valve.	Valve and hydrant standards are outlined in the City's Engineering Standards V1 – Ch. 5, which is included in Appendix C.
Water Quality Standards	WAC 246-290 The primary drinking water regulation utilized by DOH to assess capacity, water quality, and overall compliance with drinking water standards.	Same as DOH *Water System Design Manual*.

3.2.3 water quality standards

Group A public community water systems must comply with the drinking water standards of the federal Safe Drinking Water Act and its amendments. DOH adopted the updated federal standards under WAC 246-290, which was last revised July 3, 2004. A summary of the water quality standards is included in Appendix D.

Table 3-2 lists existing drinking water regulations and Table 3-3 lists the anticipated future drinking water regulations. Each table also indicates whether or not the regulation is applicable to the City of Ridgefield. Existing state law contains regulations concerning bacteriological contaminants, disinfection by-products (DBPs), inorganic chemicals and inorganic physical parameters (IOCs), volatile organic chemicals (VOCs), synthetic organic chemicals (SOCs), and radionuclides.

TABLE 3-2

Existing Drinking Water Regulations(1)

Rule	Contaminants Affected(2)	Applicable to the City of Ridgefield?
Coliform Monitoring	Coliform	Yes
Inorganic Chemicals, and Physical Parameter	IOCs	Yes
Volatile and Synthetic Organic Compounds	VOCs, SOCs	Yes
Surface Water Treatment Rule (SWTR)	Microbial Contaminants	No
Interim Enhanced Surface Water Treatment Rule	Bacteriological	No
Long Term 1 Enhanced Surface Water Treatment Rule	Bacteriological	No
Information Collection Rule	Bacteriological	No
Filter Backwash Recycling Rule	Bacteriological	No
Consumer Confidence Report	Reporting Only	Yes
Radionuclides Rule	Radionuclides	Yes
Lead and Copper Rule	Lead, Copper	Yes
Residual Disinfectant	Total Free Chlorine	Yes
Stage 1 Disinfectants/Disinfection By-Products Rule (DBPR)	TTHMs, HAA5, Chlorite, Bromate	Yes
Arsenic Rule(3)	Arsenic	Yes
Unregulated Contaminant Monitoring Rule	Acanthamoeba, Aldrin, Dieldrin, Hexachlorobutadiene, Manganese, Metribuzin, Napathalene, Sodium and Sulfate	No
Revised Public Notification Rule	Changes timing and protocol for public notification	Yes

(6) Drinking water regulations as of January 2005.
(7) TTHM = Total Trihalomethanes; HAA5 = Five Haloacetic Acids; IOCs = Inorganic Chemical and Physical Characteristics; VOCs = Volatile Organic Chemicals; SOCs = Synthetic Organic Compounds
(8) Rule became effective February 2002. Compliance is required by January 2006.

TABLE 3-3

Anticipated Future Drinking Water Regulations[1]

Rule	Contaminants Affected	Anticipated Final Rule	Applicable to the City of Ridgefield?
Groundwater Rule	Bacteriological	2005	Yes
Radon	Radon	2005	Yes
Stage 2 Disinfectants/Disinfection By-Products Rule (DBPR)	Additional public health protection from DBP and microbial pathogens	2005	Yes
Long Term 2 Enhanced Surface Water Treatment Rule	Bacteriological	2005	No

(9) Anticipated drinking water regulations as of January 2005 are discussed in Section 3.5, Future Water Quality Monitoring Requirements.

3.3 water quality monitoring schedule

Water quality monitoring is required for regulatory compliance and to monitor water system conditions. DOH prepares a Water Quality Monitoring Report each year that is distributed to each water purveyor. This report defines a monitoring schedule and provides sample locations. Table 3-4 summarizes the City's water quality monitoring requirements. A copy of the most recent City of Ridgefield Water Quality Monitoring Report is included in Appendix E.

TABLE 3-4

City of Ridgefield Water Quality Monitoring Requirements

Parameter	Sample Location	Frequency(1)	Notes
Routine Coliform	Distribution System	3 samples per month required 4 samples per month taken	See Coliform Monitoring Plan in Appendix F.
Residual Disinfectant	Distribution System	One sample for both the High and Low zone taken daily.	–
Disinfection By-products	Distribution System	1 sample/plant/year	Monitoring Plan in Appendix F.
Lead and Copper	Distribution System	As directed by DOH. Last test completed in December 2001.	–
IOCs	Source	State waiver through 2008.	(2) (3)
Nitrates	Source	1 sample annually	(2)
VOCs	Source	State waiver through 2005.	(3) (4)
SOCs	Source	State waiver through 2006.	(3)
Radionuclides	Source	Two samples every ten months. Last test completed in December 2004.	–

(10) Frequency determined by 2004 WQMR
(11) Nitrate analysis is included as part of inorganic chemical analysis. This test should not be duplicated in years when inorganic chemicals are tested.
(12) Waivers granted for Wells No. 7, 8, and 9.
(13) VOC analysis is on file with DOH for Wells No. 8 and 9. A VOC analysis for Well No. 7 needs to be completed and submitted to DOH for Abrams Park to retain the Low/Low susceptibility and vulnerability ratings.

Under the 1986 amendments to the Safe Water Drinking Act (SDWA), DOH developed a source specific monitoring reduction waiver process to evaluate whether or not any given drinking water source had to monitor for a variety of chemicals (volatile organic chemicals, pesticides, synthetic organic chemicals). The method uses information on well age, construction, depth, past water quality history, degree of confinedness, etc to provide an assessment of the source water's "physical susceptibility to contamination". This assessment (high/ medium/ low) combined with potential contaminant source inventory data enables DOH to assign a Susceptibility Rating for groups of contaminants including Volatile Organic Compounds (VOCs), Synthetic Organic Compounds (SOCs-primarily pesticides) and microbial contamination.

DOH's process for determining susceptibility ratings for individual sources of supply is initiated by the purveyor completing a Susceptibility Assessment Survey Packet for each of its sources. The Susceptibility Assessment (SA) is required of all Group A water systems having ground water or spring sources, as part of the Wellhead Protection Program. Each source must also have nitrate data and completed a minimum of one VOC analysis. Upon DOH determination of source susceptibility and evaluation of nitrate and VOC data, additional parameter-specific criteria are applied by DOH to determine the source's specific contaminant group (microbial, VOC, SOC) Susceptibility Rating. The system is notified in writing and provided this information.

Overall, the state Susceptibility Rating is based on assessment of source vulnerability to contamination (hydrogeologic susceptibility) and in the absence of direct/precise measurements of contaminant use and exposure, evaluates surrogate indicators such as the physical setting of the source and surrounding land use. Hydrogeologic susceptibility, the first component, is an evaluation of the physical potential for a source to be contaminated by the movement of chemicals from the land surface into a water supply. The second component involves an assessment of the risk of source exposure to contaminants and is determined by whether contaminants were used in the area of the water supply. This component can be difficult to assess, because inventorying all chemicals that have ever been used in an area is very difficult. In addition, once contaminants have entered the environment they can behave very differently from each other causing difficulty in predicting ground water pollution from surface exposure. The contaminant use assessment is also subject to change over time as surrounding land use changes. For these reasons, DOH regulations require water systems to update their Potential Contaminant Source Inventory every two years.

Susceptibility ratings are based on an evaluation of the Susceptibility Assessment, historical water quality information (as obtained by the system or the state), and other parameters to determine source vulnerability. A source can be determined to have low, moderate, or high vulnerability to contamination (Susceptibility).

The susceptibility and vulnerability ratings for each of the active City sources are summarized in Table 3-5.

TABLE 3-5

City of Ridgefield Source Susceptibility and Vulnerability Ratings

Source	DOH Source Number	Susceptibility(1)	Vulnerability(1)
Well No. 7	S11	Low	Low
Well No. 8	S08	Low	Low
Well No. 9	S09	Low	Low

(1) The susceptibility and vulnerability ratings for the well field are low. Currently DOH does not have VOC test results on file for Well No. 7. VOC test results for Well No. 7 are needed to maintain the Low/Low susceptibility and vulnerability ratings.

3.4 water quality analysis

This section evaluates the City of Ridgefield's efforts to comply with the required water quality regulations and testing requirements. Water quality monitoring data was reviewed through 2004.

3.4.1 Bacteriological

The City of Ridgefield takes coliform samples twice a month in accordance with their coliform monitoring plan, which is included in Appendix F. Table 3-6 summarizes the coliform sampling locations and the frequency of sample collection. The schedule results in the collection of a total of 4 coliform samples throughout the distribution system each month. In the event of an unsatisfactory sample is identified, three repeat samples are taken. The three repeat samples are taken at the following locations: the same tap as the unsatisfactory sample, an active service connection within five connections upstream of the unsatisfactory sample, an active service connection within five connections downstream of the unsatisfactory sample. It is important to note that as population increases, the monthly routine samples will also increase. Table 3-7 provides the number of monthly routine samples based on the population served during the month as required by DOH. Refer to the table in WAC 246-290-300 when the water system is larger than shown in Table 3-7.

The City has not had any positive coliform tests results at the source of supply or in the distribution system according to DOH.

TABLE 3-6

City of Ridgefield Coliform Monitoring Schedule

Week	Pressure Zone	Description	Sample Site
Week 1 Odd Months	Low	Routine Sample Site	109 West Division
	High	Routine Sample Site	2630 South Hillhurst Road (High School RP.)
Week 3 Odd Months	Low	Routine Sample Site	S. 11th Ct. (Pump hose bib)
	High	Routine Sample Site	1651 Pioneer St. (Lift Sta. Hose bib)
Week 1 Even Months	Low	Routine Sample Site	230 Pioneer St.
	High	Routine Sample Site	600 B S. 56th Pl. (Pacific Detroit Diesel)
Week 3 Even Months	Low	Routine Sample Site	1205 N. 1st Ave. Meter Box
	High	Routine Sample Site	6370 Pioneer Ave. (Country Café west hose bib)

TABLE 3-7

Monthly Sampling Requirements based on Population Served

Population Served During the Month(1)	**Monthly Routine Samples**	**Number of Routine Samples** If coliform presence found in previous month
1,001 - 2,500	2	5
2,501 - 3,300	3	5
2,301 - 4,100	4	5
4,101 - 4,900	5	5
4,901 - 5,800	6	6
5,801 - 6,700	7	7
6,701 - 7,600	8	8
7,601 - 8,500	9	9

(14) Refer to WAC 246-290-300 when the water system population served is larger than 8,500.

3.4.2 Residual Disinfectant

The City of Ridgefield monitors chlorine residual daily at the well pumphouse, the high school, and at most of the coliform sample sites. The most current chlorine residual results are included in Appendix G. Detectable chlorine residual must be present at all points throughout the distribution system. The City has not had any problems meeting this requirement over the last 5 years.

3.4.3 STAGE 1 DISINFECTANTS AND DISINFECTION BYPRODUCTS (D/DBP) rule

The Stage 1 D/DBP Rule became effective in February 1999. This rule is aimed at water systems that introduce a disinfectant during any part of the treatment process. Surface water systems are also required to have a reduction in total organic carbon (TOC) found in the source water. Since all of the City's sources are classified as groundwater sources, TOC removal requirements do not apply.

Groundwater systems serving less than 10,000 people are required to collect one sample per treatment plant per year for total trihalomethanes (TTHMs) and five haloacetic acids (HAA5). Required sampling began in 2004. A copy of the sampling plan is included in Appendix H, along with the 2004 results.

The City of Ridgefield took TTHM and HAA5 samples in July 2004 as required. The City took two samples, one in the Low Zone and one in the High Zone. TTHMs and HAA5 were not detected in the Low Zone samples. The High Zone samples indicated a TTHM level of 0.8 micrograms per liter (μg/L) and no HAA5s were detected. Sampling results are included in Appendix J. The TTHMs detected are well below the regulatory limit of 80 μg/L TTHMs. Reduced monitoring requirements can be obtained for TTHMs and HAA5s if the results are below 40 μg/L and 30 μg/L, respectively.

3.4.4 Consumer Confidence Report

This rule was finalized on August 19, 1998. The Consumer Confidence Report Rule requires community water system purveyors to prepare and distribute an annual report of water quality analyses to their customers before the 1st of July each year. The City of Ridgefield has prepared and distributed a Consumer Confidence Report each year since 1999. A copy of the City's most current Consumer Confidence Report is included in Appendix I.

3.4.5 Lead and Copper

Based on the requirements of the EPA Lead and Copper Rule (40 CFR 141), lead and copper monitoring must be completed for two consecutive six-month monitoring periods. If lead and copper action levels are not exceeded, then the number of samples may be reduced to one-half the original number for three consecutive annual periods. Assuming compliance with the action level is maintained, reduced sampling may continue once every three years thereafter.

Ninety percent (90%) of the distribution system lead samples collected according to the procedures outlined in WAC 246-290 must have concentrations below the "Action Level" of 0.015 milligrams per liter (mg/L). Similarly, 90% of the copper samples must have concentrations less than 1.3 mg/L. Systems exceeding the action levels are required to provide public notification and implement a program for reducing lead and copper levels.

Lead and copper sampling conducted by the City in 2001 indicated 90th percentile levels for copper equal to 0.745 mg/L and lead was not detected. Lead and copper testing results for the City for 2001 are summarized in Table 3-8. As shown, none of the samples exceeded the action level for lead or copper. Copies of the complete lead and copper testing results are included in Appendix J.

TABLE 3-8

Lead and Copper Sampling Results

Lead	**2001**
Action Level, mg/L	0.0150
State Reporting Level, mg/L	0.0020
90th Percentile Concentration, mg/L	Not Detected
Number of Samples Taken / Exceeding the Action Level	10 / 0
Copper	**2001**
Action Level, mg/L	1.3
State Reporting Level, mg/L	0.2
90th Percentile Concentration, mg/L	0.745
Number of Samples Taken / Exceeding the Action Level	10 / 0

3.4.6 Inorganic Chemicals and Physical Characteristics

This category includes several inorganic elements and compounds. Many of the inorganic chemicals include elemental metals such as mercury, arsenic, and iron. Some non-metallic constituents such as chloride, fluoride, and sulfate are also included. Physical properties that affect water quality in this category include turbidity, specific conductivity, total dissolved solids, and color.

WAC 246-290 specifies primary and secondary maximum contaminant levels (MCLs) for inorganic physical and chemical characteristics. Primary MCLs are based on health effects, and secondary MCLs are based on factors other than health effects, such as taste, odor, color, etc. The primary and secondary MCLs for inorganic chemical and physical characteristics are included in Appendix D.

Groundwater sources must be sampled for inorganics once every three years unless a waiver is in place. Sampling requirements for the City of Ridgefield are summarized in Table 3-4. As indicated in Table 3-4, the City has been granted a waiver for inorganics through 2008. Testing for inorganic chemicals (IOCs) and physical characteristics was last completed by the City of Ridgefield in November 1999 in accordance with DOH requirements. Table 3-9 shows the results from the 1999 IOC testing for Source Number S07, Abrams Park wellfield, which includes all three currently operating City wells. Complete IOC and physical characteristic testing results are included in Appendix J. As shown in Table 3-9, no parameters exceeded the MCL.

TABLE 3-9

Inorganic Chemicals and Physical Characteristics
November 1999

Parameter	Units	State Reporting Level (SRL)	Maximum Contaminant Level (MCL)	1999 Results(1)
Primary MCL's				
Antimony	mg/L	0.005	0.006	ND
Arsenic	mg/L	0.002	0.01	0.0013
Barium	mg/L	0.1	2	0.0009
Beryllium	mg/L	0.003	0.004	ND
Cadmium	mg/L	0.002	0.005	ND
Chromium	mg/L	0.01	0.1	ND
Copper	mg/L	0.2	(2)	0.0036
Cyanide	mg/L	0.05	0.2	ND
Fluoride	mg/L	0.5	4	0.2
Lead	mg/L	0.002	(2)	0.0005

TABLE 3-9 (CONTINUED)

Inorganic Chemicals and Physical Characteristics
November 1999

Parameter	Units	State Reporting Level (SRL)	Maximum Contaminant Level (MCL)	1999 Results(1)
Mercury	mg/L	0.0005	0.002	ND
Nickel	mg/L	0.04	0.1	ND
Nitrate	mg/L	0.5	10	0.18
Nitrite	mg/L	0.1	1	ND
Selenium	mg/L	0.005	0.05	0.0006
Sodium	mg/L	7	(2)	9.4
Thallium	mg/L	0.002	0.002	ND
SECONDARY MCL'S				
Chloride	mg/L	20	250	2.9
Fluoride	mg/L	0.5	2	0.2
Iron	mg/L	0.1	0.3	ND
Manganese	mg/L	0.01	0.05	ND
Silver	mg/L	0.01	0.1	ND
Sulfate	mg/L	10	250	0.7
Zinc	mg/L	0.02	5	0.01
Color	Color Units	5	15	ND
Conductivity	µmhos/cm	10	700	230
Total Dissolved Solids	mg/L	150	500	190
OTHER PHYSICAL PARAMETERS				
Turbidity	NTU	0.1	1	0.06
Hardness	mg/L	10	None Established	110

(15) A result showing a ND indicates the analysis was performed, but the contaminant concentration is less than the SRL.

(16) Although DOH has not established MCLs for copper, lead, and sodium, there is sufficient public health significance connected with copper, lead, and sodium levels to require inclusion in inorganic chemical and physical source monitoring. For lead and copper, the EPA has established distribution system related levels at which a system is required to consider corrosion control. These levels, called "action levels," are 0.015 mg/L for lead and 1.3 mg/L for copper and are applied to the highest concentration in ten percent of all samples collected from the distribution system. The EPA has also established a recommended level of 20 mg/L for sodium as a level of concern for those consumers that may be restricted for daily sodium intake in their diets.

Nitrate samples are required annually by DOH. Nitrate sampling results are shown in Table 3-10 for the testing completed since 2001. The City has taken all required annual samples in accordance with DOH requirements. Complete nitrate and nitrite sampling results since 2001 are included in Appendix J. None of the samples exceeded the MCL for nitrate, which is 10 mg/L.

TABLE 3-10

Nitrate Testing Results
2001-2004

Year	**2001**	**2002**	**2002**	**2003**	**2004**
Source Tested	All	Well No. 7	Well No. 9	Well No. 8	Well No. 8
Nitrate (mg/L)	0.18	0.4	0.3	0.4	0.2

3.4.7 Arsenic rule

Arsenic is an inorganic chemical that has received significant attention due to proposed rule revisions. Long term exposure to low concentrations of arsenic in drinking water can lead to skin, bladder, lung, or prostate cancer. Non-carcinogenic effects of ingesting arsenic at low levels include cardiovascular disease, diabetes, and anemia, as well as reproductive, developmental, immunological, and neurological effects.

An arsenic standard of 0.05 mg/L in drinking water was set by EPA in 1975, based on Public Health Service standard originally set in 1942. In March 1999, the National Academy of Sciences (NAS) completed a review of updated scientific data on arsenic and recommended that EPA lower the standard as soon as possible. Though NAS did not recommend a specific numeric level, its recommendation formed the basis for EPA's original proposal of 0.005 mg/L. During the comment period EPA also considered potential arsenic levels of 0.003, 0.01, and 0.02 mg/L. After weighing the potential health benefit to the cost of improvements necessary to meet these new standards, the EPA selected the final arsenic MCL of 0.01 mg/L. The new arsenic standard was published in February 2001, and was to become effective in 2004, replacing the previous standard of 0.05 mg/L. As of July 2001, changes in EPA's new administration resulted in a delay of the new standard. However, the MCL of 0.01 mg/L was reaffirmed in October 2001 and the law became effective in February 2002. Compliance with the MCL of 0.01 mg/L is required by 2006.

The City has conducted all required arsenic testing as part of IOC testing. Arsenic testing results for 1999 are included in Table 3-9 as part of the IOC testing results. The City also tested for arsenic in 2003 with results of 0.002 mg/L. All levels are below the MCL of 0.01 mg/L.

3.4.8 Volatile organic compounds and synthetic organic compounds

Volatile organic compounds (VOCs) are manufactured, carbon-based chemicals that vaporize quickly at normal temperatures and pressures. VOCs include many hydrocarbons associated with fuels, paint thinners, and solvents. This group does not include organic pesticides, which are regulated separately as synthetic organic compounds (SOCs). VOCs are divided into the two following groups:

1. Regulated VOCs that have been determined to post a significant risk to human health.

2. Unregulated VOCs for which the level of risk to human health has not been established.

There are currently 21 regulated VOCs and 33 regulated SOCs. A list of these compounds and their MCLs is included in Appendix D.

The City of Ridgefield's sampling requirements for VOCs and SOCs are summarized in Table 3-4. The City has been granted a waiver through 2005 and 2006 for VOC and SOC testing, respectively. The most recent VOC analysis was completed in 1999. VOCs were not detected in this analysis. Due to the Low/Low Susceptibility/Vulnerability ratings, DOH has not required the City to complete a SOC analysis.

3.4.9 asbestos

In recent years, there has been much concern with the health risks associated with asbestos. Several studies and case histories have documented the hazards to internal organs as a result of inhalation of asbestos fibers. Data is limited on the effects of ingestion of asbestos fibers or on the effects of inhalation exposure from drinking water. Ingestion studies have not caused cancer in laboratory animals, although studies of asbestos workers have shown increased rates of gastrointestinal cancer.

Asbestos is listed a primary inorganic contaminant. However, it is not routinely included in IOC samples for public water systems. Since the City's water distribution system has less than 10 percent asbestos cement pipe installed, asbestos sampling is not required.

3.4.10 Radionuclides

Radionuclides include radioactive substances occurring naturally in subsurface waters. Regulated substances include radium-226, radium-228, uranium, and gross alpha and beta particles. Radionuclide MCLs, as defined by EPA's Radionuclide Rule and WAC 246-290, are included in Appendix D.

WAC-246-290 requires radionuclide samples once every four years, however; the 2004 WQMR requires two samples every ten months. The City last sampled its sources of supply for radionuclides in December 2004; no radionuclides were detected above the method detection limits.

3.4.11 Groundwater Under the Influence of Surface Water (GWI) Determination

Systems are required to provide filtration treatment for groundwater sources that are under the direct influence of surface water (GWI sources). DOH determines which sources are GWI sources based on a review of existing data and the collection of water quality and microscopic particulate analysis data. GWI sources are subject to the requirements of the surface water treatment rule.

Even though Wells No. 7, 8, and 9 are adjacent to Gee Creek, DOH has stated these sources do not meet the screening criteria to warrant a GWI review due to the depth of the first screened interval and the proximity to Gee Creek.

3.5 future water quality monitoring requirements

The future water quality monitoring requirements that apply to the City of Ridgefield are summarized below.

3.5.1 STAGE 2 DISINFECTANTS AND DISINFECTION BYPRODUCTS (D/DBP) rule

The Stage 2 D/DBP Rule will require compliance with DBP standards in all parts of the distribution system. Each sample point will need to comply with the 80 mg/L and 60 mg/L limits for TTHMs and HAA5s, respectively. Based on the data from current sampling, it appears that the City of Ridgefield will not have any problems meeting the proposed requirements.

3.5.2 GROUNDWATER RULE

The Groundwater Rule (GWR) is one of the requirements of the 1994 Amendments to the SDWA. Publication of the final rule is expected by the end of 2005. This rule would establish a method for determining if disinfection of a groundwater source is required, and it would establish disinfection standards for those sources where disinfection is required. For sources requiring disinfection, it is anticipated that 4-log virus inactivation will be required. This level of inactivation requires a contact time (CT) of 6 at typical water temperature and pH. The City already voluntarily disinfects its groundwater sources to maintain a chlorine residual in the distribution system. Table 3-11 provides an estimated length of pipe required to achieve 4-log virus inactivation assuming a 0.5 mg/L dosage is maintained.

TABLE 3-11

Estimated High and Low Zone Chlorine Contact Lengths

Zone / Condition	Time Required (min)	Dia of Pipe (inches)	Flow from Source (gpm)	Length of Pipe Required
High Zone Existing	12	12	400	820
High Zone Future	12	12	800	1630
Low Zone Existing	12	10	600	1770
Low Zone Future	12	10	400	1180

3.5.3 radon rule

Though a radon MCL was included in the originally proposed Radionuclide Rule, it was determined that a radon MCL will now be issued as a separate rule. In November of 1999, EPA proposed a preliminary radon MCL of 300 picocuries per liter (pCi/L). EPA is considering an alternative MCL of 4,000 pCi/L, if states or water purveyors implement a multimedia mitigation program aimed at reducing household indoor-air health risks from radon gas from soil as well as tap water. The final Radon Rule is expected in 2005.

Radon testing for Wells No. 7, 8, and 9 in November 1999 indicated a radon level of 285±20 pCi/L, which is below the proposed preliminary radon MCL of 300 pCi/L. Additional treatment may be required for radon if the MCL is exceeded. Aeration is the typical method for radon treatment of public water systems, but other methods are currently being explored.

3.6 System component Analysis

3.6.1 Water Right Analysis

A description of the City's water rights was presented in Chapter 1. According to the *Water System Planning Handbook* published by DOH, maximum instantaneous withdrawal rates and sustainable withdrawal rates must be analyzed. Although the City currently holds several water rights, the City is currently only using three supplemental water rights for the use of Wells No. 7, 8, and 9. The certificates for these wells indicate a maximum withdrawal of 639 acre-ft annually. The 1996 water system plan stated that the City had 681 acre-ft of annual water rights. An informal interpretation of the existing water rights was determined in an April 2005 meeting between DOE and the City of Ridgefield. During the meeting, the two parties evaluated the existing water rights and determined the City has a maximum annual withdrawal volume of 962 acre-ft and a maximum instantaneous withdrawal rate of 1,875 gpm. The maximum annual withdrawal is the sum of all primary water rights including vested claims.

The following table, Table 3-12, provides an estimated annual production through 2024. This estimated value includes the same level of lost and unaccounted for water (L/UW) decreasing from 20.1% to 10% in five years, as it was identified in Table 2-10. The purpose of Table 3-12 is to anticipate when additional water rights will be needed. The annual production shown was calculated by multiplying the projected average day production including L/UW from Table 2-10 by the number of days in a year, and then converted to acre-ft.

TABLE 3-12

Annual Source Capacity Evaluation

Year	Projected Total ERU's	Annual Consumption, Acre-ft per year	Annual Production, Including L&UW, Acre-ft per year	Available Water Rights, Acre-ft per year	Additional Water Rights Required, Acre-ft per year
2005	1,795	394	467	962	-0-
2006	2,136	475	555	962	-0-
2007	2,467	557	641	962	-0-
2008	2,781	638	723	962	-0-
2009	3,168	748	823	962	-0-
2010	**3,637**	**859**	**945**	**962**	**-0-**
2011	4,087	966	1,062	962	100
2012	4,538	1,072	1,179	962	217
2013	4,988	1,178	1,296	962	334
2014	5,431	1,283	1,411	962	449
2015	5,873	1,387	1,526	962	564
2016	6,316	1,492	1,641	962	679
2017	6,758	1,596	1,756	962	794
2018	7,200	1,701	1,871	962	909
2019	7,992	1,888	2,077	962	1,115
2020	8,784	2,075	2,283	962	1,321
2021	9,576	2,262	2,488	962	1,526
2022	10,368	2,449	2,694	962	1,732
2023	11,159	2,636	2,900	962	1,938
2024	**11,161**	**2,637**	**2,900**	**962**	**1,938**

As shown in Table 3-12, the City of Ridgefield currently has adequate instantaneous water rights to serve approximately 3,702 ERUs. The City will require additional annual withdrawal by 2011. Recommendations to address the deficiencies shown in this chapter will be discussed in Chapter 8.

Table 3-13, provides an estimated instantaneous supply requirement through 2024. This estimated value includes the same level of lost and unaccounted for water (L/UW) decreasing from 20.1% to 10% in five years, as it was identified in Table 2-10. The purpose of Table 3-13 is to anticipate when additional water rights will be needed. The required supply shown was calculated by dividing the maximum day production from Table 2-10 by the number of minutes in a day.

TABLE 3-13

Instantaneous Source Capacity Evaluation

Year	Projected Total ERU's	Required Supply(1), gpm	Available Water Rights, gpm	Additional Water Rights Required, gpm
2005	1,795	714	1,875	-0-
2006	2,136	850	1,875	-0-
2007	2,467	982	1,875	-0-
2008	2,781	1,107	1,875	-0-
2009	3,168	1,261	1,875	-0-
2010	**3,637**	**1,447**	**1,875**	**-0-**
2011	4,087	1,626	1,875	-0-
2012	4,538	1,806	1,875	-0-
2013	4,988	1,985	1,875	110
2014	5,431	2,161	1,875	286
2015	5,873	2,337	1,875	462
2016	6,316	2,513	1,875	638
2017	6,758	2,689	1,875	814
2018	7,200	2,865	1,875	990
2019	7,992	3,180	1,875	1,305
2020	8,784	3,496	1,875	1,621
2021	9,576	3,811	1,875	1,936
2022	10,368	4,126	1,875	2,251
2023	11,159	4,441	1,875	2,566
2024	**11,161**	**4,442**	**1,875**	**2,567**

(1) Required Supply is shown as the Maximum Day Demand from Table 2-10 divided by 1,440 minutes per day.

As can be seen in Table 3-13, the City of Ridgefield has adequate instantaneous water rights to serve approximately 4,712 ERUs. The City is projected to need additional instantaneous withdrawal rights by 2013. Recommendations to address the deficiencies shown in this chapter will be discussed in Chapter 8.

3.6.2 Source of Supply Analysis

According to DOH Design Standards, source production capacity must be sufficient to supply maximum day demands. Maximum day and average day demands must also comply with the maximum instantaneous and maximum annual withdrawal limitations of associated water rights. For reliability purposes, DOH recommends the following:

- Development of two or more sources of supply with a total capacity able to replenish depleted fire suppression storage within a 72-hour period while concurrently supplying the maximum day demand (MDD) of the system.
- Sources capable of supplying the MDD of the system with 18 hours of pumping
- With the largest source out of service, remaining sources able to provide a minimum of average day demand (ADD) for the system.

As will be discussed later in this Chapter, the maximum fire flow requirement for the City's water system is 2,000 gpm for 2 hours, which equates to a fire suppression storage requirement of 240,000 gallons in the High Zone. A source capacity of approximately 56 gpm, would be necessary to replenish this storage in 24 hours. Using this criteria, a source capacity of at least 770 gpm would be required to meet the 2005 maximum day production of 1,028,800 gpd (714 gpm), while replenishing fire suppression storage within a 72-hour period. The City currently has adequate source of supply to meet this reliability requirement.

Table 3-14 summarizes the available source capacity using three different source reliability criteria.

TABLE 3-14

Source Capacity

Source	Rated Pumping Capacity (gpm)(1)	Current Pumping Capacity (gpm)	Current Pumping Capacity over 24 hours of Pumping (gpd)	Reliable Capacity-Wells 18 hours of Pumping (gpd)	Reliable Capacity-Wells 24 hours and Largest Source out of Service (gpd)
Well No. 7	300	300	432,000	324,000	432,000
Well No. 8	300	300	432,000	324,000	432,000
Well No. 9	400	400	576,000	432,000	0
Total	**1,000**	**1,000**	**1,440,000**	**1,080,000**	**864,000**
Emergency Source					
CPU Intertie					

(1) Pump nameplate rating.

A source analysis was completed for the various source reliability scenarios. Table 3-15 shows the total ERU's that can be served under each scenario. Emergency and abandoned sources of supply are not included in the analysis. The total ERU's that can be served under each scenario is calculated by dividing the total source of supply capacity by the peak day usage per ERU or the average day usage per ERU, based on the aforementioned DOH reliability recommendations.

TABLE 3-15

Current Source Capacity Analysis

	Current Pumping Capacity over 24 hours of Pumping (gpd)	Reliable Capacity-Wells 18 hours of Pumping (gpd)	Reliable Capacity-Wells 24 hours and Largest Source out of Service (gpd)	Replenish Fire Suppression Storage within 72 hours of Pumping (gpd)
Total Source of Supply Capacity(1)	1,440,000	1,080,000	864,000	1,360,000(5)
Average Day Usage (gpd) (2)			232	
Peak Day Usage (gpd) (3)	573	573		573
Total ERU's that can be Served(4)	2,513	1,885	3,724	2,373

(1) See Table 3-11.
(2) See Chapter 2, Section 2.2.3.1.
(3) Based on average day production times a peaking factor of 2.47.
(4) Total source capacity divided by average or peak day usage.
(5) Based on reliable capacity—wells pumping for 24 hours minus the capacity required to replenish 240,000 gallons of fire suppression storage in 72 hours.

Under all source capacity reliability scenarios the City of Ridgefield currently has adequate source capacity. The City has chosen a reliability criteria of replenishing fire suppression storage within 72 hours of pumping and therefore has a source capacity to serve approximately 2,373 ERUs. Table 3-16 provides a projection of the total supply needed to provide for MDD and to replenish fire suppression storage within 72 hours. Table 3-16 shows that the City will need additional source capacity by 2007.

TABLE 3-16

Projected Source Capacity Analysis

Year	Projected Total ERU's	Projected MDD, gpm	Required Supply(1), gpm	Total Supply Needed, gpm	Available Supply, gpm	Additional Supply Needed, gpm
2005	1,795	714	56	770	1,000	-0-
2006	2,136	850	56	906	1,000	-0-
2007	2,467	982	56	1,038	1,000	38
2008	2,781	1,107	56	1,163	1,000	163
2009	3,168	1,261	56	1,317	1,000	317
2010	**3,637**	**1,447**	**56**	**1,503**	**1,000**	**503**
2011	4,087	1,626	56	1,682	1,000	682
2012	4,538	1,806	56	1,862	1,000	862
2013	4,988	1,985	56	2,041	1,000	1,041
2014	5,431	2,161	56	2,217	1,000	1,217
2015	5,873	2,337	56	2,393	1,000	1,393
2016	6,316	2,513	56	2,569	1,000	1,569
2017	6,758	2,689	56	2,745	1,000	1,745
2018	7,200	2,865	56	2,921	1,000	1,921
2019	7,992	3,180	56	3,236	1,000	2,236
2020	8,784	3,496	56	3,552	1,000	2,552
2021	9,576	3,811	56	3,867	1,000	2,867
2022	10,368	4,126	56	4,182	1,000	3,182
2023	11,159	4,441	56	4,497	1,000	3,497
2024	**11,161**	**4,442**	**56**	**4,498**	**1,000**	**3,498**

(1) Required supply is based on replenishing 240,000 gallons of fire suppression storage in 72 hours.

The condition of City's current sources of supply is generally good. All three of the current wells were constructed in 1986 with pitless well adapters and are in fairly good condition. Well No. 9's submersible pump was replaced in 2004 after a service life of only three to four years. Upon reviewing the installation, the City discovered the sump pump in the adjacent flow meter vault was connected to the submersible pump's power supply. This connection most likely resulted in the shortened service of life of Well No. 9's submersible pump.

Well 9 is currently equipped with a 400 gpm pump. The water right for this well limits withdrawal to 300 gpm. The City has existing water rights from other wells in the same ¼, ¼ section. The City should file a replacement well declaration with the Department of Ecology to legally transfer the rights to this well.

City staff have indicated that the chlorine injection vaults and flow meter vaults have had problems at times with the groundwater and runoff entering the vaults. The chlorine injection vault for Well No.'s 7 & 8 will be reconstructed and have a locking steel lid. Submersible pumps with dedicated power supplies will be installed in vaults with water problems. For security reasons, well houses will be constructed over each well in Abrams Park.

The flowmeters on Wells 7 and 8 are not currently operational. City staff currently estimates flow based on pump run time. New flowmeters should be installed on the discharge of Wells 7 and 8 to accurately measure flow from these wells.

3.6.3 Storage Analysis

The City of Ridgefield owns and operates three storage reservoirs that serve the water system. The High School Reservoir is a welded steel standpipe that serves the High Zone and has an overflow elevation of 408 feet. The Cemetery Reservoir is an at grade bolted steel tank that serves the Low Zone at an overflow elevation of 262 feet. The Junction Reservoir is a grade level concrete tank, which has an overflow elevation of 282 feet. The Junction Booster Station allows it to provide storage to the High Zone.

Storage requirements for the City are determined by applying the design standards outlined in the DOH Group A Water System Design Manual, August 2001. The storage volume recommended according to this guidance document is based on the sum of the following:

- Operational Storage
- Equalizing Storage
- Standby Storage
- Fire Suppression Storage
- Dead Storage (if any)

3.6.3.1 Operational Storage

Operational storage is the volume of the reservoir devoted to supplying the water system while under normal operating conditions the source(s) of supply are in “off” status. This volume is dependent upon the sensitivity of the reservoir water level sensors and the tank configuration necessary to prevent excessive cycling of source pump motors. Operational storage is in addition to other storage components, thus providing a factor of safety for equalizing, standby, and fire suppression components.

The City of Ridgefield reservoirs are controlled by the elevation of the water inside the reservoir. Both the Cemetery and High School Reservoirs are seasonally controlled by the water system operators and are adjusted as needed based on demand and water quality concerns. For planning purposes, the operational storage will be estimated at 5% of the total of the equalizing, standby and fire suppression storage.

3.6.3.2 Equalizing Storage

Equalizing storage is typically used to meet diurnal demands that exceed the average day and maximum day demands. The volume of equalizing storage required depends on peak system demands, the magnitude of diurnal water system demand variations, the source production rate, and the mode of system operation. Sufficient equalizing storage must be provided in combination with available water sources and pumping facilities such that peak system demands can be satisfied.

Equalizing storage is calculated using the following equation:

$$V_{ES} = (Q_{PH} - Q_S)150 \text{ minutes}$$

V_{ES} = Equalizing storage component (gallons)
Q_{PH} = Peak hourly demand (gpm)
Q_S = Total source of supply capacity, excluding emergency sources (gpm)

The total source of supply capacity for the City of Ridgefield water system, excluding emergency sources is 1,000 gpm.

3.6.3.3 Standby Storage

Standby storage is provided in order to meet demands in the event of a system failure such as a power outage, an interruption of supply, or break in a major transmission line. The amount of standby storage should be based on the reliability of supply and pumping equipment, standby power sources, and the anticipated length of time the system could be out of service.

Standby storage is calculated using the following equation:

$$SB_{TSS} = (2\text{ days})(ADD)(N) - t_m(Q_S - Q_L)$$

SB_{TSS} = Standby storage component for a multiple source system (gallons)
ADD = Average day demand for the system (gpd/ERU)
N = Number of ERUs
Q_S = Sum of all installed and continuously available sources of supply capacities, except emergency sources (gpm)
Q_L = The largest capacity source available to the system (gpm)
t_m = Time that remaining sources are pumped on the day when the largest source is not available (minutes, generally 1440)

DOH Note: Although standby storage volumes are intended to satisfy the requirements imposed by system customers for unusual situations and are addressed by WAC 246-290-420, it is recommended that a standby storage volume be not less than 200 gallons/ERU.

The sum of all installed and continuously available sources of supply with the largest source out of service for the City is 600 gpm, or 864,000 gpd.

3.6.3.4 Fire Suppression Storage

Fire suppression storage is provided to ensure that the volume of water required for fighting fires is available when necessary. Fire suppression storage also reduces the impact of fire fighting on distribution system water pressure. The amount of water required for fire fighting purposes is specified in terms of rate of flow in gallons per minute (gpm) and an associated duration. Fire flow must be provided at a residual water system pressure of at least 20 pounds per square inch (psi).

Fire suppression storage is calculated using the following equation:

$$FSS = (FF)(t_m)$$

FSS = Required fire suppression storage component (gallons)

FF = Required fire flow rate, as specified by fire protection authority (gpm)

t_m = Duration of FF rate, as specified by fire protection authority (minutes)

DOH Note: The standby storage component or the fire suppression storage component, whichever volume is smaller, can be excluded from a water system's total storage requirement provided that such practice is not prohibited by: (1) a locally developed and adopted Coordinated Water System Plan, (2) local ordinance, or (3) the local fire protection authority or County Fire Marshal (reference WAC 246-290-235(4)).

Minimum fire flow requirements for the City of Ridgefield and the surrounding areas are shown in Table 3-17.

TABLE 3-17

Minimum Fire Flow

Development Classification	Water System Coordination Act (WAC 246-293)	Clark County Coordinated Water System Plan	City Code Section 14.02.220
Residential	500 gpm/30 minutes	1,000 gpm/30 minutes	1,000 gpm/120 minutes
Commercial & Multi-family	750 gpm/60 minutes for >4,000 square feet	1,500 gpm/60 minutes	1,500 gpm/120 minutes
Industrial	1,000 gpm/60 minutes	2,000 gpm/90 minutes	2,000 gpm/120 minutes (1)

(1) This is the minimum requirement for Type 1/II-FR construction up to 38,700 sf. The City's long term planning objective is the provision of 3,000 gpm for 180 minutes. This will be obtained with the construction of a new reservoir in the Junction area.

The design fire flow requirements shown in Table 3-17 are less than those required for the schools. The School District has recently upgraded both the Middle and High School, and elected not to install fire sprinklers, which would have significantly reduced the fire flow requirements. The City has elected not to make the water system improvements that would result in fire flows that will meet the needs of school buildings without sprinkler systems. All future large structures will be required by the International Fire Code to provide sprinklers.

For the purposes of this analysis, fire suppression storage for the High Zone is based on the current maximum fire flow requirement of 2,000 gpm for 120 minutes, or 240,000 gallons. Fire suppression storage for the Low Zone is based on a maximum fire flow requirement of 1,500 gpm for 2 hours, or 180,000 gallons. For the purposes of this analysis, it is assumed that the City of Ridgefield will nest standby and fire suppression storage.

3.6.3.5 Dead Storage

Dead storage is the volume of stored water not available to all customers at the minimum design pressure in accordance with WAC 246-290-230(5) and (6). Dead storage is excluded from the volumes provided to meet the other storage requirements.

The highest water service connection served by the Cemetery Reservoir is at approximately 160 feet. In order to be considered usable storage, storage supplying the Low Zone must be above approximately 206 feet to meet the minimum 20 psi pressure requirement at this location. The base elevation of the Cemetery Reservoir is 242.5 feet. Therefore, none of the Low Zone storage is considered dead storage

The highest service connection served by the High School Reservoir is at approximately 281 feet. In order to be considered usable storage, storage supplying the High Zone must be above approximately 327 feet. The base elevation of the High School Reservoir is at 273.75 feet and therefore approximately 53.25 feet or 245,000 gallons of the High School Reservoir is considered dead storage. Therefore the reservoir has approximately 372,000 gallons of available storage. The Junction Reservoir is pumped storage, therefore it has no dead storage.

3.6.3.6 Total Storage

Equalizing and standby storage are the only two storage components that are directly determined by water demand when looking at the physical capacity of a water system based on available storage. Operational storage is dictated by diurnal pumping needs and fire suppression storage is dictated by established fire flow requirements.

Tables 3-18 and 3-19 projects the Low and High Zone storage requirements through 2024. For both pressure zones, the minimum recommended standby storage of 200 gallons per ERU was used, since the calculated storage was substantially less when the multiple source deduction was included. Total needed storage was determined using the greater of the Standby or Fire Suppression storage. As shown in Table 3-18, it is assumed that in 2006, Well No. 8 will be reequipped with a 400 gpm pump and piping will be modified so that it pumps water to the High Zone.

TABLE 3-18

Low Zone Storage Analysis Summary

Year	Total ERU's	Fire	Standby	Equalization	Operational	Total Need	Total Available	Additional Needed	Assumed Total Source Capacity, gpm
2005	1,178	180,000	235,600	38,600	22,700	296,900	400,000	-0-	600
2006	1,183	180,000	236,600	84,100	25,000	345,700	400,000	-0-	300
2007	1,188	180,000	237,600	84,600	25,100	347,300	400,000	-0-	300
2008	1,190	180,000	238,000	84,800	25,200	348,000	400,000	-0-	300
2009	1,194	180,000	238,800	85,200	25,200	349,200	400,000	-0-	300
2010	**1,198**	**180,000**	**239,600**	**85,500**	**25,300**	**350,400**	**400,000**	**-0-**	**300**
2011	1,202	180,000	240,400	85,900	25,300	351,600	400,000	-0-	300
2012	1,206	180,000	241,200	86,300	25,400	352,900	400,000	-0-	300
2013	1,210	180,000	242,000	86,700	25,500	354,200	400,000	-0-	300
2014	1,214	180,000	242,800	87,100	25,500	355,400	400,000	-0-	300
2015	1,218	180,000	243,600	87,400	25,500	356,500	400,000	-0-	300
2016	1,222	180,000	244,400	87,800	25,600	357,800	400,000	-0-	300
2017	1,226	180,000	245,200	88,200	25,700	359,100	400,000	-0-	300
2018	1,230	180,000	246,000	88,600	25,700	360,300	400,000	-0-	300
2019	1,237	180,000	247,400	89,300	25,900	362,600	400,000	-0-	300
2020	1,244	180,000	248,800	89,900	25,900	364,600	400,000	-0-	300
2021	1,251	180,000	250,200	90,600	26,000	366,800	400,000	-0-	300
2022	1,258	180,000	251,600	91,300	26,200	369,100	400,000	-0-	300
2023	1,265	180,000	253,000	91,900	26,200	371,100	400,000	-0-	300
2024	**1,265**	**180,000**	**253,000**	**91,900**	**26,200**	**371,100**	**400,000**	**-0-**	**300**

TABLE 3-19

High Zone Storage Analysis Summary

Year	Total ERU's	Fire	Standby	Equalization	Operational	Total Need	Total Available	Additional Needed	Assumed Total Source Capacity, gpm
2005	617	240,000	123,500	15,100	18,900	274,000	472,000	-0-	400
2006	953	240,000	190,600	0	21,500	261,500	472,000	-0-	800
2007	1,279	240,000	255,800	0	24,800	280,600	472,000	-0-	1,200
2008	1,591	240,000	318,300	0	27,900	346,200	472,000	-0-	1,200
2009	1,974	240,000	394,700	0	31,700	426,400	472,000	-0-	1,950
2010	**2,439**	**240,000**	**487,700**	**0**	**36,400**	**524,100**	**472,000**	52,100	**1,950**
2011	2,885	240,000	577,000	0	40,900	617,900	472,000	145,900	1,950
2012	3,332	240,000	666,400	41,800	47,400	755,600	472,000	283,600	1,950
2013	3,778	240,000	755,700	0	49,800	805,500	472,000	333,500	2,700
2014	4,217	240,000	843,300	13,900	54,800	912,000	472,000	440,000	2,700
2015	4,655	240,000	931,100	55,700	61,300	1,048,100	472,000	576,100	2,700
2016	5,094	240,000	1,018,700	97,600	67,800	1,184,100	472,000	712,100	2,700
2017	5,532	240,000	1,106,400	26,900	68,700	1,202,000	472,000	730,000	3,450
2018	5,970	240,000	1,194,100	68,800	75,200	1,338,100	472,000	866,100	3,450
2019	6,755	240,000	1,351,000	143,700	86,800	1,581,500	472,000	1,109,500	3,450
2020	7,540	240,000	1,508,000	106,200	92,700	1,706,900	472,000	1,234,900	4,200
2021	8,325	240,000	1,665,000	181,200	104,300	1,950,500	472,000	1,478,500	4,200
2022	9,110	240,000	1,821,900	256,100	115,900	2,193,900	472,000	1,721,900	4,200
2023	9,894	240,000	1,978,900	331,000	127,500	2,437,400	472,000	1,965,400	4,200
2024	**9,896**	**240,000**	**1,979,200**	331,200	**127,500**	**2,437,900**	**472,000**	1,965,900	**4,200**

Table 3-18 shows that the Low Zone storage has a capacity to support approximately 1,539 ERUs. Table 3-19 shows that the High Zone storage has a capacity to serve approximately 1,669 ERUs. Therefore the system currently has storage that can support 3,208 ERUs. The number of ERUs that these zones can support will change as source capacity changes. The storage capacity of the system will be updated when source changes are made. The Low Zone is projected to have adequate storage capacity throughout the entire planning period. The High Zone is projected to need additional storage capacity by 2010. To facilitate industrial development in the Junction Area, the City intends to construct an additional reservoir in the High Zone during the 6-year planning period so that the City can provide fire suppression storage to support a fire flow of 3,000 gpm for 180 minutes.

The City of Ridgefield's storage facilities are maintained well. The Cemetery Reservoir was constructed in 2000, while the High School Reservoir was constructed in 1987. The Junction Reservoir was constructed in 1985, and signs of calcification are visible on the exterior of the reservoir. All three reservoirs will be drained cleaned, as the most recent cleaning was completed on the High School Reservoir approximately five years ago. The Junction Reservoir will also be pressure washed and painted to prevent future calcification if not upgraded.

The Cemetery Reservoir and High School Reservoir are both connected to the telemetry system at the WWTP. The Junction Reservoir currently is not connected to the City's telemetry system. It is recommended that the Junction Reservoir be connected to the main telemetry system. This would require a dedicated phone line and a Programmable Logic Controller (PLC) along with some programming at the WWTP.

3.6.4 booster station analysis

The City of Ridgefield water system has two booster stations: the Junction booster station and the Cemetery booster station. The Junction booster station provides supplemental water to the High Zone when needed. This booster station has three 50 h.p. pumps, each rated at 1,000 gpm, and one 2 h.p. jockey pump rated at 10 gpm. Only two 50 h.p. pumps can be run at one time producing a supplemental flow of 2,000 gpm. The 50 h.p. pumps are typically run annually to ensure proper operation. The jockey pump is used to maintain a residual inside the Junction Reservoir. The reservoir has not had any problems maintaining residual, but the Gee Creek rest area on I-5, the furthest point on the City's water system from the wells, has occasionally had low residual levels. City staff has considered installing a day tank and metering pump at the Junction booster station to maintain desirable residual levels in the Junction area. Table 3-20 provides a summary of the condition of the pumps at the Junction booster station.

TABLE 3-20

Junction Booster Pump Condition Summary

Pump Number	Horse Power	Flow (gpm)	Condition
1	2	10	Well Maintained
2	50	1,000	Well Maintained
3	50	1,000	Discharge pressure gauge is missing and has a leaking mechanical joint
4	50	1,000	Well Maintained

The Junction booster station is currently not connected to the telemetry system. It is recommended that this booster station be connected to the main telemetry system. This would require a dedicated phone line and a PLC along with some programming at the WWTP. It is possible the PLC can be installed in the service building and connected to the booster pumps as well as the Junction Reservoir.

The Cemetery booster station is the other booster station used by the City. Constructed in the 1950 or 1960's, the Cemetery booster station is much older than the Junction booster station. It is located adjacent to the Cemetery Reservoir to provide supplemental flows to the High Zone. The Cemetery booster station consists of two 10 h.p. pumps rated at 80 gpm each. This booster station is used on a regular basis transferring water from the Low Zone to the High Zone as dictated by the telemetry set points. The Cemetery booster station is approximately 6 feet above the base of the Cemetery Reservoir, which increases the potential for cavitation. Cavitation results in a loss in capacity, head (pressure) drops, efficiency drops, and possible damage to many of the system components.

The following list describes the deficiencies at the Cemetery booster station:

- The concrete masonry unit is 40-50 years old with noticeable differential settlement in the floor slab.
- Booster station is 6 feet above base elevation of adjacent reservoir, which increases the potential for cavitation.
- Booster station does not have suction and discharge gauges
- Pumps are 40-50 years old and beyond the expected useful life expectancy
- Piping is 40-50 years old
- CMU building and layout does not provide adequate space to maintain booster station components

Table 3-21 provides a summary of the condition of the pumps at the Junction booster station.

TABLE 3-21

Cemetery Booster Pump Condition Summary

Pump Title	Horse Power	Flow (gpm)	Condition
East Pump	10	80	Beyond the expected useful life expectancy
West Pump	10	80	Beyond the expected useful life expectancy

3.6.5 treatment analysis

The City of Ridgefield voluntarily disinfects each of its sources to prevent bacteriological growth within the distribution system. Wells No. 7 and 8 are treated with 12.5% sodium hypochlorite diluted at a 4:1 ratio from a 40 gpd metering pump after the combination of the two sources in an underground chlorination injection vault. Well No. 9 is also treated with 12.5% sodium hypochlorite diluted at a 4:1 ratio from a 20 gpd metering pump in an underground chlorination injection vault. The feed system for both wells, which consists of a chlorine metering pump and a 100 gallon day tank for each chlorination vault is stored in the control building at Abrams Park. The day tanks are filled regularly by City staff from totes that are stored in the control building adjacent to the day tanks. There is visible corrosion of the electrical equipment inside the control building, which suggests the chlorine day tanks and totes should be stored in a separate room.

Currently, achieving a CT of 6 is not required. The metering pump for Well No.'s 7 and 8 is typically run at full stroke, providing 40 gpd of chlorine to the distribution system. The metering pump for Well No. 9 is typically run at half stroke, providing 10 gpd of chlorine to the distribution system. Residual levels throughout the City are maintained between 0.4 mg/L and 0.7 mg/L as indicated in the monthly reports submitted to DOH. Currently, operations personnel refill the day tanks between one and three times a week. With the current growth patterns, the number of times the day tanks need to be refilled each week will greatly increase. The chlorine storage capacity should be increased over time in order to reduce additional impacts due to increased operating time.

3.6.6 telemetry system analysis

A discussion of the controls and telemetry of the City of Ridgefield water system is included in Chapter 1 of this Plan. In general, most reservoir and well sites were connected to the telemetry system via telephone lines in 2001. The exception to this is the Junction Reservoir and booster station. These facilities should be connected to the main telemetry system at the wastewater treatment plant to facilitate data collection and recording and to improve operator efficiency.

The Clark Public Utilities (CPU) intertie on the east side of the City is also not connected to the telemetry system. CPU currently has a telemetry connection to the intertie, which is managed by CPU. The City should work with CPU to have telemetry data from this intertie connected to the City's telemetry system.

3.6.7 distribution system hydraulic analysis

The development of a computer hydraulic model, which can accurately and realistically simulate the performance of a water system in response to a variety of conditions and scenarios, has become an increasingly important element in the planning, design, and analysis of municipal water systems. The Washington State Department of Health's WAC 246-290 requires hydraulic modeling as a component of water system plans.

3.6.7.1 Hydraulic Modeling Software

The City's water system was analyzed using MWHSoft's H2ONet hydraulic modeling software, which operates in an AutoCAD computer-aided design and drafting environment. The H2ONet model was created from the City's water system basemap.

The H2ONet model is configured with a graphical user interface. All water system elements, including pipes, control valves, pumps, and reservoirs are assigned a unique graphical representation within the model. Each element is assigned a number of attributes specific to its function in the actual water system. Typical element attributes include spatial coordinates, elevation, water demand, pipe lengths and diameters, and critical water levels for reservoirs. With attributes of each system element as the model input, the H2ONet software produces the model output in the form of flows and pressures throughout the simulated water system.

3.6.7.2 Model Assumptions

Prior to the calibration of the hydraulic model, the basic layout of the water system is recreated within the model. The lengths, diameters, and connection points of system piping are assigned using an updated base map of the water system. The locations of the sources, reservoirs, and pressure reducing valves (PRVs) are found on water system base maps, while the critical elevations of the reservoirs are taken from as-built drawings and past planning documents. The assumptions regarding the modeling of all water sources, system demands, and the settings of PRVs are included in the following sections.

<u>Source</u>

Well Nos. 7, 8, and 9 are modeled as fixed head reservoirs with outlet flow control valves. Wells No. 7 and No. 8 can provide 300 gpm to the Low Zone, while Well No. 9 can provide 400 gpm to the High Zone. The wells were not modeled with pumps because pump curves are not available.

<u>Booster Pump Stations</u>

The Cemetery and Junction Booster Pump Stations (BPS) are included in the model. The Junction BPS is represented by two pumps, both capable of pumping 1,000 gpm at 150 feet TDH from the Junction Reservoir to the High Zone. The lead pump is set to turn on when the outlet pressure drops below 45 psi and the lag pump is set to turn on when the outlet pressure drops below 40 psi. The Cemetery BPS is represented by two pumps capable of pumping 80 gpm each from the Low Zone to the High Zone. No controls have been assigned to the Cemetery BPS because the booster station controls are based on the reservoir level.

<u>Pressure Reducing Valves (PRV)</u>

The Abrams Park PRV station and Gee Creek PRV station are included in the model. Table 3-22 provides the size, elevation, pressure, and HGL of both PRV stations. The Cemetery PRV station is not included in the model because it is not currently in operation and its settings are unknown.

Table 3-22

PRV Model Settings

Name	Size	Elevation	Pressure	HGL
Abrams PRV	2-inch	45 ft	80 psi	229.8 ft
	6-inch	45 ft	60 psi	183.6 ft
Gee Creek PRV	2-inch	55 ft	60 psi	193.6 ft
	6-inch	55 ft	40 psi	147.4 ft

System Demands

A key element in the hydraulic modeling process is the distribution of demands throughout the water system. Total demand on the system is based on the projected demands from Table 2-10. Existing demands are distributed based on existing water connections. Future demands are distributed throughout the water service area based on the amount of land available for future construction.

Seven demand sets were used in the hydraulic analysis.

- 2004 Average Daily Demands: These demands were used while calibrating the model.
- 2004 Maximum Day Demands: These demands are used to evaluate the existing system's ability to provide fire flow during the 2004 maximum day demand at DOH's requirement of 20 psi.
- 2004 Peak Hour Demands: These demands were used to verify the system is able to meet the DOH standards to supply domestic water at a minimum system wide pressure of 30 psi.

- 2010 Maximum Day Demands: These demands were used to evaluate the system's ability to provide fire flow during the 2010 maximum day demand at DOH's requirement of 20 psi with the six-year Capital Improvement Plan implemented.

- 2010 Peak Hour Demands: These demands were used to verify the system is able to meet the DOH standards to supply domestic water at a minimum system wide pressure of 30 psi.

- 2025 Maximum Day Demands: These demands were used to evaluate the system's ability to provide fire flow during the 2025 maximum day demand at DOH's requirement of 20 psi with the twenty-year Capital Improvement Plan implemented.

- 2025 Peak Hour Demands: These demands were used to verify the system is able to meet the DOH standards to supply domestic water at a minimum system wide pressure of 30 psi.

3.6.7.3 Model Calibration

The calibration of a hydraulic model provides a measure of assurance that the model is an accurate and realistic representation of the actual system. The hydraulic model of the City's water system was calibrated using data obtained from fire hydrant tests at various locations throughout the water system. Eight fire hydrant tests were conducted, with the assistance of City personnel, on January 19, 2005. During these tests, static and residual pressures were recorded as City staff opened hydrants and recorded the flow rate. Field results were used to calibrate the hydraulic model through verification and adjustment of pipe type, sizes, roughness coefficients, and elevations.

The testing locations include multiple points within the two pressure zones. A description of each testing location is presented in Table 3-23.

TABLE 3-23

Hydrant Testing Locations

Test Number	Pressure Zone	Node Numbers	Testing Location
1	High	J-326 , J-324	Junction: S 56th Pl., N of Reservoir
2	High	J-386 , J-392	Junction: S 65th Ave. and S 5th St.
3	High	J-262 , J-548	High School: West end of development
4	High	J-258 , J-256	Hillhurst: Near Methodist Church
5	High	J-410 , J-406	Bellwood: N 5th Way
6	Low	J-10 , J-14	Downtown: 1st Street and Depot
7	Low	J-204 , J-206	Heron: Heron Drive and N 7th Circle
8	Low	J-108 , J-106	Downtown: Main St. and Sargent Ave.

Reservoir water levels and the status of the source flow rates were recorded during testing. A summary of the recorded reservoir levels and source flow rates is presented in Table 3-24. The system conditions at the time of testing were replicated in the hydraulic model during the calibration process.

TABLE 3-24

System Conditions During Hydrant Tests

Reservoir Name	Pressure Zone	HGL during testing
Cemetery Reservoir	Low	254 feet
High School Reservoir	High	398 feet

Junction Reservoir	High	280 feet

Source Name	Capacity	Status
Well No. 7	300 gpm	Off (1)
Well No. 8	300 gpm	Off (1)
Well No. 9	400 gpm	On
CLOSED VALVE LOCATIONS (2)		
Railroad Ave. and Hall Street, valve on south of tee		
Main Ave. and Maple St., valves on west, south, and east of cross		
1st Ave. and Division St., valve on north of cross		

(1) Wells No. 7 and 8 were on during test numbers 1 through 5, but off during test numbers 6 through 8.
(2) The identified closed valves were reopened after hydrant testing was completed.

Using the system conditions for each hydrant test, the hydraulic model was used to generate static pressure and residual pressure at the measured hydrant flow rate. The total system demand at the time of the hydrant tests was assumed to be the average day demand for 2004. Model output was generated at points in the model equivalent to the locations of the hydrant tests.

Model output for static pressure was generated by running the model at 2004 average day demands. Model output for residual pressure was generated at each hydrant test location by placing an added demand equal to the measured hydrant flow rate and recording the resulting pressure.

The system pressures and pipe flow rates determined in the hydraulic analysis are highly dependent on the friction loss characteristics established for each pipe. The friction losses occurring in lengths of pipe and various valves are accounted for in the hydraulic model. The friction factors for the pipes in the modeled system are adjusted throughout the calibration process until the model output best approximates the measured values. Hazen-Williams C-factors between 110 and 130 are used throughout the system. These friction factors are typical values for most pipe and are generally conservative. The friction factors for the pipe also compensates for system losses through valves and pipe fittings.

The model output was produced for two data comparisons, static pressure and residual pressure. The values measured in the hydrant flow tests are compared to the model output values in Table 3-25.

TABLE 3-25

Calibration Results

Test No.	Flow (gpm)	Static Pressure (psi)			Residual Pressure (psi)		
		Field	Model	Difference	Field	Model	Difference
1	790	67	67	0	77	76	1
2	1,210	57	56	1	56	58	-2
3	1,200	57	57	0	55	55	0
4	1,150	57	58	-1	53	53	0
5	1,130	74	71	3	59	57	2
6	1,060	79	80	-1	44	17	27
7	1,030	68	65	3	59	44	15
8	1,090	75	76	-1	62	64	-2

Hydraulic models are required to be within 5 psi of measured pressure readings for long-range planning, according to the DOH Design Manual, Table 8-1. Calibration of the hydraulic model produced results that are within 3 psi of actual field test data for static pressure. Model residual pressures in the High Zone are within 2 psi of measured values.

Flow tests no. 6 and 7 have not been replicated accurately in the model to date. The status of the five isolation valves identified in Table 3-24 greatly affects the model results. It is possible that some of these valves were not fully closed, thus resulting in significantly different hydraulic behavior than predicted by the model. The City has reopened these closed valves since the hydrant testing date.

Test no. 8, also in the Low Zone but not as affected by the closed valves, produced data that was accurately recreated in the model.

3.6.7.4 Model Input

Model input assumptions have significant impacts on peak hour and fire flow results. Table 3-26 provides the on/off status of each source during each model scenario and Table 3-27 provides the reservoir levels modeled for each scenario. For the purpose of this model, interties were used in lieu of groundwater sources as the location and production capacity of the new wells can very greatly.

During peak hour scenarios, all wells have been turned off, but the interties are operating and all reservoirs levels have been depleted of operational and equalizing storage. All fire flow scenarios and peak hour scenarios, with the exception of the 2004 industrial fire flow scenario, are modeled with no wells operating. While not required, this assumed model condition is conservative because it places a higher demand on the reservoirs and transmission system than if the wells were operating. However, industrial fire flows in the Junction area cannot be provided without additional flows from one well during the 2004 scenario. All wells currently have standby power generation available.

TABLE 3-26

Source Status During Model Scenarios

Storage Facility	Year Available	Source Capacity (gpm)	Fire Flow Scenario Status (1)	Peak Hour Scenario Status (2)
Well No. 7	2004	300	Off	Off
Well No. 8	2004	300	Off	Off
Well No. 9	2004	400	Off/On	Off
S 5th Street Intertie	2004	1,000	On	On
NW 279th Street Intertie (proposed)	2010	1,000	On	On
NW 289th Street Intertie (proposed)	2010	1,000	On	On
Future Wells (proposed)	2024	500	Off	Off

(1) All wells have been turned off during the fire flow scenarios, with the exception of the 2004 industrial fire flow scenario, to be conservative. However, industrial fire flows cannot be provided without one well operating.
(2) All wells have been turned off during peak hour scenarios because the system is able to provide adequate system pressures without the wells.

During fire flow scenarios in the High Zone, operational and equalizing storage was removed from the High School Reservoir and proposed Bellwood Reservoir. In an industrial fire flow scenario (3,000 gpm for 3 hours), the Junction BPS would operate both 1,000 gpm pumps. The existing Junction Reservoir would be empty in approximately 50 minutes (100,000 gal. / 2,000 gpm = 50 min.). The remaining fire suppression storage would then come from the High School Reservoir and CPU intertie. In the 2010 and 2024 scenarios, the Junction Reservoir has been upgraded to a 1,000,000 gallon reservoir and would remain partially full after three hours of booster station operation.

Fire flow scenarios in the Low Zone assume that all storage volumes are depleted from the Cemetery Reservoir. However, additional storage is available to the Low Zone from the High Zone through the PRV stations located in Abrams Park, the Cemetery, and Heron Ridge (proposed).

TABLE 3-27

Reservoir Levels During Model Scenarios

Storage Facility	Reservoir Height (ft)	Residential Fire Flow Level (ft)	Commercial Fire Flow Level (ft)	Industrial Fire Flow Level (ft)	Peak Hour Level (ft)
	2004 Scenarios				
Cemetery Reservoir	19.0	12.1	9.4	17.4	17.4
High School Reservoir	135.0	102.6	115.7	76.5	128.7
Junction Reservoir	25.0	25.0	15.8	0	25
	2010 Scenarios				
Cemetery Reservoir	19.0	10.6	7.9	15.9	15.9
High School Reservoir	135.0	94.6	107.7	81.6	120.7
Junction Reservoir (proposed) (1)	25.0	25	20.2	10.5	25
	2024 Scenarios				
Cemetery Reservoir	19.0	10.3	7.6	15.6	15.6
High School Reservoir	135.0	113.3	118.2	108.4	123.1
Junction Reservoir (proposed) (1)	25.0	25.0	20.2	20.2	25
Bellwood Reservoir (proposed) (2)	50.0	50.0	43.2	43.2	49.3

(1) The proposed Junction Reservoir is modeled as a 65 ft. diameter by 25 ft. tall reservoir.
(2) The proposed Bellwood Reservoir is modeled as a 58 ft. diameter by 50 ft. tall reservoir.

3.6.7.5 Peak Hour Demand Modeling Results

According to WAC 246-290, a water system must maintain a minimum pressure of 30 psi in the distribution system under peak hour demand conditions. The City's existing distribution system has been modeled under 2004, 2010 and 2024 peak hour demand conditions and the minimum pressures are provided in Table 3-28. The 2010 and 2024 peak hour scenarios include all projects as identified in the Fire Flow Analysis section. Results for all model nodes are included in Appendix K.

TABLE 3-28

Lowest System Pressures during Peak Hour Demand Conditions

Scenario	Low Zone	High Zone
2004 Peak Hour Pressure	43 psi	51 psi
2010 Peak Hour Pressure	42 psi	47 psi
2024 Peak Hour Pressure	42 psi	43 psi
Model Node	J-172	J-346
Node Elevation	160 feet	280 feet
Location	East end of Highland Street	Timm Rd, SW of I-5 exit 14

As shown in Table 3-28, pressures in the City's distribution system are at or above the minimum 30 psi requirement under peak hour demand.

3.6.7.6 Fire Flow Modeling Results

The DOH Water System Design Manual states that a water system should be designed to provide adequate fire flow under maximum day demand conditions, while maintaining a minimum system pressure of 20 psi. Table 3-29 provides a list of locations, their required fire flow, and the available fire flow for 2004, 2010, and 2024 scenarios. Complete fire flow results are available in Appendix K.

TABLE 3-29

Available Fire Flow during Maximum Day Demand Conditions

Pressure Zone	Location	Maximum Required Fire Flow (gpm)	Available Fire Flow Range (gpm)
2004 Scenario			
High	Bellwood	1,000	1,840 – 2,130
	High School	1,500	2,480 – 4,780
	Hillhurst	1,000	2,280 – 3,400
	SR 501	1,000	1,860 – 2,100
	Junction Commercial	1,500	2,560 – 3,610
	Junction Industrial	2,000	2,410 – 3,330
Low	Downtown	1,500	870 – 3,240
	Heron Ridge	1,000	1,720 – 1,850
2010 Scenario			
High	Bellwood	1,000	1,940 – 2,450
	High School	1,000	2,350 – 5,980
	Hillhurst	1,000	2,390 – 3,140
	SR 501	1,000	2,660 – 2,760
	Junction Commercial	1,500	2,510 – 4,310
	Junction Industrial	3,000	2,420 – 5,050
Low	Downtown	1,500	1,637 – 3,930
	Heron Ridge	1,000	2,920 – 3,320
2024 Scenario			
High	Bellwood	1,000	2,950 – 9,100
	High School	1,000	2,520 – 7,460
	Hillhurst	1,000	3,130 – 3,740
	SR 501	1,000	5,070 – 6,290
	Junction Commercial	1,500	2,890 – 7,490
	Junction Industrial	3,000	2,940 – 6,550
Low	Downtown	1,500	1,630 – 4,230
	Heron Ridge	1,000	2,920 – 3,510

Existing Fire Flow Analysis

The existing system can provide the residential fire flow and commercial fire flow to most areas. The residential fire flow deficiencies are the result of undersized local distribution piping. Although many areas of downtown are served by 4-inch water mains, the only residential fire flow deficiency is along Shobert Avenue. However, the commercial fire flow of 1,500 gpm cannot be provided in several areas in downtown. The hydrants located on Sargent Avenue at 4th Avenue and 6th Avenue, on Mill Street at 3rd Avenue and 4th Avenue, and on Simons Street at 3rd Avenue and 4th Avenue cannot provide 1,500 gpm.

The current fire flow requirement for the industrial park located around the Junction area is 2,000 gpm for two hours. The system is fully able to provide this flow from the Junction Reservoir and Booster Station, but only for a duration of 50 minutes. After 50 minutes, the Junction Booster Station is emptied and flow is supplied from the High School Reservoir and South 5th Street Intertie. However, without the Junction facilities, fire flows to the industrial area remain above 2,000 gpm if at least one well in Abrams Park is operating.

Figure 3-1 provides a graphical representation of the existing fire flow analysis.

2010 Fire Flow Analysis

As shown in the previous section, the existing system has several fire flow deficiencies. Without any improvements to the system, the available fire flow would decrease further with an increase in system demands. Chapter 2 projects a 120 percent increase in domestic demands in the six-year planning period. To correct these existing deficiencies while planning for anticipated growth requires additional storage and transmission facilities in addition to local distribution improvements. The available fire flow analysis results provided in Table 3-29 indicate the available fire flow in 2010, after several proposed system improvements have been implemented. Each project is discussed in further detail in Chapter 8, Capital Improvement Plan (CIP).

The six-year CIP eliminates all projected hydraulic deficiencies related to distribution capacity. Additional deficiencies may occur that are based on the physical condition of the water mains and other system facilities.

Figure 3-2 provides a graphical representation of the 2010 fire flow analysis.

2024 Fire Flow Analysis

The water system will expand during the twenty-year planning period as more development occurs. The City’s Capital Facilities Plan (CFP) provided a network of transmission piping to meet the demands of this growth. The transmission piping presented in the CFP was modeled as 12-inch water mains during the 2024 scenarios. Model results indicate that the transmission piping will provide adequate fire flow capacity.

In addition, a new reservoir will be constructed near the Bellwood development within the 20-year planning period. Although this reservoir is not necessary for any fire flow capacity deficiencies, it will improve the available fire flow to the High Zone.

Figure 3-3 provides a graphical representation of the 2010 fire flow analysis.

3.7 Summary of System Capacities

As stated previously in this Chapter, the City's current source and storage facilities are adequate to supply current demands, but will need improvements to continue to provide service to the growing community. Table 3-30 provides a summary of the existing source and storage capacities in terms of ERUs.

TABLE 3-30

City of Ridgefield Water Facility ERU Capacities

Facility	Total ERU Capacity
Water Rights	
Instantaneous	4,712
Annual	3,702
Source Capacity	2,373
Storage	3,208

3.8 Summary of System Deficiencies

Existing and future system deficiencies of the City of Ridgefield's water system are summarized below. Recommendations to correct the deficiencies listed below will be discussed in Chapter 8.

3.8.1 water quality

The City of Ridgefield is in compliance with all water quality monitoring requirements. Furthermore, all water quality results are in compliance with established MCLs.

3.8.2 water Rights

The City of Ridgefield has adequate water rights to serve the community through 2010 as shown in Table 3-12. After 2010, the City will need to obtain additional annual water rights or obtain water through the CPU intertie. The City will need approximately 1,938 acre-ft per year when looking at the twenty-year planning period.

The City has enough instantaneous water rights to last through 2012 as shown in Table 3-13, but the City will need an additional 2,567 gpm of instantaneous water rights by 2024.

The City should file a replacement well declaration with the Department of Ecology to increase the water rights on Well 9 to 400 gpm.

3.8.3 source of supply

The City of Ridgefield has adequate source capacity to provide the community through 2006 as shown in Table 3-16. After 2006, the City will need to obtain additional sources of water, whether that be through the CPU intertie, increasing source capacity at Abrams Park, transferring water rights to new wells, or a combination of these three options. By 2024 the City will need approximately 3,500 gpm of additional source capacity.

To improve system security, well houses should be constructed over each well and a new injection vault should be constructed for the Well 7 and 8 chlorine injection vault. Sump pumps with separate power supplies should be provided for each vault.

Existing wells that are not in use should be properly decommissioned.

3.8.4 storage

As can be seen in Table 3-18, the City of Ridgefield will not need additional storage in the Low Zone during the twenty-year planning period. Currently the High Zone does not need any additional storage to meet the storage requirements. The City will need to increase storage volume in the High Zone by 2010. By 2024, the City will need approximately 1,965,000 gallons of additional storage. Greater storage volumes will be required if the City's source capacity is not increased as shown in table 3-19. To encourage industrial development in the Junction Area, the City will construct storage within the six-year planning horizon to provide storage to support a fire flow in the Junction Area of 3,000 gpm for 180 minutes.

3.8.5 booster stations

The Junction Booster Station should be connected to the telemetry system. A programmable logic controller (PLC) and a dedicated phone line would be needed to connect the Junction booster station to the telemetry system.

The Cemetery booster station has multiple deficiencies. The CMU building, both 10 h.p. pumps, and building piping should be replaced due to their age and condition. Also, based on City staff comments, the adequacy of the power feed should be evaluated. The booster station should be relocated so that it has less suction piping and suction lift.

3.8.6 treatment

The treatment facility located at Abrams Park is functioning as intended. A separate room should be constructed for chlorine storage, day tanks, and metering pumps to reduce corrosion occurring on the electrical equipment inside the control building. The City should also increase chlorine storage capacity to reduce the operator time needed for maintaining the chlorination facility in the future.

The City of Ridgefield does not currently fluoridate its water. City staff would like to investigate the feasibility of adding fluoride to the water to improve dental health.

3.8.7 telemetry

The Junction Reservoir, Junction Booster Station, and the CPU intertie are not currently connected to the City's telemetry system. The telemetry system should be upgraded to include these components. This will facilitate data collection and recording, reduce operator time, and ensure prompt response in the event of a failure.

New flowmeters should be installed on the discharge of Wells 7 and 8 to accurately measure flow from these wells.

3.8.8 distribution system

The distribution system can meet all existing and projected demands while exceeding the minimum service pressure in most areas. However, it cannot provide adequate fire flow in to a few downtown areas. Local distribution projects along Mill Street and along several streets south of Pioneer are necessary to increase the fire flow availability and eliminate these deficiencies.

As the water system expands to accommodate growth, additional transmission mains will be necessary to serve these areas. All new transmission main will be sized in order to provide fire flow to the areas they serve, but will also improve the overall system reliability.

Chapter 4 – Conservation Plan

CHAPTER 4

CONSERVATION PLAN

4.1 INTRODUCTION

Minimum standards for water conservation planning are prescribed in House Bill 1338, commonly called the Municipal Water Law, and summarized in *Conservation Planning Requirements*, March 1994; Washington Water Utilities Council, Washington State Department of Health, Washington State Department of Ecology. This document describes the conservation efforts water systems must take to receive approval of water system plans and water rights permits.

A Conservation Plan, as defined by DOH, is divided into three parts:

1. Water Use Data Collection
2. Water Demand Forecast
3. Conservation Program

The specific requirements vary depending on the size of the community and competing demands for water in the region. This chapter includes the conservation measures recommended in the *Conservation Planning Requirements* for a Medium Water System, defined as a water system with 1,000 to 25,000 service connections. As shown in Table 2-2, the City had 807 service connections in 2003. The City is expected to have over 1,000 total service connections in 2005.

This Conservation Plan addresses water conservation issues within the City of Ridgefield water system service area. It provides background information and an analysis of current and recommended conservation activities. The demand forecast, presented at the end of the chapter, is a conservative estimate of the expected water savings from implementing the recommendations in the plan.

4.2 water use data collection

A summary of the water use data collection requirements for the City of Ridgefield is presented in Table 4-1. The DOH mandates these specific requirements for communities that have between 1,000 and 10,000 service connections. In 2005, the City of Ridgefield is expected to serve over 1,000 connections.

WATER USE DATA COLLECTION REQUIREMENTS SUMMARY

Required Data Type[1]	Unit(s) of Measure	Collection Frequency	Comments
Source of Supply Meter Readings	Gallons (gal)	Read daily. Report monthly and annual totals	Metered production data is recorded at the source on a daily basis and is tabulated monthly and yearly.
Import/Export from Emergency Intertie	Gallons (gal)	Monthly totals	Clark Public Utilities (CPU) meters the amount of water that passes through the CPU/Ridgefield Intertie. The total is reported monthly.
Wholesale water purchased/sold	Gallons (gal)	Monthly totals	The City of Ridgefield can purchase wholesale water from CPU. The amount is recorded monthly.
Peak Day / Peak Month	Gallons (gal)	Each year's peak day and month totals.	Production data is recorded daily. Peak day and peak month totals are reported monthly.
Unaccounted for Water	Gallons (gal)	Annual total	Calculated from production and billing records annually.
Accounted for Water	Gallons (gal)	Annual total	Calculated annually from meter consumption records.
Service Meter Readings	Gallons (gal)	Monthly totals	The City of Ridgefield reads all service meters bi-monthly.
Connections and Population Served	Number	Annual estimate	Connections come directly from billing records. Population is estimated from OFM data.
Water Rates	N/A	N/A	The City keeps past records as well as the current water rate structure.
Conservation Data	N/A	Annual	The City keeps records of conservation measures implemented each year.

(1) In 2003 the City of Ridgefield served 807 connections, as shown in Table 2-2. The City of Ridgefield is expected to have over 1,000 connections in 2005; therefore, water use data collection requirements are based on DOH 1994 Conservation Planning Requirements for a water system with 1,000 to 10,000 service connections.

4.3 Water demand forecast with conservation

A requirement of the water system plan is to implement a conservation goal for the City. The City will attempt to meet a conservation goal of 1% reduction per year over the next ten years. The City must attempt to realize more savings than this stated goal. In 2003, the City's lost and unaccounted for water was at 31%. In the event the majority of the lost and unaccounted for water is lost, the City could realize significant savings in the amount of water used. The City would conserve water and also reduce the amount it spends to produce enough water for its customers. Savings would be realized in terms of chemical costs for treating the water, power costs for pumping the excess water, and labor costs for operator time associated with the operation of the system. However, it is likely the large lost and unaccounted for water percentage is due to construction use and Fire District No. 12 training, which can be reconciled by requiring flow meters on tapped hydrants.

In the following forecast, it has been projected that the proposed conservation program will result in a reduction in both average and peak day demands of one percent each year for ten years. The revised water demand forecast is summarized in Table 4-2. The average day production without reducing L/UW has been modified from the Chapter 2 data in Table 2-10 to include 20.1% L/UW instead of transitioning to the 10% as indicated in Table 2-10. The average day production reducing L/UW assumes reducing L/UW to 10% by the use of flow meters for construction water and other conservation measures required to achieve 10% L/UW. The information presented in Table 4-2 shows that achieving a level of 10% L/UW will result in approximately a ten percent decrease in water production in ten years over the values previously shown in Table 2-10.

PROJECTED WATER DEMAND WITH CONSERVATION

Year	Service Area Projected Population (1)	Average Day Production Without Reducing L/UW (gpd)(2)	Average Day Production Reducing L/UW (gpd)(1)	Average Day Production With Conservation (gpd)	Average Day Consumption Reduction (gpd)
2005	2,094	422,400	416,500	412,300	4,200
2006	2,498	509,800	495,500	485,600	9,900
2007	2,902	597,400	572,300	555,100	17,200
2008	3,306	683,600	645,300	619,500	25,800
2009	3,710	802,400	734,900	698,200	36,700
2010	4,115	921,200	843,700	793,100	50,600
2011	4,475	1,035,300	948,200	881,800	66,400
2012	4,835	1,149,500	1,052,800	968,600	84,200
2013	5,195	1,263,600	1,157,300	1,053,100	104,200
2014	5,755	1,375,600	1,259,900	1,133,900	126,000

(1) Service Area Projected Population and Average Day Production Reducing L&UW are from Chapter 2, Table 2-10.
(2) Average Day Production Without Reducing L&UW is the Total Average Day Consumption from Chapter 2, Table 2-10, using 20.1% L&UW through the ten year period.

4.4 conservation program

4.4.1 Background Information

The City of Ridgefield serves residential, commercial, and industrial customers. Both residential and non-residential areas within the water system service area are projected to grow over the 20-year planning period, as discussed in detail in Chapter 2 of this plan. Associated with this development is a corresponding increase in water use.

Given the projected increases in water demand and the associated regulatory and capital improvements that will be required as a result, the City has sufficient incentive to pursue water conservation as part of its overall strategy to accomodate growth. The following discussion of required, provisional and recommended conservation measures is applicable to the City's public water supply system. Each measure is briefly defined and an explanation of any previous, current or proposed activities is provided.

4.4.2 Required Measures

The *Conservation Planning Requirements* state that conservation measures including source meter installation for all new or expanding public water systems needing additional water rights, and program promotion for all water conservation programs are required. A leak detection and repair program is also required for any water system whose *lost and unaccounted-for water exceeds 20%*. The Water Use Efficiency Rule goes into effect January 1, 2006, which limits the lost and unaccounted for water at 10%. The required portions of the City of Ridgefield Water Conservation Program are discussed further in the following sections under *Recommended Measures.*

4.4.3 Recommended Measures

The *Conservation Planning Requirements,* also recommend the following conservation measures for all medium public water systems:

A. Public Education
   1. Program Promotion
B. Technical Assistance
   1. Purveyor Assistance
   2. Customer Assistance
   3. Bill Showing Consumption History
C. System Measures
   1. Source Meters
   2. Service Meters
   3. Unaccounted Water/Leak Detection
D. Incentives/Other Measures
   1. Single-Family/Multi-Family Kits
   2. Nurseries/Agriculture
   3. Landscape Management/Playfields – Xeriscaping
   4. Conservation Pricing

4.4.3.1 Public Education

Program Promotion

Program Promotion is a required element of the City's conservation program. The *Conservation Planning Requirements* define Program Promotion as follows:

"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 or other printed material, informing customers, builders and contractors of new plumbing code regulations requiring efficient plumbing fixtures, and other efforts."

The City of Ridgefield does not currently provide conservation promotion materials with billing statements or in the annual Consumer Confidence Report (CCR). The City will begin including inserts in summer billings to promote conservation and a discussion regarding conservation in the CCR. Literature on conservation, including the DOH conservation brochure, is available to the general public at City Hall. The City's building code requires compliance with all applicable regulations, including current plumbing code, which requires the use of low flow fixtures.

4.4.3.2 Technical Assistance

All items under the Technical Assistance category are recommended, but not required elements of the City's Water Conservation Program.

<u>Purveyor Assistance</u>

The *Conservation Planning Requirements* define Purveyor Assistance as follows:

"Assistance from wholesale suppliers to aid wholesale customers in developing and implementing conservation programs tailored to their needs, and in carrying out the wholesale suppliers conservation program."

This would apply to any user of the water system who resells the water to other customers who are not direct customers of the City of Ridgefield. An example of this is individual mobile homes in a mobile home park. The City would assist the owner of the mobile home park to promote conservation to his mobile home park customers.

The City of Ridgefield will make water conservation brochures available to all customers. Wholesale purchasers of water from the City of Ridgefield are encouraged to get copies of these brochures from the City and distribute them to their customers. City water staff is also available on request to assist wholesale customers with water conservation program implementation.

<u>Customer Assistance</u>

The *Conservation Planning Requirements* define Customer Assistance as follows:

"Provide assistance and information to customers which facilitates water conservation."

The City of Ridgefield makes water conservation brochures available to all customers and requires compliance with plumbing code requirements as required under Program Promotion. City water staff is available on request to assist individual customers with water conservation.

<u>Bill Showing Consumption History</u>

The *Conservation Planning Requirements* define Bill Showing Consumption History as follows:

"Billings would show increase/decrease in water use over the same period from the previous year."

The City of Ridgefield water bills currently do not show consumption history. The City will try to incorporate this feature in the City's next billing software upgrade.

4.4.3.3 System Measures

Source Metering is required for all new or expanding public water systems needing additional water rights. All other items under the System Measures category are recommended, but not required elements of the City's Water Conservation Program.

Source Meters

The *Conservation Planning Requirements* define Source Meters as follows:

> "Install master source meters for all sources. Maintain periodic meter testing and repair program."

All three of the existing sources of supply are equipped with functional source meters. The City recently replaced Well No. 9's source meter in the Abrams Park well field.

The City will continue to monitor the source meters and will continue to calculate the net water production and unaccounted-for water. The City will also test these meters on an annual basis and service them to assure that they are functioning properly.

Service Meters

The *Conservation Planning Requirements* describes the installation of Service Meters as follows:

"Install individual service meters for all water users. Maintain periodic meter testing and repair program."

The City of Ridgefield currently meters all water customers. The City does not currently have a meter replacement and repair program. The City will implement a service meter testing and repair program to ensure accurate data collection.

Unaccounted Water/Leak Detection

The *Conservation Planning Requirements* describes Unaccounted Water/Leak Detection as follows:

> "Conduct a regular and systematic program of finding and repairing leaks in system mains and laterals. This includes on-site testing using computer-assisted leak detection equipment on water distribution mains, valves, services and meters."

The City of Ridgefield maintains records of water production and water sales. These records are used to annually estimate Lost and Unaccounted-For Water (L/UW). L/UW for 2004 was 20.1%, as indicated in Table 2-7. The L/UW in the City has steadily increased over the last three years, most likely due to the increase in the use of construction water. As noted earlier, hydrant meters will be used to account for construction water and promote the conservation of construction water. Also, an aggressive leak detection and repair program will be instituted to reduce the L/UW. As explained in Chapter 2, reducing the 20.1% L/UW to 10% over the next five years would result in significant decrease in unbillable water production and meet the requirements of the Water Use Efficiency Rule. A leak detection program will cycle every five years to allow deficiencies to be corrected.

4.4.3.4 Incentives/Other Measures

All items under this category are recommended program elements, with the exception that it is required that the City consider implementing a conservation rate structure.

Single-Family/Multi-Family Kits

The *Conservation Planning Requirements* define Single-Family/Multi-Family Kits as follows:

"Distribute kits containing easily installed water saving devices to single family residential homes and the owners and managers of apartment buildings and condominiums. Devices in kits could include shower flow restrictors, toilet water tank displacement devices, leak detection dye tablets, informational brochures, and other materials.

The City of Ridgefield will consider distribution of Single-Family/Multi-Family Kits to the existing residential units that may not have been constructed with low flow fixtures.

Nurseries/Agriculture

The *Conservation Planning Requirements* define Nurseries/Agriculture as follows:

"Encourage and/or require the application of current technology to water use practices of large agriculture/irrigation operations. Examples include nurseries and commercial agriculture. Moisture sensors, flow timers, low volume sprinklers, drip irrigation, weather monitoring, and other practices to increase irrigation efficiency could be installed."

The City of Ridgefield does not have any nurseries or agricultural operations on City water, but the City will require efficient practices in irrigation for commercial and industrial users.

Landscape Management/Playfields – Xeriscaping

The *Conservation Planning Requirements* define Landscape Management/Playfields – Xeriscaping as follows:

"Promote low water demand landscaping in all retail customer classes (private, public, commercial, industrial, etc.). Work with local nurseries to ensure availability of plants that achieve this objective."

The City of Ridgefield will promote xeriscaping for residential users. The City will require xeriscaping for commercial users through development standards.

Conservation Pricing

The *Conservation Planning Requirements* define Conservation Pricing as follows:

"Implement rate design techniques to provide economic incentives to conserve water. Rate setting is the responsibility of the public water system."

The City of Ridgefield currently has a rate structure that provides an economic incentive to conserve water. The base rate structure for the City is shown in Tables 4-3.

CITY BASE WATER RATES

Meter Size	Customer Class	Minimum Cubic Feet	Monthly Base Rate	
			1996-2004	2005
1” and Under	Residential	500	$17.25	$18.29
1” and Under	Commercial	0	$17.25	$18.29
1 ½”	Commercial	0	$23.36	$24.76
2”	Commercial	0	$35.26	$37.38
3”	Commercial	0	$63.03	$66.81
4”	Commercial	0	$103.42	$109.63
6”	Commercial	0	$201.19	$213.26
8”	Commercial	0	$319.60	$338.78
10”	Commercial	0	$571.30	$605.58
12”	Commercial	0	$917.58	$972.58

In addition to the base rates the City also charges a commodity charge. The commodity charges are added to the monthly base rate based upon the amount of water consumed per each billing. The commodity charges for the City of Ridgefield are shown in Tables 4-4.

CITY COMMODITY CHARGES

Customer Class	Minimum Usage for Charges to Apply (Cubic Feet)	Monthly Base Rate Per CCF	
		1996-2004	2005
Single Family Residential	500	$1.62	$1.72
Commercial	0	$2.06	$2.18
Industrial	0	$2.06	$2.18
Governmental	0	$2.06	$2.18

Additionally, a tiered approach to water rates has proven to be a successful water conservation approach and will be considered in the future.

4.5 Additional Conservation Measures

4.5.1 Commercial Water Audits

Commercial and industrial customers spend far more for water and sewer service than residential customers. Thus, water conservation would likely be highly attractive to commercial and industrial customer when it represents significant cost savings. Water savings by commercial and industrial facilities, not only lowers operating expenses for the customer, but also reduces the demand on the City’s water supply. Currently, commercial and industrial users account for almost 40% of the City’s water use, but these users are expected to grow significantly through the six and twenty year planning periods.

Performing commercial water audits generally requires specialized training to understand each customer’s operational processes. Water use can vary by customer and the operational processes can be highly technical. Staff could provide a survey form to the client prior to the visit, which enables the staff person to be better informed and able to address the customers needs. A consulting or engineering firm may be required to work on more complicated systems.

A sample Water Audit Worksheet is included in Appendix L. The worksheet would serve as a checklist during site visits.

4.6 Summary

The City will continue to implement the following required and recommended conservation measures:

- Source Meters
- Service Meters

THE CITY OF RIDGEFIELD WILL IMPLEMENT THE FOLLOWING RECOMMENDED CONSERVATION MEASURES:

- Program Promotion
- Purveyor Assistance
- Customer Assistance
- Bill Showing Consumption History
- Unaccounted Water/Leak Detection
- Single-Family/Multi-Family Kits
- Nurseries/Agriculture
- Landscape Management/Playfields – Xeriscaping

THE CITY OF RIDGEFIELD WILL CONSIDER RE-EVALUATING THE CONSERVATION PRICING TO PROVIDE AN EVEN GREATER INCENTIVE TO CONSERVE WATER. THE CITY WILL ALSO INSTALL SERVICE METERS AT ABRAMS PARK TO RECORD ANNUAL IRRIGATION USAGE AT THE PARK.

Establishing a service meter replacement program where 5% of the City's service meters are replaced annually will also increase the City's accountability of water. A service meter replacement program will be evaluated in the future.

CHAPTER 5

SOURCE WATER PROTECTION

CHAPTER 5

SOURCE WATER PROTECTION

5.1 OBJECTIVE

The objective of this chapter is to document the City's program for wellhead protection to protect and improve source water quality. This program identifies pollutant sources within a zone of contribution that may affect source waters. Protection of these sources can be accomplished through monitoring, limiting and controlling to the best extent possible all adverse effects. Specific criteria against which the adequacy of source water protection is measured are presented in the Washington Administrative Code sections 246-290-135, 668, and 690.

5.2 Wellhead Protection Program

The City of Ridgefield reduces the potential risk for contamination of groundwater within the identified wellhead protection area through the use of a wellhead protection program. The program identifies potential contaminant sources, describes procedures for notification, education and implementation of actions to protect the groundwater supply, and locally defined spill response procedures for spill incidents within the wellhead protection area. A program was developed in the 1996 Water System Plan, which provided suggestions to implement a fully functional Wellhead Protection Program. This document updates the original plan set forth in 1996.

5.2.1 Program Development and Implementation

The purpose of a wellhead protection program is to provide local utilities with a program for preventing groundwater contamination. A successful wellhead protection program consists of a number of components that must be developed before the plan can be fully implemented. The major components of the plan are described below and form the basis of the chapter that follows:

- A **Delineated Wellhead Protection Area** (WHPA) based on all reasonably available hydrogeologic information, including an assessment of susceptibility to contamination.

- An **Inventory** of all known and identifiable potential contamination sources within each wellhead protection area.

- A **Spill Response Plan** for each wellhead protection area containing documentation for coordination with local first responders (police, fire, HAZMAT team, etc.).

- **Contingency Plans** for providing alternate sources of drinking water in the event of contamination.

- A **Wellhead Protection Area Management Plan** to reduce the likelihood that potential contaminant sources will pollute the drinking water supply.

5.2.2 Susceptibility Assessment

Completion of a susceptibility assessment is an important initial step in selecting appropriate delineation methods to define wellhead protection area boundaries. Completion of the susceptibility assessment and submittal to the Department of Health (DOH) allows DOH to determine the susceptibility and vulnerability ratings. Sources that receive low susceptibility ratings may receive susceptibility waivers from DOH to reduce or waive the amount of required monitoring for volatile organic compounds (VOCs) and synthetic organic compounds (SOCs). Table 5-1 contains the susceptibility and vulnerability ratings for the City's sources. The susceptibility assessment surveys completed for the Ridgefield wells used the calculated fixed radius method for the WHPA delineations. Groundwater flow directions were not accounted for in the assessments performed. The completed susceptibility assessment forms were previously completed by City of Ridgefield for each of the production wells as part of the requirements for requesting waivers for Phase II and V monitoring required by the SDWA. The completed forms can be found in the Appendix M.

TABLE 5-1

City of Ridgefield Source Susceptibility and Vulnerability Ratings

Source	DOH Source #	Susceptibility	Vulnerability
Well No. 7	S11	Low	Low
Well No. 8	S08	Low	Low
Well No. 9	S09	Low	Low

Susceptibility ratings reflect the sensitivity of a water source to contamination from a variety of contaminant sources. The susceptibility rating is dependent upon factors such as well construction, hydrogeological conditions, and distances to known or suspected contaminant sources. Drinking water wells vary in their susceptibility to contaminants discharged at the surface. Wells with poor construction or improper surface seals have an increased susceptibility to contaminant migration into the saturated zone of the well. In addition, wells located in unconfined aquifers typically have a higher degree of susceptibility than deep wells in confined aquifers. Vulnerability ratings are specific to pesticide contamination. The vulnerability ratings are somewhat dependent on land use characteristics and reflect regional pesticide use and application practices.

5.2.3 Wellhead Protection Area

The purpose of delineating a wellhead protection area is to estimate the area capable of contributing contaminants to a pumping well. These areas are referred to as zones of contribution (ZOC) and provide a basis for focusing a community's groundwater protection efforts. Multiple methods are used to delineate zones of contribution, which predict the movement of groundwater. A groundwater model simplifies the characteristics of an aquifer in order to provide mathematical estimates of actual conditions. As the groundwater model is increasingly simplified the model becomes easier to use, but the results become less accurate. The most commonly accepted groundwater models for delineating a WHPA (zone of contribution) are the Fixed Radius, Analytical, and Numeric models.

The simplest groundwater model is based on the Calculated Fixed Radius (CFR) method. In the Calculated Fixed Radius method, the delineations are concentric areas around each well, calculated based on pumping data and known or assumed aquifer characteristics. The CFR method is the minimum acceptable delineation for groundwater sources as determined by DOH.

An Analytical model requires basic hydrological information including the direction of groundwater flow, gradient, and certain physical characteristics of the aquifer. These physical characteristics include the aquifer thickness, the rate at which the aquifer will transmit water (transmissivity), and whether the aquifer is confined or unconfined.

A Numeric model requires significantly more data than other methods. In Numeric modeling, a grid is superimposed over the study area. Each square in the grid, called a cell, is characterized by physical parameters which are estimated from data collected from a variety of sources. The sources may include well logs, geologic and hydrogeologic maps, geophysical data, groundwater elevation data, stream flow discharge, and meteorological data. The parameters used to define the hydrogeological characteristics of each cell in the study area include identification of the vertical relationship of each aquifer and confining layer, the transmissivity of each aquifer, the thickness of the fine grained materials which separate the aquifers, the annual recharge, the connection between surface water and groundwater, the relationship between the model area and the surrounding areas (boundary conditions), and lastly, the location and pumping rate of wells. The Numeric method generates more accurate results than the Fixed Radius or Analytical methods. However, Numeric models are relatively costly to develop. Consequently, Numeric models are more commonly used by large utilities, with complex aquifers, who have the resources to collect the extensive model input data required.

A Wellhead Protection Area (WHPA) is defined as the surface and subsurface area surrounding a groundwater source through which contamination can potentially travel and reach the source. WHPAs are based on zones of contribution, which are derived from the estimated time of travel required for a contaminant to move from the point of introduction into the water bearing formation to the source. The Washington Department of Health Wellhead Protection Program requires a WHPA to be subdivided into five zones, which include:

- A sanitary control zone of at least a 100-foot radius, unless engineering justification supports a smaller area (WAC 246-290-135). No source of contamination may be constructed, stored, disposed of, or applied within the sanitary control zone without the permission of DOH and the water purveyor.

- Four primary zones based on 6 month, 1-year, 5-year, and 10-year time of travel boundaries. These zones are referred to as the zones of contribution of the WHPA. Within this report, these zones will be abbreviated as $ZOC_{½}$ – six-month zone of contribution, ZOC_1 – one-year, ZOC_5 – five-year, and ZOC_{10} – ten-year zone of contribution.

- One buffer zone (if necessary) extending from ZOC_{10} to a groundwater divide and highlighting areas where the aquifer may be particularly susceptible or vulnerable to contamination.

The ZOC_{10} defines the boundary of the WHPA and defines the area to be inventoried and managed to reduce the risk of contamination.

5.2.3.1 Wellhead Protection Ordinance

The Ridgefield Municipal Code currently has Title 18.280.025, which limits the development with in the City Wells critical aquifer recharge areas. The critical aquifer recharge area is defined in the Municipal Code as lands within the ten-year zone of contribution (ZOC_{10}). The following list defines new developments that must demonstrate through the land use approval process that the proposed activity will not have any adverse impacts on groundwater in the critical aquifer recharge area based on the Safe Drinking Water Act and the Wellhead Protection Area Program pursuant to Public Water Supplies. Title 18.280.025 is included in Appendix N.

- Landfills
- Class V injection wells
- Radioactive disposal sites
- Surface mining operations

- Above and below ground storage tanks
- Facilities that conduct biological research
- Boat repair shops
- Chemical research facilities
- Dry cleaners
- Gasoline service stations
- Pipelines
- Printing and publishing shops (that use printing liquid)
- Below-ground transformers and capacitors
- Sawmills (producing over 10,000 board foot per day)
- Solid waste handling and processing
- Vehicle repair, recycling and auto wrecking
- Funeral services
- Furniture stripping
- Motor vehicle service garages
- Photographic Processing
- Chemical manufacture and treatment
- Creosote and asphalt manufacture and treatment
- Electroplating activities
- Petroleum and Petroleum products refining
- Wood products
- Golf course
- Regulated waste treatment storage disposal facilities
- Medium Quantity Generators
- Large Quantity Generator

5.2.4 Analysis

The Calculated Fixed Radius Method was used to analyze the wellhead protection area zones of contribution for the City of Ridgefield Wells. This method is the minimum acceptable method of delineation for public water systems. The following equation is applicable:

$$r = \sqrt{\frac{Qt}{\pi n H}}$$

where

r = Radius of ZOC_t
Q = Volume of water withdrawal (cubic feet per year)
t = travel time (½, 1 ,5 and 10 years)
n = Porosity = 0.22 (default value)
H = well screen interval (ft)

This equation was used to calculate zone of contribution radii for the six month (½ year), 1 year, 5 years and 10 year time horizons for the City of Ridgefield's wells. The value to be used for Q, the groundwater withdrawal rate, should be a value that will reflect the maximum annual withdrawal anticipated for each well. As noted in Chapter 3, the City has an annual withdrawal cap of 639 acre-feet per year. For the purposes of this analysis, the annual withdrawal used is the instantaneous withdrawal converted to acre-feet per year, as a conservative value. Current well information is detailed in Table 5-2.

Table 5-2

CURRENT CITY OF RIDGEFIELD WATER RIGHTS

SOURCE	Q_I (GPM)	CUBIC FEET/YEAR	SCREENED INTERVAL (FEET)
WELL NO. 7	300	21,080,214	36
WELL NO. 8	300	21,080,214	31.5
WELL NO. 9	400	28,106,952	37

Radius values calculated for the various times of travel are presented in Table 5-3.

Table 5-3

CITY OF RIDGEFIELD WELLHEAD PROTECTION ZONES OF CONTRIBUTION (CFR METHOD)

Time of Travel	Well No. 7 ZOC Radius, feet	Well No. 8 ZOC Radius, feet	Well No. 9 ZOC Radius, feet
6 month	650	700	740
1 year	920	980	1,050
5 years	2,060	2,200	2,340
10 years	2,910	3,110	3,320

The Wellhead Protection Area Map, Figure 5-1, shows the limits of the sanitary control zone and the six-month, one, five, and ten-year zones of contribution as determined by the CFR method.

5.2.5 Contaminant Source Inventory

An essential element of wellhead protection is an inventory of all potential sources of groundwater contamination in and around the delineated wellhead protection areas. The purpose of the inventory is to identify past, present, and proposed activities that may pose a threat to the wells, or surrounding area. Partial inventories may have already been conducted for other purposes, such as those discussed at the beginning of this chapter. For the inventory to be effective, a full accounting of all known and potential sources of contamination within the zones must be conducted and the information accurately mapped.

Other purposes for maintaining an inventory of potential contaminant sources are to help plan management strategies, establish a mailing list to notify businesses located within wellhead protection areas, and notification of agencies regarding inventory findings. An accurate description of inventory data sources is also necessary and can be used to update the management plan as required by WAC 246-290-135.

5.2.6 POTENTIAL CONTAMINANT SOURCES

Within a wellhead protection zone, there are many diverse activities that may contaminate an aquifer, thereby jeopardizing the water supply. It is important that these activities are properly inventoried and, if necessary, regulated to prevent degradation of the groundwater supply. Relevant activities include land use and zoning practices, landfills, commercial and industrial operations, underground storage tanks, septic tanks, dry wells and catch basins, as well as known sites of contamination. A discussion of these practices, their potential effects on groundwater, and the regulatory requirements which may apply are included in the following sections.

5.2.6.1 Landfills

A landfill is a disposal facility in which solid waste is permanently placed and is not a land treatment facility. Minimum functional standards for solid waste hauling are regulated by the Washington State Department of Ecology under WAC 173-304. These regulations set siting and closure criteria, performance standards, and operating requirements for landfills. The regulations are highly restrictive in that a proposed landfill site must meet a series of “fatal flaw” tests. A wellhead protection area would qualify as a fatal flaw, thereby prohibiting the construction of a new landfill.

Past landfill practices were not so restrictive, however. Abandoned and improperly maintained landfills and dump sites are often a major source of groundwater contamination. Leachate from landfills poses a threat to groundwater quality should it migrate to the water table. The Department of Ecology is responsible for mitigating dump site cleanup when potentially hazardous leachates are present.

According to long time City residents, land just east of the current City cemetery was previously used as a landfill. It is unknown when this facility was abandoned and if the facility was lined or capped. No other known landfills active or extinct are located within the City of Ridgefield wellhead zones of contribution.

5.2.6.2 Commercial and Industrial Activity

Areas of commercial and industrial land use are located within most wellhead protection boundaries. Businesses that may contribute contaminants to the groundwater include dry cleaners, gas stations and other businesses with fuel storage tanks, auto repair shops, metal plating facilities, asphalt and concrete facilities, and machine shops. Wastes generated at these businesses include substances such as petroleum products, solvents, surfactants, heavy metals, and other organic materials. These wastes can potentially enter the groundwater system through inadequate disposal practices or accidental spills. Table 5-4 presents typical commercial and industrial activities and the potentially hazardous chemicals that may be associated with them.

Table 5-4

CHEMICALS ASSOCIATED WITH COMMERCIAL AND INDUSTRIAL ACTIVITIES

Commercial/Industrial Activity	Potential Contaminants
Automobile/Truck Service	waste oils, solvents, acids, paints, soaps
Boat Yard/Marinas	detergents, gasoline, diesel fuels, batteries, oil, seepage from boat waste disposal areas, wood preservative and treatment chemicals, paints, waxes, varnishes, automotive wastes
Dry Cleaners	solvents (perchloroethelyene, petroleum solvents, Freon) spotting chemicals, (trichloroethane, methylchloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate)
Cemeteries	fertilizers, pesticides
Country Clubs/Golf Courses	fertilizers, herbicides, pesticides, swimming pool chemicals, automotive wastes
Electric/Electronic Equipment Manufacturers	nitric, hydrochloric and sulfuric acid, heavy metal sludges, ammonium persulfate, cutting oil and degreasing solvent, corrosive soldering flux, waste plating solution, cyanide, methylene chloride, perchloroethylene, trichloroethane, acetone methanol
Furniture/Wood Manufacturing	paints, solvents, degreasing and solvent recovery sludge
Metal Plating Shops	sodium and hydrogen cyanide, metallic salts, alkaline solutions, acids, solvents, heavy metal contaminated wastewater/sludge
Lawns and Gardens	fertilizers, herbicides, pesticides
Printers, Publishers	solvents, inks, dyes, oils, miscellaneous organics, photographic chemicals
Sand and Gravel Mining	diesel fuel, motor oil, hydraulic fluids
Scrap, Salvage and Junkyards	used oil, gasoline, antifreeze, polychlorinated biphenyl contaminated oils, lead acid batteries

The siting and operation of facilities which treat, store, or dispose of hazardous waste are subject to the requirements of the Resource Conservation and Recovery Act (RCRA), Subtitle C. In Washington State, the Department of Ecology regulates facilities which generate more than 220 pounds of hazardous waste per month under WAC 173-303, Dangerous Waste Regulations. The regulations are significant in that they establish a number of requirements for these facilities including surveillance and monitoring, record keeping, performance and design criteria, and siting and closure procedures. Ecology divides the facilities into three levels of hazardous waste accumulation: Level 1 facilities generate 2,200 pounds of waste per month or more; level 2 facilities generate between 220 and 2,200 pounds per month; and level 3 facilities generate less then 220 pounds. Level 3 generators are exempt from the regulations. All level 1 and 2 facilities must initially file a report of their activities with Ecology and update those activities annually. From these reports an identifier code is established for each facility. This code is required by a transporter to deliver or accept shipments. A summary of those activities are published annually by Ecology, thereby allowing water purveyors the opportunity to determine the types of activities present within their WHPA. Table 5-5 lists all of the potential contaminant sources known within the 10-year zone of contribution for all the City of Ridgefield well sites.

5.2.6.3 Underground Storage Tanks

Underground storage tanks (USTs) and leaking underground storage tanks (LUSTs) are a major threat to groundwater quality. Petroleum products which may contain impurities that are mobile in the groundwater system are the most commonly stored substances in USTs. The EPA estimates that 35 percent of all USTs could be leaking. The most common causes of leaks are structural failure, corrosion, improper fittings, and improper installation. Ecology regulates underground storage tanks in Washington State under WAC 173-360. The regulations require that owners and operators of underground storage tanks comply with the following sections of the regulations:

- Notification, reporting, and record keeping
- Performance standards and operating closure requirements
- Registration and licensing
- Financial responsibility

The WAC allows a number of exemptions including tanks whose capacity is 110 gallons or less, farm and residential tanks with less than 1,100 gallons, heating oil less than 1,100 gallons per premises, and septic tanks.

As of July 1, 1991, owners and operators of all existing nonexempt underground tanks must have a permit from Ecology. A valid permit is a requirement for delivery of regulated substances. The permit must be updated annually. As a condition of the permit, the owner must have completed the following requirements:

- An assessment of the tank condition by an Ecology licensed tank service provider. Replacement of leaking tanks and site cleanup.
- Installation of leak detection devices.
- Proof of insurance to compensate a third party in the event of bodily injury or property damage resulting from a leaking tank. One million dollars insurance is required for petroleum marketing facilities.

By 1998, all existing nonexempt underground storage tanks must provide cathodic protection and spill and overflow containment, in addition to the above requirements.

Installation and replacement of underground storage tanks must meet the specifications and performance and design standards identified in the WAC. Ecology follows the federal UST guidelines, which at this time do not require double wall vessels.

Underground storage tank inspections are performed by Ecology primarily through the information developed in the permitting process. Although routine annual inspections are not performed, Ecology inspectors do prioritize sites considered potentially hazardous. Technical assistance visits are also conducted at the request of the owner/operator. This provides another avenue in which Ecology can monitor the status of USTs.
Ecology maintains a file on all permitted USTs in Washington State, as required by RCRA, Subtitle 1. The file provides the site name and address, tank identification number, date of installation, size, tank status, and the substance stored at the site.

Multiple underground tanks were identified in the City of Ridgefield within the 10-year Zone of Contribution as shown in Table 5-5. It is important to note that the City of Ridgefield Wastewater Treatment Plant, which contains an underground storage tank, is located outside of the 10-year Zone of Contribution.

5.2.6.4 Clandestine Drug Labs

Clandestine drug labs have been becoming an increasing problem in many parts of the country. Labs that produce illicit drugs use a wide variety of solvents and toxic, caustic and acidic substances. Because their activities are strictly illegal they rarely dispose of wastes in an environmentally friendly manner. Therefore, these sites are potential sources of groundwater contamination. The Washington State Department of Health maintains a list of clandestine drug labs that have been discovered in the State. The list dated February 11th, 2005 contains four sites listing a Ridgefield address, however none are inside the WHPA. This list is not comprehensive because there is no way to know the location of sites that have not been discovered and closed.

5.2.6.5 Septic Systems

Clark County is responsible for regulating and permitting residential and small commercial on site sewage disposal systems within the county, excluding federal facilities. Contaminants associated with septic tank effluent include pathogenic organisms, toxic substances, and nitrogen compounds. Ammonia and nitrate nitrogen are highly soluble in water.

Old septic systems within the City limits may remain in use as long as they are not in a utility local improvement district and are not failing. The City of Ridgefield does not allow new septic tanks in the City limits. Currently there are six septic systems within the wellhead protection area. Septic system locations are shown in Figure 5-1.

5.2.6.6 Drywells, Catch Basins, and Improperly Sealed or Secured Wells

Stormwater serves as a source of groundwater recharge, but it can also be a source of groundwater contamination. Runoff from streets, parking lots and other impervious surfaces can contain heavy metals, hydrocarbons, petroleum products, pesticides, and animal wastes. Dry wells may be used for stormwater, septic waste, or other wastewater disposal at commercial, industrial, and multi-family residential sites. Dry wells and catch basins may be located along major transportation corridors. Contaminants generated along transportation routes, such as Interstate 5 and railroad corridors, include petroleum products, lead, hazardous chemicals and other emission products. Dry wells and catch basins are potential sites of contamination because their intended use often discharges contaminants directly into the groundwater. The City has many stormwater facilities throughout the WHPA. No drywells have been identified within the WHPA.

5.2.6.7 Accidental Spills in Transportation Corridors

Accidental spills or releases of contaminants can potentially impact groundwater supplies. Potential sources of spills and leaks include underground storage tanks, accidents in transportation corridors and poor disposal practices. State Route 501 passes through the City's ½, 1, 5 and 10 year ZOCs, and is a potential source of hazardous material spills. The Burlington Northern Railroad (BNRR) corridor also runs through the 10 year WHPA. The probability of a spill on the BNRR line contaminating the water supply is low due to its location on the other side of a ridge from the wellfield, downgradient from the City's source of supply, and its location at the edge of the 10 year ZOC. The third major corridor through the City's WHPA is a portion of the Olympic Pipeline, which runs north and south through the City's ½, 1, 5 and 10 year ZOCs. Refined petroleum products including diesel fuel, gasoline, and jet fuel, are transported through the City in a 14-inch steel pipe.

The Clark County Fire District (CCFD) No. 12 is the first responder to all spills of hazardous material within their jurisdiction. Depending on the extent of the spill, CCFD No. 12 will contact Clark County Regional Emergency Services Agency (CRESA) and CRESA will activate the Regional Hazardous Materials Response Plan. The Washington State Patrol Fire Marshal has responsibility for hazardous material spills on State and Federal highways and will coordinate any response in the event a spill occurs on SR 501.

Any contamination of a public drinking water supply requires notification to DOH and coordination of public notification with State as well as County Health Agencies. These procedures are further outlined in the Emergency Response section of Chapter 6.

5.2.6.8 Fertilizers and Pesticides

The use of fertilizers and pesticides throughout the City could also pose a potential threat to the water system. Land applications of fertilizers and pesticides are most likely to occur at the cemetery, Abrams Park, and the middle school within the WHPA. While it appears that past practices have not had any impact of the water system, Public Works staff should coordinate with maintenance crews and school district staff to ensure that fertilizers and pesticides are applied in a manner that will not adversely impact the water system

5.2.6.9 Confirmed and Suspected Contamination Sites

Under the Model Toxics Control Act Cleanup, WAC 173-340, the Department of Ecology is responsible for ensuring all hazardous waste sites are properly remediated. This includes confirmed and suspected sites of contamination as well as Leaking Underground Storage Tanks (LUSTs). A separate inventory for each, which includes the status of cleanup efforts, is maintained by Ecology. Ecology conducts an initial site investigation within 90 days of learning of a potentially contaminated site. If this investigation shows that remediation action is required, the site will appear on the Confirmed and Suspected Contaminated Sites Report. The sites are also given a Washington Ranking Mode BIN number between 1 and 5. A ranking of 1 indicates the greatest assessed risk to human health and the environment. The contaminant type and the affected media, such as groundwater, is also noted. Once the remedial action has been completed, Ecology's Toxics Cleanup Program determines if the site can be removed from the list.

Table 5-5 lists all of the potential contaminant sources known within the 10-year zone of contribution for all the City of Ridgefield well sites. This list combines information found on the Facility/Site Query and the CSCS database produced by DOE and information obtained from a windshield survey conducted March 2, 2005 by Gray & Osborne, Inc.

table 5-5

POTENTIAL SOURCES OF CONTAMINATION IN THE CITY OF RIDGEFIELD ZONES OF CONTRIBUTION

No. on Figure	WDOE ID#	Facility Name	Description
1	-	Abrams Park	Diesel Generator, Pesticides and Fertilizers
2	-	-	Fiber Glass Boat Manufacturer (Removed in the 1960's)
3	47557399	D & L Ent (Bob's Automotive)	Underground Storage Tank, Inactive LUST Facility (Oil, Gas, Used Fluids)
4	-	Heron Ridge Lift Station	Sewage Overflow
5	22484	Knapp Estate Property	Inactive LUST Facility, Inactive Independent Remedial Action Program, Underground Storage Tank
6	-	Ridgefield Cemetery	Fertilizer and Pesticides
6	-	Former Landfill	Potential solid and hazardous waste

7	-	Olympic Pipeline	Petroleum Transportation
8	16992216	Ridgefield School District Maintenance Shop	Underground Storage Tank (Petroleum Storage, Oil, Gas, Used Fluids)
9	1105153	Shaffer Property	State Cleanup Site
10	19614199	Symons Frozen Foods Inc	Inactive Underground Storage Tank
11	-	View Ridge Middle School and Union Ridge elementary School	Petroleum Products Storage, Fertilizer and Pesticides

5.2.7 Notification of Findings

The Water System will notify State and local agencies of the wellhead protection program's findings, including the wellhead area boundaries. The Water System will notify residents and customers within the contribution radii with a letter discussing risks to the water system and actions to be taken in case of a spill or accidental contaminant application. Any residents with on-site sewage disposal systems will also be sent notification of precautions they can take to minimize impacts from on site sewage disposal systems.

5.2.8 Inventory Data Sources

The inventory of potential contaminant sources was compiled using various data sources. AutoCAD maps from the City of Ridgefield were used to locate the sewer lines and storm drain lines. Agencies such as Ecology and EPA maintain contaminant databases which list businesses that handle and store potential contaminants. In addition, the following databases were used to create the inventory for the City of Ridgefield's WHPA:

- **Underground Storage Tank Report, (January 2005)**
  The most recent version of the Underground Storage Tanks Report was obtained from Ecology's Toxics Cleanup Program. This list was used to locate the facilities that contain underground storage tanks and verify facilities located by field surveys of the wellhead protection areas. These facilities are summarized in the inventories and located on the maps.

- **Leaking Underground Storage Tank Report, (March 2005)**
  The most recent Leaking Underground Storage Tank (LUST) Report was also obtained from Ecology Toxics Cleanup Program. This report was used to locate the leaking underground storage tanks on the wellhead protection area maps and note the status of remedial action at the site. The LUST report lists the site name, address, age, volume, and status of sites that contain leaking underground storage tanks.

- **Dangerous Waste and Materials Generators**
  This program, the EPA's RCRA program, has been delegated to Ecology within the State of Washington and is regulated under the Dangerous Waste Regulations (173-303 WAC).

- **Title III Facilities**
  Title III facilities are identified as those which generate, treat, store, or dispose of hazardous materials in sufficient quantity to pose a threat to the community. There are several different types of Title III facilities depending upon the amount of and the nature of the material handled. All of these companies must report to the County on an annual basis. This reporting was a result of the 1986 Superfund Amendments and Reauthorization Act. Title III was subsequently renamed to the Emergency Planning and Community Right to Know Act (EPCRA).

- **Confirmed and Suspected Contaminated Sites Report, (March 2005)**
  Ecology maintains the Confirmed and Suspected Contamination Sites Report. The list is

updated continuously as new information becomes available. Each site is given a site status code indicating the status of the cleanup process.

- **<u>Clandestine Drug Lab List</u>, (February 2005).** The Washington State Department of Health maintains a listing of clandestine drug labs that have been uncovered in the state. A current list and map of drug lab locations was obtained from the Department of Heath web site. Four sites with Ridgefield addresses were discovered, however none are known to be located within the wellhead protection areas.

- **<u>Septic Systems</u>**
  Clark County issues permits for all septic systems within the county, except those on federal facilities. The City of Ridgefield does not allow new septic systems within the City limits.

- **<u>Zoning and Land Use</u>**
  Electronic files containing zoning designations were obtained from the City of Ridgefield.

- **<u>Base Map File and City Sewer and Stormwater Information</u>**
  The City of Ridgefield maintain AutoCAD file base maps with sewer and stormwater overlays for their system.

Field surveys were conducted to verify, where practical, the potential contaminant sources indicated in the databases. Table 5-6 summarizes the potential sources of contamination found within the six month, one, five, and ten-year zones of contribution for all wells. These operations may pose a threat to groundwater if contaminants are spilled or leaked into the ground.

Table 5-6

POTENTIAL CONTAMINANT SOURCES WITHIN THE WELLHEAD PROTECTION AREAS OF ABRAMS PARK WELLFIELD (1)

Potential Source (2)	Six Month Zone of Contribution	One Year Zone of Contribution	Five Year Zone of Contribution	Ten Year Zone of Contribution
Underground Tanks				D&L Ent (Bob's Automotive), Knapp Estate Property, Ridgefield School District Maintenance Shop, Symons Frozen Foods Inc.
LUST Facility				D&L Ent (Bob's Automotive), Knapp Estate Property
Hazardous Waste Generators				
State Cleanup Site				Shaffer Property
Petroleum Storage	Abrams Park, Olympic Pipeline		View Ridge MS and Union Ridge ES	
Pesticide and Fertilizer Used	Abrams Park		View Ridge MS and Union Ridge ES, Ridgefield Cemetery	
Traffic Corridors	Pioneer Street (SR 501)			Burlington Northern Railroad

(1) For clarity, the potential sources of contamination shown in this table are only shown in the smallest ZOC.
(2) Potential sources of contamination shown are active and inactive as determined by the Department of Ecology.

5.2.9 Contingency Plan

Contingency planning is an important component of a wellhead protection program, however, planning alone cannot account for unanticipated incidents. A worst case scenario would be a contamination event which would render all the wells unusable. This scenario is possible given the distances separating the wells in Abrams Park. Should this happen, the City would be forced to rely on the intertie with Clark public Utilities (CPU). Ridgefield is currently in the process of adding two more 6-inch interties with CPU.

5.2.10 Spill Response Planning

Spill response planning is an important aspect of both an emergency management plan and a wellhead protection program. The release of hazardous materials in a wellhead protection area can create problems other than the initial contamination of soil and surface water. When the release occurs in either the one, five, or ten year zones of contribution, there is the possibility that the spill will eventually contaminate aquifers that supply the City's drinking water. Planning for spill response should reflect the needs and concerns of the community while maintaining the quality of the groundwater. Gaining community support in the preparation of a spill response program is important. Coordination of federal, state, and more importantly, local emergency response organizations is required as well.

Specific response procedures for wellhead protection areas must be determined prior to the occurrence of a contamination incident. The information obtained as a result of the susceptibility assessment and the wellhead protection area inventory can be used to determine what types of spill response measures are necessary for the protection of drinking water sources. In order to be accepted by local emergency responders, spill response procedures for wellhead protection areas should be realistic and easily implemented.

The following are examples of simple measures that can be taken during a spill/incident response to reduce the likelihood of groundwater contamination in a wellhead protection area.

- In wellhead protection areas, attempt to contain hazardous liquid spills by using absorbents to reduce infiltration into the ground.

- Do not allow spills to be routed into drywells for clean up.

In order for spill response procedures to be effectively executed, coordination, cooperation, and communication among the responding agencies, organizations, and individuals is imperative. There are many spill response organizations at the local, state, and federal levels. Depending on the magnitude and type of the release, any of the following organizations may be involved in a spill response for a wellhead protection area in Washington State.

- **Environmental Protection Agency (EPA)**
  The EPA is primarily responsible for all land spills including spills that occur on inland U.S. waters not under the jurisdiction of the United States Coast Guard.

- **City of Ridgefield**

The Clark County Fire District No. 12 is the first responder to any spills or releases of hazardous materials into the environment within city limits. Upon arrival at the scene, they will conduct an appropriate survey of the situation and call for assistance through the Clark County Regional Emergency Services Agency (CRESA), which is responsible for coordinating hazardous material response at the regional level.

- **Department of Ecology (Ecology)**
  Ecology's Spill Response Team is responsible for determining the source and cause of the release and the responsible party. If the responsible party is unknown, Ecology will investigate to determine who is responsible and ensure that containment, clean up, and disposal proceedings begin. Additionally, they have a 24-hour on call HAZMAT team should a spill occur. The DOE Spill Response 24-hour Hotline number is (360) 407-6311.

- **Department of Health (DOH)**
  The DOH is developing a set of standard operating procedures that first responders can use in wellhead protection areas, critical aquifer recharge areas, and other sensitive groundwater

areas. These standards were developed in conjunction with organizations such as Ecology's Spill Operations Section and the Association of Fire Chiefs. DOH also provides assistance through laboratory support and services, if necessary, to the clean up effort. The DOH 24-Hour Hotline number is 1-877-481-4901.

- **Washington State Department of Transportation (WSDOT)**
  WSDOT can provide spill response assistance through traffic control, equipment, and personnel for non-hazardous clean up activities on state and interstate highways.

- **Washington State Patrol**
  The Washington State Patrol is the "Incident Command Agency" for all spills on Interstate highways.

There are many spill response plans in existence in Washington State. These plans address specific geographical areas such as wellhead protection areas and types of materials such as oil discharges. Organizations involved in the storage and transport of hazardous substances have also been required to develop spill response plans. In addition, clean-up contractors are on call 24 hours a day to respond to spills. These plans are designed to be consistent and compatible with each other to ensure that response efforts are carried out effectively. Examples of the types of federal and state plans are listed below:

- **Oil and Hazardous Substance Pollution Contingency Plan for Federal Region Ten**
  This plan divides responsibilities among federal, state, and local governments; provides procedures for establishing local contingency plans; and provides procedures for response actions in accordance with the Clean Water Act and the Comprehensive Environmental Response, Compensation, and Liability Act.

- **Washington Statewide Master Oil and Hazardous Substance Spill Contingency Plan**
  This plan provides a means for coordinating statewide response to spills by Ecology and other state agencies.

- **Wellhead Protection Program Guidance Document-Spill/Incident Response Planning**
  As stated previously, the public water system is required to coordinate with local emergency responders, Ecology's Spill Operations Section, the local health department, and any local emergency planning committee.

These and other similar documents can be used for guidance in preparing a local spill response program for the City of Ridgefield.

5.2.11 SPILL RESPONSE PROGRAM

The City of Ridgefield is currently developing a Spill Response Program.

It is important that the City be notified of any spills occurring within the WHPA. To facilitate notification, the City must provide copies of the WHPA map to Clark County and Ecology. Accompanying each map should be a letter requesting that the agency in question notify the City in the event of a hazardous materials spill.

5.3 WELLHEAD PROTECTION AREA MANAGEMENT STRATEGIES

Wellhead protection areas have been defined and potential sources of contamination have been identified. In order for this to result in actual protection for Ridgefield's wells, a management plan must be put into place. The goals of a management plan are to:

- Reduce the likelihood that potential groundwater contaminants will be disposed, spilled, leaked or otherwise discharged in the wellhead protection area such that they could contaminate groundwater.
- Increase the likelihood that any potential groundwater contaminants that do get disposed, spilled, leaked or otherwise discharged in the wellhead protection area will get cleaned up before they reach the public water supply wells.
- Detect any groundwater contamination that may occur before public health is affected.
- Develop a plan of action in the event that Ridgefield's water supply should become contaminated.

5.3.1 Minimum Requirements

Minimum management requirements for wellhead protection plans are specified in WAC 246-290-135 (3)(c)(iv)-(vii). These requirements are as follows:

(iv) Notification to owners and operators of potential sources of contamination of the wellhead protection areas and the findings of the wellhead protection plan upon adoption of the plan and any time the plan is amended.

(v) Notification to regulatory agencies and local governments of the wellhead protection areas and the findings of the wellhead protection plan upon adoption of the plan and any time the plan is amended.

(vi) A contingency plan to assure water system customers will have an adequate supply of potable water in the event of temporary or permanent loss of the principal source of supply.

(vii) Documentation of coordination with local emergency incident responders including notification of wellhead protection area boundaries, results of susceptibility assessment, inventory findings and contingency plan.

5.3.2 Recommended Additional Actions

In addition to the minimum requirements in regulation there are some other measures that Ridgefield could take to enhance the effectiveness of the wellhead protection program:

- Include tenants of property in notification of potential sources of contamination.
- Make general information available for the public at City Hall regarding location of wellhead protection area and place signs on all major arterials regarding the boundary the WHPA.
- Public education regarding appropriate handling and disposal of potential groundwater contaminants.
- Public assistance for appropriate disposal of potential groundwater contaminants.
- Formation of a Local Wellhead Protection Committee.

5.3.3 Notification

The following parties must be notified of wellhead protection area boundaries upon adoption of the plan and any time the plan is amended: owners and operators of potential sources of contamination, regulatory agencies, local governments, and local emergency incident responders.

5.3.3.1 Notices to Owners of Potential Sources of Contamination

Several potential sources of contamination have been discussed above, including industrial and commercial activities, hazardous materials storage, underground storage tanks, septic tanks, accidental spills and confirmed and suspected contamination sites.

Information regarding the wellhead protection area will be provided to all property owners in the estimated ten-year zone of contribution. A map of the wellhead protection area and general information regarding proper disposal of potential groundwater contaminants would be appropriate. Information will be included in the City's annual Consumer Confidence reports. The Washington State Department of Health also has published materials available that Ridgefield will distribute and/or make available at City Hall to water system customers.

Notices will also be provided to the listed owners of potential sources of contamination shown in Table 5-6. These notices will be provided separately by mail. The notices will include a map of the wellhead protection area and general information on appropriate disposal of hazardous wastes.

5.3.3.2 Notification to Regulatory Agencies and Local Governments

It is required by regulation that notification be provided to regulatory agencies and local government. The following regulatory agencies and local government must receive a copy of this Wellhead Protection Plan:

Southwest Drinking Water Operations
2411 Pacific Avenue
PO Box 47823
Olympia, WA 98504-7823
Main phone: (360) 664-0768
FAX: (360) 664-8058
24-Hour Hotline number: (877) 481-4901

Clark County Health Department
Division of Environmental Health
P.O. Box 9825
Vancouver, WA 98666-8825
Main phone: (360) 397-8215

Dick Szymarek, Wellhead Protection Program Coordinator
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775
Emergency: 911
Main Phone: (360) 407-6000

Washington State Department of Community Trade and Economic Development
Division of Growth Management
906 Columbia Street SW
PO Box 48300
Olympia, WA 98504-8300
Phone: (360) 753-2222

5.3.3.3 Notification to Local Emergency Incident Responders

It is required by regulation that documentation of coordination with incident responders be provided. The following incident responders need to be contacted and provided with information regarding Ridgefield's WHPA:

Clark County Fire District No. 12
26506 NE 10th Ave.
Ridgefield, WA 98642
Business: (360) 887-4609
Emergency: 911

Eric Heinitz, Spill Response Program
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775
Business: (360) 407-6311

Bruce Hall, Chief of Police, Ridgefield Police Department
230 Pioneer Ave
PO Box 608
Ridgefield, WA 98642-0608
Emergency: 911
Business: (360) 887-3556

Clark Regional Emergency Services Agency
710 West 13th Street
Vancouver, WA 98660
Business: (360) 737-1911

Washington State Patrol District 5
11018 NE 51st Circle
Vancouver, WA 98682-6686
Business: (360) 260-6333
Emergency: 911

Clark County Road Operations
4700 NE 78th Street
Vancouver, WA 98665
Business: (360) 397-2446
Emergency: (253) 798-3842

5.3.4 PUBLIC EDUCATION AND ASSISTANCE

5.3.4.1 Public Notification
In order to inform the general public as well as aid emergency responders, the City will consider posting signs along all major roads at the boundaries of the WHPA. In addition, the City will consider posting maps of the wellhead protection area in prominent locations in City Hall and other select locations throughout City.

5.3.4.2 Hazardous Waste
Management of hazardous waste is a responsibility of every citizen. Ridgefield's wells are susceptible to contamination from improper waste disposal into septic systems or directly into the ground. The county hazardous waste program can be reached at:

Hazardous Waste Contact Number: 1-360-397-6118 ext. 4352
Email: solidwaste@clark.wa.gov

5.3.4.3 Septic Tank Management Assistance
Clark County Health Department runs the county septic system program. They can provide assistance regarding proper septic system design, operation and maintenance as well as what not to put down septic systems.

On-site Septic System Program: (360) 397-8215

5.3.5 Formation of a Local Wellhead Protection Committee

The DOH Wellhead Protection Program Guidance Document recommends the formation of a Wellhead Protection Committee consisting of:

- Jurisdictions with land use controls over the wellhead protection area
- Public water systems within the wellhead protection area
- Local planning agencies
- Regulatory agencies
- Tribes in the wellhead protection area
- Industrial, commercial and agricultural organizations
- Citizens groups

In the case of Ridgefield, the wellhead protection committee could be composed of citizen volunteers. A suggested meeting frequency would be quarterly or as needed. The purpose of the meetings would be to share information about wellhead protection program at State, County and City level, review activities and proposed development within the wellhead protection area and advise the City Council on wellhead protection issues.

5.4 recommendations

The following actions are recommended to enhance the protection of the City's water resources:

1. Distribute informational letters to property owners within the wellhead protection area.
2. Distribute advisory letters to potential sources of contamination.
3. Notify regulatory agencies and local governments regarding the location and extent of the City's WHPA.
4. Notify local emergency incident responders regarding the location and extent of the City's WHPA.
5. Develop a Spill Response Plan
6. Establish a local WHPA committee.
7. Enhance Public Notification Program by providing information regarding the WHPA at City Hall.
8. Enhance public notification by placing signs along SR-501 at the boundaries of the WHPA.

CHAPTER 6

OPERATIONS & MAINTENANCE

Program

CHAPTER 6

OPERATION & MAINTENANCE PROGRAM

6.1 OBJECTIVE

The objective of this chapter is to provide an evaluation of the City's operation and maintenance (O&M) program and its ability to assure satisfactory management of the water system operations in accordance with WAC 246-290 -100, -300, -310, -320, -440, -480, and -490, and WAC 246-292-020, -050, and -090. The City's Operation and Maintenance Manual and specific component related documentation are maintained by the City for use by operations personnel. This information is considered sensitive information and is not intended for general distribution to the public.

The O&M Program includes the following elements:

- Water System Management and Personnel
- Operator Certification
- System Operation and Control
- Comprehensive Monitoring Plan
- Emergency Response Program
- Safety Procedures
- Cross-Connection Control Program
- Customer Complaint Response Program
- Recordkeeping and Reporting
- O&M Improvements

The following comments are presented as an assessment of the adequacy of each section of the City's Operation and Management Program.

6.2 Water System Management and Personnel

The current Public Works Directior is Justin Clary, P.E. The current Public Works Supervisor is Frederick Crippen. Jim Strickler, Jeff Bolling and Nick Crockford are other water system operators.

6.2.1 Chain of Command and Organizational Chart

Figure 6-1 provides a general overview of the organization structure of the water utility.

6.2.2 Operator Certification

Department of Health (DOH) requires all Group A systems to have at least one certified Water Distribution Manager (WDM) under WAC 246-292-050. The WDM must further be certified at a level equal to or higher than the water system's classification rating as described in Table 6-1 and in accordance with WAC 246-292-040. The City currently serves approximately 2,200 people, which classifies the City as a Group 2 water system.

TABLE 6-1

Water System Group Classification

Classification	Population Served
Group 1	Less than 1,500
Group 2	1,501 to 15,000
Group 3	15,501 to 50,000
Group 4	Greater than 50,000

Additionally, the City is required to develop a Cross Connection Control (CCC) Program and must ensure that a Cross Connection Specialist (CCS) is responsible for overseeing the program and for periodic inspections of premises for cross-connections. Finally, the City must ensure that a Backflow Assembly Tester (BAT) is responsible for inspecting, testing, and monitoring backflow prevention assemblies in accordance with WAC 246-290-490. The City can perform these tests or can allow the customers to have their device tested by an approved BAT. Currently, the City requires owners to have devices tested by contractors annually. Table 6-2 provides a list of the maintenance personnel, positions and certifications.

TABLE 6-2

City of Ridgefield Personnel Certification

Staff	Position	Certifications
Frederick Crippen	Water System Supervisor	WDM (2) # 9889
Jim Strickler	Water System Operator	WDM (2) #5141
Jeff Bolling	Water System Operator	WDM (1) #9874
Nick Crockford	Water System Operator	CCS (1), WDM (2) # 4758

6.2.3 Professional growth requirements

In order to promote and maintain expertise for the various grades of operator certification, Washington State requires all certified operators meet professional growth requirements by completing no less than three continuing education units (CEUs) every three years. Programs sponsored by both Washington Environmental Training Resource Center (WETRC) and the American Water Works Association (AWWA) Pacific Northwest Subsection are the most popular source of CEUs for certified operators in Washington State. The professional growth requirement may also be met by advancement by examination or certification in a different classification.

6.3 system operation and control

The City staff is responsible for the daily operations of its wells, treatment facility, telemetry equipment, storage facilities, and distribution system.

6.3.1 Identification of Major System Components

There are various components of the City's water system that consist of three wells, two booster stations, three reservoirs, and the distribution system.

Figure 1-6 provides a schematic of the major system components.

6.3.2 major system components

6.3.2.1 Source of Supply

All three of the City's wells are located in Abrams Park.

Well No. 7

This well has an 8-inch diameter casing and is finished to a depth of 145 feet below ground surface (bgs). The well is equipped with a 40 h.p. pump with the capacity to pump 300 gpm. Water from Well No. 7 is pumped to the City's Low Zone. Well No. 7 is screened with a slot size of 0.03 inches from 145.5 feet to 166 feet and 171 feet to 186.5 feet below ground surface.

Well No. 8

This well has an 8-inch diameter casing and is finished to a depth of 153 feet bgs. The well is equipped with a 40 h.p. pump capable of producing 300 gpm. Water from Well No. 8 is pumped to the City's Low Zone. Well No. 8 is screened with a slot size of 0.03 inches from 130.5 feet to 193 feet below ground surface.

Well No. 9

This well has a 8-inch diameter casing and is finished to a depth of 162 feet bgs. The well is equipped with a 60 h.p. pump capable of producing 400 gpm. Water from Well No. 9 is pumped to the City's High Zone. Well No. 9 is screened with a slot size of 0.03 inches from 162.5 feet to 199.5 feet below ground surface.

Emergency Generator

The Abrams Park wellfield is equipped with an emergency generator adjacent to the control building. The generator is a diesel-powered generator with secondary containment. It is used to power the well pumps in the event of a power failure at Abrams Park.

Clark Public Utilities Intertie

The City of Ridgefield has an emergency intertie with Clark Public Utilities (CPU) located on the east side of I-5, within the city limits. The 6-inch intertie is pressure controlled to allow flow into the City water system in the event of low pressure emergencies.

6.3.2.2 Treatment

The City of Ridgefield voluntarily provides disinfection treatment with sodium hypochlorite to maintain a chlorine residual within the distribution system. Sodium hypochlorite is stored in twenty-gallon totes and fed from two 100 gallon day tanks located inside the telemetry building at Abrams Park. Water from Well Nos. 7 and 8 is disinfected with sodium hypochlorite from one day tank, with a diaphragm metering pump that pumps it into an injection point located in a vault west of the telemetry building. Water from Well No. 9 is disinfected with sodium hypochlorite from the other day tank with a diaphragm metering pump that pumps the chlorine into an injection point located in a vault to the east of the telemetry building. More information on the City's disinfection system can be found in Chapter 3.

6.3.2.3 Storage

The City of Ridgefield owns and operates three storage reservoirs that serve the water system. The High School Reservoir is a welded steel standpipe serving the High Zone and has an overflow elevation of 408 feet above mean sea level (MSL) and a capacity of 600,000 gallons. The Junction Reservoir is a 100,000 gallon concrete tank that has an overflow elevation of 282 feet above MSL. It is currently operated offline and is used to supplement flows from the High School Reservoir with the Junction Booster Station.

The third reservoir, the Cemetery Reservoir serves the Low Zone. It is a bolted steel reservoir with a capacity of 400,000 gallons. The hydraulic grade line for the Low Zone is based on the elevation of the overflow for the Cemetery Reservoir, which is located at 262 feet above mean sea level.

6.3.2.4 Booster Stations

The City of Ridgefield water system has two booster stations: the Junction Booster Station and the Cemetery Booster Station. The Junction Booster Station provides supplemental fire flow to the High Zone when needed. This booster station has three 50 h.p. pumps rated at 1,000 gpm and one 2 h.p. jockey pump rated at 10 gpm. Only two 50 h.p. pumps can be run at one time, producing a supplemental flow of 2,000 gpm. The 50 h.p. pumps are typically run annually to ensure proper operation. The jockey pump is used to maintain a chlorine residual inside the Junction Reservoir. The Junction Booster Station is currently not connected to the telemetry system except by an autodialer.

The Cemetery Booster Station is the other booster station used by the City. It is located adjacent to the Cemetery Reservoir and is used to transfer water from the Low Zone to the High Zone. The Cemetery Booster Station consists of two 10 h.p. pumps rated at 80 gpm each. This booster station is used on a regular basis for transferring water from the Low Zone to the High Zone as dictated by the telemetry set points.

6.3.2.5 Operation and Control

A discussion of the controls and telemetry of the City of Ridgefield water system is included in Chapters 1 and 3 of this Plan. In general, most reservoir and well sites were connected to the telemetry system via radio telemetry and telephone lines in 2001. The exception to this is the Junction Reservoir and Booster Station.

The City's water system is currently controlled by the water level in the Cemetery and High School Reservoirs. The water level inside the Cemetery Reservoir controls the well pumps for Wells No. 7 and 8. The water level inside the High School Reservoir controls the well pump for Well No. 9 and the Cemetery booster pumps. The set points for all wells and booster pumps are seasonally changed to encourage turnover during the low use months.

The Junction Reservoir and Booster Station are currently not connected to the City's telemetry system. However, the booster station has two on/off setpoints based on the pressure in the High Zone.

6.3.3 Water Quality Monitoring

The City receives a yearly statement from the Department of Health defining water quality tests and associated testing frequencies. The monitoring requirements are found in Appendix E. An analysis of the

City's most current test results can be found in Chapter 3. The City is also required to publish a Consumer Confidence Report (CCR) every year to explain any deficiencies the water system may have to its customers. A copy of the most recent CCR can be found in Appendix I.

6.3.4 Preventive Maintenance

In order to lengthen the amount of service from the various components of the water system, various preventative maintenance tasks are performed on a regular basis. Certain tasks are performed on a daily, weekly, monthly, quarterly, or yearly basis. The tasks associated with the water system include the following:

<u>Daily</u>

- Respond to customer inquiries.
- Respond to service requests.
- Monitor chlorine residuals.
- Monitor for leaks in the system.
- Monitor water level in the reservoirs.
- Record production of each well.
- Check level and fill chlorine day tanks.
- On-call 24 hours per day.

Weekly

- Inspect well and reservoir facilities.

Monthly

- Inspect the static and dynamic water levels and compute the specific capacity of the wells within the system.
- Read water meters (bi-monthly for residential meters).
- Complete monthly reports.
- Exercise booster pumps.
- Check alarms to ensure they are functioning properly.

Yearly

- Inspect all City-owned backflow prevention devices.
- Clean reservoir exterior.
- Inspect wellhead protection areas for contaminant sources.

Three to Five Years

- Drain, clean, and inspect reservoirs.

6.4 Emergency Response Program

Water utilities have the responsibility to provide an adequate and reliable quantity and quality of water at all times. To meet this requirement, utilities must reduce or eliminate the effects of natural disasters, accidents, and intentional acts. Although it is not possible to anticipate all potential disasters affecting the City's water system, formulating procedures to manage and remedy common emergencies is appropriate.

6.4.1 Water System Personnel Emergency Call-Up List

Table 6-3 is the emergency phone list. In the event of a contaminant spill, the phone list provided in the City's Wellhead Protection Plan under the heading Incident Response Management, should also be consulted.

TABLE 6-3

WATER SYSTEM EMERGENCY PHONE LIST

Agency/Group/Business	*Contact*	**PHONE NUMBER**
Fire/Police Emergency	--	911
City of Ridgefield Police Department	--	(360) 887-3556
Clark County Sheriff	--	(360) 397-2366
Washington State Patrol	District 5	(360) 260-6333
Clark County Fire District No. 12	--	(360) 887-4609
Electrical Contractor	CED	(360) 892-0907
Chemical Supplies	Cascade Columbia	(503)-625-5293
	Emergency Number	(503)-519-3016
Waterworks Supplies	Ferguson Enterprise	(360)-892-0907
Waterworks Supplies	National Waterworks	(360)-256-6151
Testing Lab (Coliform)	Addy Lab	(360) 750-0055
Washington State Dept. of Health	SW Regional Office, Belle Fuchs	(360) 664-0768
	24-Hour Emergency Number	(877) 481-4901
Washington State	Emergency Management	(800) 258-5990
State Wide One-Call	Utility Locates	(800) 424-5555
Ridgefield Public Works Shop Water System Supervisor	Main Line	(360) 887-3897
	Pager Number	(360) 699-2596
Gray & Osborne Inc.	Olympia Office	(360) 754-4266

6.4.2 emergency procedures

In the event that any of these situations should arise, the City has an intertie with Clark Public Utilities. The City may be able to receive water from this source while arrangements are being made to rectify the problem the City is experiencing with its water supply. Chapter 3 also discusses the possibilities of other sources of emergency water. The City utilizes the Clark County Regional Emergency Services Agency (CRESA) as its emergency management agency. CRESA also serves as the Local Emergency Planning Authority under the Superfund Amendments and Reauthorization Act (SARA) Title III (also known as the Emergency Planning and Community Right to Know Act – EPCRA) for communities in Clark County, including the City of Camas, the City of Washougal and the City of Vancouver. The CRESA website is:

www.co.clark.wa.us/emergency

In the event local capabilities to manage an incident are exceeded, the City will utilize mutual aid partners through the Clark County Regional Hazardous Materials Response Plan.

6.4.2.1 Contamination of Water Supply

In the event of intentional contamination of the City's water supply with a chemical agent, procedures outlined under accidental spill procedures in Chapter 5 should be followed with the following exceptions:

- Jurisdictional law enforcement officials should contact the Federal Bureau of Investigation

- The City should coordinate public notifications with DOH as well as jurisdictional law enforcement officials.

WAC 246-290-320 establishes specific procedures for water utilities to follow should bacteriological contamination be detected in the water system. These procedures are outlined in Figure 6-2. If the chlorine disinfection residual in the distribution system is lost, it may be necessary to batch chlorinate the reservoirs and flush distribution piping. For every 1.0 million gallons of storage, 18 gallons of 5.25 percent sodium hypochlorite, available as household bleach in the supermarket, can be added to 1.0 million gallons to provide a dose of 1.0 mg/L.

In the event of a suspected intentional contamination with a microbial agent, the protocols for intentional contamination shall be followed in addition to the procedures outlined here. Law enforcement authorities will need to be consulted prior to making public notifications.

Boil Water Notification

Emergencies such as floods, earthquakes, and other disasters can result in damage to water system infrastructure, thereby warranting a boil water notice as a cautionary measure. A suggested boil water notification form is presented in Appendix O. The City would issue the order through radio, television and newspapers serving the local area. Prior to the issuance of a boil water notice, the City should consider the experience gained by other communities in the past and contact DOH prior to the situation being announced to the media. A summary of pertinent information follows:

- An initial press conference should be held following issuance of the boil water notice to advise the public of the situation. All press releases will go the City's Public Information Officer.

- Consolidated press releases, announced on morning and evening television and radio news broadcasts, can also be used to keep the public informed.

- A 24-hour telephone hotline will be established to respond to public and media inquiries regarding the notice. The hotline should be staffed with knowledgeable representatives from the City and other governmental agencies. In order to maintain the consistency of information released, hotline operators should be provided with standard question and answer sheets and briefed as new information becomes available. The hotline should remain available for 24 hours after the boil water notice has been rescinded to provide relevant information and reassurance for concerned customers. All media inquiries shall be directed to the Public Information Officer.

- During a boil water emergency, DOH should be the jurisdictional agency contacted. Other State, County, and City agencies will be consulted prior to release of information to the public, including the Clark County Health Department. A consensus will be reached among the jurisdictional agencies regarding information to be released and actions to be taken. It is important not to release conflicting information so as not to confuse the public.

- Agencies and hot line phone operators should be aware of difficult questions that could be asked by the public or the press. A few examples follow:

  1. What other utilities are affected?

  2. What should be done about coffee and ice machines that use water directly from the system?

  3. How did the system get contaminated and what is being done about it?

- DOH will set guidelines for rescinding boil water notices. One example includes two consecutive days of no detection of Cryptosporidium, Giardia, or coliform bacteria in the system.

- Once the boil water notice is rescinded, a notice should be developed to inform the public regarding appropriate measures for use of the water supply including flushing of pipes and fixtures as required.

A thorough investigation of the contamination source should be conducted and strategies developed to avoid similar future occurrences. The public should be informed and given updates regarding investigation findings in order to restore confidence in the quality of water provided by the water system.

6.4.2.2 VOC/SOC and Inorganic Chemical/Physical Characteristics Detection Procedures

In the event of a volatile organic compound or synthetic organic compound event, a procedure to comply with DOH requirements is presented in Figure 6-3. A procedure for an inorganic chemical/physical characteristic detection is presented in Figure 6-4.

6.4.2.3 Power Failure

Various types of weather can cause a loss of power. These weather conditions include wind, lightning, freezing rain, or freezing snowstorm. Additionally, power can be lost through traffic accidents.

In the event of a power outage, public works staff will first check reservoir levels visually on a reader board at the Cemetery Reservoir, and monitor the High Zone pressure gauge at the Cemetery Booster Pump Station. The power company will be contacted to determine the length of the power outage. The Customers will be notified of the emergency and water conservation will be requested through radio, television, newspaper and/or police loudspeaker.

The City has auxiliary power to run the wells located at Abrams Park. The auxiliary power is in the form

of a diesel generator with secondary containment.

In the event of cold weather, a space heater in the telemetry building may be utilized to minimize damage to piping and electrical equipment.

6.4.2.4 Severe Earthquake

The County's assessment indicates that of all potential disasters, the City is most vulnerable to a severe earthquake. However, the ability of the City's water system facilities to withstand a major earthquake has not been fully characterized.

The Northridge earthquake, which struck on January 17, 1994, left the Metropolitan Water District of Southern California (MWDSC) facing a major disaster. Fortunately, the MWDSC had established emergency planning procedures that proved to be essential to restoring water service to its customers. Two essential components were an Emergency Response Center and pre-established reconnaissance patrols that were able to quickly conduct damage inspections. The MWDSC had also stockpiled considerable repair parts and materials in order to be virtually self-sufficient in an emergency. Following the Northridge earthquake, however, the MWDSC found that most parts and equipment were readily available via overnight shipping from around the nation, indicating that stockpiling does not need to be wholly relied on for effecting repairs.

The Pacific Northwest is a very seismically active area. The Clark County HIVA states that potential earthquake sources in Clark County are not well characterized because of their infrequent occurrence compared to California. Estimations of possible earthquake sources are limited to studies of many small earthquakes, investigations of known faults, and other geological surveys.

CRESA indicates that earthquakes in Clark County are most likely to originate from three sources: 1) the Mt. St. Helens seismic Zone 2) the Portland/Vancouver Seismic Zone and 3) the Cascadia Subduction Zone. Descriptions of each of these seismic zones are summarized from the Clark County HIVA below.

1. Mt. St. Helens Seismic Zone – This seismic zone is most commonly a source of several small earthquakes (<4 M). The strongest earthquake associated with this zone was the Elk Lake earthquake of February 13, 1981. This was approximately 5.5 M magnitude earthquake. While this was just a moderate earthquake it was felt over an area of about 104,000 km^2 that ran as far north as Ferndale, Washington and as far South as Salem, Oregon. Geologists suggest that the possibility exists for an earthquake as great as 6.5 M originating from this zone.

2. Portland/Vancouver - The Portland metropolitan area is the most seismically active region in Oregon in historic times. In the past 150 years there have been six earthquakes of magnitude 5 or greater. The Washington side of the seismic area is the second most seismically active area in Washington (the Puget Sound area is the most seismically active area in the state). The area between the Lacamas Creek Fault and the Portland Hills Fault borders this seismic region. The existence of the Portland Hills fault was only recently confirmed by the digging of the light rail tunnel through the West Hills of Portland. This discovery, matched with other geophysical studies suggest that earthquakes as large as 6 M or larger should occur in the Portland region every 300-350 years and an event of M 6.5 or larger about every 800-900 years. Earthquakes in this area present what may be the worst-case scenario for Clark County because the epicenters may be quite close. Geologists theorize there may be faults directly underneath the cities of Portland and Vancouver. Recent studies suggest that the epicenter for the 5.5 M earthquake in November 5, 1962 was located underneath the City of Vancouver.

3. Cascadia Subduction Zone - The Cascadia Subduction Zone lies about 50 miles offshore, extending from near Vancouver Island to northern California. The zone is where the

oceanic Juan de Fuca plate dives beneath the continental North American plate. These plates are converging at a rate of 1 – 1.5 inches per year.

CRESA considers the entire county population, property, commerce, infrastructure and services as vulnerable to an earthquake. The scope of damage will be a function of earthquake magnitude and level of preparedness. Damage could range from minimal to extreme loss of life and destruction of property.

Most injury, death, and property damage in an earthquake result from seismic impacts on structural and non-structural materials. The vulnerability of certain areas partially depends on the types of structures in that area. A wood frame residential structure that is adequately secured to the foundation is relatively safe. An un-reinforced masonry building is at greatest risk from seismic impacts. Most injuries in earthquakes result from non-structural materials such as light fixtures, equipment, and furniture, falling on people and causing injury.

Another factor in earthquake vulnerability is soil type. Water-saturated loose sand and silt lose their ability to support structures in an earthquake. Areas in Clark County that are near flood plains or areas with silt deposits are at the greatest risk during an earthquake.

Within the limits of predictability, CRESA assigns a high probability of occurrence for a damaging earthquake during the next 25 years. A large earthquake could have a catastrophic impact on Clark County suggesting high vulnerability. Accordingly, a high-risk rating is assigned. Earthquake response measures for the City's water system are shown in Table 6-4.

TABLE 6-4

SEVERE EARTHQUAKE RESPONSES

System Component	Proposed Actions
Reservoirs	• Observe structures for visual signs of structural damage. • If structural damage is apparent, drain reservoir and inspect the interior of the tank • Check storm drainage system for significant flows • If leakage is suspected, isolate one reservoir at a time and monitor water level for at least 24 hours
Distribution Lines	• Close valves to isolate breaks • Check reservoir level • Notify water customers of emergency and request water conservation
Transmission Lines	• Shut down source pumps • Isolate break and check the base water system section maps for valve locations • Repair break • Disinfect isolated section
Booster Stations, Wells, Treatment Facilities & Meters	• Inspect for joint leakage and leaking storage tanks • Inspect wells for operation • Inspect well seals to prevent contamination from entering the wellhead • Inspect for alignment of pump column and casing • Have a contractor inspect well screen integrity with a video camera
Supply Facilities	• Inspect for leakage or other structural damage

6.4.2.5 Major Fire

In the event of a major fire within the service area, low-pressure conditions could result in the extremities of the distribution system due to fire suppression demand. Proper functioning of pumps should offset this effect. In the event of fire or drastically low static pressures, the system setpoints of pumps and reservoirs should be changed to ensure all pumps are running.

6.4.2.6 Cold Weather Conditions

The most significant anticipated impact of a severe snowstorm is limiting access to the City's facilities. City personnel may not be able to access water mains, reservoirs or valves for maintenance and/or manual operation of system components. During a severe snowstorm the City will rely on the telemetry system for information on the major system components. Additional hazards to be considered with severe winter storms include:

- Freezing in City Reservoirs – Mitigated by ensuring continuous turnover.
- Water service line breaks – Mitigated by asking customers to be vigilant for flooding around homes and businesses.
- Roof Collapse on City buildings and reservoirs – Mitigated by observing snow levels and having City crews remove when snow load may be exceeded.

6.4.2.7 Floods

The Clark County HIVA states that floods are the most common disaster in Washington State and Clark County. The County's climate, topography, and geology are conducive to flooding. Normal annual precipitation ranges from 38 inches on the western floodplains to over 114 inches in the mountainous northeastern part of the county.

HISTORY OF FLOODING IN CLARK COUNTY AND ADJACENT AREAS

- **December 1933 –** The largest flood of record on the Lewis River.

- **May 30, 1948 –** Columbia River crested at 34.4 ft. Flood stage at that time was 15 ft. This is the flood that destroyed the City of Vanport. Vanport, with a population at the time of the disaster of 18,500, was the second largest city in Oregon. The destruction of the town occurred when a 600-foot section of dike protecting the settlement from the rising Columbia River broke. Unfortunately, few people evacuated Vanport prior to the dam rupture. Evacuation was hampered by the fact that there were very few good evacuation routes. Fifteen people died in the flood.

- **June 1956 –** Columbia River flooded due to snowmelt runoff.

- **January 1972 –** A combination of intense rainfall and snowmelt caused major East Fork of the Lewis River floods.

- **December 1977 –** Heavy rainfall and snowmelt caused flooding on the East Fork of the Lewis River. Salmon Creek had largest flood since gages were placed on Salmon Creek. The Washougal River also received its largest flood since gages were placed in 1944. This flood was an extremely rare event, greater than a 500-year flood.

- **February 8, 1996 –** The Columbia River crested at 27.1 ft. on February 9. This flood produced some of the worst flooding seen in the County since 1948. Approximately 1500 people were evacuated, and 177 homes were destroyed. This flood occurred because of the confluence of several factors. The winter of 1995/96 was extremely rainy. Prior to the flooding period, the region experienced a cold snap with low elevation freezing, ice, and snow. This was followed by a strong warming trend with heavy precipitation.

In Clark County, the weather that produces the most serious flooding events are extensive wet conditions that follow a period of mid and high elevation ice and snow pack development. Many rivers in Clark County historically flood every few years. These include the East Fork of the Lewis River, Washougal River, Salmon Creek, and the Columbia River. Flooding on these rivers usually occurs between October and February. Long periods of heavy rainfall and mild temperatures coupled with snowmelt contribute to flooding.

There are three types of flood threats:

- Riverine
- Tidal
- Flash and Surface

The greatest threat of flooding in the City will be flash and surface flooding due to inundation of stormwater collection and conveyance systems. This may impact the water system operation through a number of mechanisms, including:

- Restricting access to water system facilities due to flooded streets
- Flooded valve and meter vaults

- Flooded City facilities
- Increasing groundwater levels that threaten contamination of leaking underground water lines

Actions the City will consider depending on the extent of flooding and the risks that might be mitigated include:

PRE-FLOOD

- Sandbagging around essential City facilities
- Securing large pieces of equipment and materials that could be carried off by floodwaters
- Raising electronic equipment and computers off the floor
- Moving valuable records to locations expected to remain dry

POST-FLOOD

- Checking coliform levels in the water system for contamination (see incident specific plan for bacteriological contamination)
- Inspecting meters and PRV stations to ensure proper operation
- Cleaning debris from around reservoirs

Historically, flooding occurs along one or more of the County's waterways every few years, suggesting a high probability of occurrence. Because of the relative land area and population affected, the County is exposed to moderate vulnerability. Although the vulnerability is moderate, the frequency of flooding, the potential for simultaneous flooding events, plus the historical record of recurrent flooding and cumulative costs, all suggest the assignment of a high risk rating. Flood response measures for the City's water system are shown in Table 6-5.

TABLE 6-5

SEVERE FLOOD RESPONSES

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Transmission and distribution mains could be affected by landslides or high water levels. City staff transportation for monitoring the system and making repairs may be limited.	Monitor possible areas of concern for waterline conditions. Monitor waterline bridge crossings for possible damage. Prepare to valve off any washed out or damaged waterlines. Contact DOH.
Storage Facilities	Minimum physical/structural impact due to locations. Flooding could cause elevated coliform levels in water system.	Monitor coliform levels. Contact DOH to advise of acute of nonacute coliform violations.
Booster Stations	Minimal operational impact.	None.
Wells	Facilities could be overwhelmed by flood waters.	Prepare to disconnect any well affected by flood waters. Contact DOH.

6.4.2.8 Distribution System Low/High Pressure

The water surface elevation in the storage reservoirs and booster station settings control distribution system pressures. Under normal conditions, the reservoir overflow levels set the maximum pressure within the City. The following table proposes investigative and corrective actions for both low and high pressure conditions. Distribution system high/low pressure response measures for the City's water system are shown in Table 6-6.

TABLE 6-6

DISTRIBUTION SYSTEM HIGH/LOW PRESSURE RESPONSE

SYSTEM COMPONENT	PROPOSED ACTIONS	
	HIGH PRESSURE	LOW PRESSURE
Reservoirs	• Check reservoir levels • Manually throttle discharge valves on pump	• Check reservoir levels • Check drain line • Check for leakage
Distribution and Transmission Lines	• Excess pressure may cause damage to some older pipes. Open hydrants at various locations to reduce system pressure • Check status of pressure reducing valves	• Contact City Hall, Fire and Police Departments • Demands due to fires, open hydrant or peak demands may be the cause. • Check roads, storm drainage facilities and sewer manholes along distribution system for excessive flows, that would indicate a broken main.

6.5 CROSS CONNECTION CONTROL PROGRAM

Water utility purveyors have the responsibility to protect customers from water contamination due to cross connections, as required by WAC 246-290-490. A cross connection is any physical arrangement where the potable water supply is connected, directly or indirectly, to any liquid, gas, or solid of unknown or unsafe quality that may contaminate the public water supply through backflow. The regulation also requires utilities to develop and implement a comprehensive program to control cross connections within the system.

6.5.1 Water System Cross Connection Control Program

The City of Ridgefield adopted Ordinance 521 in 1998 which is codified in Chapter 13.15 of the City Municipal Code. This ordinance is intended to protect the water supply from contamination; prohibit cross-connections; require backflow prevention devices; require landowners or water users receiving its water supply from the City to conform to applicable regulations of the City; and adopt state standards for cross-connection control regulation. Chapter 13.15 is included as Appendix P.

The City's Cross-Connection Control Program establishes minimum standards for the City to protect the public potable water supply from possible contamination due to cross connections. The Program addresses authority, responsibility, requirements, administrative procedures, minimum requirements, record keeping, and standard forms and letters.

The City Engineer conducts plan reviews and is in charge of record management, while the building inspector surveys new facilities, and the water system operators interact with customers to educate and deal with compliance issues. The City utility clerk maintains a list of devices installed throughout the City. The utility clerk also maintains a list of certified contractors, which is mailed to the customers along with the reminder for annual BPA testing. After annual testing is completed, the results are sent to the utility clerk for entry into the BPA records. The following records are included in these files:

- date of inspection
- results of inspection

- recommended protection
- list of approved assemblies
- test and maintenance reports
- list of certified testers
- customer account number, billing address, service address, phone numbers, device history, and maintenance records

The City's cross connection control program was implemented by identifying a priority list of services considered potentially hazardous to the water system in the event of back siphonage within the distribution system. An inspection of the premises was conducted by City personnel to evaluate the existing hazard. The inspection established the level of potential hazard and the protection required. Recommendations were then prepared by the City as to what type of cross connection control devices, if any, were required. A copy of the letter, together with a time frame for compliance, was sent to the customer. City staff resurveyed premises at the end of the scheduled time frame to verify compliance. Due to changes in personnel at the City in the last several years, the City should re-conduct a survey of potentially hazardous services to verify that all potential cross connections have been identified and addressed.

6.5.2 cROSS-cONNECTION cONTROL pROGRAM rEQUIREMENTS

WAC 246-290-490 lists 10 minimum elements of a cross-connection control program required for water purveyors. The following paragraphs describe the requirement and summarize the action taken by the City for each element. Table 6-8 also summarizes these requirements and provides a description how the City currently addresses each element of this regulation.

Element 1

Element 1 requires the purveyor to establish legal authority, describe the operating policies and technical provisions, and corrective actions used to ensure that consumers comply with the purveyor's cross-connection control requirements. Chapter 13.15 of the City Municipal Code requires landowners or water users receiving its water supply from the City to conform to applicable regulations of the City.

Element 2

Element 2 pertains to the implementation procedures and schedules for evaluating new and existing connections. Currently, the City conducts a review of all new connections during the project approval process. Existing connections retained from the previous year, are tested by certified contractors and included in the device database. A post-construction site visit is completed by the CCS to verify backflow prevention assemblies (BPAs) have been installed.

Element 3

Element 3 pertains to the procedures of eliminating cross-connections whenever possible or ensuring approved backflow presenters are installed when necessary. The City conducts a review of all new connections to the water system and ensures approved backflow prevention devices are installed.

Construction activities are also a concern for cross-connections. The connection to a hydrant during construction activities provides a potential cross-connection hazard that can easily be avoided. The use of an approved BPA should be required for all temporary connections to the City's water system to prevent back siphonage.

Element 4

Element 4 pertains to the purveyor ensuring that at least one person certified as a CCS is employed to help develop and implement the CCC program. Currently Mr. Nick Crockford is the CCS for the City of Ridgefield water system and the City Engineer, Mr. Steve Wall, manages the program.

Element 5

Element 5 is designed to ensure that approved backflow preventers are inspected and/or tested as required. Currently, annual testing for BPAs is the responsibility of any property owner with a BPA on said property. The owner then hires an approved BPA testing contractor to complete the BPA testing and submits the results to the City. All information required by DOH is included on the result slip submitted to the City after BPA testing has been completed.

Element 6

Element 6 requires the development and implementation of a backflow prevention assembly testing quality control assurance program, including, but not limited to, documentation of tester certification and test kit calibration, test report contents, and time frames for submitting completed test reports. As noted previously, property owners are responsible for testing of the BPA's on their own. All documentation of tester certification, kit calibration, and test reports are included in the result slip submitted to the City.

Element 7

Element 7 requires the purveyor to develop and implement procedures for responding to backflow incidents. The City currently does not have procedures in place for responding to backflow incidents. In the event of a backflow incident, the City must meet the minimum record keeping and reporting requirements listed below.

- Notify DOH no later than the end of the next business day when a backflow incident is known to have contaminated the public water system or occurred within the premises of a consumer served by the water system.
- Document details of backflow incidents on a backflow incident form similar to the form included in the most recent edition of the PNWS-AWWA Manual.
- Include all backflow incident reports in the annual cross-connection program summary report required by WAC246-290-490.

Element 8

Element 8 requires a consumer education program on cross-connection control. The City does not currently provide billing inserts or have information available at City Hall regarding cross-connection control. Using billing inserts in an attempt to educate customers regarding the cross-connection control program would be one alternative to attempt to meet the requirements of Element 8.

Element 9

Element 9 pertains to the record keeping of cross-connection control records. As mentioned previously, the City maintains a list of cross connection control devices on file in their computer network. All new cross connections are added to the list as they are constructed.

Element 10

Element 10 pertains to purveyors distributing or receiving reclaimed water. Currently the City of Ridgefield does not use reclaimed water. If the City is expecting to use reclaimed water in the future, any cross-connection control requirements imposed by DOH under the required permit for the use of reclaimed water will need to be met.

TABLE 6-8

MINIMUM ELEMENTS OF A CROSS-CONNECTION CONTROL PROGRAM AS REQUIRED BY RCW 246-290-490

ELEMENT NO.	*DESCRIPTION*	CITY OF RIDGEFIELD COMPLIANCE
1	The purveyor shall adopt a local ordinance, resolution, code, bylaw, or other written legal instrument to establish legal authority, describe the operating policies and technical provisions, and corrective actions used to ensure that consumers comply with the purveyor's cross-connection control requirements.	Complete – The City has adopted a Cross Connection Control ordinance.
2	The purveyor shall develop and implement procedures and schedules for evaluating new and existing service connections to assess the degree of hazard posed by the consumer's premises to the purveyor's distribution system and notifying the consumer within a reasonable time frame of the hazard evaluation results.	Complete – The City completed an initial survey and conducts an evaluation of new service connections.
3	The purveyor shall develop and implement procedures and schedules for ensuring that: (i) Cross-connections are eliminated whenever possible; (ii) When cross-connections cannot be eliminated, they are controlled by installation of approved backflow preventers commensurate with the degree of hazard; and (iii) Approved backflow preventers are installed	Complete – Procedures for the elimination of cross-connections and installation of BPAs are established in Chapter 13.15 of the City's Municipal Code.
4	The purveyor shall ensure that personnel, including at least one person certified as a CCS, are provided to develop and implement the cross-connection control program.	Complete – The City has a certified Cross Connection Control Specialist on staff and the City Engineer manages the cross connection control program.

TABLE 6-8 (CONTINUED)

MINIMUM ELEMENTS OF A CROSS CONNECTION CONTROL PROGRAM AS REQUIRED BY RCW 246-290-490

ELEMENT NO.	DESCRIPTION	CITY OF RIDGEFIELD COMPLIANCE
5	The purveyor shall develop and implement procedures to ensure that approved backflow preventers are inspected and/or tested (as applicable) as required.	Complete – Annual BPA inspection is done by contractors who submit the results to the City.
6	The purveyor shall develop and implement a backflow prevention assembly testing quality control assurance program, including, but not limited to, documentation of tester certification and test kit calibration, test report contents, and time frames for submitting completed test reports.	Complete – City staff maintains the required documentation.
7	The purveyor shall develop and implement (when appropriate) procedures for responding to backflow incidents	Incomplete – Incident response procedures have not yet been established.
8	The purveyor shall include information on cross-connection control in the purveyor's existing program for educating consumers about water system operation. Such a program may include periodic bill inserts, public service announcements, pamphlet distribution, notification of new consumers and consumer confidence reports (CCR).	Incomplete – CCC program education not currently included in billing statement or other forms of distributed material.
9	The purveyor shall develop and maintain cross-connection control records including list of devices.	Complete – Inventory is complete of known assemblies.
10	Purveyors who distribute and/or have facilities that receive reclaimed water within their water service area shall meet any additional cross-connection control requirements imposed by the department under a permit issued in accordance with chapter 90.46 RCW.	Not Applicable

6.6 OPEration & Maintenance Improvements

The City of Ridgefield Public Works water system staff is current with all certifications and training requirements. The staff is in charge of a growing water system, which requires significant time and effort to operate and maintain. In addition to the current maintenance performed by water system staff, the following recommendations are made to improve the overall operation and maintenance of the City's water system.

Basic Maintenance and Operations Recommendations

- Establish an electronic database containing all testing results.

Cross Connection Control Program

- Re-conduct a survey of potential hazardous services to verify all cross connections have been identified and addressed.
- Develop incident response procedures for backflow incidents.
- Provide educational material to the consumers via billing inserts or by making information available at City Hall.
- Ensure BPA's are used during construction connections to the water system. Also, require flow meters in conjunction with BPA's to reduce lost and unaccounted for water.

CHAPTER 7

Distribution Facilities

DESIGN AND CONSTRUCTION STANDARDS

CHAPTER 7

DISTRIBUTION FACILITIES
DESIGN & CONSTRUCTION STANDARDS

7.1 Objective

The objective of this chapter is to document the City of Ridgefield's design and construction standards to allow the City to obtain DOH approval to utilize the submittal exception process for water distribution facilities. Through this process, a purveyor needs no further approval from DOH for distribution related projects. Source of supply facilities, booster pump stations, and reservoirs are not eligible for the alternative review process

This chapter includes the following elements:

- System Standards, Policies and Procedures
- Project Review Procedures
- Policies and Requirements for Outside Parties
- Design Standards
- Construction Standards
- Construction Inspection Procedures
- Preparation and Retention of Design and Record Drawings

The majority of these items can be found in the City's *Engineering Standards for Public Works Construction* (March, 2005), located in Appendix Q.

7.2 System Standards, Policies and Procedures

The City has developed design and construction standards, *Engineering Standards for Public Works Construction* (March, 2005) for:

- Any improvement within the public right-of-way and/or public easements,
- All improvements required within the proposed right-of-way of new subdivisions,
- All improvements intended for maintenance by the City, and
- All other improvements for which the City Code requires approval from the Public Works Department.

Appendix Q includes copies of the water design and construction standards from the City's *Engineering Standards for Public Works Construction*.

7.3 Project Review Procedures

Project reports and construction documents are submitted to the City Engineer and the Public Works Director for review and approval. Construction documents that do not meet the standards are returned for resubmittal if the deviation is significant, or returned with corrections noted if the deviation is minor. Construction may not proceed unless the Public Works Director signed the drawings “Approved.”

7.4 Policies and Requirements for Outside Parties

The policies and requirements for development within the City can be found in Appendix Q. These are taken from the *Engineering Standards for Public Works Construction Vol. 1* (March, 2005). Included in the Appendix are written descriptions of the policies regarding the water system and also standard details which show the requirements.

Any project that needs to be approved by the City has to meet these requirements.

7.5 Design Standards

Appendix Q includes copies of the water design standards from the City’s *Engineering Standards for Public Works Construction Vol. 1*.

Any improvements not specifically covered by the City’s Public Works Standards must meet or exceed the *2004 Standards Specification for Road, Bridges, and Municipal Construction*, and any current amendments to said document.

7.6 Construction Standards (materials and methods)

Appendix Q includes copies of the water construction standards from the City’s *Engineering Standards for Public Works Construction Vol. 2* (March, 2005).

7.7 Construction Inspection Procedures

The City inspects all new construction during and after construction to ensure that the projects are constructed in accordance with the construction standards. This inspection includes being present during pressure test procedures and, if applicable, disinfection procedures and water quality sampling procedures to ensure that all have been properly performed. As-builts of the final system are to be submitted for each project. Service will not be provided until all requirements are satisfied.

If a Construction Report is required for the project by WAC 246-290-040, the developer for the new development prepares the Construction Report. New development Construction Reports are submitted to the City Engineer and the Public Works Director for review and approval.

7.8 Preparation and Retention of Design and Record Drawings

The City retains all as-built drawings indefinitely. Developer design and record drawings are completed by the developer. For Public Works projects, the City consulting engineer or City staff completes the design and record drawings. The City reviews and approves the drawings for construction and for the record drawings in both situations.

CHAPTER 8

IMPROVEMENT PROGRAM

8.1 Objective

The objective of this chapter is to present the Improvement Program for the City of Ridgefield water system. This chapter identifies and evaluates alternatives for correcting deficiencies identified in previous chapters. The preferred alternatives for correcting deficiencies are then assessed and prioritized for implementation over six- and twenty-year planning periods.

8.2 Identification of System Improvements

8.2.1 Source of Supply

Chapter 3 of this plan evaluated the source of supply for the City of Ridgefield water system. The evaluation showed that City of Ridgefield currently has adequate source capacity to serve its existing and short-term water supply needs. However, the city population is expected to grow rapidly in the near future requiring additional water supply.

The City of Ridgefield currently obtains all of its water from three wells located in Abrams Park. Table 8-1 summarizes the current capacity of these wells and their associated water rights. Table 8-1 also shows projected water supply needs and the additional water supply that will be required within the 20-year planning period.

TABLE 8-1
PROJECTED WATER SUPPLY NEEDS

Item	Existing Quantity	20-Year Projected Quantity	Additional Needed
Pumping Capacity	1,000 gpm	4,498 gpm	3,498 gpm
Annual Water Rights	962 acre-ft	2,900 acre-ft	1,938 acre-ft

To make full used of its current water rights, the City will expand the capacity of Well 8 to 400 gpm and drill a new well in Abrams Park. To meet the City's water supply needs beyond this, the City has two main options:

1. Obtain water rights and develop additional sources by drilling wells.
2. Purchase water from Clark Public Utilities.

To evaluate these two options, the capital and operations costs for each alternative were estimated for the 20-year planning period. Table 8-2 summarizes capital and operating costs factors utilized in the financial comparison of Options 1 and 2.

TABLE 8-2
CAPITAL & OPERATING COST FACTORS

Develop Additional Well Sources	Purchase Future Water from CPU
• Four new wells would be constructed and one well not in use would be restored and upgraded. • Wells are assumed to produce 750 gpm each • Additional water rights would need to be acquired • Wells would be constructed 1-2 years prior to the need for the water • Operations costs consist of power, labor, and chemical costs • Chemical treatment is limited to disinfection • Iron and manganese removal is assumed to be needed on wells constructed outside of the Gee Creek area.	• The existing intertie would be used • Three additional 6” interties would be needed • Intertie costs would include construction cost and SDC costs • Interties would be installed 1 year prior to the need for water • Purchased water costs including CPU monthly meter base rates and consumption rates

The analysis performed includes an assessment of the two alternatives. The first alternative, Option 1, addresses costs associated with the City constructing and operating new sources and obtaining additional water rights. The second alternative, Option 2, addresses purchasing additional water from CPU.

ANALYSIS

In performing this analysis, the major uncertainties include the timing of additional water demand by the City, future capital construction costs (including water right acquisition) and City operation and maintenance costs; and future system development charges (SDCs) and water rates charged by CPU. All costs associated with any of the two options can be generally segregated into two types. The first type includes all costs under the direct control of the City that can be expected to increase as a result of inflation. These costs include capital costs to construct new wells, water right acquisitions, and intertie construction costs and O&M (operation and maintenance) costs for the City to operate new sources. All preceding City controlled costs are projected to increase based on 3 percent annual inflation. The other type of costs, are those costs under the control of CPU and include system development charges for new capacity (SDCs), monthly base charges for meters in interties, and consumption charges on all water purchased. All of these costs associated with purchasing water from CPU cannot be accurately predicted with a single inflation factor because these charges are not solely based on inflation. For example, system development charges (SDCs) are usually stable until major projects are planned and then SDCs may double or triple in magnitude. Therefore, this analysis varies CPU charges based on annual inflation rates from 0 to 5 percent to assess the sensitivity of the analysis to changes in these rates. Historically, annual rate increases by CPU have been at the lower end of this range.

In addition to varying CPU charges, this analysis also includes two additional water demand estimates in order to assess the sensitivity of the results to changes in water demands. Water demands as currently projected in Chapter 2 are referred to as predicted growth. The analysis also includes results for greater water demand, referred to as high growth (10 percent more demand than predicted) and for low growth (10 percent less water demand than predicted).

All net present value (NPV) calculations are based on an annual discount rate of 4.5 percent that is the average LGIP (Local Governmental Investment Pool) return from 1992 through 2002.

Option 1

The City would incur capital construction costs, water right acquisition costs, and operation and maintenance costs (O&M) with Option 1. Capital and water right acquisition costs occur with the installation of additional well sources as the demand increases. O&M costs are based on power, labor, and chemical costs resulting from an increase in the number of well pumps and annual water demand. All costs, capital, water rights, and O&M are increased for an annual inflation rate of 3 percent. Table 8-3 summarizes projected capital and O&M costs associated with Option 1 based on more detailed O&M costs shown in Table 8-4 and water demand projections have been shown in Chapter 3.

The assumptions for Table 8-3 are:

- First New Well needed would be drilled in Abrams Park. This well will be constructed for both options to allow the City to reach its annual and instantaneous water rights limitations. As the well will be constructed for both options, no cost has been included for the construction of the new Abrams Park Well in Table 8-3.
- One New Well will be installed in the Junction Area and an existing well will be rehabilitated and upgraded.
- Two New Wells will be installed in the Royle Road Area
- Water Right Assumed Cost = $1,000 per acre-ft
- Inflation Rate = 3%
- Discount Rate = 4.5%

The assumptions for Table 8-4 are:

- Pump Size = 75 hp
- Power Cost = $0.07/kWhr
- Labor Rate = $40/hr
- Hours = 1 hr/day
- Operations = 1 hr/day
- Maintenance = 16 hr/month per new well
- Months in Service = 6 months/year

TABLE 8-3
PROJECTED CAPITAL AND O&M COSTS ASSOCIATED WITH OPTION 1

Year	Additional Capacity (gpm)	Wells Installed	Capital Cost in 2005 Dollars	Additional Water Rights Needed (acre-ft)	Water Right Acquisition Cost	Operations and Maintenance Cost in 2005 Dollars	Total Annual Cost in 2005 Dollars	Total Annual Cost in Future Year Dollars	Net Present Value
2005	0			0	$0	$0	$0	$0	$0
2006	0			0	$0	$0	$0	$0	$0
2007	0			0	$0	$0	$0	$0	$0
2008	0			0	$0	$0	$0	$0	$0
2009	400	Ex. Junction Well	$775,000	0	$0	$11,000	$786,000	$911,200	$731,200
2010	**0**			**0**	**$0**	**$11,000**	**$11,000**	**$13,100**	**$10,100**
2011	0			100	$100,000	$17,500	$117,500	$144,500	$106,200
2012	0			117	$117,000	$25,000	$142,000	$179,900	$126,500
2013	750	New Junction Well 1	$1,225,000	117	$117,000	$30,900	$1,372,900	$1,791,300	$1,205,400
2014	0			115	$115,000	$33,800	$148,800	$200,000	$128,800
2015	0			115	$115,000	$36,800	$151,800	$210,100	$129,500
2016	0			115	$115,000	$39,800	$154,800	$220,700	$130,100
2017	750	New Royle Rd. Well 1	$500,000	115	$115,000	$47,400	$662,400	$972,800	$548,900
2018	0			115	$115,000	$49,400	$164,400	$248,700	$134,300
2019	0			206	$206,000	$53,100	$259,100	$403,700	$208,600
2020	0			206	$206,000	$63,200	$269,200	$432,000	$213,600
2021	750	New Royle Rd. Well 2	$295,000	205	$205,000	$66,100	$566,100	$935,700	$442,800
2022	0			206	$206,000	$69,100	$275,100	$468,300	$212,000
2023	0			206	$206,000	$72,100	$278,100	$487,700	$211,300
2024	**0**			**0**	**$0**	**$72,100**	**$72,100**	**$130,200**	**$54,000**
						Total	**$5,431,000**	**$7,750,000**	**$4,593,000**

TABLE 8-4
DETAILED O&M COSTS

Year	Number of Pumps Running	Total Flow from New Wells (gpm)	Pump Run Time (hours)	Additional Supply Needed Annually (MG)	Power Cost	Labor Cost	Chemical Costs	Annual Total
2005	0	0	0	0	$0	$0	$0	$0
2006	0	0	0	0	$0	$0	$0	$0
2007	0	0	0	0	$0	$0	$0	$0
2008	0	0	0	0	$0	$0	$0	$0
2009	1	400	0	0	$0	$11,000	$0	$11,000
2010	**1**	**400**	**0**	0	**$0**	**$11,000**	**$0**	**$11,000**
2011	1	400	1,358	33	$5,900	$11,000	$600	$17,500
2012	1	400	2,946	71	$12,800	$11,000	$1,200	$25,000
2013	2	1,150	1,577	109	$6,900	$22,100	$1,900	$30,900
2014	2	1,150	2,121	146	$9,200	$22,100	$2,500	$33,800
2015	2	1,150	2,664	184	$11,600	$22,100	$3,100	$36,800
2016	2	1,150	3,207	221	$14,000	$22,100	$3,700	$39,800
2017	3	1,900	2,270	259	$9,900	$33,100	$4,400	$47,400
2018	3	1,900	2,598	296	$11,300	$33,100	$5,000	$49,400
2019	3	1,900	3,187	363	$13,900	$33,100	$6,100	$53,100
2020	4	2,650	2,707	430	$11,800	$44,200	$7,200	$63,200
2021	4	2,650	3,128	497	$13,600	$44,200	$8,300	$66,100
2022	4	2,650	3,550	564	$15,400	$44,200	$9,500	$69,100
2023	4	2,650	3,972	632	$17,300	$44,200	$10,600	$72,100
2024	**4**	**2,650**	**3,972**	632	**$17,300**	**$44,200**	**$10,600**	**$72,100**

OPTION 2

In this option, the City would purchase all water above the City's current annual water right limitation from CPU and would pay capital cost for constructing interties, system development charges (SDCs) for additional CPU capacity, and CPU service rates including both monthly base charges and consumption charges. Capital intertie construction costs are estimated at $40,000 per 6-inch intertie in 2005 dollars. Intertie construction costs are increased for 3 percent annual inflation until the year installed.

In this option, SDC costs are based on the current CPU charge of $1,500 per 5/8-inch water meter multiplied by a meter equivalency factor of 50 for a 6-inch meter. This method was used to determine capacity costs for the City's existing 6-inch intertie. CPU monthly service costs rates are based on a monthly base charge of $305.40 per 6-inch meter and a consumption rate of $1.25 per 100 cubic feet of water purchased. Table 8-5 shows a projection of costs for Option 2 with no planned rate increases in either SDC costs or CPU service charges.

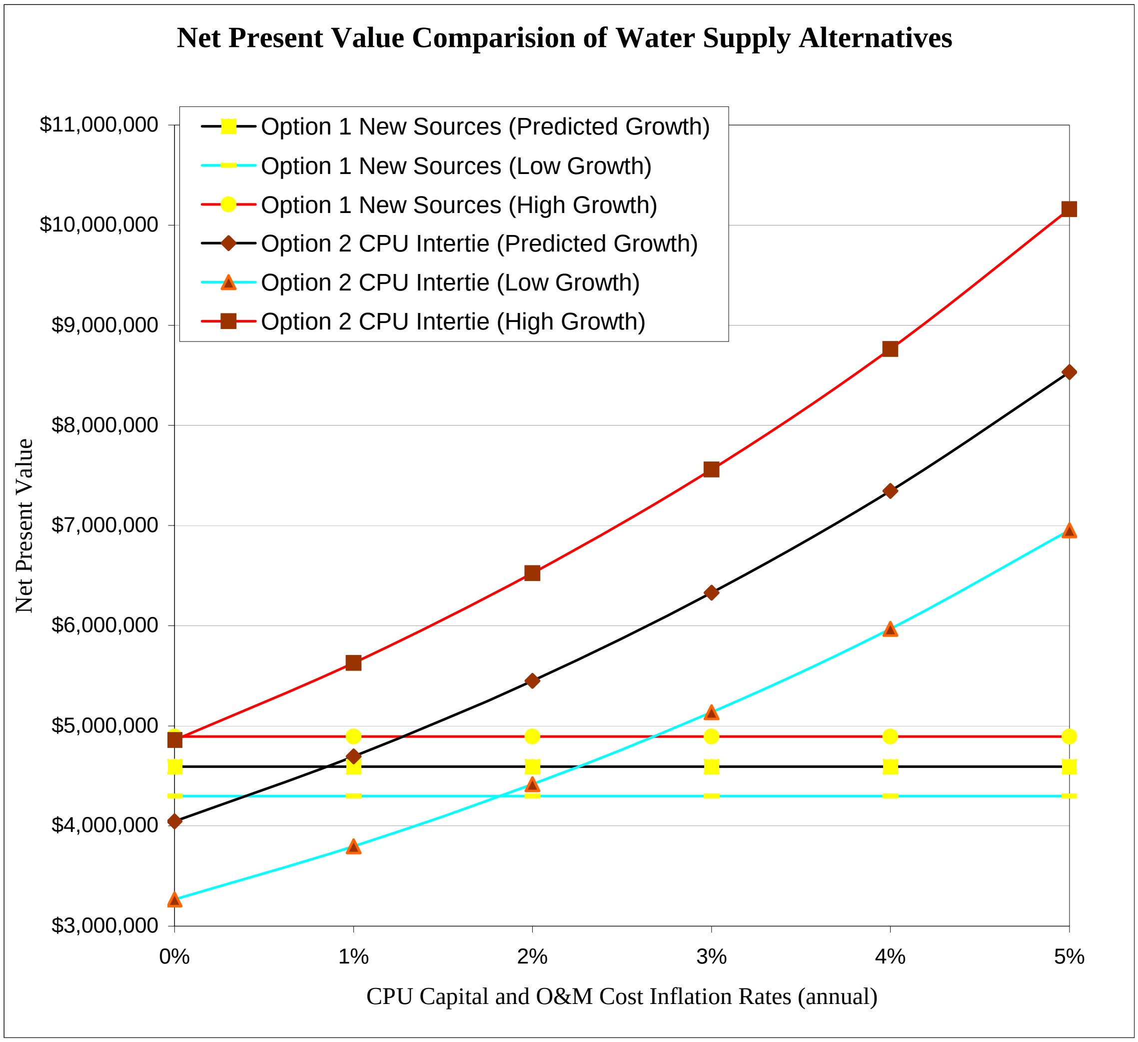
TABLE 8-5
PROJECTED COSTS ASSOCIATED WITH OPTION 2

Year	Capacity to obtain (gpm)	Number of interties	Meter Equi. Size (MES)	Cost Per MES	Const. Cost	Initial Cost of Intertie	Annual Service Charge	Additional Annual Supply Needed, MG	Annual CPU Consumption Charge	Annual Cost in 2004 Dollars	Total Annual Cost in Future Year Dollars	Net Present Value
2005	0	1		$1,500	$0	$0	$3,700	0	$0	$3,700	$3,700	$3,500
2006	0	1		$1,500	$0	$0	$3,700	0	$0	$3,700	$3,700	$3,400
2007	0	1		$1,500	$0	$0	$3,700	0	$0	$3,700	$3,700	$3,200
2008	0	1		$1,500	$0	$0	$3,700	0	$0	$3,700	$3,700	$3,100
2009	0	1		$1,500	$0	$0	$3,700	0	$0	$3,700	$3,700	$3,000
2010	0	1		$1,500	$0	$0	$3,700	0	$0	$3,700	$3,700	$2,800
2011	1000	2	50	$1,500	$40,000	$75,000	$7,300	33	$54,500	$136,800	$186,000	$136,700
2012	0	2		$1,500	$0	$0	$7,300	71	$118,200	$125,500	$125,500	$88,200
2013	0	2		$1,500	$0	$0	$7,300	109	$181,900	$189,200	$189,200	$127,300
2014	0	2		$1,500	$0	$0	$7,300	146	$244,500	$251,800	$251,800	$162,100
2015	0	2		$1,500	$0	$0	$7,300	184	$307,100	$314,400	$314,400	$193,700
2016	0	2		$1,500	$0	$0	$7,300	221	$369,700	$377,000	$377,000	$222,300
2017	1000	3	50	$1,500	$40,000	$75,000	$11,000	259	$432,300	$518,300	$577,000	$325,600
2018	0	3		$1,500	$0	$0	$11,000	296	$495,000	$506,000	$506,000	$273,200
2019	0	3		$1,500	$0	$0	$11,000	363	$607,100	$618,100	$618,100	$319,400
2020	800	4	50	$1,500	$40,000	$75,000	$14,700	430	$719,300	$809,000	$873,200	$431,800
2021	0	4		$1,500	$0	$0	$14,700	497	$830,900	$845,600	$845,600	$400,100
2022	0	4		$1,500	$0	$0	$14,700	564	$943,100	$957,800	$957,800	$433,700
2023	0	4		$1,500	$0	$0	$14,700	632	$1,055,200	$1,069,900	$1,069,900	$463,600
2024	0	4		$1,500	$0	$0	$14,700	632	$1,055,200	$1,069,900	$1,069,900	$443,600
									Total	**$7,815,000**	**$7,987,000**	**$4,044,000**

Comparing Financial Scenarios
Table 8-6 presents a summary of net present values when each option is analyzed for one of three levels of water demand (predicted, high, or low) and for annual price increases of 0 to 5 percent for CPU charges (SDC charges, monthly base rates, and consumption rates). The net present values listed in Table 8-6 are also presented in graph form on the next page.

Table 8-6
NET PRESENT VALUES FOR OPTION 1 AND 2 (IN $1,000)

	Annual Price Increases of CPU Charges					
Line Descriptions	**0%**	**1%**	**2%**	**3%**	**4%**	**5%**
Option 1 New Sources (Predicted Growth)	$4,593					
Option 1 New Sources (Low Growth)	$4,299					
Option 1 New Sources (High Growth)	$4,893					
Option 2 CPU Intertie (Predicted Growth)	$4,044	$4,694	$5,449	$6,327	$7,346	$8,530
Option 2 CPU Intertie (Low Growth)	$3,265	$3,796	$4,416	$5,137	$5,967	$6,952
Option 2 CPU Intertie (High Growth)	$4,859	$5,628	$6,522	$7,560	$8,762	$10,158



The following conclusions can be drawn from the results:

- The NPV of Option 1 and Option 2 are essentially equal at the predicted water demand and with a 0.85% increases in CPU rates and charges.
- Option 1, Developing New Sources, has the lowest NPV if CPU rates are expected to increase at 1% or more over the planning period.
- Purchasing water from CPU is the most cost effective if actual water demand is less than expected. Similarly, CPU water will be most cost effective if lower monthly rates and capacity charges can be negotiated.

The analysis also illustrates the fact that once capital facilities are constructed, the actual cost to produce untreated water is relatively inexpensive. If the total cost to construct and operate new facilities in 2004 dollars of $4,593,000 over the twenty year period (total NPV as listed in Table A-1) is divided by the total amount of additional water needed of 4,437,100,000 gallons (or 5,931,130 ccf), the resulting cost per 100 cubic feet is $0.77 which, as expected, is much lower than the current cost charged by CPU of $1.25 per ccf. It is important to note that the cost per unit of water under Option 1 is based on a twenty-year period and source facilities are assumed to have longer useful lives. Therefore, the NPV and actual cost to produce a ccf of water will be lower than as indicated in this analysis.

Finally, the analysis shows that the financial viability of obtaining water from CPU is dependent upon the terms of any agreement that might be reached with CPU. The current water consumption rate of $1.25 per ccf charged by CPU is much higher than the total cost for the City to construct and maintain their own new facilities. Therefore, in any negotiation with CPU, the City should seek a wholesale rate for water provided by CPU. Furthermore, the City should seek to minimize the impact of future cost increases on CPU rates. Any potential contract should specify the methodology by which the CPU water rate is calculated. The City should work with CPU to develop a methodology that results in future rate adjustments reflecting the actual cost to provide water.

OTHER CONSIDERATIONS

There are several other factors that should be considered which cannot be addressed in a quantitative analysis. Option 1 assumes the City will be able to develop additional well sources and obtain additional water rights required. However, there is some risk that an adequate quantity of water will not be found or that the water would need additional treatment for constituents such as iron and manganese. There is also a high risk that additional water rights will not be obtainable or may not be obtained in a timely manner to serve the growth that is occurring. To account for some of this risk, costs for acquisition of water rights and treatment for the Junction Wells have been included in Option 1. If new water rights can be obtained from the Department of Ecology or if treatment is not required for the Junction Wells, the cost for this option would be substantially lower.

For Option 2, the reliability of the water supply from CPU needs to be considered. If the City will rely on 75% of its water supply coming from CPU in the future, the risk associated with interruption in service from CPU becomes substantially greater for the City. The City also loses some control over the ability to ensure adequate supply will be available when the City needs it due to growth in the system. The risk associated with these issues can be mitigated through language in an intertie agreement that requires adequate notice from CPU that projected water supply is not likely to be available. It is important to note that CPU is fast approaching their water right limit as well, but are currently in the process of developing a new source near Vancouver Lake.

Also, CPU is currently working with the City of Vancouver on a joint water supply project. The outcome of this study may impact the cost to purchase water from CPU in the future.

CONCLUSIONS

Due to the substantial amount of growth that the City will be seeing in the short-term and the length of time that it takes to develop additional sources and water rights, the City will begin the water rights application process in 2005. It is projected that the City will need additional source capacity prior to 2007. The City will requip Well 8 with a 400 gpm pump and file a replacement well declaration with Ecology to make use of existing Abrams Park water rights for this well. The City will also conduct hydrogeologic investigations and pursue development of an additional well in Abrams Park to make use of the City's existing water rights.

The City will then pursue redevelopment of the existing Junction Well. This effort will include working the Ecology water right cost reimbursement program to process the existing application, development of additional hydrogeologic information in support of this application and redevelopment of the well.

To meet future demands and concurrent with obtaining additional water rights, the City will conduct a hydrogeologic study to determine the best possible locations for new wells. Since the cost of constructing and maintaining facilities to provide additional water will likely be lower than the cost of water provided by CPU, the City's long-term costs will be minimized with every new source that lowers the amount of water purchased from CPU.

The City will continue negotiations with Clark Public Utilities towards a long-term agreement to determine if acceptable terms can be reached for supply of water to the Ridgefield service area. The City will pursue terms in any agreement that specify how future capacity costs will be determined (EDU versus meter size), sale or water at a wholesale water consumption rate instead of the current retail rate, and define how future rates will be adjusted. The City will also seek provisions in the agreement that do not penalize the City for development of their own sources to reduce reliance on CPU.

Recommended projects to improve the City of Ridgefield source of supply are described in the following sections. These projects assume that a wholesale agreement is not reached between the City and CPU. Estimated costs are provided for each project and detailed cost estimates are included in Appendix R.

8.2.1.1 Conduct Hydrogeologic Study (SO-1)

In order to determine the best possible location for new wells, the City will conduct a hydrogeologic study. The study will include a review of existing well logs, pump test data and available hydrogeologic information to determine preferred areas to drill new wells. This study will be completed in 2005 and is estimated to cost $25,000.

8.2.1.2 Build Well Houses (SO-2)

Currently, the City's wells in Abrams Park are uncovered. In order to increase security of the public water supply and facilitate maintenance, each well will have a well house placed over the well. The estimated cost of this improvement is $99,000 in 2005 dollars.

8.2.1.3 Obtain Additional Water Rights (SO-3)

As noted in Chapter 3, the City currently has sufficient water rights to meet projected demands through 2009. In 2009, the City will need additional annual water rights and in 2011, the City will need additional instantaneous water rights. To obtain the needed water rights, the City will consider participating in the Department of Ecology's Cost Reimbursement Program, to expedite the process of obtaining additional water rights. Another option is to purchase water rights from existing owners in the general vicinity. The City will begin the process of obtaining additional water rights in 2005. The cost of this project is uncertain at this time. A total of $250,000 will be budgeted for obtaining new water rights within the six-year planning period.

8.2.1.4 Abandon Wells Not in Use (SO-4)

Chapter 1 provided information regarding wells that are not currently in service or that have been abandoned. These wells will be properly decommissioned and the well houses for the associated wells will be demolished. Well No. 1, 2, 3, 5, and 6 will to be properly abandoned. The City will also file a replacement well declaration with the Department of Ecology to transfer some of these rights to Well 9. The estimated cost for this project is approximately $25,000 in 2005 dollars.

8.2.1.5 Existing Well Improvements (SO-5)

Wells No. 7 and 8 currently provide water to the City's Cemetery Reservoir for use in the Low Zone, while Well No. 9 provides water to the High Zone. As shown in Chapter 3, only one well is required to support the Low Zone, as all the growth will occur in the High Zone. By switching Well No. 8 to supply the High Zone, this delays the need for an additional well. The estimated cost of this portion of the improvement is $74,000 in 2005 dollars. The piping reconfiguration for the High and Low Zone sources at Abrams Park will be completed in 2006.

8.2.1.6 Complete a Fluoridation Study (SO-6)

The City has expressed interest in the addition of fluoride the water supply. To determine the feasibility of adding fluoride to the water supply, the City will complete a fluoridation study. The estimated cost for this project is approximately $5,000 in 2005 dollars.

8.2.1.7 Drill New Well At Abrams Park (SO-7)

As discussed in Chapter 3, the City will need to develop additional sources. A hydrogeologic evaluation will be conducted to select an appropriate site. For planning level cost estimating, it was assumed that a 750 gpm well would be drilled to a depth of 200 feet with a 10-inch diameter casing at Abrams Park. The location of the new well may vary depending on the findings of the hydrogeologic study. The estimated capital cost for drilling a well in this location is $335,000 in 2005 dollars. The new well in the Abrams Park will be constructed in 2006.

It should be noted that drilling a new well has many unknowns at this time. This option assumes that the City can drill a new well in a location and to a depth that would produce 750 gpm. In addition, the water quality of a replacement well is unknown at this time. Based on the existing wells in Abrams Park, it is assumed that an adequate quality and quantity can be obtained from near these sources.

8.2.1.8 Redevelop the Existing Junction Well (SO-8)

The City currently has a well located in the Junction area that is no longer in use due to iron and manganese. This well will be redeveloped and provide treatment for iron and manganese. The estimated cost of this portion of the improvement is $775,000 in 2005 dollars. This improvement will be made in 2008.

8.2.1.9 Drill a New Well in the Junction Area (SO-9)

An additional source will also be developed in the Junction area. A hydrogeologic evaluation would likely be necessary to select an appropriate site. For planning level cost estimating, it was assumed that a 750 gpm well would be drilled to a depth of approximately 200 feet, each with a 10-inch diameter casing in the Junction area. The location of the new well may vary depending on the findings of the hydrogeologic study. The estimated capital cost, in 2005 dollars, for drilling this well is $1,430,000. The estimated cost includes the construction of the well, the well house, control building, telemetry system, disinfection and iron and manganese removal equipment, as well as all piping, valves and appurtenances. The new well in the Junction area, based on the projections completed in Chapters 2 and 3, will most likely be installed in 2013.

Again, it should be noted that drilling a new well has many unknowns at this time. Many wells in Western Washington have low pH and high levels of iron and manganese that require further treatment. This option assumes that the City can drill a new well in this location that will produce 750 gpm. Costs for iron and manganese removal have been included at this time, as the existing junction well has not recently been used due to elevated iron and manganese concentrations.

8.2.1.10 Drill Two New Wells at the Royle Road Area (SO-10)

Two additional sources may be able to be developed in the Royle Road area, an area northeast of the high school. A hydrogeologic evaluation will be completed to select an appropriate site. For planning level cost estimating, it was assumed that two 750 gpm wells would be drilled to a depth of 200 feet, each with a 10-inch diameter casing in the Royle Road area. The location of the new well may vary depending on the findings of the hydrogeologic study. The estimated capital cost for drilling these wells is $795,000. The estimated cost includes the construction of the well, the well house, control building, telemetry system, treatment equipment, as well as all piping, valves and appurtenances for both wells. The new wells in the Royle Road area, based on the projections completed in Chapter 2 and 3, will most likely not need to be installed until 2017.

This option also assumes that the City can drill a new well in a location and to a depth that would produce 750 gpm without the need for treatment besides disinfection.

8.2.2 Water Treatment

The City of Ridgefield water treatment facilities were evaluated and deficiencies were identified in Chapter 3 of this Plan. Projects to improve the City of Ridgefield water treatment facilities are described below. Estimated costs are provided for each project and detailed cost estimates are included in Appendix R.

8.2.2.1 Upgrade Treatment Facility (T-1)

As noted in Chapter 3, chlorine storage and feed pumps are located in the same building as the telemetry equipment in Abrams Park. Noticeable corrosion of the electrical equipment has occurred. To extend the useful life of these facilities, the chlorine storage and feed pumps will be located in a separate room. Currently, the building has only one room, so an additional room will need to be added to the building. It is also important to note that the sodium hypochlorite is stored in 20 gallon totes and poured into the 100 gallon day tanks by City staff at regular intervals. In order to reduce operator time spent refilling the day tanks, a bulk sodium hypochlorite feed system will be installed. The estimated cost of this improvement is $70,000, and is planned to be completed in 2006.

8.2.2.2 Install new Chlorine Injection Vault for Well Nos. 7 and 8 (T-2)

The existing chlorine injection vault for Wells No. 7 and 8 is a vertical corrugated metal pipe with a steel cover over the pipe. City staff has indicated the vault has problems with groundwater entering the vault. This vault will be removed and replaced with a concrete vault with a locking lid and a sump pump. The existing Abrams Park injection vaults and meter vaults with water intrusion problems will also be provided with sump pumps and dedicated outlets. The estimated cost of this project is $45,000 in 2005 dollars. The project will be constructed in 2006.

8.2.3 Water Storage

The City of Ridgefield water storage facilities were evaluated and deficiencies were identified in Chapter 3 of this Plan. The evaluation showed that City of Ridgefield will require additional storage capacity to serve its short-term and long-term water storage needs. By 2024, the City will need approximately 1,966,000 gallons of additional storage as shown in Table 3-19. Because most of this growth will occur in the upper pressure zone, all new storage will be located there. To balance the supply of water available in this zone, the City will replace the existing Junction Reservoir and construct a new reservoir in the Bellwood Heights / Heron Ridge area.

Projects to improve the City of Ridgefield storage facilities are described below. Estimated costs are provided for each project and detailed cost estimates are included in Appendix R.

8.2.3.1 Junction Reservoir (ST-1)

To supply storage in the Junction area, a new reservoir will replace the existing Junction Reservoir to provide 1.0 million gallons of active storage. The City has two main options for the construction of this reservoir:

1. Construct a welded steel standpipe (3.6 million gallons needed to supply 1.0 million gallons of active storage).
2. Construct a 1.0 million gallon welded steel at grade tank and upgrade the existing booster station.

Other options such as concrete reservoirs and elevated storage tanks are not typically cost competitive in this size range, so they were not considered for further analysis.

Option 1 - Standpipe

The first option for replacing the existing Junction Reservoir would be to construct a 3.6 million gallon welded steel standpipe in its place. The large size of the reservoir, 3.6 million gallons, is required to provide an operational storage of 1.0 million gallons. The remaining 2.6 million gallons would essentially be dead storage, as it would be below the hydraulic gradient required to provide 30 psi within the distribution system. The overflow elevation for the High Zone is at 407 feet above sea level, while the highest service that will need to be served will be at approximately 290 feet above sea level. This indicates that if a standpipe were to be used, the volume below 360 feet would be unusable due to hydraulic head requirements for gravity fed systems. This allows for roughly 47 feet of operational storage, or 1.0 million gallons as previously mentioned.

Option 2 – At-Grade Reservoir
The second option for replacing the Junction Reservoir would be to install a 1.0 million gallon at-grade welded steel reservoir. The existing Junction Reservoir would be demolished and replaced with a 1.0 million gallon at-grade reservoir. Some minor modifications to the adjacent booster pump station would also be required. The existing booster pump station would supply water from the reservoir to the distribution system. The existing 2 hp jockey pump would be replaced with a 10 hp pump to increase circulation throughout the reservoir in order to maintain a chlorine residual and water quality.

Conclusion
A capital cost estimate has been generated for both options with the total estimated project cost being $3,213,000 for Option 1, and $1,521,000 for Option 2. Aside from the initial capital costs, the power and labor requirements were estimated for the booster pump station, totaling approximately $24,000 per year. Additionally, a life cycle cost analysis was completed to compare the total cost of each option over a 20-year period, which showed a net present value of $3,525,000 for Option 1 and $2,030,000 for Option 2. It is also important to consider non-cost factors such as aesthetics and water quality when comparing reservoir options. Standpipes are very tall and are visible from a long distance. Maintaining water quality and water turnover can also be problematic within standpipes due to the large volume of dead storage. In reviewing all the above information, the preferred alternative for the replacement of the Junction Reservoir is to proceed with Option 2, an at-grade welded steel reservoir. All information regarding the cost analysis is included in Appendix R.

8.2.3.2 Bellwood Heights / Heron Ridge Reservoir (ST-2)

In order to meet the demands of the 20-year projection discussed in Chapter 3, additional storage will also be constructed in the Bellwood Heights / Heron Ridge area. This new reservoir will need to provide 1.0 million gallons of active storage. The City has two main options for the construction of this reservoir:

1. Construct a welded steel standpipe (3.1 million gallons required to supply 1.0 million gallons of active storage).
2. Construct a 1.0 million gallon welded steel at-grade tank with a booster station.

Option 1 - Standpipe
As discussed in Option 1 of the Junction Reservoir section, using a standpipe will require additional dead storage to achieve the hydraulic head required to provide 30 psi to the distribution system. This means that 1.0 million gallons must be above 360 feet above sea level, requiring 2.1 million gallons to be used as dead storage.

Option 2 – At-Grade Reservoir
The second option for a new reservoir would be to construct a 1.0 million gallon at-grade reservoir with a booster pump station. This reservoir would function similarly to Option

2 of the Junction Reservoir, as the pump station would supply water from the reservoir to the distribution system. In order to provide adequate redundancy during a power outage, a backup generator has also been included in the estimate.

Conclusion

A capital cost estimate has been generated for both options with the total estimated project cost being $3,059,000 for Option 1, and $2,518,000 for Option 2. Aside from the initial capital costs, the power and labor requirements were estimated for the booster pump station, totaling approximately $24,000 per year. Additionally, a life cycle cost analysis was completed to compare the total cost of each option over a 20-year period, which showed a net present value of $3,327,000 for Option 1 and $3,044,000 for Option 2. As with the Junction Reservoir, aesthetics and water quality are concerns for a standpipe. In reviewing the analysis above, the preferred alternative for the construction of the Bellwood Heights / Heron Ridge Reservoir is an at-grade welded steel reservoir with a booster station. All information regarding the cost analysis is included in Appendix R.

8.2.4 Water Distribution

The City of Ridgefield water distribution facilities were evaluated and deficiencies were identified in Chapter 3 of this Plan. Deficiencies generally consisted of undersized water mains or areas with dead ends or inadequate looping. As a result, improvements to correct the deficiencies identified in Chapter 3 focused on increasing pipe sizes and looping dead-end water mains. In addition, the City plans on expanding its water distribution and transmission system to provide water service to developing areas. Proposed projects to address each of the deficiencies and system expansion are discussed below. Estimated costs are provided for each project and detailed cost estimates are included in Appendix R.

8.2.4.1 Mill Street, Railroad Avenue to West (D-1)

The City plans to replace approximately 350 feet of 6-inch diameter water main with an 8-inch diameter water main. The project is located along Mill Street, from Railroad Avenue to the west. The project will include approximately 75 feet of boring under the railroad tracks. The project is scheduled to coordinate with roadway improvements in the area. The estimated total cost of this improvement is $77,900, and is planned to be completed in 2006.

8.2.4.2 Royle Road - High School to Gee Creek (D-2)

The City plans to install approximately 4,000 feet of 12-inch diameter water main along Royle Road from the High School to Gee Creek. This project, in conjunction with D-3, will improve flow capacity to the Junction area and provide water service to additional areas of the City. The estimated total cost of this improvement is $682,000, and is planned to be completed in 2008.

8.2.4.3 45th Ave. - Gee Creek to Pioneer (D-3)

The City plans to install approximately 6,100 feet of 12-inch diameter water main along 45th Avenue from Gee Creek to Pioneer Street. This project, in conjunction with D-2, will improve flow capacity to the Junction area and provide water service to additional areas of the City. The estimated total cost of this improvement is $926,400, and is planned to be completed in 2007-2008.

8.2.4.4 8th Street, Pioneer to Shobert (D-4)

The City plans to replace approximately 650 feet of 4-inch diameter water main with an 8-inch diameter water main along 8th Street, from Pioneer to Shobert Street. This project, in conjunction with D-5 and D-6, will improve fire flow capacity to the southern part of downtown. The estimated total cost of this improvement is $104,000, and is planned to be completed in 2009.

8.2.4.5 4th Street, Pioneer to Sargent (D-5)

The City plans to replace approximately 450 feet of 4-inch diameter water main with an 8-inch diameter water main along 4th Street, from Pioneer to Sargent Street. This project, in conjunction with D-4 and D-6, will improve fire flow capacity to the southern part of downtown. The estimated total cost of this improvement is $76,000, and is planned to be completed in 2009.

8.2.4.6 Sargent Street, 4th to 5th (D-6)

The City plans to replace approximately 330 feet of 4-inch diameter water main with an 8-inch diameter water main along 4th Street, from Pioneer to Sargent Street. This project, in conjunction with D-4 and D-5, will improve fire flow capacity to the southern part of downtown. The estimated total cost of this improvement is $49,500, and is planned to be completed in 2010.

8.2.4.7 Mill Street, Main to 5th (D-7)

The City plans to install approximately 850 feet of 4-inch diameter water main with an 8-inch diameter water main along 4th Street, from Pioneer to Sargent Street. This project will improve fire flow capacity to the downtown area. The estimated total cost of this improvement is $124,600, and is planned to be completed in 2010.

8.2.4.8 Bellwood to Heron Ridge with PRV Station (D-8)

The City plans to install approximately 1,900 feet of 8-inch diameter water main between the Bellwood development and the Heron Ridge development. A pressure reducing valve station is included as part of this project. This project will improve fire flow capacity to the 262 Zone. The estimated total cost of this improvement is $276,600, and is planned to be completed 2006.

8.2.4.9 45th Ave. - Pioneer to NW 289th (D-9)

The City plans to install approximately 5,300 feet of 12-inch diameter water main along 45th Avenue, between Pioneer Street and NW 289th Street. This project will provide a primary transmission main to the northeast portion of the service area. The estimated total cost of this improvement is $804,000, and is planned to be completed in 2008.

8.2.4.10 NW 289th - 45th Ave. to NW 11th (D-10)

The City plans to install approximately 5,050 feet of 12-inch water main along NW 289th Street between 45th Avenue to NW 11th Street. This project does not include crossing I-5. This project, in conjunction with D-11, will provide a transmission main between the west and east side of I-5 in the northeast part of the service area. The estimated total cost of this improvement is $764,900, and is planned to be completed in 2008.

8.2.4.11 NW 289th Street Bridge Crossing (D-11)

The City plans to install approximately 150 feet of 12-inch diameter water main on an I-5 overpass at NW 289th Street. This project will be constructed during construction of the NW 289th Street overpass. This project, in conjunction with D-10, will provide a transmission main between the west and east side of I-5 in the northeast part of the service area. The estimated total cost of this improvement is $96,000, and is planned to be completed after 2010.

8.2.4.12 NW 11th - Pioneer St to NW 289th (D-12)

The City plans to install approximately 5,100 feet of 12-inch diameter water main along NW 11th Street between Pioneer Street and NW 289th. This project will connect the existing transmission main that ends at Pioneer and NW 11th Street with project D-10. The estimated total cost of this improvement is $772,300, and is planned to be completed in 2008.

8.2.4.13 NW 289th - Reiman Road to 45th Ave. (D-13)

The City plans to install approximately 5,300 feet of 12-inch diameter water main along NW 289th from Reiman Road to 45th Avenue. This project will provide a transmission main to the northern part of the service area and eventually provide a second flow path from the proposed Northwest Reservoir (project ST-2). The estimated total cost of this improvement is $805,800, and is planned to be completed in 2007.

8.2.4.14 Bertsinger Road - Pioneer to 45th Ave (D-14)

The City plans to install approximately 12,000 feet of 12-inch diameter water main between Pioneer Street at Bertsinger Road and 45th Avenue. This project will provide a transmission main through the central part of the water service area. The estimated total cost of this improvement is $1,809,500, and is planned to be completed after 2010.

8.2.4.15 South 15th - 45th Ave. to I-5 (D-15)

The City plans to install approximately 5,500 feet of 12-inch diameter water main along S 15th, between 45th Avenue and the west side of I-5. This project, in conjunction with D-16, will provide a transmission main between the west and east side of I-5 in the southeastern portion of the service area. The estimated total cost of this improvement is $705,600, and is planned to be completed in 2009.

8.2.4.16 I-5 Bridge Crossing at Pioneer Street (D-16)

The City plans to install approximately 2,500 feet of 12-inch diameter water main on an I-5 overpass at Pioneer Street. This project will be constructed during construction of the Pioneer Street overpass. This project will provide a transmission main between the west and east side of I-5 in the southeast part of the service area. The estimated total cost of this improvement is $370,000 and is planned to be constructed in 2009.

8.2.4.17 East Side of I-5 - S. Dolan to S. 6th (D-17)

The City plans to install approximately 3,000 feet of 12-inch diameter water main along S 6th Avenue between S Dolan Road and S 6th Street. This project will provide a transmission main between the existing transmission main at 6th Street and 6th Avenue and looped around to the existing 12-inch main located on S. Dolan Road. The estimated total cost of this improvement is $388,600, and is planned to be completed in 2007.

8.2.4.18 Cemetery Booster Station Upgrade (D-18)

The City plans to construct a replacement booster station for the aging Cemetery Booster Station. The proposed booster station will include a CMU building, new site piping, pumps, controls, and a manual connection for auxiliary power. The estimated total cost of this improvement is $236,000, and is planned to be completed in 2007.

8.2.4.19 Distribution Summary

The 18 distribution projects listed above display a total cost for the project. However, the majority of these projects will be completed as part of developer extensions to serve newly developed areas. The City's current oversizing ordinance allows the City to compensate developers for the oversizing of planned water mains through System Development Charge credits or other means. Table 8-7 provides a summary of distribution projects along with the overall cost and the anticipated cost to the City for the oversizing of specific water mains. The proportioning of costs shown is an estimate assuming that the City will participate in the oversizing of most transmission mains. The actual City share and development share will be determined by the actual cost of oversizing on each project.

Table 8-7
ESTIMATED WATER DISTRIBUTION PROJECT COSTS(1)

Project Number	Project Name	Total Project Cost	Estimated City Cost	Estimated Developer Cost
D-1	Mill Street, Railroad Avenue to West	$77,900	$77,900	$0
D-2	Royle Road - High School to Gee Creek	$682,000	$682,000	$0
D-3	45th Ave. - Gee Creek to Pioneer	$926,400	$115,100	$811,300
D-4	8th Street, Pioneer to Shobert	$104,000	$104,000	$0
D-5	4th Street, Pioneer to Sargent	$76,000	$76,000	$0
D-6	Sargent Street, 4th to 5th	$49,500	$49,500	$0
D-7	Mill Street, Main to 5th	$124,600	$124,600	$0
D-8	Bellwood to Heron Ridge with PRV Station	$276,600	$0	$276,600
D-9	45th Ave. - Pioneer to NW 289th	$804,000	$100,700	$703,300
D-10	NW 289th - 45th Ave. to NW 11th	$764,900	$96,000	$668,900
D-11	NW 289th Street Bridge Crossing	$61,600	$61,600	$0
D-12	NW 11th - Pioneer St to NW 289th	$772,300	$96,800	$675,500
D-13	NW 289th - Reiman Road to 45th Ave.	$805,800	$100,800	$705,000
D-14	Bertsinger Road - Pioneer to 45th Ave	$1,809,500	$226,700	$1,582,800
D-15	South 15th - 45th Ave. to I-5	$705,600	$104,100	$601,500
D-16	I-5 Bridge Crossing at Pioneer Street	$368,100	$368,100	$0
D-17	East Side of I-5 - S. Dolan to S. 6th	$388,600	$97,100	$291,500
D-18	Cemetery Booster Station Upgrade	$236,000	$236,000	$0

(1) – Estimated costs shown in this table are based on standard public works bid processes. Private development costs may be lower than shown in this table.

8.2.5 Water System Control

The City of Ridgefield water system control facilities were evaluated and deficiencies were identified in Chapter 3 of this Plan. A proposed project to address the deficiency is discussed below. An estimated cost is provided for the project and detailed cost estimates are included in Appendix R.

8.2.5.1 Telemetry Upgrade (SC-1)

The City's reservoir and well sites are connected to the main telemetry system via radio telemetry. The Junction booster station and the CPU intertie are not currently connected to the telemetry system. To facilitate data collection and to reduce operation time, the Junction Reservoir and Booster Station will be connected to the main telemetry system during the Junction Reservoir upgrade mentioned previously in this Chapter. Also, the CPU intertie will be connected to the City's telemetry system. The estimated cost for this project in 2005 dollars is $20,000.

8.2.5.2 Source Meter Replacement (SC-2)

To improve source production data collection, the City intends to replace the existing flowmeters for Wells 7 and 8. This improvement is scheduled for 2006. The estimated cost for this project in 2005 dollars is $12,000.

8.2.6 Water Conservation

The City of Ridgefield Conservation Program presented conservation goals and recommended steps to achieve those goals in Chapter 4 of this Plan. Proposed projects to address conservation measures are discussed below.

8.2.6.1 Implement Conservation Program (CO-1)

A conservation program, for the purposes of this deficiency, can be defined as implementing many of DOH's recommended conservation measures. Costs have not been associated with this project because current Public Works Staff can complete the recommended conservation measures listed below. The City of Ridgefield will implement the following recommended conservation measures:

- Program Promotion – The City will provide conservation promotion materials with billing statements. $1,000 will be allocated for providing the materials.
- Purveyor Assistance – The City of Ridgefield will continue to make water conservation brochures available to all customers and encourage Wholesale purchasers of water distribute copies of the brochures to their customers.
- Customer Assistance – The City will continue to make water conservation brochures available to all customers and assist customers upon request.
- Bill Showing Consumption History – The City will incorporate this feature in the City's next billing software upgrade. It is estimated the billing software will cost $5,000.
- Single-Family/Multi-Family Kits – The City will distribute Single-Family/Multi-Family Kits to the existing residential units that may not have been constructed with or upgraded to low flow fixtures. Kits are estimated to cost $20/household. The City currently have an estimated 600 residences that have do not have low flow fixtures. Providing kits to these residences will cost approximately $12,000.
- Nurseries/Agriculture – The City does not have any nurseries or agricultural operations on City water, but the City will require efficient practices in irrigation for commercial and industrial users.
- Landscape Management/Playfields – Xeriscaping – The City will promote xeriscaping for residential users. Also, the City will develop xeriscaping standards for commercial users and right-of-way landscaping.

The total estimated cost to implement the conservation program is $18,000 in 2005 dollars.

8.2.6.2 Unaccounted for Water and Leak Detection (CO-2)

As noted in Chapter 4, an aggressive leak detection and repair program will be instituted to reduce the L/UW. As explained in Chapter 2, reducing the 20.1% L/UW to 10% over the next five years would result in significant decrease in unbillable water production. The estimated cost of completing a comprehensive leak detection is $5,000. The City will also plan on $20,000 annually for the next 5 years, in order to repair the deficiencies found during the leak detection.

8.2.6.3 Meter Water Use At Abrams Park (CO-3)

Chapter 2 and Chapter 4 discussed the irrigation of Abrams Park. The park currently has approximately six services, all of which are un-metered. The City will install service meters at each of the services used for irrigation. The anticipated cost for this project will be $10,000 and will be constructed in 2006.

8.2.7 source Protection

The City of Ridgefield water system source protection program was evaluated and deficiencies were identified in Chapter 5 of this Plan. Proposed projects to address each of the deficiencies are discussed below.

8.2.7.1 WHPA Coordination (SP-1)

Chapter 5 recommended a variety of actions to enhance the protection of the City's water resources. The following list provides a summary of coordination items the City will complete:

9. Distribute informational letters to property owners within the wellhead protection area.
10. Distribute advisory letters to potential sources of contamination.
11. Notify regulatory agencies and local governments regarding the location and extent of the City's WHPA.
12. Notify local emergency incident responders regarding the location and extent of the City's WHPA.
13. Establish a local WHPA committee.
14. Enhance Public Notification Program by providing information regarding the WHPA at City Hall.
15. Enhance public notification by placing signs along SR-501 at the boundaries of the WHPA.

Costs have not been associated with these projects because current Public Works Staff will complete the projects.

8.2.7.2 Create a Spill Response Plan (SP-2)

Chapter 5 also noted the City is currently in the process of completing a spill response plan. The City will facilitate this process as described in Chapter 5. It is important that the City be notified of any spills occurring within the WHPA. To facilitate notification, the City must provide copies of the WHPA map to Clark County and Ecology. Accompanying each map will be a letter requesting that the agency in question notify the City in the event of a hazardous materials spill. The estimated cost to complete the spill response plan is $5,000, and will be completed by the City in 2006.

8.2.8 Operations and Maintenance

The City of Ridgefield water system operations and maintenance practices were evaluated and deficiencies were identified in Chapter 6 of this Plan. Proposed projects to address each of the deficiencies are discussed below. Estimated costs are provided for each project and detailed cost estimates are included in Appendix R.

8.2.8.1 Establish Electronic Database for Water Quality Test Results (M-1)

In an effort to consolidate and organize all test results pertaining to the water quality of the public water supply, the City will establish a database to maintain records of this nature. The following list is a summary of WAC 246-290-480 that outlines the minimum required residency time for the City of Ridgefield records.

- Required to maintain for a minimum of 3 years
    - Records of operation and analyses required by the department
    - Copies of all public notifications
    - Daily records of the following:
        - Chlorine residual;
        - Source meter readings; and
        - Other information as specified by the department.
- Required to maintain for a minimum of 5 years
    - Bacteriological and turbidity analysis results
- Required to maintain for a minimum of 10 years
    - Records of daily source meter readings
    - Sanitary surveys or SPIs of the system
- Required to maintain for life of the facility
    - Chemical analysis results
    - Project reports, construction documents and related drawings, inspection reports and approvals

A cost has not been associated with this project because current Public Works Staff will complete this project.

8.2.8.2 Meter Reading Improvements (M-2)

Chapter 6 identified the water meter reading and billing system as in need of improvements. The current meter reading system is labor intensive, and modern automated reading systems are less prone to errors.

Assessment of Alternatives

The three major types of automated meter reading systems are hand-held devices, walk-by systems, and drive-by systems. Following is an analysis of each alternative.

Hand Held Data Entry Device

The meter reader visually reads the meters, and enters the reading into a handheld device. The device notes significant deviations from expected reads and advises an immediate re-read, thereby reducing reading errors and additional trips for re-reads. The data is directly downloaded to a computer billing system; thereby saving data transfer time and errors. The advantage of this system is that it does not require any changes to the meters, it improves meter reading efficiency, it greatly improves data entry efficiency and reduces errors both in reading and in data entry. All that is required is the handheld device with appropriate capacity for the system, the computer software for the data download and management, and a compatible computer. The estimated cost of a meter reading system using a hand-held device is $10,000.

Walk-By Reading Device

The meter reader passes a hand-held wand over the meter box to pick up the meter read. The reader still walks the system, but it is much faster because he doesn't need to open boxes and read meters, and it is be less prone to data entry errors. The meters would all have to be compatible with the reading equipment, which would probably mean replacing all the meters with new meters and data registers, and installing meter transmitter units (MTUs) on all meters. This increases the cost considerably over a hand-held device. At an estimated $200 per meter to purchase and install the meters and sending devices, the installation cost for 811 meters would be an estimated $162,200. The walk-by device is slightly more expensive than the hand-held device and the computer requirements are similar. Time required for downloading data to the billing computer would be similar to a hand-held device. The estimated cost of a meter reading system using a walk-by reading device is $178,200.

Drive-By Reading Device

The meter reader drives past the meter boxes with the device in the vehicle to pick up the meter reads. For some short blocks the device may pickup an entire block from the end of the street. This is much faster than either a handheld device or a walk-by device. As with the walk-by device, the meters would all have to be compatible with the reading equipment, which would probably mean replacing all the meters equipped with registers, and installing MTUs on all meters. The cost per meter would be similar to the cost for a walk-by device at an estimated $200 per meter and an estimated total of $162,200. The drive-by reader is slightly more expensive than the walk-by device and the computer requirements are similar. Time required for downloading data to the billing computer would be similar to a hand-held or walk-by device. The estimated cost of a meter reading system using a drive-by reading device is $182,200.

Conclusion

Tables 8-8 and 8-9 summarize estimated costs and benefits of automatic meter reading systems. Due to the substantial growth occurring in the City, City staff believe that a drive-by system will meet the City's long term meter reading needs. This device provides the greatest potential for reducing time spent reading meters. Due to the high cost of replacing existing service meters with meters suitable for automated reading, the City will replace existing meters incrementally as part of an overall meter replacement program. The City will begin replacing existing meters with a new meter, register, and MTU at a rate of 5% of the existing service connections per year. In addition to replacing existing service meters, the City will require all new service connections to be installed with a standard register and MTU. In 2006, the City will solicit proposal from vendors for a drive-by meter reading system. The City will purchase the device and software and begin requiring new meters be installed with MTU. For budgeting purposes, the City will budget $20,000 in 2006 for meter reading device and software. The City will also budget $8,100 per year for meter replacement.

Table 8-8
ESTIMATED AUTOMATIC METER READING COSTS

Item	Hand Held Device	Walk-By Device	Drive-by Device
New Meter with Register and MTU	N/A	$150	$150
Estimated Installation Costs per Meter	N/A	$50	$50
Total Installation Costs for 811 Meters	N/A	$162,200	$162,200
Reader Cost	$5,000	$8,000	$10,000
Billing Software & Computer	$5,000	$8,000	$10,000
Total Installation Cost	$10,000	$178,200	$182,200

Table 8-9
ESTIMATED AUTOMATIC METER READING SAVINGS

Item	Manual	Hand-Held Device	Walk-By Device	Drive-by Device
Meters per Hour	50	100	300	1000
Monthly Meter Reading Hours	17	8.45	2.82	0.85
Monthly Wage Cost at $30/hr	$510	$254	$85	$26
Monthly Data Transfer Time (in Hours)	4	0.25	0.25	0.25
Monthly Data Cost at $30/hr	$120	$8	$8	$8
Estimated Total Annual Cost	$7,560	$3,130	$1,110	$400
Annual Savings	-	**$4,430** (58.6%)	**$6,450** (85.3%)	**$7,160** (94.7%)

8.2.9 Cross Connection Control Program

The City of Ridgefield cross connection control program was evaluated and deficiencies were identified in Chapter 6 of this Plan. Proposed projects to address each of the deficiencies are discussed below. Estimated costs are provided for each project and detailed cost estimates are included in Appendix R.

8.2.9.1 Re-conduct a Survey of Potentially Hazardous Services (CC-1)

It is unknown when the most recent citywide survey took place. As mentioned in Chapter 6, the City Clerk maintains a list of backflow prevention devices throughout the city. This list will be verified during the citywide survey. An estimated cost for this project to be completed is $10,000.

8.2.9.2 Develop Incident Response Procedures for Backflow Incidents (CC-2)

City of Ridgefield currently has a limited program or process in place to respond to backflow incidents. In an effort to minimize operator time during backflow incidents, it would be beneficial to implement procedures for the response of backflow incidents prior to the need of such procedures. A cost has not been associated with this project because current Public Works Staff will complete this project.

8.2.9.3 Provide Educational Material to the Consumers (CC-3)

Education material regarding cross connections can be readily found at the regional Department of Health office or online at their website, www.doh.wa.gov. The City will provide handouts and fliers at City Hall and provide billing inserts on a regular basis. A cost has not been associated with this project because current Public Works Staff will complete this project.

8.2.9.4 Ensure BPA's Are Used During Construction Connections (CC-4)

In an effort to reduce lost and unaccounted for water, and to protect the public water supply, the City will enact a policy to ensure backflow prevention assemblies are used in conjunction with hydrant meters for all construction projects throughout the City.

8.3 Summary of Recommended Improvements

Table 8-10 provides a summary of the recommended improvements and estimated costs outlined in this chapter. Detailed cost estimates are included in Appendix R of this report. Figure 8-1 displays the location of the recommended system capital improvements.

CHAPTER 9

FINANCIAL ANALYSIS

9.1 Objective

This chapter contains an analysis that describes how the City can finance the water system improvements outlined in Chapter 8, Capital Improvement Program. The potential funding sources, financial status of the water utility, the funding required to pay for the scheduled improvements, and the impact of water improvements on water rates are presented herein.

9.2 FINANCIAL STATUS OF EXISTING WATER UTILITY

9.2.1 CURRENT water rates

Water rates and charges for the City are specified in the Ridgefield Municipal Code (RMC) 13.10.010. Monthly water rates consist of a monthly base charge that is dependent on the meter size. Each customer is also charged a volume rate depending on their customer classification. All customers located outside of the city limits pay a 50 percent surcharge on their total bill. Tables 9-1 and 9-2 list the City's current schedule of rates and charges.

TABLE 9-1

Monthly Water Service Base Charges (1)

Meter Size	Monthly Base Charge (2)	Meter Equivalent Size (3)
1-inch and smaller	$ 17.25	Varies
1-1/2 -inch	$ 23.36	5.0
2 -inch	$ 35.26	8.0
3 -inch	$ 63.03	15.0
4 -inch	$ 103.42	25.0
6 -inch	$ 201.19	50.0
8 -inch	$ 319.60	80.0
10 -inch	$ 571.30	-
12 -inch	$ 917.58	-

(1) Source: Ridgefield Municipal Code sections 13.10.010 and 13.10.030.
(2) Customers outside the City's corporate limits also pay a surcharge of 50%.
(3) Meter Equivalent Size (MES) as noted in RMC section 13.08.010 is defined as the hydraulic equivalency of any meter related to a 5/8" by 3/4" meter.

TABLE 9-2

Monthly Volume Rates (1)(2)

Service Location	Minimum Usage Included in Base Charge	Volume Rate
Single Family Residential	5 ccf	$ 1.62 / ccf
Multi-User	5 ccf per unit	$ 2.06 / ccf
Commercial	0 ccf	$ 2.06 / ccf
Industrial	0 ccf	$ 2.06 / ccf
Governmental	0 ccf	$ 2.06 / ccf

(1) Source: Ridgefield Municipal Code sections 13.10.010 and 13.10.040.
(2) A ccf is 100 cubic feet

9.2.2 CURRENT Connection Fees

Ridgefield Municipal Code section 13.13.030 specifies that the City will collect a system development charge based on the size of the water meter. Effective June 13, 2005, the City's water system development charge will be $3,950 per MES.

9.2.3 HISTORICAL EXPENSES

The City operates a combined water and sewer utility operating fund. The Water Sewer Fund (No. 401) segregates expenses into several categories: salaries and benefits, administration, maintenance/repairs, and 112 N Main Suite B (office). The Water Sewer System Development Fund (No. 402) itemizes all capital expenses to the combined utility. Table 9-3 provides the historical water utility operating expenses for the years 2001-2004.

TABLE 9-3

Historical Water Utility Operating Expenses (Fund No. 401)

OPERATING EXPENDITURES	2001	2002	2003	2004
SALARIES & BENEFITS				
SALARIES	77,388	74,642	85,925	103,212
OVERTIME			2,255	2,041
HEALTH CARE			13,692	14,585
BENEFITS	20,173	18,452	10,834	19,663
SUBTOTAL SALARIES & BENEFITS	**97,561**	**93,094**	**112,706**	**139,501**
ADMININSTRATION				
UNIFORMS/CLEANING	811	1,027	1,172	1,355
SUPPLIES	10,901	6,279	5,877	5,940
FUEL CONSUMED	1,208	938	2,148	2,125
SMALL TOOLS/MINOR REPAIR	519	458	1,644	1,190
PROF SERVICES LEGAL				28
CELLULAR	88	120	544	395
TELPHONE/TELEMETRY/TECH	3,308	3,689	3,452	5,905
PAGER	16		145	145
POSTAGE	980	344	1,286	615
TRAVEL SEMINARS	566	875	1,456	2,145
ADVERTISING	217	535	65	1,370
RENTALS/LEASES - PITNEY/OFFICE	746	907	1,281	1,400
UTILITIES	9,130	16,940	16,091	17,710
INTER-DEPT & ADMINISTRATION	23,232	25,200	37,580	41,146
INTER-DEPT & ADMINISTRATION (AUDIT)	122	2,500	101	
EXCISE TAX (1)				
SUBTOTAL ADMININSTRATION	**51,844**	**59,812**	**72,842**	**81,469**
MAINTENANCE/REPAIR				
COMPUTER -REPAIR/MAINT		323	300	440
VEHICLE MAINTENANCE			7,892	2,415
MISC REPAIR & MAINTENANCE		2,162	382	12,257
MISC/DUES/PERMITS	1,489	1,587	1,829	1,652
SUBTOTAL MAINTENANCE/REPAIR	**1,489**	**4,072**	**10,403**	**16,764**
PUBLIC WORKS				
OFFICE EQUIPMENT/COPIER			39	245
OFFICE FURNISHINGS			191	100
CUSTODIAL SERVICES				60
TELEPHONE/COMMUNICATIONS			520	165
OFFICE SPACE RENT			1,250	1,155
ELECTRICTY/HEAT			17	115
WATER/SEWER				35
MISCELLANEOUS			109	
SUBTOTAL PUBLIC WORKS	**0**	**0**	**2,126**	**1,875**
TOTAL	**150,894**	**156,978**	**198,077**	**239,609**

(1) Historical excise taxes are unknown.

9.2.4 HISTORICAL REVENUES

The water utility records revenues in two accounts, the Water Sewer Fund and the Water Sewer System Development Fund. Water utility revenues for the years 2001 through 2004 are shown in Table 9-4.

TABLE 9-4

Historical Water Utility Operating Revenues

Operating Revenues	**2001**	**2002**	**2003**	**2004**
Water Revenue	260,118	303,207	326,790	316,300
Miscellaneous	423	1,084	9,712	5
Total Revenues	**260,541**	**304,291**	**336,502**	**316,305**

9.2.5 summary of current financial status

In comparing water system operating expenses (Table 9-3) and revenues (Table 9-4), the water utility generated positive net operating revenue in 2001, 2002, 2003, and 2004. In 2004, the water system portion of the utility generated a total net operating revenue of approximately $76,696 ($316,305 - $239,609). This net revenue was available for building up capital reserves and for planned capital expenditures.

9.3 PROJECTED EXPENSES, REVENUES, AND RESERVES

9.3.1 GROWTH

Projected growth in water demand is required to estimate expenses associated with providing water (supplies and utilities) and to estimate future revenues. Table 2-10 projects a 15.50 percent average increase in water usage during the 6-year planning period and a 8.34 percent average increase in water usage over the 20-year planning period. The financial projections presented in this chapter assume the same growth rates as shown in Chapter 2. If growth does not proceed as projected in Chapter 2, the City will need to reevaluate the timing of projects or use different methods of financing projects.

9.3.2 Projected FUTURE EXPENSES

Table 9-5 summarizes projected water utility operating and capital expenses, respectively, for the years 2005 through 2010. Future expenses have been projected based on a review of the historical expenses from 2001 through 2004 and the potential impact of inflation and growth on each expense. Historical expenses that appear stable or have been growing are projected using 2004 expenses while historical expenses that show significant variation from year to year are projected using the average expenses from 2001 through 2004. All projected expenses, except debt, capitalized expenditures, salaries and benefits, have been adjusted for the effects of 2.2 percent annual inflation. Salary and benefit costs have been increased proportionally to the increase in ERUs and also by a cost of living adjustment of 3.0 percent per year. Fuel, professional services, insurance, and repairs and maintenance expenses have been increased annually for the projected average annual growth in customers of 3.0 percent. State B&O Tax (1.5 percent) is charged on all water system development revenue, discussed in the next section. The Washington State excise tax (5.029 percent) is applied to all water sale revenue, also discussed in the next section.

TABLE 9-5

Projected Water Utility Operating Expenses

OPERATING EXPENDITURES	2005	2006	2007	2008	2009	2010
SALARIES & BENEFITS						
SALARIES	123,300	147,400	176,200	210,600	251,600	300,800
OVERTIME	2,100	2,100	2,200	2,200	2,300	2,300
HEALTH CARE	15,000	15,500	16,000	16,400	16,900	17,400
BENEFITS	23,700	28,400	34,100	41,000	49,200	59,100
SUBTOTAL SALARIES & BENEFITS	**164,100**	**193,400**	**228,500**	**270,200**	**320,000**	**379,600**
ADMININSTRATION						
UNIFORMS/CLEANING	1,400	1,500	1,500	1,500	1,600	1,600
SUPPLIES	7,400	7,500	7,700	7,900	8,000	8,200
FUEL CONSUMED	2,100	2,200	2,200	2,300	2,300	2,400
SMALL TOOLS/MINOR REPAIR	1,200	1,300	1,300	1,300	1,300	1,400
CELLULAR	400	400	400	400	400	500
TELPHONE/TELEMETRY/TECH	6,000	6,200	6,300	6,400	6,600	6,700
PAGER	100	100	100	100	100	100
POSTAGE	600	600	600	700	700	700
TRAVEL SEMINARS	2,100	2,200	2,200	2,300	2,300	2,400
ADVERTISING	1,400	1,500	1,500	1,500	1,600	1,600
RENTALS/LEASES - PITNEY/OFFICE	1,400	1,500	1,500	1,500	1,600	1,600
UTILITIES	21,700	26,500	32,500	39,800	48,700	59,600
INTER-DEPT & ADMINISTRATION	42,000	42,900	43,900	44,800	45,800	46,800
INTER-DEPT & ADMINISTRATION (AUDIT)	2,600	-	2,700	-	2,800	-
EXCISE TAX	19,000	22,800	27,400	32,900	39,500	47,500
SUBTOTAL ADMININSTRATION	**109,400**	**117,200**	**131,800**	**143,400**	**163,300**	**181,100**
MAINTENANCE/REPAIR						
COMPUTER -REPAIR/MAINT	400	400	400	400	400	500
VEHICLE MAINTENANCE	5,300	5,400	5,600	5,700	5,800	5,900
MISC REPAIR & MAINTENANCE	5,000	5,100	5,200	5,300	5,500	5,600
MISC/DUES/PERMITS	1,800	1,900	1,900	2,000	2,000	2,100
SUBTOTAL MAINTENANCE/REPAIR	**12,500**	**12,800**	**13,100**	**13,400**	**13,700**	**14,100**
PUBLIC WORKS						
OFFICE EQUIPMENT/COPIER	200	200	200	200	200	200
OFFICE FURNISHINGS	200	200	200	200	200	200
CUSTODIAL SERVICES	100	100	100	100	100	100
TELEPHONE/COMMUNICATIONS	500	500	500	500	600	600
OFFICE SPACE RENT	1,300	1,400	1,400	1,400	1,400	1,500
ELECTRICTY/HEAT	100	100	100	100	100	100
MISCELLANEOUS	100	100	100	100	100	100
SUBTOTAL PUBLIC WORKS	**2,500**	**2,600**	**2,600**	**2,600**	**2,700**	**2,800**

TOTAL O&M EXPENSES	**288,500**	**326,000**	**376,000**	**429,600**	**499,700**	**577,600**

Table 9-6 shows the scheduled debt payments for the Junction water main. The water utility does not have any other debt and no capital projects are planned on being debt funded at this time.

TABLE 9-6

Projected Water Utility Debt Expenses

Debt	2005	2006	2007	2008	2009	2010
Junction Water Main	49,500	56,200	54,800	50,200	80,600	90,000

Table 9-7 shows the capital improvement projects recommended to occur in the next six years as identified in Chapter 8. The cost of each project has been inflated by 2.2% from 2005 dollars to the year in which it is scheduled to be completed.

TABLE 9-7

Projected Water Utility Capital Expenses

Capital Expenses	2005	2006	2007	2008	2009	2010
SO-1: Conduct hydrogeologic study	25,000					
SO-2: Build wellhouses		101,200				
SO-3: Obtain additional water rights	50,000	50,000	50,000	50,000	50,000	
SO-4: Abandon Wells Not in Use	25,000					
SO-5: Existing Well Improvements		75,600				
SO-6: Complete Fluoridation Study	5,000					
SO-7: Drill New Well at Abrams Park		342,400				
SO-8: Redevelop Junction Well				827,300		
T-1: Chlorine Storage Improvements		71,500				
T-2: Install new chlorine injection vault for Wells 7 &8	38,000					
ST-1: Junction Reservoir Upgrade			1,587,600			
D-1: Mill Street, Railroad Avenue to West	77,900					
D-2: Royle Road - High School to Gee Creek				728,000		
D-3: 45th Ave. - Gee Creek to Pioneer			483,800	483,800		
D-4: 8th Street, Pioneer to Shobert					113,500	
D-5: 4th Street, Pioneer to Sargent					82,900	
D-6: Sargent Street, 4th to 5th						55,200
D-7: Mill Street, Main to 5th						138,900
D-8: Bellwood to Heron Ridge with PRV Station		282,700				
D-9: 45th Ave. - Pioneer to NW 279th		121,900	121,900	121,900		
D-12: NW 11th - Pioneer St to NW 289th			403,400	403,400		
D-15: South 15th - 45th Ave. to I-5		180,300	180,300	180,300	180,300	
D-16: S 15th Street Bridge Crossing				65,800		
D-17: East Side of I-5 - S. 15th to S. 6th			63,600	63,600	63,600	63,600
D-18: Cemetery Booster Station Upgrade			246,500			
SC-1: Telemetry System Upgrade		46,000				
SC-2: New Flowmeters for Well 7 and Well 8		12,300				
CO-1: Implement Conservation Program	18,000					
CO-2: Unaccounted Water/Leak Detection	17,500	17,500	17,500	17,500	17,500	17,500
CO-3: Meter water use at Abrams Park		10,200				
W-2: Create a Spill Response Plan		5,100				
M-1: Establish Electronic Database for Test Results		5,100				
M-2: Meter Reading Improvements	8,700	8,700	8,700	8,700	8,700	8,700
CC-1: Re-conduct a survey of potential		10,200				

hazardous services						
Total Capital Expenses	**265,100**	**1,340,700**	**3,163,300**	**2,950,300**	**516,500**	**283,900**

9.3.3 Projected FUTURE REVENUES

Projected future operating revenues are shown in Table 9-8. Water rates have increased in the past by three percent per year in accordance with City ordinance. The future water sales projected herein are also increased by an annual growth rate of 3.0% from the revenue generated in 2004. Water excise tax is collected from customers based on their total water bill. Investment interest earnings is based on mid-year water fund balances and the current return rate in the Local Government Investment Pool of 1.1 percent. All other revenues have been adjusted for the effects of 2.2 percent annual inflation.

TABLE 9-8

Projected Water Operating Fund Revenues

Operating Revenue	2005	2006	2007	2008	2009	2010
Water Revenue	376,300	447,700	532,500	633,500	753,700	896,600
Miscellaneous	2,800	2,800	2,800	2,800	2,800	2,800
Total Operating Revenue	**379,100**	**450,500**	**535,300**	**636,300**	**756,500**	**899,400**

Projected capital revenue is shown in Table 9-9. Many projects will be partially funded by contributions in aid of construction (CIAC). Again, if the actual growth is less than the projected growth shown in Chapter 2, the actual amount of connection charge revenue will be less than projected.

TABLE 9-9

Projected Capital Revenues

Capital Revenues	2005	2006	2007	2008	2009	2010
Connection Charges	936,200	1,082,300	1,252,200	1,445,700	1,670,900	1,927,600
New CIAC - Project D-3			822,500			
New CIAC - Project D-8		282,700				
New CIAC - Project D-9		310,900				
New CIAC - Project D-12			685,700			
New CIAC - Project D-15		612,900				
New CIAC - Project D-17			216,200			
Interest Earnings from Cash	9,300	19,000	24,500	16,900	17,200	35,400
Total Capital Revenues	**988,400**	**2,380,300**	**3,113,200**	**1,631,200**	**1,882,300**	**2,220,800**

Table 9-10 illustrates the potential operating cash flows projected through the year 2010. This includes operations revenue and expenses and debt expenses.

TABLE 9-10

Projected Water Operating Cash Flows

Operating Fund	2005	2006	2007	2008	2009	2010
Operating Revenues	379,100	450,500	535,300	636,300	756,500	899,400
Operating Expenses	(286,700)	(321,800)	(368,400)	(417,500)	(481,700)	(551,600)
Total Debt	(49,500)	(56,200)	(54,800)	(50,200)	(80,600)	(90,000)
Net Operating Revenue	**42,900**	**72,500**	**112,100**	**168,600**	**194,200**	**257,800**

Future capital improvement fund revenues projected through 2010 are shown in Table 9-11.

TABLE 9-11

Projected Water Capital Fund Cash Flows

Capital Fund	2005	2006	2007	2008	2009	2010
Capital Revenues	945,500	1,101,300	1,276,700	1,462,600	1,688,100	1,963,000
Capital Expenses	(265,100)	(1,340,700)	(3,163,300)	(2,950,300)	(516,500)	(283,900)
Transfer from Operations	42,900	72,500	112,100	168,600	194,200	257,800
Net Capital Revenue	**723,300**	**1,039,600**	**(50,100)**	**(1,319,100)**	**1,365,800**	**1,936,900**

Total net revenue through 2010 is shown in Table 9-12.

TABLE 9-12

Projected Water Combined Fund Cash Flows

	2005	2006	2007	2008	2009	2010
Net Capital Revenue	723,300	1,039,600	(50,100)	(1,319,100)	1,365,800	1,936,900
Net Operating Revenue	42,900	72,500	112,100	168,600	194,200	257,800
Total Net Revenue	**766,200**	**1,112,100**	**62,000**	**(1,150,500)**	**1,560,000**	**2,194,700**

9.4 RECOMMENDATIONS

Based on the projected revenues and expenses detailed in this chapter, the City's operating fund is stable through the six-year planning period. The capital fund also is stable over the six-year planning period while cash financing all capital improvement projects presented in Chapter 8. If actual growth is less than projected growth, revenue will be less than projected in Tables 9-8 through 9-12. If growth slows, the City will need to reevaluate project scheduling or potentially use other financing to complete projects. The City may also choose to debt finance some of the improvements in order to improve cash flow.

9.5 AVAILABLE CAPITAL PROJECT FUNDING SOURCES

This section describes several funding sources available to the City without reference to any specific project, including information on the following:

Grants:	Community Development Block Grant Community Investment Fund US Economic Development Administration US EPA State and Tribal Assistance Grant USDA Forest Service, Rural Assistance Program USDA Rural Development
Loans:	Public Works Trust Fund Community Economic Revitalization Board Drinking Water State Revolving Fund USDA Rural Development
Bonds:	Revenue Bonds General Obligation Bonds
Other:	Utility Local Improvement Districts

9.5.1 COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

The Community Development Block Grant program is a competitive source of federal funding for a broad range of community development projects. A primary requirement of the CDBG program is that the project must principally benefit at least 51 percent of the low-to-moderate income residents of the project area. The State typically receives about $7 million in federal funds per funding cycle. CDBG has several grant programs including General Purpose, Community Investment Fund, Planning Only, and Imminent Threat. The General Purpose program provides grant funds for the design, construction, or reconstruction of water and sewer systems up to $1,000,000. The Community Investment Fund is similar to General Purpose, but the projects must be rated as one of the three top projects on the county's WA-CERT list. The Planning Only program includes projects such as comprehensive plans, community development plans, capital improvement plans, and other plans such as land use and urban environmental design, economic development, floodplain and wetlands management, transportation, and utilities. Planning Only grants are limited to $35,000 for a single applicant or $50,000 for a joint applicant. The Imminent Threat program typically has $300,000 available for all applicants, is only provided on a one-time basis for minor mitigation projects, and the project is not eligible under the PWTF program.

Eligible applicants for the CDBG programs include cities and towns with less than 50,000 people or counties with populations less than 200,000. Though port districts and economic development districts are not eligible to apply directly, a city or county can submit a joint application and include these entities as partners.

9.5.2 COMMUNITY INVESTMENT FUND (CIF)

The Community Investment Fund partners with CDBG to fund projects that benefit at least 51 percent low-to-moderate income residents. The objective of the CIF fund is to provide an opportunity for eligible jurisdictions to access funds throughout the year on a funds available basis. Grants are generally awarded to those projects that are high priority, ready to proceed, and serve a population with at least 51 percent low-to-moderate income residents. Grant funds can be obtained in the amount of approximately $1 million.

To qualify for CIF, the project must be rated as one of the top three of the local WA-CERT Priority Rating Process, serve a minimum of 51.5 percent low-to-moderate income residents, and receive at least 65 points on the application.

9.5.3 PUBLIC WORKS TRUST FUND (PWTF)

The Public Works Trust Fund is a revolving loan fund designed to help local governments finance public works projects through low-interest loans and technical assistance. The PWTF program was established in 1985 by legislative action and offers loans substantially below market rates, payable over periods ranging up to 20 years. To be eligible for the PWTF programs, an applicant must be a local government such as a city, county, or a special purpose utility district.

PWTF has four loan programs including Construction, Pre-Construction, Planning, and Emergency. PWTF loan terms are summarized below:

TABLE 9-13

PWTF Loan Terms

Local Match	Interest Rate/Term	Loan Limit
Construction:		
15%	0.5%, 20 years	$12,500,000
10%	1.0%, 20 years	
5%	2.0%, 20 years	
Pre-Construction(1):		
15%	0.5%, 5 years	$2,000,000
10%	1.0%, 5 years	
5%	2.0%, 5 years	
Planning:		
0% (2)	0.0%, 6 years	$50,000
Emergency:		
0%(2)	3.0%, 20 years	$500,000

(1) Pre-construction loans can be refinanced to a 20-year term, if the applicant obtains a subsequent PWTF Construction loan.

(2) While a match is not required, it is recommended.

The Construction Program accepts applications once per year in the spring, and the money becomes available approximately one year later. The Pre-Construction and Planning programs are open on a year-round basis and must be submitted to the Public Works Board prior the 5th of the month to be reviewed at the next Public Works Board meeting. These funds become available shortly after the Board makes its final decision as to the award. Emergency projects must have a locally declared

emergency and are applied for on an open cycle depending on the availability of funds. Project expenditures are reimbursable from the date of the declared emergency.

An applicant must have a long-term plan for financing its public works needs. If the applicant is a county or city, it must adopt the ¼ percent real estate excise tax that is dedicated to public works construction projects. Eligible public works projects include streets and roads, bridges, storm sewers, sanitary sewer collection and treatment systems, and domestic water. Loans are presently offered only for purposes of repair, replacement, rehabilitation, reconstruction, or improvement of existing eligible public works systems. Eligible project costs can include expenses related to serving 20-year forecasted growth as identified in a growth management comprehensive plan.

Since substantially more trust fund dollars are requested than are available, local jurisdictions must compete for the available funds. The applications are carefully evaluated, and the Public Works Board submits a prioritized list projects to the Legislature that are recommended to receive low-interest financing. The Legislature reviews the list and indicates its approval through the passage of an appropriation from the Public Works Assistance Account to cover the cost of the proposed loans. Once the Governor has signed the appropriation bill into law (an action that usually occurs by the following April), those local governments recommended to receive loans are offered a formal loan agreement with appropriate interest rates and terms as determined by the Public Works Board.

9.5.4 COMMUNITY ECONOMIC REVITALIZATION BOARD (CERB)

The Community Economic Revitalization Board's prime mission is to partner with business and industry and local governments to maintain and create jobs. Established by the Legislature in 1982, CERB provides low-interest loans or, in unique circumstances, grants to help finance local public infrastructure necessary to develop or retain stable business and industrial activities. Projects eligible for funding include roads, domestic and industrial waters systems, sanitary and storm sewers, port facilities, and general-purpose industrial buildings.

Typically, CERB provides loans in the amount of $1 million and, where applicable, grants in the amount of $300,000. The interest rate is tied to the current cost of a 10-year bond and a local match of 10 percent is required.

Eligible applicants include Washington State subdivisions in partnership with private enterprise. If there is no economic partner, a local government can produce a feasibility study that documents realistic job retention or creation. Applications must be submitted 45 days prior to a regularly scheduled CERB meeting, which typically occurs in January, March, July, and November

9.5.5 DRINKING WATER STATE REVOLVING FUND (DWSRF)

In 1996, Congress established the Drinking Water State Revolving Fund through the reauthorization of the federal Safe Drinking Water Act. The program is managed by the Washington State Department of Health and the Washington State Public Works Board. The purpose of the program is to provide low-interest loans to assist publicly- and privately-owed water systems improve drinking water and protect public health.

Eligible publicly owned water systems include city and county governments, public utility districts, and special purpose districts. Privately-owned systems are eligible as long as they are a Group A system.

Eligible projects include the following:

- Water systems that exceed health standards,

- Replacement of aging infrastructure,
- Acquisition of real property,
- Planning and design costs,
- Water conservation projects,
- Reservoirs (clear wells) that are part of a treatment process,
- Distribution reservoirs (finished water),
- Existing systems who elect to connect to a municipal system
- Upgrade to or creation of a Group A system.

Maximum award per water system is $4,000,000 and for combining systems an award of $6,000,000 is available. DWSRF requires a one (1) percent loan fee, but no local match. A summary of interest rates and loan terms follows:

TABLE 9-14

DWSRF Loan Terms

Applicant's Income Level	Interest Rate	Repayment period
Water system not financial distressed	1.5% Fixed	20 years or life of project, whichever is less
Water system in distressed county	1.0% Fixed	20 years or life of project, whichever is less
Income survey results demonstrates that 51% of the households are at 80% or below the county's median household income.	0.5% Fixed	20 years or life of project, whichever is less
Income survey results demonstrates that 51% of the households are at 50% or below the county's median household income.	0.0% Fixed	30 years or life of project, whichever is less

9.5.6 USDA RURAL DEVELOPMENT, RURAL UTILITY SERVICES (RUS)

The Rural Utility Service program administers a loan and grant program to improve the quality of life and promote economic development in rural areas.

Rural Development has a loan program that, under certain conditions, includes a limited grant program. Grants may be awarded when the annual debt service portion of the utility rate exceeds 1.0 percent to 1.5 percent of the municipality's median household income.

In addition, RD has a loan program for needy communities that cannot obtain funding by commercial means through the sale of revenue bonds. The loan program provides 30- to 40- year loans at an interest rate that is based on federal rates and varies with the commercial market. RD loans are revenue bonds with a 1.1 debt coverage factor.

Eligible projects include the construction, expansion, extension or improvement of rural water, sanitary sewers, solid waste disposal, storm, and wastewater disposal facilities.

Basic criteria for obtaining funds under the RUS program follows:

- Dependent on inability to obtain funds from other sources at reasonable terms.

- A 45 percent grant is available if the median household income of the service area exceeds 80% of the statewide non-metropolitan median household income.

- A 75 percent grant is eligible if the service area is below the higher of the poverty line or 80% of the state non-metropolitan median household income, and the project is necessary to alleviate a health and safety issue. However, RD rarely awards this level of grant funding.

Eligible applicants include municipalities; counties; non-profit corporations, associations, or cooperatives; and federally-recognized Indian tribes in rural areas with populations less than 10,000.

9.5.7 US Economic Development Administration (US EDA)

US EDA offers competitive grants up to $1 million for projects within Region 10. Projects are selected locally by an economic development district and submitted to Congress for competitive selection among other regions in the US. Similar to CERB, applicants must have an industrial partner ready to proceed or a feasibility study that establishes realistic job creation.

9.5.8 US EPA State and Tribal Assistance Grant

Local jurisdictions within the state of Washington can apply to the State and Tribal Assistance Grant program through the office of their local Congressional representative. The Congressional representative will work to add the project as a line item to the VA/HUD Appropriations Bill. Applicants can obtain grant funds up to approximately $2 million.

9.5.9 US FOREST SERVICE

Forest Service grants are available through the Rural Community Assistance Program to rural communities that are dependent on natural resources. Project proposals must show a broad community benefit that result in greater ability to improve economically, socially, or environmentally. The project must have the potential for economic development and/or job creation/retention. An application must be located within 100 miles of a Forest Service office and be able to document a history of at least 15 percent dependency on forest products. Grant funds are available for components of planning and design and are limited to $50,000. However, for year 2005 the Forest Service had no funds to distribute.

9.5.10 REVENUE BONDS

The most common source of funds for construction of major utility improvements is the sale of revenue bonds. These are tax-free bonds issued by a city. The major source of funds for debt service on revenue bonds is from monthly sewer service charges. In order to make qualify to sell revenue bonds marketable to investors, the bonds typically have contractual provisions for the city to meet debt coverage requirements. The city city's must show that its annual net operating income (gross income less operation and maintenance expenses) is must be equal to or greater than a factor, typically 1.2 – 1.4 times the annual debt service on all par debt. If a coverage factor has not been specified it will be determined at the time of any future bond issues.

9.5.11 GENERAL OBLIGATION BONDS

By council action or special election, a city may issue general obligation bonds to finance most any project of general benefit to the city. The bonds are repaid by tax assessments levied against all privately owned properties within the city. Owners of vacant property would be assessed because the property would not otherwise contribute to the cost of a specific improvement. This type of bond issue is usually reserved for municipal improvements that are of general benefit to the public, such as arterial streets, bridges, lighting, municipal buildings, fire fighting equipment, parks, and water and wastewater facilities. General obligation bonds are the most attractive bonds to investors because they are backed by the municipality's full taxing authority and carry the lowest rate of interest of any type of bond that a city may issue.

Disadvantages of general obligation bonds include the following:

- Voter approval is often required. The city would incur the legal costs of drafting a ballot measure and pay for the cost of holding a special election. There is also the additional cost of investing staff time in public education for the need of the project, and there is always uncertainty as to the outcome of elections.

- There are legal, as well as practical limits on the amount of general obligation debt a city can issue. Financing capital improvements through general obligation debt reduces the ability of the city to issue additional general obligation debt, which is often the only source of outside financing for many general government facilities.

9.5.12 UTILITY LOCAL IMPROVEMENT DISTRICTS

Another potential source of funds for improvements can be obtained through the formation of Utility Local Improvement Districts (ULIDs) involving a special assessment made against properties benefiting by the improvements. ULID bonds are further backed by a legal claim to the revenues generated by the utility, similar to revenue bonds.

Water system expansion is a frequent application of ULID financing. Typically, a ULID is formed by the city at the written request (by petition) of the property owners within a specific section of the service area. Upon receipt of a sufficient number of signatures or petitions, and acceptance by the city council, the local improvement area is formed. Therefore, a water system is designed for that particular area in accordance with the city's water comprehensive plan. Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the water system improvements. A citywide ULID could form part of a financing package for large-scale capital projects such as water line extensions or replacements that benefit all residents in the service area. The assessment places a lien on the property that must be paid in full upon sale of the property. ULID participants have the option of paying their assessment immediately upon receipt, thereby reducing the portion of the costs financed by the ULID bonds.

The advantages of ULID financing, as opposed to rate financing, to the property owner include:

- The ability to avoid interest costs by early payment of assessments.

- If the ULID assessment is paid in installments, it may be eligible to be deducted from federal income taxes.

- Low-income senior citizens may be able to defer assessment payments until the property is sold.

- Some Community Block Grant funds are available to property owners with incomes near or below poverty level. Funds are available only to reduce assessments.

The major disadvantage to the ULID process is that it may be politically difficult to approve formation. The ULID process may be stopped if 40 percent of the property owners protest its formation. Also, there are significant legal and administrative costs associated with the ULID process, which increases total project costs by approximately 30% over other financing options.