CITY OF
MILLWOOD

City of Millwood

WATER SYSTEM PLAN

DECEMBER 30, 2011 – FINAL

VARELA & ASSOCIATES, INC.
ENGINEERING AND MANAGEMENT
PLANNING • DESIGN • MANAGEMENT • INSPECTION

City of Millwood
WATER SYSTEM PLAN

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DECEMBER 30, 2011 – FINAL

12/30/11

VARELA & ASSOCIATES, INC.
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Prepared By: Ben Varela

CITY OF MILLWOOD

Water System Plan

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Abbreviations

(the following abbreviations may or may not be used in this report)

AC	asbestos cement water main material
ADD	average day demand
ac-ft/yr	acre-feet per year (a measure of water volume
add'l.	additional
avg.	average
CCS	Cross Connection Control Specialist
CDBG	Community Development Block Grant
CFP	Capital Facilities Plan
cfs	cubic feet per second
CY	cubic yards
DI	ductile iron water main material
dia.	diameter
DOE	Wash. State Department of Ecology
DFW	Wash. State Department of Fish & Wildlife
DOH	Wash. State Department of Health
DU	Dwelling Unit
DWSRF	Drinking Water State Revolving Fund
elev.	elevation
ERU	equivalent residential user (a measure of water
ES	Equalizing Storage
FF	fire flow
FFS	Fire Suppression Storage
gal(s)	gallons
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GMA	Growth Management Act
GO	general obligation (a type of bond secured by
HP	horsepower
IOC	inorganic chemicals
LF	lineal feet
LID	Local Improvement District
max	maximum
MCL	maximum contaminant level
MDD	max day demand
MG	million gallons
mgd	million gallons per day
mg/L	milligrams/liter
MHI	median household income
mi.	mile
min	minimum
NRCS	Natural Resources Conservation Service
NEPA	National Environmental Protection Act
NPDES	National Pollutant Discharge Elimination
O&M	operation and maintenance
PHD	peak hour demand
PRV	pressure reducing valve
PVC	polyvinyl chloride (plastic) water main
PWTF	Public Works Trust Fund
Qa	maximum annual water use
Qi	maximum instantaneous water use
RCW	Revised Code of Washington
RD	USDA Rural Development
ROW	right-of-way
SB	Standby Storage
SCADA	supervisory control and data acquisition
SEPA	State Environmental Protection Act
suppl.	supplemental
UGA	Urban Growth Area
ULID	Utility Local Improvement District
VOC	volatile organic chemicals
WAC	Washington Administrative Code
WSDM	Water System Design Manual
WSE	water surface elevation
WSP	Water System Plan
WTP	water treatment plant

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EXECUTIVE SUMMARY

Section 2 – Existing Water System

- Millwood's water service area lies entirely within its corporate limits, but is smaller than the corporate limits. A portion of the City of Millwood lies within the water service area of Orchard Avenue Irrigation District to the west.
- Major components of Millwood's water system consists of: three wells, a diesel powered backup power generator currently connected to the Old Park well, an 800,000 gallon standpipe with two 75-Hp variable speed driven booster pumps, approximately 12 miles of distribution system main pipelines; a SCADA control system; and three separate interties to neighboring water utilities.
- All demands are normally supplied either directly from well pumps or by pumping from the standpipe via booster pumps.
- 82% of the system's water mains are PVC or ductile iron replaced within the last 15 years; the remainder is cast iron pipe. 18% (~ 11,500 LF) of the water mains is believed to be old cast iron pipe with leaded-joints.

Section 3 – Planning Data & Demand Forecast

- The water system serves a total of 765 accounts, 729 of which are residential single and multi-family accounts (650 connections) and 115 are non-residential or commercial accounts.
- Total water service area population is about 1,544.
- Over the past three years City wells have pumped on average approximately 256 million gallons annually.
- Water service area population and water demand are projected to grow by less than 7% over the next 20 years.
- Millwood's future water service area is not expected to change from its existing service area.

Section 4 – Design Standards

- In general, the City structures its standards based on regulatory requirements, engineering judgment, industry practice, staff expertise, customer input, and aesthetic considerations.

Section 5 – Existing System Analysis

- The existing wells have adequate capacity to supply existing and projected twenty year demands.
- The Old Park well building is deteriorating and in need of replacement to house the existing pump and related equipment, upgrade electrical, and house the existing backup power generator and proposed auto-transfer switch.
- The existing backup power generator for the Old Park well should also be connected to the existing booster pumps for backup and an automatic transfer switch installed to eliminate the current need for manual start and transfer.

- Water rights are adequate for current and projected 20-year demand but should be integrated to avoid potential violations of individual well's instantaneous or annual rights.
- The existing storage volume is less than the theoretically required capacity by 190,000 gallons. The potential shortfall however is not considered a system deficiency in terms of the water system's capability to meet both current and projected normal and emergency demands for the following reasons.

    1. Current operational storage can be readily decreased and other storage volumes increased for such things as fire suppression storage, simply by resetting the "fill" mode to a higher level. Operational standards such as pump cycling time and recommended reservoir circulating must also be maintained.
    2. Existing interties, current backup power generation of Old Park well and planned backup power for the booster pumps provide adequate emergency backup capabilities.

- The existing booster station and pumps are adequate to meet the current and projected 20-year peak demand.
- The existing 75Hp booster pumps are inefficient at meeting the low flow demands, or late night demands, of the system since the reduction in system water demand (presumably system leakage) resulting from the replacement of most of the distribution system piping since 1992. A smaller size booster pump is recommended to be installed in the existing booster station to better handle these low system demand periods.
- Overall the distribution system is well designed (i.e. pipe size, looping, valving, etc.) and in excellent condition. It is capable of delivering the required water at sufficient pressure to meet current and projected 20-year needs.
- Minimum system pressures under peak demands are in the high 40 psi range with the lowest pressures occurring toward the east and northeast end (highest in elevation) of the system.
- Fire flow capabilities generally range from 1,200 gpm to over 4,000 gpm throughout the system with most locations over 2,000 gpm. They are more than adequate to meet design standards throughout the system with the following exceptions:

    1. Low fire flow capability (2,200 to 2,400 gpm) in the commercial area along Trent Avenue at the fire hydrants at Trent/Laura and at Trent/Sargent where about 700 feet of old undersized 4" cast iron pipe still exists.
    2. Low fire flow capability (about 600 gpm) in the residential area along Frederick Avenue at the fire hydrant east of Locust Rd. where about 700 feet of old undersized 4" cast iron pipe still exists.

- Distribution System Leakage is estimated at 20% (99 gpm) of total annual water production. Potential contributing factors include meter inaccuracies, errors in flow records, unmetered water services, unauthorized water use and distribution system leakage. System leakage would most likely be in the old, leaded-joint, cast iron pipe and associated service connections that remain in the system
- The recently updated SCADA control system appears to be operating effectively and provides the operators great flexibility and opportunity to operate the system most efficiently and effectively.
- The Millwood water system has a relatively high level of reliability.

Section 6 – Improvements

- The planned improvements are shown in the Capital Facilities Plan are presented in the table below.

Section 7 – Implementation

- Funding will dictate the implementation schedule for the required improvements.

Section 8 – System Finances

- Expenditures have exceeded revenues for the past two years due to changes in allocation of personnel and other costs.
- The City reads meters monthly. Customers pay a base water rate which includes a 4,000 CF allotment. Customers are then charged on an inclining block rate.

Capital Improvements Plan

- The Capital Improvements Plan from **Section 7** has been reproduced in this Executive summary for reader convenience.

City of Millwood Capital Facilities Plan

Period		Improvement	Purpose	Estimated Cost	Potential Funding Sources
6-YEAR PLANNING PERIOD (2011 - 2016)	Supply	Old Park Well bldg. and Backup Power Generator Improvements	Improve system reliability	$400,000	City Reserves/Revenue Bonds/RD/PWTF
		New meters on all wells	Improve accuracy	$15,000	
		Add chlorination equipment to Butler and New Park wells	Provide ability to add disinfection to distribution system at all sources	$15,000	
	Storage	New Exterior Coating	Extend life of reservoir	$80,000	City Reserves/Revenue Bonds/RD/PWTF
		Interior Inspection	Routine inspection and spot repairs to extend life of reservoir coating	$5,000	
	Water Rights	Pursue integration of water rights	Remedy potential individual water right exceedences	$5,000	City Reserves
	Booster Station	Add third booster pump and VFD to existing booster building to more effectively handle the low flows	Accommodate low flow pumping needs more effectively, preserve existing higher capacity pumps	$50,000	City Reserves/Revenue Bonds/RD/PWTF
	Distribution System	Water audit and determination of distribution system losses, leak detection	Identify and reduce water losses (DSL)	$820,000	City Reserves/Revenue Bonds/RD/PWTF
		Replacement of 4" main on Trent from Laura to Dale	Replace deteriorated and leaking mains		
		Replacement of 4" main on Frederick from Locust east to dead end	Replace deteriorated and leaking mains		
		Replacement of 8" main on Marguerite from Buckeye to Grace	Replace deteriorated and leaking mains		
		Replacement of 8" main on Liberty from Vista to Bessie	Replace deteriorated and leaking mains		
		Replacement of 6" main on Buckeye, Bessie, and Marietta between Buckeye and Marietta	Replace deteriorated and leaking mains		
		Replace 6" main north of Empire between Fowler and Davis	Replace deteriorated and leaking mains		
			Total Estimated 6 Yr. Cost	$1,390,000	
20-YEAR PLANNING PERIOD (2016-2030)	Distribution System	Replace balance of old cast iron pipe (est. 5,700 LF)	Improve fire flow, replace deteriorated and undersized mains	$1,200,000	City Reserves/Revenue Bonds/RD/PWTF
			Total Estimated 20 Yr. Cost	$2,590,000	

1. INTRODUCTION

1.1. Background

The City of Millwood initiated this Water System Plan (WSP) in compliance with Washington State Department of Health (DOH) requirements. This WSP has been prepared in accordance with WAC 246-290 and the *Water System Design Manual* (WSDM).

1.2. Purpose and Scope

The purpose of this Water System Plan is to identify and summarize water system deficiencies if any, and corresponding improvement alternatives. This Plan organizes system improvements by planning horizon (6-year and 20-year) and sets forth a long range plan based on the system's projected growth.

We would like to acknowledge the significant input and assistance provided by the City Superintendent, Cleve McCoul, Assistant Manager, Paul Allen, the City Clerk/Planner, Tom Richardson, and City Treasurer, Debbie Matkin.

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2. DESCRIPTION OF WATER SYSTEM

2.1. Ownership and Management

The water system is owned and operated by the City of Millwood. Names and addresses are as follows.

DOH ID Number:	54850
Address:	City of Millwood 9103 E. Frederick Millwood WA, 99206
Phone:	(509) 924-0960
Fax:	(509) 927-2867
Mayor:	Daniel N. Mork
Public Works Director:	Cleve McCoul
Assistant Public Works Director:	Paul Allen
Clerk/Planner	Tom Richardson

2.2. System Background

2.2.1. History

A brief history of the development of the water system, derived from past Water System Plans (WSP) and other City records, is as follows.

- Incorporated in 1927, the City's water system consisted of purchased well water from Inland Empire Paper Company (IEPCo) and a wooden pipe distribution system.
- 1950-52: Acquired its own supply by purchasing the Hedman Well (now abandoned) and drilling a new well in the City park (the Old Park Well). Use of IEPCo supplied water was discontinued. Distribution system improvements including new cast iron pipes and water meters over the next 9 years.
- 1959: Butler Well (originally, Grandview) was drilled, a pump house built and the new supply added to the system.
- 1969: The existing 800,000 gal. storage standpipe w/booster pump station (old) constructed.
- 1975: The first automatic controls for the wells were installed.
- 1977: A larger pump was installed in the Butler Well.
- 1980-82: The Hedman Well began to fail, was rehabilitated, but then abandoned due to surface water contamination. The New Park well was then drilled and added to the system. Also the old Hedman Well pump control valve was installed on the Old Park Well pump to alleviate pressure surge problems.

- 1985: Central computerized control system installed to allow operation of pump stations from water department office.
- 1986: Leak detection and repair program eliminated approx. 1000 gpm leakage from distribution system, reducing operating costs and eliminating need for additional supply.
- 1988: 10" ductile iron water main installed on Trent Rd. from Boeing to Woodruff St. to improve system efficiency and fire flows along the commercial area of Trent Road.
- 1992-96: Replacement of nearly all the distribution system mains (old leaded joint CI pipe) and services to the property line or meter with new PVC and DI mains and copper service pipe, in conjunction with new sanitary sewer collection system construction.
- 1992: Existing standpipe repainted (inside and outside) & installation of 16" pipe penetration (for proposed new booster pump connection) and floor-level tank drain.
- 1992: Construction of new booster pump station with variable frequency drives (next to standpipe) and new 14" T-main/distribution pipe on Frederick Ave. from new booster station to Argonne Road. Old booster pump (1969) left in place as backup but no longer used.
- 1994: Replacement of old control system with new SCADA system with radio telemetry linking all wells and the new booster pumps together with a central control station (computer) at the water department office at City Hall.
- 1995: Intertie with Irvin Water District on east boundary of Millwood's service area for mutual emergency backup supply (manually operated valve normally closed).
- 1996: Intertie with Orchard Avenue Irrigation District near northwest boundary of Millwood's service area for mutual emergency backup supply (manually operated valve normally closed).
- 1999: Installation/connection of a 400KVA backup generator to power the nearby Old Park Well pump with capacity to start and run the booster pumps.
- 1999-2001: SCADA system data collection and reporting upgrades.
- 2002: Second intertie with Orchard Avenue Irrigation District near southwest boundary of Millwood's service area for mutual emergency backup supply (manually operated valve normally closed).
- Installed remote-read meters at essentially all services.
- Chlorination equipment was installed in December, 2009 at the Old Park well house, available for use when needed for disinfection.
- New production meters were installed during 2010 at the Old Park and New Park wells which should improve accuracy of production data.

2.2.2. Geography/Location

The City of Millwood is located in the Spokane valley, about 3 miles east of the City of Spokane, in Spokane County, Washington. The incorporated boundary of the City covers about 7/10ths of a square mile area. Millwood lies within Sections 5,6,7 & 8 of Township 25 N, Range 44 E, WM.

Millwood is bordered by the Spokane River on the north and surrounded by developed, mostly residential areas of Spokane County. Millwood is primarily a residential community with commercial districts along the main north-south arterial, Argonne Road, and along Trent Avenue which forms the southern boundary of the City limits. The community includes the Inland Empire Paper Company mill, the City Hall, a city park with a wading pool, a fire station and elementary school and is adjacent to West Valley High School on the west.

The topography of Millwood is typical of the Spokane valley. The ground generally slopes gradually to the west and north toward the Spokane River where it drops sharply, from 10 to about 70 vertical feet in some areas, to meet the river. The land within the water distribution system however is generally flat to gently sloping with an overall elevation difference of about 45 feet.

The City's underlying geology is typical valley gravels laid down in prehistoric floods that formed the Spokane-Rathdrum aquifer. This deep gravel aquifer, one of the most transmissive in the world, provides the sole source of water for Millwood and most surrounding areas.

2.2.3. Neighboring Purveyors

Adjacent water districts are Orchard Avenue Irrigation District #6 on the west, Irvin Water District #6 on the east and southeast, Modern Electric Water Company (private) to the south across Trent Avenue and Spokane County Water District #3 to the southeast also across Trent Avenue. Pasadena Park Irrigation District #17 lies to the north across the Spokane River.

2.2.4. Ordinances

Refer to the Appendix for the City's water/sewer ordinances.

2.3. Inventory of Existing Facilities

The existing Millwood water system is shown in **Figure 2**, Existing Water System map. Specific water system components are listed in the following table. System operation is delineated briefly below and more completely in a subsequent section.

2.3.1. Ground Water Supply – Old Park, Butler, and New Park Wells

The following table summarizes the details of the City's three wells.

Table 2-1 Description of Wells

System	Component	Description	
Supply	Old Park Well	Log Available	See Appendix
		Depth	112'
		Diameter	16"
		Screen/Perforations	Perforations from 56' to 111'
		Date constructed	April 26, 1952
		SWL	40'(at time of drilling)
		Approx. wellhead elev.	1947'
		Present pumping rate	1,000 gpm
		Pressure zones served	Main
		Enclosure	CMU
		Location	E. end of City Park near standpipe
Supply	Butler Well	Log Available	See Appendix
		Depth	130'
		Diameter	16"
		Screen/Perforations	Perforations from 80' to 130'
		Date constructed	June 19, 1959
		SWL	70' (at time of drilling)
		Approx. wellhead elev.	1993'
		Present pumping rate	750 gpm
		Pressure zones served	Main
		Enclosure	CMU
		Location	S. of intersection of Empire & Butler
Supply	New Park Well	Log Available	See Appendix
		Depth	196'
		Diameter	18"
		Screen/Perforations	Johnson 18" telescope from 175' to 196'
		Date constructed	July 9, 1981
		SWL	50' (at time of drilling)
		Approx. wellhead elev.	1949'
		Present pumping rate	2,200 gpm
		Pressure zones served	Main
		Enclosure	CMU
		Location	W. end of City Park @ Stout & Frederick

2.3.2. *Reservoir*

Millwood has one reservoir. The following table summarizes the reservoir details:

Table 2-2 Description of Reservoir

Description	Reservoir
Zone Served	Main Zone
Year Built	1969
Repainted	1992 (interior and exterior)
Construction Type	Welded Steel
Shape	Round
Approx. dimension	35' dia., 110' tall, overflow @ 108'
Location	East End of City Park, 60' south of Old Park Well

Table 2-2 Description of Reservoir (Cont.)

Description	Reservoir
Approximate Base Elevation	1,960'
Approximate Volume	800,000 gal

The reservoir is a standpipe originally constructed in 1969, and is located at the east end of the City Park north of the intersection of Frederick Ave. and Locust St.

2.3.3. Transmission and Distribution System

Most of the City's water mains were replaced during the sewer improvements project in the early 1990's with more being replaced throughout the mid-nineties.

The water distribution system within Millwood consists of mains ranging in diameter from 4" to 12" with a majority of the pipe being 6" and 8". What little 4" remains consists of old cast iron pipe. Other pipe materials include ductile iron and PVC.

The following table summarizes total lengths, materials, and diameters of distribution/transmission mains:

Table 2-3 Description of Transmission/Distribution Mains

Main Diameter	Length
14" Ductile Iron	Approx. 1,370'
12" PVC	Approx. 136'
10" Ductile Iron	Approx. 4,614'
10" PVC	Approx. 6,403'
8" Ductile Iron	Approx. 2,870'
8" PVC	Approx. 19,595'
8" Cast Iron	Approx. 3,608'
6" Ductile Iron	Approx. 830'
6" PVC	Approx. 15,957'
6" Cast Iron	Approx. 5,791'
4" Cast Iron	Approx. 2,054'
4" PVC	Approx. 320'
Total	**Approx. 63,548'**

2.3.4. Booster Station

Millwood has one booster station which supplies the entire service area. The booster station is comprised of a slab-on-grade concrete block building adjacent to the standpipe built in 1992. The building contains two 75 hp horizontal split-case booster pumps with VFD drives which pump a maximum of 1,750 gpm each. The building also includes provisions (pipe and electrical conduit) for a future 3rd pump.

Also contained in the booster station is a 50 hp, 1,000 gpm booster pump which is no longer used and the "tower valve" which is a 6" fill control valve for the standpipe.

2.3.5. Number of Service Connections

The number of existing service connections is approximately 765 including commercial, residential and multi-family. The WFI does not indicate an approved number of service connections (see **Appendix** for the City's most recent WFI Form). The actual current number of connections may not match exactly the number of connections stated on the WFI. The City updates the WFI annually to ensure the information contained therein remains current.

2.3.6. Existing Interties

There are three existing interties the City shares with neighboring water purveyors. Two interties are with Orchard Avenue Irrigation District (OAID) and are located near the northwest boundary of the distribution system at the intersection of Vista Rd. and Courtland Avenue, the other near the southwest boundary of the distribution system at the intersection of Bessie Rd. and Marietta Ave. The other intertie is with Irvin Water District and is located at the far southeast end of the distribution system on Butler St. just north of Trent Road. All three interties are valved, normally closed and manually operated. All are for emergency water supply purposes and are covered in intertie agreements. The interties are not metered.

Per the agreements between OAID or Irvin Water District and Millwood, either party is entitled to water through the intertie on an emergency basis only. Provisions are also addressed for contacting the other party, conditions pertaining to contamination or damage of either water system either before or after using the intertie, reimbursement for costs, and termination of the agreement and intertie. Refer to the appendix for copies of these intertie agreements.

2.4. Overview of System Operation

Millwood's water system is composed of the components described in the tables above. Although the system includes a standpipe, this storage reservoir water elevation provides insufficient system pressure for gravity operation. The system therefore is pressurized by continuous operation of either the well pumps or the booster pumps. System pressure is maintained and water demand met by alternating cycles of well (or wells) pumping and booster pumping in separate standpipe "fill" and "draw" modes (i.e. system pressure is not dependant on standpipe water level). The system is monitored and controlled, including the "fill" and "draw" modes, via the SCADA system. The normal operating interval of the standpipe, between "fill" and "draw" modes, is currently set at 60 to 100 feet above the tank bottom. Normal operating pressure, referred to as system pressure, is currently set to be maintained at 70 psi as measured at the booster station location

2.4.1.1. Fill Mode

When the standpipe level drops to 60 ft. the SCADA system switches to the "fill" mode. One or more of the City's wells operate automatically to meet the water demand, maintain system pressure and fill the standpipe. The tower valve is set (manual adjustment) to maintain local system pressure at 70 psi by opening only as pressure climbs above this point, otherwise it remains closed. If one well pump (Lead) is unable to satisfy the demand, the pressure drops and a second (Lag1) well pump comes on automatically and, if pressure continues to drop, a third (Lag 2) is automatically started. The pressure settings at which these lag pumps come on are set and can be adjusted by the operator from the SCADA computer terminal. The operator sets the priority in which the SCADA

system turns on the well pumps to most closely match the well pumping capacity to the current demand normally on a seasonal basis. Typical operating scenarios are:

	Well "On" Priority		
Scenario	Lead	Lag 1	Lag 2
Winter (typically Nov. – April)	Butler	Old Park	New Park
Spring/Fall	Old Park	Butler	New Park
Summer Peak (typ. Aug. &/or Sept)	New Park	Butler	Old Park

2.4.1.2. Draw Mode

Once the standpipe level rises to 100 ft via well pumping, the SCADA system switches to the "draw" mode. The well pump (or pumps) is shut off while a variable frequency drive (VFD), or variable speed driven, booster pump is already on and speeding up drawing water from the standpipe. The booster(s) pumps water into the system to maintain the system pressure and thereby meet system demand. The tower valve is closed via a signal from the SCADA system so that water is not circulated back through the standpipe. Therefore the amount pumped during the "draw" mode exactly meets system demand. If a single booster is unable to meet the demand, the pressure drops and the second booster pump ramps up until the demand is matched and the pressure stabilizes.

The automatic control system consists of RTUs, or remote telemetry units, located at each well, the booster station and the office where the central control unit of the SCADA system is also located. A significant feature of this system and specifically these RTU devices is that they are programmable and set up to function independently if radio communication with each other or the central unit is lost. Those at each well site are set up to, among other things, maintain the operator preset minimum pressure based on local sensing equipment. That means that if the local (well area) pressure should drop to that low set point due to some high demand like a fire flow, even during a "draw" cycle and even during some loss of radio communication event between sites, the well pump would come on to help meet the demand and boost the pressure. In this way, there is every opportunity for the existing sources to supply the system with as much water as possible in a fire flow or some other high demand situation. The well control systems also have an operator preset, high pressure shutoff in order to protect the system from overpressure once the high demand event has subsided.

2.5. Related Plans and Documents

This WSP is consistent with the Spokane Aquifer Joint Board Wellhead Protection Program, dated January 2000 which the City has adopted, and with the Spokane County's Coordinated Water System Plan. The growth projections, zoning, etc. used herein have been derived from the City of Millwood's 2009 Comprehensive Plan.

2.6. Existing Service Area

Figure 1 shows land use designations provided by the City's land use plan.

The service area boundary for Millwood is as shown on Figure 1. A portion of Orchard Avenue Irrigation District's service area extends within the City of Millwood's corporate limits on the west, also as shown in Figure 1. These service area boundaries are consistent with the Spokane County's Coordinated Water System Plan map of service areas; adoption dated July 20, 1999. There are no other water service systems within the City's service area.

The future service area of Millwood is not expected to change from the existing service area since all surrounding areas are already served by viable, well managed water systems.

2.7. Service Area Policies

The City of Millwood Municipal Code contains the City's administrative policies. Water system related ordinances and resolutions are contained in the appendix. Water System policies include the requirements for new service connections, as well as construction and maintenance requirements for system expansion.

2.8. Satellite Management

The City currently does not serve any other private or public water systems.

2.9. Duty to Serve and Conditions of Service

The City of Millwood has a duty to provide service to all new connections within the Retail Service Area (refer to **Figures 1, 2,** and **3** for Retail Service Area) when the circumstances meet four threshold factors (see RCW 43.20.260):

1. The municipal water supplier has sufficient capacity to serve water in a safe and reliable manner.
2. The service request is consistent with adopted local plans and development regulations.
3. The municipal water supplier has sufficient water rights to provide service.
4. The municipal water supplier can provide service in a timely and reasonable manner.

The City's process for addressing a request for service determines whether the request meets the four threshold factors defined in RCW 43.20.260.

The City's Development Policy Manual outlines the City's conditions for water service.

Process for Requesting Service
Potential customers submit water service applications to the City. The City processes and responds to all applications within two weeks of receiving service request.

System Capacity Determination
The City consults the Water System Plan to see if any obvious issues exist that would prevent service of an additional customer. The City consults the City Engineering Consultant if it appears the system may not have capacity to serve the proposed connection. The City Engineering Consultant then conducts an analysis to ascertain whether sufficient system capacity exists

(supply, storage, distribution system, water rights, etc.) to serve the requesting customer and determines what additional improvements are required to provide service. The customer requesting service is responsible for financing the system improvements necessary to provide service. If the City has insufficient water rights to serve the customer requesting service, the requestor is responsible for supplying water rights to the City in the amount necessary for the addition of the customer.

Non-Technical Conditions Affecting Provision of Service
Those requesting annexation must comply with relevant City ordinances and development codes. The City can only provide service if adequate water rights are available to serve the requestor (see System Capacity Determination above).

Denial of Service and Appeals
If City Staff deny a request for service based on the process described above, the person/entity requesting service may appeal the decision to the City Council which meets twice monthly.

2.10. Complaints

Complaints are taken at the City Hall by office staff. Those that require maintenance or otherwise can be addressed by the superintendent are forwarded to him. Those that involve administrative matters that cannot be handled by the superintendent or City Clerk are forwarded to the Millwood Mayor and/or City Council.

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3. PLANNING DATA

3.1. Current System Data

3.1.1. Types and Numbers of Connections

As of winter 2010, the City served the following connections (meters):

Table 3-1 Current Connections

	City
Single-Family Residential[1]	622
Multifamily[2]	28
Non Residential[3]	115
Total	765

(1) *Number of current customer accounts*
(2) *There are 107 customer accounts associated with the 28 multifamily connections*
(3) *Includes commercial, City, and school connections*

3.1.2. Population

The City's water service area is shown on **Figure 1**. The current population figure for Millwood's service area is based on information from the City's Comprehensive Plan. Millwood's population is 1,660 (OFM 2010). However, the corporate limits of the City include some areas annexed in 1991 which are served by Orchard Avenue Irrigation District and therefore outside the City's water service area. According to the City's Comprehensive Plan, the original annexation included 59 residential units in 28 acres with a population of 105 persons. Based on a current count of 65 residential units within the annexed area and 1.78 persons per unit, from the original population (i.e. 105÷59=1.78 persons/DU), Millwood's existing service area population is estimated at:

$$1{,}660 - (65 \times 1.78) = \textbf{1,544 Estimated Water Service Area Population}$$

3.1.3. Current Source Production and System Demands

The following table contains source production and demand data for the past three years taken from daily records of well production. Monthly well production data is presented in **Table 3-5**.

Table 3-2 Existing Source Production and System Demands

Item	2008	2009	2010	Average
New Park Well	59.61 MG	55.60 MG	63.46 MG	59.56 MG
Old Park Well	112.18 MG	143.33 MG	86.45 MG	113.99 MG
Butler Well	81.02 MG	65.63 MG	101.60 MG	82.75 MG
Total Volume Pumped	252.81 MG	264.56 MG	251.51 MG	256.29 MG
Total Water Sales	166.94 MG	191.58 MG	153.97 MG	170.83 MG
Authorized Water Use(1)	33.41 MG	33.41 MG	33.41 MG	33.41 MG
Distribution System Leakage (% of total volume pumped)(2)	52.46 MG	39.57 MG	65.21 MG	52.05 MG
	20.8%	15%	25.9%	20.3%
Average Day Demand(3)	0.69 MG	0.72 MG	0.69 MG	0.70 MG
	479 gpm	500 gpm	479 gpm	486 gpm
Max Day Demand(4)	1.80 MG	1.94 MG	1.75 MG	1.83 MG
	1,250 gpm	1,347 gpm	1,217 gpm	1,271 gpm
Peak Hour Demand(4)	1,803 gpm	1,934 gpm	1,923 gpm	1,887 gpm

(1) *Authorized water use includes well pump pre-lube (31.54 million gals), hydrant flushing (.8 million gals) and non-metered irrigation (1.07 million gallons)*

(2) *This is the designation required by DOH. It includes all losses, potentially including leakage, inaccurate meters, etc.*

(3) *Based on pumping records*

(4) *Based on records from City's SCADA system.*

3.1.4. Current Metered Water Use and Seasonal Consumption Patterns

The City of Millwood meters all services and sources. This allows the City to accurately account and bill for water used by customers. The following Table contains metered use for the past three years (2008-2010).

Table 3-3 Current Metered Water Use

Area	Customer Class	2008 (MG)	2009 (MG)	2010 (MG)
Total System	Residential	123.63	141.53	114.03
	Multi-Family	7.87	8.52	7.95
	Commercial	34.37	40.46	30.92
	Irrigation	1.07	1.07	1.07
	Total	166.94	191.58	153.97

The rate of consumption within customer classes changes seasonally throughout the year. The City has two main customer classes: residential and commercial. The City reads residential and commercial meters every month which provides insight into the summer/winter consumption ratio. The following table shows the estimated percentage use by each customer class by season.

Table 3-4 Seasonal Consumption Patterns

Season	Residential	Commercial
Summer	75%	65%
Winter	25%	35%
Total	100%	100%

The following Table contains each well's production data for the previous three years.

Table 3-5 Monthly Well Production Data

Item		2008	2009	2010	Average
New Park Well					
January		0 MG	0 MG	0 MG	0 MG
February		0 MG	0 MG	0 MG	0 MG
March		0 MG	0 MG	0 MG	0 MG
April		0 MG	0 MG	0 MG	0 MG
May		0 MG	0.78 MG	0.025 MG	0.27 MG
June		0.002 MG	0.60 MG	0 MG	0.20 MG
July		44.80 MG	8.68 MG	18.94 MG	24.14 MG
August		14.80 MG	44.67 MG	44.49 MG	34.65 MG
September		0.004 MG	0.88 MG	0 MG	0.29 MG
October		0 MG	0 MG	0 MG	0 MG
November		0 MG	0 MG	0 MG	0 MG
December		0 MG	0 MG	0 MG	0 MG
	Subtotal	59.61 MG	55.60 MG	63.46 MG	59.56 MG
Old Park Well					
January		0 MG	0 MG	0 MG	0 MG
February		0 MG	0.05 MG	0 MG	0 MG
March		0 MG	0 MG	0 MG	0 MG
April		0 MG	5.05 MG	0 MG	1.68 MG
May		14.78 MG	24.12 MG	12.98 MG	17.29 MG
June		26.40 MG	31.13 MG	21.04 MG	26.19 MG
July		2.49 MG	29.70 MG	19.71 MG	17.30 MG
August		19.03 MG	0 MG	1.49 MG	6.84 MG
September		27.61 MG	19.96 MG	25.71 MG	24.43 MG
October		13.40 MG	13.89 MG	5.52 MG	10.94 MG
November		8.46 MG	10.92 MG	0 MG	6.46 MG
December		0.014 MG	8.52 MG	0 MG	2.84 MG
	Subtotal	112.18 MG	143.33 MG	86.45 MG	113.99 MG
Butler					
January		11.83 MG	12.59 MG	12.76 MG	12.39 MG
February		10.77 MG	11.62 MG	11.37 MG	11.25 MG
March		11.64 MG	12.70 MG	12.62 MG	12.32 MG
April		12.20 MG	8.29 MG	14.90 MG	11.80 MG
May		9.24 MG	1.12 MG	8.35 MG	6.24 MG
June		2.66 MG	5.14 MG	0 MG	2.60 MG
July		0.76 MG	9.47 MG	4.64 MG	4.96 MG
August		6.92 MG	0 MG	0 MG	2.31 MG
September		0 MG	1.07 MG	1.30 MG	0.79 MG
October		0 MG	0 MG	10.64 MG	3.55 MG
November		2.45 MG	0 MG	12.23 MG	4.89 MG
December		12.54 MG	3.62 MG	12.81 MG	9.66 MG
	Subtotal	81.02 MG	65.63 MG	101.60 MG	82.75 MG
	Total	**252.81 MG**	**264.56 MG**	**251.51 MG**	**256.29 MG**

3.1.5. Equivalent Residential Units

An Equivalent Residential Unit (ERU) is defined as the amount of water consumed by a typical full-time single family residence. ERUs are calculated herein based on water sales records for the period January 2010 through December 2010. Residential sales (single family dwellings) comprised 114,026,698 gallons (75% of total sales), and non-residential sales (commercial, schools, apartments, etc.) contributed 38,864,876 gallons (25% of total sales).

Daily ERU Demand (ADD)

Formula: ERU = (Ave. Annual Metered Use by SF Residences) ÷ (Num. of Single Family Residences) ÷ (365 days/year)

Millwood: (114,026,698 MG/year) ÷ (622 Res.) ÷ (365 days/year) = 502 gpd/ERU

Commercial ERUs (includes Multi-Family)

Formula: ERUs = (Ave. Annual Metered Use) ÷ (365 days/year) ÷ (ERU ADD)

Comm. ERUs: (38,864,876 MG/year) ÷ (365 days/year) ÷ (502 gpd/ERU) = 212 ERUs

Distribution System Leakage (DSL) ERUs

Formula: ERUs = (Ave. Annual DSL) ÷ (365 days/year) ÷ (ERU ADD)

DSL ERUs: (65,209,024 MG/year) ÷ (365 days/year) ÷ (502 gpd/ERU) = 356 ERUs

Authorized Water Use ERUs

Formula: ERUs = (Ave. Annual Authorized Water Use) ÷ (365 days/year) ÷ (ERU ADD)

DSL ERUs: (33,410,400 MG/year) ÷ (365 days/year) ÷ (502 gpd/ERU) = 182 ERUs

Total Number of ERUs

622 (Residential) + 212 (Commercial) + 356 (Distribution System Leakage) = 1,190 ERUs (total does not include Authorized Water Use ERUs, see discussion below)

Due to the high number of DSL ERUs and the Authorized Water Use being comprised mostly of a continuous pump pre-lube system (estimated at 31,536,000 gallons annually) which the City has eliminated as of this writing, only residential, commercial and DSL ERUs will be used herein. That is, the ERU projections presented below based on a current ERU total of 1,190 as show above.

3.2. Future Data Projections

3.2.1. Introduction

For the purposes of water system planning, DOH requires population and water use projections for 6-year and 20-year planning periods. The Washington State Office of Financial Management, (OFM) provides the most current information and projections for growth for counties. Larger cities often have planning departments which make these projections. Smaller systems may adopt their own projections based on one or more of the following: projections published by the OFM, historical population trends, known development plans, comprehensive plans, and local considerations.

3.2.2. Projected Land Use

For the purposes of this WSP, projected land use will be as shown in **Figure 1** as defined in the relevant Comprehensive Plans.

3.2.3. Projected Population

The Millwood Comp Plan projects a population of 1,692 for the year 2016 and 1,770 for the year 2030 (From Section 5.3 of the 2009 Comp Plan). This is a 1.9% and a 6.6% increase respectively, over the current City population of 1,660. These populations however, include Millwood residents served by the Orchard Avenue Irrigation District (OAID) water system along the west boundary of the City limits. If we apply the same percentage of population increase is applied to the current Millwood service area population of 1,544 which excludes OAID customers, the results are as follows:

Table 3-6 Projected 6 and 20-Year Water Service Area Population

Year	Approximate Population
2010[1]	1,544
2016	1,573
Increase (%)[2]	1.9%
2030	1,646
Increase (%)[2]	6.6%

(5) *Water service area population*
(6) *Percent increase from 2010*

3.2.3.1. Population Distribution

All of the projected growth will be infill. Since the City's future water service area is not expected to change there are limited areas for added development.

From the table above, it is projected that the Millwood water service area population will increase by 102 persons to a population of 1,646 by the end of the 20 year planning period.

3.2.4. Projected System ERUs

The following table projects ERUs through the 20-year planning period based on the preceding discussion. It is assumed that residential and commercial water usage will grow at the same rate as population.

Table 3-7 Projected ERUs[1][2]

Year	Total ERUs
2010	**1,190**
2011	1,194
2012	1,197
2013	1,201
2014	1,205
2015	1,209
2016	**1,212**
2017	1,216
2018	1,220
2019	1,224
2020	1,227
2021	1,231
2022	1,235
2023	1,239
2024	1,243
2025	1,247
2026	1,250
2027	1,254
2028	1,258
2029	1,262
2030	**1,266**

(1) *See Section 3.1.5.*
(2) *Includes DSL*

3.2.4.1. Future Estimated Demand Distribution

The following table summarizes existing and projected demands. Refer to the footnotes following the table for documentation of these figures.

Table 3-8 Summary of Millwood Existing and Projected Demands

Planning Horizon	ERUs[1]	ADD (gpm)[2]	MDD (gpm)[3]	PHD (gpm)[4]
2010	1,190	479	1,217	1,923
2016	1,212	488	1,240	1,959
2030	1,266	511	1,298	2,051

(1) *ERUs are based on well pump production, includes Distribution System Leakage (DSL). See* ***Section 3.1.5****.*
(2) *Includes Distribution System Leakage.*
(3) *MDD figure based on City's SCADA data*
(4) *Peak hour figures based on City's SCADA data*

4. DESIGN STANDARDS

4.1. Introduction

This section sets forth the criteria used to evaluate existing and future facilities. Standards adopted herein provide the basis for future additions, extensions, and expansions of the City of Millwood water system facilities.

The standards and criteria by which public water systems are evaluated and designed in the State of Washington are generally based on one or more of the following:

- Washington State Department of Health *Water System Design Manual* (WSDM)
- Recommended Standards for Water Works (*10 State Standards*)
- System owner requirements and preferences
- Local fire protection authority input
- Washington Surveying & Rating Bureau (regarding fire flow)
- Engineering judgment
- Industry practice

Washington Administrative Codes (WACs) pertaining to public water systems administered by Washington State Departments of Health (DOH) and Ecology (DOE) comprise the regulatory criteria applicable to this water system.

The sections following define City's system design standards.

4.2. Supply Requirements

The DOH *Water System Design Manual* recommends systems develop source capacity that enables supply to replenish depleted fire suppression storage within a 72-hr period while concurrently supplying the max day demand of the system. *10 State Standards* recommend a minimum of two sources and total source capacity at least equal to the design maximum day demand with the largest source out of service. The *10 State Standards* recommendation will be used herein. If these criteria can not be met due to financial limitations, total supply capacity should not be less than the DOH recommended minimum stated above.

4.3. Storage Requirements

As required by WAC 246-290-235, all District storage facilities shall be designed with sufficient capacity to meet the requirements of the following storage components as defined in the WSDM:

- Dead Storage
- Operational Storage
- Equalizing Storage
- Standby Storage
- Fire Suppression Storage

4.3.1 Dead Storage (DS)

Dead storage is the portion of a reservoir below which some customers in the system will experience pressures less than the minimum requirement. Standpipes typically have a portion of the reservoir intentionally designed as dead storage.

Conversely, if a system's source (well or booster pump) does not have sufficient capacity to fill a reservoir above a certain elevation, that portion of the reservoir cannot provide storage to the system and technically qualifies as dead storage.

4.3.2 Operational Storage (OS)

Operational storage is the volume in a reservoir used during normal operation of the system; it is the storage volume used between turning the supply pumps on and off. In general, systems control the operation of supply sources with level sensors or floats in the reservoirs they fill. Using OS allows a reasonable amount of time between pump start/stop which protects the motors from heat damage that can result from excessive cycling of the pump. The system uses OS when supply sources are off. Systems that utilize variable speed pumps can eliminate OS by setting up the pumps to maintain a full reservoir.

4.3.3 Equalizing Storage (ES)

Equalizing storage is the quantity of storage required to meet peak demands that exceed supply capacity. The following equation from the WSDM calculates the volume of required ES:

$$ES = (PHD - Q) \times 150 \text{ minutes}$$

Where ***ES*** = *equalizing storage in gallons*

PHD = *peak hour demand in gpm*

Q = *source capacity in gpm*

4.3.4 Standby Storage (SB)

The purpose of SB is to provide a measure of reliability should sources fail or when unusual conditions impose higher demands than anticipated. The WSDM provides separate equations for calculating required SB volume for systems served by one source and for systems served by multiple sources as described below.

- **Water Systems With A Single Source**

  The required SB volume for systems served by a single source of supply is two times the system's ADD for the design year to be available to all service connections at minimum service

pressure of 20 psi.

SB = (2 days) (ADD) (N)

Where ***SB*** *= is the total standby storage in a single source system in gallons*
ADD *= Average day demand, gpd/ERU*
N *= Number of ERUs*

- **Water Systems with Multiple Sources**

  The required SB volume for systems served by multiple sources must be available to all service connections at a minimum service pressure of 20 psi and is based upon the following equation.

SB = (2 days) (ADD) (N) – (1,440 min) ($Q_S - Q_L$)

Where ***SB*** *= the total standby storage in a multiple source system in gallons (in no case can volume be less than 200 gal per ERU)*
ADD *= Average day demand, gpd/ERU*
N *= Number of ERUs*
Q_S *= Sum of all available source, gpm*
Q_L *= Capacity of largest source, gpm*

SB storage is intended to satisfy the requirements imposed by the system customers for unusual situations; DOH requires that the SB volume be not less than 200 gallons/ERU.

A further reduction in required SB volume can be achieved by providing automatic backup power at the sources of supply. To be considered equivalent to gravity storage all sources used in the SB calculation must be equipped with automatic backup power.

4.3.5 Fire Suppression Storage (FS)

FS is the quantity of storage needed to meet required firefighting flows. If a public water system provides fire flows, it is required to construct and maintain facilities, including storage reservoirs, capable of delivering fire flows while maintaining a minimum pressure of 20 psi at all service connections within the distribution system [WAC 246-290-221(5)].

The volume of FS required for each pressure zone is the product of the maximum fire flow rate and duration established as City criteria; this may or may not be the same fire flow rate and duration required by the local fire protection authority or County Fire Marshal for individual structures within the water system.

4.3.5.1 Nesting of Fire Suppression Storage and Standby Storage

A purveyor may elect to "nest" the SB and FSS storage volumes [WAC 246-290-235(4)]. If a purveyor chooses to nest SB and FSS, the larger of either SB or FSS is used as the total volume required. Provided that such practice is not prohibited by:

- Adopted Coordinated Water System Plan
- Local Ordinance
- Local Fire Protection Authority

Millwood elects to nest the SB and FSS storage volumes in storage calculations as allowed by the WAC. The City consulted the local Fire Marshall on this decision; refer to the **Appendix** for documentation of Fire Marshall involvement.

This WSP uses the DOH storage criteria summarized above. As an aid to visualize the different components of the storage calculation, the DOH *Water System Design Manual* provides a useful diagram (see **Figure 9-1** in Chapter 9 of the *WSDM*). This figure has been reproduced on the following page.

4.3.6 Storage Alternate Design Concept

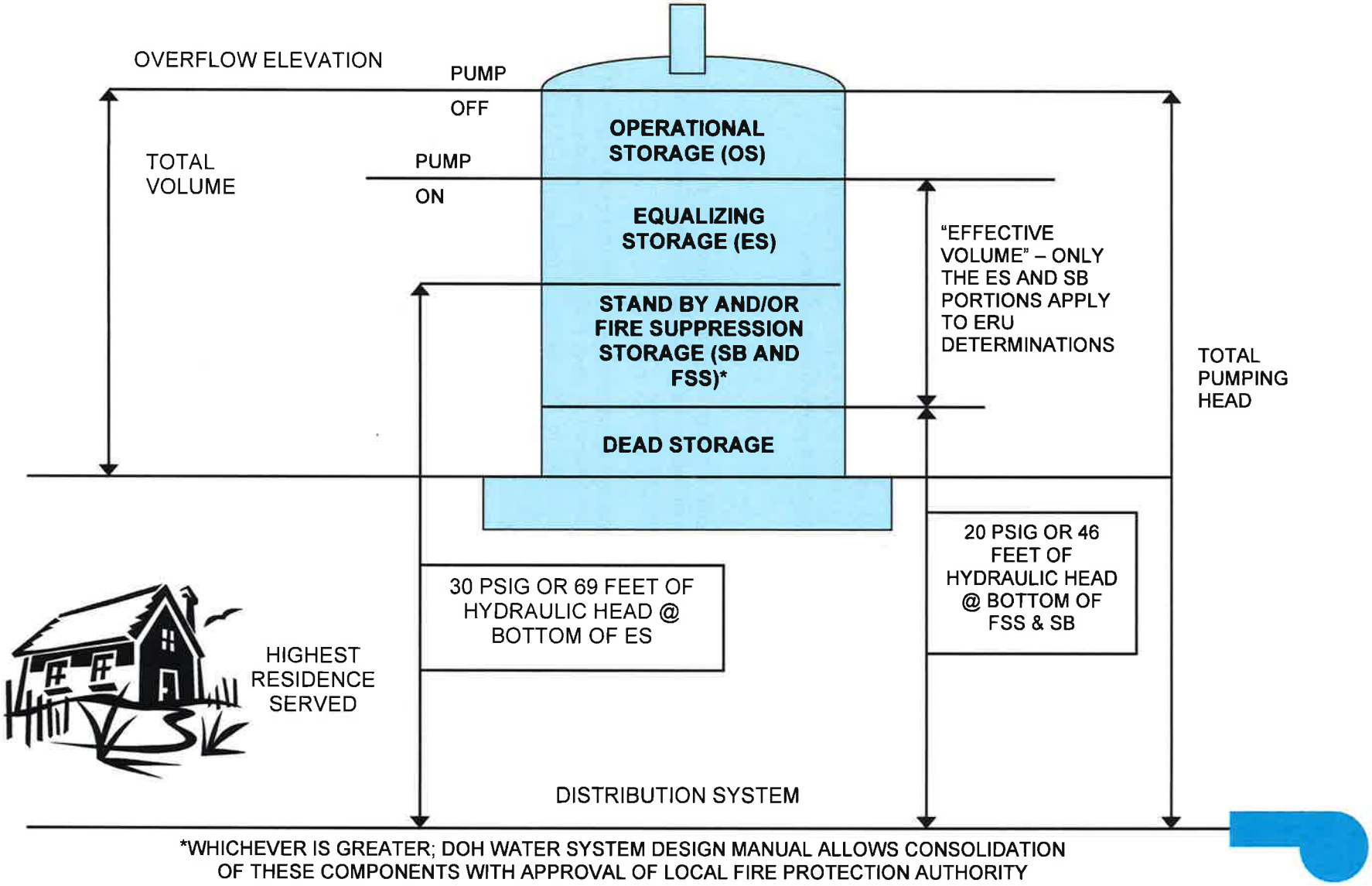
The DOH WSDM provides criteria for reservoir design and storage volume. During the capital facilities planning process, systems typically apply these criteria to determine whether existing storage volume meets the needs of the system and satisfies regulatory criteria.

The WSDM provides an "Alternate Design Concept" (Section 9.1.3 of the WSDM) which outlines circumstances under which systems may reduce or in some cases eliminate the standby and fire storage component requirements. Systems can substitute source capacity for storage volume provided certain requirements are satisfied.

Water systems substituting source capacity for storage volumes need to consider and provide appropriate justification for varying from the following:

- Exclude capacity of the largest producing source of supply from the calculations
- Each source of supply used in the calculations be equipped with on-site backup power facilities, promptly started by an automatic transfer switch upon loss of utility power.
- Incorporate provisions into the system design for pump protection during low demand periods.

The City elects to utilize the storage alternate design concept at its discretion where it is deemed cost effective and in the City's best interest to do so.



*WHICHEVER IS GREATER; DOH WATER SYSTEM DESIGN MANUAL ALLOWS CONSOLIDATION OF THESE COMPONENTS WITH APPROVAL OF LOCAL FIRE PROTECTION AUTHORITY

4.4. Booster Stations

4.4.1. Open Systems

An open system transfers water from a lower pressure zone to a higher pressure zone that has storage open to the atmosphere (gravity storage). Pump operation is typically controlled directly or indirectly by the water surface elevation in the higher elevation storage tank.

To provide for satisfactory operation and meet the requirements of WAC 246-290-230, open systems will generally be designed to meet the Max Day Demand (MDD) for the pressure zone. An open system need not necessarily be designed for peak demand flows because the reservoir can provide equalizing storage if adequate capacity exists. This will minimize the hydraulic impact to the lower zone caused by the draw of the booster station, by reducing the required booster pump capacity. Additional capacity will be considered for purposes of expansion or reliability. Ideally open system pump stations will be designed to meet the MDD with the largest pump out of service. At a minimum, open systems pump capacity will meet the MDD with all pumps in service and meet the ADD with the largest pump out of service.

4.4.2. Closed Systems

A closed system pumps out of a lower zone into a higher zone that is closed to the atmosphere (no reservoir). These systems typically use either continuously running variable speed pumps (VFD) and/or pressure tanks to maintain constant pressure in the booster zone.

The DOH *Water System Design Manual* indicates that closed systems must be designed to provide PHD at no less than 30 psi. A closed system must be designed to meet PHD with the largest pump out of service. A closed system must also be capable of supplying fire suppression requirements at no less than 20 psi with the largest pump out of service. Auxiliary power may be required to provide additional redundancy to areas the system owner deems necessary.

Millwood's water system operates as a closed system only while in the "draw" mode under normal conditions as discussed earlier in Section 2 when demand does not exceed the booster station's capacity. Because the SCADA control system is set up to maintain system pressure, the water system is not truly a closed system as defined in the paragraph above. For example, if during the "draw" mode system pressure drops due to system demand greater than the booster pumps' capacity (or booster pump's capacity, if one is out of service), one or more of the well pumps will come on automatically to maintain system pressure and meet the demand. Additional backup supply is also available via the interties with two separate, adjoining water systems as described earlier.

4.5. Distribution System Requirements

4.5.1. Hydraulics

Requirements of the DOH *Water System Design Manual* include:

- Pressures at all services shall be at least 30 psi during peak hour demand, 20 psi during maximum day demand plus fire flow, maximum pressure generally shall be less than 90 psi
- Minimum new main size of at least 6" unless justified by hydraulic analysis
- Minimum size of main providing fire flow is 6"

Recommendations of *10 State Standards* include:

- Pressures at all services shall be at least 35 psi during peak hour demand, 20 psi during fire flow
- Minimum new main size of at least 6" unless justified by hydraulic analysis
- Minimum size of main providing fire flow at least 6"
- Distribution valving located at one block intervals
- Hydrant spacing of about 350 feet in commercial areas and about 600 feet in residential areas

The *WSDM* and *10 State Standards* are more or less in agreement. The more stringent of the two will be utilized. Minimum pressures will be designed for at least 40-50 psi whenever possible rather than the 30-psi required.

Additional design and construction criteria including standard detail drawings are contained in the City's construction standards in the Appendix. Along with approval of this Water System Plan, the City of Millwood is seeking advanced approval of these design and construction standards for distribution main and other distribution-related facilities projects to be constructed during the 6-year planning period. This is expected to allow Millwood to proceed with such distribution projects without having to submit project reports or Plans and Specification to DOH for approval.

4.5.2. Fire Flow

A community's ability to extinguish a fire is determined by a number of factors, including the rate at which water can be delivered, the duration that rate can be sustained, hydrant coverage/spacing, condition of hydrants, as well as other factors beyond the scope of this plan, such as skill and training of fire fighting crews, fire fighting equipment and condition, etc.

The Washington Surveying and Rating Bureau (WSRB) is a non-profit institution which rates the ability of a community to extinguish a fire. The WSRB rating is used by the insurance industry to set Cities' insurance rates. WSRB uses a 10 class system; Class 1 being communities with greatest ability to extinguish a fire and Class 10 being the lowest. Millwood has recently been rated as a Class 3.

WSRB assigns a basic fire flow rate (basic fire flow is the average required fire flow for the commercial areas). In Millwood, that number was 3,000 gpm for 2 hour. The WSRB representative also indicated the following notes from the last review regarding fire flow assignment: [1]

3,000 gpm for the Millwood Early Childhood Education Center
4,000 gpm for Albertsons

2,250 gpm for Big R
4,000 gpm for Craftsman Construction

(1) *Based on email from Robert Ferrell of the WSRB dated 5/26/11*

The City recognizes that for individual structures (existing and future) the International Fire Code, Local Fire District, and the recommendations of the Washington Surveying and Rating Bureau may differ from the City's fire flow rate and duration criteria. However, the City feels that the fire flow criteria established herein provide a reasonable level of fire protection for the land use types within the City.

In general, the City sets the following fire flow criteria for each development type. The City will supply up to the following rates and durations:

- Single-family Residential: 1000 gpm, 1 hr
- Multi-family Residential: 2500 gpm, 2 hr
- Commercial areas: 2500 gpm, 2 hr
- School Bldg.: 3500 gpm, 3 hr

5. EXISTING SYSTEM ANALYSIS

5.1. Reported System Problems

A Water System Plan provides a detailed engineering analysis of a water system. However, this analysis is incomplete without input from the system's operator(s) and any other individuals or entities that have intimate knowledge of the day to day operations and problems of the system. Comments provided by individuals with close working knowledge of the system follow.

5.1.1. Comments from City Staff

City staff has identified the following issues with the system.

- A third, smaller booster pump is needed to efficiently supply lower flows during times of lower demand and to extend the life of the larger booster pumps.
- The standpipe exterior coating is beginning to chip and spall in areas. Additionally, the reservoir interior has not been inspected in almost 10 years.
- A consolidation of the City's water rights is needed to avoid exceeding the instantaneous water right at the Butler Well.
- The Old Park well building needs to be replaced and expanded in order to house the backup generator.
- The backup generator needs to be connected to the booster station to improve system reliability.
- Standby chlorination facilities should be added to the New Park and Butler Wells for emergencies.

5.2. Supply

5.2.1. Supply Capacity

Refer to **Table 2-1** for details on the City's wells and refer to the Appendix for copies of the available well reports. The condition and efficiency of the wells is unknown, as is the aquifer capacity. The well and related pumps and piping operate satisfactorily with no major operational problems reported.

Tables 5-1 and **5-2** summarize supply capacity, projected demand, and current water rights.

Table 5-1 Supply Capacity Evaluation[1]

Element	Existing	6 Year	20 Year
Total Supply Capacity[2]	**3,950 gpm**	**3,950 gpm**	**3,950 gpm**
Approx. Max Day Demand	1,217 gpm	1,240 gpm	1,298 gpm
Excess/(Deficiency)	2,733 gpm	2,710 gpm	2,652 gpm
Capacity with largest source out of service	**1,750 gpm**	**1,750 gpm**	**1,750 gpm**
Approx. Max Day Demand	1,217 gpm	1,240 gpm	1,298 gpm
Excess / (Deficiency)	533 gpm	510 gpm	452 gpm

(1) *This table does not consider water rights. Figures in this table are from **Table 3-8**.*
(2) *Present well pump capacity. Well capacity unknown.*

The existing wells have adequate capacity to supply existing and projected demands.

Table 5-2 Supply Capacity Analysis

	# of ERUs	Annual Source Production (MG/year)	ADD (gal/day)	MDD (MG/day)	PHD (gpm)	Source Capacity (MG/day) [1]	Source Capacity (gpm) [2]	Water Rights Qi (gpm)	Water Rights Qa (MG/year)
Millwood									
Current	1,190	251.51	690,000	1.75	1,923	5.83	3,950	3,900	1,540
6-year	1,212	256.60	703,000	1.79	1,959	5.83	3,950	3,900	1,540
20-year	1,266	268.64	736,000	1.87	2,051	5.83	3,950	3,900	1,540

(1) *At 24hrs/day*
(2) *The City does not operate all three sources simultaneously under any scenario*

5.2.2. Condition of Supply Facilities

5.2.2.1. New Park Well

This is the newest of the City's three wells and was constructed in 1981. It is located at the west end the Millwood City Park and is housed in a concrete block building. The roof of the building was replaced with a metal roof in early 2000. There are no other reported problems with this well, pump or building.

5.2.2.2. Butler Well

This well and building was constructed in 1959 and is located at the east end of the City's corporate limits, on Butler Street. Except for minor repairs and improvements including the replacement of the old control system features with the SCADA components, the major system components have operated relatively trouble-free. The building is of concrete block construction and no urgent problems are apparent. At this time there are no reported problems with this well, pump or building.

5.2.2.3. Old Park Well

This is the oldest of the City's three wells and was constructed in about 1952. It is located near the standpipe and booster station at the east end of the Millwood City Park. The building is of concrete block construction. It once housed its own gasoline engine that served as backup power for the well pump and remnants of the abandoned equipment remain, cluttering up the interior. The City would like to replace the building in order to expand it to house the current backup generator and improve the building's overall appearance. The well, pump and equipment seems to be operating satisfactorily and there are no reported problems with them.

5.2.3. Reliability of Supply Facilities

In 1999, the City purchased a 400KVA diesel generator as backup power for the water system. The generator was modified to accommodate the startup and continuous running of both the Old Park Well pump and the booster pumps and was intended to be installed with an automatic transfer switch to respond immediately in the case of a power failure. The desire was to replace the Old Park Well building with a new structure that would also house the backup generator and transfer switchgear. In late 1999 the generator was installed but, due to a lack of funds at the time, it was only possible to connect it to the Old Park Well pump without automatic transfer or startup. The generator was installed on a concrete pad outside the existing Old Park well building in its own metal enclosure. It was located according to the original plan to eventually incorporate it into a new Old Park Well building, connect it also to the booster pump power system and add an auto-transfer switch.

5.2.4. Water Rights

The water rights information contained herein is based on available records, including those provided by the Washington State Department of Ecology. This Water System Plan does not constitute legal analysis or interpretation by the City nor Varela & Associates of the rights or quantities reported herein.

Copies of Water Rights Certificates are included in the appendix. Refer to the tables below for a summary of water rights as shown on these documents.

Table 5-3 Current Water Rights Status[1]

Permit, Certificate or Claim #	Name of Right Holder or Claimant	Priority Date	Source	Primary or Supplemental Source	Existing Water Rights		Existing Consumption		Current Water Right Status (Excess/Deficiency)	
					Max Instantaneous Flow Rate (Qi)(gpm)	Max Annual Volume (Qa)(ac-ft)	Max Instantaneous Flow Rate (Qi)(gpm)[2]	Max Annual Volume (Qa)(ac-ft)[3]	Max Instantaneous Flow Rate (Qi)	Max Annual Volume (Qa)
CERTIFICATES										
1813-A	Millwood	1952	Old Park	Primary	1,200	405	1,000	265	200	140
4139-A	Millwood	1959	Butler	Primary	500	800	750	312	(250)	488
3744-A	Millwood	1960	New Park	Primary	2,200	3,520	2,200	195	0	3,325
2045-A	Millwood	1954								
G3-26769C	Millwood	1981								
				TOTAL	3,900	4,725	3,950	772	(50)	3,953

(1) *The water rights information contained herein is based on available records, including those provided by the Washington State Department of Ecology. This Water System Plan does not constitute legal analysis or interpretation by the City nor Varela & Associates of the rights or quantities reported herein.*

(2) *Max pumping capacity of City wells. Refer to **Table 2-1**. The current total instantaneous usage is 1,217gpm (MDD) and 1,924 gpm (PHD).*

(3) *2010 annual use. Refer to **Table 3-2**.*

Table 5-4 Forecasted Water Rights Status (2016)[1]

Permit, Certificate or Claim #	Name of Right Holder or Claimant	Priority Date	Source	Primary or Supplemental Source	Existing Water Rights		Existing Consumption		Current Water Right Status (Excess/Deficiency)	
					Max Instantaneous Flow Rate (Qi)(gpm)	Max Annual Volume (Qa)(ac-ft)	Max Instantaneous Flow Rate (Qi)(gpm)[2]	Max Annual Volume (Qa)(ac-ft)[3]	Max Instantaneous Flow Rate (Qi)	Max Annual Volume (Qa)
CERTIFICATES										
1813-A	Millwood	1952	Old Park	Primary	1,200	405	1,000		200	
4139-A	Millwood	1959	Butler	Primary	500	800	750		(250)	
3744-A	Millwood	1960	New Park	Primary	2,200	3,520	2,200		0	
2045-A	Millwood	1954								
G3-26769C	Millwood	1981								
				TOTAL	3,900	4,725	3,950	787	(50)	3,938

(1) *The water rights information contained herein is based on available records, including those provided by the Washington State Department of Ecology. This Water System Plan does not constitute legal analysis or interpretation by the City nor Varela & Associates of the rights or quantities reported herein.*

(2) *Max pumping capacity of City wells. Refer to **Table 2-1**. The projected total instantaneous usage is 1,240 gpm (MDD) and 1,959 gpm (PHD).*

(3) *Projected 6-year use. Refer to **Table 3-8**.*

Table 5-5 Forecasted Water Rights Status (2030) [1]

Permit, Certificate or Claim #	Name of Right Holder or Claimant	Priority Date	Source	Primary or Supplemental Source	Existing Water Rights		Existing Consumption		Current Water Right Status (Excess/Deficiency)	
					Max Instantaneous Flow Rate (Qi)(gpm)	Max Annual Volume (Qa)(ac-ft)	Max Instantaneous Flow Rate (Qi)(gpm)[2]	Max Annual Volume (Qa)(ac-ft)[3]	Max Instantaneous Flow Rate (Qi)	Max Annual Volume (Qa)
CERTIFICATES										
1813-A	Millwood	1952	Old Park	Primary	1,200	405	1,100		200	
4139-A	Millwood	1959	Butler	Primary	500	800	750		(250)	
3744-A	Millwood	1960	New Park	Primary	2,200	3,520	2,200		0	
2045-A	Millwood	1954								
G3-26769C	Millwood	1981								
				TOTAL	3,900	4,725	3,950	824	(50)	3,901

(1) *The water rights information contained herein is based on available records, including those provided by the Washington State Department of Ecology. This Water System Plan does not constitute legal analysis or interpretation by the City nor Varela & Associates of the rights or quantities reported herein.*

(2) *Pumping rate of City wells. Refer to* ***Table 2-1****. The projected total instantaneous usage is 1,298 gpm (MDD) and 2,051 gpm (PHD).*

(3) *Projected 20-year use. Refer to* ***Table 3-8****.*

Several items regarding the City's water rights should be noted.

- Total instantaneous and annual water rights are adequate for existing demands as well as projected 20-yr demands.
- The Butler well currently appears to be exceeding its instantaneous water right.
- All wells are producing far below their annual water rights.

The current control system allows the operator to choose which well will pump in the lead position. This flexibility along with the SCADA systems record keeping capabilities allows for adjustments to be made in order to keep each well within its annual water right. Therefore the operator can keep track of well production and adjust the operating scenario as necessary to keep the Old Park well operating within its annual water right.

A remedy to the problem of the Butler well pump exceeding its instantaneous water right is to integrate all the City's existing water rights into one. This integration of rights requires approval by the Department of Ecology. If approved, the resulting instantaneous total water right would be above the projected peak hour demand greater than the capacity of any two well pumps combined. Integrating the water rights would also ensure that the annual water rights would not be exceeded as well.

5.3. Water Quality and Treatment

DOH generates a Water Quality Monitoring Report (WQMR) for water systems on an annual basis; the WQMR summarizes the system's water quality sampling requirements for the year (see the Appendix for a copy of the City's 2011 WQMR). **Table 5-6** summarizes the City's water quality sampling requirements.

The Old Park Well is identified as S01, the Butler Well is identified as S02, and the New Park Well is identified as S03.

Table 5-6 Monitoring History and Requirements As Reported By DOH

Contaminant	Sample Location	Schedule/Status	Trends/Comments
Asbestos	Distribution System	State Waiver Thru Dec 2019	No apparent concerns
Bacteriological	Distribution System	Twice Monthly	2 monthly samples required
Dioxin	All Sources	State Waiver Thru Dec 2013	No apparent concerns
Endothall	All Sources	State Waiver Thru Dec 2013	No apparent concerns
EDB & other soil fumigants	S01	State Waiver Thru Dec 2013	No apparent concerns
EDB & other soil fumigants	S02	State Waiver Thru Dec 2013	No apparent concerns
EDB & other soil fumigants	S03	State Waiver Thru Dec 2013	No apparent concerns
Glyphosphate	All Sources	State Waiver Thru Dec 2013	No apparent concerns
Herbicides	S01	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Herbicides	S02	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Herbicides	S03	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Insecticides	S01	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Insecticides	S02	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Insecticides	S03	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Inorganic Contaminants	S01	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns
Inorganic Contaminants	S02	1 Sample Between Jan 2011 - Dec 2013	No apparent concerns

Table 5-6 Monitoring History and Requirements As Reported By DOH (Cont.)

Contaminant	Sample Location	Schedule/Status	Trends/Comments
Inorganic Contaminants	S03	1 Sample Between Jan 2011 – Dec 2013	No apparent concerns
Lead/Copper	Distribution System	LCR 1 Set of 5 samples between Jan 2010 – Dec 2012	No apparent concerns
Nitrate	S01	Collect 1 sample(s) every 1 year	No apparent concerns
Nitrate	S02	Collect 1 sample(s) every 1 year	No apparent concerns
Nitrate	S03	Collect 1 sample(s) every 1 year	No apparent concerns
General Pesticides	S01	1 sample between Jan 2011 – Dec 2013	No apparent concerns
General Pesticides	S02	1 sample between Jan 2011 – Dec 2013	No apparent concerns
General Pesticides	S03	1 sample between Jan 2011 – Dec 2013	No apparent concerns
Diquat	All Sources	State Waiver Thru Dec 2013	No apparent concerns
Volatile Organic Contaminants	S01	1 sample between Jan 2011 – Dec 2013	No apparent concerns
Volatile Organic Contaminants	S02	1 sample between Jan 2011 – Dec 2013	No apparent concerns
Volatile Organic Contaminants	S03	1 sample between Jan 2011 – Dec 2013	No apparent concerns

All monitored water quality constituents are within permissible levels. Refer to **Appendix E** for recent water quality sample results.

5.3.1. Disinfection

Disinfection for emergencies is available to the system by liquid hypochlorite solution injected at the Old Park Well. The City plans to add similar standby disinfection systems to the New Park and Butler Wells within the 6-year planning horizon.

5.3.2. Groundwater Rule

The Environmental Protection Agency (EPA) finalized their Groundwater Rule in October 2006. The rule builds upon the Total Coliform Rule. The Groundwater Rule requirements went into effect December 1, 2009. The Table following provides an overview of the Groundwater Rule.

Table 5-7 Groundwater Rule Overview

Requirement	Comments
Sanitary survey by DOH every 3 years	May be every 5 years if certain conditions are met
Determination of hydrogeologic sensitivity	Gravel wells without hydrogeologic barrier are defined as sensitive setting (this is the case for Leavenworth's two wells)
Triggered source water monitoring: • Test source water for coliform within 24 hours of distribution system hit • Monthly source monitoring for coliform of sources in hydrogeologically sensitive settings	-
If the above steps indicate a fecally contaminated source or one with significant deficiencies that can act as a potential pathway for contamination, the system must do one of the following: • eliminate the source of the contamination or correct the significant deficiency • provide alternate source water • provide treatment which achieves at least 99.99% removal or inactivation of viruses and monitoring to verify same	-

5.4. Booster Stations

5.4.1. Facilities

The booster station was constructed in 1992 and is located in a slab-on-grade, concrete block building adjacent to the standpipe. Located inside this building are 2 booster pumps, their individual variable frequency drive (VFD) units and associated suction and discharge piping and valves. The booster station is also equipped with below grade discharge piping, electrical conduits, a block-out in the concrete floor and space to add a third booster pump, VFD and suction piping as needed in the future. At the time of the design of the booster station it was anticipated that system demand would eventually drop sufficiently to warrant the addition of a third, smaller booster pump to handle the low flows periods as old, leak-prone pipelines were replaced.

Also, the old booster pump, originally installed with the standpipe, remains in its original location and building that is now a room adjoining the new booster station building. It remains incorporated into the original piping that functioned then as the fill and discharge pipe for the standpipe. This piping now functions primarily as the fill piping only for the standpipe as it also incorporates the original "Tower" valve that functions to control flow into the standpipe. Although the old booster pump remains in place and could potentially be operated manually if needed in an unusual situation, it is not an operating component of the normal operating system.

5.4.2. Function and Capacity

The automatic function of the booster pumps and its interaction with the rest of the water system is controlled by the SCADA system. Normally the booster pumps function only during a standpipe "draw" mode as described above in Section 2 of this WSP. Each booster pump's output is controlled by its VFD unit in response to system pressure via a pressure transducer located at the booster station site. Both boosters will run automatically and simultaneously as system demand, based on system pressure, warrants. Each of the two existing pumps is capable of delivering 1,750 gpm. Therefore the existing booster pumps together are capable of meeting the current peak hourly demand (1,923 gpm) as well as the projected future peak hourly demand (2,051 gpm). For reasons explained earlier, the ability of the booster pump system component to meet peak hourly demand with one booster pump out of service is not a factor in this SCADA controlled system.

The low flow capability of the existing booster pumps is limited. While the VFD units are capable of operating at very low speed, the pumps themselves must maintain sufficient flow for cooling purposes while running. At very low flows the existing 75 hp pumps do not move water very efficiently. A sampling of SCADA records indicate the low nighttime flows reach about 200 gpm. Operators report seeing flows as low as 150 gpm since the completion of the new sewer collection system which included replacement of most of the water distribution pipelines. The pump supplier does not recommend continually operating the existing 75 Hp pumps at these low flows.

5.4.3. Conclusion

As indicated in the first paragraph above, the need for a third, smaller booster pump was anticipated in order to handle the low flow periods when the system is in the "draw" mode. The existing booster pumps are adequate and needed to provide the normal daytime average, maximum, peak and even fire flows. A new smaller booster pump with VFD should be added to the booster station in the space provided to handle the low flow periods more efficiently.

5.5. Storage

The standpipe serves to provide system pressure relief during the "fill" mode allowing the well pumps to operate at their most efficient level. It also serves as the supply for the booster pumps during the "draw" mode. Finally, it provides storage for emergency purposes to supplement supply capacity to meet necessary demands if one or more of the well pumps are out of service.

5.5.1. Storage Capacity Assessment

Storage is provided by a 110-foot tall, 800,000-gallon standpipe used to supply the booster pumps. This is approximately 7,200 gallons per vertical foot.

The following paragraphs calculate the volume of storage provided or required per the design criteria outlined earlier in Section 4.

Operational storage (OS):

An overview of system operation was given earlier in Section 2. The operating range of the standpipe is adjustable by the operator and is currently set at 100 feet to 60 feet above the bottom of the reservoir. This is approximately equivalent to 288,000 gallons.

Dead storage (DS):

It is only during the "draw" mode of system operation that the standpipe supplies the demand for water, and this via booster pumps. Therefore dead storage is considered that amount which is unavailable to the suction of the booster pumps. For purposes of net positive suction head and safety factor to protect the pumps, 10 feet is considered a minimum level. This is approximately equivalent to 72,000 gallons.

Standby storage (SB):

Present

2 x 690,000 gpd (ADD, Table 4-3) – 1850 gpm (O.P. & Butler wells) x 1440 min/day < 0
Therefore, standby storage is not required from a well capacity standpoint.
DOH recommended minimum of 200 gal/day/ERU x 1,190 ERUs (Table 3-8) = 238,000 gal.

Projected 20-Yr

2 x 736,000 gpd (ADD, Table 4-3) – 1850 gpm (O.P. & Butler wells) x 1440 min/day < 0
Again, standby storage is not required from a well capacity standpoint.

DOH recommended minimum is 200 gal/day/ERU x 1,266 ERUs (Table 3-8) = 253,000 gal.

Fire suppression storage (FSS):

3500 gpm (fire flow for the School, see Section 4) x 180 min. = 630,000 gal.

Equalization storage (ES):

Present

[1,923 gpm (PHD) – 3950 gpm (all wells)] x 150 min. < 0 gal.

Therefore equalization storage is not required

Projected 20-Yr (w/o demand reduction)

[2,051 gpm (PHD) – 3950 gpm (all wells)] x 150 min. < 0 gal.

Therefore equalization storage is not required

Table 5-8 Storage Evaluation Summary

Component	2011 (gal)	2030 (gal)
Operational Storage	288,000	288,000
Dead Storage	72,000	72,000
Standby Storage	238,000	253,000
Fire Suppression Storage	630,000	630,000
Equalization Storage	0	0
Total Required Capacity[1]	990,000	990,000
Existing Capacity	800,000	800,000
Excess or (Deficiency)	(190,000)	(190,000)

(1) *This total "nests" fire flow and standby storage volumes as allowed by the Water System Design Manual; the larger of the two volumes contributes to the sum. See Appendix for local fire authority approval of nesting.*

5.5.2. Summary of Storage Capacity

Fire suppression and standby storage are often nested due to economic considerations and on the assumption that the likelihood of a source outage and a major fire occurring on the same day is small. The City is operating three individually powered wells, each of which is on separate utility power feeders which reduces the likelihood of more than one well at a time effected by a power outage. One well (Old Park) is also equipped with an emergency backup power generator. Also available to the City are three emergency intertie connections to two separate public water purveyors at opposite ends of Millwood's system, who, again operate their systems within two separate power grids. Therefore, nesting the standby within the fire suppression storage volume seems an acceptable risk. A letter from the local fire protection authority documenting that he does not object to this nesting of standby and fire suppression storage is included in the Appendix.

The following are other important observations regarding storage capacity.

- The system falls somewhat short of the theoretically required storage volume (about 19%).
- With the standby and fire suppression storage nested, the needed storage amount does not change from now to the projected future.

- Operational storage can be readily decreased and other storage volumes increased by the operator, for such things as FSS, simply by resetting the "fill" mode to a higher level. Operational standards such as pump cycling time and recommended reservoir circulating however would need to be checked and maintained.

For example: "Fill" mode at 87 feet ("Draw" mode remains at 100 feet), then

OS = 13 ft. x 7200 gal/ft =	93,600 gal		
Plus DS @	72,000 gal		
Plus FSS @	630,000 gal		
Total =	795,600 gal	⇒	No storage deficiency

- Existing interties and backup power generation are important considerations in evaluating existing and future storage requirements.

Based primarily on the final two observations above, the deficiencies in calculated DOH required storage volume (i.e. 190,000 gal.) are not considered to be a system deficiency in terms of the water system's capability to meet both current and projected normal and emergency demands. Present storage capacity is therefore adequate. In addition, the City plans to evaluate its reservoir operation in order to optimize storage requirement volumes.

5.5.3. Condition of Existing Reservoir

The reservoir is reported to be in good overall condition. It was completely repainted inside and out in 1992. The reservoir was last inspected in 2001 and should be inspected in the near future and cleaned if necessary. Also, it is reported that the exterior is beginning to pit and may need recoating.

5.6. Distribution System

This section evaluates the adequacy of the City's existing distribution system facilities under current and projected demands. **Section 4** outlines the criteria used in this analysis.

5.6.1. System Hydraulics

Due to the lack of growth and system changes since the City's previous Water System Plan, hydraulic data and findings from the 2003 WSP are assumed to also be unchanged since the previous WSP. Sections 5.6.1 through 5.6.3 are taken from Millwood's 2003 WSP.

The following paragraphs describe the hydraulic model and its setup.

- Distribution system hydraulics was analyzed using WaterCAD 3.1 by Haestad Methods.
- Existing and future demand levels are as shown in Section 3 above.
- From Section 3, projected growth is expected to be distributed more or less uniformly over the system. The projected increase in water demand is approximately 7%. To account for the potential that projected water demands will increase more in some areas than in other (i.e., non-uniform growth), existing demands were scaled up 25% over the entire system for the future demand conditions.
- Except for the larger commercial services, demand was distributed by counting buildings on an aerial photo.

- There are three main pipe types, cast iron, DI and PVC, with roughness factors (C) taken to be 100, 130 and 130 respectively.
- Hydrant tests were not available for model calibration.
- A map of the network system and hydraulic model data including selected junction reports showing the results of the hydraulic modeling are included in the Appendix.

The following paragraphs describe system pressures, fire flows and hydraulics.

5.6.2. Existing Demand

5.6.2.1. Pressures – Existing Demand

- Static pressures throughout the system range from the nearly 50 psi in the highest area of the system to the mid 70s in the lowest areas.
- Pressures drop by less than 3 psi throughout the system under existing peak hour demand as compared to static conditions.
- This change in pressures (<3 psi) is the same regardless of reservoir level since the system hydraulic grade is set by the booster station (and/or Tower valve).
- Minimum system pressure under peak hour demand conditions is at the east end of the system (highest in elevation) and are in the high 40s. Maximum system pressure under static conditions are in the NW part of the system (lowest in elevation) and are in the mid 70s.
- The above statements are accurate whether or not the well pumps are on.
- See attached model data – "Scenario: Existing PHD Steady State Analysis Junction Report" which has been sorted by ascending pressure.

5.6.2.2. Fire Flows – Existing Demand

- Fire flow was modeled under max day demand conditions without any of the wells on. Because the booster station sets the hydraulic grade, the status of the reservoir does not affect available fire flows.
- Available fire flows in all residential areas were above 1000 gpm except at the hydrant on Frederick east of Locust where available fire flow was approx. 600 gpm. See "Scenario: Existing MDD Fire Flow Analysis Fire Flow Report All Nodes" which has been sorted by ascending available fire flow.
- Available fire flows in all commercial areas were above 3500 gpm except on Trent/Laura and Trent/Sargent where model projected fire flows were in the range of 2200 to 2400 gpm. Commercial areas are those areas along Trent, Argonne and Frederick between Marguerite and Maple. See "Scenario: Existing MDD Fire Flow Analysis Fire Flow Report Commercial Nodes" which has been sorted by ascending available fire flow.
- There are no mains indicated by the model with excessive velocities (>8 ft/s) or excessive head loss under peak hour demand conditions.

5.6.3. Future Demand

As described above, future demand was modeled as an increase of 25% over existing demand at all locations. This assumption is intended to accommodate potential high localized rate of increased water demand as compared to the projected system-wide 13% increase.

5.6.3.1. Pressures – Future Demand

- Under future PHD, pressures at all points throughout the system are within approximately 1 psi of existing PHD. That is, minimum system pressures will be in the high 40s psi or above.
- See attached model data – "Scenario: Existing PHD Steady State Analysis Junction Report" which has been sorted by ascending pressure.
- All other observations from above are applicable.

5.6.3.2. Fire Flow

- Available fire flows in all commercial areas are above 3500 gpm except on Trent/Laura and Trent/Sargent where model projected fire flows were in the range of 2200 - 2400 gpm. See "Scenario: Future MDD Fire Flow Analysis Fire Flow Report Commercial Nodes" which has been sorted by ascending available fire flow.
- Available fire flows in all residential areas were above 1000 gpm except at the hydrant on Frederick east of Locust where available fire flow was approx. 600 gpm. See "Scenario: Future MDD Fire Flow Analysis Fire Flow Report All Nodes" which has been sorted by ascending available fire flow.
- There are no mains indicated by the model with excessive velocities (>8 ft/s) or excessive head loss under peak hour demand conditions.

5.6.4. Condition of Distribution System

5.6.4.1. Overview

- See Table 3-1 for a component inventory of the distribution system.
- Nearly 82% of the water mains in Millwood are newer ductile iron (DI) or PVC (AWWA C-900) pipe installed in construction projects from 1992 – 1996.
- Roughly 18% of the existing water mains are CI pipe, much of it thought to be over 50 years old. Much of that amount is thought to be constructed of leaded joint pipe, which has been found in other cases to be prone to leakage.
- About 1,400 LF is undersized 4" pipe serving fire hydrants along Trent Ave., Laura to Dale, and on Frederick Ave., east of Locust St.
- This 4" pipe on Frederick Ave., east of Locust St. is also a dead end pipe with no blow-off or fire hydrant.
- Depth of bury for both mains and services is generally four feet or greater.
- Taps for services consist of saddles and corp. stops. Nearly all homes have curb stops.
- Service pipes are copper and galvanized steel (GS). GS service pipes on all mains replaced from 1992-96 where replaced to the property lines with copper pipe.
- Due to the replacement projects indicated above, valving of the system and hydrant spacing is generally adequate.

5.6.4.2. Unaccounted-for Water/Potential System Leakage

Distribution System Leakage is calculated to be approximately 20% (99 gpm) of the total water production average for the three-year period of record as described in **Section 3.1.3**. This amount could be the result of a number of factors. Since most of the distribution system is relatively new and not likely to be a significant source of leakage, any leakage that may be present in the system would most likely be in the old CI portion of the system piping.

5.6.5. Conclusions Regarding Distribution System Analysis

Overall Millwood's distribution system is in excellent condition. Due to extensive improvements over the last fifteen years the majority of the system is new materials including mains and service pipe. The system is well looped and well planned with sufficient pipe sizes capable of delivering the peak demand satisfactorily to any part of the system and more than the minimum fire flow to nearly all parts of the system. The distribution network deficiencies noted are summarized as follows.

- Low fire flow capability in the commercial area along Trent Avenue at the fire hydrants at Trent/Laura and at Trent/Sargent where about 700 feet of old, leak-prone, undersized 4" cast iron pipe still exists.
- Low fire flow capability in the residential area along Frederick Avenue at the fire hydrant east of Locust Rd. where about 700 feet of old, leak-prone, undersized 4" cast iron pipe still exists.
- This 4" pipe on Frederick Ave., east of Locust St. is also a dead end pipe with no blow-off or fire hydrant.
- Distribution System Leakage is estimated at 20% (or 99 gpm) of total annual water production. Most likely would from the nearly 8,000 feet of old, leaded-joint, cast iron pipe and associated service connections that remain in the system.

5.7. Control System

A description of the SCADA (control) system is provided in **Section 2**. A description of how the operation of the water system is controlled by the SCADA system is provided in **Section 2.4**.

The SCADA package was revised and updated in 1999-2000 by Automatic Electrical Systems (Rathdrum, Idaho). The package includes all software and equipment necessary for the control and telemetry system for each well pump, the booster station and the reservoir. Software for the SCADA package has since been upgraded in 2010.

Each remote site is connected to the host computer at Millwood's office via wireless spread spectrum radio equipment. The SCADA package provides real time numeric/graphical information displays and reports. The reservoir level, alarms, flows, system pressures and pump on/off conditions at each site are provided. Each well site and the booster station site have pressure transducer controls that are monitored by a PLC which operates each site independently of and/or in conjunction with the other sites through the host computer. Pressure transducer settings for well pump on/off control and reservoir level controls may be selected or changed from the office host computer or at each site.

The SCADA system includes an auto-dialer that dials consecutive preprogrammed numbers to alert the operator of system alarms. Currently the auto-dialer is programmed to contact first the operators' pager, then the superintendent's home and finally the assistant manager's home.

Equipment manuals, operating procedures etc. are located at the City office. Automatic Electrical Systems is available on a 24-hour emergency basis.

6. IMPROVEMENTS

6.1. Introduction

This section identifies a system improvement, or range of system improvement alternatives, for each deficiency listed in **Section 5**. Where applicable, **Figure 3** shows system improvements.

The costs included in this section are planning level estimates based on preliminary evaluations and assumptions to indicate approximate financing needed in preparation of a Capital Improvements Plan (CIP). Estimated costs were derived from similar projects in eastern Washington in the past 5-7 years and will vary depending on actual project design specifics as well as the cost of labor, materials and market conditions at the time of project implementation. When Millwood prepares to implement the capital projects identified herein, a more detailed evaluation and cost estimate should be reviewed. In some cases DOH may require a Project Report per WAC 246-290-110 to address project specifics prior to project approval and final design.

6.2. Supply

The supply capacity analysis indicates the City has adequate supply to meet 20-year MDD.

From **Section 5.2** the following improvements are proposed:

- Replace the existing Old Park well building including electrical.
- Connect the existing backup power generator as necessary to provide power to the booster pumps as well as maintaining its current backup power status for the Old Park well.
- Add an automatic transfer switch to (automatically) transfer the power source to the backup generator in the event of normal utility power source failure.
- Provide a permanent building for the existing backup power generator and the new transfer switch equipment by incorporating it into the Old Park building.
- Add site fencing for security and paved surface for access.

The following table presents the estimated costs for these improvements.

Table 6-1 Estimated Cost of Old Park Well Building and Backup Power

Item Description	Estimated Cost
Mobilization and Administration	$24,000
Demolition of Old Park Bldg.	10,000
Old Park Well and Generator Building (Conc. block type)	60,000
Site Piping	30,000
Site work, Surface Restoration, Fencing, Paving	10,000
Electrical (Incl. relocating & reusing existing OP well pump electrical controls, adding new bldg. lights, switches & receptacles, automatic transfer switch and connection to boosters)	100,000
Miscellaneous	25,000
Subtotal	259,000
Tax and Contingencies (25%)	65,000
Engineering design, construction admin & inspection (25%)	65,000
Total	$389,000

6.3. Water Rights

Millwood has adequate water rights to meet existing and projected 20-year instantaneous demand (Qi) and annual (Qa) needs.

Section 5 discusses the pertinent water rights issues to be addressed and potential solutions. To recap, the City should:

1. pursue integration of water rights through an Application For Change with DOE, and
2. adjust seasonal well operating scenarios as needed by tracking well production amounts in order to function within existing water rights.

6.4. Emergency Disinfection Equipment

The City's water quality monitoring history indicates that all source water quality parameters meet statutory requirements. Millwood plans no changes to its water quality monitoring program at this time.

The City currently has standby liquid chlorine available to the system at the Old Park Well. The City intends to add standby disinfection equipment to Butler and New Park Wells in the near future. They would be standby in nature and used to introduce and maintain chlorine residual in the distribution system in the event of some system contamination event. The preliminary plan is to add liquid chlorine type units similar to what is currently in the Old Park Well. A package system type unit is estimated to cost about $ 7,500 including installation in an existing building.

6.5. Booster Station

Section 5 addresses the need for a third booster pump to handle the low flow periods of booster pumping. The new pump would be smaller than the existing 75 Hp pumps and would be installed in the location designed for such a future addition inside the existing booster station building. Many of the facilities necessary to accommodate this third pump are already in place, such as underslab piping and floor slab blockout for penetrations, space for pump pedestal, housekeeping

pad and electrical panels with space for a third VFD, and suction pipe string to be extended for a third pump. The expected work and estimated cost breakdown is as follows.

Table 6-2 Estimated Cost of Booster Station Modification

Item Description	Estimated Cost
Furnish and Install pump (assume 15Hp)	$10,000
Furnish and Install Variable Frequency Drive (VFD), incl. start-up & testing	10,000
SCADA, VFD Programming	5,000
Misc. inside piping & appurtenances, PRV valve, conduits, pump pedestal	5,000
Underground piping outside bldg. incl. surface restoration	5,000
Subtotal	30,000
Tax and Contingencies (25%)	7,500
Engineering design, construction admin & inspection (25%)	7,500
Total	$50,000

6.6. Storage

The Millwood reservoir standpipe was last coated in 1992. City staff report exterior paint spalling and spot deterioration. Below is a cost breakdown for re-coating the steel tank exterior.

Table 6-3 Estimated Cost of Exterior Standpipe Re-coating

Item Description	Estimated Cost
Mobilization and Administration	$5,000
Exterior pressure wash and coat (13,100 SF x $3.00 SF)	39,000
Miscellaneous	10,000
Subtotal	54,000
Engineering – design, inspection, construction admin (20%)	11,000
Contingencies (20%)	11,000
Total	$76,000

6.7. Distribution System

The overall effectiveness of a water system largely depends on the capacity of the distribution system to convey water to points of use. The following sections identify improvements that address the distribution system deficiencies identified in **Section 5**.

6.7.1. Fire Flows below Adopted Criteria

Two locations throughout the entire system were identified as having substandard fire flow capabilities. Their locations, minimum recommended improvements and results of those improvements are as follows.

1. Replace approximately 700 feet of existing 4" cast iron main along Trent Avenue from Laura Rd. (extended) to Dale Rd. with a 8" PVC pipe. This improvement would provide over 2,500 gpm at a minimum 20-psi fire flow capability in this commercial area.
2. Replace approximately 700 feet of existing 4" cast iron main with 8" PVC pipe along Frederick Avenue east from Locust Street to the existing dead end and install a new fire hydrant. This improvement would provide over 1,100 gpm at a minimum 20-psi fire flow capability in this residential area.

Refer the appendix for the hydraulic model and output related to these improvements. Estimated main replacement costs are shown in the following table. See **Figure 3** for proposed distribution main replacements.

6.7.2. Leaking Water Mains

The system's remaining cast iron mains frequently experience leaks and breaks and are at the end of their service life (60 years). The City will continue to replace these mains as funding permits.

6.7.3. Mains Related to Future Development

As noted in earlier sections, Millwood is basically "built out" with very little room for further development.

6.7.4. Improvements to Distribution System

Refer to **Figure 3** for location of improvements and required main sizes. The following table contains the high priority main replacements which are leaking and/or deteriorated. These existing mains are likely comprised of leaded joint cast iron pipe.

Table 6-4 6-Year Millwood Distribution System Improvements

Description	Quantity	Unit
4" Main on Trent from Laura to Dale	720	LF
4" Main on Frederick from Locust east to dead end	600	LF
8" Main on Marquerite from Buckeye to Grace	480	LF
8" Main on Liberty from Vista to Bessie	660	LF
6" Main on Buckeye, Bessie, and Marietta between Buckeye and Marietta	1,260	LF
6" Main north of Empire between Fowler and Davis	660	LF
Total Replacements	4,380	LF

(1) *Refer to **Figure 3** for locations of proposed distribution mains to be added or replaced.*

The following table contains the lower priority mains which are aged cast iron but are not currently showing signs of leakage or deterioration. If any of these mains were to exhibit leakage or breaks they would move up in priority for replacement.

Table 6-5 20-YearMillwood Distribution System Improvements

Description	Quantity	Unit
6" Main on Vista from Liberty to Courtland	660	LF
8" Main on Laura from Grace to Frederick	660	LF
6" Main on Grace from Sargent to Laura	360	LF
6" Main on Buckeye from Laura to Stout	2,040	LF
6" Main on Dale south from Buckeye	420	LF
6" Main on Stout from Buckeye to Frederick	1,020	LF
8" Main in City Park from Stout to Locust	960	LF
4" Main in City Park from Stout to Maple	660	LF
Total Replacements	6,780	LF

(1) *Refer to **Figure 3** for locations of proposed distribution mains to be added or replaced.*

6.7.5. Estimated Unit Costs of Distribution System Improvements

The following table lists the estimated approximate cost of construction for water mains with and without the cost of asphalt replacement. The table does not include tax, contingencies, and engineering; subsequent tables for specific improvement projects include those items. These costs do not reflect current low pricing caused by the current economic recession, and are intended as a general guide only. Specific projects should be estimated individually as they arise.

Table 6-6 Estimated Distribution System Unit Costs

Diameter (in)	Cost per LF ($)						
	Main and Install (1)	Valves, Fittings, Restraints (2)	Fire Hydrants (3)	Service Connections (4)	Asphalt Replacement (5)	Total for Construction without asphalt	Total for Construction with asphalt
8	41	8	10	20	20	75	95
10	48	10	10	20	20	84	104
12	52	10	10	20	20	88	108
14	64	13	10	20	20	103	123
16	77	15	10	20	20	118	138
18	87	17	10	20	20	130	150
20	100	20	10	20	20	146	166
24	126	25	10	20	20	177	197

(1) *Based on recent bid tabulations and pipe material costs – assumes PVC C900/905 mains.*
(2) *Assume 20% of cost of main and install*
(3) *Assume one hydrant every 500 ft*
(4) *Assume one service every 100 ft*
(5) *Assume 8' wide restoration*

The following table indicates the estimated cost (in 2011 dollars) of the Millwood distribution system improvements identified in the six year improvement plan. Refer to **Figure 3** for location of improvements.

Table 6-7 Estimated Cost of 6-Year Distribution System Improvements

Item Description	Estimated Cost
Contractor Mobilization	$47,000
Water mains and appurtenances (PVC or DI pipe)	416,000
Landscape restoration, and misc.	50,000
Distribution System Improvements Subtotal	513,000
Taxes (8.7%)	45,000
Engineering – design, inspection, construction admin (25%)	128,000
Contingencies (25%)	128,000
Total	$814,000

The following table indicates the estimated cost (in 2011 dollars) of the Millwood distribution system improvements identified in the twenty year improvement plan. Refer to **Figure 3** for location of improvements.

Table 6-8 Estimated Cost of 20-Year Distribution System Improvements

Item Description	Estimated Cost
Contractor Mobilization	$64,000
Water mains and appurtenances (PVC or DI pipe)	644,000
Landscape restoration, and misc.	50,000
Distribution System Improvements Subtotal	758,000
Taxes (8.7%)	66,000
Engineering – design, inspection, construction admin (25%)	190,000
Contingencies (25%)	190,000
Total	$1,204,000

6.8. Summary of Planned Improvements

Table 7-1 summarizes the planned improvements as presented above and prioritizes each for implementation. Section 7 discusses potential financing of improvements and Section 8 discusses the City's operating budget.

7. IMPLEMENTATION

7.1. Introduction

This section summarizes planned improvements and prioritization, describes financing alternatives and presents this information in the form of a Capital Facilities Plan (CFP).

7.2. Improvement Implementation

Planned improvements are summarized in **Table 7-1** in the CFP at the end of this section. The following are issues involved in the implementation of the CFP.

7.2.1. Permits/Approvals

Following Department of Health (DOH) approval of this Water System Plan the City can begin implementing the improvements identified herein, on a schedule that reflects financial feasibility. DOH may require a Project Report for various components of the proposed improvements and will review construction documents for major facilities.

7.2.2. Financing

Financing of improvements usually represents the most significant hurdle in the process of implementation of the improvements. While the City has funds in reserve, it's likely that they will pursue additional funding from outside the water system fund in order to preserve a reasonable minimum reserve amount for emergency or other unforeseen capital needs.

7.3. Available Funding Sources

The following paragraphs provide a brief overview of funding sources for public works projects available to the City.

7.3.1. Capital Contributions

Capital contributions, variously known as "impact fees," "system development charges," "facility charges," or "connection charges" are one-time charges assessed against developers or individual new customers to recover all or a part of the cost of the additional system capacity constructed for their use or benefit (or to "buy in" to reserve capacity of existing facilities). Capital contributions improve financial equity because they require new customers to repay users who have invested in facilities through monthly service charges or fees and/or finance new facilities required to serve new customers.

Millwood's present connection fee is $1,000 for any size tap plus 110% of the City's time and expenses for installation of the service including the meter setting.

7.3.2. Reserve Funds

Most funding agencies want to see a financial commitment on the part of a system toward the project the funding agency is being asked to fund. A reserve fund allows a system to contribute funds to a project and demonstrate commitment to the project to funding agencies. Millwood currently has a reserve fund.

7.3.3. Revenue Bonds

Revenue bonds issued by the City provide a means of borrowing funds to finance capital improvements to the water system. These bonds constitute a lien against the earnings of the utility, in this case water revenues. Such bonds may be issued for varying terms and interest rates depending on the needs of the City and the bond market at the time of issuance. Interest earned by bondholders is generally non-taxable income, reducing the interest rate required to make bonds attractive to investors. Systems pay debt service out of system revenues. The issuer is usually required to maintain utility rates at a level sufficient to pay the annual debt service plus 25% to 50%, which often goes into a reserve fund. Current interest rates for unrated municipalities are in the 4-6% range depending on specifics.

7.3.4. Local Improvement District (LID) Bonds

Using LID financing allows specifically benefited properties to pay for the improvements. A resolution or a petition of the majority of property owners can form an LID. Under certain circumstances where the jurisdiction declares the improvements necessary for the public health and safety (and with other criteria being met), an LID formed by System resolution is immune to protest; otherwise a 3/5 majority of property owners may prevent its formation by submission of a protest petition. Properties within the LID are assessed annually a total amount adequate to service bonds which are issued with the LID assessments as security. In essence, LID financing provides a method for developers and property owners to make appropriate capital contributions to new facilities required to support service to their properties.

The City could use LID financing for improvements benefiting presently served properties or newly developed properties. Disadvantages of LID financing in fully developed areas of the City include the significant time and costs associated with the formation and assessment determination process.

7.3.5. RD Loans and Grants

The Rural Development (RD) Water and Environmental Programs (WEP) provides federal loans, grants and loan guarantees for design and construction of water, sanitary sewer, solid waste and stormwater capital improvements and facilities in rural areas and in cities and towns of 10,000 or less. RD is primarily a loan program, but provides grants if specific criteria are met. Like other programs, RD likes to see other funding partners (due to limited program funding).

Loan interest rates vary and are based on federal standards. Interest rates and grant eligibility are based on a comparison of applicants' median household income (MHI) to the Statewide Non-metropolitan Median Household Income, which is $47,479 (2000 census). Millwood's MHI

suggests that it would be eligible for an intermediate rate, as opposed to RD's poverty rate or market rate.

Grant funding may be allocated when system debt service has made rates exceed or will make them exceed those of other similar systems without grant funding, and 2) if the program has grant funds available.

Loan term is for the life of the facility, up to 40 years. RD requires that the utility user rates provide for an annual 10% reserve income in addition to annual debt service. Each loan agreement is individual to the applicant. RD funds are not available until project construction begins and the applicant must typically procure RD-approved interim financing.

Threshold requirements for submitting an application include an approved environmental assessment, a preliminary engineering report, and a financial feasibility and cost analysis. Applications are accepted year round; grants are available until funds run out. It generally takes three to nine months to arrange this funding source. Loan security is normally a revenue bond ordinance, with loan repayment from utility rates, although repayment from taxes can also be used for RD loans.

7.3.6. Washington State Public Works Trust Fund

PWTF is a low-interest loan program for the repair, rehabilitation and reconstruction of municipal infrastructure systems. The mission of the Public Works Board is to "provide financial and technical assistance to communities for critical public health, safety, and environmental infrastructure to support economic vitality".

7.3.6.1. **Pre-Construction Loan**

Eligible activities include engineering design, environmental studies, land acquisition, and right-of-way delineation. However, no funding is currently available. In the past, applications were accepted throughout the year pending the availability of funding.

If the program stays alive, it will likely offer the same or similar funding: Loans available up to $1 million per biennium/per jurisdiction, with interest rates ranging from 0.5% – 2%, directly linked to the amount of local match. A minimum 5% local match required, and can be as high as 15%. The maximum loan term is 5 years, or 20 years with proof of secured construction funding. Projects must be completed within 18 months of contract execution.

7.3.6.2. **Construction Loan**

Eligible activities include engineering, design, and construction. Applications are typically due in May, with funding available the following spring. However, no funding is currently available. It may become available after July 2011, in which case applications would be accepted in the spring or early summer of 2012.

If the construction loan program is funded, it will likely offer the same or similar funding as it did for the most recent funding cycle: A minimum 5% match is required and can be as high as

15%. There is no match requirement for qualifying distressed communities. The loan limit per jurisdiction per biennium is $10 million, with interest rates from 0.25% to 2.0%. Interest rates depend upon the amount of Local Match and whether or not the applicant is a Distressed or Severely Distressed community. The term is between 20 and 30 years depending on the life of the asset being financed and whether or not the applicant is classified as a Distressed or Severely Distressed community.

Threshold requirements include Growth Management Act compliance, adoption of a greenhouse gas policy, adoption of a Capital Facilities Plan that meets PWB standards, and a project scope and schedule in compliance with the CIP. Applicants must have a one-quarter of 1% Real Estate Excise Tax (REET) in place. Special purpose districts must show consistency with local comprehensive land use plans. Projects must meet one or more program priorities: 1) Public health and safety; 2)Environmental health; 3) System performance (repair/replacement); and 4) Growth/Economic development.

7.3.7. Drinking Water State Revolving Fund (DWSRF)

This federal loan program is available primarily for projects that address Safe Drinking Water Act (SDWA) health standards and are for systems that have exceeded health standards or are at risk of future violations (i.e., water quality related projects). The program also highlights green or environmentally beneficial projects and assistance to small and disadvantaged communities. DWSRF projects include distribution, source, storage, and treatment projects. The program also refinances existing infrastructure debt for municipal utilities.

The maximum DWSRF loan available is $6 million, not including a 1% non-refundable loan fee. Interest rates are 1% - 1.5%. The term is 20 years. Disadvantaged applicants may receive 30% or 50% subsidy, depending on the affordability index, which is the criteria for a disadvantaged community. The Affordability Index is the percentage of a community's median household income (MHI) that the average water bill will be *after* the loan. The projects where the average monthly water rate will exceed 2% of the MHI for the service area qualify for subsidy. Qualifying for subsidy does not guarantee that it will be offered. There is a set amount available each year and it is awarded based on project scores.

Applications are due March 1, 2012 with funding available upon Board and EPA approval, usually in July of the same year (assuming the application is successful). Minimum eligibility criteria include a current, approved Water System Plan or Small Water System Management Plan at the time of application. The Washington State Department of Health (DOH) and the Public Works Board (PWB) jointly manage the DWSRF program.

7.3.8. Spokane County Housing and Community Development Block Grant Program (CDBG)

The Community Development Block Grant (CDBG) Program allocates an estimated $1.9 million in federal funds per year to subrecipients throughout the Spokane area to conduct activities that improve the lives and living conditions of these residents. CDBG funds can be used to improve

local infrastructure, provide needed human services, improve parks and public facilities, increase recreational opportunities, and create jobs for low-income persons.

The department allocates these funds each year through a Request For Proposal (RFP) process. Generally, CDBG applications are made available in early November each year and are due in mid-December. As one of Spokane's 11 participating entities, the City of Millwood is eligible for CDBG funds and has been awarded approximately $375,000 in CDBG funding since 1989. Millwood has completed 7 projects with CDBG funding, including its previous Water System Plan, water tank improvements, and sewer improvements and connections.

7.4. 6-Year Improvement Funding

The City plans to fund the 6-year improvements from a combination of sources including City reserve funds and any available loans/grants. If grants and loans are not made available to Millwood the City will fund its capital improvements plan by continuing to contribute to its reserve fund and applying for loans/grants until improvements can be afforded.

7.5. Capital Facilities Plan

The following table presents the City's Capital Facilities Plan including needed improvements and estimated costs. **Table 7-1** is duplicated in the Executive Summary.

Table 7-1 City of Millwood Capital Facilities Plan

Period		Improvement	Purpose	Estimated Cost	Potential Funding Sources
6-YEAR PLANNING PERIOD (2011 - 2016)	Supply	Old Park Well bldg. and Backup Power Generator Improvements	Improve system reliability	$400,000	City Reserves/Revenue Bonds/RD/PWTF
		New meters on all wells	Improve accuracy	$15,000	
		Add chlorination equipment to Butler and New Park wells	Provide ability to add disinfection to distribution system at all sources	$15,000	
	Storage	New Exterior Coating	Extend life of reservoir	$80,000	City Reserves/Revenue Bonds/RD/PWTF
		Interior Inspection	Routine inspection and spot repairs to extend life of reservoir coating	$5,000	
	Water Rights	Pursue integration of water rights	Remedy potential individual water right exceedences	$5,000	City Reserves
	Booster Station	Add third booster pump and VFD to existing booster building to more effectively handle the low flows	Accommodate low flow pumping needs more effectively, preserve existing higher capacity pumps	$50,000	City Reserves/Revenue Bonds/RD/PWTF
	Distribution System	Water audit and determination of distribution system losses, leak detection	Identify and reduce water losses (DSL)	$820,000	City Reserves/Revenue Bonds/RD/PWTF
		Replacement of 4" main on Trent from Laura to Dale	Replace deteriorated and leaking mains		
		Replacement of 4" main on Frederick from Locust east to dead end	Replace deteriorated and leaking mains		
		Replacement of 8" main on Marguerite from Buckeye to Grace	Replace deteriorated and leaking mains		
		Replacement of 8" main on Liberty from Vista to Bessie	Replace deteriorated and leaking mains		
		Replacement of 6" main on Buckeye, Bessie, and Marietta between Buckeye and Marietta	Replace deteriorated and leaking mains		
		Replace 6" main north of Empire between Fowler and Davis	Replace deteriorated and leaking mains		
			Total Estimated 6 Yr. Cost	$1,390,000	
20-YEAR PLANNING PERIOD (2016-2030)	Distribution System	Replace balance of old cast iron pipe (est. 5,700 LF)	Improve fire flow; replace deteriorated and undersized mains	$1,200,000	City Reserves/Revenue Bonds/RD/PWTF
			Total Estimated 20 Yr. Cost	$2,590,000	

8. SYSTEM FINANCES

8.1. Revenue and Expenditure Overview

The following table presents an overview of Millwood's actual costs from their 2008 through 2010 Annual Reports.

Table 8-1 Water System Annual Financial Report Summary

Category	2008	2009	2010	2011 Budget	2011 Pro Forma[1]
Revenue					
Charges For Services:					
Water Sales	$86,868	$158,849	$159,909	$176,137	$176,137
Improvement Fee	73,967				
Miscellaneous Revenue:					
Investment Interest	4,783	261	152	1,000	1,000
Penalty Charges	6,620	4,391	5,923	5,000	5,000
Other Financing Sources:					
City Hall Water Sales	208	265	136	200	200
Butler Well Water Sales	201	211	156	200	200
Park Water Sales	1,522	1,871	1,027	2,800	2,800
Shop Water Sales			44	200	200
Hydrant Rental	0	0	0	0	0
Total Revenue	$ 174,169	$ 165,848	$167,347	$185,537	$185,537
Non-Revenue:					
Connection Charges	4,000	8,653	0	2,000	2,000
Other Non-Revenue	1,922	$1,214	1,210		
Total Revenues:	$ 180,091	$ 175,715	$168,557	$187,537	$187,537
Water Sales Revenue per ERRU per Month[2]	$10.10	$18.46	$18.59	$20.47	$20.47
Expenditures					
Operating Expenditures (Water):					
Salaries	63,166	61,401	93,184	107,038	107,038
Overtime	787	0	0		
Benefits	22,751	22,001	16,128	27,254	27,254
Supplies	8,857	13,050	13,879	6,250	6,250
Other Services	68,117	59,156	80,815	93,025	93,025
Intergov't	0	0	0		
Capital Outlay	7,408	14,085	16,369	0	0
Total Operating Expenditures	$ 171,086	$ 169,693	$220,375	$233,567	$233,567
Non-Expenditures					
Operating Trans-Debt Princ	0	0	0		
Operating Trans-Debt Intrst	0	0	0		
Non-Expenditure	0	6,755	0	25,000	25,000
Total Expenditures:	$ 171,086	$ 176,448	$220,375	$258,567	$258,567
Total Expenditures per ERRU per Month[2]	$19.88	$20.51	$25.61	$30.05	$30.05
Excess/Deficit	9,005	(733)	(51,818)	(71,030)	(71,030)

(1) *Pro Forma budget is intended to show normal and usual annual costs and revenues at 2011 levels.*
(2) *See Section 8.3.2. Assumes 717 ERRUs for years 2008 and 2009.*

From the preceding table, several things are apparent:

- Expenditures have exceeded revenues for the past two years due to changes in allocation of personnel and other costs. For example, insurance costs which were previously paid by the General Fund are now proportionately allocated to the utility funds. An 18% retail rate increase was approved by city council effective January 1, 2011.
- The City started using a separate capital reserves line item in the 2011 budget.

A 6-year budget is provided in **Table 8-2** below.

Table 8-2 6-Year Water System Budget[4]

	Category	2010 Actual	2011 Budget	2012 Budget	2013	2014	2015	2016
Revenues	Carry over of non-expenditure[8]			25,000	25,000	25,000	25,000	0
	Water Sales[1]	159,909	176,137	214,887	247,120	318,785	318,785	328,349
	Misc. Revenue[2]	8,648	11,400	5,000	5,075	5,151	5,228	5,307
	Total Revenues:	$ 168,557	$ 187,537	$ 244,887	$ 277,195	$ 348,936	$ 349,013	$ 333,655
	Revenue per ERRU/Month:	**19.59**	**21.80**	**28.46**	**32.22**	**40.56**	**40.56**	**38.78**
Expenses	Salaries[3]	93,184	107,038	85,000	87,550	90,177	92,882	95,668
	Overtime	0	0	0	0	0	0	0
	Benefits	16,128	27,254	36,000	37,080	38,192	39,338	40,518
	Supplies[3] [5]	13,879	6,250	13,700	14,111	14,534	14,970	15,419
	Other Services[3]	80,815	93,025	65,250	67,208	69,224	$ 71,300	73,439
	Intergov't	0	0	12,320	13,940	17,550	17,560	16,780
	Loan Repayments (DWSRF) [7]	0	0	0	0	82,000	82,000	82,000
	Capital Outlay	16,369	0	5,000	5,100	5,300	5,500	5,700
	Non-Expenditure[8]	0	25,000	25,000	25,000	25,000	0	0
	Total Expenses:	$ 220,375	$ 258,567	$ 242,270	$ 249,989	$ 341,977	$ 323,551	$ 329,525
	Expenditures per ERRU/Month:	**25.61**	**30.05**	**28.16**	**29.05**	**39.75**	**37.60**	**38.30**
Net Income	Excess/Deficit:	$ (51,818)	$ (71,030)	$ 2,617	$ 27,207	$ 6,959	$ 25,463	$ 4,130
	Reserve/Beginning Balance:	182,000	328,000[6]	330,617	357,824	364,783	390,246	394,376

(1) *Assumes the City increases user fees 22% in spring 2012, 15% in 2013, 29% in 2014 and 3% in 2016.*

(2) *Assumes 1.5% annual growth.*

(3) *Assumes 3% annual growth (approximate rate of inflation).*

(4) *A rate analysis and determination of specific rate increases is currently in process. This table is preliminary.*

(5) *Includes Water Use Efficiency Measures.*

(6) *A change in the City's accounting methods allowed for additional reserve from other City reserve funds starting in 2012. Reserve of $328,000 is a projection, balance not available at time of report.*

(7) *This table assumes the City receives a DWSRF loan. The amount shown is approximate and depends on the actual funding obtained.*

(8) *Non-expenditure amount is a rate stabilization set aside and carried over as net revenue into the following year.*

8.2. Water Rates and Reserves

The following is a summary of the City's water rates history.

1977-79	$7.50 per quarter plus 10 cents per 100 CF over 12,000 CF per quarter
1980	$10.00 per quarter plus 20 cents per 100 CF over 12,000 CF per quarter
1981-84	$10.00 per quarter plus 20 cents per 100 CF over 12,000 CF per quarter and $10 per quarter improvement fee
1985-92	$20.00 per quarter plus 20 cents per 100 CF over 12,000 CF per quarter and $10 per quarter improvement fee
1993-95	$13.70 per month plus 20 cents per 100 CF over 4,000 CF per month

These past rates where applicable to both residential and commercial services.

1995-2010	$14.70 per month plus 20 cents per 100 CF over 4,000 CF per month for residential and 14 cents for commercial.

The following are the City's current water rates.

Base Rate:	$17.35 per month for 4000 cubic feet (i.e. ~ 30,000 gal.) for Residential or Commercial
Overage Charge:	$ 0.20 per 100 cubic feet (i.e. ~ 750 gal.) – Residential
	$ 0.14 per 100 cubic feet (i.e. ~ 750 gal.) – Commercial

8.2.1. Observations Regarding Rates

The current allowable base water usage amount, 4,000 cubic feet/mo. (i.e. 30,000 gallons/mo) is high. A frequently estimated minimum average daily demand is 200 gpd/ERU (6,000 gal/mo.). This minimum is accepted as representing the average indoor household water use and is consistent with Chapter 5 of the DOH Water System Design Manual.

Millwood is currently performing a water rate study. The City expects to implement a new rate structure by late spring of 2012.

8.2.2. Reserves

Millwood has a Reserved Cash line item in their budget specifically for reserves. Most of the revenue in excess of expenditures is invested through the Washington State Local Government Investment Pool. Currently this water system cumulative reserve amount is approximately $182,000. This reserve, which equals roughly 100% of annual operating expenses, is acceptable but should not be allowed to decrease.

8.3. Description of Existing Debt

Millwood has no debt service currently in their Water Fund. However the City is carrying significant debt which is currently being paid from the Sewer Fund. This debt is for Revenue Bonds associated with past water and sewer system improvements. The bonds were sold based on projected revenues from both utilities. The status of this debt is shown in the following table.

Table 8-3 Summary of Current Utility Debt

Description	Beginning Date	Yr. Debt To Be Retired	Status as of 12/31/2010		
			Debt Retired	Remaining Debt	Avg. Annual Debt Service [1]
2003 Water & Sewer Revenue Refinancing Bond	12/2003	12/2015	$1,025,000	$700,000	$155,000

[1] Currently paid from sewer revenues only

8.3.1. Observations Regarding Debt Service

As indicated above, the current debt is attributable to both water and sewer system improvements. Water system distribution pipe replacements were completed simultaneously in construction projects planned and designed to install the sewer collection system throughout Millwood from 1990 through 1996. The funding for these projects came from sources originally targeted for the sewer construction. The debt service was applied to the sewer fund, which has been operating and continues to operate in the black. Although both the water and the sewer funds are currently viable, the sewer fund is supporting the debt service attributable to the improvements made to both the water system and the sewer system. While this practice may be acceptable (and in some cases even preferable), it does not distribute the debt service equitably to all ratepayers since not all sewer system users/rate-payers are water system users/rate-payers and visa versa. Equitability of both water and sewer rate structures is generally enhanced when identifiable water expenditures including debt service make up the water rate and likewise for the sewer rate.

8.3.2. Equivalent Residential Rate Units (ERRUs)

The number of equivalent residential units (ERUs) determined on the basis of water use is presented in **Section 3**. However, unless the system's water rate structure distributes system costs exactly in proportion to water use, utilizing the number of water use ERUs for financial analysis will be inaccurate; therefore, it is important to determine the number of the Equivalent Residential Rate Units ("Rate ERUs") or ERRUs. This is an important distinction because financial impacts will be distributed among system customers in proportion to the rate structure, not water use. The number of ERRUs is used when determining the impact of new capital debt on the various customer classes *based on the actual proportion of the total system costs each class pays under the current rate structure.* It is also informative in comparing water use versus revenue contribution of the classes (e.g. residential versus non-residential).

Table 8-4 Comparison of Annual Residential and Non-residential Revenue/Water Use

User	Water Sales (gal)[1]	% of Total Water sales	Total Revenue[1]	% of Total Revenue	Revenue ($/1,000 gal)
Residential	114,026,698	75%	$138,743	87%	$1.22
Non-Residential	38,864,876	25%	$21,166	13%	$0.54

[1] *From City records*

The following calculations utilize revenue records for the period January 1st, 2010 – December 31st, 2010.

Revenue per Equivalent Residential Rate Unit (ERRU)
= Annual Residential Revenue / # of Residential Services (ERUs)
= $138,743 / 622 / 12 mo.
= $18.59 per ERRU per month

Number of Non-Residential ERRUs
= Annual Non-Residential Revenue / Revenue per ERRU
= $21,166 / $18.59 / 12 mo.
= 95 Non-Residential ERRUs

Total number of ERRUs
= Residential Rate ERUs + Non-Residential ERRUs
= 622 + 95
= 717 total ERRUs

Compare # of ERRUs to Water Use ERUs	
Residential Water Use ERUs	622
Residential ERRUs	622
Non-Residential Water Use ERUs	212
Non-Residential ERRUs	95
Total Water Use ERUs	1,190
Total "Rate ERUs" (ERRUs)	717

The number of ERRUs as estimated above is used in computing the impact of potential new debt on residential customer water rates because the distribution of system costs by the rate structure in place (not water use) determines the actual rate impact of potential new capital debt service.

8.4. FUNDING FOR PLANNED IMPROVEMENTS

As shown in **Table 7-11**, the City has $1.4-2.6M in water system infrastructure improvements that will eventually become necessary. The improvements identified in **Section 6** to address existing system deficiencies mainly involve replacing water mains. The improvements the City preliminarily plans to implement during the next six years will cost approximately $1.4M.

The ability of the City to construct improvements hinges on securing funding. The City may have to delay planned improvements if the City cannot secure funding on terms that maintain rate affordability.

The following table contains potential funding scenarios and associated rate effects. The Table estimates approximate rate impacts for several funding scenarios. Note that the City will not likely implement all planned improvements simultaneously; the following Table provides funding scenarios that will help the City plan how to phase proposed projects. The City could implement some projects on a pay as you go basis over several years rather than rolling several improvements into large projects.

Table 8-5 Potential Funding Scenarios and Resulting Rate Impacts

Approximate Rate Impacts[1]		
Description		6 –Year Improvements
Total Cost of Improvements [2]		$ 1,400,000
Increase in Monthly Bill per Rate ERU [3]	Scenario 1 - Revenue Bond (5.5%, 20-yr)	$20
	Scenario 2 - PWTF Loan (2.0%, 20-yr)	$10
	Scenario 3 - RD Loan (3.0%, 40-yr)	$8
	Scenario 4 - DWSRF Loan (1.5%, 20-yr)	$10
Existing Average Monthly Bill		$19
Total Monthly Bill	Scenario 1 - Revenue Bond (5.5%, 20-yr)	$36
	Scenario 2 - PWTF Loan (2.0%, 20-yr)	$29
	Scenario 3 - RD Loan (3.0%, 40-yr)	$26
	Scenario 4 - DWSRF Loan (1.5%, 20-yr)	$28

(1) *The estimates do not include increases that may be needed for O&M costs (for example, for capital reserves, inflation, emergency reserves, etc.).*

(2) *The total cost of improvements are planning level estimates for the purpose of evaluation and funding acquisition.*

(3) *Assumes existing residential customers pay an average monthly bill of $19 and that the City currently receives approximately $160,000 in revenue from rates.*

The feasibility of the preceding funding scenarios depend on the maximum water rates the City believes its residents can afford, availability of funds in the identified programs, and success of the applications submitted to the various funding agencies.

9. WATER USE EFFICIENCY

WAC 246-290-810 requires that water system plans and small water system management programs must describe the municipal water supplier's existing Water Use Efficiency (WUE) Program. The municipal water supplier must continue existing levels of water use efficiency.

9.1. Metering Requirements

9.1.1. Source Meters

WAC 246-290-496(1) requires that systems measure the volume of water produced or purchased using a source meter or other meter installed upstream of the distribution system. The requirements of this section of the WAC do not apply to volumes of water delivered to a public water system through an emergency intertie; however, interties used as permanent or seasonal sources must have meters. The City's three emergency interties are not metered.

Millwood currently meters production at the City's source of supply. However, a small strip of irrigated lawn on Dalton Ave. is not metered. The City will install a meter at this location in the near future.

9.1.2. Consumption Meters

WAC 246-290-496(2) requires systems to measure the volume of water delivered to consumers by installing meters on all direct service connections. Systems may serve certain clustered entities through a single meter (e.g. campgrounds, RV parks, mobile home parks, buildings with multiple units, and complexes with multiple buildings served as a single connection).

Millwood currently meters all service connections other than one irrigation connection located along East Dalton Ave. The City is currently in the process of adding a meter to this connection.

As required by WAC 246-290-496(3), the City selects, installs, operates, calibrates, and maintains customer service meters according to generally accepted industry standards and information from the manufacturer.

9.2. Data Collection

The Water Use Efficiency (WUE) Rule requires systems to collect production and consumption data on a regular basis and report that information in the annual performance report. Water production and consumption data has numerous uses including: calculating system leakage, forecasting demand, identifying areas for more efficient use of water, and evaluating the effectiveness of the WUE program.

9.2.1. Source and Service Meter Data

The City collects and records daily totals from all source meters; service meter data is collected and recorded on a monthly basis. The City uses this data to calculate distribution system losses. Refer to **Sections 3.1.3** and **3.1.4** for the City's source and service meter data.

9.3. Water Supply Characteristics

9.3.1. Ground Water Supply – Old Park, New Park, and Butler Wells

All of Millwood's wells withdraw water from the Spokane-Rathdrum Aquifer. This aquifer has proven a reliable and high quality water resource for Millwood for generations. The City is not aware of any specific potential impacts to its source. See **Table 2-1** for source capacities and information. See **Section 5.2** for a discussion regarding supply capacity and demand.

9.4. Current WUE Program

The City's existing WUE program seeks to gradually and permanently reduce average per-capita demand. Short-term voluntary or mandatory reductions in water use to overcome temporary water shortages associated with drought, transmission line failures, or emergency conditions are not considered elements of a WUE program. Rather, WUE program elements constitute a long-term voluntary reduction in customer demand through education, improved technology, and water rate structure. Customers are educated annually on how to use water efficiently through the use of information contained in the City's yearly consumer confidence report.

As a part of the existing WUE program the City trains employees to perform water use efficiency oriented public outreach in the normal course of their duties.

9.4.1. Estimated Conservation Savings to Date

The City's 2003 WSP calculated the City's ERU usage at 620 gpd/ERU. As shown in Section 3.1.5 the City has reduced ERU usage to 502 gpd/ERU. Millwood has saved approximately 118 gpd/ERU.

9.5. Goal Setting and the Public Forum

One of the most important steps in achieving efficient water use is setting goals that can be measured. The Water Use Efficiency Rule requires systems to set goals through a public process. Involving the public allows water users to understand the characteristics and future needs of the City's system and to set a reasonable, attainable goal.

9.5.1. WUE Goals

In June of 2011, Millwood established the following WUE goals:

Supply Side Goal: reduce distribution system leakage to 10% over the effective period of this water system plan.

Demand Side Goal: reduce water use by 1% annually over the effective period of this water system plan.

9.5.2. Public Forum for Establishing WUE Goal

The Water Use Efficiency Rule requires that systems allow customers and interested members of the public to participate in the goal setting process through a public forum. This allows the public an opportunity to provide input on the decisions and it helps customers to understand the need to use water more efficiently and how they can help achieve the WUE goal.

The City conducts public forums when establishing or revising the WUE goals in accordance with the requirements of WAC 246-290-830(4). See the **Appendix** for WUE related items.

9.6. Evaluation of WUE Measures

9.6.1. Required Number of WUE Measures

The City serves approximately 765 connections. The following Table contains the number of measures systems must either implement or evaluate for cost effectiveness based on the number of connections served. The City must either implement or evaluate for cost effectiveness at least four measures.

Table 9-1 Required Number of WUE Measures

Number of Connections	Less than 500	500 – 999	1,000 – 2,499	2,500 – 9,999	10,000 – 49,999	50,000 or more
Number of WUE Measures Required	1	4	5	6	9	12

9.6.2. WUE Measures Evaluated and Implemented

The following Sections list the WUE measures evaluated by the City. Each section contains a description of the measure, whether or not the City chose to implement the measure, and an analysis of the measure's cost efficacy (if not implemented).

9.6.2.1. Measure #1: Rates that Encourage Efficiency

Currently the City allows 4,000 cu ft in its base rate. Millwood plans to implement a new rate structure that reduces the allowable quantity included in the base rate while simultaneously increasing rates. A water rate study is currently under way and the City chooses to implement the new rate structure during Spring of 2012. It is difficult to estimate water saving from this measure however it will contribute to achieving the City's WUE goal.

9.6.2.2. Measure #2: Irrigation Conservation Information Kits

The City will provide information and simple tools such as rains sensors to consumers. The City chooses to implement this measure to help achieve the WUE goal. It is difficult to estimate water saving from this measure however it will contribute to achieving the City's WUE goal.

9.6.2.3. Measure #3: Consumer Rebates for Efficient Appliances

The City chooses to implement a consumer rebate program for installing water efficient fixtures or appliances. It is difficult to estimate water saving from this measure however it will contribute to achieving the City's WUE goal.

9.6.2.4. Measure #4: Pump Pre-Lube Controls

The City chooses to eliminate the continuous pre-lube in each of its well pump stations. The City estimates it will save approximately 31 million gallons per year.

9.6.2.5. Budget for WUE Measures

The City estimates the selected WUE measures will cost approximately $1,000 annually. The measures were implemented as of September, 2011.

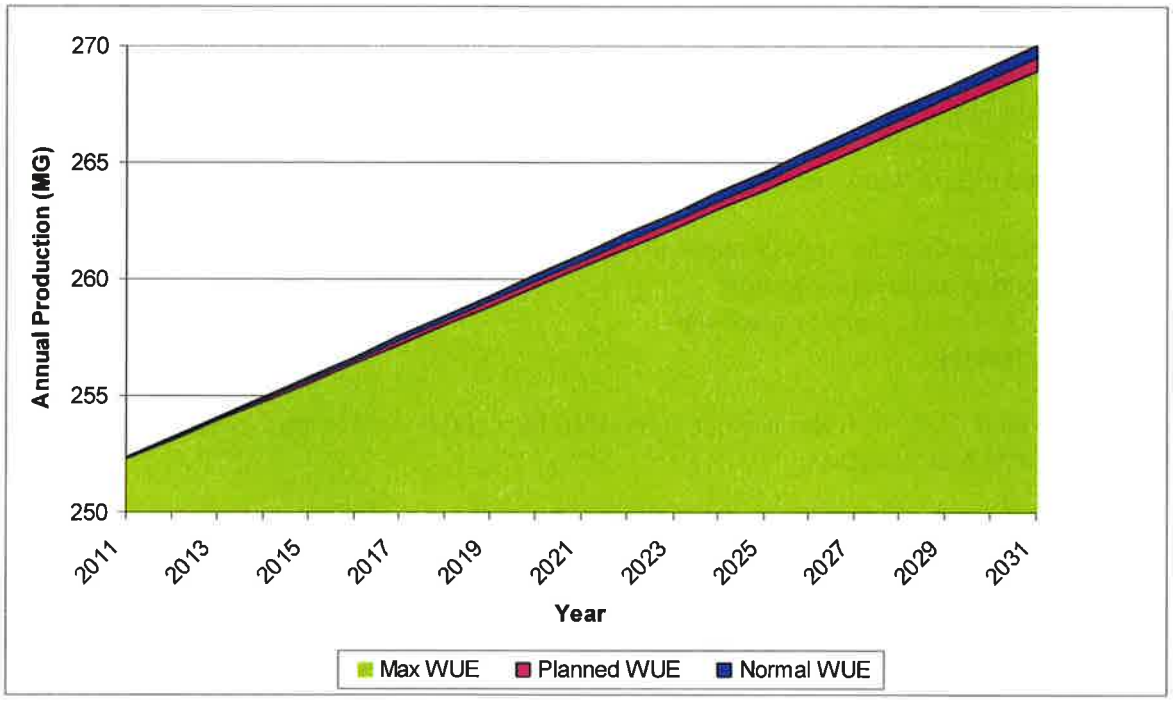
9.7. Evaluating Efficacy of WUE Measures

The City will monitor total system annual water use and average customer water use to determine whether WUE measures reduce actual water use.

9.8. Demand Forecasting – Projected Conservation

The Demand projections developed in **Section 3** do not take into account WUE efforts that might reduce future demand. The City projects total water use to increase 0.32% annually without WUE. With planned WUE measures the City believes it possible to reduce annual water use growth to .31%. If the City implemented all available WUE measures annual growth could conceivably reduce to .30%. The figure following illustrates potential water savings due to more efficient use of water.

Figure 9-1 Projected Water Use with WUE



The City plans to review water consumption annually to determine success of WUE efforts. The City also plans to review its WUE program annually to evaluate future water saving targets, and assess program benefits versus costs.

9.9. Distribution System Leakage Standard

The Water Use Efficiency Rule divides system water use into two categories: authorized consumption and distribution system leakage (DSL). DOH defines authorized consumption as the volume of water authorized for use by the water system. In addition to normal water sales metering records, systems can track and estimate other types of authorized water uses such as:

- Maintenance flushing of the water system
- Fire fighting and hydrant testing
- Cleaning of water tanks or reservoirs
- Street cleaning

DOH considers DSL all water use not authorized by a water system; this includes both apparent losses and real losses such as:

- Leakage
- Theft
- Meter inaccuracies
- Meter reading errors
- Data collection errors
- Calculation errors
- Water main breaks

The City calculates DSL by comparing source production meters with water sales from customer meters. **Table 3-2** contains the Millwoods's current calculated DSL. The City's three year average DSL is estimated to be approximately 20% (see **Section 3**). The high distribution system leakage is likely due to deteriorated cast iron pipe however, City staff recently discovered a meter reading error that reduced its previous DSL number by about 15%.

9.10.Water Loss Control Action Plan

The City is currently assessing its data accuracy and collection methods to identify any further errors. Additionally, the City is in the process of implementing a leak detection program to identify leakage with in the distribution system.

9.11.Evaluation of Conservation Oriented Rate Structure

An inclining block type rate structure encourages conservation by directly linking a customer's increased consumption to higher water bills. Implementing an inclining block rate structure is relatively simple and inexpensive (to the water system) to implement. The City utilizes an inclining block rate structure for all of its customers (refer to **Section 8**); this encourages conservation. However, customers receive a large base allotment (4,000 CF) so rate blocks have likely have little or no effect on conservation. Reducing the base allotment volume would further orient the City's water rates towards conserving water.

9.12. Water Shortage Response Plan

With three sources, one reservoir, two booster stations, and three interties connected to the system, the City's water supply is relatively secure. Nevertheless, there are conceivable circumstances under which the City would need to respond to short-term or long-term water shortages. The plans for responding to such an incident are delineated in the following paragraphs.

The likely duration of the water shortage, which sources are affected and the time of year the shortage occurs largely determine which response steps are required.

The City has high redundancy. Nevertheless, there could come a time when severe water use reductions would be needed. The following table lays out the water shortage response plan.

Table 9-2 Water Shortage Response Plan

Stage 1 Minor Shortage Voluntary Measures 5% – 10% reduction goal	Stage 2 Moderate Shortage Mandatory Program 10% – 20% reduction goal	Stage 3 Severe Shortage Rationing Program 20% – 30% reduction goal
A. PUBLIC INFORMATION ACTIONS		
– Prepare & distribute water conservation materials (bill insert, etc.) – Prepare & disseminate technical conservation information to specific customer types – Coordinate media outreach program – Issue news releases to the media	– Continue public information program	– Continue public information program
B. GOVERNMENT ACTIONS		
– Increase enforcement of hydrant opening – Increase meter reading frequency & meter maintenance – Promote intensive leak detection & repair program – Draft & adopt ordinances banning water waste. A typical ordinance could require: ▪ No unfixed leaks; ▪ No hosing of paved surfaces; ▪ No fountains except those using re-circulated water; ▪ No water running onto streets; ▪ No watering during the middle of the day; and ▪ No irrigation runoff ▪ Draft & adopt ordinances allowing City to declare a water emergency and require fixed consumption allotments or % cutbacks (rationing)	– Reduce water usage for main flushing, street cleaning, public fountains, & park irrigation – Watering of parks, cemeteries, etc., restricted to nights or designated irrigation days	– All public water uses not required for health or safety prohibited unless using tank truck water supplies or reclaimed wastewater – Irrigation of public parks, cemeteries, etc., severely restricted – Pool covers required for all municipal pools – Main flushing allowed only for emergency purposes
C. USER RESTRICTIONS		
– Implement voluntary water use reductions (see A. Stage 1)	– Implement ordinance banning water waste (See B. Stage 1 above) – Adopt landscape irrigation restrictions incorporating one or more of the following: ▪ Time of day (e.g., 7 pm to 7 am) ▪ Weekly frequency (e.g., odd/even, time per week) ▪ Sprinkler bans (e.g., hand) – Commercial car washes should intensify voluntary use reductions – Golf course irrigation times and weekly watering limits reduced	– Implement ordinance allowing utilities to declare a water emergency & to require rationing (see B. Stage 1) – Car washing permitted only during specified watering hours of designated irrigation days – Times of day restrictions applied to commercial car washes – Golf course watering times & weekly watering limits reduced – Permissible watering hours & weekly frequency for landscaping irrigation further reduced
D. PENALTIES		
– None	– Warning – House call – Shut off and reconnection fee	– Fines
E. PRICING		
– None	– Impose surcharges	– Impose surcharges

The City Council has the necessary authority to implement the above measures at such time as they are required.

10. SOURCE WATER PROTECTION

10.1. Introduction

WAC 246-290-135 outlines the requirements for source water protection. The sections following address source water protection requirements.

The City of Millwood has been a member of the Spokane Aquifer Joint Board (SAJB) since August 7, 1995 and participated in the development of the SAJB's wellhead protection program. In May of 2000, Millwood informed DOH that they had adopted the SAJB's Wellhead Protection Program dated January 2000 and requested that DOH consider it part of this Water System Plan. A copy of this request letter along with pertinent Millwood Resolutions are included in the Appendix. The SAJB Wellhead Protection Plan contains nearly all the necessary information regarding source water protection and is therefore adopted by reference.

10.2. Susceptibility Assessment and Wellhead Protection Area Information

In conjunction with the SAJB's wellhead protection program, the City of Millwood completed the susceptibility assessment and submitted it to DOH. A copy of "Figure 3-30", the proposed wellhead protection area delineation map for Millwood, developed by the SAJB is included in the appendix. Further information regarding this wellhead protection area and other pertinent information can be found in the SAJB Wellhead Protection Program plan.

10.3. Potential Contaminant Source Inventory

The SAJB Wellhead Protection Plan contains the comprehensive list of potential contaminant sources and supporting information including color-coded maps. According to WAC 246-290-135, Source Water Protection, this list of known or potential contaminant sources must be updated every two years.

The City of Millwood is participating in the update of the Potential Contaminant Source Inventory (PCSI) list through their membership with the SAJB. Under the management of a Wellhead Protection Program Leader hired by the SAJB membership, the SAJB has contracted with the Spokane County Water Quality Management Program (WQMP), through the Spokane County Division of Utilities, to update the PCSI list annually. This coordinated effort involves gathering information on existing and new businesses, industries, etc., from numerous data sources including DOE and City and County planning departments and providing the information to each of the SAJB member districts to review and refine as actual or potential contaminant sources. From this "refined" information the final updated PCSI list will be completed, using GIS technologies, and provided to all SAJB members. At this writing, the SAJB's WHP Program leader anticipates this updated PCSI list to be completed in June of this year (2011).

10.4. Notification of Findings

The property owners listed in the SAJB Wellhead Protection Plan original PCSI indicated above were notified as to their location and their potential to contaminate the system's water supply in the fall of 2010. Notification was by means of a letter and informational attachments as indicated in the SAJB Wellhead Protection Plan. Agencies were also notified and given an interactive ArcGIS file of the sites. Copies of the letters sent out as well as a discussion of the process and responses are included in the SAJB Wellhead Protection Plan.

The SAJB plans to reissue a notification every two years in conjunction with the update to the PCSI list at those times.

10.5. Contingency and Emergency Response Plans

A contingency plan for wellhead protection relating to potential contamination threats is presented in the SAJB Wellhead Protection Plan. Contingency plans for water shortages are presented in **Section 9** of this WSP. Emergency response procedures are also presented in **Section 9** of this WSP.

Based on information provided in the SAJB Wellhead Protection Plan including the wellhead protection area delineation map, it is unlikely that a single contaminant source would effect all three of the City's wells. If one or more of the City's wells were contaminated and the remaining usable well(s) could not meet system demand, Millwood could implement emergency conservation measures and purchase water for a period from either or both Irvine Water District (IWD) or Orchard Avenue Water District (OAID) via the existing interties.

11. OPERATION AND MAINTENANCE

11.1. Water System Management

The following City personnel have responsibility for the water system and carry the following certifications.

Cleve McCoul, City Superintendent, (WDM-3)
Paul Allen, Assistant Manager, (WDM-2)

Mr. McCoul and Mr. Allen both share the day to day responsibilities for system operation and maintenance and are competent to oversee the water system operation in the absence of the other. Both can be reached at City Hall at (509) 924-0960. Both are certified as a CCS.

11.2. System Operation And Control

11.2.1. Identification of Major System Components

Refer to **Section 2** for an inventory of system facilities.

11.2.2. Routine System Operation

Routine operation is summarized in the Abbreviated O & M Manual in the Appendix. Also included in the Appendix is a listing of suppliers for system components.

11.3. Monitoring Procedures

Millwood performs all routine water quality monitoring as required by WAC 246-290-300. Refer to **Section 5.3** for a summary of the City's sampling requirements. The City is generally in compliance with the requirements of the WAC and no adjustments to its procedures appear necessary at this time.

11.4. Emergency Response Procedures

The following paragraphs describe the City's planned response for various types of emergencies. In an emergency the Millwood City Hall (509) 924-0960 should be notified whereupon the City Superintendent or in his absence, the Assistant Manager (or the person on call if after hours) will assign responsibilities. The DOH general office telephone number is (509) 329-2100 and the after hours and weekend emergency number is (877) 481-4901.

Table 11-1 Emergency Response Procedures

Potential Emergency	Action
Fire	• Contact Millwood operator at 924-0960. • Make sure that all wells and booster pumps are operational and available. • Provide assistance to fire department as needed. • Consider use of intertie(s) if needed.
Contaminant spill near wells	• Contact Millwood operator at 924-0960. • Contact fire department – 911. • Contact police department – 911. • Contact DOE spill response unit 456-2926. • Contact DOH Eastern Region Office 329-2100 • Shut down well pump(s) if contaminant could reach aquifer. • Consider use of intertie(s) if needed. • If necessary, notify public of emergency water consumption restrictions by way of Spokane TV and radio stations and/or other means. • Implement standby chlorination (once equipment is installed) as needed.
Main break	• Contact Millwood operator at 924-0960. • Isolate reach by closing nearest valves. • Repair main, if parts unavailable from inventory, refer to appendix for suppliers. • Implement standby chlorination (once equipment is installed) as needed. • Provide direct line disinfection.
Power outage at wells and booster pump station	• Contact Millwood operator at 924-0960 • Confirm operation of emergency backup generator (Old Park Well only). • Contact Avista emergency line 800-227-9187. • Notify Fire Department of power outage • If needed notify residents and request temporary water use reduction. • Consider use of intertie(s) if needed.
Booster pump(s) off-line	• Contact Millwood operator at 924-0960. • Contact pump repair personnel – see appendix • Wells should be able to meet all demands in this closed system however close monitoring of system controls is necessary and operating adjustments may be needed to prevent standpipe overflow or erratic system pressure fluctuations.
Well pump controls knocked out by lightening or some other means, Well pump(s) out of service	• Contact Millwood operator at 924-0960. • Contact controls repair personnel – see appendix. Depending on time of year and which well pump is inoperable, this situation may or may not present an immediate problem. • Adjust control system settings for appropriate well pump operation as necessary • If multiple wells out of service, consider use of intertie(s) if needed.
Backflow incident	• Contact Millwood operator at 924-0960. • If unknown source, determine contaminant then inspect facilities suspecting of using or storing this type of contaminant immediately • If possible, flush system and isolate affected piping • Contact Spokane Regional Health District (324-1500) if assistance is needed in determining type or source of contaminant • When source is determined, shut off water service until plumbing modifications can be made. • Contact DOH Eastern Region Office 329-2100

11.5. Cross Connection Control

Millwood's cross control program, described below, is based on WAC 246-290-490, a copy of which is included in the Appendix. The following paragraphs describe the various program elements as required in the WAC. Refer also to the City's master list, which incorporates many of the following elements.

Element 1 - Ordinance

Millwood had a resolution, adopted in March of 1984, on the books pertaining to cross connection control. The City has recently adopted a new overall Water System Regulations Ordinance that includes a section on Cross Connection Control which replaces the 1984 ordinance. A copy of that Water System Regulations Ordinance is included in the appendix.

Elements 2 & 3 – Procedures Evaluating New and Existing Services For Potential Hazard and Correcting Same

- Prior to connection of a new service to the City's water system, City of Millwood personnel will determine the nature of the new service. If such service presents a potential hazard, the City will notify the property owner and require that the cross connection be eliminated, or, if that is not possible, that an appropriate backflow preventer will be installed.
- All new irrigation systems are required to have backflow protection.
- The City is reviewing all existing service connections to determine the nature of the water use and whether or not a backflow preventer is required. If necessary, the cross connection will be eliminated or an appropriate backflow preventer will be installed.
- Upon completion of the initial review, the City will annually review the adequacy/necessity of backflow prevention devices. In addition, whenever there is a change in building occupancy or use, the City will review the adequacy/necessity of the backflow prevention device.

Element 4 – Certification of Personnel as Cross Connection Specialist (CCS)

Millwood employs two personnel certified as a CCS (Cleve McCoul & Paul Allen) who are responsible for implementation of the cross connection control program.

Elements 5 & 6 – Procedures to ensure that Backflow Preventers are Inspected and/or Tested by Qualified Personnel

Millwood requires that property owners make arrangement for and have their backflow assemblies tested annually by a certified BAT with the results submitted to Millwood for review. In addition, backflow assemblies must be tested at time of installation and after any repair. The customer will immediately repair Backflow assemblies that fail the test or service may be terminated.

Test results are kept on file at the City's office on the master list. The City sends a letter out to customers stating when testing must be completed and results submitted to the City. If the customer fails to meet the deadline, the City sends a second letter indicating a new date by which their water service will be terminated if they don't respond appropriately. Millwood does not do its own testing.

Element 7 – Response to Backflow Incident

The City's water system has experienced no known backflow incidents. If one were to occur, the City would take all necessary steps to determine the origin and nature of the problem and remedy that problem. A response plan is included in **Table 11-1** Emergency Response Procedures found in the preceding section of this WSP.

Element 8 - Education
Millwood will mail to all customers once per year public information literature pertaining to cross connection control hazards, copies of which are included in the appendix.

Element 9 – CCC Records
The City is developing and updating a comprehensive list of services with installed backflow assemblies using "Tokay" software. This list includes the locations, types, sizes, brand, model numbers, dates of testing, person or company performing the test, and repairs made for all installed backflow assemblies. The City is also expanding this list (see Elements 2 & 3 above) to include those services that should but do not yet have backflow assemblies. The expanded list will include a "status" field for monitoring progress toward installation of those devices. A current list of installed backflow devices is included in the Appendix.

Element 10 – Reclaimed Water
Reclaimed water is not utilized within Millwood's boundaries.

Premise Isolation
The City believes that, based on Table 9 of WAC 246-290-490, the following premises require isolation.

Table 11-2 Services Requiring Premises Isolation

Location	Status	Last Tested
Presbyterian Church (boiler), 3223 N. Marguerite	¾" RPBA installed	Not Tested (1)
Bank of America (boiler), 2716 N. Argonne	¾" RPBA installed	1993
Millwood Elementary (boiler), 8818 E. Grace	¾" RPBA installed	2001
Convenience Store (pop machine) 8915 E. Trent	¾" RPBA installed	Not Tested (1)
Veterinary Clinic 9303 E. Trent	No device [2]	NA (2)
Inland Empire Paper Co. (onsite well & piping) 3320 N Argonne	No device [2]	NA (2)

(1) *Millwood will follow the procedures identified in Elements 5 & 6 above for notifying the customer of the need for testing the RPBA devices.*
(2) *Millwood will notify the owners that they are required to install and test RPBA devices and will follow the procedures identified in Elements 5 & 6 above.*

11.6. Customer Complaint Response

Refer to **Section 2.10** for a description of the City's complaint response program.

11.7. Record Keeping and Reporting

All water system records are filed at City Hall. Available records include:

- Water quality sampling results
- Source meters records
- Service meter records
- Customer complaints

- Project record drawings
- Equipment maintenance records
- Coliform results

The period of record for each of these types of records varies widely. In general it is the City's policy to not dispose of any potentially valuable system records.

11.8. Operation & Maintenance Program Improvements

The water system is operated efficiently and effectively. Unlike many water systems of similar size, full knowledge of the water system's overall operation and maintenance requirements are shared by more than one qualified person who can be in responsible charge of its operation. Also the system is equipped with up to date SCADA equipment for system control and data acquisition with personnel trained to operate it. These advantages greatly enhance system reliability.

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