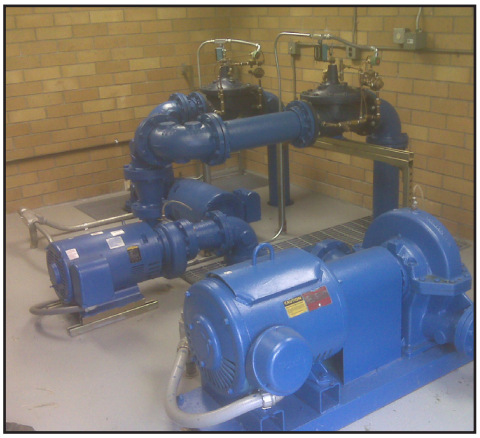
CITY OF WASHOUGAL

Water System Plan Update



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WATER SYSTEM PLAN UPDATE

FOR

CITY OF WASHOUGAL

JUNE 2012

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EXECUTIVE SUMMARY

Purpose and Compliance

The purpose of this Water System Plan Update is to document the City of Washougal's (City's) water system infrastructure and evaluate the system's physical and financial adequacy to provide water to existing customers and projected growth within the water service area. This Plan includes an inventory of existing facilities, establishing criteria for water system analysis and analyzing the hydraulic capacity of the system, developing a capital improvement program (CIP) based on the hydraulic analysis and developing a financial plan to fund the proposed CIP and assess existing revenue and expenses. This Plan also includes an assessment of the City's groundwater resources, water rights and water use efficiency program.

This Plan follows the Washington State Department of Health Office of Drinking Water's guidelines for Water System Plans and complies with Washington Administrative Code (WAC) 246-290-100.

Water System Ownership and Management

Washougal's municipal water system (Water System ID: 93400) is owned and operated by the City. The Public Works Director works under the City Administrator and in collaboration with the Assistant Public Works Director and City Engineer to manage and plan for the future of the City's utility infrastructure, including the water supply and distribution system.

The Water System Manager, working under the Public Works Director is responsible for requisitioning materials and equipment necessary for water system function, inspecting water system components for compliance with standards, providing oversight and training for water system operators and working with the public to resolve complaints related to water system activities. The Water System Supervisor, Lead and staff focus on water quality, operational duties, system maintenance, cross-connection control and installing new water services.

Existing Water System Facilities

Supply Wells

The City's drinking water is supplied entirely by six groundwater wells in two wellfields. The Hathaway Park (Upper) Wellfield, located near 28th Street and I Street and the Westside (Lower) Wellfield, located on 1st Street between the Burlington Northern Railroad and C Street near the Camas/Washougal border. The majority of the City's production wells are located at the Lower Wellfield.

The wells produce water year round and serve as the City's sole water supply source. Any one of Well Nos. 5, 6 and 7 at the Lower Wellfield can generally supply all of the City's existing water demand during the winter months. During the winter, these wells are operated on a rotating schedule. During the summer, primary water supply needs may be fulfilled by Well Nos. 1, 11 or 12.

All wells at the Lower Wellfield are disinfected with chlorine. Well No. 1 at the Upper Wellfield is disinfected using a bulk sodium hypochlorite system. All wells are treated with sodium hydroxide to adjust pH for lead and copper corrosion control.

Emergency Interties

The City has two emergency interties with the City of Camas water system; the South intertie at 3rd Street and James in Camas and the North intertie on the west end of Shepherd Road at the Washougal/Camas City limits. Both interties are normally closed with manually operated isolation valves and 8-inch diameter pressure reducing valves (PRVs).

Pressure Zones, Storage Reservoirs and Booster Pump Stations

Water distribution systems are typically separated into pressure zones to provide service pressures within an acceptable range to all customers. Pressure zones are defined by ground topography and designated by overflow elevations of water storage reservoirs or discharge pressures of PRVs or booster pump stations feeding the zone, also known as a zone's hydraulic grade line (HGL). Typically, water from a reservoir will serve customers by gravity within a specified range of ground elevations so as to maintain acceptable minimum and maximum water pressures at each individual service connection. When it is not feasible or practical to have a separate reservoir for each pressure zone, pumping facilities or pressure reducing valves are used to serve customers in different sub-zones from a single reservoir.

Washougal's water system is divided into four primary pressure zones (1, 2, 3 and 4) which are served from three booster pump stations (Pump Station Nos. 1, 3 and 4) and seven finished water storage reservoirs with a combined storage capacity of 4.88 million gallons (MG). The primary pressure zones are further divided into seven sub-zones supplied through 14 PRV stations. Existing pressure zones with their service elevation ranges and the finished water storage reservoirs, booster pump stations and PRVs that supply each primary and sub-zone are summarized in Table ES-1.

Table ES-1
Existing Pressure Zone Summary

Pressure Zone	Approx. HGL (ft)	Supplied by	Planned Service Elevated Range (ft)[1]		Existing Service Elevation Range	
			90 psi	30 psi		
1	236	Reservoirs 1A & 1B All Wells WHS, Evergreen & Lebrun 2 PRVs	30	165	20	160
2	362	Reservoirs 2A & 2B Pump Station 1 57th Street PRV	155	290	140	300
2-2	274	Sunset Ridge PRV	65	205	60	180
3	658	Reservoir 3 Pump Station 3	450	590	160[3]	540
3-2	537	Lookout Ridge 2 PRV	330	470	340	450
3-3	495[2]	Lebrun & Lookout Ridge 1 PRVs	290	430	120[3]	400
3-4	353[2]	N 10th Street & Columbia Ridge PRVs	145	285	140	280
3-5	296	Crown Pointe PRV	90	225	100	240
4	677	Reservoirs 4 & 4B Pump Station 4	470	605	380[3]	600
4-2	532	Arborview PRV	325	460	300	440
4-3	425[2]	Summer Slope & 49th Street PRVs	220	355	220	360

Note: 1. Planned service elevation range reflects desired lower and upper limits of normal operating pressure.
2. Where a PRV-controlled sub-zone is served by multiple PRVs, the HGL is assumed to be the average of the small valve settings for all PRVs supplying the zone.
3. Individual PRVs are assumed to be present on service connections in the lowest elevations of Zones 3, 3-3 and 4.

Water Service Area and Planning Period

Washougal supplies water to customers within the existing city limits. The City has a duty to provide service to new customers within this area which is also referred to as the retail water service area. The retail water service area, the entire area within the city limits, is used to develop water demand projections and analyze water system capacity for the 6-year planning horizon (through 2018). The future water service area used to develop water demand projections and analyze water system capacity for the 20-year planning horizon (through 2032) is defined as all land within the existing Urban Growth Area (UGA).

Water Demand

The term "water demand" refers to all of the water requirements of the system including residential (domestic), commercial, public and industrial. Demands are discussed in terms of gallons per unit of time such as million gallons per day (mgd).

Public Works staff record daily well production meter readings at all of the City's groundwater supply wells. Daily well production meter readings reflect daily consumption and are used to estimate historical average day (ADD) and maximum day (MDD) water demand trends.

Historical Population and Demand

Water demand projections are based on an approximate 2009 population of 14,095 residents served through 5,747 water system service connections within the existing city limits. The 2009 total annual well production was 611.79 MG. 2009 average day demand (ADD) was 1.68 mgd and maximum day demand (MDD) was 3.71 mgd.

The City experienced unusually low water demands during the summer of 2010 compared to those observed over the last eight to ten years in the City of Washougal. Given this substantial difference from average historical demands, forecasting future demand based on 2009 data is considered more prudent for planning purposes. The CIP developed in this plan is based on a 20-year planning period of 2012 to 2032. Given the limited amount of growth in the City's water service area in the last 3 years, water demand projections based on 2009 water use data are considered to be an accurate representation of current (2012) conditions for planning purposes.

Equivalent Residential Units (ERUs)

Washougal's public water system serves predominantly single-family residential customers who generally have a consistent pattern of water use or demand. Water demands for multi-family residences, commercial and industrial users may vary significantly from service to service. When projecting future water demands based on population change, the water needs of non-residential and multi-family residential customers are represented by comparing their water use volume to the average single-family residential unit. The number of single-family residential units that could be served by the water demand of these other types of customers is referred to as a number of "equivalent residential units" (ERUs). ERUs differ from actual metered service connections in that they relate all water services to an equivalent number of representative single-family residential services based on typical annual consumption.

In order to establish average consumption for a single-family residential service connection in the Washougal water system, the total number of single-family residential service connections was compared to the total consumption by single-family residential customers. The current average annual demand per ERU (ADD/ERU) is approximately 227 gallons per

day (gpd). Maximum day demand per ERU (MDD/ERU) is estimated at approximately 503 gpd per ERU. The existing number of ERUs in the Washougal system is 7,384.

Forecast Population and Demand

Water demand forecasts for the six-year and 20-year planning horizons were developed using historical water demand trends, forecasted population and commercial/industrial growth within the City's UGA. Population and water demand forecasts are summarized in Table ES-2.

Table ES-2
Water Demand Forecast Summary

Year	Population	Total ERUs	ADD (mgd)	MDD (mgd)
6-Year (2018)	16,288	8,425	1.91	4.24
20-Year (2032)	25,376	11,882	2.70	5.98

Water System Analysis Criteria, Evaluation and Recommendations

Water system performance criteria outlined in the following paragraphs are used in conjunction with demand projections in Table ES-2 above to evaluate water system capacity and recommend improvements to mitigate water system capacity deficiencies. Improvement projects and their estimated costs are compiled in the CIP presented in Table ES-3. Improvements are divided into Immediate (through 2018), Short Term (2019 to 2022) and Long Term (2023 to 2032) timeframes.

Source Capacity

In accordance with Washington State Department of Health's *Water System Design Manual*, the City's groundwater supply wells should be capable of providing, with 18 hours of pumping, estimated maximum day demands through the end of the 20-year planning period. With all wells, including standby Well No. 10, pumping concurrently for 18 hours, the City's existing groundwater wells are capable of delivering approximately 6.5 million gallons. Based on projected MDD shown in Table ES-2, the supply system has adequate capacity to meet maximum day demand of approximately 6.0 mgd in the year 2032.

Service Pressure

Pressure zones and distribution piping should be configured such that the system is capable of providing the peak hour demand (PHD) while maintaining a minimum service pressure at

any meter in the system between 30 and 90 pounds per square inch (psi). The system should meet this criterion with all equalization storage depleted. Conformance to this pressure range may not always be possible or practical due to topographical relief, existing system configurations and economic considerations. In some areas system pressures of up to 125 psi are allowed, anticipating the need for individual PRVs to be installed at each service connection in order to satisfy maximum pressure requirements of the Uniform Plumbing Code.

Proposed Future Pressure Zones

Future pressure zones and associated storage and pumping facilities are recommended to efficiently provide adequate service pressures throughout the City's future water service area, the entire area within the current UGA.

Available Fire Flow

The amount of water recommended for fire suppression is based on the size and duration of the anticipated fire which is typically associated with the building type or land use of a specific area within the distribution system. Fire flow recommendations are typically much greater in magnitude than the normal maximum day demand present in any local area. Adequate hydraulic capacity must be provided for these large fire flow demands.

The distribution system should be capable of providing recommended fire flow to a given location while, at the same time, supplying MDD and maintaining a minimum residual service pressure at any meter in the system of 20 psi. Equalization and fire suppression storage in all reservoirs are assumed to be depleted during fire flow events.

Multiple piping improvements are recommended to provide adequate hydraulic capacity for fire flow.

Storage Capacity

Water storage facilities should be in place to provide gravity supply to each pressure zone except in special cases where direct pumping can be justified. Storage facilities are provided for four purposes: operational storage, equalization storage, standby or emergency storage and fire storage. The total storage required is the sum of these four elements.

New storage reservoirs are recommended to serve proposed Pressure Zone 6 in the immediate term, existing Zones 2 and 3 in the short term and proposed Zone 7 in the long term.

Pump Station Capacity

According to *Water System Design Manual* guidelines, Washougal's pump stations should have sufficient capacity to meet the maximum day demand for the pressure zone that they

serve with all pumps running. At firm capacity, each pump station should be capable of supplying average day demands for the zone. Firm pumping capacity is defined as a station's pumping capacity with the largest pump out of service.

Pump stations supplying storage reservoirs in one pressure zone that serve as the suction supply to a pump station in a higher pressure zone should be sized to accommodate the demand of both pressure zones. Sizing the lower elevation pump station to meet demands in both pressure zones prevents excessive reservoir drawdown during high demand periods or emergencies in the higher elevation zone. All existing booster pump stations in the City's water system have sufficient capacity to meet these requirements through the 20-year planning period (to 2032). Additional booster pump stations are included in the CIP to serve proposed pressure zones 5, 6 and 7.

Table ES-3
Capital Improvement Program

Category	Project Name	Project Priority	Project Description	CIP Schedule and Project Cost Summary			Estimated Project Cost
				Immediate (2012 - 2018)	Short-Term (2019 - 2022)	Long-Term (2023 - 2032)	
Storage Facilities	Reservoir 6	R1	Reservoir to serve mid-level Pressure Zone 6 west of River	$ 2,100,000			$ 2,100,000
	Reservoir 3B	R2	Second reservoir at existing Reservoir 3 Woodburn Hill site		$ 2,115,000		$ 2,115,000
	Reservoir 7	R3	Reservoir to serve high elevations in northeast corner of UGA			$ 2,210,000	$ 2,210,000
	Reservoir 2C	R4	New reservoir at existing Reservoir 2A and 2B site		$ 2,540,000		$ 2,540,000
	Reservoir 6	R5	Site Alternatives Analysis for Proposed Reservoir 6	$ 300,000			$ 300,000
	Reservoir 2C	R6	Site Alternatives Analysis for Proposed Reservoir 2C	$ 300,000			$ 300,000
	Reservoir 3B	R7	Site Alternatives Analysis for Proposed Reservoir 3B	$ 300,000			$ 300,000
			Sub-Total	*$ 3,000,000*	*$ 4,655,000*	*$ 2,210,000*	*$ 9,865,000*
Pumping Facilities	Pump Station No. 6	PS1	Pump station to fill Reservoir 6 from Zone 1 and serve Zone 6	$ 760,000			$ 760,000
	Pump Station No. 3B	PS2	Replace existing Pump Station No. 3 with new station at Reservoir 6 site	$ 810,000			$ 810,000
	Pump Station No. 5	PS3	Constant pressure pump station to serve high elevations west of river from Zone 3 distribution			$ 800,000	$ 800,000
	Pump Station No. 7	PS4	Pump station to fill Reservoir 7 from Zone 4 and serve high elevation Zone 7			$ 760,000	$ 760,000
			Sub-Total	*$ 1,570,000*	*$ -*	*$ 1,560,000*	*$ 3,130,000*
Distribution System Piping		P1 - P5	Pressure Zone 6 Transmission	$ 486,400			$ 486,400
		P6	New Pump Station 3B Transmission	$ 66,500			$ 66,500
		P7 - P21	Fire Flow Improvements	$ 1,735,500			$ 1,735,500
		P22 - P25	Pressure Zone 6 west expansion to Existing Zone 3-3		$ 401,000		$ 401,000
		P26 - P27	Pressure Zone 6 central expansion between Lebrun Road and N 6th Street		$ 684,500		$ 684,500
		P28 - P29	Pressure Zone 6 east expansion from Reservoir 6 to Zone 3-4 and city limits		$ 319,600		$ 319,600
		P30 - P35	Pressure Zone 3 northern expansion between city limits and UGA			$ 4,866,300	$ 4,866,300
		P36 - P37	Pressure Zone 3-2 northwestern expansion between city limits and UGA			$ 821,600	$ 821,600
		P38	Pressure Zone 3-3 northwestern expansion between city limits and UGA			$ 191,100	$ 191,100
		P39 - P40	Pressure Zone 3-7 piping			$ 819,000	$ 819,000
		P41	Pressure Zone 4-2 expansion north of city limits			$ 542,100	$ 542,100
		P42 - P46	Pressure Zone 5 piping			$ 1,085,200	$ 1,085,200
		P47 - P51	Pressure Zone 7 piping			$ 4,072,200	$ 4,072,200
		P52 - P56	Fire Flow Improvements for Commercial Zoning (development driven)			$ 424,700	$ 424,700
	Pipe Replacement		Water Service Line Replacement Program	$ 120,000	$ 80,000		$ 200,000
	Pressure Reducing Facilities	Pressure Zone 3-2	SE 23rd Street PRV			$ 110,000	$ 110,000
			30th Circle PRV			$ 110,000	$ 110,000
		Pressure Zone 3-3	Crown Road PRV			$ 110,000	$ 110,000
		Pressure Zone 3-7	SE Woodburn Road PRV			$ 110,000	$ 110,000
			N T Street PRV			$ 110,000	$ 110,000
		Pressure Zone 4-2	SE 330th Court PRV			$ 110,000	$ 110,000
		Pressure Zone 4-3	Second 57th Street PRV			$ 110,000	$ 110,000
			Sub-Total	*$ 2,408,400*	*$ 1,485,100*	*$ 13,592,200*	*$ 17,485,700*
Other	Planning Studies		Water Rate and SDC Study	$ 50,000	$ 50,000	$ 100,000	$ 200,000
			Water System Plan		$ 100,000	$ 200,000	$ 300,000
			Sub-Total	*$ 50,000*	*$ 150,000*	*$ 300,000*	*$ 500,000*
Capital Improvement Plan (CIP) Total				***$ 7,028,400***	***$ 6,290,100***	***$ 17,662,200***	***$ 30,980,700***

$7,028,400 6 Year Total	$13,318,500 10 Year Total
$1,171,400 Annual Ave.	$1,331,850 Annual Ave.

Water Resource Analysis and Water Use Efficiency

Water Rights

All of Washougal's water rights are for municipal supply purposes and all wells have a place of use corresponding with the Washougal water service area. The City recently obtained approval for two new water rights applications, G2-30564 and G2-30565. These permits, with a priority date of January 20, 2011 are non-additive water rights which supplement the City's existing water rights certificates and claims. These permits authorize:

- Withdrawal of 1,325 gpm (Qi) and 2,120 acre-feet per year (Qa) from the Upper Wellfield at Wells 1, 3 and 10
- Withdrawal of 4,675 gpm (Qi) from the Lower Wellfield and 3,786 acre-feet per year (Qa) from all sources (including the Upper Wellfield)

The City's current water right allocation is adequate to satisfy 20-year demand projections.

Wellhead Protection

The *Wellhead Protection Assessment Report* prepared by Pacific Groundwater Group in March 2012 rated the aquifer as highly susceptible and highly vulnerable to potential contamination. The high susceptibility rating is based on the aquifer composition (permeable sand, gravel and cobbles) and lack of an extensive confining layer above the shallow water table. Vulnerability is also considered high because of known and potential contaminant sources identified within the wellfield capture zone.

Water Use Efficiency

Washington State's 2003 Municipal Water Law requires all municipal water suppliers to enact measures to ensure the efficient use of water. The Washington State DOH has established water use efficiency (WUE) requirements for all municipal suppliers in conjunction with the Municipal Water Law. Washougal's current WUE program was adopted in 2008. The City has established a WUE goal to reduce residential peak day demand by 5 percent over a 6-year period between 2007 and 2013.

WUE measures implemented by the City to promote conservation include annual conservation flyers, water consumption history displayed on each customer's bill and peak season water conservation signs.

The WUE requirements also mandate that water systems maintain distribution system leakage (DSL) at 10 percent or less of total production based on a three year running average. DSL includes both apparent losses such as water theft or meter inaccuracies and

real losses such as leaking water mains or reservoir overflows. A review of historical consumption and production meter data indicates distribution system leakage in the range of 6 to 10 percent.

Financial Plan

Feasible long-term capital funding strategies must be defined to ensure adequate resources are available to fund the CIP. City resources appropriate for funding capital needs include accumulated cash above the operating reserve threshold, water rate revenues designated for capital spending purposes and capital related revenues, such as System Development Charges (SDCs) and other connection fees.

System Development Charges

The City currently imposes an SDC of $2,930 per ERU to all new water customers. Based on current system investment, projected infrastructure needs identified in the 20-year CIP and system capacity; an updated charge of $4,244 per ERU is calculated for 2012.

Capital Funding Plan

The capital funding plan, presented in Table ES-4, defines a strategy for funding the CIP, including an analysis of available resources from rate revenues, existing reserves, SDCs, debt financing and any special resources that may be readily available, such as grants and developer contributions. The funding plan impacts water rates where debt issuance is projected and therefore repayment required by annual revenues.

Table ES-4
Capital Funding Plan

Capital Funding	2012	2013	2014	2015	2016	2017	2018	2012-2018 CIP	2012-2032 Total CIP
Total Capital Projects	**$ 2,400,000**	**$ 783,212**	**$ 830,048**	**$ 842,930**	**$ 868,217**	**$ 894,264**	**$ 921,092**	**$7,539,763**	**$ 43,658,527**
Capital Fund Balance	$ -	$ 783,212	$ 175,203	$ 180,555	$ 196,790	$ 202,145	$ 182,450	$1,720,356	$ 32,025,530
2011 Revenue Bond Proceeds	2,400,000	-	-	-	-	-	-	2,400,000	2,400,000
Projected New Revenue Bond Proceeds	-	-	654,845	662,375	671,427	692,119	738,641	3,419,408	9,232,996
Total Funding Sources	**$ 2,400,000**	**$ 783,212**	**$ 830,048**	**$ 842,930**	**$ 868,217**	**$ 894,264**	**$ 921,092**	**$7,539,763**	**$ 43,658,527**

[a] Includes annual System Development Charge revenues and system reinvestment funding

The CIP identifies a total of $31 million ($43.7 million adjusted for inflation) in projects. The Immediate (2012 to 2018) forecast period includes $7.0 million ($7.5 adjusted for inflation). Of the $7.5 million of projects in through 2018, 77% are forecast to be debt-funded. As a result of projected system reinvestment funding, the long term funding mix is projected to be 73% cash-funded, improving the City's debt to equity ratio over the life of this CIP.

Revenue Requirements Forecast

The revenue requirement analysis forecasts the amount of annual revenue that needs to be generated by water rates. This analysis incorporates operating revenues, O&M expenses, debt service payments, rate funded capital needs and any other identified revenues or expenses related to water operations, and determines the sufficiency of the current level of rates. Typically, two revenue sufficiency criteria are tested to determine the annual revenue need: 1) cash needs must be met; and 2) debt coverage requirements must be realized.

The City has adopted a schedule of 13% rate increases for years 2013 through 2015. The updated forecast shown in Table ES-5 indicates that while the 13% increase adopted for 2013 is necessary for the utility to meet its annual obligations, the City has opportunity to reduce the adopted 2014 and 2015 rate increases if costs continue to be projected at levels estimated in this forecast.

Table ES-5
Revenue Requirements Forecast 2012-2018

	Current Year	Projected					
Revenue Requirements	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Revenues							
Rate Revenues Under Existing Rates [a]	$ 2,704,803	$ 2,794,001	$ 2,828,926	$ 2,864,287	$ 2,900,091	$ 2,936,342	$ 2,973,046
Non-Rate Revenues	41,151	41,509	42,766	44,722	48,379	52,884	58,893
Total Revenues	**$ 2,745,954**	**$ 2,835,509**	**$ 2,871,692**	**$ 2,909,009**	**$ 2,948,469**	**$ 2,989,226**	**$ 3,031,939**
Expenses							
Cash Operating Expenses	$ 2,140,914	$ 2,215,378	$ 2,280,567	$ 2,348,168	$ 2,417,603	$ 2,490,494	$ 2,566,229
Existing Debt Service	567,646	787,047	900,022	905,684	908,775	906,840	642,055
New Debt Service	-	-	55,435	111,508	168,347	226,937	226,937
Rate-Funded System Reinvestment	-	67,428	69,489	83,590	86,101	63,541	326,336
Total Expenses	**$ 2,708,560**	**$ 3,069,853**	**$ 3,305,512**	**$ 3,448,950**	**$ 3,580,826**	**$ 3,687,812**	**$ 3,761,557**
Annual Surplus / (Deficiency)	**$ 37,394**	**$ (234,344)**	**$ (433,820)**	**$ (539,941)**	**$ (632,357)**	**$ (698,587)**	**$ (729,618)**
Net Revenue from Rate Increases	$ -	$ 237,821	$ 456,398	$ 564,673	$ 657,242	$ 754,635	$ 857,068
Net Surplus / (Deficiency)	**$ 37,394**	**$ 3,477**	**$ 22,577**	**$ 24,732**	**$ 24,885**	**$ 56,048**	**$ 127,450**
Annual Rate Adjustment		13.00%	8.00%	3.00%	3.00%	3.00%	3.00%
Cumulative Rate Adjustment		13.00%	22.04%	25.70%	29.47%	33.36%	37.36%
Residential Bi-Monthly Bill (assumes 16 ccf)	$69.22	$78.22	$84.48	$87.01	$89.62	$92.31	$95.08
Rate Revenues After Rate Increase	$ 2,704,803	$ 3,096,684	$ 3,409,798	$ 3,582,965	$ 3,736,585	$ 3,896,791	$ 4,063,866
No of Days of Cash Operating Expenses	61	60	63	65	68	76	90
Coverage Ratio After Increase	2.39	2.14	2.00	1.94	1.87	1.86	2.56

[a] Additional revenues from adopted 2012 increase of 13.5% included in Revenue under Existing Rates

SECTION 1

SECTION 1
WATER SYSTEM DESCRIPTION

General

This section describes the City of Washougal's (City) water service area and inventories water distribution system facilities. Included in this section is a discussion of water system management and background, existing supply, transmission and distribution facilities and water service area characteristics.

Ownership and Management

Washougal's water system (Water System ID: 93400) is owned and operated by the City. The City is governed by an elected Mayor and an elected seven-member City Council. The Public Works Committee, comprised of three members of the City Council, is charged with discussing public works related issues within the City and forwarding agenda items to the larger City Council for consideration.

The City Administrator, appointed by the Mayor and approved by a majority of the City Council, oversees the business operations of the City. The Public Works Director works under the City Administrator and in collaboration with the Assistant Public Works Director and City Engineer to manage and plan for the future of the City's utility infrastructure, including the water supply and distribution system.

The Water System Manager is a certified State of Washington Water Distribution Manager (WDM) who works under the Public Works Director. The Water System Manager is responsible for requisitioning materials and equipment necessary for water system function, inspecting water system components for compliance with standards, providing oversight and training for water system operators and working with the public to resolve complaints related to water system activities. The Water System Supervisor and Water System Lead, working under the Water System Manager, focus on water quality, operational duties, overseeing system maintenance and implementing a cross-connection control program. Water system staff is responsible for installing new water services, performing maintenance activities and collecting water quality samples. Water system personnel certifications are discussed in more detail in Appendix H Operation and Maintenance Program.

System Background

The City of Washougal was established in 1880 and incorporated in 1908 on the north shore of the Columbia River at the entrance to the Columbia River gorge. Historically, population growth in the City was driven by the timber industry as well as paper and woolen mills. Although the City's population growth rate slowed during the Depression and World War II, industrial growth continued to play a role in the community's growth particularly with the development of the Port of Camas/Washougal's Industrial Park on the Columbia River

beginning in 1967. Population growth in Washougal today is also influenced by the City's proximity to the Portland/Vancouver metropolitan area.

A vicinity map showing the City's existing water service area and neighboring water providers is presented in Figure 1-1.

Inventory of Existing Facilities

Groundwater Supply Wells

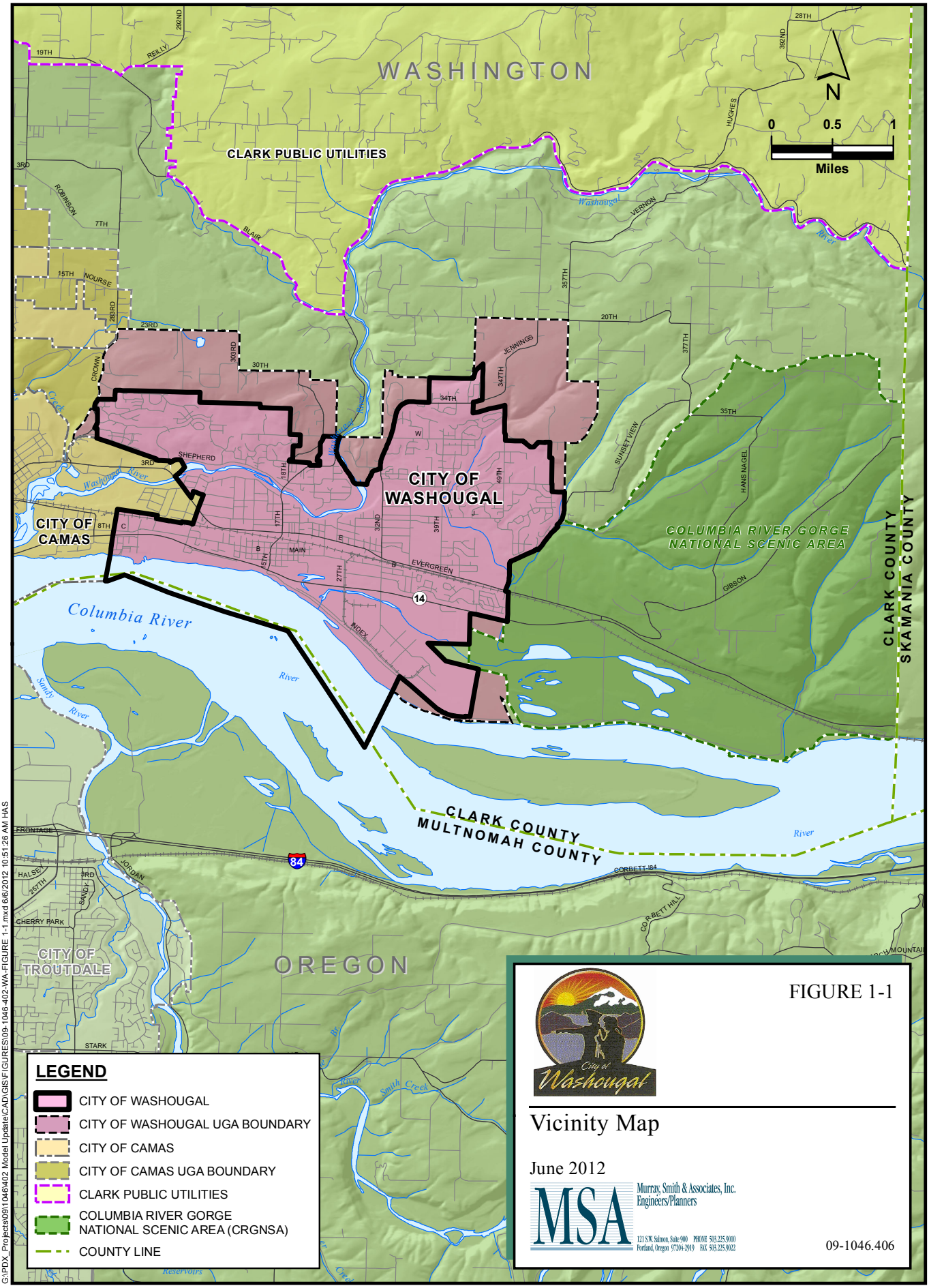
The City's drinking water is supplied entirely by six groundwater wells in two wellfields within the City Limits. Groundwater supply development began with Well Nos. 1 through 4 at the Hathaway Park (Upper) Wellfield between 1931 and 1939. The Hathaway Park Wellfield is located near 28th Street and I Street. Due to limited space at Hathaway Park, Well Nos. 5, 6 and 7 were constructed at the new Westside (Lower) Wellfield between 1942 and 1954. The Westside Wellfield is located between the Burlington Northern Railroad and C Street on 1st Street near the Camas/Washougal border.

Well No. 9 was constructed at what is now Hamllik Park in 1977 but is no longer in use due to water taste and odor concerns. Well No. 10 was constructed in 1984 at Hathaway Park as a partial replacement for Well Nos. 2, 4 and 9 which are no longer in service. Well No. 10 is currently on standby as an emergency supply source, there is no pump installed in the well. Well No. 11 was constructed in 1984 alongside existing Well Nos. 5, 6 and 7 at the Westside Wellfield. An additional well, Well No. 12, was added at the Westside Wellfield in 2009 to serve customers in new residential developments annexed by the City from within Washougal's Urban Growth Area (UGA).

The City's historical and current water supply is from groundwater wells located within the city limits that have been developed and expanded since the construction of the first well in 1931. Additional water storage reservoirs, pump stations, pressure reducing valves (PRVs) and pressure zones were also added to the City's water distribution system as higher elevation developments north of W Street were incorporated into the City.

The wells produce water year round and serve as the City's sole water supply source. According to City staff, any one of Well Nos. 5, 6 and 7 can generally supply all of the City's existing water demand during the winter months. During the winter, the City operates these wells on a rotating schedule. During the summer, primary water supply needs may be fulfilled by Well Nos. 1, 11 or 12.

Each well's capacity in gallons per minute (gpm) is summarized in Table 1-1.


WASHINGTON
OREGON
CLARK PUBLIC UTILITIES
CITY OF WASHOUGAL
CITY OF CAMAS
CITY OF TROUTDALE
COLUMBIA RIVER GORGE NATIONAL SCENIC AREA
CLARK COUNTY
SKAMANIA COUNTY
CLARK COUNTY
MULTNOMAH COUNTY
Columbia River
Washougal River
Sandy River
Smith Creek
N
0
0.5
1
Miles
LEGEND
CITY OF WASHOUGAL
CITY OF WASHOUGAL UGA BOUNDARY
CITY OF CAMAS
CITY OF CAMAS UGA BOUNDARY
CLARK PUBLIC UTILITIES
COLUMBIA RIVER GORGE NATIONAL SCENIC AREA (CRGNSA)
COUNTY LINE
FIGURE 1-1
Vicinity Map
June 2012
Murray, Smith & Associates, Inc.
Engineers/Planners
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Portland, Oregon 97204-2919 FAX 503.225.9022
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G:\PDX_Projects\09\1046402 Model Update\CAD\GIS\FIGURES\09-1046-402-WA-FIGURE 1-1.mxd 6/6/2012 10:51:26 AM HAS

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Table 1-1
Existing Well Summary

Well No.	Wellfield	Approximate Capacity (gpm)
1	Upper	925
5	Lower	650
6	Lower	675
7	Lower	850
10 (Inactive)	Upper	400
11	Lower	1,000
12	Lower	1,500

Emergency Interties

The City has two emergency interties with the City of Camas water system; the South intertie at 3rd Street and James in Camas and the North intertie on the west end of Shepherd Road at the Washougal/Camas City limits. Both interties are normally closed with manually operated isolation valves and also include 8-inch diameter PRVs. The City is on the low pressure side of the interties with the downstream pressure ranging from 75 to 82 psi. The existing water system interties are shown on the Water System Maps in Appendix A.

Pressure Zones, Storage Reservoirs and Booster Pump Stations

The City's water system is divided into four primary pressure zones which are served from three booster pump stations and seven finished water storage reservoirs with a combined capacity of 4.88 million gallons (MG). The primary pressure zones are further divided into sub-zones supplied through 14 PRV stations. Existing finished water storage reservoirs, booster pump stations and PRVs are summarized in the following Tables 1-2 through 1-4.

Table 1-2
Existing Storage Reservoir Summary

Reservoir Name	Effective Capacity (MG)	Floor Elevation (ft)	Overflow Elevation (ft)
1A	1.5	197	236
1B	1.0	197	236
2A	0.161	332	362
2B	0.45	338	361.5
3	0.423	630	658
4[1]	0.1	578	677
4B	1.25	654	677

Note: Reservoir 4 is a standpipe with a physical capacity of 0.531 MG but only 0.1 MG of this is capacity provides effective storage to Zone 4.

Table 1-3
Existing Booster Pump Station Summary

Pump Station	Pump No.	Nominal Capacity (gpm)
1	1	1,000
	2	1,000
	3	1,000
3	1	350
	2	350
	3	350
4	1	300
	2	300
	3	300

Table 1-4
Existing Pressure Reducing Valve (PRV) Summary

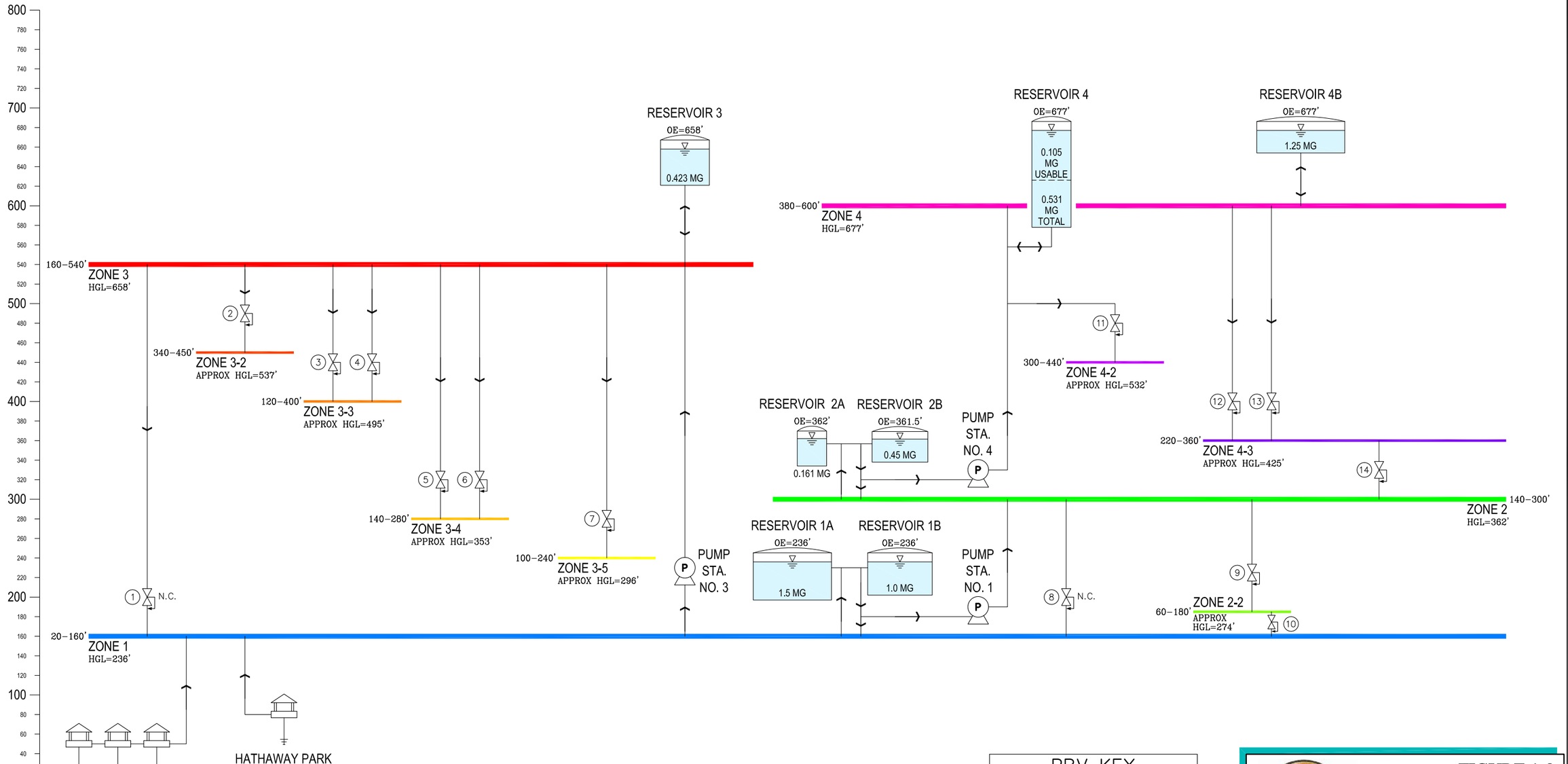
PRV Name	Large Valve Dia. (in)	Small Valve Dia. (in)	Elevation (ft)	Pressure Setting (psi)	Zone From	Zone To
WHS	6	3	100	56	2	1
Evergreen	6	2	50	80	2-2	1
Lebrun 2	6	1.5	160	32	3	1
Sunset Ridge	6	2	135	60	2	2-2
Lookout Ridge 1	8	2	325	78	3	3-3
Lookout Ridge 2	8	2	357	78	3	3-2
Lebrun	8	2	290	85	3	3-3
N 10th Street	6	1.5	190	73	3	3-4
Columbia Ridge	6	2	250	40	3	3-4
Crown Pointe	6	1.5	180	50	3	3-5
Arborview	6	2	324	90	4	4-2
Summer Slope	8	2	361	30	4	4-3
49th Street	6		338	30	4	4-3
57th Street	6		260	48	4-3	2

Figure 1-2, Existing Hydraulic Profile, illustrates the configuration of pressure zones, booster pump stations and storage reservoirs as described below. Pressure zones are also summarized in Table 1-6 and the limits of each zone are highlighted on the Water System Maps in Appendix A.

Pressure Zone 1

Pressure Zone 1 is the largest zone in the City and contains both wellfields and the two emergency interties with the City of Camas. Zone 1 serves most water customers south of Shepherd Road between the City of Camas to the west and the eastern city limit. Pressure Zone 1 serves City water customers in areas with elevations below approximately 160 feet above mean sea level (msl).

Pressure Zone 1 is served by Reservoirs 1A and 1B located on a single site near the intersection of Stiles Road and W Street with capacities of 1.5 MG and 1.0 MG respectively. The reservoirs are welded steel tanks supplied through distribution mains from the wellfields. The wells are sequenced and controlled by the water system Supervisory Control and Data Acquisition (SCADA) system to maintain the water level in the reservoirs. Both reservoirs have an overflow elevation of 236 feet above msl.



LEGEND

- WATER MAIN
- HIGHEST GROUND ELEVATION SERVED BY PRESSURE ZONE OR SUBZONE
- RESERVOIR (OE=240' OVERFLOW ELEVATION; 1.0 MG CAPACITY)
- ALTITUDE VALVE
- PRESSURE REDUCING VALVE
- PUMP STATION
- WELL

ABBREVIATIONS

EL	ELEVATION
FT	FEET
GPM	GALLONS PER MINUTE
HP	HORSE POWER
MG	MILLION GALLONS
OE	OVERFLOW ELEVATION
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
TDH	TOTAL DYNAMIC HEAD
WTP	WATER TREATMENT PLANT
N.C.	NORMALLY CLOSED

PRV KEY

PRV NO.	NAME
1	LEBRUN NO. 2 (N.C.)
2	LOOKOUT RIDGE 2
3	LOOKOUT RIDGE 1
4	LEBRUN
5	N 10th STREET
6	COLUMBIA RIDGE
7	CROWN POINTE
8	WASHOUGAL HIGH SCHOL (N.C.)
9	SUSNSET RIDGE
10	EVERGREEN BLVD
11	ARBORVIEW
12	SUMMER SLOPE
13	49th STREET
14	57th STREET

FIGURE 1-2

EXISTING WATER SYSTEM HYDRAULIC PROFILE

Water System Plan

June 2012

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Engineers/Planners
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PHONE 503-225-9010 FAX 503-225-9022

09-1046.405

The Washougal High School (WHS) PRV on 39th Street at J Street can provide water to Zone 1 from the higher elevation Zone 2. The WHS PRV is currently "off", that is, it is isolated from the system with a normally closed valve. The Evergreen PRV on Evergreen Way at Sunset View Road provides water to Zone 1 from Zone 2-2. The Lebrun 2 PRV at Lebrun Drive near Shepherd Road can feed water back to Pressure Zone 1 from Pressure Zone 3 but it is also "off", isolated from the system with a normally closed valve.

Pressure Zone 2

Pressure Zone 2 is served by the 0.16 MG Reservoir 2A and the 0.45 MG Reservoir 2B located on a single site near 37th Street and W Street. Reservoir 2A has an overflow elevation of 362 feet above msl and Reservoir 2B has an overflow elevation of 361.5 feet above msl. The Zone 2 reservoirs are supplied by Pump Station No. 1 which draws suction supply from Reservoirs 1A and 1B. Pump Station No. 1 is located adjacent to Reservoirs 1A and 1B. Pressure Zone 2 is also supplied from Pressure Zone 4-3 by the 57th Street PRV at 57th and L Streets. Pressure Zone 2 serves customers east of the Washougal River between approximate ground elevations of 140 and 300 feet above msl.

Pressure Zone 2-2

The Sunset Ridge PRV reduces water pressure as it flows from Pressure Zone 2 to lower elevations in the Sunset Ridge Phase 1 subdivision near Sunset Ridge Drive and F Street. Service connections in this area are considered part of sub-zone 2-2 with approximate ground elevations between 60 and 180 feet above msl. This zone also serves a small number of customers outside Washougal's eastern city limit on Evergreen Way as far east as SE 356th Avenue. These customers, including the Jemtegaard Middle School, are within the Columbia River Gorge National Scenic Area (CRGNSA).

Pressure Zone 3

Pressure Zone 3 is served by the 0.42 MG Reservoir 3 which is a glass fused bolted steel tank with an overflow elevation of 658 feet above msl. The reservoir is supplied from Pump Station No. 3 on N 10th Court north of Shepherd Road. Pump Station No. 3 draws suction supply from the Pressure Zone 1 distribution grid. Pressure Zone 3 and the four sub-zones supplied from Zone 3 serve water system customers west of the Washougal River between approximate ground elevations of 160 and 540 feet above msl. Water mains at lower elevations in Pressure Zone 3, particularly in the Granite Highlands development centered at N Stonegate Drive and N 4th Street will provide excessive service pressures. Service pressures for customers in this area are regulated by individual PRVs at each service.

Pressure Zone 3-2

The Lookout Ridge 2 PRV at the intersection of W X and W Y Streets reduces Zone 3 water pressure to serve customers on W Y Street between W X and W Z Streets as well as all existing customers on W Z Street north to the dead end of W 9th Street south of SE McKever

Road. Service connections in this area are considered part of sub-zone 3-2 with approximate ground elevations between 340 and 450 feet above msl.

Pressure Zone 3-3

The Lebrun PRV on W Lookout Ridge Drive at N Stonegate Drive and the Lookout Ridge 1 PRV near the dead end of W 7th Street north of W Lookout Ridge Drive reduce water pressure from Zone 3 to sub-zone 3-3. Zone 3-3 serves customers at lower elevations of the Crown Terrace, Lookout Ridge and Riverview Terrace subdivisions along W 10th, Bamboo and Alder Streets, W Lookout Ridge Drive and S, T, U and X Streets. Service connections in Zone 3-3 have approximate ground elevations between 120 and 400 feet above msl. Water mains at lower elevations in Pressure Zone 3-3, particularly in the River View Terrace development south of W U Street provide excessive service pressures. Service pressures for customers in this area are regulated by individual PRVs at each service.

Pressure Zone 3-4

The N 10th Street PRV near the intersection of N 10th and N S Streets reduces Zone 3 water pressure from the transmission main between Pump Station No. 3 and Reservoir 3 into the River View Place and Jordan Pointe subdivisions on N S Street and Columbia Ridge Way. Service connections in this area are considered part of sub-zone 3-4 with approximate ground elevations between 140 and 280 feet above msl. This zone is also fed from Zone 3 by the Columbia Ridge PRV on Columbia Ridge Way south of 40th Street.

Pressure Zone 3-5

The Crown Pointe PRV on N 6th Street near N Q Street reduces Zone 3 water pressure into the Crown Pointe Estates subdivision on N P and N R Streets between N 6th and N 9th Streets. Service connections in this area are considered part of sub-zone 3-5 with approximate ground elevations between 100 and 240 feet above msl.

Pressure Zone 4

Pressure Zone 4 is served by the 0.53 MG Reservoir 4 and the 1.25 MG Reservoir 4B. Reservoir 4 is a welded steel standpipe with an effective storage capacity of approximately 0.1 MG. Reservoir 4B is a welded steel tank. Both reservoirs have an overflow elevation of approximately 677 feet above msl. The reservoirs are supplied by Pump Station No. 4 which draws suction supply from Reservoirs 2A and 2B through Zone 4 distribution piping. Pressure Zone 4 serves water customers east of the Washougal River and north of W Street between approximate ground elevations of 380 and 600 feet above msl. Water mains at lower elevations in Pressure Zone 4, particularly in the Columbia View development on 45th, 48th and Z Streets provide excessive service pressures. Service pressures for customers in this area are regulated by individual PRVs at each service.

Pressure Zone 4-2

The Arborview PRV, adjacent to the Zone 2 reservoirs and Pump Station No. 4, reduces Zone 4 water pressure to serve customers around Reservoirs 2A and 2B, north of the reservoirs between Stiles Road and 41st Street. Service connections in this area are considered part of sub-zone 4-2 with approximate ground elevations between 300 and 440 feet above msl.

Pressure Zone 4-3

The Summer Slope PRV located at the intersection of Y, Z and 45th Streets reduces water pressure from Reservoir 4 to serve customers northwest of Campen Creek between Z and U Streets. The 49th Street PRV at 49th and W Streets reduces water pressure from Reservoir 4 to serve customers southeast of Campen Creek between U Drive and L Street. Customer connections served by these PRVs are considered part of sub-zone 4-3 with approximate ground elevations between 220 and 360 feet above msl.

Distribution System

The distribution system consists of approximately 77 miles of pipe ranging from 1.5-inch diameter to 16-inch diameter. All new mains constructed in the water system are ductile iron, with the exception of some PVC pipe for sizes smaller than 6 inches in diameter. Existing piping includes older welded steel, galvanized and non-galvanized iron, cast iron and asbestos cement. Table 1-5 summarizes total lengths of pipe by size for the water system.

Table 1-5
Existing Pipe Inventory

Pipe Diameter	Estimated Length (miles)
Less than 4 inches	3.1
4-inch	3.2
6-inch	9.3
8-inch	39.1
10-inch	5.9
12-inch	13.3
14-inch	3.4
16-inch	0.1
TOTAL	**77.4**

Table 1-6
Existing Pressure Zone Summary

Pressure Zone	Approx. HGL (ft)	Supplied by	Planned Service Elevated Range (ft)[1]		Existing Service Elevation Range	
			90 psi	30 psi		
1	236	Reservoirs 1A & 1B All Wells WHS, Evergreen & Lebrun 2 PRVs	30	165	20	160
2	362	Reservoirs 2A & 2B Pump Station 1 57th Street PRV	155	290	140	300
2-2	274	Sunset Ridge PRV	65	205	60	180
3	658	Reservoir 3 Pump Station 3	450	590	160[3]	540
3-2	537	Lookout Ridge 2 PRV	330	470	340	450
3-3	495[2]	Lebrun & Lookout Ridge 1 PRVs	290	430	120[3]	400
3-4	353[2]	N 10th Street & Columbia Ridge PRVs	145	285	140	280
3-5	296	Crown Pointe PRV	90	225	100	240
4	677	Reservoirs 4 & 4B Pump Station 4	470	605	380[3]	600
4-2	532	Arborview PRV	325	460	300	440
4-3	425[2]	Summer Slope & 49th Street PRVs	220	355	220	360

Note: 1. Planned service elevation range reflects desired lower and upper limits of normal operating pressure.
2. Where a PRV-controlled sub-zone is served by multiple PRVs, the HGL is assumed to be the average of the small valve settings for all PRVs supplying the zone.
3. Individual PRVs are assumed to be present on service connections in the lowest elevations of Zones 3, 3-3 and 4.

Related Plans

The following plans are related to the Washougal service area and this Water System Plan:

1. *Water System Plan Update* (December 2004)

   This document prepared by Murray, Smith & Associates, Inc., Wallis Engineering, Inc. and LDC Design Group, Inc. serves as the basis of this Water System Plan.

2. *Clark County Comprehensive Growth Management Plan* (September 2007, Amended 2008, 2009)

   This document identifies land use designations in unincorporated areas of Clark County.

3. *Clark County Coordinated Water System Plan* (CWSP, 1983 original plan with updates in 1991, 1997 and 2010)

   This document and its subsequent updates are prepared as a cooperative effort between Clark County water utility providers in order to define their ultimate service area boundaries and policies concerning conditions of service.
   - Washougal's future service area reflects that adopted in the CWSP
   - Minimum water system design standards and specifications identified in this plan are consistent with those adopted in the CWSP

4. *Clark Public Utilities Water System Plan* (May 2001)

   Water System Plan for Clark Public Utilities which provides water service north of Washougal's ultimate water service area.

5. *City of Camas Water System Plan* (2010)

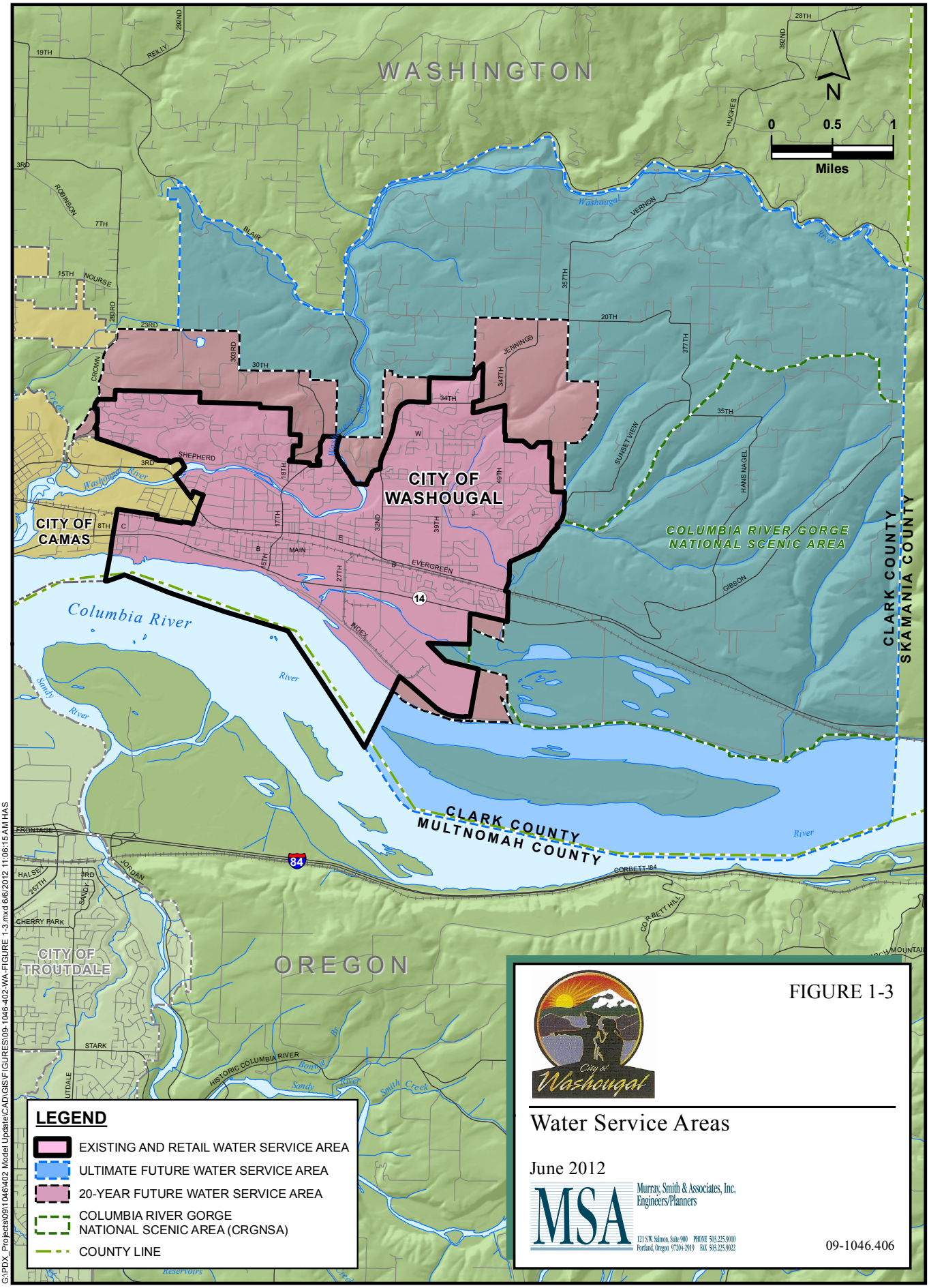
   Water System Plan for the City of Camas water system located west of the Washougal water service area.

The Washougal Water System Plan is compatible with the objectives stated for the documents above.

The current Water Facilities Inventory (WFI) form for the Washougal water system is included as Appendix B.

Water Service Area

State of Washington Municipal Water Law allows municipal water providers such as the City of Washougal, to expand the place-of-use for an existing water right to a water service area defined in the City's approved Water System Plan. The City is required to define their existing, retail and future water service areas within this Water System Plan. These water service areas, described below, are also illustrated in Figure 1-3.


WASHINGTON
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CITY OF WASHOUGAL
CITY OF CAMAS
CITY OF TROUTDALE
COLUMBIA RIVER GORGE NATIONAL SCENIC AREA
CLARK COUNTY
SKAMANIA COUNTY
CLARK COUNTY
MULTNOMAH COUNTY
Columbia River
Washougal River
Sandy River
HISTORIC COLUMBIA RIVER
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LEGEND
EXISTING AND RETAIL WATER SERVICE AREA
ULTIMATE FUTURE WATER SERVICE AREA
20-YEAR FUTURE WATER SERVICE AREA
COLUMBIA RIVER GORGE NATIONAL SCENIC AREA (CRGNSA)
COUNTY LINE
FIGURE 1-3
Water Service Areas
June 2012
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G:\PDX_Projects\09\1046402 Model Update\CAD\GIS\FIGURES\09-1046-402-WA-FIGURE 1-3.mxd 6/6/2012 11:06:15 AM HAS

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Existing Service Area

The existing water service area is defined as the area containing the City's transmission mains and distribution system. Water service is available in this area through short extension from existing in-street water mains. The boundaries of Washougal's existing water service area are: the Camas city limits on the west side; the Columbia River on the south side; 57th Street on the eastside; and a northern boundary that generally follows the city limits beginning to the east at SE Lawton Road and proceeding westward to the city limits at SE Crown Road. The majority of the City's existing water service area is comprised of low-density residential and retail commercial land as well as the Port of Camas-Washougal industrial park southeast of the City, which occupies approximately 400 acres.

Future development within the existing water service area is expected to consist of single family housing, in-filling of vacant properties, redevelopment to higher-density multifamily housing, conversion of marginal residential properties to commercial zoning, and continued development of industrial-zoned land.

Retail Service Area

The retail service area is defined as the area where the City currently provides water to customers and areas where the City has a duty to provide service to new customers under the conditions set forth in the 2003 Washington Municipal Water Law. Title 13 of the City's municipal code states that the City will provide water service to customers within the city limits, thus Washougal's retail water service area is the entire area within the existing city limits.

Future Service Area

The City of Washougal's water service area has experienced consistent growth over the last two decades due in part to the City's proximity to the Portland-Vancouver Metropolitan area as well as industrial development by the Port of Camas-Washougal and annexations of approximately 1,700 acres of surrounding urbanized lands into the City. The City's Comprehensive Plan, in conjunction with the Clark County Comprehensive Plan, provides a framework for growth within the City's adopted Urban Growth Area. The UGA provides sufficient and appropriate land for future development while protecting rural areas surrounding Washougal and the neighboring City of Camas. The 20-year future water service area is defined as all land within the existing UGA.

The Clark County Coordinated Water System Plan Update (CWSP) identifies service areas for the provision of public water supply throughout the County. Central to the identification process is the selection of a qualified water provider who could most logically serve the area. Washougal's ultimate future water service area boundary, as defined in the CWSP, is generally described as west to the Camas Water Service Area, north to the Little Washougal and Washougal Rivers, east to the Skamania County line and south to the Columbia River. This area contains approximately 15,200 acres. Any future boundary adjustments must be

negotiated with adjoining providers and adopted through inter-local agreements or as part of a CWSP update. Existing service area inter-local agreements are included as Appendix C.

The Columbia River Gorge National Scenic Area (CRGNSA) overlays approximately 5,200 acres of Washougal's ultimate future water service area. Within the CRGNSA boundary, approximately 730 acres have low density residential zoning designations with the remaining 4,470 acres set aside for agriculture, open space or forest land. Significant future development in the CRGNSA is not anticipated. Existing water customers within the CRGNSA boundary will continue to be served by the City's water system. Washougal's UGA, the CRGNSA overlay and city zoning designations within the water service area are illustrated in the UGA Zoning Map Figure 1-4.

Service Area Policies

The City has defined service area policies within the municipal code and development standards which govern both the means of providing water service to customers and the requirements for becoming a City of Washougal water customer.

Washougal supplies water to customers within the city limits. Potential water customers residing or developing property outside the city limits must agree to enter into a contractual agreement binding them to annexation of the unincorporated property in order to become water system customers. The City does not currently offer water for wholesale purchase nor does the City maintain connections to satellite water systems. All City water customers are directly connected to the distribution system.

In order to accommodate new customers, distribution water mains may be extended. The cost of these extensions is the responsibility of the developer or property owner requesting City services. Late-comers or property owners requesting connection to an extended line after its completion, are assessed a cost for connection to the extended water main which is then paid to the original developer until the full shared cost of the main extension has been repaid or until 10 years have elapsed following the water main's completion, whichever occurs first. Any additional connection fees after this time accrue to the City.

Extension of existing water mains and new water mains installed in new development areas must meet City of Washougal Engineering Standards for Public Works Construction. Chapter 5 of these standards, pertaining to the City's water system, is included as Section 7 of this water system plan. The City will provide financial assistance for oversizing of water mains when the projected future needs of the system exceed the existing requirements. The City also offers assistance in the formation of a Local Improvement District (LID) outside the city limits provided that the LID is within Washougal's future water service area.

The City's Cross-Connection Control Program is mandated by Title 13 of the City's municipal code in compliance with state requirements. Details of the program may be found in the City of Washougal's Operation and Maintenance Program in Appendix H of this plan.

CITY OF CAMAS

Washougal River

Lacamas Creek

Columbia River

Water

CLARK COUNTY
MULTNOMAH COUNTY

COLUMBIA RIVER GORGE NATIONAL SCENIC AREA

N

0 2,000
Feet

LEGEND

- WASHOUGAL CITY LIMITS
- CAMAS CITY LIMITS
- URBAN GROWTH AREA (UGA) BOUNDARY
- COLUMBIA RIVER GORGE NATIONAL SCENIC AREA (CRGNSA)
- COUNTY LINE
- RAILROAD

ZONING:

- AR-16
- AR-22
- Community commercial
- Convenience Commercial
- Heavy industrial
- Highway commercial
- LDR-15,000 SF lot
- Light industrial
- Office campus
- Parks/OS
- Parks/Wildlife refuge
- R-16
- R-22
- R-30
- R1-10
- R1-20
- R1-5
- R1-6
- R1-7.5
- Schools/Public facilities
- Town Center Core
- Town Center East Village
- Town Center West Village
- Water

FIGURE 1-4

City of Washougal

UGA Zoning Map

June 2012

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09-1046.406

G:\PDX_Projects\09\1046402 Model Update\CAD\GIS\FIGURES\09-1046-402-WA-FIGURE 1-4.mxd 06/20/12 11:09:42 AM HAS

Title 13 of the City's municipal code which governs the provision of drinking water and Title 3 which governs development charges and water rates are included as Appendix D of this plan.

Conditions of Service

Water Provider Responsibilities

The City is responsible for providing customers with a consistent, sufficient quantity of drinking water that meets State of Washington Department of Health quality standards while minimizing service disruptions during maintenance, repair or construction activity.

Water Customer Responsibilities

Water system customers agree to pay monthly water service charges and comply with City requests for water conservation or curtailment during emergencies. Customers agree to grant access to the City for inspection, maintenance and repair of water facilities and to select, install and test cross connection control devices in accordance with City standards.

Developer Responsibilities

Developers are responsible for installing required water system facilities and water main extensions within the public right-of-way and in accordance with the City of Washougal's development standards. City notification and review of proposed facilities are also required. Developers are responsible for paying system development charges and costs associated with extension of existing water mains if necessary to serve new development. Developers paying for a water main extension may be eligible to receive compensation under a latecomer agreement as described in the Service Area Policies section above.

Complaints

Water system customer complaints may be filed through the Citizen Referral form process at Washougal City Hall. Complaints regarding the water system are forwarded to water department staff members who then begin a work order to investigate and address the customer's concern. The City also accepts citizen comments and complaints through their website.

Summary

This section provided a description of the City of Washougal's existing water system and a general overview of the water system organization, service area, policies and standards. Further detailed information is presented in later sections of this Water System Plan.

SECTION 2

SECTION 2
PLANNING DATA

General

This section presents existing estimates and future projections of population and water demand for the City of Washougal's (City's) retail water service area. The water demand projections presented in this section are based on existing planning information regarding land use, population growth and historical water use characteristics. In subsequent sections, these projected water demands will be used to evaluate the capacity of existing water system facilities and identify system improvements needed to satisfy future water demand conditions.

Planning Period

The planning period for this Water System Plan is 20 years, through the year 2032. Six-year and 20-year population and water demand projections are presented for the City's retail and 20-year future service areas respectively. As discussed in Section 1, the 6-year retail water service area is the entire area within the current city limits and the 20-year future water service area is the City's entire Urban Growth Area (UGA).

Current Population and Service Connections

For the purposes of this plan, water production and demand data are taken from 2009 records. Although 2010 estimated population and recorded water production totals are shown in the following tables, 2010 totals are not used for estimating future water demands. The City experienced unusually low water demands during the summer of 2010 compared to those observed over the last eight to ten years in the City of Washougal. Given this substantial difference from average historical demands, forecasting future demand based on 2009 data is considered more prudent for planning purposes.

Due to significant delays in resolving water rights issues with the Washington State Department of Ecology, this plan and its recommendations are anticipated to be accepted by the State and implemented by the City of Washougal in 2012. Thus the Capital Improvement Program (CIP) developed in later sections of this plan is based on a 20-year planning period of 2012 to 2032. Given the limited amount of growth in the City's water service area in the last 3 years, water demand projections based on 2009 water use data are considered to be an accurate representation of current (2012) conditions for planning purposes.

Water demand projections are based on an approximate 2009 population of 14,095 residents served through 5,747 water system service connections. There are approximately 25 residential service connections outside of the existing water service area (city limits); however, these service connections are not active and the water mains serving this area have

been isolated from the distribution system with closed valves. A summary of the number and type of water service connections is shown in Table 2-1.

Table 2-1
Water Service Connection Summary

Service Type		Number of Services
Residential	Single Family	4,425
	Multi-Family	971
Recreational		138
Commercial, Industrial & Public		213
Total		**5,747**

Historical Population and Water Demand

The term "water demand" refers to all of the water requirements of the system including residential (domestic), commercial, public and industrial. Demands are discussed in terms of gallons per unit of time such as million gallons per day (mgd).

As discussed in Section 1, Washougal provides water to its customers from six active groundwater supply wells in two wellfields. Public Works staff record daily well production meter readings at all of the City's groundwater supply wells. Monthly and annual water production totals for all wells are summarized in Table 2-2.

Daily well production meter readings reflect daily consumption and are used to estimate historical average day (ADD) and maximum day (MDD) water demand trends. The City's available customer billing data was not used to determine consumption because historical consumption reports from the billing software provided inconsistent information and could not be clearly separated by service type. Corrections have been made to the operational procedures for the billing software and it is anticipated that future consumption reports will more accurately reflect customer water use.

Washougal's historical population estimates were extracted from the Washington State Office of Financial Management's (OFM) April 1, 2010 report. Table 2-3 summarizes Washougal's population, water production and estimated demands from 2001 through 2010.

Table 2-2
Well Production Summary

Water Production (million gallons)										
Month	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Jan	43.76	42.91	42.95	55.27	42.12	48.11	46.11	40.49	41.43	42.22
Feb	40.14	41.42	38.49	47.06	40.94	46.89	39.39	39.17	36.42	38.97
Mar	47.44	44.47	44.19	52.16	45.93	50.52	43.85	40.97	40.40	40.33
Apr	45.1	44.91	43.74	52.91	43.62	47.86	41.82	41.04	41.85	38.50
May	54.94	47.09	45.2	54.76	50.27	61.62	52.77	50.22	51.59	41.06
Jun	53.48	57.42	32.36	65.66	51.43	62.96	64.36	56.3	66.29	43.44
Jul	66.26	70.88	73.14	82.74	74.32	96.65	75.07	73.07	87.60	73.45
Aug	64.44	71.71	73.04	70.88	87.42	86.35	65.59	61.62	76.16	77.68
Sep	59.39	59.81	54.31	55.3	68.73	67.31	52.27	55.16	53.41	52.31
Oct	48.34	47.88	46.18	51.62	47.71	51.98	46.93	41.97	34.92	45.14
Nov	44.89	42.43	45.32	43.52	43.38	44.31	43.21	39.6	39.79	39.01
Dec	43.7	43.27	48.5	42.99	45.58	46.97	40	43.06	41.95	37.40
Total Production	**611.88**	**614.20**	**587.42**	**674.87**	**641.45**	**711.53**	**611.37**	**582.67**	**611.79**	**569.51**

Table 2-3
Historical Water Demand Summary

Year	Population	Total Annual Well Production, (MG)	Daily Demands (mgd)	
			Average Day (ADD)	Maximum Day (MDD)
2001	8,790	611.88	1.68	2.67
2002	9,100	614.20	1.68	3.04
2003	9,775	587.42	1.61	3.26
2004	10,770	674.87	1.85	3.67
2005	11,350	641.45	1.76	3.71
2006	12,270	711.53	1.95	5.10
2007	12,980	611.36	1.67	3.66
2008	13,480	582.67	1.60	3.00
2009	13,870	611.79	1.68	3.71
2010	14,095	569.51	1.56	3.03

Water Demand Projections and Equivalent Residential Units

Washougal's public water system serves predominantly single-family residential customers who generally have a consistent pattern of water use or demand. Water demands for multi-family residences, commercial and industrial users may vary significantly from service to service. When projecting future water demands based on population change, the water needs of non-residential and multi-family residential customers are represented by comparing their water use volume to the average single-family residential unit. The number of single-family residential units that could be served by the water demand of these other types of customers is referred to as a number of "equivalent residential units" (ERUs). ERUs differ from actual metered service connections in that they relate all water services to an equivalent number of representative single-family residential services based on typical annual consumption.

In order to establish average consumption for a single-family residential service connection, the total number of single-family residential service connections was compared to the total consumption by single-family residential customers. Based on an analysis of consumption data from 1999 to 2003, as documented in the City's *Water Demand Update Memo* (MSA, March 2009), it is estimated that 60 percent of the water produced was consumed by single-family residential service connections. The current average annual demand per ERU is 227 gallons per day (gpd) as summarized in Table 2-4. Maximum day demand per ERU is calculated similarly as 60 percent of the total MDD in 2009 divided by the number of single-family residential services, 503 gpd per ERU. The existing number of ERUs in the Washougal system is 7,384.

Table 2-4
ERU Calculation Summary

Number of Single-Family Residential Services (Annual average)	4,425
Average Day Demand per ERU	
2009 Well Production (as an analog for total consumption)	611,794,000 gallons/year
Total Average Daily Consumption (ADD)	1,676,148 gallons/day
Assumed Residential Average Daily Consumption (60% of total)	1,005,689 gallons/day
Average ERU Demand	**227 gallons/day**
Maximum Day Demand per ERU	
2009 Total Maximum Daily Consumption (MDD)	3,710,000 gallons/day
Assumed Residential Maximum Daily Consumption (60% of total)	2,226,000 gallons/day
Maximum ERU Demand	**503 gallons/day**

Forecast Population and Water Demand

Water demand forecasts for the six-year and 20-year planning horizons were developed using historical water demand trends, forecasted population and commercial/industrial growth within the City's UGA. Population and water demand forecasts are summarized in Table 2-5. As discussed above, demand projections are developed on an ERU basis assuming the following:

1. Population growth within the City's UGA is approximately three percent annually. This growth rate is based on a review of previous water system planning, City and County Comprehensive Plans and historical data.

2. Based on an analysis of consumption data from 1999 to 2003, 60 percent of the City's water demand is residential. Based on available land use and non-residential water use trends, future water use characteristics are not anticipated to change significantly.

3. Water demand growth from non-residential land uses is approximately one percent annually.

4. The total number of ERUs is based on a per ERU average daily water demand (ADD) of 227 gallons per day per ERU (gpd/ERU).

5. MDD is estimated at 503 gpd/ERU.

Water use efficiency measures are established in the November 2007 *City of Washougal Water Use Efficiency Goals* and discussed in Section 4 of this plan. These efficiency measures are anticipated to reduce annual water demand by 2 percent. Table 2-5 summarizes water demand forecasts with and without this water conservation savings.

Table 2-5
Water Demand Forecast Summary

Year	Population	Total ERUs	ADD (mgd)	MDD (mgd)	Annual Water Demand (mg)	
					Base	With Conservation
6-Year Projection (2018)	16,288	8,425	1.91	4.24	698	684
20-Year Projection (2032)	25,376	11,882	2.70	5.98	985	965

Water Demand by Pressure Zone

Each pressure zone in the Washougal water system is served by a combination of storage reservoirs, booster pump stations and pressure reducing valves (PRVs). The water system capacity analysis presented in Section 3 uses the criteria and methodology defined in the Washington State Department of Health's *Water System Design Manual* to evaluate water facilities based on the number of ERUs they serve.

The number of existing ERUs in each pressure zone is estimated based on the percentage of land within the Washougal water service area currently served by each pressure zone. Forecasted ERUs are estimated for each pressure zone based on the percentage of area within the 6-year and 20-year service areas that will ultimately be served by each zone. For the purpose of calculating ERUs all PRV-controlled sub-zones are included in the ERUs for the major zone, for example ERUs for properties in sub-zone 4-2 are included in the Pressure Zone 4 total. PRV controlled sub-zones are not considered independently because their boundaries and hydraulic grades may be changed significantly depending on the timing of adjacent development. The amount of developable land in each zone is determined based on Clark County Geographic Information Systems (GIS) tax lot data.

ERUs and maximum day water demand for each pressure zone are summarized in Table 2-6.

ERUs and Proposed Pressure Zones

As discussed previously, the City's water service area for 6-year projections is the area within the current city limits. The City's water service area for 20-year projections is the entire area within the current UGA. The 6-year and 20-year water service areas include land at elevations that cannot be served at the required service pressures (approximately 30 to 90 psi) by existing adjacent pressure zones. The water system analysis detailed in Section 3 identifies proposed future pressure zones to efficiently provide adequate service pressures within the city limits for the 6-year growth projection and throughout the City's UGA for the 20-year projection. Projected ERUs for each of these proposed pressure zones are incorporated into Table 2-6 below. The proposed zones are described in Section 3, Table 3-3 and illustrated on Plates 1, 2 and 3 in Appendix A.

Table 2-6
ERUs and MDD by Pressure Zone

Pressure Zone	Existing		6-Year (2018)		20-Year (2032)	
	Number of ERUs	MDD (mgd)	Number of ERUs	MDD (mgd)	Number of ERUs	MDD (mgd)
1	3,928	1.98	4,604	2.32	5,458	2.75
2	1,959	0.99	2,062	1.04	2,273	1.14
3	967	0.49	867	0.44	1,725	0.87
4	530	0.27	641	0.32	1,316	0.66
5	–	–	–	–	136	0.07
6	–	–	251	0.13	467	0.23
7	–	–	–	–	507	0.26

Summary

This section summarized population, historical well production and water demand estimates. Historical data was used to develop 6-year and 20-year population and water demand projections and establish ERUs and water demands for each pressure zone. Water demands developed in this section will be used in conjunction with capacity criteria presented in Section 3 to evaluate the water system's ability to meet current and future demands.

SECTION 3

SECTION 3
WATER SYSTEM ANALYSIS

General

This section presents an analysis of the City of Washougal's (City's) water source, distribution and treatment systems based on criteria outlined in the following paragraphs. The water demand forecasts summarized in Section 2 are used in conjunction with these criteria to assess water system characteristics including service pressures, storage and pumping capacity and emergency fire flow availability. This section concludes with a summary of water system deficiencies and recommended improvement projects.

Water Source Criteria and Analysis

Capacity

As described in Section 1, the City's water is supplied from six groundwater production wells located in two wellfields. The Hathaway Park (Upper) Wellfield located at 28th and I Streets and the Westside (Lower) Wellfield on 1st Street between the Burlington Northern Railroad and C Street on the Camas/Washougal border. The current total capacity of production Well Nos. 1, 5, 6, 7, 11 and 12 is approximately 5,600 gallons per minute (gpm) or 8.1 million gallons per day (mgd).

Well No. 9 at Hamlik Park is no longer in use due to water taste and odor concerns. Well No. 10 is on standby as an emergency supply source with an approximate capacity of 400 gpm, there is currently no pump installed in the well.

In accordance with Washington State Department of Health's *Water System Design Manual*, the City's groundwater supply wells should be capable of providing, with 18 hours of pumping, estimated maximum day demands (MDD) through the end of the 20-year planning period. With all wells, including standby Well No. 10, pumping concurrently for 18 hours, the City's existing groundwater wells are capable of delivering approximately 6.5 million gallons (MG). Based on water demand estimates presented in Section 2, the supply system has adequate capacity to meet maximum day demand of approximately 6.0 mgd in the year 2032.

Water Quality and Treatment

Chlorination

The City has gas chlorinators at the Westside Wellfield for five of its six active wells (Nos. 5, 6, 7, 11 and 12). The chlorinators are Wallace and Tiernan Model VT100 flow-proportioned units with manually adjusted dosage control. Chlorinators for Well Nos. 5, 6, 7 and 11 are located in the No. 11 well house. Each of the wells has a dedicated chlorinator

with a solenoid valve on the chlorinator vacuum line that is interconnected with the respective pump starter circuit. Well House No. 11 includes an isolated chlorination room with forced air draft. The chlorination room is also equipped with chlorine leak detection and alarm systems. Well Nos. 11 and 12 are independent units having their own injectors and jockey pumps. Well Nos. 5, 6 and 7 discharge to a common manifold where they are injected with chlorine from a common injector and jockey pump.

Well No. 1 at Hathaway Park has a bulk sodium hypochlorite feed system. The metering pump is interconnected with the well pump starter circuit.

pH Adjustment

Washougal adjusts the pH of the groundwater supply to minimize the potential for lead and copper corrosion in the distribution system. pH adjustment is achieved through the addition of liquid sodium hydroxide. The sodium hydroxide pumps for Well Nos. 5, 6, 7, 11 and 12 are located in a chemical feed and storage building between Well Nos. 5 and 11. Chemical storage and feed equipment are housed in a separate room at Well No. 1.

Distribution System Planning and Analysis Criteria

The water distribution system should be capable of operating within certain system performance limits, or guidelines, under several varying demand and operational conditions. The recommendations of this plan are based on the following performance guidelines, which have been developed through a review of state and city requirements and American Water Works Association (AWWA) acceptable practice guidelines.

The recommended analysis criteria are as follows:

1. The distribution system should be capable of providing the peak hour demand (PHD) while maintaining a minimum service pressure at any meter in the system of 30 pounds per square inch (psi). The system should meet this criterion with all equalization storage depleted.

2. The distribution system should be capable of providing the recommended fire flow to a given location while, at the same time, supplying MDD and maintaining a minimum residual service pressure at any meter in the system of 20 psi. Equalization and fire suppression storage in all reservoirs are assumed to be depleted during fire flow events.

Water Main Sizing

Washington Administrative Code pertaining to public water distribution systems requires a minimum pipe diameter of 6 inches. Typically, proposed or new water mains should be at least 8 inches in diameter in order to supply minimum fire flows. In special cases, 6-inch diameter mains may be adequate if no fire hydrant connection is required, there are limited

services on the main, the main is dead-ended and looping or future extension of the main is not anticipated. For areas serving existing or planned industrial, commercial and mixed use development, the minimum recommended pipe size is 12-inch diameter.

Fire Flow Recommendations

While the water distribution system provides water for domestic uses, it is also expected to provide water for fire suppression. The amount of water recommended for fire suppression is based on the size and duration of the anticipated fire which is typically associated with the building type or land use of a specific area within the distribution system. Fire flow recommendations are typically much greater in magnitude than the normal maximum day demand present in any local area. Adequate hydraulic capacity must be provided for these large fire flow demands.

Fire protection within the City's water service area is provided by the Washougal Fire Department inside the city limits and by East County Fire and Rescue for areas outside the city limits. The City of Washougal's building code complies with the State of Washington's adoption of the 2009 International Fire Code which defines fire flow requirements. Based on the International Fire Code and fire flow guidelines as developed by the AWWA; it is recommended that areas with a residential zoning designation provide a 1,500 gpm fire flow, areas with an office campus zoning designation provide a 2,500 gpm fire flow and areas with a commercial or industrial zoning designation provide a 3,500 gpm fire flow. Specific structures may require fire flows other than those identified for their zoning designation as determined by the Fire Marshall. These facilities include Washougal High School and Columbia Ridge Senior Living, the assisted living center on Woodburn Hill. Recommended fire flows and durations are summarized in Table 3-1.

Table 3-1
Summary of Recommended Fire Flows

Zoning Description or Facility	Recommended Fire Flow Rate (gpm)	Duration (hours)
Single Family Residential	1,500	2
Multi-Family Residential	1,500	2
Office Campus	2,500	2
Commercial or Industrial	3,500	3
Columbia Ridge Senior Living	2,000	2
Washougal High School	2,000	4

Pressure Zones and Service Pressures

Water distribution systems are typically separated into pressure zones, established by ground topography, to provide water service pressures within an acceptable range to all customers. Water from storage reservoirs will serve customers by gravity within a specified range of ground elevations to maintain acceptable minimum and maximum water pressures at individual service connections. When it is not feasible or practical to have a separate reservoir serving each pressure zone, pumping facilities or pressure reducing facilities are used to serve customers in pressure sub-zones from a single reservoir. Washougal's existing water service area is divided into four primary pressure zones based on overflow elevations of water storage reservoirs. An additional seven sub-zones are defined by outlet settings of pressure reducing facilities connecting the sub-zones to the primary zones.

90 psi is considered the desirable upper pressure limit for any pressure zone and 30 psi the lower limit as defined in the City's *Engineering Standards for Public Works Construction* included in Appendix E of this plan. Conformance to this pressure range may not always be possible or practical due to topographical relief, existing system configurations and economic considerations. In some areas system pressures of up to 125 psi are allowed, anticipating the need for individual pressure reducing valves (PRVs) to be installed at each service connection in order to satisfy maximum pressure requirements of the Uniform Plumbing Code. Table 3-2 summarizes the service pressure criteria used in the analysis of the water system.

Table 3-2
Recommended Service Pressure Criteria

Condition	Pressure (psi)
Minimum Service Pressure Under Fire Flow Conditions	20
Minimum Normal Service Pressure	30
Maximum Preferred Service Pressure	90
Maximum Service Pressure	125

Pressure Zone Analysis

Due to Washougal's rapidly rising topography north of the Washougal River as well as swift residential development to the north in the past decade the City's current pressure zone configuration includes several PRV-controlled sub-zones. These sub-zones and several PRVs at individual services are required to meet the service pressure criteria outlined above.

A PRV is used to reduce pressure from a higher elevation pressure zone, usually one served by gravity storage, to serve a lower elevation area at the service pressure range shown in Table 3-2. The PRV is essentially dissipating the energy of the stored water in the reservoir

serving the higher elevation pressure zone. In the Washougal water system, booster pump stations are used to deliver water to these storage reservoirs. Thus it is prudent to limit the use of PRVs where possible to avoid any unnecessary energy costs for pumping water to higher elevation storage reservoirs only to dissipate that energy through a PRV as water is delivered back to lower elevation customers. In steep water service areas like Washougal's the use of PRV-controlled sub-zones is generally more cost effective and requires less maintenance than providing booster pump stations or storage reservoirs to serve small groups of customers at similar elevations. In the long term some of these sub-zones may be combined with currently undeveloped adjacent properties into larger pressure zones that are more effectively served by their own storage reservoirs or booster pump stations rather than through PRVs from higher zones.

Future pressure zones and associated facilities will also need to be developed to serve customers within the City's future service area and above the maximum elevations served by existing pressure zones. Washougal's 20-year water service area, the entire area within the City's Urban Growth Area (UGA), includes properties at elevations up to 700 feet above mean sea level (msl). Pressure Zone 4, the City's highest elevation existing zone, can deliver water at the minimum service pressure of 30 psi to customers at an approximate maximum elevation of 605 feet above msl. Recommended pressure zone changes are summarized in Table 3-3 and illustrated on the proposed hydraulic profiles in Figures 3-1 and 3-2 at the end of this section.

Recommended Immediate (through 2018) Pressure Zone Changes

Proposed Pressure Zone 6

Based on the service pressure criteria outlined above, many existing customers and several large undeveloped parcels northwest of the Washougal River between N Shepherd Road and W Lookout Ridge Drive cannot be served effectively from adjacent Pressure Zone 1 or 3. Existing customers are served from Pressure Zone 3 through a combination of PRV-controlled sub-zones and PRVs at individual services. Mainline pressures in this area, particularly near Pump Station No. 3 on N 10th Court, exceed 150 psi and are as high as 200 psi. It is recommended that the City develop a mid-level Pressure Zone 6 northwest of the Washougal River between adjacent Zones 1 and 3. Pressure Zone 6 would serve customers between 160 and 300 feet above msl.

The proposed Pressure Zone 6 would be supplied by a proposed storage reservoir with an overflow elevation of approximately 400 feet above msl. This reservoir would be supplied from Pressure Zone 1 by a proposed booster pump station. Development of gravity storage and pumping facilities for Zone 6 in the immediate term (through 2018) will provide for system-wide water storage needs and facilitate future growth on the mid-hillside.

Existing pressure sub-zone 3-5 served by the Crown Pointe PRV will be eliminated as part of immediate Pressure Zone 6 development. Recommended immediate piping improvements for Pressure Zone 6 are minimized in order to distribute pipe construction costs over a longer

time period. Additional piping improvements are recommended for completion in the 6-year timeframe (2018 to 2022) to expand Pressure Zone 6 from the Camas city limits at Crown Road east to the Washougal River. It is further recommended that Pump Station No. 3 be relocated to the Reservoir 6 site as part of Pressure Zone 6 development. Relocating Pump Station No. 3 up the hillside adjacent to the proposed Reservoir 6 will significantly reduce pump station discharge pressures.

Recommended immediate improvements and proposed Pressure Zone 6 boundaries are illustrated on Plate 1 in Appendix A. Proposed pump station and reservoir locations shown meet necessary requirements for elevation and proximity to existing piping, however, final facility locations are to be determined as part of preliminary facility design.

Recommended Short Term (2018 to 2022) Pressure Zone Changes

With the addition of Pressure Zone 6 presented above, the majority of the 6-year future service area within the current city limits can be effectively served from adjacent pressure zones. Areas that cannot currently be supplied water at adequate service pressures due to their elevations include properties east of the Washougal River bordering Pressure Zone 4-3 east of 50th Street and north of S Street and properties north of Forest View Drive. Recommended short term pressure zone changes are discussed below, summarized in Table 3-3 and illustrated in Plate 2 in Appendix A.

Proposed Pressure Zone 4-4

Properties to the northeast of Pressure Zone 4-3 may be incorporated into a new PRV-controlled sub-zone 4-4. Pressure Zone 4-4 would have an approximate hydraulic grade line (HGL) of 550 feet above msl, serving customers at elevations between 340 and 460 feet above msl. The creation of Zone 4-4 would be achieved by extending a Pressure Zone 4 main east on W Street from 49th Street and installing a new PRV to serve Zone 4-4. A large portion of proposed Zone 4-4 falls within the Campen Creek riparian area and is unlikely to develop. Construction of Zone 4-4 facilities should be driven by development in this area. No distribution system improvements are recommended to serve this area in the short term.

Extension of Pressure Zone 4-2

Two large properties north of SE Lawton Road and west of SE Lehr Road are ultimately recommended to be incorporated into existing sub-zone 4-2. The properties are currently owned as common green space around a small creek by the Forest Glen and Forest View Homeowners Associations. It may not be cost effective to extend piping from the current Zone 4-2 east on Lawton Road and north of the Forest View development. Due to their current status as common green spaces and the presence of the creek running through both properties they are considered unlikely to develop and no distribution system improvements are recommended to serve this area in the short term.

Extension of Pressure Zone 6

Low elevation portions of developed Zone 3-3 south of W Lookout Ridge Drive and Zone 3-5 along N S Street experience excessive main line pressures. It is recommended that Pressure Zone 6 be extended west to serve currently undeveloped properties on either side of Lebrun Drive and low elevation portions of Zone 3-3. It is further recommended that Zone 6 be extended east to encompass all of existing Zone 3-4.

Recommended Long Term (2023 to 2032) Pressure Zone Changes

The 20-year future water service area is the entire area within the City's UGA. Two additional pressure zones, Zone 5 and 7 are recommended to serve areas within the UGA at higher elevations than those currently served by the City's water distribution system. It is recommended that these new pressure zones be supplied by storage and pumping facilities. An additional PRV-controlled sub-zone is also recommended between Woodburn Hill and the Washougal River.

Recommended long term improvements and proposed pressure zone boundaries are illustrated on Plate 3 in Appendix A. Proposed pump station and reservoir locations shown meet necessary requirements for elevation and proximity to existing piping, however, final facility locations are to be determined as part of preliminary facility design.

Proposed Pressure Zone 5

It is recommended that Pressure Zone 5 be created to serve customers northwest of the Washougal River from Woodburn Hill traveling west across the ridge top at approximately SE 30th Street. Due to the small size of the proposed zone and lack of suitable reservoir sites west of the river, Pressure Zone 5 is recommended to be served by a proposed constant pressure pump station without gravity storage.

Proposed Pressure Zone 7

It is recommended that Pressure Zone 7 be created to serve customers above the service elevation of existing Zone 4 in the northeast corner of the UGA between SE 20th and W Streets east of SE 347th Avenue. The proposed Pressure Zone 7 would be served by a proposed storage reservoir supplied from Zone 4 by a proposed booster pump station.

Proposed Pressure Zone 3-7

It is recommended that an additional PRV-controlled sub-zone 3-7 be created to accommodate anticipated customers within the UGA on the south and west slopes of Woodburn Hill west of the Washougal River.

Table 3-3
Existing and Proposed Pressure Zones

Pressure Zone	Existing and Immediate Improvements			6-Year (City Limits)			20-Year (UGA)			Facilities Currently Serving Zone	Facility Changes
	HGL (ft)	Approx Service Elev Range (ft)		HGL (ft)	Approx Service Elev Range (ft)		HGL (ft)	Approx Service Elev Range (ft)			
1	236	20	160	NO HGL OR SERVICE ELEV CHANGES						Reservoirs 1A and 1B	-
										All supply wells	-
										WHS, Evergreen and Lebrun 2 PRVs	At 6 years Lebrun 2 PRV will feed from Zone 6 (not Zone 3) to Zone 1 for fire flow emergencies only
2	362	140	300							Reservoir 2A and 2B	At 6 years construct third or replacement Reservoir 2C.
										Pump Station 1	-
										57th Street PRV	-
2-2	274	60	180							Sunset Ridge PRV	-
3	658	160	540	658	320	580	NO HGL OR SERVICE ELEV CHANGES			Reservoir 3	Raise minimum elevation of Zone 3, transistion low elevation customers to Zone 6. At 20 years construct second Reservoir 3
										Pump Station 3	Relocate Pump Station No. 3 to Reservoir 6 site, recommended in immediate term
3-2	537	340	450	NO HGL OR SERVICE ELEV CHANGES						Lookout Ridge 2 PRV	At 20 years install additional 23rd & 30th Circle PRVs in northwest corner of UGA between Zone 3 and upper end of Zone 3-2
3-3	495	120	400	505	230	410	NO HGL OR SERVICE ELEV CHANGES			Lebrun and Lookout Ridge 1 PRVs	At 6 years, connect Lebrun PRV piping to Zone 6 at Lebrun Dr and Lookout Ridge Dr, abandon connection to Zone 3-3. At 20 years, install Crown Rd PRV in northwest corner of the UGA between Zone 3-2 and upper end of Zone 3-3
3-4	353	140	280	ELIMINATE SUB-ZONE						N 10th Street and Columbia Ridge PRVs	Abandon N 10th Street PRV with relocation of Pump Station No. 3, recommended in immediate term. At 6 years eliminate Zone 3-4, split customers between Zones 1 and 6, adjust Columbia Ridge PRV setting to serve Zone 6.
3-5	ELIMINATE SUB-ZONE									Crown Pointe PRV	In the immediate term eliminate Zone 3-5, split between Zones 1 and 6, abandon Crown Pointe PRV
3-7	OUTSIDE EXISTING AND 6-YEAR SERVICE AREA						510	300	440		At 20 years, install Woodburn Rd and N T Street PRVs from Zone 3 to serve proposed Zone 3-7
4	677	380	600	NO HGL OR SERVICE ELEV CHANGES						Reservoir 4 and 4B	-
										Pump Station 4	-
4-2	532	300	440							Arborview PRV	At 20 years, install additional 330th PRV between Zone 4 and Zone 4-2 between existing city limits and the Washougal River
4-3	425	220	360							Summerslope and 49th Street PRVs	At 20 years, install second 57th Street PRV to serve Zone 4-3 from Zone 7, adjust existing PRV settings as needed
4-4	UNDEVELOPED						550	340	460		primarily riparian area, facilities to be determined when development occurs
5	OUTSIDE EXISTING AND 6-YEAR SERVICE AREA						730	580	640		At 20 years add constant pressure Pump Station No. 5 from Zone 3 to serve proposed Zone 5
6	400	160	300	NO HGL OR SERVICE ELEV CHANGES							Recommended in immediate term, construct Reservoir 6 and Pump Station No. 6 , eliminate Zone 3-5. At 6 years, expand Zone 6 by connecting Lebrun PRV to Zone 6 and adjust Columbia Ridge PRV to supply fire flow only to Zone 6, eliminate Zone 3-4.
7	OUTSIDE EXISTING AND 6-YEAR SERVICE AREA						800	600	700		At 20 years, construct Reservoir 7 and Pump Station No. 7 in northeast corner of UGA. Pump from Zone 4.

Note: Where a PRV-controlled sub-zone is served by multiple PRVs, the HGL is assumed to be the average of the small valve settings for all PRVs supplying the zone.

Storage Criteria and Analysis

Existing Reservoirs

The City of Washougal operates seven finished water storage reservoirs with a combined usable storage capacity of 4.88 million gallons (MG). All of the City's existing reservoirs are above-ground cylindrical steel tanks. Capacities, dimensions and materials of each reservoir as well as the pressure zone they serve are summarized in Table 3-4 below.

Table 3-4
Reservoir Summary

Reservoir Name	Usable Capacity (MG)	Reservoir Diameter (ft)	Reservoir Height (ft)	Floor Elevation (ft)	Overflow Elevation (ft)	Pressure Zone Served	Steel Reservoir Type	Year Built
1A	1.5	81.5	40	197	236	1	welded	1970
1B	1.0	75	35	202	236	1	welded	1991
2A	0.161	30	29	334	362	2	bolted	1991
2B	0.45	56	25	338	361.5	2	bolted	2005
3	0.423	50	28	621	648.1	3	bolted	2000
4	0.1	30	100.5	578	677	4	welded standpipe	2003
4B	1.25	96	29	654	677	4	welded	2011

Note: Reservoir 4 is a standpipe with a physical capacity of 0.531 MG but only 0.1 MG of this is capacity provides effective storage to Zone 4.

Reservoir Condition

Reservoirs 1A and 1B

Reservoirs 1A and 1B are both welded steel tanks with 1.5 MG and 1.0 MG capacities respectively. The reservoirs share a single site on Stiles Road between S and W Streets. The two tank exteriors were sandblasted and re-coated in 2000. This work also included a cleaning and touch-up of the interior coating of Reservoir 1B. Both reservoirs were inspected in 2006 and cleaned in 2007. Reservoirs 1A and 1B are filled through the distribution system by all of the City's production wells. An pressure transducer mounted on the common outlet for the reservoirs controls well operation based on reservoir level.

Reservoirs 2A and 2B

Reservoirs 2A and 2B are both bolted steel tanks with 0.16 MG and 0.45 MG capacities respectively. They share a single site on 37th Street north of W Street. The reservoirs were inspected in 2006. They are filled by Pump Station No. 1 which boosts water from

Reservoirs 1A and 1B at the Stiles Road site up to Pressure Zone 2. A transducer mounted on the inlet/outlet pipe of Reservoirs 2A and 2B monitors reservoir level and controls pump operation.

Reservoir 3

Reservoir 3 is a 0.423 MG bolted steel tank constructed on Woodburn Hill west of the Washougal River and north of the current city limits. The reservoir was inspected in 2006. Reservoir 3 is filled by Pump Station No. 3 located on N 10th Street north of Shepherd Road. A pressure transducer at Reservoir 3 controls the pump station operation. Due to the remote location of Woodburn Hill a solar panel and battery pack powers the transducer and telemetry equipment. According to City staff, on rare occasions the battery pack has failed resulting in overflow of Reservoir 3.

Reservoir 4 and 4B

Reservoir 4 is a 0.531 MG welded steel standpipe constructed in the northeast corner of the city limits off of Lehr Road. Although the physical capacity of Reservoir 4 is 0.531 MG, due to service elevations in Zone 4 only approximately 0.1 MG of the physical capacity is considered usable storage. Reservoir 4 is filled from Reservoirs 2A and 2B by Pump Station No. 4 located adjacent to Reservoirs 2A and 2B. The reservoir was inspected in 2009.

Reservoir 4B is a 1.25 MG welded steel reservoir constructed in 2011 to provide additional storage to high elevation areas of the City's UGA. The reservoir is located on SE 352nd Avenue north of SE 20th Street outside the northeast corner of the UGA.

Storage Capacity Analysis

Water storage facilities should be in place to provide gravity supply to each pressure zone except in special cases where direct pumping can be justified. Storage facilities are provided for four purposes: operational storage, equalization storage, standby or emergency storage and fire storage. The total storage required is the sum of these four elements. The Washington State Department of Health's *Water System Design Manual* provides the basis for determining the volume of each of the four storage elements. A brief discussion of each element is provided below.

Operational Storage

Operational storage is required to meet water system demands in excess of delivery capacity from the City's wells and booster pump stations to system reservoirs. This storage component limits pump cycling and promotes reservoir turnover. Water level sensors at each reservoir site control the operation, on or off, of pumps supplying the reservoir. The volume of water used between the pump "off" and pump "on" settings is the required operational storage volume. In the Washougal water system the "off" and "on" settings are adjusted seasonally to ensure adequate turnover in each storage reservoir. For example, sensors at

Reservoirs 1A and 1B allow a 6-foot average drop in reservoir water level before signaling the pumps to turn on, thus the required operational storage in Pressure Zone 1 is the volume of 6 feet of water in Reservoirs 1A and 1B. In Pressure Zone 4, operational storage volume is calculated based on the water level drop in Reservoir 4B alone. The operational storage volume contribution of the Reservoir 4A standpipe is negligible compared to Reservoir 4B. The average drop in reservoir water level for proposed Zone 6 and 7 reservoirs is assumed to be 6 feet. Operational storage volumes for each pressure zone are summarized in Table 3-5 below.

Table 3-5
Operational Storage Volume

Pressure Zone	Average Reservoir Drop (ft)	Operational Volume (MG)
1	6.0	0.43
2	4.0	0.09
3	4.0	0.06
4 (Res. 4B)	6.0	0.32
Future Reservoirs	6.0	Varies with Reservoir Dia.

Equalization Storage

Equalization storage is provided to supplement delivery capacity from the City's wells and booster pump stations in order to meet peak demands within a zone while maintaining a minimum service pressure of 30 psi throughout the distribution system. Required equalization storage volume is estimated as the PHD minus the capacity of all pumps serving the zone calculated over a 2.5 hour period. Equalization storage is only needed if the PHD exceeds the total capacity of all pumps serving the zone.

Standby (Emergency) Storage

Standby storage is intended to provide water during emergencies such as pipeline failures, equipment failures, power outages or natural disasters. The amount of standby storage for a water system can be highly variable depending upon an assessment of risk, the desired degree of system reliability and the number of available water sources. Required standby storage volume for each pressure zone is estimated as two times average day demand (ADD) with the largest water source out of service or 200 gallons per ERU, whichever is greater. For existing pressure zones 2, 3 and 4 as well as future pressure zones 6 and 7 the largest source of supply to the zone is a booster pump station. Although each booster pump station contains multiple pumps there are emergency situations, such as a break in the suction supply line to the pump station, which would take the entire station out of service. Thus, for the purpose of calculating recommended standby storage volume in zones 2, 3, 4, 6 and 7 it is

assumed that the whole booster pump station is out of service. In pressure zone 1, which contains all of the City's existing groundwater wells, there is still adequate supply to the zone with the highest capacity Well No. 12 out of service, thus a standby storage volume of 200 gallons per ERU is considered appropriate for this zone.

Fire Suppression Storage

Fire suppression storage should be provided to meet the single most severe fire flow demand within each zone. The fire storage volume is determined by multiplying the recommended fire flow rate by the expected duration of that flow as outlined in the International Fire Code. Fire flow recommendations were summarized in Table 3-1 above.

Total Recommended Storage Capacity

Recommended storage for each pressure zone is the sum of the operational, equalization, standby and fire suppression storage volume components. Storage requirements for each existing pressure zone under existing demands and proposed pressure zones under projected 6-year and 20-year demands are summarized in Table 3-6 below. As previously discussed, service areas for the existing and 6-year projected water demands include all properties within the current city limits. 20-year water demands are projected for all properties within the current Urban Growth Area. Immediate, short term and long term recommended pressure zone configurations are illustrated in Plates 1, 2 and 3 respectively in Appendix A.

Average Day Demand (ADD) = 227 gallons per day (gpd)/equivalent residential unit (ERU)
Maximum Day Demand (MDD) = 503 gpd/ERU
PHD is calculated according to *Water System Design Manual* guidelines.

Storage Capacity Deficiencies

Recommended storage capacities under existing and future conditions for each pressure zone are summarized in Table 3-6. New storage reservoirs are recommended to serve proposed Pressure Zone 6 in the immediate term, existing Zones 2 and 3 in the short term as well as proposed Zone 7 in the long term.

<u>Pressure Zone 2 Nested Storage</u>

Using the storage component analysis described above, existing Zone 2 storage reservoirs have insufficient capacity to meet calculated storage requirements under current and future conditions. Washington State Department of Health's *Water System Design Manual* allows water providers to consolidate or "nest" standby and fire suppression storage components to reduce overall storage volume requirements. Nesting storage components presents some additional risk should a fire and emergency occur at the same time. This risk is not of great concern in Pressure Zone 2 because, in addition to Reservoirs 2A and 2B, water can be delivered by gravity from Pressure Zone 4 storage through the 57th Street PRV. By reducing the volume of additional storage needed, nesting can reduce the cost for design and

construction of reservoirs and mitigate water quality issues associated with slow reservoir turnover in a pressure zone where a secondary gravity supply is available under fire suppression or emergency conditions. It is recommended that standby storage be nested inside fire suppression storage for Washougal's Pressure Zone 2.

Pressure Zone 3 Storage Capacity and Proposed Zone 5 Demands

Based on the storage criteria outlined above, there is a storage deficiency in Zone 3 under existing conditions. However, with the construction of the proposed Reservoir 6, existing Zone 3 customers will be transferred to the new Pressure Zone 6 thereby reducing demand and apparent storage deficiency in Zone 3. Any remaining immediate term deficiency in Zone 3 after the transfer of existing services to the proposed Zone 6 can be managed by nesting standby and fire storage as discussed for Zone 2 above and adjusting operational set points as discussed for Zone 4 below. Zone 3 storage capacity recommendations summarized in Table 3-6 do not include nested standby storage or operational set point adjustments. A new storage reservoir is proposed for existing Pressure Zone 3 in the short term to meet recommended storage needs at the 6-year and 20-year demand projections.

Proposed Pressure Zone 5 is recommended to be served by a constant pressure pump station without the benefit of gravity storage. This proposed Pump Station No. 5 will boost water from Zone 3 to meet Zone 5 demands. Thus, the Zone 3 recommended storage volume of 0.90 MG at the 20-year demand projection includes proposed Pressure Zone 5 demands.

Pressure Zone 4 Fire Suppression Storage and Operational Adjustments

The Pressure Zone 4 storage analysis indicates a storage deficiency at the 20-year demand projection. This storage deficit is entirely due to a threefold fire suppression storage increase between the 6-year and 20-year projections. The increase in required fire flow for Zone 4 is due to the potential development of commercially zoned land along SE Lawton Road outside the existing city limits but within the 20-year water service area (the City's UGA). Commercial fire flow requirements may vary widely depending on the type of commercial development. It is recommended that fire flow requirements for these commercially zoned properties in the future Zone 4 service area be evaluated in concert with their development to avoid construction of otherwise unnecessary storage facilities.

Should large commercial fire flow be required in Zone 4, a long term storage deficit may also be mitigated by adjusting the operational set points for the booster pump station serving Reservoir 4B in lieu of constructing additional Zone 4 storage. Currently, sensors at the reservoir allow a 6-foot average drop in reservoir water level before signaling the booster pumps to turn on; this is the required operational storage in Pressure Zone 4. The Reservoir 4B water level drop may be adjusted to 4 feet in order to reduce the operational storage volume needed thereby allowing sufficient storage volume to be dedicated to fire flow requirements. This operational adjustment may be made without impacting water service in Zone 4.

Table 3-6
Recommended Storage Capacity

		Number of ERUs	Pump/Well Capacity (gpm)		PHD (gpm)	Largest Fire Flow in Zone		Required Storage Volume (MG)				Storage Required in Zone (MG)	Existing Effective Storage (MG)	Storage Volume Needed (MG)
			Zone Total	Largest		Flow Rate (gpm)	Duration (hours)	Operational	Equalizing	Standby	Fire Suppression			
Pressure Zone 1	**Existing**	3,928	5,600	1,500	2,292	3,500	3	0.43	0.00	0.79	0.63	1.85	2.50	**0.00**
	6-Year	4,604	5,600	1,500	2,670	3,500	3	0.43	0.00	0.92	0.63	1.98	2.50	**0.00**
	20-Year	5,458	5,600	1,500	3,147	3,500	3	0.43	0.00	1.09	0.63	2.15	2.50	**0.00**
Pressure Zone 2[1]	**Existing**	1,959	2,680	1,000	1,191	2,000	4	0.10	0.00	0.41	0.48	0.99	0.611	**0.40**
	6-Year	2,062	2,680	1,000	1,249	2,000	4	0.10	0.00	0.46	0.48	1.03	0.611	**0.50**
	20-Year	2,273	2,680	1,000	1,367	2,000	4	0.10	0.00	0.55	0.48	1.13	0.611	**0.60**
Pressure Zone 3	**Existing**	967	1,050	350	637	2,000	2	0.06	0.00	0.44	0.24	0.74	0.423	**0.40**
	6-Year	867	2,680	350	581	2,000	2	0.06	0.00	0.39	0.24	0.69	0.423	**0.30**
	20-Year[2]	1,861	1,050	350	1,137	2,500	2	0.14	0.01	0.84	0.30	1.30	0.423	**0.90**
Pressure Zone 4	**Existing**	530	900	300	393	1,500	2	0.03	0.00	0.24	0.18	0.45	1.35	**0.00**
	6-Year	641	900	300	455	1,500	2	0.03	0.00	0.29	0.18	0.50	1.35	**0.00**
	20-Year	1,316	900	300	832	3,500	3	0.36	0.00	0.60	0.63	1.58	1.35	**0.30**
Pressure Zone 6	**6-Year**	251	800	400	237	1,500	2	0.13	0.00	0.11	0.18	0.42	0.00	**0.50**
	20-Year	467	800	400	358	1,500	2	0.13	0.00	0.21	0.18	0.52	0.00	**0.60**
Pressure Zone 7	**20-Year**	507	800	400	380	2,500	2	0.15	0.00	0.23	0.30	0.68	0.00	**0.70**

Note: 1. A portion of Pressure Zone 2 Standby storage volume is nested inside Fire suppression storage volume. 2. Pressure Zone 3 20-Year demands include proposed Zone 5.

Pump Station Criteria and Analysis

Existing Pump Stations

Two of the City's three pump stations, Pump Station Nos. 1 and 4, boost water from adjacent reservoirs 1A and 1B and 2A and 2B respectively up to higher elevation reservoirs. The third, Pump Station No. 3 boosts water from distribution mains in Pressure Zone 1 up to Reservoir 3.

Due to its relatively low elevation and high design head, Pump Station No. 3 discharge pressure is approximately 250 psi. A transmission line break at this excessive discharge pressure has the potential to cause damage to both public and private property. High discharge pressures from Pump Station No. 3 also create excessive service pressures at higher elevations between the pump station and Reservoir 3. These high pressures are currently controlled with individual PRVs at each service.

Pump Station Capacity Criteria and Analysis

Water System Design Manual guidelines define the City's existing pump station configurations, that is booster pump station's pumping to higher elevation reservoirs, as "open systems". According to these guidelines, open system pump stations should have sufficient capacity to meet the maximum day demand for the pressure zone that they serve with all pumps running. At firm capacity, each open system pump station should be capable of supplying average day demands for the zone. Firm pumping capacity is defined as a station's pumping capacity with the largest pump out of service.

Pump stations supplying storage reservoirs in one pressure zone that serve as the suction supply to a pump station in a higher pressure zone should be sized to accommodate the demand of both pressure zones. Sizing the lower elevation pump station to meet demands in both pressure zones prevents excessive reservoir drawdown during high demand periods or emergencies in the higher elevation zone. For example, in Washougal's system Pump Station No. 1 supplies Pressure Zone 2 Reservoirs 2A and 2B which are on the suction side of Pump Station No. 4. Thus, Pump Station No. 1 should be sized to meet water demands in both Pressure Zone 2 and 4 including all sub-zones. The same approach is used to size the proposed Pump Station No. 6 to meet demands in Zones 6 and 3. Proposed Pump Station No. 6 will supply proposed Reservoir 6 on the suction side of the relocated Pump Station No. 3.

All existing booster pump stations in the City's water system have sufficient capacity to meet these requirements through the 20-year planning period (to 2032). Proposed open system booster pump stations should be sized to meet the anticipated 20-year demand for the pressure zone they serve.

Proposed constant pressure Zone 5 would be served only by a pump station without the benefit of gravity storage, this is defined as a "closed system". According to *Water System*

Design Manual guidelines pump stations of this type should provide peak hourly demand for the zone with the largest pump out of service. Constant pressure pump stations must also be capable of meeting fire flow requirements for the zone. This may be accomplished by including a dedicated fire pump in the pump station design. Recommended pump station capacities are summarized in Table 3-7 below.

Table 3-7
Pump Station Capacity

	Pump Station No.	Full Capacity (gpm)	Firm Capacity (gpm)	Pressure Zone Served	Zone PHD (gpm)	Zone MDD (gpm)	Zone ADD (gpm)	Additional Capacity Needed (gpm)
Existing	1	3,000	2,000	2 and 4	1,585	870	392	**0**
	3	1,050	700	3	637	338	152	**0**
	4	900	600	4	393	185	84	**0**
6-Year (2018)	1	3,000	2,000	2 and 4	1,704	944	426	**0**
	3	1,050	700	3	581	303	137	**0**
	4	900	600	4	455	224	101	**0**
	6			6 and 3	818	391	176	**391**
20-Year (2032)	1	3,000	2,000	2, 4 and 7	2,579	1,431	646	**0**
	3	1,050	700	3 and 5	1,284	650	293	**0**
	4	900	600	4 and 7	1,212	637	287	**0**
	5			5	147	48	21	**147**
	6			6 and 3	1,494	766	346	**766**
	7			7	380	177	80	**177**

Recommended Water System Improvements and Capital Improvement Program

Based on the analysis presented in this section, the following water system improvements are recommended including proposed storage reservoirs, pump stations, pressure reducing facilities and distribution piping. A capital improvement program (CIP) is presented in Table 3-11 at the end of this section summarizing the recommended improvements, proposed project priorities and estimated project costs. It is recommended that the City's capital improvement program be funded at approximately $1.2 million annually for the next six years.

The CIP implementation schedule provides for project sequencing by showing prioritized immediate, short and long term recommendations. Immediate recommendations are those suggested to be completed in the next one to six years (2012 to 2018), short term in the next

seven to 10 years (2019 to 2022) and long term in the next 11 to 20 years (2023 to 2032). CIP project timeframes are intended to assist City staff in planning for capital expenditures. Many of these improvements are recommended based on anticipated future growth and should be constructed in accordance with demand for water service in order to maintain acceptable water rates and water quality.

Cost Estimating Data

An estimated project cost has been developed for each improvement project recommendation presented in the CIP. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The American Association of Cost Engineers (AACE) classifies cost estimates depending on project definition, end usage and other factors. The cost estimates presented here are considered Class 4 with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Itemized project cost estimate summaries are presented in Appendix F. This appendix also includes a cost data summary for recommended water main improvements developed on a unit cost basis. Estimated project costs include approximate construction costs and an allowance for administrative, engineering and other project related costs. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating; the current ENR CCI for Seattle, Washington is 9060 (January 2012).

Recommended Storage Improvements

Pressure Zone 6 Reservoir

Previous analyses conducted by the City of Washougal and observed operational conditions, such as rapid turnover during high water demand periods indicate a storage deficiency in Pressure Zone 3. In addition, many existing Zone 3 customers require individual PRVs to reduce excessive main line pressure to acceptable service pressure. Much of the Zone 3 storage deficiency and excessive main line pressure could be mitigated by transitioning Zone 3 mains and customers at lower elevations to a new mid-level Pressure Zone 6 served by a new storage reservoir. The reservoir should be sized to meet projected 20-year storage requirements for Pressure Zone 6 as presented in Table 3-6.

It is recommended that the City construct an approximately 0.6 MG Reservoir 6 with an overflow elevation of approximately 400 feet above msl in the immediate term (through 2018). It is further recommended that the City conduct a site alternatives analysis to select the most appropriate location for proposed Reservoir 6. Site alternatives analyses for proposed reservoirs recommended in this plan include an allowance for preliminary property acquisition.

Pressure Zone 2 Reservoir

It is recommended that an approximately 0.8 MG Pressure Zone 2 reservoir be constructed in the short term to mitigate existing storage deficiencies and meet projected 20-year storage requirements for the zone. To minimize property acquisition, transmission piping and reservoir maintenance costs, proposed Reservoir 2C is planned with sufficient capacity to replace the existing 0.161 MG Reservoir 2A. Proposed Reservoir 2C should have the same 362-foot overflow elevation as the existing Reservoir 2B to maintain the hydraulic grade of Zone 2.

Estimated project cost for Reservoir 2C reflects construction of the proposed reservoir at the same site as the existing Zone 2 reservoirs, demolition of the 0.161 MG Reservoir 2A and relocation of existing Pump Station No. 4 on the same site. Due to potential site constraints, it is recommended that the City conduct a site alternatives analysis prior to proceeding with reservoir design. Site alternatives analyses for proposed reservoirs recommended in this plan include an allowance for preliminary property acquisition.

Second Pressure Zone 3 Reservoir

A small existing storage deficiency in Zone 3 is expected to decrease in the short term with the development of mid-level Zone 6. Due to this anticipated demand decrease, no immediate storage improvements are recommended. As future development expands into the current UGA north and east of the Washougal River, the land area of Pressure Zone 3 is anticipated to nearly double. Much of this expansion area is currently zoned for office campus development which requires a slightly higher fire flow than the existing residential development in Zone 3.

It is recommended that a second approximately 0.9 MG Pressure Zone 3 reservoir, Reservoir 3B, be constructed in the short term to meet projected 6-year and 20-year storage requirements for the zone. Proposed Reservoir 3B should have the same 658-foot overflow elevation as the existing Reservoir 3 to maintain the hydraulic grade of Zone 3. The proposed reservoir is shown on Plate 2 in Appendix A at the same site as the existing Reservoir 3; however, due to site constraints, it is recommended that the City conduct a site alternatives analysis prior to proceeding with reservoir design. Site alternatives analyses for proposed reservoirs recommended in this plan include an allowance for preliminary property acquisition.

Pressure Zone 7 Reservoir

Future development in the northeast corner of the UGA above the elevations served by existing Pressure Zone 4 must be served by a new, higher hydraulic grade Pressure Zone 7. Due to the size of the proposed Zone 7, its higher fire flow requirement and office campus zoning, it is recommended that this area be served by gravity from a storage reservoir.

It is recommended that an approximately 0.7 MG Reservoir 7 with an approximate overflow elevation of 800 feet above msl be constructed in the long term to meet projected 20-year storage requirements for the zone.

Recommended Pumping Improvements

Pressure Zone 6 Pump Station

In order to establish the proposed mid-level Pressure Zone 6 between existing Zone 1 and 3 service elevations, a booster pump station is required to supply the proposed Reservoir 6. It is recommended that a Pump Station No. 6 with an approximate firm capacity of 400 gpm be constructed in the immediate term (through 2018) to boost water from existing Zone 1 distribution piping to Reservoir 6.

Pump Station No. 3 Relocation

In order to mitigate the risks associated with excessive discharge pressures at the existing Pump Station No. 3 site and maximize available suction supply; it is recommended that Pump Station No. 3 be relocated adjacent to the proposed Reservoir 6. The new Pump Station No. 3 is recommended for construction in the immediate term (through 2018) in concert with the proposed Reservoir 6 site development. Estimated project costs for the new pump station include decommissioning of the existing Pump Station No. 3. The existing Pump Station No. 3 capacity is adequate to meet projected demands through the 20-year planning horizon.

Pressure Zone 5 Pump Station

Proposed Pressure Zone 5 is recommended to be served by a constant pressure pump station without the benefit of gravity storage due to the small number of anticipated customers in the zone and the lack of suitably high-elevation reservoir sites west of the Washougal River. In order to serve customers in proposed Zone 5 it is recommended that Pump Station No. 5 be constructed in the long term, in accordance with adjacent development. It is recommended that Pump Station No. 5 have an approximate firm capacity of 150 gpm and include a fire pump to provide a minimum flow of 2,500 gpm.

Pressure Zone 7 Pump Station

In order to establish the proposed Pressure Zone 7 above Zone 4 service elevations in the northeast corner of the UGA, a booster pump station is required to supply the proposed Reservoir 7. It is recommended that a Pump Station No. 7 with an approximate firm capacity of 200 gpm be constructed in the long term to boost water from existing Reservoir 4B transmission piping to Reservoir 7.

Recommended Pressure Reducing Facilities

Immediate Term – Abandon Zone 3-5

As part of piping improvements and pump station construction related to the development of mid-level Pressure Zone 6 in the immediate term, it is recommended that the Crown Pointe PRV be abandoned.

Short Term – Existing PRV Modifications

In the short term (2019 to 2022) it is recommended that proposed Pressure Zone 6 be expanded to include all existing customers in the PRV-controlled sub-zone 3-4 and a large portion of Zone 3-3. As part of the Zone 6 expansion into Zone 3-3 it is recommended that the existing Lebrun PRV piping at Lebrun Drive and Lookout Ridge Drive be reconfigured to provide flow from the Zone 3 proposed W 1st Street main (P35 in Table 3-9) to the Zone 6 main on Lookout Ridge Drive. It is further recommended that the existing Columbia Ridge PRV setting be adjusted to only provide flow from Zone 3 to Zone 6 if required in an emergency. The N 10th Street PRV is recommended to be abandoned.

Long Term – Proposed PRVs to Serve UGA

In the long term (2023 to 2032) it is recommended that additional PRVs be established northwest of the Washougal River to provide water main looping for existing Zones 3-2 and 3-3 and proposed Zone 3-7 between Woodburn Hill and the Washougal River. It is further recommended that additional PRVs be installed east of the Washougal River and outside the existing city limits to provide looping in Zone 4-2 and to supply water from Pressure Zone 7 to Zone 4-3 in an emergency.

Recommended Distribution Piping Improvements

Immediate Improvements (through 2018)

<u>Pressure Zone 6 Transmission</u>

In order to develop recommended Pressure Zone 6 storage and pumping facilities, additional delivery capacity is required from the Pressure Zone 1 distribution system to proposed Pump Station No. 6 and from the pump station discharge to proposed Reservoir 6. A minor piping improvement is also needed to provide Pressure Zone 6 service to N 8th Street.

<u>Relocated Pump Station No. 3 Transmission</u>

Relocating existing Pump Station No. 3 in coordination with development of the proposed Reservoir 6 site will require some additional transmission piping from the new pump station discharge to a connection with existing Zone 3 transmission piping.

Piping Improvements for Fire Flow

Distribution system improvements under existing conditions are recommended to increase fire flow delivery capacity particularly at lower elevations in the City's Pressure Zone 1. Piping in these areas is much smaller in diameter and older than that in areas of new development north of the Washougal River. Piping improvements to meet existing fire flow requirements are recommended for completion in the immediate term (through 2018). These improvements are summarized in Table 3-8 below and illustrated on Plate 1 in Appendix A.

Table 3-8
Immediate Piping Improvements

CIP Priority	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Pressure Zone 6 Transmission						
P1	N 8th Street	Shepherd Road	N P Street	12	660	$ 125,400
P2	N R Street	N 8th Street	Proposed Pump Station No. 6	12	680	$ 129,200
P3	N 6th Street	Proposed Pump Station No. 6	N U Street	12	570	$ 108,300
P4	N V Street	N 7th Street	Proposed Reservoir 6	12	190	$ 36,100
P5	N T Street	N 7th Street	N 8th Street	12	460	$ 87,400
					Zone 6 Transmission Subtotal	$ 486,400
Relocated Pump Station 3 Transmission to Reservoir 6 Site						
P6		New Pump Station No. 3	Existing Zone 3 transmission	12	350	$ 66,500
Piping Improvements for Fire Flow						
P7	34th Street	Evergreen Way	G Street	8	1,290	$ 167,700
P8	K Street	32nd Street	34th Street	8	1,220	$ 158,600
P9	J Street	32nd Street	34th Street	8	1,200	$ 156,000
P10	I Street	32nd Street	34th Street	8	1,230	$ 159,900
P11	G Street	32nd Street	34th Street	8	1,220	$ 158,600

CIP Priority	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Immediate Piping Improvements for Fire Flow (continued)						
P12	32nd Street	G Street	K Street	8	1,340	$ 174,200
P13	Webster Lane	33rd Street	34th Street	8	300	$ 39,000
P14	33rd Street	Webster Lane	F Street	8	410	$ 53,300
P15	F Place	F Street	33rd Street	8	350	$ 45,500
P16	Addy Street	S 27th Street	Existing dead-end	8	490	$ 63,700
P17	9th Street	K Street	I Street	8	950	$ 123,500
P18	F Street	12th Street	14th Street	8	1,280	$ 166,400
P19	51st Street	49th Street	Existing dead-end	8	270	$ 35,100
P20	D Street	11th Street	12th Street	8	280	$ 36,400
P21	S A Street	8th Street	12th Street	8	1,520	$ 197,600
					Fire Flow Piping Improvements Subtotal	$ 1,735,500
					Immediate Piping Improvements Total	**$ 2,288,400**

Short Term (2019 to 2022)

Pressure Zone 6 Expansion

In order to provide adequate service pressures throughout the mid-hillside north and east of the Washougal River it is recommended that Pressure Zone 6 be expanded in three areas:

- West: south of Lookout Ridge Drive between Crown Road and Lebrun Road
- Central: south of Stonegate Drive between Lebrun Drive and N 6th Street
- East: south of N V Street from Reservoir 6 east across Columbia Ridge to the city limits

West Zone 6 recommended piping improvements include a 12-inch loop between W V Street and W Lookout Ridge Drive via Crown Road, a new connection to the Lookout Ridge 1 PRV from Zone 3 and an extension of W U Street piping east to Lebrun Drive.

Central Zone 6 is currently undeveloped. Recommended piping improvements include 8-inch and 12-inch diameter mains connecting Lebrun Drive piping east to N 3rd and N 6th Streets.

East Zone 6 recommended piping is primarily an extension of the N V Street 12-inch diameter transmission main from Reservoir 6 east and south to N T Street to connect with existing Zone 3 10-inch diameter transmission piping. A portion of the existing Zone 3 transmission piping connecting N T Street with Reservoir 3 is recommended to be abandoned. A small additional piping improvement is recommended on N 15th Court to ensure adequate fire flow as these mains are moved to lower-pressure Zone 1.

Recommended short term improvements are summarized in Table 3-9 and illustrated on Plate 2 in Appendix A.

Table 3-9
Short Term Piping Improvements

Priority	Location	From	To	Proposed Diameter	Length (LF)	Estimated Cost
West Pressure Zone 6 Expansion to Existing Zone 3-3						
P22	W V Street	W 9th Street	Crown Road	12	770	$ 146,300
P23	Crown Road	W Lookout Ridge Drive	W V Street	12	320	$ 60,800
P24	W U Street	Dead-end east	Lebrun Drive	12	740	$ 140,600
P25	W 1st Street	N X Street	W Lookout Ridge Drive	8	410	$ 53,300
					West Zone 6 Expansion Subtotal	$ 401,000
Central Pressure Zone 6 Expansion between Lebrun Road and N 6th Street						
P26	south main	Lebrun Drive	N Q Street dead-end	12	2,330	$ 442,700
P27	north main	south main	N 3rd Street	8	1,860	$ 241,800
					Central Zone 6 Expansion Subtotal	$ 684,500
East Pressure Zone 6 Expansion from Reservoir 6 to city limits						
P28	N V Street	Reservoir 6	N 12th Street	12	1,470	$ 279,300
P29	N 15th Court	N R Street	N 15th Court cul-de-sac	8	310	$ 40,300
					East Zone 6 Expansion Subtotal	$ 319,600
					Short Term Piping Improvements Total	**$ 1,405,100**

Long Term (2023 to 2032)

Pressure Zone 3 Expansion

Undeveloped areas northwest of the Washougal River are anticipated to be served primarily by Pressure Zone 3 and its PRV-controlled sub-zones. Recommended long term piping improvements in this area include large diameter mains intended to provide a distribution backbone to the northern portion of Pressure Zone 3 and smaller diameter distribution mains to provide looping in sub-zones 3-2, 3-3 and 3-7.

Pressure Zone 4-2 Expansion

In the long term, existing Pressure Zone 4-2 served from the Arborview PRV is recommended for expansion to serve customers northeast of Lawton Road between the city limits and UGA boundary. Some additional piping in Pressure Zone 4 and a new PRV are also recommended to provide looping for the expanded Zone 4-2.

Pressure Zone 5

In order to provide water service to future customers at high elevations north of the existing city limits and west of Woodburn Road it is recommended that a small constant-pressure Zone 5 be created. The proposed zone is long and narrow, intended to serve customers at the crest of Columbia and Lookout Ridges around SE 32nd Circle. Piping improvements recommended for this area are intended to supply both domestic water and fire protection without the benefit of looped water mains.

Pressure Zone 7

Large areas of undeveloped land in the northeast corner of the UGA sit at higher elevations than the City's water system is currently capable of supplying at adequate service pressures. These areas, designated as proposed Pressure Zone 7, are recommended to be served by proposed storage Reservoir 7 which would be supplied from Reservoir 4B by a proposed Pump Station No. 7. The majority of the proposed Zone 7 land is currently zoned for office campus use. Zone 7 recommended piping improvements are intended to provide a large diameter distribution backbone to accommodate future water demands for anticipated development in this area.

Fire Flow Improvements for Commercial Development

As described above and summarized in Table 3-1, for the purposes of this plan fire flow requirements are based on the current zoning of each property in Washougal's water service area. Some piping improvements recommended to meet fire flow requirements based on zoning are not necessary to meet the fire flow needs of the existing land use. For instance, there are several residential areas near the SR-14 Highway that are zoned for commercial development but are currently fully developed residential neighborhoods. The recommended

piping improvements will not be necessary to provide commercial fire flow until these properties are re-developed to a commercial use. Development driven piping improvements such as these are included in the long term recommended piping improvements in Table 3-10 and are distinguished by a dashed rather than a solid red line on the Long Term Recommended Water System Improvements map, Plate 3 in Appendix A.

Table 3-10
Long Term Piping Improvements

CIP Priority	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Pressure Zone 3 Expansion between City Limits and northern UGA boundary						
P30	South Main - W 2nd Street extension east of W Dogwood Street			12	5,020	$ 953,800
P31	Woodburn Road Loop (Woodburn Road - SE 30th Street - Reservoir 3)			12	3,410	$ 647,900
P32	Central Main - SE 28th Street extension west of SE 303rd Avenue			12	6,510	$ 1,236,900
P33	Central Main East Loop (SE 303rd Avenue - SE 23rd Street - SE 293rd Avenue - Central Main)			12	5,240	$ 995,600
P34	Central Main West Loop (SE 293rd Avenue - SE 23rd Street - W 6th Street northern extension - Central Main)			12	3,140	$ 596,600
P35	Central Main - Existing Distribution Loop (W 7th and W 8th Streets)			8	3,350	$ 435,500
					Zone 3 Expansion Subtotal	$ 4,866,300
Pressure Zone 3-2 Expansion between City Limits and northern UGA boundary						
P36	North-South Main (SE 23rd Street PRV - SE Crown Road - SE 282nd Court - SE Mckever Road - W 9th Street)			8	4,900	$ 637,000
P37	East-West Main (proposed 30th Circle PRV - Crown Road)			8	1,420	$ 184,600
Pressure Zone 3-3 Expansion north of City Limits						
P38	Proposed Crown Road PRV connection to existing distribution (SE Crown Road - SE Mckever Road - W 10th Street)			8	1,470	$ 191,100

CIP Priority	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Long Term Piping Improvements (continued) - Pressure Zone 3-7 Piping						
P39	Woodburn Road - N T Street Loop			8	3,930	$ 510,900
P40	SE 315th Avenue - SE Woodburn Road Double Loop			8	2,370	$ 308,100
Pressure Zone 4-2 Expansion north of City Limits						
P41	Eagle Woods Loop (SE 34th Street - SE 330th Court - SE Eagle Woods Drive - SE 328th Avenue - Y Street)			8	4,170	$ 542,100
Zone 5 Piping						
P42	Proposed Pump Station No. 5 suction from Zone 3 Central Main			12	450	$ 85,500
P43	SE 32nd Circle Loop			8	2,680	$ 348,400
P44	SE 32nd Circle - SE 293rd Avenue Loop			8	1,810	$ 235,300
P45	SE 32nd Circle extension west of SE 293rd Avenue			8	1,550	$ 201,500
P46	SE 30th Street extension east of SE 300th Avenue			8	1,650	$ 214,500
					Zone 5 Subtotal	$ 1,085,200
Pressure Zone 7 Piping						
P47	Reservoir 7 Transmission			12	2,100	$ 399,000
P48	Jennings Road to 357th Loop (SE 357th Avenue - SE 31st Way east extension - SE 347th Avenue - SE Jennings Road - SE 352nd Avenue)			12	10,160	$ 1,930,400
P49	Saint Clair Road Loop (SE 362nd Avenue - SE Saint Clair Road - W Street)			12	5,760	$ 1,094,400
P50	57th Street north extension (P Street - W Street - Saint Clair Loop)			12	2,920	$ 554,800
P51	Zone 4-3 P Street and 57th Street Fire Flow Improvements			8	720	$ 93,600
					Zone 7 Subtotal	$ 4,072,200

CIP Priority	Location	From	To	Diameter (inches)	Length (lf)	Estimated Project Cost
Long Term Piping Improvements (continued) - Future Fire Flow Improvements for Commercial Zoning						
P52	8th Street	C Street	B Street	8	270	$ 35,100
P53	A Street	SR 14 Hwy	14th Street	8	1,020	$ 132,600
P54	G Street	Evergreen Hwy	9th Street	8	1,250	$ 162,500
P55	G Street	9th Street		12	80	$ 15,200
P56	23rd Street	G street	E Street	8	610	$ 79,300
Future Fire Flow Improvements for Commercial Zoning Subtotal						$ 424,700
Long Term Piping Improvements Total						**$ 12,822,200**

Routine Pipe Replacement

The capital improvement program summarized in Table 3-11 includes $20,000 per year for the City's water service line replacement program.

Financial Evaluation and Plan

A long-term financial planning evaluation and strategy is required to support the recommended capital improvement program. Revenue generated from water rates and system connection fees is typically used to fund operating and maintenance costs, renewal and replacement costs of existing facilities and capital improvement projects. Adequate system development charges (SDCs) should be established to collect funds from new customers to pay for improvements that expand the capacity of the system without placing an undue burden on existing customers. It is recommended that approximately $50,000 be budgeted in the next six years to review and update the financial plan including the water rate and SDC analyses completed in 2010.

Planning Updates

The City should plan for future updates of this Water System Plan every six years as required by Washington State Department of Health planning guidelines. The Plan should be updated more frequently if significant changes occur in the water system.

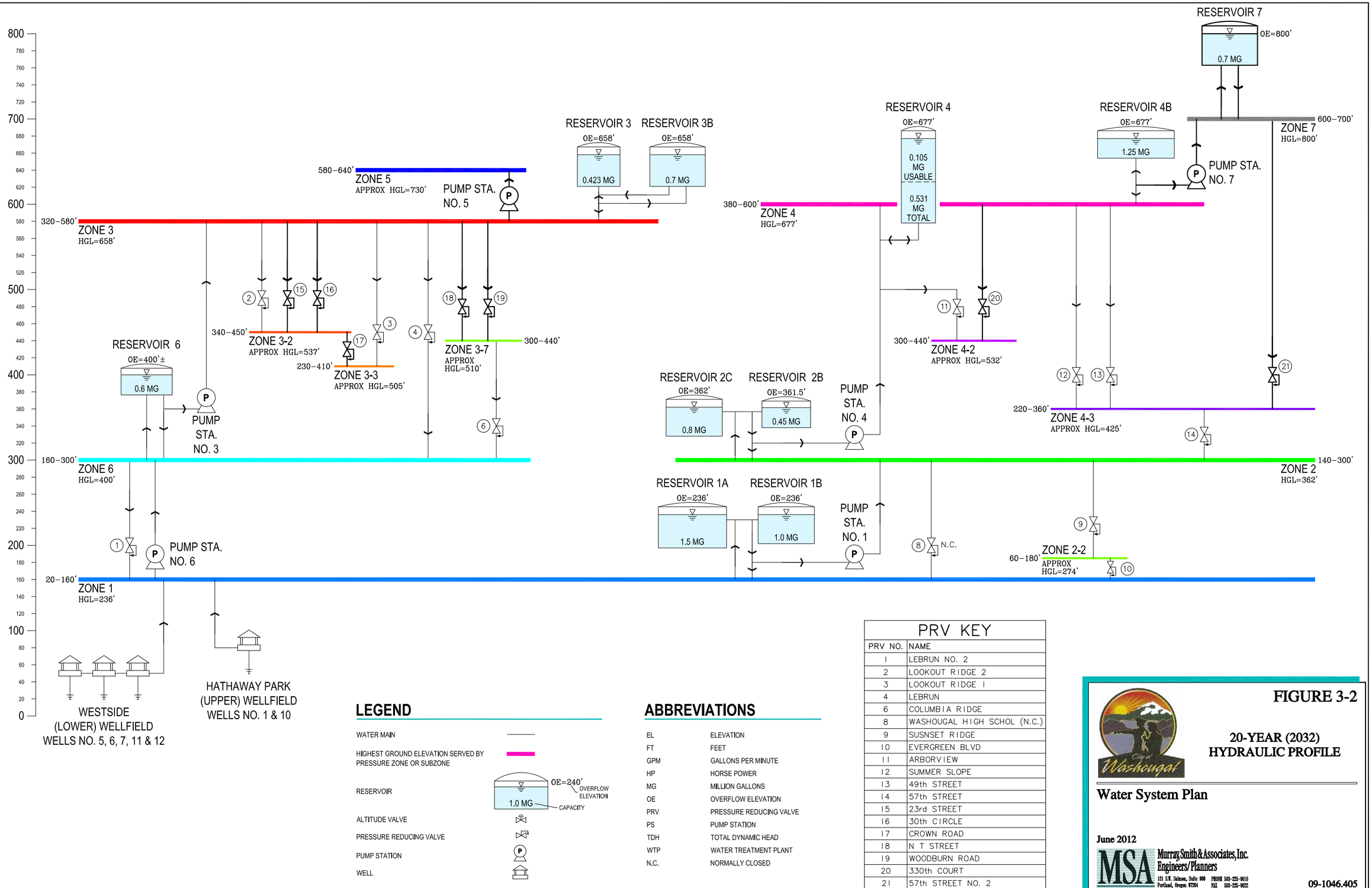
Summary

This section presents an analysis of Washougal's water source, distribution and treatment systems based on criteria outlined above. Based on this analysis, recommended improvements are identified for the City's storage reservoirs, pump stations and distribution system. The total estimated project cost of these improvements is approximately $31 million for the 20-year planning horizon. Of the improvements recommended in the 20-year planning horizon, approximately $13.3 million of these improvements are recommended in the next ten years. Approximately $1.2 million should be budgeted annually over the next six years for improvement projects. Recommended improvements are summarized in Table 3-11 and illustrated on Plates 1, 2 and 3 in Appendix A.

Table 3-11
Capital Improvement Program

Category	Project Name	Project Priority	Project Description	CIP Schedule and Project Cost Summary			Estimated Project Cost
				Immediate (2012 - 2018)	Short-Term (2019 - 2022)	Long-Term (2023 - 2032)	
Storage Facilities	Reservoir 6	R1	Reservoir to serve mid-level Pressure Zone 6 west of River	$ 2,100,000			$ 2,100,000
	Reservoir 3B	R2	Second reservoir at existing Reservoir 3 Woodburn Hill site		$ 2,115,000		$ 2,115,000
	Reservoir 7	R3	Reservoir to serve high elevations in northeast corner of UGA			$ 2,210,000	$ 2,210,000
	Reservoir 2C	R4	New reservoir at existing Reservoir 2A and 2B site		$ 2,540,000		$ 2,540,000
	Reservoir 6	R5	Site Alternatives Analysis for Proposed Reservoir 6	$ 300,000			$ 300,000
	Reservoir 2C	R6	Site Alternatives Analysis for Proposed Reservoir 2C	$ 300,000			$ 300,000
	Reservoir 3B	R7	Site Alternatives Analysis for Proposed Reservoir 3B	$ 300,000			$ 300,000
			Sub-Total	*$ 3,000,000*	*$ 4,655,000*	*$ 2,210,000*	*$ 9,865,000*
Pumping Facilities	Pump Station No. 6	PS1	Pump station to fill Reservoir 6 from Zone 1 and serve Zone 6	$ 760,000			$ 760,000
	Pump Station No. 3B	PS2	Replace existing Pump Station No. 3 with new station at Reservoir 6 site	$ 810,000			$ 810,000
	Pump Station No. 5	PS3	Constant pressure pump station to serve high elevations west of river from Zone 3 distribution			$ 800,000	$ 800,000
	Pump Station No. 7	PS4	Pump station to fill Reservoir 7 from Zone 4 and serve high elevation Zone 7			$ 760,000	$ 760,000
			Sub-Total	*$ 1,570,000*	*$ -*	*$ 1,560,000*	*$ 3,130,000*
Distribution System Piping		P1 - P5	Pressure Zone 6 Transmission	$ 486,400			$ 486,400
		P6	New Pump Station 3B Transmission	$ 66,500			$ 66,500
		P7 - P21	Fire Flow Improvements	$ 1,735,500			$ 1,735,500
		P22 - P25	Pressure Zone 6 west expansion to Existing Zone 3-3		$ 401,000		$ 401,000
		P26 - P27	Pressure Zone 6 central expansion between Lebrun Road and N 6th Street		$ 684,500		$ 684,500
		P28 - P29	Pressure Zone 6 east expansion from Reservoir 6 to Zone 3-4 and city limits		$ 319,600		$ 319,600
		P30 - P35	Pressure Zone 3 northern expansion between city limits and UGA			$ 4,866,300	$ 4,866,300
		P36 - P37	Pressure Zone 3-2 northwestern expansion between city limits and UGA			$ 821,600	$ 821,600
		P38	Pressure Zone 3-3 northwestern expansion between city limits and UGA			$ 191,100	$ 191,100
		P39 - P40	Pressure Zone 3-7 piping			$ 819,000	$ 819,000
		P41	Pressure Zone 4-2 expansion north of city limits			$ 542,100	$ 542,100
		P42 - P46	Pressure Zone 5 piping			$ 1,085,200	$ 1,085,200
		P47 - P51	Pressure Zone 7 piping			$ 4,072,200	$ 4,072,200
		P52 - P56	Fire Flow Improvements for Commercial Zoning (development driven)			$ 424,700	$ 424,700
	Pipe Replacement		Water Service Line Replacement Program	$ 120,000	$ 80,000		$ 200,000
	Pressure Reducing Facilities	Pressure Zone 3-2	SE 23rd Street PRV			$ 110,000	$ 110,000
			30th Circle PRV			$ 110,000	$ 110,000
		Pressure Zone 3-3	Crown Road PRV			$ 110,000	$ 110,000
		Pressure Zone 3-7	SE Woodburn Road PRV			$ 110,000	$ 110,000
			N T Street PRV			$ 110,000	$ 110,000
		Pressure Zone 4-2	SE 330th Court PRV			$ 110,000	$ 110,000
		Pressure Zone 4-3	Second 57th Street PRV			$ 110,000	$ 110,000
			Sub-Total	*$ 2,408,400*	*$ 1,485,100*	*$ 13,592,200*	*$ 17,485,700*
Other	Planning Studies		Water Rate and SDC Study	$ 50,000	$ 50,000	$ 100,000	$ 200,000
			Water System Plan		$ 100,000	$ 200,000	$ 300,000
			Sub-Total	*$ 50,000*	*$ 150,000*	*$ 300,000*	*$ 500,000*
Capital Improvement Plan (CIP) Total				***$ 7,028,400***	***$ 6,290,100***	***$ 17,662,200***	***$ 30,980,700***

$7,028,400 6 Year Total	$13,318,500 10 Year Total
$1,171,400 Annual Ave.	$1,331,850 Annual Ave.



LEGEND

- WATER MAIN
- HIGHEST GROUND ELEVATION SERVED BY PRESSURE ZONE OR SUBZONE
- RESERVOIR (OE=240', 1.0 MG; OVERFLOW ELEVATION; CAPACITY)
- ALTITUDE VALVE
- PRESSURE REDUCING VALVE
- PUMP STATION
- WELL

ABBREVIATIONS

EL	ELEVATION
FT	FEET
GPM	GALLONS PER MINUTE
HP	HORSE POWER
MG	MILLION GALLONS
OE	OVERFLOW ELEVATION
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
TDH	TOTAL DYNAMIC HEAD
WTP	WATER TREATMENT PLANT
N.C.	NORMALLY CLOSED

PRV KEY

PRV NO.	NAME
1	LEBRUN NO. 2
2	LOOKOUT RIDGE 2
3	LOOKOUT RIDGE 1
4	LEBRUN
6	COLUMBIA RIDGE
8	WASHOUGAL HIGH SCHOL (N.C.)
9	SUSNSET RIDGE
10	EVERGREEN BLVD
11	ARBORVIEW
12	SUMMER SLOPE
13	49th STREET
14	57th STREET
15	23rd STREET
16	30th CIRCLE
17	CROWN ROAD
18	N T STREET
19	WOODBURN ROAD
20	330th COURT
21	57th STREET NO. 2

FIGURE 3-2

20-YEAR (2032) HYDRAULIC PROFILE

Water System Plan

June 2012

Murray, Smith & Associates, Inc.
Engineers/Planners
121 S.W. Salmon, Suite 900 Portland, Oregon 97204
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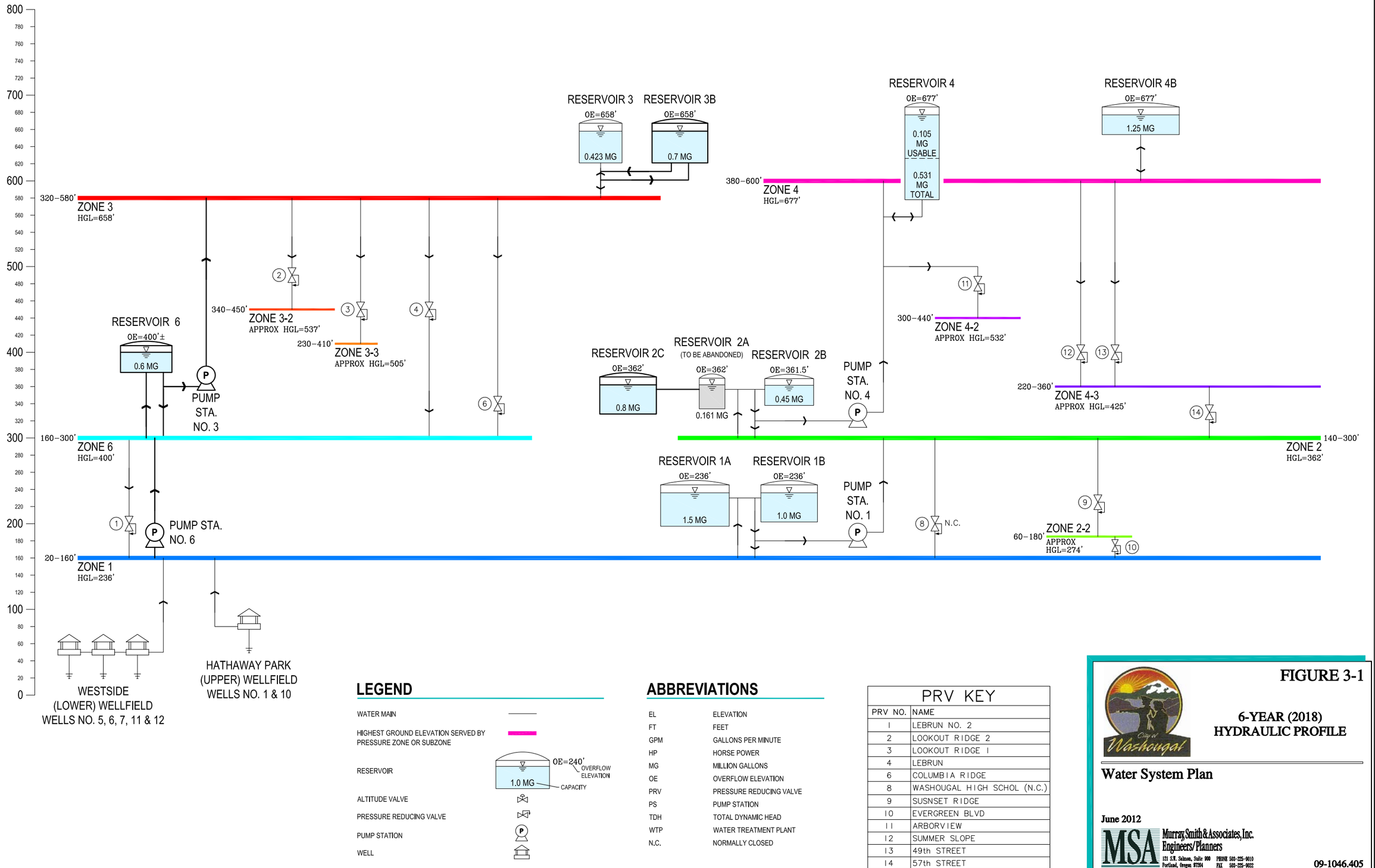
09-1046.405



LEGEND

- WATER MAIN
- HIGHEST GROUND ELEVATION SERVED BY PRESSURE ZONE OR SUBZONE
- RESERVOIR (OE=240' OVERFLOW ELEVATION; 1.0 MG CAPACITY)
- ALTITUDE VALVE
- PRESSURE REDUCING VALVE
- PUMP STATION
- WELL

ABBREVIATIONS

EL	ELEVATION
FT	FEET
GPM	GALLONS PER MINUTE
HP	HORSE POWER
MG	MILLION GALLONS
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PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
TDH	TOTAL DYNAMIC HEAD
WTP	WATER TREATMENT PLANT
N.C.	NORMALLY CLOSED

PRV KEY

PRV NO.	NAME
1	LEBRUN NO. 2
2	LOOKOUT RIDGE 2
3	LOOKOUT RIDGE 1
4	LEBRUN
6	COLUMBIA RIDGE
8	WASHOUGAL HIGH SCHOL (N.C.)
9	SUSNSET RIDGE
10	EVERGREEN BLVD
11	ARBORVIEW
12	SUMMER SLOPE
13	49th STREET
14	57th STREET

FIGURE 3-1

6-YEAR (2018) HYDRAULIC PROFILE

Water System Plan

June 2012

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SECTION 4

SECTION 4
WATER RESOURCE ANALYSIS AND WATER USE EFFICIENCY

Water Supply Analysis

Source Description

The City of Washougal (City) produces all of its drinking water from six groundwater wells in two well fields within the City Limits. Wells No. 5, 6, 7, 11 and 12 are located in the City's Westside (Lower) Wellfield, while Well No. 1 is located in the City's Hathaway Park (Upper) Wellfield. Well No. 10, also at the Hathaway Park Wellfield, is currently on standby as an emergency supply source, there is no pump installed in the well. The total production capacity of all active and standby wells is approximately 6,000 gallons per minute (gpm) or 8.6 million gallons per day (mgd). This capacity is adequate to meet existing and forecasted demands through the 20-year planning horizon. Washougal well capacities are summarized in Table 4-1 below. Existing well locations are illustrated on the Water System Maps in Appendix A.

Table 4-1
Existing Well Summary

Well No.	Wellfield	Approximate Capacity (gpm)
1	Hathaway	925
5	Westside	650
6	Westside	675
7	Westside	850
10 (Standby)	Hathaway	400
11	Westside	1,000
12	Westside	1,500

Aquifer Characteristics

All of the City's wells produce water from the shallow Pleistocene Alluvial Aquifer. The alluvial deposits that comprise this aquifer are approximately 100 feet thick in the vicinity of the City's Westside Wellfield. The aquifer is very permeable and serves as a source of supply to most of the industrial wells owned by Georgia Pacific and many of the municipal wells owned by the City of Camas. Depth to the water table ranges from 38 to 46 feet at the Westside Wellfield and 55 to 81 feet at the Hathaway Park Wellfield. Well capacities typically exceed 1,000 gpm and well specific capacities typically range between 250 and 500 gpm per foot. Groundwater in this aquifer generally flows in a southwesterly direction.

Water Rights

All of Washougal's water rights are for municipal supply purposes. All wells have a place of use corresponding with the Washougal Water Service Area as shown in Figure 1-3. There are no known time-of-use limitations on any of the City's water right certificates or claims. There is a limiting condition associated with one certificate that states "The total annual water allocation for the City of Washougal shall be limited to 3,786 acre-feet per year for municipal use from all rights." There are no known legal constraints which could limit the City's ability to utilize the full water right associated with this certificate.

The City recently obtained approval of two new water rights applications, G2-30564 and G2-30565. These two new permits, with a priority date of January 20, 2011 are non-additive water rights which supplement the City's existing water rights certificates and claims. The City's existing water rights include, Claims 000773, 000774, 000776, 000777, and certificates G2-25796 and G2-24581. The two new permits authorize:

- Withdrawal of 1,325 gpm (Qi) and 2,120 acre-feet per year (Qa) from the Upper Wellfield at Wells 1, 3 and 10.

- Withdrawal of 4,675 gpm (Qi) from the Lower Wellfield and 3,786 acre-feet per year (Qa) from all sources (including the Upper Wellfield)

Water Rights Self Assessments, Tables WR-1, WR-2 and WR-3 are included at the end of this section. A copy of the City's existing water rights claims, permits and certificates are included in Appendix J.

Based on water demands developed in Section 2 and as identified in the Table WR-3, the City's current water right allocation is adequate to satisfy 20-year demand projections.

Water Quality

Chemical tests performed on water samples from both wellfields reveal good water quality in terms of specific chemical and physical constituents. Critical elements are less than the maximum contamination levels (MCLs) mandated by federal and state regulations. However, the naturally low water pH results in the corrosion of copper pipes (service lines and customer piping) such that excessive levels of copper were recorded in past water sampling. A chemical treatment facility located at the Westside Wellfield provides for the addition of sodium hydroxide to increase pH, which has resulted in copper levels consistently below federal standards.

The *Wellhead Protection Assessment Report* prepared by Pacific Groundwater Group in March 2012 rated the aquifer as highly susceptible and highly vulnerable to potential contamination. The high susceptibility rating is based on the aquifer composition (permeable sand, gravel and cobbles) and lack of an extensive confining layer above the shallow water

table. Vulnerability is also considered high because of known and potential contaminant sources identified within the wellfield capture zone. The City's *Wellhead Protection Assessment Report* is included in Appendix G of this plan.

Well Operation and Drawdown

City staff have observed, under past recurrent drought conditions, that the Hathaway Park Wellfield Well No. 1 does not have sufficient suction head to operate on a 24-hour basis with dropping water tables in the aquifer during summer and early fall. During these times, the well pump must be operated on a manual basis with close observation of the well drawdown. The Westside Wellfield has not been as severely impacted by drawdown under drought conditions. The record low water table for the Westside Wellfield was recorded in the fall of 1994. Historical drops in the aquifer water level that were significant enough to limit well pump operation are attributed to drought conditions affecting an otherwise excellent aquifer with a history of high production and minimal pump drawdown effects.

Step-drawdown and constant-rate pumping tests were conducted by GSI Water Solutions, Inc. during the development of Well No. 12 at the Westside Wellfield. Additional wells were operated during the tests to reveal potential interference from the operation of multiple sources. Tests revealed minimal drawdown while pumping the 1,500 gpm Well No. 12 capacity.

Water Metering Program

Source and Intertie Meters

All City of Washougal well sources are currently metered. Recent source metering improvements include the replacement of Well No. 5, 6, and 7 positive displacement meters with magnetic flow meters in 2006. The new magnetic flow meters provide improved accuracy.

The City of Washougal has two emergency interties with the City of Camas. These interties are not metered as allowed by the Washington State Department of Health (DOH). The interties will operate only under emergency conditions.

Service Meters

All City water system customers are currently metered. Individual customer service meters are currently inspected during each reading. In the event the meter appears damaged or unusual readings are recorded, the meter is scheduled for replacement. Nearly 85 percent of customer meters are less than 10 years old. In addition, all meters 3-inch and larger are flow tested on an annual basis to ensure accuracy.

Water Use Efficiency (WUE) Program

Background

The Washington State Legislature passed the Municipal Water Law in 2003 to address the increasing demand on the state's water resources. This law requires all municipal water suppliers to enact measures to ensure the efficient use of this critical resource in exchange for water right certainty and flexibility to meet future demands. The Washington State DOH has established water use efficiency (WUE) requirements for all municipal suppliers in conjunction with the Municipal Water Law.

Washougal's current WUE program was adopted in 2008, satisfying the January 2008 WUE goal-setting deadline in accordance with Washington Administrative Code (WAC) 246-290-810 and the DOH *Water Use Efficiency Guidebook*. The development of WUE goals, including the evaluation and implementation of water use efficiency measures, is outlined in the following discussion. The November 2007 document, *City of Washougal Water Use Efficiency Goals* (Wallis Engineering, 2007) was used to prepare this section.

The DOH water use efficiency rules have the following key elements:

- *Water Use Efficiency Planning* – including collection of water production and consumption data, forecast of future water demands, evaluation of system leakage, evaluation of water rate structures and the implementation of water use efficiency measures.

- *Water Use Efficiency Goal-Setting and Performance Reporting* – Municipal water suppliers are required to set water use efficiency goals through a public process and report annually on their performance to customers and DOH.

- *Distribution System Leakage Standard* – Municipal water suppliers are required to satisfy a distribution system leakage standard equal to less than 10 percent of total production.

Adopted Goals

The City has established a WUE goal to reduce residential peak day demand by 5 percent over a 6-year period between 2007 and 2013. This goal was proposed by Public Works Staff and approved by the City Council through a public process in January 2008.

WUE Measures

The inefficient use of water, particularly during the summer months, results in excessive consumption during peak demand periods. DOH requires municipal water suppliers to adopt specific mandatory water use efficiency measures that contribute to the achievement of adopted WUE goals. Based on the number of service connections in the Washougal water

system, the City is required to implement a minimum of six WUE measures. The adopted WUE measures and their estimated costs are described below and summarized in Table 4-2.

1. *Customer Education Flyers*- water conservation educational flyers are included with the annual consumer confidence report (CCR) to educate customers regarding indoor and outdoor water conservation, irrigation efficiency, etc.

2. *Conservation Rate Structure*- Cost neutral, additional revenue anticipated with the increasing block rate structure is conservatively expected to be negated by reduced consumption. This measure's implementation has been delayed for further assessment over concerns that industrial customers may be inclined to re-locate outside of the City. Rate structures are discussed in more detail in Section 5 Financial Program.

3. *Indoor Water Conservation Kits*- indoor water conservation kits distributed during public events and by customer request. Kits include low flow showerheads, faucet aerators, water heater temperature gauges, faucet drip gauges and toilet leak tablets.

4. *Outdoor Water Conservation Kits*- outdoor water conservation kits distributed during public events and by customer request. Kits include a low flow garden hose spray nozzle, rain/sprinkler gauge, soil moisture gauge and hose repair kit.

5. *Water Bill with Consumption History*- the City's utility billing software provides customers with a history of past consumption on bimonthly billing statements. Historical consumption information encourages customers to conserve water and establishes benchmarks from which to track individual conservation efforts.

6. *Public Outreach at Community Events*- the City's public outreach program includes display boards and interactive promotions focused on water conservation. Public outreach presentations have been limited in recent years.

Table 4-2
Water Use Efficiency Measures

WUE Measure	Description	Cost Estimate ($ annually)	Estimated Water Savings
1	CCR Customer Education Flyers	$ 500	2% reduction in peak day consumption
2	Conservation Rate Structure	$ -	Seasonal 2% reduction in peak day consumption
3	Indoor Water Conservation Kits	$ 5,000	1,125,000 gallons per year (gpy)
4	Outdoor Water Conservation Kits	$ 5,000	Seasonal 2% reduction in peak day consumption
5	Water Bill with Consumption History	$ -	1% reduction in annual and peak day consumption
6	Public Outreach at Community Events	$ 1,000	Used as a means to spread information about other conservation measures

Water conservation kits have been discontinued due to financial constraints. It is recommended that the reassess funding for this program annually.

Program Evaluation

The WUE rule requires annual performance reporting to system customers and DOH. The City prepares an annual performance report as an opportunity to review the effectiveness of adopted WUE measures and determines if established goals require revision or if new goals and/or conservation measures need to be implemented. The annual effectiveness evaluation and DOH report includes the following elements:

- Calculation of distribution system leakage in terms of volume and percent of total production.
- Identification of WUE goals.
- Evaluation of established WUE goals, including estimating water savings achieved through implemented measures and progress towards satisfying goals.

The City distributes the performance report to customers in conjunction with the annual Consumer Confidence Report on or before July 1st. In addition, the report is available at City Hall, the Public Works office and on the City's website. Washougal's 2011 WUE performance report is included as Appendix I.

Consumer Education Program

The City's current consumer conservation education program incorporates the following elements:

- *CCR Conservation Flyers* –Water conservation education flyers are included with the annual consumer confidence report.

- *Water Bill Consumption History* – Water consumption history is provided on individual customer bills.

- *Water Conservation Signs* – Conservation signs are posted at 17th and E Street and 32nd and Addy Street during the peak use summer months.

Distribution System Leakage (DSL)

The DSL standard is a significant element of the WUE requirements. It requires that all water systems track authorized consumption, that is, the volume of water authorized for use by the water provider. All water that cannot be tracked is considered distribution system leakage. DSL includes both apparent losses such as water theft or meter inaccuracies and real losses such as leaking water mains or reservoir overflows. The WUE requirements mandate that water systems maintain distribution system leakage at 10 percent or less of total production based on a three year running average.

The primary method for tracking authorized consumption is through the installation of meters on all customer services. Additional authorized uses that may not be metered, but are estimated and recorded, include hydrant use for fire fighting and water distribution system flushing. As previously discussed, all customer services and well production sources are currently metered. Well production meter readings are recorded daily. Customer service meters are read every other month. The two interties with the City of Camas are not currently metered, but are only activated in an emergency.

City water production and consumption data is collected in accordance with WUE guidelines. A review of historical consumption and production meter data indicates distribution system leakage in the range of 6 to 10 percent.

Table 4-3
Water Consumption, Production and Distribution System Leakage Summary

Year	Total Production (MG)	Total Consumption (MG)	DSL
2009	611.8	574.9	6.0%
2010	537.3	499.2	7.6%
2011	589.5	549.0	6.9%

Reclaimed Water Opportunities

The previous WUE Program included a detailed examination of the potential for reclaiming wastewater treatment plant (WWTP) effluent, documented in the memorandum *WWTP Effluent Evaluation* (Wallis Engineering, 2004). The evaluation included the WWTP effluent and a review of the following as potential sources for beneficial water reuse:

- Park, school and open space lands
- Port industrial area
- Steigerwald Wildlife Refuge
- Orchard Hills Golf Course/School Irrigation

The reclaimed water evaluation made the following conclusions, as taken from the 2004 technical memorandum.

1. Additional investigation into the need for water reclamation to satisfy future wastewater treatment plant NPDES permit requirements is not warranted at this time. It is not anticipated that the City will face effluent discharge restrictions on the Columbia River which would require the examination of water reclamation as an option to meet stringent pollutant loading limits.

2. The construction of new water reclamation facilities to produce a Class A reuse quality water to offset existing industrial potable water use and delay the development of new groundwater sources is not cost effective at this time. The estimated cost to produce a Class A effluent of approximately 0.5 MGD is nearly $1.7 million dollars. Estimates to develop a new 1.0 MGD groundwater source is approximately $1.2 million dollars (*2004 Water System Master Plan*).

3. The future siting of an industry with the need for a large quantity of Class C or D non-potable water would warrant additional consideration. Development of a Class C or D resource may be cost effective compared to the equivalent development of potable water sources.

4. The Orchard Hills Golf Course, schools and cemetery provide an excellent opportunity for effluent reuse which eliminates the need for the golf course well and the use of potable water for school and cemetery irrigation. These irrigation demands, however, currently have a minimal impact on the potable water system and the seasonal nature of the demand would provide for only seasonal effluent reuse. In addition, a significant investment in transmission infrastructure would be required.

Recommendation

Per the 2004 technical memorandum, the preliminary evaluation of beneficial reuse opportunities in the City of Washougal does not support a more detailed evaluation at this time. While reuse opportunities may exist, the cost of permitting and construction of necessary treatment facilities are cost prohibitive.

Summary

The City of Washougal holds sufficient water rights and maintains wells with adequate capacity to satisfy 20-year demand projections as presented in Section 2. All water system customers are metered and the City has an active water use efficiency (WUE) program that focuses on reducing peak water use. Estimated distribution system leakage is below the 10 percent threshold mandated by WUE requirements.

SECTION 5
WATER SYSTEM FINANCIAL PLAN

Introduction

The objective of a water system financial plan is to identify the total cost of providing water service, as well as provide a financial program that allows the water utility to remain financially viable during execution of its 6-year (2012-2018) and 20-year (2012-2032) Capital Improvement Program (CIP). This viability analysis considers the historical financial condition of the utility, the sufficiency of utility revenues to meet current and future financial and policy obligations, and the financial impact of executing the CIP. Furthermore, the financial plan provides a review of the utility's current rate structure with respect to rate adequacy, equity, promotion of water conservation, and customer affordability.

Past Financial Performance

This section includes a historical summary of financial performance as reported by the City of Washougal (City) on the Fund Resources and Uses Arising from Cash Transactions statements. The City has operated on a cash basis since 2009 and no longer tracks accruals, depreciation, assets or liabilities. Separate summaries are provided for the years 2005 through 2008 accrual-based statements, and 2009 through 2010 cash-based statements. The City reports a combined water and sewer financial statement, so evaluation of historical financial performance will reflect the combined performance of water and sewer.

Table 5-1a
Statement of Revenues, Expenses, and Change in Fund Net Assets / Net Assets

Statement of Revenues, Expenses, and Changes in Fund Net Assets // Net Assets	2005 Water Sewer	2006 Water Sewer	2007 Water Sewer	2008 Water Sewer
OPERATING REVENUES	$ 5,208,389	$ 4,884,308	$ 5,850,741	$ 4,527,387
Charges for services	948	13,452	1,244	6,959
Miscellaneous	5,209,337	4,897,760	5,851,985	4,534,346
TOTAL OPERATING REVENUES				
OPERATING EXPENSES				
Salaries and wages	538,302	686,162	707,268	775,181
Personnel benefits	206,854	258,434	291,148	357,577
Supplies and contractual services	448,431	394,849	324,248	204,133
Professional services	560,934	1,113,646	1,002,424	868,268
Insurance	30,064	31,633	35,920	30,986
Utilities	164,424	187,766	181,079	183,152
Taxes	419,816	522,645	730,087	615,211
Miscellaneous	7,490	25,395	28,017	77,669
Repairs and maintenance	73,949	105,757	128,712	213,513
Interfund services	466,960	987,445	1,218,726	1,082,375
Depreciation	970,597	1,168,692	1,862,543	2,324,238
TOTAL OPERATING EXPENSES	3,887,821	5,482,424	6,510,172	6,732,303
OPERATING INCOME (LOSS)	1,321,516	(584,664)	(658,187)	(2,197,957)
NON-OPERATING REVENUES				
Interest earnings	124,149	192,268	64,073	45,431
Tax revenue	-	-	-	-
Other Non-Operating Revenues (expenses)	-	25,310	49,690	7,601
Interest and fiscal charges	(337,089)	(366,310)	(319,578)	(291,134)
TOTAL NON-OPERATING REVENUES (EXPENSES)	(212,940)	(148,732)	(205,815)	(238,102)
INCOME (LOSS) BEFORE TRANSFERS AND CONTRIBUTIONS	1,108,576	(733,396)	(864,002)	(2,436,059)
Capital contributions	1,887,700	5,544,747	4,337,247	673,934
Transfers - (out)	(14,326)	(14,326)	(236,968)	-
CHANGE IN NET ASSETS	2,981,950	4,797,025	3,236,277	(1,762,125)
NET ASSETS BEGINNING OF YEAR	18,065,675	21,047,625	24,843,317	28,079,594
NET ASSETS END OF YEAR	$ 21,047,625	$ 25,844,650	$ 28,079,594	$ 26,317,469

Table 5-1b
Statement of Net Assets

STATEMENT OF NET ASSETS	2005 Water Sewer	2006 Water Sewer	2007 Water Sewer	2008 Water Sewer
ASSETS				
Current assets:				
Cash and cash equivalents	$ 4,042,114	$ 2,282,283	$ 1,948,244	$ 2,124,092
Receivables (net):				
Taxes/assessments	18,149	10,109	6,352	6,004
Accounts	373,208	447,032	503,274	347,534
Interfund loan receivable	1,358	839	2,675	2,675
Due from other govt units	-	25,310	75,000	11,350
Inventory	49,289	94,542	151,198	232,569
Total current assets	4,484,118	2,860,115	2,686,743	2,724,224
Long-term assets:				
Property, plant equipment (net)	24,630,211	30,587,698	33,580,832	34,490,676
Deferred charges	123,272	114,726	106,179	97,633
Total long-term charges	24,753,483	30,702,424	33,687,011	34,588,309
TOTAL ASSETS	29,237,601	33,562,539	36,373,754	37,312,533
LIABILITIES				
Current liabilities				
Interfund loan payable	$ -	$ -	$ -	$ 500,000
Accrued employee benefits	6,540	5,306	4,430	4,091
Retainage payable	-	-	-	35,818
G.O. bonds payable - current	59,344	62,750	66,340	70,141
Revenue bonds payable - current	330,000	370,000	420,000	440,000
Other debt payable - current	53,851	64,714	120,625	371,570
Total current liabilities	449,735	502,770	611,395	1,421,620
Long-term liabilities				
G.O. bonds payable - long-term	663,367	600,623	534,283	464,142
Revenue bonds payable - long-term (net)	5,888,500	5,543,112	5,147,722	4,732,333
Other debt payable - long-term	1,129,509	1,023,633	1,965,317	4,340,139
Other long-term liabilities	58,865	47,751	35,443	36,830
Total noncurrent liabilities	7,740,241	7,215,119	7,682,765	9,573,444
TOTAL LIABILITIES	8,189,976	7,717,889	8,294,160	10,995,064
NET ASSETS				
Invested in capital assets, net of related debt	16,505,640	22,922,866	25,432,724	24,072,351
Unrestricted	4,541,985	2,921,784	2,646,870	2,245,118
TOTAL NET ASSETS	$ 21,047,625	$ 25,844,650	$ 28,079,594	$ 26,317,469

Table 5-1c
Fund Resources and Uses Arising from Cash Transactions

Fund Resources and Uses Arising from Cash Transactions	2009 Water Sewer	2010 Water Sewer
BEGINNING CASH AND INVESTMENTS	2,124,092	
308.1 Reserved	-	-
308.8 Unreserved	-	1,777,694
Prior Period Adjustments (388.80 and 588.80)	-	
REVENUES AND OTHER SOURCES		
310 Taxes	-	-
320 Licenses and Permits	-	-
330 Intergovernmental	2,067,500	-
340 Charges for Goods and Services	4,269,080	4,916,935
350 Fines and Forfeits	-	-
360 Miscellaneous	25,660	26,789
390 Other Financing Sources	751,774	1,242,962
TOTAL REVENUES AND OTHER FINANCING SOURCES	7,114,014	6,186,686
TOTAL RESOURCES	9,238,106	7,964,380
OPERATING EXPENDITURES		
510 General Government	557,032	448,290
520 Security of Persons and Property	20,732	18,451
530 Physical Environment	2,869,774	2,798,780
540 Transportation	-	-
550 Economic Environment	-	-
560 Mental and Physical Health	-	-
570 Cultural and Recreational	-	-
TOTAL OPERATING EXPENDITURES	3,447,538	3,265,522
591-93 Debt Service	280,048	259,430
594-95 Capital Outlay	2,050,752	110,248
TOTAL EXPENDITURES	5,778,338	3,635,200
597-99 Other Financing Uses	751,774	1,242,962
TOTAL EXPENDITURES AND OTHER FINANCING USES	6,530,112	4,878,162
Excess (Deficit) of Resources Over Uses	2,707,994	3,086,218
380 Non-Revenues (except 384)	1,400	-
580 Non-Expenditures (except 584)	931,700	1,036,420
ENDING CASH AND INVESTMENTS	1,777,694	
508.1 Reserved		2,049,798
508.8 Unreserved		

The City's revenues increased in 2010 consistent with the adopted 14.5% rate increase to both water and sewer rates.

The City realized a reduction in all operating expenditure line items in 2010.

Declining revenue and increasing expenditures resulted in significant operating losses realized in years 2005 through 2008.

Current Financial Structure

This section summarizes the current financial structure of the water utility, which is used as the baseline for the capital financing strategy and financial forecast developed for this financial plan.

Funds

The City maintains the combined Water and Sewer Operating Fund 401, the Water and Sewer Capital Fund 406, as well as debt repayment reserves. In order to evaluate the sufficiency of water rates, an allocation was made between the Water and Sewer utilities to determine the funds available for water utility costs.

Financial Policies

Minimum Fund Balance

Operating reserves are designed to provide a liquidity cushion to ensure that adequate cash working capital will be maintained to deal with significant cash balance fluctuations, such as seasonal fluctuations in billings and receipts, unanticipated cash expenses or lower than expected revenue collections.

A capital contingency reserve is an amount of cash set aside in case of an emergency should a piece of equipment or a portion of the utility's infrastructure fail unexpectedly. Additionally, the reserve could be used for other unanticipated capital needs, including capital project cost overruns.

In order to ensure sufficient cash management levels in each of the funds, separate minimum policies for each fund are used in this analysis. The financial plan incorporates a minimum balance target of 60 days of operations and maintenance (O&M) in the Operating Fund. Based on the $1.7 million in operating expenses identified in 2012, the minimum operating reserve level is $280,000.

A minimum balance equal to 1% of system assets is targeted for the minimum Capital Reserve (406). Based on $25 million in assets and $2.4 million of CIP in 2012, the minimum Capital Reserve is $275,000 in 2012. In order to avoid additional bond issuance, the reserve is managed to 50% of this target by the end of the 2012-2018 forecast.

System Reinvestment

The purpose of system reinvestment funding is to provide for the replacement of aging system facilities to ensure sustainability of the system for ongoing operation. Each year, the utility's assets lose value, and as they lose value they move toward eventual replacement. This accumulating loss in value and future liability is typically measured for reporting purposes through an annual depreciation expense, which is based on the original cost of the asset over its anticipated useful life. While this expense reflects the consumption of the

existing asset and its original investment, the replacement of that asset will likely cost much more when factoring in inflation and construction conditions. Therefore, the added annual replacement liability is even greater than the annual depreciation expense.

The City operates on a cash basis and does not track accruals or asset balances and depreciation. The City does maintain asset records that allow a reasonable estimate of depreciation expense for the purpose of calculating an appropriate level of annual system reinvestment funding.

This analysis incorporates a policy of annual system reinvestment funding equal to the annual depreciation expense (estimated) less the annual debt principal repayment. This policy is planned for phase-in at 25% in 2013, and increased annually to the fully funded level in 2016.

Debt Management

The City has two revenue bonds, one G.O. Bond, one Public Works Trust Fund (PWTF) loan and one interfund loan. Annual debt repayment makes up 25% of the water revenue need in 2013.

The water portion of the City's outstanding debt principal - $8.5 million - makes up 33% of the estimated total $25 million in water assets. The industry benchmark is to maintain debt at no greater than 60% of equity assets.

Available Funding Assistance and Financing

Feasible long-term capital funding strategies must be defined to ensure adequate resources are available to fund the CIP. In addition to the utility's resources, such as accumulated cash reserves and rate funded capital and connection charges, capital needs can be met from outside sources such as grants, low interest loans and bond financing.

Utility Resources

Utility resources appropriate for funding capital needs include accumulated cash above the operating reserve threshold; rate revenues designated for capital spending purposes; and capital related revenues, such as System Development Charges (SDCs) and other connection fees.

System Development Charge

A System Development Charge (SDC), also called a connection charge as provided for in RCW 35.92.025, refers to a one-time charge imposed on new customers as a condition of connecting to the utility system. The purpose of the SDC is two-fold: 1) to promote equity between new and existing customers; and 2) to provide a source of revenue to fund capital projects. SDCs provide a way for new customers to share in the capital costs incurred to support their addition to the system. SDC revenues provide a source of cash flow that is used

to support utility capital needs; however, the SDC revenue can only be used to fund utility capital projects or pay debt service incurred to finance capital projects. In the absence of an SDC, growth-related capital costs would be borne in large part by existing customers. In addition, the net investment in the utility already collected from existing customers, whether through rates, charges and/or assessments, would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments. To establish equity, an SDC should recover a proportionate share of the existing and future infrastructure costs from a new customer. From a financial perspective, a new customer should become financially equivalent to an existing customer by paying the SDC.

The City currently imposes an SDC of $2,930 per equivalent residential unit (ERU) to all new water customers. Based on current system investment, projected infrastructure needs identified in the 20-year CIP, and system capacity, an updated charge of $4,244 per ERU is calculated for 2012. The updated schedule of charges is based on the recommended method of charging the SDC based on meter size. The updated SDC calculation and schedule of charges are as follows.

Table 5-2a
SDC Calculation

Existing Cost Basis			**Notes**
PLANT-IN-SERVICE			
Utility Capital Assets		$ 25,133,098	Original cost of plant-in-service as of 2011
less: Contributions-In-Aid of Construction		(4,543,759)	Water's allocated portion of contributed assets
plus: Interest on Non-Contributed Plant		9,571,922	Interest on assets up to a maximum 10-year period
Existing Cash Balances	$ 925,397		Ending cash balances (allocated to Water) for year 2011
less: Debt Principal Outstanding	(8,482,296)		Principal outstanding on existing debt for plant-in-service
less: Net Debt Principal Outstanding		(7,556,899)	Debt principal outstanding, net of cash reserves
TOTAL EXISTING COST BASIS		**$ 22,604,361**	

Future Cost Basis		**Notes**
CAPITAL IMPROVEMENT PLAN		
Total Future Projects	$ 30,980,700	Total projects identified in CIP (2012 - 2032)
less: Identified Repair & Replacement Projects	(3,159,852)	R&R projects are not eligible for SDC
less: Contributed Future Upgrade & Expansion Assets	-	Not eligible for recovery through SDC
TOTAL FUTURE COST BASIS	**$ 27,820,848**	

Customer Base	**ERU**	**Notes**
Existing Equivalent Residential Units	7,384	Existing equivalent residential units as of 2012
Future Equivalent Residential Units (Incremental)	4,498	Incremental growth in ERUs
TOTAL CUSTOMER BASE	**11,882**	**Projected 2032 ERU Capacity**

Resulting Charge	**Total**	**Notes**
Existing Cost Basis	$ 22,604,361	
Future Cost Basis	27,820,848	
Total Cost Basis	$ 50,425,209	
Total Customer Base	11,882	
TOTAL CHARGE PER EQUIVALENT RESIDENTIAL UNIT	**$ 4,244**	**Updated SDC per ERU**
EXISTING CHARGE	*$ 2,930*	

Table 5-2b
SDC Schedule of Charges per Meter Size

Existing Water SDCs	
Customer Group	**Charge**
Zone 1 Low Level	$ 2,930
Zone 2 Intermediate	3,370
Multiple dwellings:	
2 units	$ 4,395
3 units	6,595
4 units	8,790
More than 4 (per unit)	2,038
Service Stations	$ 6,350
Public buildings/offices, churches	6,350
Small business / offices	4,760
Restaurants and taverns, laundromats	9,525
Industrial	12,700

Proposed Water SDCs	
Meter Size	**Calculated Charge**
5/8" or 3/4"	$ 4,244
1"	$ 10,610
1 1/2"	$ 21,219
2"	$ 33,951
3"	$ 63,657
4"	$ 106,096
6"	$ 212,192
8"	$ 339,507

Local Facilities Charge

While an SDC is the manner in which new customers pay their share of general facilities costs, local facilities funding is used to pay the costs of local facilities that connect each property to the system's infrastructure. Local facilities funding is often overlooked in a rate forecast since it is funded upfront by either connecting customers and developers or through an assessment to properties, but typically not from rates. Although these funding mechanisms do not provide a capital revenue source toward funding CIP costs, the discussion of these charges is included because they impact the new system customers.

There are a number of mechanisms that can be considered toward funding local facilities. One of the following scenarios typically occurs: a) the utility charges a connection fee based on the cost of the local facilities (under the same authority as the SDC); b) a developer funds the extension of the system to their development and turns those facilities over to the utility (contributed capital); or c) a local assessment is set up called a Utility Local Improvement District (ULID/LID) that collects property assessments from benefited properties.

A Local Facilities Charge (LFC) is a variation of the connection charge authorized by RCW 35.92.025. It is a City-imposed charge to recover the cost related to extending service to local properties. Often called and applied as a front-footage charge imposed based on the length of water main footage "fronting" a particular property, it is usually implemented as a reimbursement mechanism to a utility for the cost of a local facility that directly serves a property. It is a form of connection charge and, as such, can accumulate up to ten years of interest. LFCs typically apply to instances where no developer-installed facilities are needed through developer extension due to the prior existence of available mains already serving the developing property.

A Developer Extension is a requirement that a developer install onsite and sometimes offsite improvements as a condition of extending service. These are in addition to the SDC required and must be built to utility standards. Utilities are authorized to enter into developer extension agreements under RCW 35.91.020. Part of the developer extension agreement between a utility and developer might include a latecomer agreement, resulting in a latecomer charge to new connections to the developer extension.

Latecomer Charges are a variation of developer extensions whereby a new customer connecting to a developer-installed improvement makes a payment to a utility based on their share of the developer's cost (RCW 35.91.020). The utility passes this payment to the developer who installed the facilities. This is part of the developer extension process, and defines the allocation of costs and records latecomer obligations on the title of affected properties. No interest is allowed, and the reimbursement agreement cannot exceed 15 years in duration.

A LID/ULID is another mechanism for funding infrastructure that assesses benefited properties based on the special benefit received by the construction of specific facilities (RCW 35.43.042). Most often used for local facilities, some ULIDs also recover related general facilities costs. Substantial legal and procedural requirements can make this a relatively expensive process, and there are mechanisms by which a ULID can be rejected by a majority of property ownership within the assessment district boundary.

Outside Sources

Government Programs

Grants and low cost loans for Washington State utilities are available from the Departments of Ecology and Community Trade and Economic Development. Each includes programs for which the City might be eligible, but are primarily targeted at sewer programs or low income and/or rural communities.

Washington State Department of Ecology

The Department of Ecology (Ecology) Water Quality Program administers three major funding programs that provide low interest loans, grants or loans and grant combinations for projects that protect, preserve and enhance water quality in Washington State. These are primarily for wastewater projects and are not applicable to the City's water CIP. Further detail is available in the Funding Guidelines found at http://www.ecy.wa.gov/programs/wq/funding/funding.html.

Washington State Department of Commerce

The Department of Commerce has four grant and loan programs that the City could potentially be eligible for:

- Community Development Block Grants General Purpose Grant;
- Community Economic Revitalization Board Grant and Loan Program;
- Public Works Trust Fund Loan Program; and
- Drinking Water State Revolving Fund Loan Program.

Community Development Block Grants (CDBG) General Purpose Grants

CDBGs are made available to Washington State small cities, towns and counties in carrying out significant community and economic development projects that principally benefit low and moderate income persons. Eligible applicants are Washington State cities and towns with a population less than 50,000 and counties with a population less than 200,000 that are non-entitlement jurisdictions or are not participants in a HUD Urban County Entitlement Consortium. Eligible projects include public facilities for water, wastewater, storm sewer and streets. The application period is September through November annually.

Community Economic Revitalization Board (CERB)

CERB, a division of the Washington State Department of Commerce, primarily offers low cost loans; grants are made available only to the extent that a loan is not reasonably possible. The CERB targets public facility funding for economically disadvantaged communities, specifically for job creation and retention. Priority criteria include the unemployment rates, number of jobs created and/or retained, wage rates, projected private investment, and estimated state and local revenues generated by the project. Traditional construction projects are offered at a maximum dollar limit of $1 million per project. A local match of 25 percent is targeted.

Eligible applicants include cities, towns, port districts, special purpose districts, federally recognized Indian tribes and municipal corporations.

The CERB's policy is that all loans will be secured by a general obligation pledge of the taxing power of the borrowing entity. Terms do not exceed 20 years, including available payment deferral of interest and principal for up to 5 years. Interest rates match the most current rate of Washington State bonds (not to exceed 10 percent). Application deadlines are 45 days prior to a CERB meeting, which are scheduled 6 times per year. For more information, see www.choosewashington.com/SiteCollectionDocuments/CERB/CERB Fact Sheet.pdf

Public Works Trust Fund (PWTF)

Cities, towns, counties and special purpose districts are eligible to receive loans from the Public Works Board, a division of the Washington State Department of Commerce. Water, sewer, storm, roads, bridges and solid waste/recycling infrastructure projects are eligible, as well as projects for some non-traditional systems that were added in the 2012 funding update.

The 2014 funding cycle makes available up to $400 million, with $15 million available per jurisdiction. The standard loan offer is for 1% interest over 20 years of repayment, though terms can vary by repayment term and can be reduced to recognize distressed financial status. Among revisions to the program in 2012 is the elimination of the required local funds match.

For more information, see: http://www.pwb.wa.gov/

Drinking Water State Revolving Loan Program (DWSRL)

The DWSRL is jointly administered by the Public Works Board and the Department of Health. The program is intended to improve drinking water systems and protect public health for publicly and privately owned systems.

There is no match required, terms are not to exceed 20 years and project completion time is 36 months after loan execution. The loan limit is $3 million, with a loan fee of 1 percent, and interest rates range from 0 to 1.5 percent depending upon the number of households at or below the county's median income. Applications are accepted annually in May.

For more information, see: http://www.doh.wa.gov/ehp/dw/our_main_pages/dwsrf.htm

Bond Financing

General Obligation Bonds

General obligation (GO) bonds are secured by the full faith and credit of the issuing agency, committing all available tax and revenue resources to debt repayment. With this high level of commitment, GO bonds have relatively low interest rates and few financial restrictions. However, the authority to issue GO bonds is restricted in terms of the amount and use of the funds, as defined by the Washington State Constitution and statute. Specifically, the amount of debt that can be issued is linked to assessed valuation.

RCW 39.36.020 states:

(ii) Counties, cities, and towns are limited to an indebtedness amount not exceeding one and one-half percent of the value of the taxable property in such counties, cities, or towns without the assent of three-fifths of the voters therein voting at an election held for that purpose.

(b) In cases requiring such assent counties, cities, towns, and public hospital districts are limited to a total indebtedness of two and one-half percent of the value of the taxable property therein.

While bonding capacity can limit availability of GO bonds for utility purposes, these can sometimes play a valuable role in project financing. A rate savings may be realized through two avenues: 1) the lower interest rate and related bond costs; and 2) the extension of repayment obligation to all tax-paying properties (not just developed properties) through the authorization of an ad valorem property tax levy.

Revenue Bonds

Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility and the debt obligation does not extend to the City's other revenue sources. With this limited commitment, revenue bonds typically bear higher interest rates than GO bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (added bond debt service coverage). The utility agrees to satisfy these requirements by ordinance as a condition of the bond sale.

Revenue bonds can be issued in Washington State without a public vote. There is no bonding limit, except perhaps the practical limit of the utility's ability to generate sufficient revenue to repay the debt and provide coverage. In some cases, poor credit might make issuing bonds problematic.

Funding Options Summary

An ideal funding strategy would include the use of grants and low cost loans when debt issuance is required. However, these resources are very limited and competitive in nature and do not provide a reliable source of funding for planning purposes (unless already approved). It is recommended that the City pursue these funding avenues but assume bond financing to meet needs above the utility's available cash resources. GO bonds may be useful for special circumstances; however, due to the bonding capacity, limits are most often reserved for other City (non-utility) purposes. Revenue bonds are a more reliably available financing mechanism for utility needs. The capital financing strategy developed to fund the CIP assumes the following funding priority:

- Accumulated capital cash reserves
- Annual revenue collections from SDCs
- Annual transfers of rate-funded capital or excess cash (above minimum balance targets) from operating accounts

- Interest earnings on capital fund balances and other miscellaneous capital resources
- Revenue bond financing

Funding and Financing the CIP

The forecast of capital project funding is based on the 2012 through 2032 CIP. Costs are stated in 2012 dollars and escalated to the year of planned spending at an annual inflation rate of 3.0 percent, based on the change in the ENR index for the most recent 12 month period. The CIP identifies a total of $31 million ($43.7 million escalated) of projects. The 2012-2018 forecast period includes $7.0 million ($7.5 escalated).

Table 5-3
Summary of CIP Costs to be Funded

CIP Summary	2012 $	Escalated
Immediate (2012-2018) CIP	$ 7,028,400	$ 7,539,763
Total (2012-2032) CIP	$ 30,980,700	$ 43,658,527

The capital funding plan defines a strategy for funding the CIP, including an analysis of available resources from rate revenues, existing reserves, SDCs, debt financing and any special resources that may be readily available (e.g. grants, developer contributions, etc.). The funding plan impacts rate levels where debt issuance is projected and therefore repayment required by annual revenues.

Table 5-4
Capital Funding Plan

Capital Funding	2012	2013	2014	2015	2016	2017	2018	2012-2018 CIP	2012-2032 Total CIP
Total Capital Projects	**$ 2,400,000**	**$ 783,212**	**$ 830,048**	**$ 842,930**	**$ 868,217**	**$ 894,264**	**$ 921,092**	**$ 7,539,763**	**$ 43,658,527**
Capital Fund Balance	$ -	$ 783,212	$ 175,203	$ 180,555	$ 196,790	$ 202,145	$ 182,450	$ 1,720,356	$ 32,025,530
2011 Revenue Bond Proceeds	2,400,000	-	-	-	-	-	-	2,400,000	2,400,000
Projected New Revenue Bond Proceeds	-	-	654,845	662,375	671,427	692,119	738,641	3,419,408	9,232,996
Total Funding Sources	**$ 2,400,000**	**$ 783,212**	**$ 830,048**	**$ 842,930**	**$ 868,217**	**$ 894,264**	**$ 921,092**	**$ 7,539,763**	**$ 43,658,527**

[a] Includes annual System Development Charge revenues and system reinvestment funding

Of the $7.5 million of projects in 2012-2018, 77% are forecast to be debt-funded. As a result of projected system reinvestment funding, the long term funding mix is projected to be 73% cash-funded, improving the City's debt to equity ratio over the life of this CIP.

Revenue Requirements Forecast

The revenue requirement analysis forecasts the amount of annual revenue that needs to be generated by rates. The analysis incorporates operating revenues, O&M expenses, debt service payments, rate funded capital needs, and any other identified revenues or expenses related to utility operations, and determines the sufficiency of the current level of rates. Revenue needs are also impacted by debt covenants (typically applicable to revenue bonds) and specific fiscal policies and financial goals of the utility.

Typically, two revenue sufficiency criteria are tested to determine the annual revenue need: 1) cash needs must be met; and 2) debt coverage requirements must be realized. In order to operate successfully with respect to these goals, both tests of revenue sufficiency must be met.

Cash Test

The cash flow test identifies all known cash requirements for the utility in each year of the 2012 through 2018 planning period. Typically, these include O&M expenses, debt service payments, rate funded capital and any additions to specified reserve balances. The total annual cash needs of the utility are then compared to total operating revenues (under current rates) to forecast annual revenue surpluses or shortfalls.

Coverage Test

The coverage test is based on a commitment made by the City when issuing revenue bonds and some other forms of long-term debt. As a security condition of issuance, the City is required per covenant to agree that the revenue bond debt would have a higher priority for payment (a senior lien) compared to most other utility expenditures; the only outlays with a higher lien are O&M expenses. Debt service coverage is expressed as a multiplier of the annual revenue bond debt service payment. For example, a 1.0 coverage factor would imply no additional cushion is required. A 1.25 coverage factor means revenues must be sufficient to pay O&M expenses and annual revenue bond debt service payments, plus an additional 25 percent of annual revenue bond debt service payments. The excess cash flow derived from the added coverage, if any, can be used for any utility purpose, including funding capital projects. The forecast includes a 1.25 coverage requirement based on the City's outstanding bonds.

In determining the annual revenue requirement, both the cash and coverage sufficiency tests must be met. The test with the greatest deficiency drives the level of deficiency in a given year.

Financial Forecast

The financial forecast is developed from the City's 2012 budget along with other key factors and assumptions, to develop a complete portrayal of the water utility's annual financial

obligations. The following is a list of the key revenue and expense factors and assumptions used to develop the forecast.

- This financial plan assumes 1.25% percent annual growth to the customer base for the 6-year forecast, based on 2011 actual growth, as indicated by SDC revenue collections.
- Water rate revenues are forecasted incorporating annual customer growth and based on actual reported 2011 water rate revenue.
- Interest earnings on cash balances are projected at 0.2 percent in 2013 and projected to increase at 0.5% per year until achieving 3% in 2020.
- The 2012 budget forms the baseline for operating costs.
- O&M expenses are escalated from the 2012 budget at 3 percent per year for general cost inflation (based on 2011 CPI change). State taxes are calculated based on prevailing tax rates.
- Existing debt service schedules were provided by the City and include two revenue bonds, a G.O. Bond, a PWTF loan and an interfund loan.
- System reinvestment funding is based on annual depreciation net of debt principal repayment and is phased in over four years beginning in 2013.

Although the capital funding plan is completed for the 20-year time horizon, the financial plan focuses on the 2012-2018 planning period.

Table 5-5
Revenue Requirements Forecast 2012-2018

Revenue Requirements	Current Year 2012	Projected 2013	2014	2015	2016	2017	2018
Revenues							
Rate Revenues Under Existing Rates [a]	$ 2,704,803	$ 2,794,001	$ 2,828,926	$ 2,864,287	$ 2,900,091	$ 2,936,342	$ 2,973,046
Non-Rate Revenues	41,151	41,509	42,766	44,722	48,379	52,884	58,893
Total Revenues	**$ 2,745,954**	**$ 2,835,509**	**$ 2,871,692**	**$ 2,909,009**	**$ 2,948,469**	**$ 2,989,226**	**$ 3,031,939**
Expenses							
Cash Operating Expenses	$ 2,140,914	$ 2,215,378	$ 2,280,567	$ 2,348,168	$ 2,417,603	$ 2,490,494	$ 2,566,229
Existing Debt Service	567,646	787,047	900,022	905,684	908,775	906,840	642,055
New Debt Service	-	-	55,435	111,508	168,347	226,937	226,937
Rate-Funded System Reinvestment	-	67,428	69,489	83,590	86,101	63,541	326,336
Total Expenses	**$ 2,708,560**	**$ 3,069,853**	**$ 3,305,512**	**$ 3,448,950**	**$ 3,580,826**	**$ 3,687,812**	**$ 3,761,557**
Annual Surplus / (Deficiency)	**$ 37,394**	**$ (234,344)**	**$ (433,820)**	**$ (539,941)**	**$ (632,357)**	**$ (698,587)**	**$ (729,618)**
Net Revenue from Rate Increases	$ -	$ 237,821	$ 456,398	$ 564,673	$ 657,242	$ 754,635	$ 857,068
Net Surplus / (Deficiency)	**$ 37,394**	**$ 3,477**	**$ 22,577**	**$ 24,732**	**$ 24,885**	**$ 56,048**	**$ 127,450**
Annual Rate Adjustment		13.00%	8.00%	3.00%	3.00%	3.00%	3.00%
Cumulative Rate Adjustment		13.00%	22.04%	25.70%	29.47%	33.36%	37.36%
Residential Bi-Monthly Bill (assumes 16 ccf)	$69.22	$78.22	$84.48	$87.01	$89.62	$92.31	$95.08
Rate Revenues After Rate Increase	$ 2,704,803	$ 3,096,684	$ 3,409,798	$ 3,582,965	$ 3,736,585	$ 3,896,791	$ 4,063,866
No of Days of Cash Operating Expenses	61	60	63	65	68	76	90
Coverage Ratio After Increase	2.39	2.14	2.00	1.94	1.87	1.86	2.56

[a] Additional revenues from adopted 2012 increase of 13.5% included in Revenue under Existing Rates

The City has adopted a schedule of 13% rate increases for years 2013 through 2015. The updated forecast shows that while the 13% increase adopted for 2013 is necessary for the utility to meet its annual obligations, the City has opportunity to reduce the adopted 2014 and 2015 rate increases if costs continue to be projected at levels estimated in this forecast.

Existing Rate Structure

The existing water rate structure consists of a base bi-monthly fee that includes an allowance of water varying by size of meter, plus a charge per 100 cubic feet (cf) of water over the allowance. Multifamily customers pay the base charge per unit, as well as the usage-based charge. Customer classes are distinguished by residential or nonresidential.

To enhance conservation, the City might consider eliminating the usage allowance in the base charge, charging for all water use in the volume rate. This serves to provide a stronger signal to the cost of the each unit of water used. The City could also evaluate whether additional customer class distinctions are appropriate based on the different usage patterns exhibited by residential, commercial, or irrigation categories of customers. Among the potential rate classes, a variety of rate structure options might be utilized such as seasonal rates for commercial customers and an inclining block rate structure for residential.

The following table shows the existing City water rate schedule, as well as the rate with the projected rate increases applied across-the-board to the existing rate structure components.

Table 5-6
Existing 2012 and Projected 2013-2018 Water Rates

			Existing 2012 Bi-Monthly Rates		Across-the-Board Increases											
					2013 Rates 13.00%		2014 Rates 8.00%		2015 Rates 3.00%		2016 Rates 3.00%		2017 Rates 3.00%		2018 Rates 3.00%	
	Meter Size	Allowance	Inside City	Outside City	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
Multi-Family	First Unit	10	$ 53.44	$ 84.80	$ 60.39	$ 95.82	$ 65.22	$ 103.49	$ 67.17	$ 106.59	$ 69.19	$ 109.79	$ 71.27	$ 113.09	$ 73.40	$ 116.48
	Each Add'l	10	35.50	56.30	40.12	63.62	43.32	68.71	44.62	70.77	45.96	72.89	47.34	75.08	48.76	77.33
All Other Classes	5/8" or 3/4"	10	53.44	84.79	60.39	95.81	65.22	103.48	67.17	106.58	69.19	109.78	71.27	113.07	73.40	116.47
	1"	13	61.04	97.18	68.98	109.81	74.49	118.60	76.73	122.16	79.03	125.82	81.40	129.60	83.84	133.48
	1 1/2"	28	101.46	160.04	114.65	180.85	123.82	195.31	127.54	201.17	131.36	207.21	135.30	213.42	139.36	219.83
	2"	47	148.94	242.43	168.30	273.95	181.77	295.86	187.22	304.74	192.84	313.88	198.62	323.30	204.58	332.99
	3"	105	312.24	493.67	352.83	557.85	381.06	602.47	392.49	620.55	404.26	639.17	416.39	658.34	428.88	678.09
	4"	170	471.31	747.00	532.58	844.11	575.19	911.64	592.44	938.99	610.22	967.16	628.52	996.17	647.38	1,026.06
	6"	300	790.35	1,252.71	893.10	1,415.56	964.54	1,528.81	993.48	1,574.67	1,023.28	1,621.91	1,053.98	1,670.57	1,085.60	1,720.69
	8"	500	1,318.61	2,089.93	1,490.03	2,361.62	1,609.23	2,550.55	1,657.51	2,627.07	1,707.23	2,705.88	1,758.45	2,787.06	1,811.20	2,870.67
Usage Above Allowance (per ccf)	0 - 500 ccf		$ 5.20	$ 8.75	$ 5.88	$ 9.89	$ 6.35	$ 10.68	$ 6.54	$ 11.00	$ 6.73	$ 11.33	$ 6.93	$ 11.67	$ 7.14	$ 12.02
	500 - 3,500 ccf		5.09	8.46	5.75	9.56	6.21	10.32	6.40	10.63	6.59	10.95	6.79	11.28	6.99	11.62
	3,500 - 7,500 ccf		3.80	6.17	4.29	6.97	4.64	7.53	4.78	7.76	4.92	7.99	5.07	8.23	5.22	8.47
	7,500 - 12,500 ccf		2.58	3.83	2.92	4.33	3.15	4.67	3.24	4.81	3.34	4.96	3.44	5.11	3.54	5.26
	12,500 - 17,500 ccf		2.13	3.05	2.41	3.45	2.60	3.72	2.68	3.83	2.76	3.95	2.84	4.07	2.93	4.19
	over 17,500 ccf		1.83	2.77	2.07	3.13	2.23	3.38	2.30	3.48	2.37	3.59	2.44	3.69	2.51	3.80

Affordability

A common affordability benchmark for utility rates is to test the monthly median income equivalent against the existing and projected monthly utility rates. If monthly bills are less than 2.0 percent of the median household income for the demographic area, they are generally considered affordable (per Drinking Water State Revolving Fund subsidy guidelines).

Table 5-7
Affordability Benchmark

	Current	With Projected Increases					
	2012	2013	2014	2015	2016	2017	2018
Median Income	$ 62,354	$ 63,602	$ 64,874	$ 66,171	$ 67,494	$ 68,844	$ 70,221
2% Bi-Monthly	$ 155.89	$ 159.00	$ 162.18	$ 165.43	$ 168.74	$ 172.11	$ 175.55
Projected Bi-Monthly Bill *	$69.22	$44.60	$45.94	$47.77	$49.69	$52.17	$54.78

* Assumes 16 ccf bi-monthly

The forecast shows that the City remains well within the benchmark of affordability throughout the forecast period.

Conclusion

Based on the source data and assumptions used, the financial analysis indicates that the rate adjustment strategy provided herein would be sufficient to fund utility operations and the CIP developed for this Water System Plan Update, while maintaining reasonably affordable rates.

It is recommended that the City perform a rate study to develop rate classes, evaluate equity and develop conservation-enhanced rate structures for each class.