COMPREHENSIVE WATER MASTER PLAN

Adopted April 17, 2012

CITY OF ASHLAND

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COMPREHENSIVE WATER MASTER PLAN

FINAL

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City of Ashland

COMPREHENSIVE WATER MASTER PLAN

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Comprehensive Water Plan

EXECUTIVE SUMMARY

This Comprehensive Water Master Plan (Plan) is an update to the City of Ashland's (City's) 2000 Water System Master Plan. This plan was developed to satisfy the Oregon Health Division (OHD) water master plan requirements as outlined in Oregon Administrative Rules (OAR) 333-61-060. This Executive Summary briefly summarizes the contents of each chapter in the plan, including major activities, conclusions, and recommendations.

The purpose of this Plan is to describe the City's water system, identify required system modifications, and outline capital improvement projects to resolve existing deficiencies and meet future water demands. The Plan evaluates the existing system and its ability to meet the anticipated requirements for water source, quality, transmission, storage, and distribution. Water system improvement projects have been developed to meet the changing demands of regulatory impacts, population growth, and infrastructure repair and replacement. The Plan also identifies planning level costs of the improvement projects and provides a financial plan for funding the projects.

ES.1 EXISTING SYSTEM

The City owns and operates the water supply system to meet the water needs of the residents, businesses, institutions, and industries within the City limits. Figure ES.1 presents a map of the City limits and general extents of the water system. The City limits currently include 4,209 acres, with an Urban Growth Boundary of 4,733 acres. The water system extends to the northwest up to Ashland Mine Road and to the southeast to properties along Highway 66. The system is bounded to the west by the topography of the Siskiyou Mountain Range, and to the east generally by the Interstate 5 (I-5) corridor.

The City's primary source of raw water comes from the Ashland Creek watershed. In 1928, the City constructed Hosler Dam at the confluence of the West and East Forks of Ashland Creek. Reeder Reservoir, the resulting impoundment, provides 280 million gallons (MG) of storage for the City's water supply. Water from the reservoir is conveyed to the City's Water Treatment Plant (WTP) located along Ashland Creek, approximately one mile below Reeder Reservoir. The City also has an agreement with the Talent Irrigation District (TID) to provide additional supply in drought years. When needed, TID water is pumped from the Ashland Canal by the City's Terrace Street Pump Station up to the WTP, where it is treated with the Ashland Creek supply.

The Ashland water system comprises Reeder Reservoir, the WTP, four reservoirs that provide 7.1 MG of storage (Crowson, Granite, Fallon, and Alsing), four pump stations (PS) (Hillview, South Mountain, Park Estates, and Strawberry), 32 pressure-reducing valve (PRV) stations, and over 126 miles of distribution piping. The WTP has a capacity of approximately 7.5 mgd. The treatment process currently consists of flocculation, filtration, and disinfection. The location of the WTP places the facility at risk of flooding, fire, and landslides. High flows in Ashland Creek during the 1996 flood caused much damage to the WTP, disrupting the City's water supply.

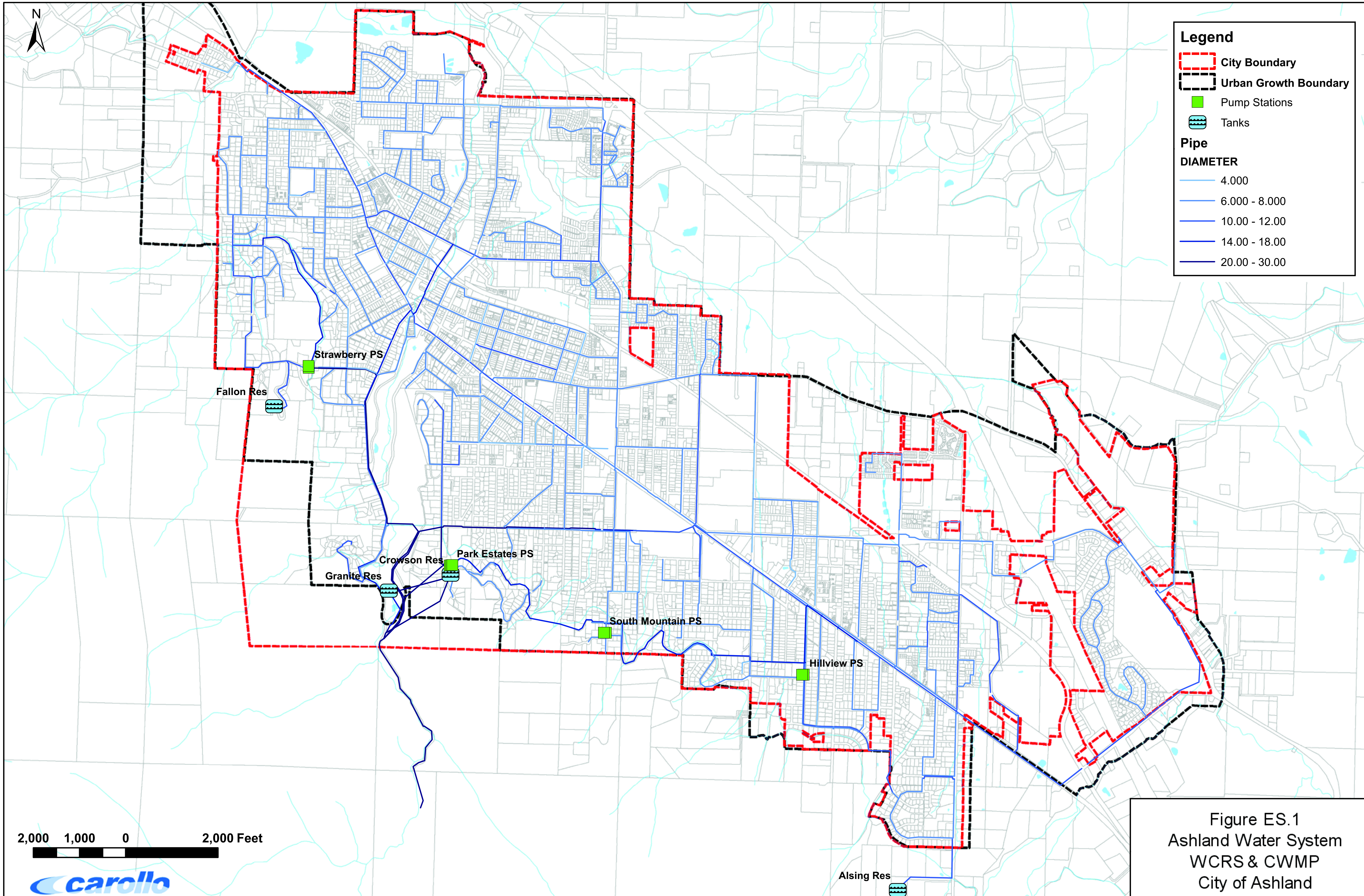


Figure ES.1
Ashland Water System
WCRS & CWMP
City of Ashland

ES.2 LEVEL OF SERVICE GOALS

Chapter 2 describes the Level of Service (LOS) Goals, and the roles played by the Ashland Water Advisory Council (AWAC) and Technical Review Committee (TRC) in establishing the goals. These LOS goals are the foundation of the analyses conducted for both the CWMP and the accompanying Water Conservation and Reuse Study (WCRS), attached as Appendix A.

The role of the AWAC is to serve as an advisory group to the Council and the City's water staff, providing a link with the community and involving impacted persons and interest groups with the WCRS and CWMP. The TRC is intended to provide technical review and input to the consultant's work, supporting the AWAC and Council in their decision-making processes.

Table ES.1 presents the LOS goals for the water system capacity, water system reliability, water system redundancy, and regulatory requirements. Chapter 2 summarizes additional LOS goals for the distribution system piping, pump stations, and storage, and required fire flows.

Table ES.1 Selected LOS Goals

Goal Area	Goal
Water System Capacity	Have sufficient supply to meet projected demands that have been reduced based on 5 percent additional conservation. However, City will have a goal of achieving 15 percent conservation.
Water System Reliability	Community will accept curtailments of 45 percent during a severe drought.
Water System Redundancy	Implement redundant supply project to restore fire protection and supply for indoor water use shortly after a treatment plant outage.
Regulatory Requirements	Meet or exceed all current and anticipated regulatory requirements.

ES.3 POPULATION & DEMANDS

Chapter 3 reviews the City's historic water system demands, and projects future demands through 2060 using historic per capita usage and population projections. Historical water demands per capita from 2005 through 2009 were analyzed. During this five-year period, the City's population increased slightly from 20,880 to 21,505. The average per capita demand based on billing data was 144 gallons per capita per day (gpcd); the average per capita demand based on supply data (which includes unaccounted for water) was 157 gpcd. An average peaking factor of 2.06 was calculated by dividing historical maximum day demand (MDD) by average day demand (ADD).

Projected demands were developed using the future population and historical average per capita demand of 157 gpcd. Projected water demands through 2060 are summarized in Table ES.2.

Table ES.2 Projected Water Demands, Including Unaccounted for Water, No Additional Conservation

Year	Projected Average Day Demands (mgd)	Projected Max Day Demands (mgd)[1]
2009 (current)	3.38	6.96
2020	3.59	7.40
2030	3.88	7.99
2060	4.76	9.81

Notes:
1. Max Day Demand = Average Day Demand * Peaking Factor.

ES.4 CONSERVATION

Chapter 4 documents the City's current and future water conservation efforts and the impacts of conservation on water demands. In the past, the City has implemented various measures to conserve water, such as rebates for ultra low flow and high efficiency toilets, low flow showerheads, efficient washing machines, and dishwashers. Additionally, the City conducts irrigation audits, performs leak detection, and promotes water conservation through its rates and codes.

The water consumption data from 2005 to 2009 indicates water savings due to conservation, improved metering, and a reduction in distribution system losses. The average unaccounted-for water (UFW) over the 5-year period was 8.4 percent, excluding data from 2009. In all years except 2005, the City has maintained a UFW percentage of less than 10 percent, which is considered the industry standard for water use efficiency.

The City's per capita consumption (157 gpcd) is slightly below the national average (160 gpcd), and well below the California average (229 gpcd). However, it is not as low as communities that have implemented very aggressive conservation programs, such as the City of Santa Cruz (107 gpcd, estimated to be 117 gpcd with UFW), indicating that additional conservation could still be achieved.

The City considered three increasing levels of conservation to help meet its projected demands: 5-, 10-, and 15-percent reductions in existing per capita demands. The City anticipates that 75 percent of the conservation program water savings would be achieved through outdoor use and 25 percent through indoor use. This results in a smaller MDD to ADD peaking factor. Table ES.3 shows projected water demands assuming the three potential levels of conservation.

Table ES.3 Projected Day Demands with Varying Levels of Conservation

	Projected Demands (million gallons per day)					
	5 percent reduction		10 percent reduction		15 percent reduction	
Year	ADD	MDD	ADD	MDD	ADD	MDD
2010	3.38	7.14	3.38	7.14	3.38	7.14
2020[1]	3.50	7.59	3.41	7.32	3.32	7.04
2030[2]	3.69	8.00	3.49	7.40	3.30	6.79
2060	4.52	9.36	4.29	8.66	4.05	7.95

Notes:
1. Assumes half of the targeted additional conservation level is achieved by 2020.
2. Assumes the targeted additional conservation level is achieved by 2030.

Meeting the 15 percent conservation target identified by the AWAC will required significant expansion of the City's current conservation efforts, including additional staffing and funding for programs. The next step is for the City to conduct a detailed Water Conservation Study to evaluate the various potential measures to identify the costs and implementation issues associated with them, and select those that will most cost-effectively achieve the desired demand reductions.

Until that study is complete, it is recommended that the City continue its existing water conservation programs, and continue to improve public education and awareness on the importance of water conservation.

ES.5 DISTRIBUTION SYSTEM EVALUATION

The City's water distribution system was evaluated for sufficient capacity to meet future demands. The specific components that were evaluated include finished water storage volume, pump station capacity, and pipeline capacity. All evaluations were conducted according to the criteria established by the LOS goals and according to projected demands with 5 percent additional conservation for the years 2010 (current), 2015, and 2030.

The storage analysis compared the storage volume in the City's existing reservoirs to the operational, emergency, and fire flow storage required per the City's established criteria for each service level. The required emergency storage was calculated in two ways: to provide 12 hours of demand during MDD, and to provide one full day of demand during MDD (equivalent to two days of ADD). Additionally, reductions in the required emergency storage were evaluated by reviewing the impacts of redundant, reliable supply sources, and "nesting" the fire flow and emergency storage volumes together. Assuming an emergency storage provision of 2 x ADD and reducing the required storage by the secondary supply source, the City will have a storage deficit of 2.6 to 3.6 MG in the combined Crowson and Granite Service Levels, depending on the selected secondary supply source. Storage improvements include expanding the Alsing Service area, and constructing a second reservoir near the existing Crowson reservoir.

Pumping capacity was also evaluated for each of the City's service areas. Pumping capacity was evaluated to be adequate with the exception of the Park Estates and South Mountain service areas. The pumping deficit correlates to the City's criteria of providing 1,500 gpm of fire flow. Pumping improvements include connecting the South Mountain and Park Estates service areas with a pipe extension, and replacing the Park Estates Pump Station with a larger pump station.

Hydraulic modeling of the system identified pressure deficiencies for meeting future peak hour demands and fire flows. Several pipe improvement projects were proposed to meet the capacity requirements under the 2030 scenario. Cost estimates for the projects are provided in Chapter 7 – Capital Improvements Plan.

ES.6 WATER QUALITY AND TREATMENT EVALUATION

The quality of its drinking water is of primary concern to the City. The City's water is tested regularly for the presence of contaminants at frequencies prescribed by the Oregon State Department of Human Services (DHS) regulations. The City is in compliance with all DHS reporting requirements, including publication and distribution of an annual Consumer Confidence Report (CCR) that keeps consumers informed of the quality of the City's water supply and water delivery systems.

Chapter 6 describes the current drinking water quality regulations, summarizes the current monitoring programs, summarizes the City's compliance with EPA and DHS regulations, and makes recommendations for improving the effectiveness of the City's water treatment processes. The City has identified a number of systems at the WTP that require minor capital improvements including the raw water bypass, SCADA system, final chlorine disinfection process, and WTP security. Improvements to the final chlorine disinfection process are critical for ensuring that the City will comply with future regulations beginning in October 2013.

The existing WTP does not have adequate capacity to meet future peak demands for the City. Considering of the vulnerability, limited capacity, and age of the existing WTP, the City and AWAC decided that constructing a new WTP in a better location would be a wiser City investment than expansion and further upgrades to the existing WTP.

ES.7 CAPITAL IMPROVEMENTS PLAN

Chapter 7 presents a Capital Improvements Plan (CIP) for the City to continue consistent, efficient, and high-quality water supply to its water service area. The CIP provides cost estimates and prioritizes all previously identified projects as part of this CWMP. The recommended projects are presented for the Short-Term (2011-2018), and Long-Term (2019-2030).

Planning-level cost estimates were developed for each of the recommended projects for budgeting purposes. Cost estimates are presented as total project costs in September 2011 dollars. Cost estimates were developed using a Class 3 budget estimate, as established by the American Association of Cost Estimators (AACE).

The capital projects identified can be categorized into general improvements (G), water supply (S), Treatment and Storage (T), Distribution (D), and piping (P). The CIP projects have been assigned a project identification number (Project ID) and are shown on Figures ES.2 and ES.3.

Throughout development of this CWMP, the City has been evaluating two potential secondary water supply alternatives: Installing an emergency intertie to the Talent Ashland Phoenix (TAP) pipeline (Initial cost: $9.6M), or constructing a new 2.5-MG WTP to supplement and eventually replace the existing WTP (Initial cost $12.0M). Upon review of the comprehensive capital improvements plan and financial impacts, the AWAC selected to implement a new 2.5-MG WTP and construct a less costly emergency intertie to the TAP pipeline.

Table ES.4 summarizes the short and long-term CIP projects. All project costs shown in the table are in September 2011 dollars. Adding up the Short- and Long-Term costs results in total CIP costs of $31.5M.

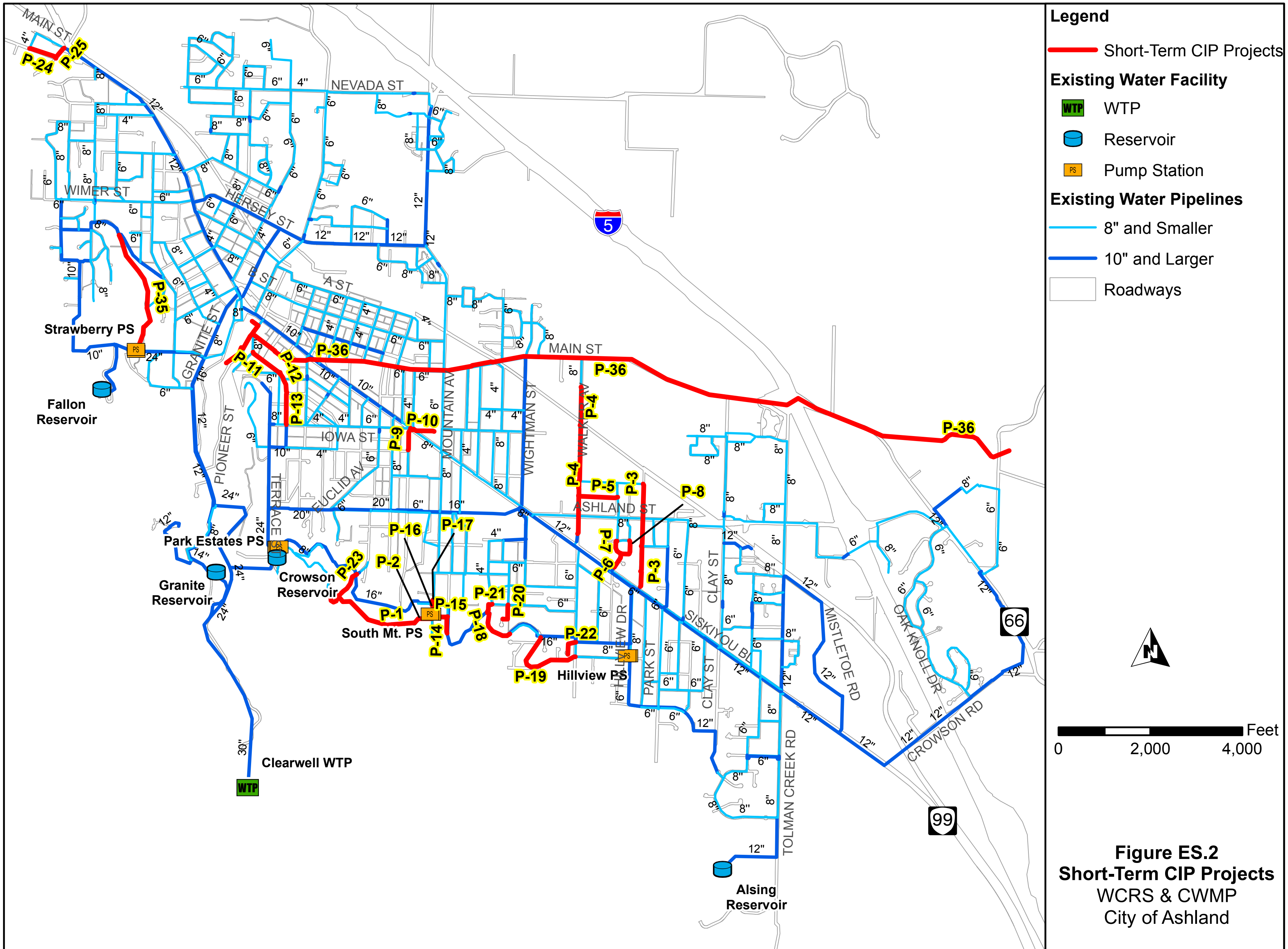
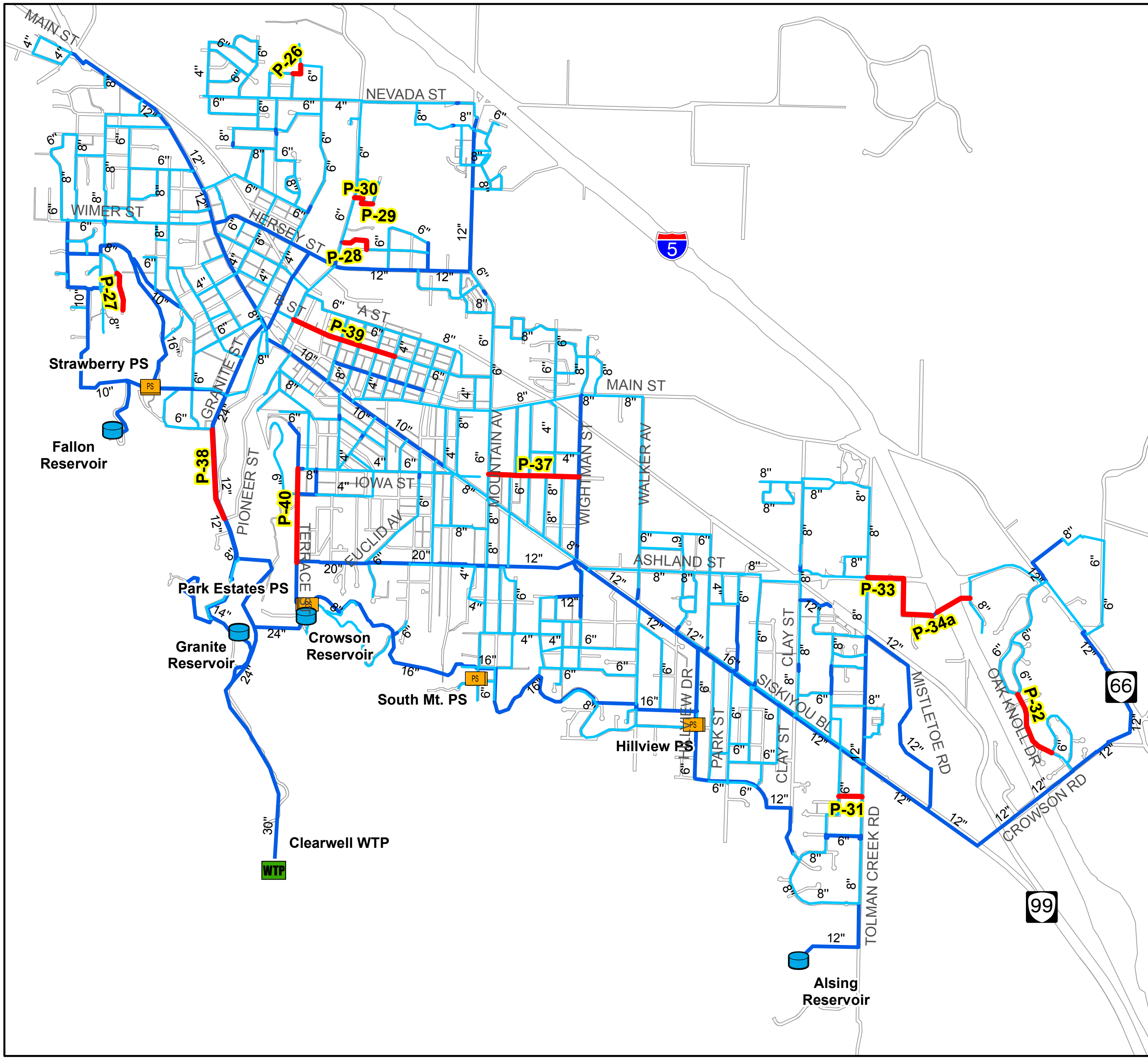


Figure ES.2
Short-Term CIP Projects
WCRS & CWMP
City of Ashland



Legend

Long-Term CIP Projects

Existing Water Facility

WTP

Reservoir

Pump Station

Existing Water Pipelines

8" and Smaller

10" and Larger

Roadways

Feet
0 2,000 4,000

Figure ES.3
Long-Term CIP Projects
WCRS & CWMP
City of Ashland

carollo
Engineers...Working Wonders With Water®

Table ES.4 Capital Improvements Projects Summary

ID	NAME	Current	Short-Term											Long-Term
		FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2013-2022 Total	FY 2023 – 2032
	SUPPLY													
S-1	FERC Dam Security & Telemetry Impr (50% Electric, 50% Water)	$ 25,000											**$ -**	**$ -**
S-2	FERC Dam Spillgate Upgrades (50% Electric, 50% Water)	$ 50,000											**$ -**	**$ -**
S-3	FERC Structural Stability Analysis (50% Electric, 50% Water)	$ 90,000											**$ -**	**$ -**
S-4	FERC Part 12 Dam Safety Inspection (50% Electric, 50% Water)			$ 40,000				$ 40,000					**$ 80,000**	**$ 80,000**
S-5	Ashland Creek West Fork Bridge Construction		$ 12,000	$ 108,000									**$ 120,000**	**$ -**
S-6	Sediment TMDL in Reeder Resv.	$ 10,000	$ 60,000		$ 60,000		$ 60,000		$ 60,000		$ 60,000		**$ 300,000**	**$ 300,000**
S-7	Reeder Resv Study Implementation	$ 50,000	$ 30,000										**$ 30,000**	**$ -**
S-8	Reeder Resv Access Road TMDL Compliance						$ 10,000	$ 90,000					**$ 100,000**	**$ -**
S-9	Reeder Resv Variable Depth Intake								$ 100,000				**$ 100,000**	**$ -**
S-10	TID Terrace St Pump Station Improvements				$ 20,000	$ 200,000							**$ 220,000**	**$ -**
S-11	TID Canal Piping: Starlite to Terrace Street							$ 1,100,000					**$ 1,100,000**	**$ -**
S-12	Test existing high capacity wells		$ 50,000										**$ 50,000**	**$ -**
S-13	Water Conservation Smart Controller Pilot Project				$ 50,000								**$ 50,000**	**$ -**
S-14	Water Conservation Management Plan (due April 2012)	$ 50,000											**$ -**	**$ -**
S-15	Emergency TAP Pipeline & Pump				$ 2,000,000								**$ 2,000,000**	**$ -**
	Supply Subtotal	**$ 275,000**	**$ 152,000**	**$ 148,000**	**$ 2,130,000**	**$ 200,000**	**$ 70,000**	**$ 1,230,000**	**$ 160,000**	**$ -**	**$ 60,000**	**$ -**	**$ 4,150,000**	**$ 380,000**
	TREATMENT & STORAGE													
T-1	Raw Water Bypass Measurement		$ 25,000										**$ 25,000**	**$ -**
T-2	SCADA Radio Frequency FCC Compliance		$ 45,000										**$ 45,000**	**$ -**
T-3	Final CT Disinfection Improvements		$ 85,000										**$ 85,000**	**$ -**
T-4	Permanganate Feed Facility Study & Implementation				$ 25,000	$ 240,000							**$ 265,000**	**$ -**
T-5	WTP Security Upgrades			$ 50,000									**$ 50,000**	**$ -**
T-6	Existing Plant Mech. Elec. & Scada Upgrades												**$ -**	**$ 1,500,000**
T-7	Ozone /UV Analysis & Disinfection												**$ -**	**$ 1,750,000**
T-8	Bear Creek Cu WLA Source Control Study & Implementation												**$ -**	**$ 50,000**
T-9	2.6-MG Reservoir & Clearwell (“Crowson II”)					$ 746,000	$ 3,000,000	$ 3,000,000					**$ 6,746,000**	**$ -**
T-10	2.5 MGD Water Treatment Plant					$ 1,000,000	$ 5,500,000	$ 5,500,000					**$ 12,000,000**	**$ -**
	Treatment Subtotal	**$ -**	**$ 155,000**	**$ 50,000**	**$ 25,000**	**$ 1,986,000**	**$ 8,500,000**	**$ 8,500,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 19,216,000**	**$ 3,300,000**
	DISTRIBUTION													
D-1	Telemetry Station at Water Warehouse			$ 50,000									**$ 50,000**	**$ -**
D-2	Water Master Plan Updates					$ 100,000					$ 200,000		**$ 300,000**	**$ 400,000**
D-3	Park Estates Pump Station/Loop Road Reservoir Alternatives		$ 200,000	$ 1,800,000									**$ 2,000,000**	**$ -**
D-4	Lit Way New PRV												**$ -**	**$ 341,000**
D-5	Tolman Creek Road New PRV												**$ -**	**$ 341,000**
D-6	Pipe Replacement Program												**$ -**	**$ 3,700,000**
D-7	Radio Read Meter Program								$ 96,500	$ 96,500	$ 96,500	$ 96,500	**$ 386,000**	**$ 965,000**
D-8	Hydrant Replacement								$ 44,000	$ 44,000	$ 44,000	$ 44,000	**$ 176,000**	**$ 440,000**
D-9	Emergency Response Plan Update			$ 20,000									**$ 20,000**	**$ -**
D-10	Cross Connection Control Plan Update				$ 15,000								**$ 15,000**	**$ -**
D-11	Safety Plan Update					$ 20,000							**$ 20,000**	**$ -**
D-12	Granite Reservoir Valving							$ 100,000					**$ 100,000**	**$ -**
	Distribution Subtotal	**$ -**	**$ 200,000**	**$ 1,870,000**	**$ 15,000**	**$ 120,000**	**$ -**	**$ 100,000**	**$ 140,500**	**$ 140,500**	**$ 340,500**	**$ 140,500**	**$ 3,067,000**	**$ 6,187,000**

Table ES.4 Capital Improvements Projects Summary

ID	NAME		Current	Short-Term											Long-Term
			FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2013-2022 Total	FY 2023 – 2032
	PIPES	**Project Extents**													
P-1	Ivy Lane	Morton Street to west end of Ivy Lane		$ 35,000	$ 311,000									**$ 346,000**	**$ -**
P-2	Ivy Lane	South Mountain to FH-16AD-038		$ 10,000	$ 84,000									**$ 94,000**	**$ -**
P-3	Normal Ave	Siskiyou Blvd to Homes Ave			$ 50,000	$ 467,000								**$ 517,000**	**$ -**
P-4	Walker Ave	Siskiyou Blvd to Ashland Middle School				$ 75,000	$ 709,000							**$ 784,000**	**$ -**
P-5	Parker Street	Walker Ave to Lit Way					$ 20,000	$ 142,000						**$ 162,000**	**$ -**
P-6	Harmony Lane	Siskiyou Blvd to Lit Way					$ 10,000	$ 55,000						**$ 65,000**	**$ -**
P-7	Lit Way	Joy Avenue to Ray Lane					$ 5,000	$ 30,000						**$ 35,000**	**$ -**
P-8	Ray Lane	Lit Way to Joy Ave					$ 5,000	$ 49,000						**$ 54,000**	**$ -**
P-9	Beach Street	Larkin Lane to Iowa Street						$ 10,000	$ 81,000					**$ 91,000**	**$ -**
P-10	AHS Property	Fire hydrant in school property						$ 9,000	$ 81,000					**$ 90,000**	**$ -**
P-11	Vista Street	Fork St to Hillcrest St							$ 149,000					**$ 149,000**	**$ -**
P-12	Vista Street	Intersection of Vista, Hillcrest, Glenview Dr							$ 5,000					**$ 5,000**	**$ -**
P-13	Meade Street	Vista St/Hillcrest to Iowa Street							$ 235,000					**$ 235,000**	**$ -**
P-14	Elkader Street	Ivy Lane to Pinecrest Trail								$ 72,000				**$ 72,000**	**$ -**
P-15	Ivy Lane	South Mountain Ave to Elkader St								$ 64,000				**$ 64,000**	**$ -**
P-16	South Mountain Ave	S. Mountain Ave to Emma St								$ 6,000				**$ 6,000**	**$ -**
P-17	South Mountain Ave	From S. Mountain Ave to FH 16AD-043								$ 17,000				**$ 17,000**	**$ -**
P-18	Pinecrest Trail	Penny Drive to Woodland Drive									$ 178,000			**$ 178,000**	**$ -**
P-19	Pinecrest Trail	Walker Ave to Starlight Place									$ 396,000			**$ 396,000**	**$ -**
P-20	Penny Drive	Woodland Dr to Weissenback Way										$ 83,000		**$ 83,000**	**$ -**
P-21	Woodland Drive	Leonard St to Pinecrest Trail										$ 52,000		**$ 52,000**	**$ -**
P-22	Hiawatha Place	Walker Ave to FH 15CA-020										$ 58,000		**$ 58,000**	**$ -**
P-23	Morton Street	FH 16AC-023 to PRV 12											$ 130,000	**$ 130,000**	**$ -**
P-24	Ashland Mine Road	Cedar Way to Fox Street											$ 115,000	**$ 115,000**	**$ -**
P-25	Fox Street	Ashland Mine Road to N. Main Street											$ 54,000	**$ 54,000**	**$ -**
P-26	Almeda Drive	Almeda Dr to Dog Park Road												**$ -**	**$ 35,000**
P-27	Skycrest Drive	Orchard St to south end of Skycrest Dr												**$ -**	**$ 162,000**
P-28	Crispin Street	Oak Street to Patterson Street												**$ -**	**$ 131,000**
P-29	Oak Lawn Ave	Oak Street to Sylvia Street												**$ -**	**$ 29,000**
P-30	Sylvia Street	Oak Lawn Ave to FH 04CA-019												**$ -**	**$ 64,000**
P-31	Black Oak Way	Tolman Creek Road to Bellview Ave.												**$ -**	**$ 85,000**
P-32	Oak Knoll Dr	Twin Pines Creek Dr to Cypress Point Loop												**$ -**	**$ 287,000**
P-33	Ashland Street	Tolman Creek Rd to Washington St												**$ -**	**$ 432,000**
P-34	I-5 Crossing	Washington St to Clover Lane												**$ -**	**$ 794,000**
P-35	Ditch Road	Strawberry PS to Grandview Dr				$ 75,000	$ 75,000	$ 75,000						**$ 225,000**	**$ -**
P-36	Lithia	Lithia Water Line							$ 70,000					**$ 70,000**	**$ -**
P-37	Iowa Street	S. Mountain Ave to Wightman St												**$ -**	**$ 640,000**
P-38	Granite Street	Strawberry to Pioneer												**$ -**	**$ 300,000**
P-39	B Street	Oak St to 5th St												**$ -**	**$ 250,000**
P-40	Terrace Street	Iowa to TID Ditch												**$ -**	**$ 350,000**
		Piping Subtotal	**$ -**	**$ 45,000**	**$ 445,000**	**$ 617,000**	**$ 824,000**	**$ 370,000**	**$ 621,000**	**$ 159,000**	**$ 574,000**	**$ 193,000**	**$ 299,000**	**$ 4,147,000**	**$ 3,559,000**
	TOTAL		**$ 275,000**	**$ 552,000**	**$ 2,513,000**	**$ 2,787,000**	**$ 3,130,000**	**$ 8,940,000**	**$ 10,451,000**	**$ 459,500**	**$ 714,500**	**$ 593,500**	**$ 439,500**	**$ 30,580,000**	**$ 13,426,000**

ES.8 OPERATIONS AND MAINTENANCE

A review of the City's water system operation and maintenance was performed to evaluate the City's water utility operation and maintenance systems by documenting existing procedures and identifying areas where improvements could enhance operation. Chapter 8 summarizes staffing, operation, maintenance and control, emergency response operations, safety, the City's cross-connection control program, supplies and equipment, record keeping and reporting, and customer service.

Staffing. Based on the above programs, the following changes to water system staffing are recommended:

- **WTP Operations**. Current staffing levels are sufficient assuming no significant increase in use of the TID supply at the WTP. If additional TID use is implemented on an ongoing basis rather than on an emergency basis, an additional full time operator with a Level II or greater certification (Level III preferred) would be required at that point in time. Alternatively, if a second WTP is implemented to provide a redundant water supply, one FTE of additional treatment staff would also be required, because a new WTP would be capable of being operated by one additional FTE, even if TID was the water source.
- **Water Distribution.** It is recommended that the open Water Utility Worker position, which is already budgeted, be filled to allow the City to meet its current maintenance needs and to restart its pipeline replacement program.
- **Administration and Engineering.** Current staffing levels are not sufficient to meet existing regulatory reporting requirements. An additional 0.5 FTE is required to meet current needs and implement the proposed CIP program.
- **Conservation.** Current staffing levels are sufficient to continue the existing conservation program. An additional 0.5 FTE are required to implement an enhanced conservation program.

Large Meter Calibration. It is recommended that large meters be inspected, maintained, and calibrated annually. It is recommended that the City develop a goal for maintaining a set proportion of the large meters each year.

Distribution System Flushing. It is recommended that the City implement a system-wide flushing program, per AWWA standards. The City would establish a goal of flushing a certain percentage of the distribution system each year, based on the total number of hydrants that need to be flushed and availability of crews for flushing operations.

ES.9 FINANCIAL ANALYSIS

The funding analysis addresses the level of water rates needed to support the future infrastructure investments along with the operations and maintenance costs of the City's water utility. A twenty year planning model was developed for this project, however, the focus for the rate projections is for the years covering the period fiscal year (FY) 2012 through FY 2022, when the bulk of the capital improvements are to be constructed. A revised water system development charge (SDC) was also prepared which overlays these capital needs and their allocations to growth onto the City's existing SDC methodology.

The financial modeling of the AWAC preferred alternative is limited to an analysis of the impact of the plan's future costs on the water utility's overall system revenue requirements. This analysis should not be construed as a cost of service study that identifies how revenues should be recovered from specific classes of customers.

While the scope of the financial analysis did not include a cost of service analysis, the City requested a review of the revenue volatility being experienced by the utility due to reduced water sales during the summer irrigation months. Based on direction from the City, adjustments to the base portion of the City's water rate were prepared to mitigate this under-recovery of revenue.

ES.9.1 Revenue Stability

Under the existing rate structure, the City has experienced an under recovery of water revenue. In FY 2011 the shortfall was an estimated to be $466,129, while in the FY 2012 the under recovery was $159,000. These shortfalls result from a pattern of wetter spring and early summer weather with a corresponding reduction in water use for irrigation. In order to mitigate the revenue effects of wetter weather, City staff recommended that water base rates be increased by ten percent (10%) on May 1, 2012. The resulting residential base rate will increase to $16.32 per month, a net monthly increase of $1.48. This increase is proposed before considering rate increases due to the planned capital projects.

ES.9.2 Capital Improvements Plan Funding

This task determines the amount of revenue needed from water rates to fund the CIP. This is driven by water utility cash flow or income requirements, constraints of bond covenants, and specific fiscal policies related to the utility. The total cost of the recommended improvements is $30.6 million ($35.5 million inflated to the time of construction) and will be paid through water rate and system development charge (SDC) revenues. Construction costs will be financed through revenue bonds.

In order to mitigate rate spikes, the project team developed a model scenario herein called "advance funding" that distributes the rate increases. The advance funding strategy is to increase rates in advance of incurring significant debt service costs. This cash would be transferred to a rate stabilization account/fund, where it will be used in the out years of the forecast to support the payment of future debt service on the Master Plan projects. In this scenario, water system revenue requirements are forecast to increase by approximately 10 percent per year for FY'13 through 16. The modeling of the AWAC preferred alternative assumes construction costs will be financed through the proceeds of newly issued serial revenue bonds. For the AWAC preferred alternative, modeling indicates the City will issue revenue bonds in FY 2014-2018, and in 2020. The total amount of new revenue bonds issued to fund the ten year Master Plan CIP is $34,055,642. Out of this total, $23,899,724 will be borrowed during the peak construction time of FY 2017-18.

By the end of the ten-year construction period, the City will have "upsized" cumulative borrowings by $2,732,713 in order to fully fund the debt service reserve account. The debt service that will result from the issuance of these revenue bonds will be paid through water rate and SDC revenues.

As discussed above, the strategy is to increase rates in advance of incurring significant debt service costs. In this scenario, water system revenue requirements are forecasted to increase by approximately 10 percent per year for FY'13, 14, 15 and 16. These actions result in building up a cash reserve of ~$4.5 million by the end of FY'17. Starting in FY'17, the model begins to apply this cash to pay for debt service incurred to fund the larger capital projects in the CIP. This process continues through FY'22. With the support of this rate stabilization cash, the resulting average annual rate increase for FY '17 to 22 is approximately 4 percent per year.

ES.9.2.1 System Development Charges Update

This update of the City's system development charges (SDC) for water was done in conjunction with the 2012 Water Conservation and Reuse Study and Comprehensive Water Master Plan (Master Plan) prepared by Carollo Engineers.

This 2012 update pertains to the water SDC only and applies the same methodology used in 2006 to revised costs related to existing fixed water assets and future capital projects (along with their cost allocations between existing and future water users via the Master Plan). Habitable square footage data was developed in the 2006 analysis and those projections were updated to reflect current growth forecasts (.0665% growth rate) through the 20-year planning period. Current meter and meter equivalency counts were obtained from the City's meters-in-service data.

Under ORS 223, there are two elements to an SDC: the reimbursement fee and the improvement fee. The reimbursement fee considers the cost of existing facilities, prior contributions by existing users of those facilities, the value of the unused/available capacity, and generally accepted ratemaking principles. The improvement fee portion of the SDC is based on the cost of planned future facilities that expand the system's capacity to accommodate growth. The total proposed water SDC combines the reimbursement and improvement elements of the calculation, as shown in Table ES.5.

Table ES.5 Proposed Total Water SDC

City of Ashland
Summary of Proposed Water SDCs

	Reimbursement	Improvement	Total
Residential:			
$/square foot of habitable area	$ 0.8040	$ 1.6436	$ 2.4476
Non-Residential:			
$/equivalent 3/4" meter	$ 1,522.18	$ 3,111.76	$ 4,633.93

City of Ashland
Proposed Schedule of Non-Residential Water SDCs by Meter Size

Water Meter Size	Reimbursement	Improvement	Total
¾" meters	$ 1,522.18	$ 3,111.76	$ 4,633.93
1" meters	2,537	5,186	7,723.22
1.5" meters	5,074	10,373	15,446.45
2" meters	8,118	16,596	24,714.32
3" meters	17,759	36,304	54,062.57
4" meters	30,444	62,235	92,678.69
6" meters	63,424	129,657	193,080.61
8" meters	91,331	186,706	278,036.08

Current - Water SDC is $4,940 for a 3/4- inch meter

Proposed - Water SDC would be $4,895 for a “typical” 2,000 habitable square foot home

Note:

Consistent with the methodology established in 2006, the SDC for non-residential properties will be based on meter size and flow factor equivalency. These factors are based on the *American Water Works Association standard for cold water meters - displacement type, bronze main case; ANSI/AWWA C700-02 Effective January 1, 2003; ANSI approved October 11, 2002.*

CHAPTER NO. 1

EXISTING SYSTEM

1.1 INTRODUCTION

The purpose of this chapter is to summarize the existing City water system, including service area, existing distribution system and treatment facilities, and general operations and maintenance.

1.2 OWNERSHIP

The City of Ashland (City) owns and operates a water supply system for meeting the water needs of the City's residents, businesses, institutions, and industries. The City has had some form of a water system since 1887, when the first distribution system was completed for providing fire flow protection[1].

1.3 SERVICE AREA

The City supplies water to customers within the City limits. Properties outside the City limits are required to annex to the City prior to receiving service. The City limits currently include 4,209 acres, with an Urban Growth Boundary of 4,733 acres. The water system extends to the northwest up to Ashland Mine Road and to the southeast to properties along Highway 66. The system is bounded to the west by the topography of the Siskiyou Mountain Range, and to the east generally by the Interstate 5 (I-5) corridor. A small area of the water system crosses the I-5 corridor in the southwest. Figure 1.1 presents an aerial view of the City and Figure 1.2 presents a map of the City limits and general extents of the water system.

Due to the topography of the City, with steep rising hills along the west border, the City's service area varies in elevation from 1,695 to 2,700 feet above sea level.

1.4 EXISTING SUPPLIES

The City's primary source of raw water comes from the Ashland Creek watershed. In 1928, the City constructed Hosler Dam at the confluence of the West and East Forks of Ashland Creek. Reeder Reservoir, the resulting impoundment, provides 280 million gallons (MG) of storage for the City's water supply. Water from the reservoir is conveyed to the City's Water Treatment Plant (WTP) through a 30-inch diameter raw water transmission line.

The City also has an agreement with the Talent Irrigation District (TID) to provide additional supply. The TID supply is typically used only in drought years. When needed, TID water is pumped from the Ashland Canal by the City's Terrace Street Pump Station up to the WTP, where it is treated with the Ashland Creek supply.

These sources are described further in Chapter 7 – Sources of Supply.

[1] Where Living Waters Flow: An Overview of Ashland's Water Source. Kay Atwood, 1998.

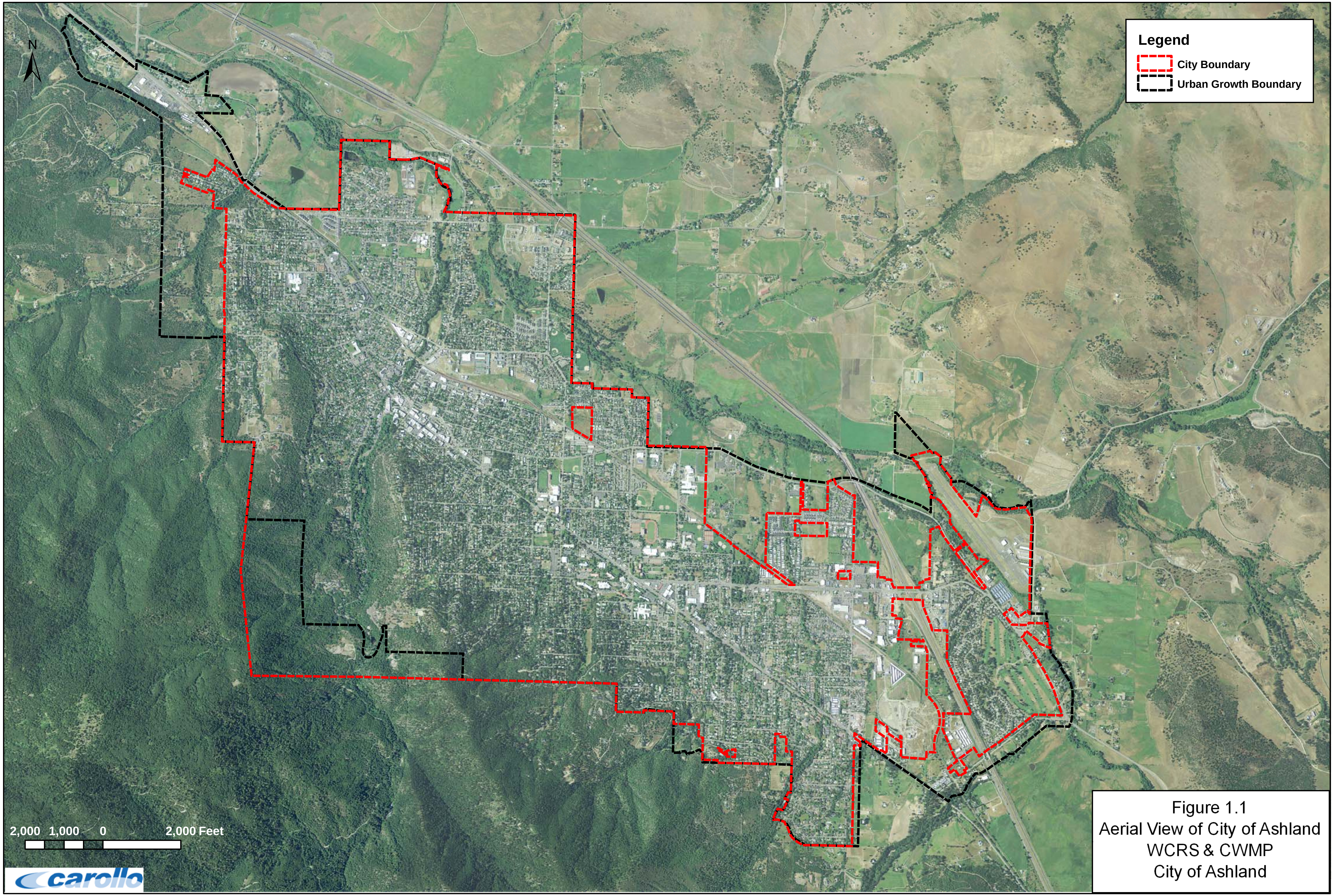


Figure 1.1
Aerial View of City of Ashland
WCRS & CWMP
City of Ashland

1.5 EXISTING FACILITIES

The Ashland water system comprises Reeder Reservoir, the Water Treatment Plant, four reservoirs, four pump stations, 32 pressure-reducing valve (PRV) stations, and over 126 miles of distribution piping. Figure 1.2 shows the location of these facilities and all pipes over 4 inches in diameter. Figure 1.3 shows the system pressure zones and PRV locations, and Figure 1.4 presents a hydraulic profile of the existing system. The following sections provide a brief description of these system components.

1.5.1 Pipes

Table 1.1 presents a summary of the materials and diameters of pipe in the City's distribution system. The City documents pipe data in its Geographical Information Systems (GIS) database. As seen in the table, the pipe sizes range from 2 to 30 inches in diameter; over 50 percent of the system is 6- and 8-inch diameter piping. The piping system is constructed of a wide range of materials, with 80 percent of the water system constructed of ductile iron and cast iron pipe.

In 2007, the City replaced the raw water transmission pipeline from Reeder Reservoir to the WTP with a 30-inch diameter ductile-iron pipeline, and replaced the 24-inch diameter "main feeder" pipeline from the WTP to Crowson Reservoir, the initial point of distribution to the south end of the system.

Three pipes are connected to the 24-inch diameter transmission line between the WTP and Crowson Reservoir. A 16-inch diameter line conveys flow to Granite Reservoir, and a 24-inch diameter line continues down Glenview Drive, crosses Lithia Park and Ashland Creek, and eventually connects to the Strawberry Pump Station and Fallon Reservoir. A third 24-inch diameter pipe continues down Glenview Drive and turns east to connect to a pipe in Ashland Street.

Two distribution pipes deliver flows from the Crowson Reservoir. A 24-inch diameter pipe, serving as an overflow, connects Crowson Reservoir to Granite Reservoir, 250 vertical feet below it. A 20-inch diameter pipe leaving Crowson Reservoir to the northwest diverges into a 16-inch and two 24-inch pipes. The 16-inch line follows the TID right-of-way to the southeast, and serves the southeast area of the City, including the Alsing Reservoir. The Park Estates Pump Station draws from this line. One of the two 24-inch pipes continues north on Terrace Street, conveying water to the central area of the City. The second 24-inch pipe creates a loop by connecting back to the 24-inch pipe in Glenview Drive.

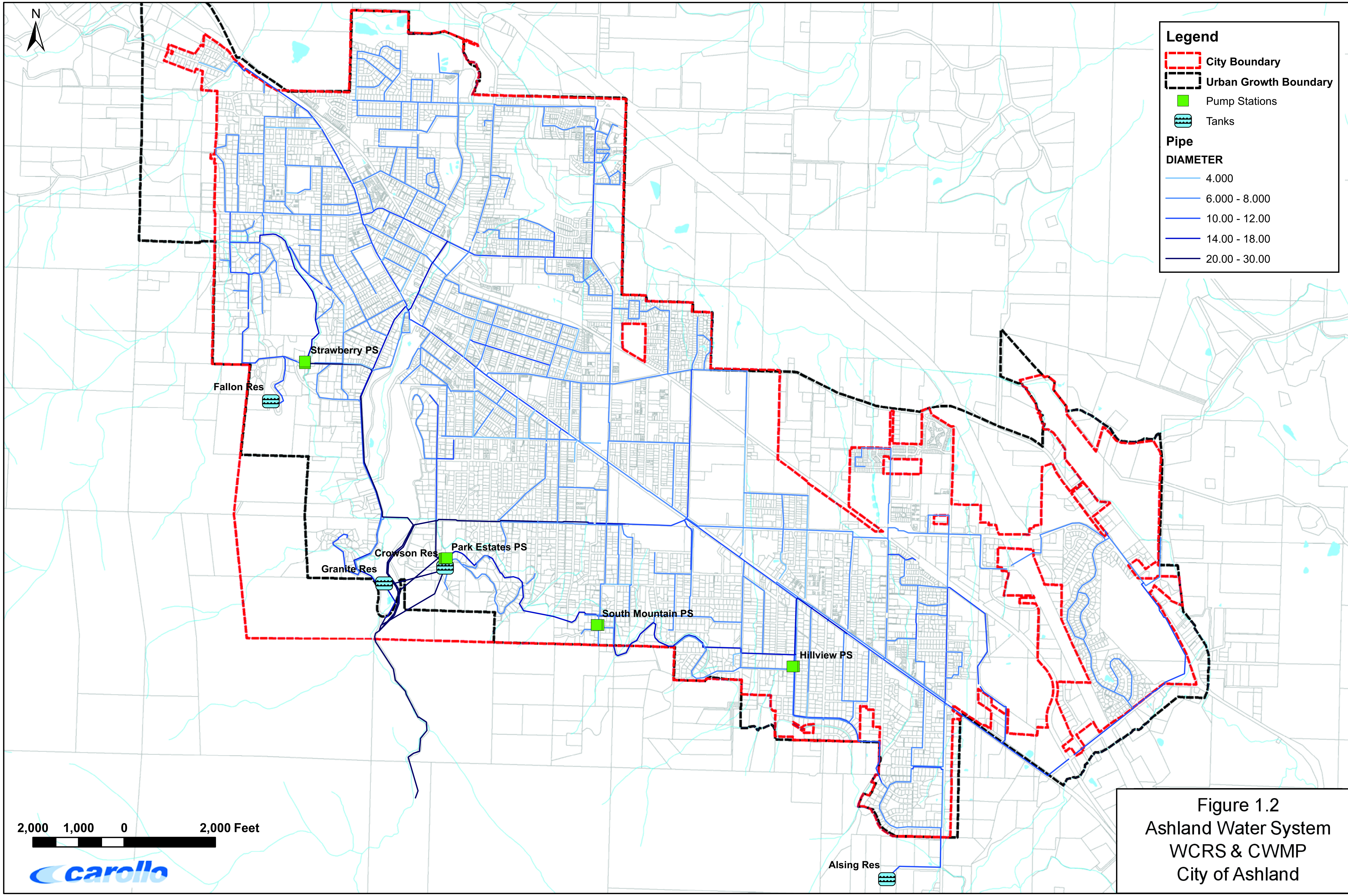


Figure 1.2
Ashland Water System
WCRS & CWMP
City of Ashland

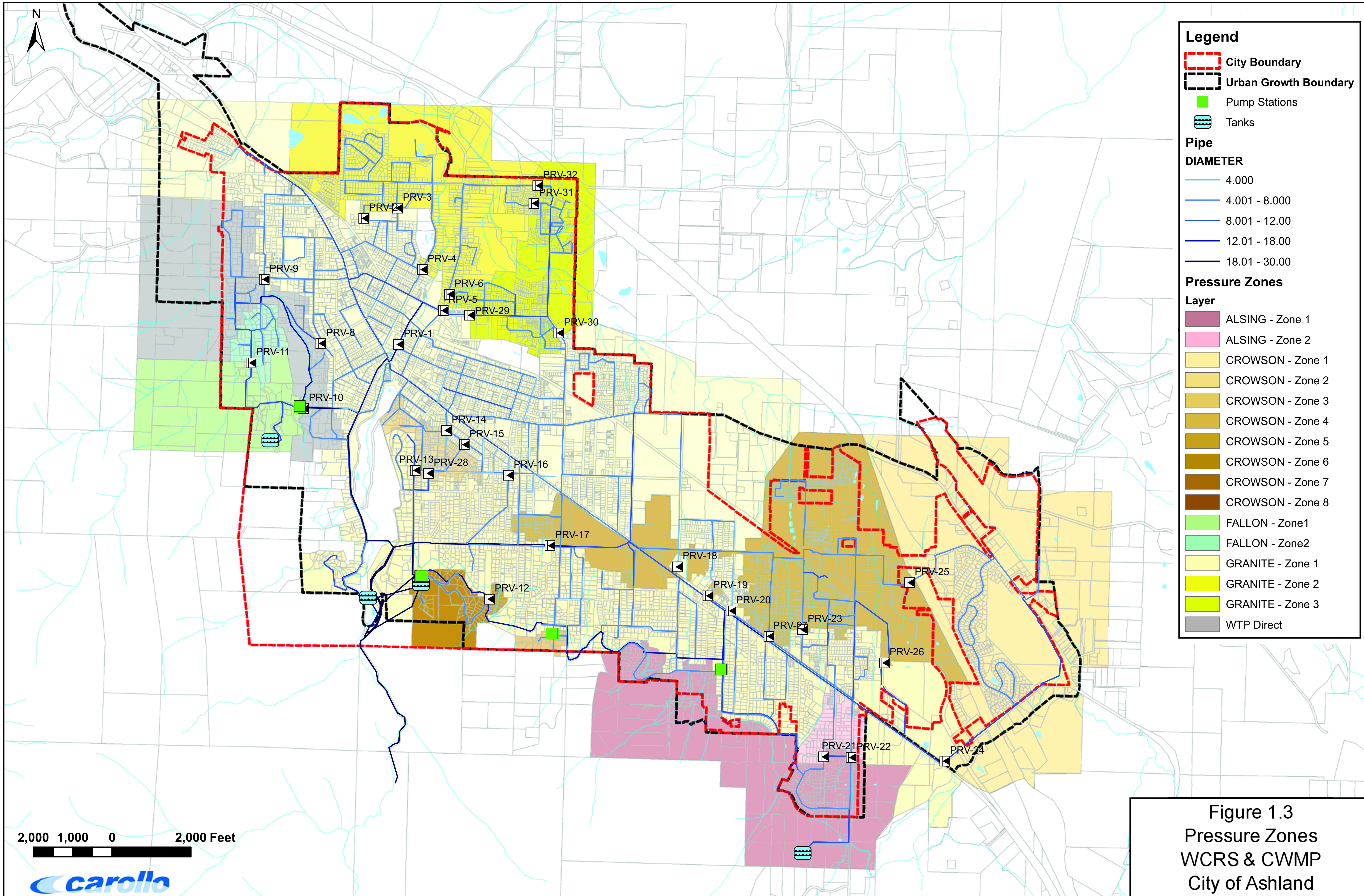


Figure 1.3
Pressure Zones
WCRS & CWMP
City of Ashland

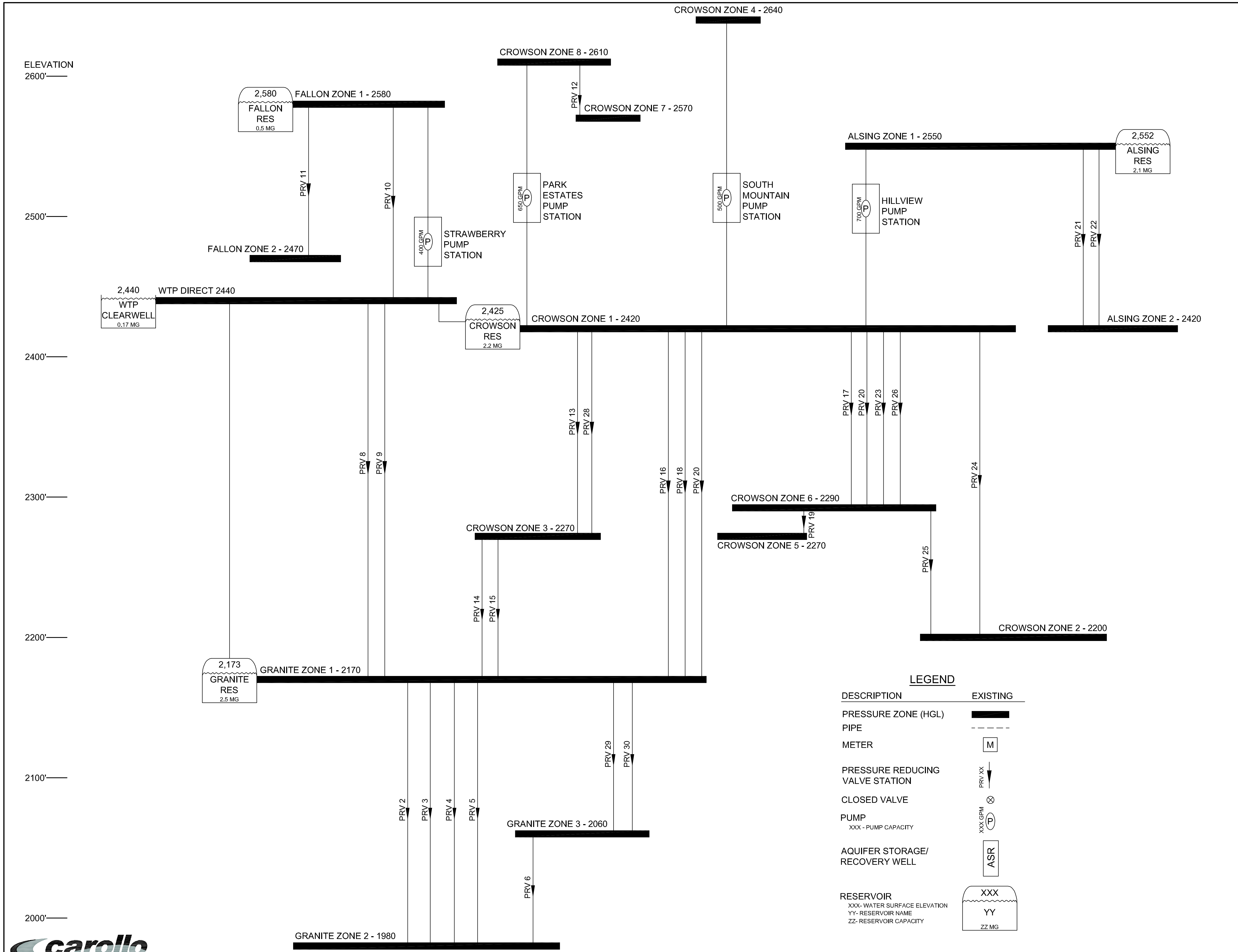


Figure 1.4
Existing System Hydraulic Profile
WCRS & CWMP
City of Ashland

1.5.2 Storage Facilities

The City's storage facilities provide 7.1 MG of storage and include the Crowson, Granite, Fallon, and Alsing Reservoirs. Table 1.2 presents a summary of the reservoirs. Storage is generally provided on the south side of the City, which is higher in elevation than the rest of the City. As stated above, the Crowson Reservoir is the initial point of distribution to the entire City, and provides emergency and peak storage for the Crowson Zones 1 through 6 in the south-central area of the City. The oldest reservoir, the Granite Reservoir is located near Ashland Creek, in the upper area of Lithia Park, and provides emergency and peak storage to the downtown and north-central Ashland area. Located at the top of Hitt Road, the Fallon Reservoir (also referred to as Strawberry Reservoir) serves Fallon Zones 1 and 2 in the northwest area of the City.

Located in the far south of the City, the Alsing Reservoir is filled by the Hillview Pump Station, about a mile and a half away. This reservoir serves Alsing Zones 1 & 2 in the southeast area of the City.

1.5.3 Pump Stations

The City's four distribution system pump stations are summarized in Table 1.3 below. The Hillview Pump Station maintains pressure in Alsing Zone 1 in the southeast of the City, and serves the Alsing Reservoir. The South Mountain Pump Station boosts water to serve several homes in Crowson Zone 4. The Strawberry Pump Station boosts water to Fallon Zone 1 in the hilly northwest area of the City. Lastly, the Park Estates Pump Station serves residents in Crowson Zone 8, along Ashland Loop Road and Morton Street.

1.5.4 Pressure Reducing Valve Stations

Table 1.4 summarizes the City's 32 PRV stations. Most of the PRV stations are equipped with two different sized PRVs, allowing low flows under normal operating conditions and higher flows under fire flow or emergency conditions.

1.5.5 Pressure Zones

As seen in Figure 1.3, the City's water system comprises five major service areas, named after the storage tanks that serve them. The boundaries of the pressure zones in each of the service areas are defined by a combination of PRV stations, closed valves, and booster pump stations. Crowson Zones 1 through 8 are served from the Crowson Reservoir, Granite Zones 1 through 3 are served from the Granite Reservoir, Alsing Zones 1 and 2 are served from the Alsing Reservoir, and Fallon Zones 1 and 2 are served from the Fallon Reservoir. The WTP Direct Zone is served from the 24-inch pipe that extends down Granite Street, bypassing the Granite Reservoir. The zones are delineated based on properties served by pipes within that pressure zone. Figure 1.4 presents the relative elevations of the hydraulic grade line (HGL) of each pressure zone.

Table 1.1 Existing Pipe Lengths by Diameter and Material

Diameter	Length (feet)											Percentage (%)
	Asbestos Cement (AC)	Cast Iron Pipe (CIP)	Copper	Ductile Iron (DIP)	Galvanized	HDPE	Polyvinyl Chloride (PVC)	Steel	Tile	Unknown	Total	
¾-inch	0	0	0	0	0	0	0	0	0	2,298	**2,298**	0.3%
2-inch	0	594	30	72	5,828	0	15,868	0	0	9,594	**31,986**	4.8%
3-inch	0	0	0	0	0	0	0	0	0	180	**180**	0.0%
4-inch	996	93,924	0	5,115	687	0	0	2,061	0	11,914	**114,696**	17.2%
6-inch	7,907	115,187	0	74,770	0	0	0	1,020	19	14,787	**213,690**	32.1%
8-inch	0	32,718	0	125,969	0	0	1,204	84	0	16,947	**176,922**	26.6%
10-inch	0	4,595	0	11,379	0	0	0	786	0	489	**17,248**	2.6%
12-inch	0	2,917	0	42,740	0	0	0	6,623	0	4,462	**56,742**	8.5%
14-inch	0	0	0	0	0	0	0	1,927	0	612	**2,539**	0.4%
16-inch	0	0	0	19,627	0	0	0	3,726	0	45	**23,397**	3.5%
18-inch	0	0	0	0	0	0	0	0	0	92	**92**	0.0%
20-inch	0	0	0	3,384	0	0	0	0	0	0	**3,384**	0.5%
24-inch	0	0	0	9,769	0	1,084	0	1,533	0	526	**12,912**	1.9%
30-inch	0	0	0	4,899	0	0	0	0	0	0	**4,899**	0.7%
Unknown	0	0	0	0	0	0	0	0	0	5,280	**5,280**	0.8%
Total	**8,903**	**249,936**	**30**	**297,724**	**6,515**	**1,084**	**17,072**	**17,759**	**19**	**67,225**	**666,267**	**100.0%**
Percentage (%)	1.3%	37.5%	<0.1%	44.7%	1.0%	0.2%	2.6%	2.7%	<0.1%	10.1%	100.0%	

Table 1.2 Existing Storage Facilities

Reservoir	Capacity (MG)	Type	Year Constructed	Diameter (ft)	Height (ft)	Ground Elevation (ft)	Overflow Elevation (ft)	Altitude Valve Setpoint	Location
Crowson	2.1	Buried Tank	1997	(1)	19.9	2,406	2,425	N/A	SW corner of Ashland Loop Road and Terrace Street
Alsing	2.1	Above-Ground Tank	1984	107	31	2,530	2,559	N/A	End of unnamed road between Morninglight Drive and Green Meadows Way off Tolman Creek Road
Fallon	0.5	Above-Ground Tank	1994	58	25.5	2,560	2,586	N/A	Hitt Road, ~0.3 miles south of Strawberry Lane
Granite	2.1	Above-Ground Tank	1948	134	28	2,145	2,173	2,169	Granite Street between Ashland Creek Drive and Glenview Drive
Total	**6.8**								

Notes:
1. Reservoir has an oval shape with a cross-sectional area of 13,813 SF.

Table 1.3 Pump Stations

Pump Station	Pump No.	HP	Rated Capacity[1] (gpm)	Rated Head[1] (ft)	Firm Capacity[2] (gpm)	Year Constructed/ Rehabilitated	Pump Manufacturer & Model No.	Pump RPM	Motor Manufacturer & Model No.	Emergency Power Connection[3]	Location	Supply To
Hillview	1	30	350/650	300/200	650	1984	Queen Pump HE Vertical	1760	GE5K6235XM546R	Yes	Hillview Drive and Peachey Road	Alsing Reservoir; Alsing Zone 1
	2	30	350/650	300/200			Queen Pump HE Vertical	1760	GE5K6235XM546R			
South Mtn	1	15	100/145	270/220	145	Unknown	Berkley BI ½ ZPH	3490	US Motors C524AUO4UO5OR136F	Yes	South Mountain Avenue and Ivy Lane	Crowson Zone 4
	2	40	400/600	260/200			Cornell 2 ½ YHB-40-2	3535	GE 5K286JL1101A			
Straw-berry	1	40	200	192	200	1994	PACO UM93B00 18801B	1760	BALDOR M2539T-B	Yes	Nutley Street and Ditch Road	Fallon Zones 1 & 2
	2	40	200	192			PACO UM93B00 18801A	1760	BALDOR M2539T-B			
Park Estates	1	10	50	215	150	Unknown	PACO 10-1595.1 LC	3500	BALDOR EJMM3312T	Yes	Ashland Loop Road and Terrace Street	Crowson Zone 8
	2	15	100	215			PACO B2MAGYGP60522	3515	BALDOR SK2150LI538A			
	3	40	500	215			PACO 02GYGP60521	3525	BALDOR 40E171144			

Notes:
1. At design point.
2. Firm capacity is the total capacity with the largest pump out of service.
3. Emergency power is provided by a connection to an auxiliary power source. No pump stations are equipped with onsite power generation.

Table 1.4 Pressure Reducing Valves

PRV (by downstream zone)[1]	Elevation (ft)	Size (Inch)	Downstream Pressure Setpoint (psi)	Location; Comments
PRV-01	1,866	3	127	Water & B St.
PRV-02	1,800	4	76	Elizabeth & Otis
		1.5	83	
PRV-03	1,791	4	80	Laurel & Randy
		2	87	
PRV-04	1,824	6	74	Helman & Orange
PRV-05	1,845	4	60	Oak & Hersey
		1.5	67	
PRV-06	1,834	6	55	Crispin & Oak
		1.5	60	
PRV-08	2,093	8	38	Grandview & Scenic
		3	45	
PRV-09	2,095	6	38.5	Walnut & Wimer
		2	45	
PRV-11	2,306	8	70	Westwood
		4	75	
PRV-12	2,377	4	83	Morton & Waterline Rd.
		2	90	
PRV-13	2,168	8	45	Iowa &Terrace
		2	54	
PRV14	1,988	6	65	Gresham & Allison
PRV-15	1,978	8	85	Union & Allison
PRV-16	1,975	6	81	Morton & Iowa
PRV-17	2,059	10	90	1067 Ashland
		6	98	
PRV-18	2,017	6	56	Walker & Siskiyou
		2	63	
PRV-19	2,057	2	93	Harmony & Siskiyou
PRV-20	2,060	6	55	Normal & Siskiyou
		2	60	
PRV-21	2,236	6	77	Bellview & Miranda
PRV-22	2,208	8	95	Tolman & Moranda
PRV-23	1,990	6	92	842 Clay St.
		2	98	
PRV-24	2,137	10	30	Crowson Road
		4	35	
PRV-25	1,998	6	85	Washington & Ivy
		2	90	

Table 1.4 Pressure Reducing Valves

PRV (by downstream zone)[1]	Elevation (ft)	Size (Inch)	Downstream Pressure Setpoint (psi)	Location; Comments
PRV-26	2,086	10	90	Mistletoe Road
		4	97	
PRV-27	2,078	4	93	Faith & Siskiyou
		1.5	100	
PRV-28	2,110	8	70	Meade & Iowa
		4	76	
PRV-29	1,841	10	90	Hersey Street
		3	105	
PRV-30	1,789	6	120	Mountain Ave
		2	135	
PRV-31	1,809	6	82	Fair Oaks
		2	87	
PRV-32	1,793	6	82	Nevada
		2	85	

Notes:
1. Data updated by survey of PRVs in June 2010 by Terra Survey, Inc.

1.5.6 Existing Water Treatment Plant

The City's Water Treatment Plant (WTP) is located along Ashland Creek, approximately one mile below Reeder Reservoir. Figure 1.5 provides a schematic of the WTP process. The WTP has a capacity of approximately 7.5 mgd, based on the plant's historical performance and input from operations staff. The following sections describing the history of the WTP were updated from the 1991 Comprehensive Water Plan.

Prior to 1948, screening and chlorination were the only treatment given to Ashland Creek water. In 1948, a rapid sand filtration plant was built adjacent to the power generating facility, utilizing alum as a coagulant and lime for pH control. The water treatment plant was converted to a high rate filtration plant in the mid-1960s.

The treatment process now consists of flocculation, filtration, and disinfection. Water flows into the treatment plant from a combination of three sources: (1) diversion water from the power generator (2) direct flows from Ashland creek, and (3) flows from the TID intertie. The water flows through a flash mixing process, then to the flocculation basins. The high rate filtration plant continues utilizing alum as a coagulant to aid particle agglomeration and soda ash for alkalinity adjustment and pH control. A chlorine solution is fed immediately ahead of the flocculation tanks. The chlorine feed is adjusted in response to the water temperature. Following flocculation, the water flows through the filter beds and then into a 168,000 gallon clearwell where the water is chlorinated and distributed to the system.

Alum, sodium hypochlorite, soda ash, and activated carbon can be mixed with the raw water in the flash mixing tank as part of the treatment process to aid in the removal of solid particles and other contaminates. The activated carbon is used only when TID water is included in the system or the color is high. Color may be the result of organic matter, manganese, copper, or iron in the water. The activated carbon absorbs the organic material in the raw TID water, which removes the water color.

New mechanical flocculators were recently installed in the flocculation basins. Sediment from the flocculation chamber and the filter backwash waste is piped to a sludge lagoon. The six filters contain a dual media filter material of sand and anthracite coal. These filters remove the remaining particles in the water before it enters the clearwell. Backwash water for the filters is pumped from the clearwell.

Administration and laboratory facilities are located in the control building. The laboratory has the necessary equipment to conduct routine water quality analysis. All of the records prior to 1990 were developed and maintained manually. A computer system was installed in early 1990 for generating reports and for storing data.

The water treatment plant produces water that meets State and Federal water quality standards.

1.6 SYSTEM OPERATIONS

Table 1.5 presents the current system operational controls for the City's reservoirs and pump stations.

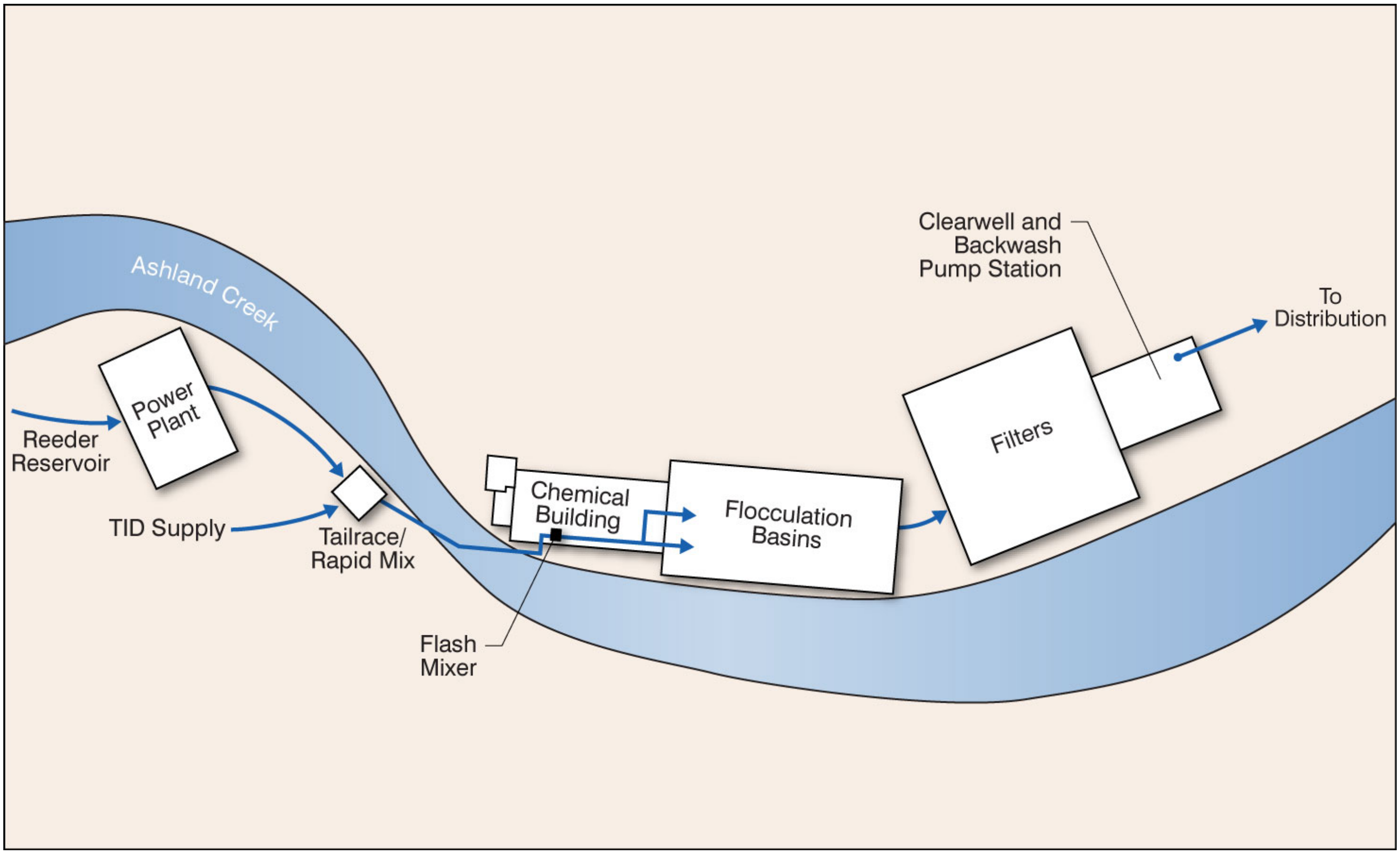


Figure 1.5
Water Treatment Plant
Schematic
WCRS & CWMP
City of Ashland

carollo

Table 1.5 System Operational Control

Source	Called By	Winter On	Winter Off	Summer On	Summer Off
Pump Stations					
Hillview – Pump 1	Alsing Res	8 ft	10 ft	18 ft	22 ft
Hillview – Pump 2	Alsing Res	8 ft	10 ft	18 ft	22 ft
South Mtn – Pump 1	Pressure in Crowson Zone 4	N/A	N/A	N/A	N/A
South Mtn – Pump 2	Pressure in Crowson Zone 4	N/A	N/A	N/A	N/A
Strawberry – Pump 1	Strawberry Res	19 ft	22 ft	19 ft	22 ft
Strawberry – Pump 2	Strawberry Res	14 ft	22 ft	22 ft	22 ft
Park Estates – Pump 1	Pressure in Crowson Zone 8	N/A	N/A	N/A	N/A
Park Estates – Pump 2	Pressure in Crowson Zone 8	N/A	N/A	N/A	N/A
Park Estates – Pump 3	Pressure in Crowson Zone 8	N/A	N/A	N/A	N/A

CHAPTER NO. 2

LEVEL OF SERVICE GOALS

2.1 INTRODUCTION

The purpose of this chapter is to summarize the Level of Service (LOS) Goals that were established as the foundation of the analyses conducted for both the Comprehensive Water Master Plan (CWMP) and the accompanying Water Conservation and Reuse Study (WCRS). To support both studies, the City established both an Ashland Water Advisory Council (AWAC) and a Technical Review Committee (TRC). This chapter describes these two groups, the LOS goals used to select a water supply package in the WCRS, and the LOS goals used for the system analysis for the CWMP.

2.2 ORGANIZATIONAL OVERVIEW

The role of the AWAC is to serve as an advisory group to the Council and the City's water staff, providing a link with the community and involving impacted persons and interest groups with the WCRS and CWMP. The TRC is intended to provide technical review and input to the consultant's work, supporting the AWAC and Council in their decision-making processes. The AWAC was established in accordance with the City of Ashland's committee policies and was intended to be in existence throughout development and implementation of the water supply program. The AWAC's authority was limited to collecting information, conducting analyses and making recommendations.

2.3 WCRS LEVEL OF SERVICE GOALS

One of the main roles of the AWAC is to establish LOS goals for the water supply evaluation conducted for the WCRS. The AWAC established goals in four areas, as summarized in Table 2.1.

Table 2.1 Selected LOS Goals

Goal Area	**Goal**
Water System Capacity	Have sufficient supply to meet projected demands that have been reduced based on 5 percent additional conservation. However, City will have a goal of achieving 15 percent conservation.
Water System Reliability	Community will accept curtailments of 45 percent during a severe drought.
Water System Redundancy	Implement redundant supply project to restore fire protection and supply for indoor water use shortly after a treatment plant outage.
Regulatory Requirements	Meet or exceed all current and anticipated regulatory requirements.

2.4 CWMP LEVEL OF SERVICE GOALS

Additional LOS goals were established by the TRC for the CWMP. The LOS goals described herein are used to evaluate the capacity of the City's treatment and distribution system.

2.4.1 Distribution System Piping

The pipeline criteria are summarized in Table 2.2. The main criteria for evaluating distribution system pipeline capacity are system pressures under fire flow and peak hour conditions. Though reservoirs and pump stations have an impact on pressures within any particular zone, the distribution system piping often has the largest impact in maintaining system pressures under higher water demand conditions. The main criterion of 20 pounds per square inch (psi) under maximum day demands (MDD) plus fire flows was established by the Oregon Department of Human Services (ODHS).

Table 2.2 Distribution System Criteria

Parameter	Criterion
Minimum Service Pressure under Peak Hour Demand	30 psi
Minimum Service Pressure under Peak Day Demand plus Fire Flow	20 psi

2.4.2 Pump Stations

Pump station LOS goals are described in Table 2.3. Pump stations are designed to have sufficient firm capacity to deliver maximum day demands (MDD), with the firm capacity defined as the capacity with the single largest pump out of service. It is assumed that flows in excess of MDD, including diurnal peaks and fire flows, will be met through reservoir storage in each service level. The exception is zones that do not have storage. In these "closed-end" zones, the pump station must have sufficient capacity to provide peak hour demands as well as required fire flows.

Table 2.3 Pump Station Evaluation Criteria

Parameter	Criterion
Capacity for service levels with storage facilities	• Supply Maximum Day Demand to service zone assuming the single largest capacity pump is off line (i.e., firm capacity).
Capacity for service levels with no storage facilities	• Supply Peak Hour Demand and fire flow assuming the single largest capacity pump is off line (i.e., firm capacity).
Power supply	• New pump stations require a main power source and an emergency source. • Secondary power source for new pumps stations to be sized to meet full pump station demands.

2.4.3 Storage

Storage evaluation criteria are summarized Table 2.4. Storage criteria were based on those used for the 2003 Water Master Plan Review (2003 WMP) and the 2006 Water Master Plan Update (2006 Update). Storage is required to meet three functions: operational storage, emergency storage, and fire storage. A brief description of the three types of storage follows the table.

Table 2.4 Storage Evaluation Criteria

Parameter	Criterion
Operational Storage	• 0.25 x Maximum Day Demand of the area served by each reservoir.
Fire Storage	• Provide volume for single most severe required fire flow and duration for each reservoir service area. • System-wide, provide volume for two largest fires.
Emergency Storage	• 0.5 x Maximum Day Demand of the area served by each reservoir.

Operational Storage. Operational storage is used to meet diurnal peaks in excess of maximum day demands. Operational storage should be used throughout the year, not just under maximum day conditions, to control the system water age and maintain disinfectant residuals. The criterion of 25 percent of MDD is typically sufficient both to meet peak demands as well as to provide the required reservoir turnover.

Fire Storage. Fire storage is defined as the volume held in the reservoir for fire fighting and is determined by multiplying the required maximum fire flow rate in gallons per minute (gpm) for a reservoir's service area by the required duration. It is assumed that not more than one maximum fire will occur in any service level at one time. The recommended fire flow rates and durations for the storage analysis are summarized in Table 2.5. The criteria for single-family residential and commercial/industrial are based on the criteria used for the 2006 Water Master Plan Update; an additional category was added for multi-family residential. The required fire storage volumes based on the flows and durations in the table are 0.96 MG for Crowson and Granite Reservoirs and 0.18 MG for Gallon and Alsing Reservoirs. For the entire distribution system, required fire storage was assumed to consist of two commercial fire events of 4,000 gpm for 4 hours, for a total of 1.92 MG.

Table 2.5 Fire Flow Criteria

Land Use (Tax Lot Categories)	**Reservoir Service Areas**	**Required Fire Flow (gpm)**	**Duration (hrs)**
Single-family Residential (LDR, MDR)	All reservoirs	1,500	2
Multi-family Residential (MFR)	Crowson and Granite Reservoirs only	2,500	3
Commercial/Industrial (C, I, HC, NM)	Crowson and Granite Reservoirs only	4,000	4

Notes:
1. LDR – low-density residential; MDR – medium-density residential; MFR – multi-family residential

Emergency Storage. Emergency storage is the volume of water held in reserve at all times to meet demands in the event of a supply failure. Emergency situations may include pipeline failures, pump failures, electrical power outages, or natural disasters. The 2003 WMP used a criterion of 50 percent of MDD, which is equivalent to approximately one Average Day Demand (ADD). Given the City's intent to improve system redundancy, this volume of emergency storage was considered to be sufficient.

CHAPTER NO. 3

POPULATION AND DEMAND PROJECTIONS

3.1 INTRODUCTION

This chapter reviews the City of Ashland's (City's) historic water system demands and projects future demands. Future demands are projected through 2060 using historic per capita usage and population projections in the City's 1981 Comprehensive Plan. The effect of additional water conservation beyond what the City has already implemented on demands is discussed separately in *Chapter 4 - Water Conservation*.

3.1.1 Historic and Projected Populations

3.1.1.1 Historic Population

Historic populations and demands were reviewed to calculate the City's typical per capita usage. The Portland State University Population Research Center (PRC) provides current and historical population estimates for the State of Oregon, its counties, and its cities. Historic population in the City of Ashland is shown in Table 3.1.

Table 3.1 Historic Population

Year	Population Served[1]
2005	20,880
2006	21,430
2007	21,630
2008	21,485
2009	21,505

Notes:
1. Source: Portland State University's Population Research Center.

3.1.2 Projected Population

Population projections from the City's 1981 Comprehensive Plan were used since they are the most recent projections accepted by City Council, and are preferred by the City's Planning Department. The Comprehensive Plan projects an annual increase in population of 187 people. Projected populations are shown in Table 3.2.

Table 3.2 Projected Population

Year	Projected Population[1]
2020	22,846
2030	24,716
2040	26,586
2050	28,456
2060	30,326

Notes:
1. Source: City of Ashland Comprehensive Plan (1981).

The historic population trend has been somewhat higher than the Comprehensive Plan projections, as shown in Figure 3.1. For example, historic population from the PRC shows population in 2009 as 21,505, whereas the population projected in 2009 by the Comprehensive Plan is 20,793. However, given the unknowns inherent in projecting future populations, the Comprehensive Plan projections have been very accurate and City planning staff believes that these projections are representative of long-term trends.

3.2 HISTORICAL AND PROJECTED DEMANDS WITHOUT CONSERVATION

The term “water demand” refers to all the water requirements of the system including residential, commercial, governmental, and unaccounted for water. Unaccounted for water is the difference between the volume of water produced at the water treatment plant and the volume of water billed. It includes system losses (i.e., leakage), incomplete billings due to meter inaccuracies, and non-revenue uses such as pipeline flushing. This section presents the historical and projected demands for the City without taking into account the effects of additional water conservation beyond what the City has already accomplished. It is anticipated that the City will implement additional water conserving measures in the future, as documented in Chapter 4. Hence, actual projected requirements are anticipated to be lower than documented in this chapter.

3.2.1 Historical Demands

The historical water demands are presented in Table 3.3. Note that since these data are based on production data at the water treatment plant, they include unaccounted for water. There are two main types of demands that are evaluated: average day demand (ADD), which is the total usage averaged over a one-year period and maximum day demand (MDD), which is the peak usage observed on any one day of the year. The City’s ADD over the past five years ranged from 2.93 to 3.44 million gallons per day (mgd). The lowest demand year occurred in 2009. During that year, both voluntary and mandatory curtailments were in place during the summer, which likely contributed to overall lower water use when averaged over the year. The City’s MDD over the past five years ranged from 6.50 to 7.17 mgd. The average peaking factor (ratio of MDD to ADD) was 2.06 over the 5-year period, excluding data from 2009. Data from 2009 were excluded from the average due to the curtailments in that year.

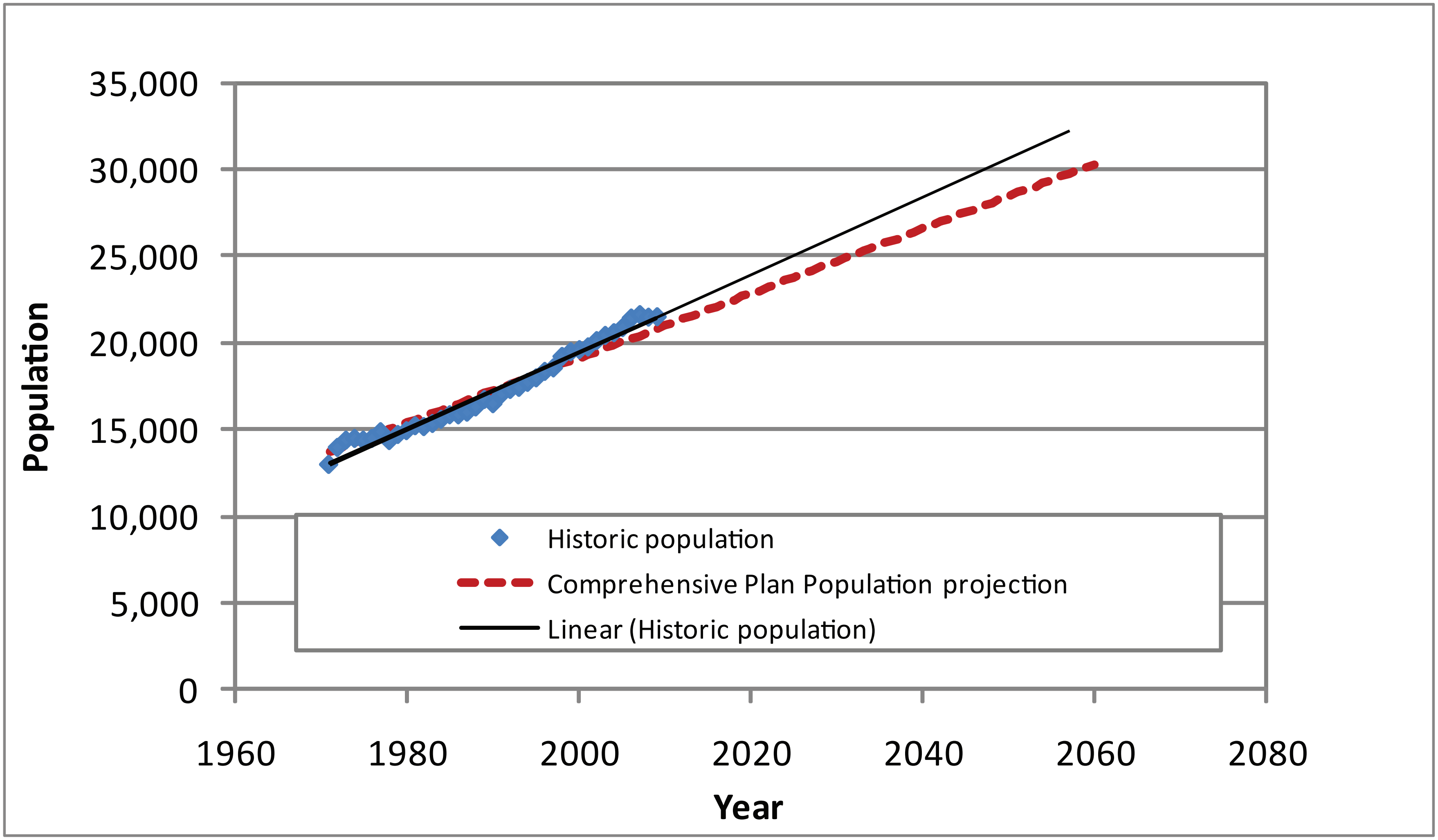


Figure 3.1
POPULATION PROJECTIONS
WCRS and CWMP
City of Ashland

Table 3.3 Historical Water Demands

Year	Average Day Demands[1] (mgd)	Maximum Day Demands[1] (mgd)	Peaking Factor (Max Day/Avg Day)
2005	3.33	7.17	2.15
2006	3.44	7.04	2.04
2007	3.33	6.96	2.09
2008	3.28	6.50	1.98
2009	2.93	6.74	2.30
Average[(2)]	**3.35**	**6.92**	**2.06**

Notes:

1. Source: Ashland Water Treatment Plant production data for finished water; this number includes Unaccounted for Water, or losses.
2. Excluding 2009 because of voluntary and mandatory curtailment in that year.

Average annual per capita demands were calculated based on two sets of data. First, usage was calculated based on production at the water treatment plant (supply). These data include unaccounted for water. Usage was also calculated based on historical billings; these data do not include unaccounted for water.

Per capita demands including unaccounted for water are presented in Table 3.4. These data are based on the average day production at the water treatment plant, as presented in Table 3.3, and the historical population, as presented in Table 3.1. The average per capita demand over the 5-year period was 157 gpcd. Data from 2009 were again excluded in the calculation of the average demands due to curtailments.

Table 3.4 Historical Per Capita Demands Based on Supply

Year	Average Day Demands[1] (mgd)	Population	Per Capita Demands (gpcd)
2005	3.33	20,880	160
2006	3.44	21,430	161
2007	3.33	21,630	154
2008	3.28	21,485	153
2009	2.93	21,505	137
Average[(2)]	**3.35**		**157**

Notes:

1. Source: Water Treatment Plant production data for finished water; this number includes Unaccounted for Water, or losses.
2. Excluding 2009 because of voluntary and mandatory curtailment in that year.

Average annual per capita demands were also calculated excluding unaccounted for water, as shown in Table 3.5. These data are based on City billing data and the historical population, as presented in Table 3.1. The average per capita demand over the 5-year period was 144 gpcd. Data from 2009 were again excluded due to curtailments.

Table 3.5 Historical Per Capita Demands Based on Historical Billing Data

Year	Average Day Demands[1] (mgd)	Population	Number of Accounts[1]	Per Capita Demands (gpcd)
2005	2.96	20,880	8,099	142
2006	3.17	21,430	8,428	148
2007	3.11	21,630	8,524	144
2008	3.04	21,485	8,608	142
2009	2.93	21,505	8,659	136
Average[(2)]	**3.07**		**8,415**	**144**

Notes:
1. Source: City billing data; excluding TID water and unaccounted for water.
2. Excluding 2009 because of voluntary and mandatory curtailment in that year.

The City also bills for Talent Irrigation District (TID) water served to properties in the lower portion of the Ashland Canal. Some properties within the City limits along the upper portions of the Ashland Canal are billed directly by TID. TID water is not produced at the City's water treatment plant, and is therefore not reflected in Tables 3.4 or 3.5.

3.2.2 Projected Demands without Additional Water Conservation

Estimates of future water demand were developed based on historic consumption and population forecasts presented in earlier sections. Current (2009) estimates are based on the current (2009) PRC population data. Projected average daily water demands are developed by multiplying the estimated per capita usage by the forecasted population for a given year. The projected demands presented in this memorandum do not consider the demand reductions expected due to additional water conservation beyond what the City is already achieving.

Table 3.6 presents the projected demands including unaccounted for water. These projections are based on an average per capita water use of 157 gpcd, as calculated in Table 3.4 above. The average day demands were then multiplied by the average peaking factor of 2.06, as calculated in Table 3.3 above, to calculated projected MDD. Resulting MDD projections ranged from a current demand of 6.92 mgd up to 9.81 mgd in 2060.

Table 3.6 Projected Water Demands, Including Unaccounted for Water, No Additional Conservation

Year	Projected Average Day Demands (mgd)	Projected Max Day Demands (mgd)[1]
2009 (current)	3.35	6.92
2020	3.59	7.40
2030	3.88	7.99
2060	4.76	9.81

Notes:
1. Max Day Demand = Average Day Demand * Peaking Factor.

Table 3.7 presents the projected demands excluding unaccounted for water. These projections are based on an average per capita water use of 144 gpcd, as calculated in Table 3.5 above. The average day demands were then multiplied by the average peaking factor of 2.06, as calculated in Table 3.3 above, to the calculated projected MDD. Resulting MDD projections ranged from a current demand of 6.40 mgd up to 9.03 mgd in 2060.

Table 3.7 Projected Water Demands, Excluding Unaccounted for Water, No Additional Conservation

Year	Projected Average Day Demands (mgd)	Projected Max Day Demands (mgd)[1]
2009 (current)	3.07	6.40
2020	3.29	6.78
2030	3.56	7.36
2060	4.37	9.03

Notes:
1. Maximum Day Demand = Average Day Demand * Peaking Factor.

The overall projections are shown in Figure 3.2. As noted above, these projections do not include the impact of additional conservation beyond what the City is already achieving. The impact of conservation on projected demands is evaluated in *Chapter 4 – Water Conservation*.

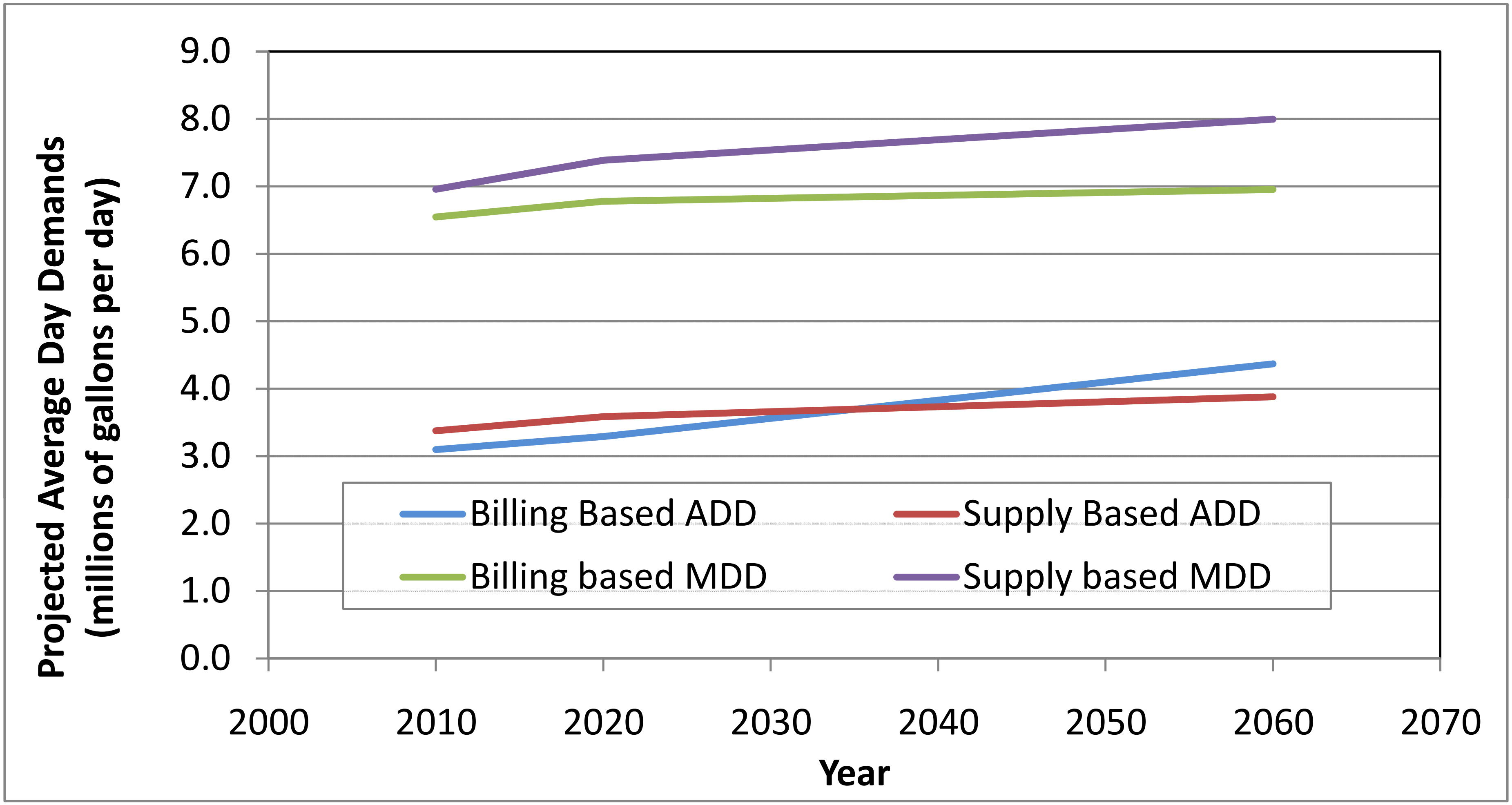


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Figure 3.2
PROJECTED DEMANDS
WCRS and CWMP
City of Ashland

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CHAPTER NO. 4

WATER CONSERVATION

4.1 INTRODUCTION

This chapter documents the City's current water conservation efforts, historical water use trends, water losses, consumption by customer category, comparison of the City's water use with other communities, and conservation goals for the future. Finally, it documents the projected demands after the effect of water conservation is taken into consideration.

Water conserving rate structures are discussed in the Financial Plan chapter and will be developed later in the project. Staffing needs are discussed in the Operations and Maintenance chapter.

4.2 LEVEL OF SERVICE GOALS

The assumed demands for the existing supply analysis are based on the level of service goals established by the Ashland Water Advisory Council (AWAC), as discussed in *Chapter 2 – Level of Service Goals*. There are two key goals that impact the projected demands:

1. Water System Capacity – The raw water supply system must be capable of meeting projected demands that have been reduced based on 5 percent conservation in addition to conservation already being achieved by the City. However, the City will have a goal of achieving 15 percent additional conservation.

2. Water System Reliability – The raw water supply system must be capable of meeting projected demands assuming 45 percent mandatory curtailments during a severe (approximately 1 in 100-year) drought, in addition to planned conservation levels.

Though it was originally intended that the level of service goals would be established prior to initiating the supply evaluation, additional information was needed to support the AWAC in selecting a level of service goal for raw water supply capacity. As such, this chapter describes projected demands for three different potential conservation levels: 5, 10 and 15 percent conservation in addition to the conservation already achieved by the City.

4.3 CURRENT CONSERVATION PROGRAMS

In the past, the City has implemented various measures to conserve water, such as rebates for ultra low flow and high efficiency toilets, low flow showerheads, efficient washing machines, and dishwashers. Additionally, the City conducts irrigation audits, performs leak detection, and promotes water conservation through its rates and codes. Table 4.1 summarizes the City's programs and water savings through the years 2005 and 2007. In both cases, the savings are cumulative from initiation of the conservation program. Hence, 2005 values document all the water savings the City has accrued since the initiation of its conservation program, including the year 2005. The values of 2007 consist of 2005 values plus additional savings from 2006 and 2007.

Table 4.1 Past Conservation Measures		
Measure	**Water savings in 2005[1] (gpd)**	**Water savings in 2007[1] (gpd)**
Toilet rebates	54,600	57,200
Showerhead rebates	40,420	41,070
Washing machine rebates	29,260	33,600
Dishwasher rebates	5,160	6,000
Irrigation audit	9,800	15,600
Leak detection	125,000	125,000
Rates	135,000	135,000
Codes	25,000	25,000
New technology[2]	15,000	15,000
Total water savings (gpd)	**439,240**	**453,470**

Notes:
1. Information from City staff.
2. Park's irrigation system.

4.4 HISTORICAL WATER SAVINGS THROUGH CONSERVATION

4.4.1 Per Capita Demands

Calculation of per capita demands is useful to compare trends of water use over time, and compare Ashland's water use with other communities. There are two ways to calculate per capita demands – based on the amount of water produced, and based on the amount of water consumed. Both these amounts are metered and recorded by the City. Per capita calculation based on the water produced, also known as "supply based per capita" is done by dividing production at the water treatment plant by total population. This calculation will inherently include the amount of water that is lost through the distribution system. These losses, known as unaccounted for water (UFW), are not captured in the per capita demands calculated using the water consumed. The "billings based per capita" is calculated from City billing records and does not include UFW.

Over the last five years, there has been a significant decrease in the amount of water produced per capita. However, there has not been a significant decrease in the amount of water billed per capita. This does not mean that the City's conservation measures are not working, rather it indicates improved metering and reduction in water losses. Losses are discussed further herein.

Table 4.2 shows historic per capita consumption rates based on supply and billing. Figure 4.1 shows this information graphically. Both values show decreased usage in 2009, which can be attributed to the voluntary and mandatory curtailments in that year.

Table 4.2 Historical Per Capita

Year	Supply Based Per capita Demands[1]	Billings Based Per Capita Demands[2]
2005	160	142
2006	161	148
2007	154	144
2008	153	142
2009	137	136
Average[3]	**157**	**144**

Notes:
1. Finished water data from City's water treatment plant.
2. Billing data from City staff.
3. The average does not include data from 2009 because of voluntary and mandatory curtailments in that year.

4.5 UNACCOUNTED FOR WATER

As discussed above, the difference between the water produced and the water billed is termed unaccounted for water (UFW). UFW includes leakage from the distribution system, metering inaccuracies, and non-metered City uses (e.g., pipeline flushing). Table 4.3 shows the percentage of UFW over the analysis period.

The average UFW over the 5-year period was 8.4 percent, excluding data from 2009. The City has maintained a UFW percentage of less than 10 percent, which is considered the industry standard for water conservation, in all years except 2005. As noted above, the City has seen a significant decrease in UFW over the past 10 years. This is likely due to two factors: (1) maintenance and replacement of old meters (which tend to under-read over time) and (2) pipeline improvements that have reduced leakage. The UFW was extremely low (0.5 percent) in 2009. Such a low value is unexpected and likely reflects an inaccuracy in metering of either produced or billed water.

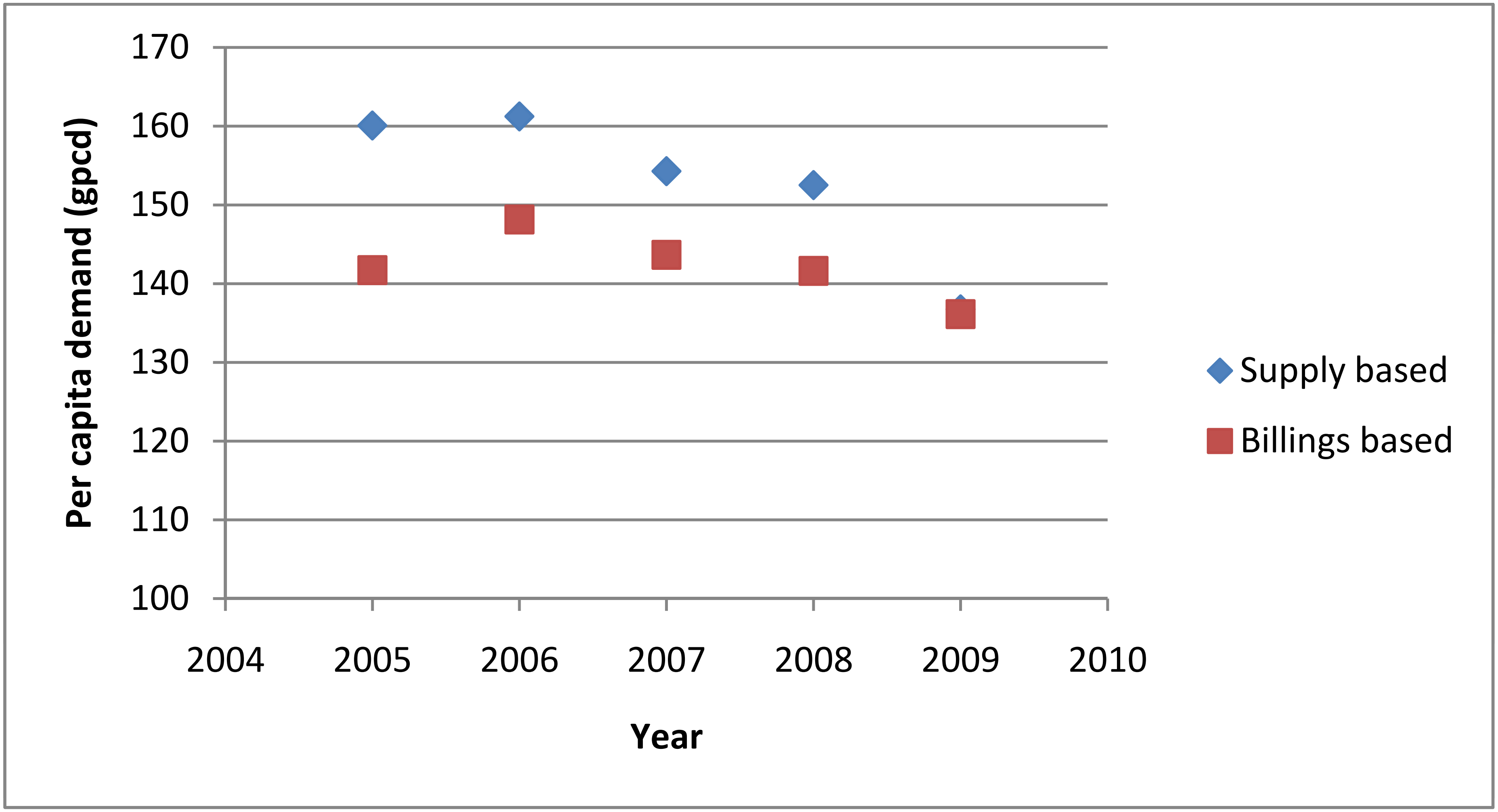

Figure 4.1
HISTORICAL PER CAPITA DEMANDS
WCRS and CWMP
City of Ashland

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Table 4.3 Historic Unaccounted For Water

Year	Water Produced[1] (MG)	Water Billed[2] (MG)	Unaccounted for Water[3] (%)
2005	1220	1080	11.5
2006	1261	1159	8.1
2007	1218	1134	6.9
2008	1196	1111	7.1
2009	1073	1069	0.5
Average[4]	**1224**	**1121**	**8.4**

Notes:
1. Source: Water Treatment Plant production data.
2. City billing data.
3. Calculated percentage of losses.
4. The average does not include data from 2009 because of voluntary and mandatory curtailments in that year.

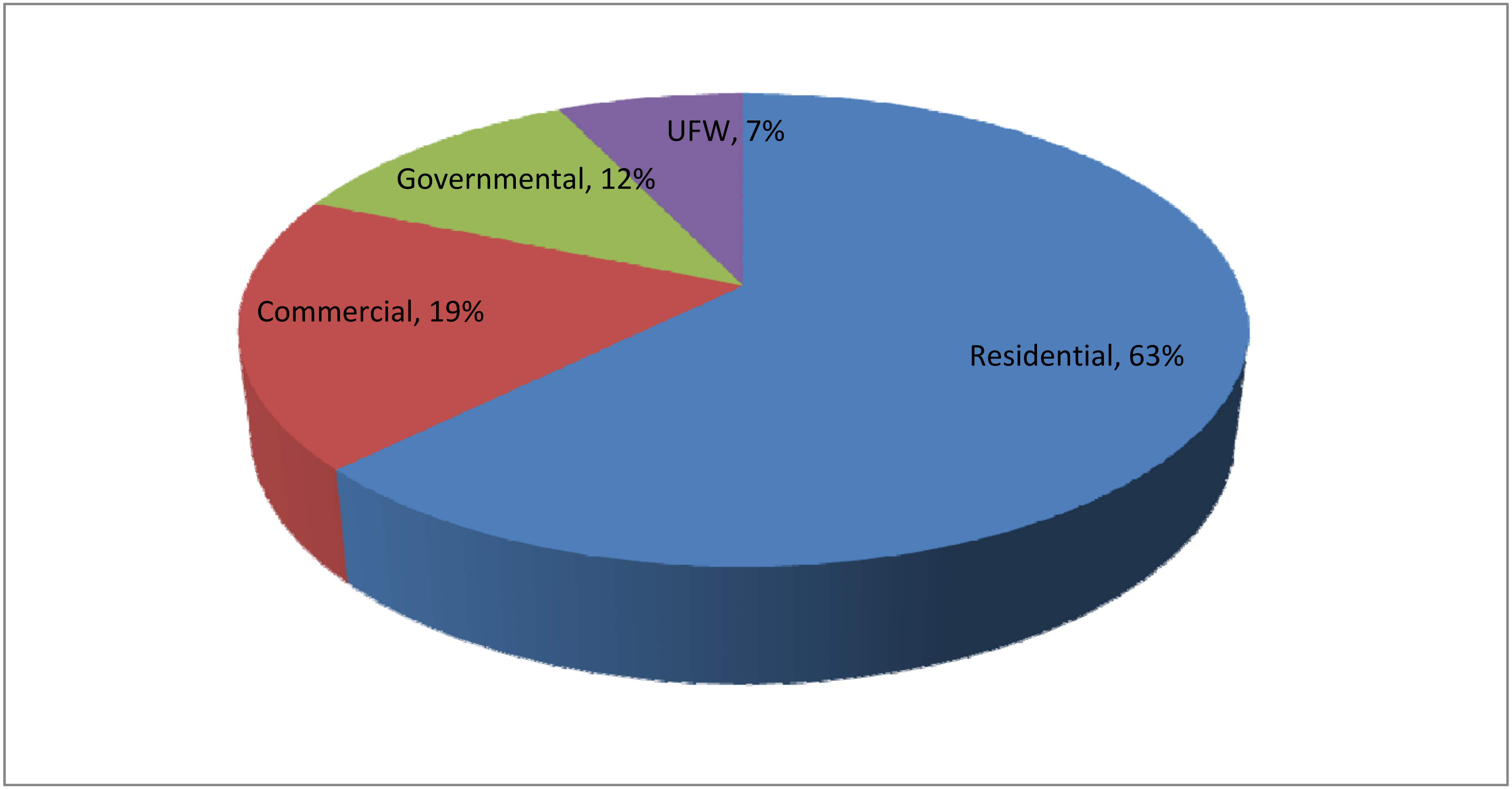
4.6 WATER USE PATTERNS

4.6.1 Customer Categories

The City bills four kinds of users separately – residential, commercial, governmental, and some TID accounts. Given Ashland's land use makeup, residential water uses constitute the majority of the City's water use, followed by commercial, and then governmental. Figure 4.2 shows a typical breakdown of water uses amongst the City's customer classes. The percentage of UFW is also shown.

4.6.2 Indoor Versus Outdoor

An analysis of indoor versus outdoor uses helps City staff track water use and target water-conserving measures most effectively. To evaluate indoor versus outdoor uses, a monthly water use analysis was performed. Figure 4.3 shows the average daily demand by month over the year. As can be seen from Figure 4.3, the water use in Ashland is highly influenced by the season, with peak usage occurring around July, and minimum usage occurring during the December through March period. This pattern is typical for municipal water systems.



NOTE: 2008 data was used to generate the figure as it was most representative of average years.

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Figure 4.2
WATER USE BY CUSTOMER CLASS
WCRS and CWMP
City of Ashland

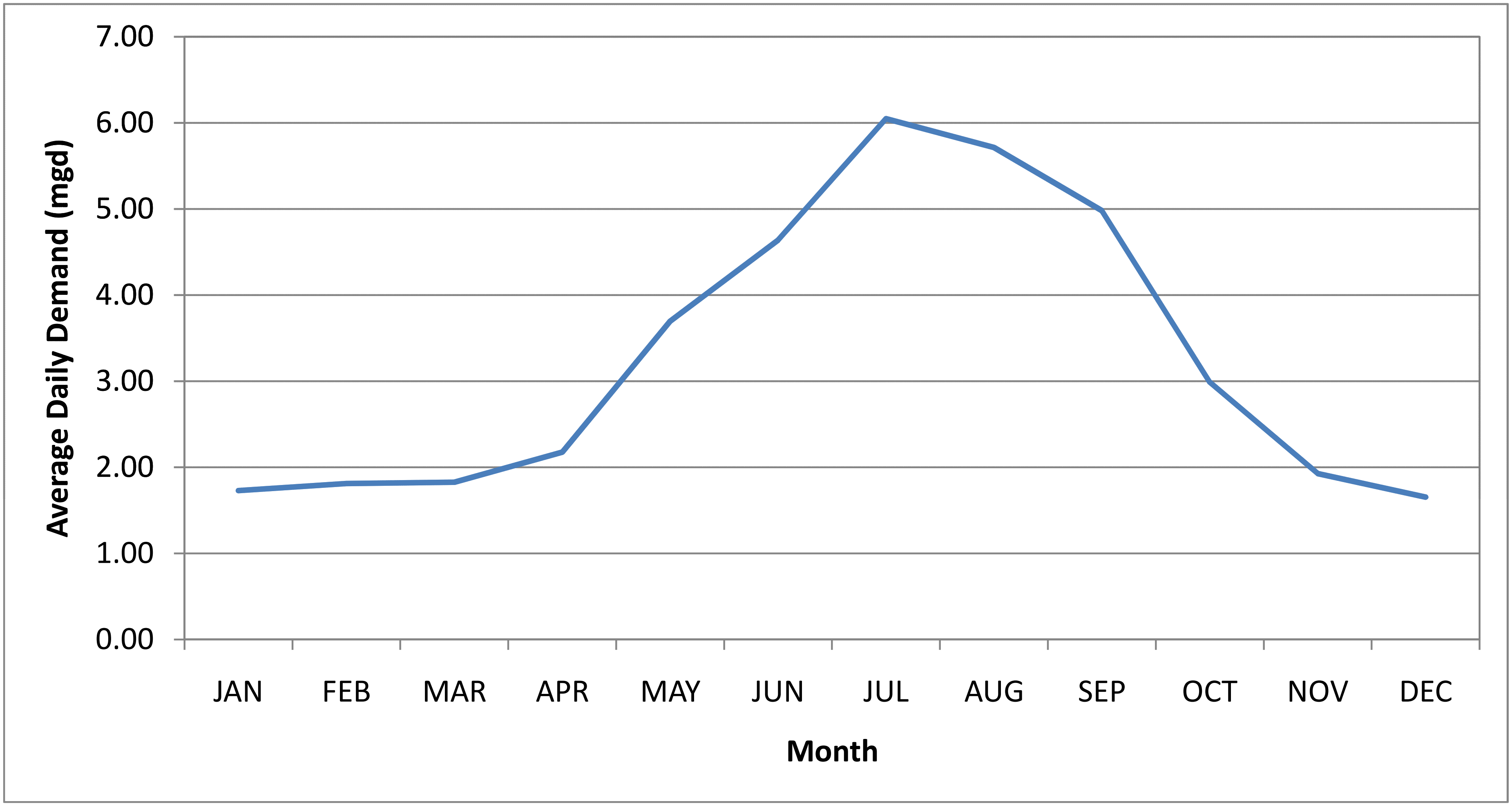


Figure 4.3
MONTHLY TRENDS IN WATER USE
WCRS and CWMP
City of Ashland

It is assumed that the minimum water use represents the indoor water use, which stays constant through the year. Additional use beyond this minimum amount is attributed to outdoor use. Table 4.4 shows the break up of indoor and outdoor uses every month in a typical year. Note, total indoor usage varies each month due to variation in the number of days per month.

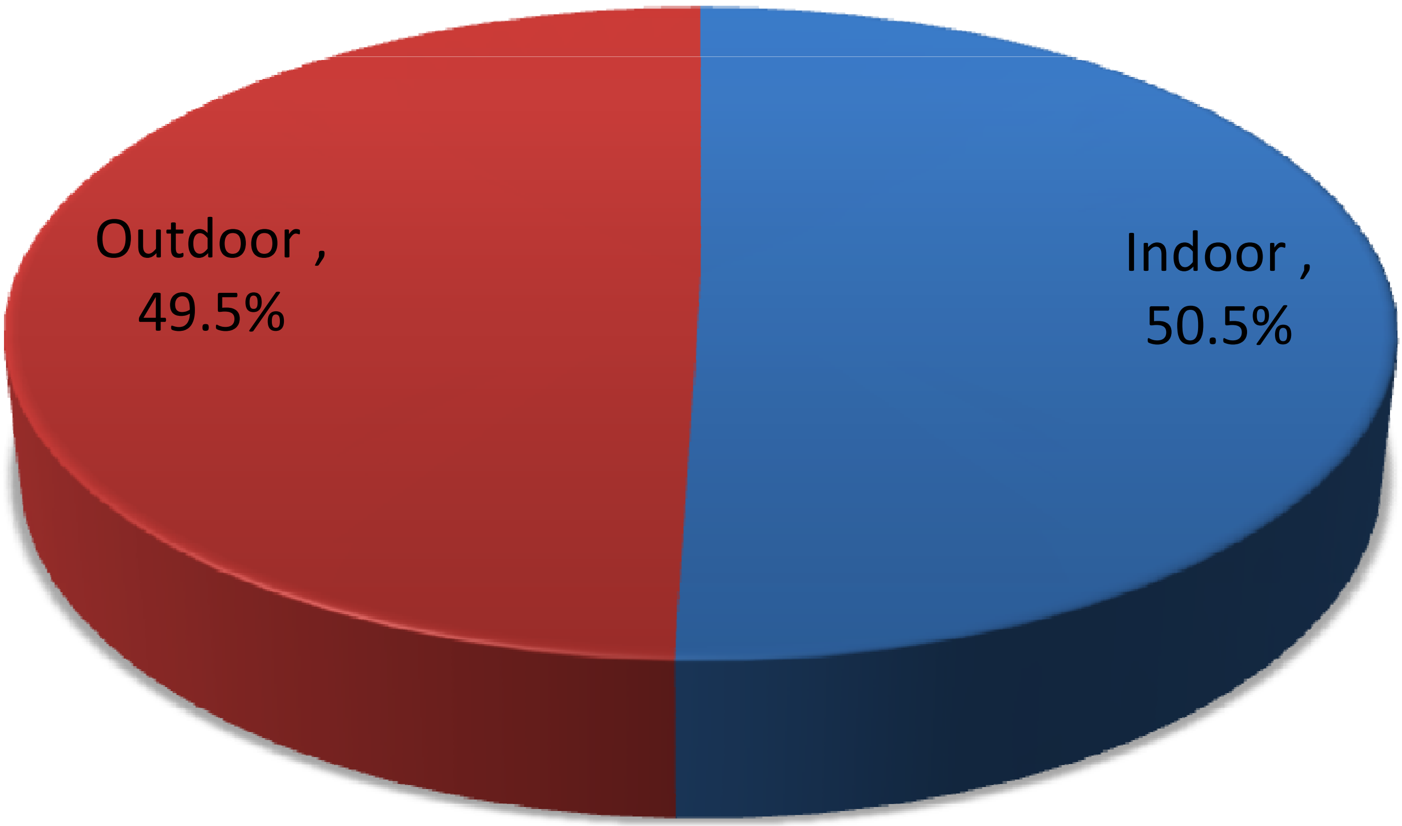
Table 4.4 Indoor versus Outdoor Uses

Month	Total Demands[1] (MG)	Indoor Use[2] (MG)	Outdoor Use (MG)
January	53.6	51.3	2.3
February	50.8	46.3	4.4
March	56.7	51.3	5.4
April	65.3	49.6	15.6
May	114.6	51.3	63.3
June	139.2	49.6	89.5
July	187.5	51.3	136.2
August	177.2	51.3	125.9
September	149.5	49.6	99.8
October	92.6	51.3	41.3
November	57.8	49.6	8.2
December	51.3	51.3	0.00
Total	1196	604	592

Notes:

1. Source: 2008 Water Treatment Plant production data for a typical year for finished water; this number includes Unaccounted for Water.
2. Assumes the minimum daily use in December is representative of indoor use through the year. Monthly indoor use is calculated by multiplying the minimum daily use (the average daily use during the month of December) with the number of days in the month.

As shown in Table 4.4, over a one-year period, the total indoor usage (604 million gallons, MG) is similar to total outdoor usage (592 MG). Figure 4.4 shows the percentage of indoor and outdoor use over the entire year. Figure 4.5 shows the total water usage for each month in MG, divided into indoor and outdoor usage.



NOTE: 2008 data was used to generate the figure as it was most representative of average years.

Figure 4.4
INDOOR AND OUTDOOR USES
WCRS and CWMP
City of Ashland

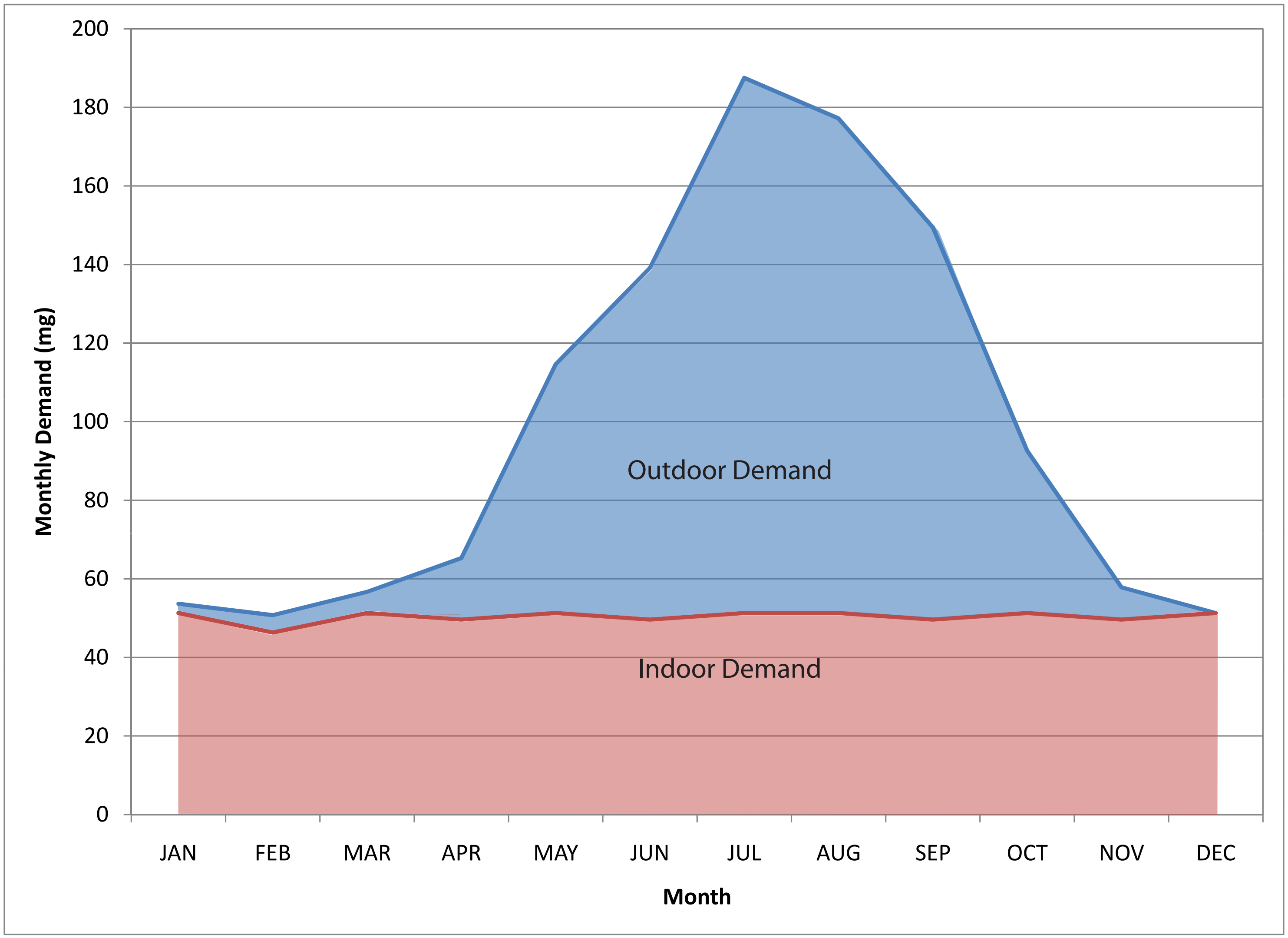


Figure 4.5
MONTHLY TREND OF INDOOR AND OUTDOOR USES
WCRS and CWMP
City of Ashland

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It is understood that the population of the City increases during the summer due to tourism. Hence, a portion of the increased summer water usage is due to increased indoor water usage due to tourism, and not only due to outdoor water usage. However, as commercial usage accounts for only around 20 percent of total City usage, this amount was assumed to be small and the influence of seasonal population on indoor versus outdoor usage was not included in the study.

4.7 COMPARISON WITH OTHER COMMUNITIES

The average historical per capita water demand for the City of Ashland is 157 gpcd including UFW. Figure 4.6 shows the per capita demand of Ashland compared with other communities and the national average. Note that various communities calculate water losses at varying points in the system, and report per capita demands in different ways. Figure 4.6 does not account for those differences.

Water use varies significantly among communities due to region, climate and socioeconomic factors, as well as due to conservation measures. In the United States, the regional differences in per capita demands are largely due to variations in outdoor water use. The impact of climate can be seen in comparing the California average (229 gpcd) to the nationwide average (160 gpcd). One example of the impact of socioeconomic factors is a comparison between per capita usage in Tualatin Valley Water District (TVWD) and the City of Lake Oswego. Both communities are located in the Portland metropolitan area and have similar climates; however, Lake Oswego has a relatively wealthier population on average. As expected, the per capita usage in TVWD (117 gpcd) is significantly less than that for Lake Oswego (170 gpcd). Due to these factors, it is not possible to do a true “apples to apples” comparison of the City of Ashland to other communities.

However, it can be noted that the City of Ashland’s per capita consumption (157 gpcd) is below the national average (160 gpcd), and well below the California average (229 gpcd). However, it is not as low as communities that have implemented very aggressive conservation programs, such as the City of Santa Cruz (107 gpcd, estimated to be 117 gpcd with UFW), indicating that additional conservation could still be achieved.

Additionally, Ashland’s residential customers were analyzed separately as they constitute approximately 63 percent of the demands. Since it is only possible to calculate the residential uses from the billing data, billings based per capita consumption rates were calculated. The supply-based per capita usage (including UFW) was estimated from these data assuming the percentage of UFW would apply consistently across all customer types. Table 4.5 documents the trends in residential water use.

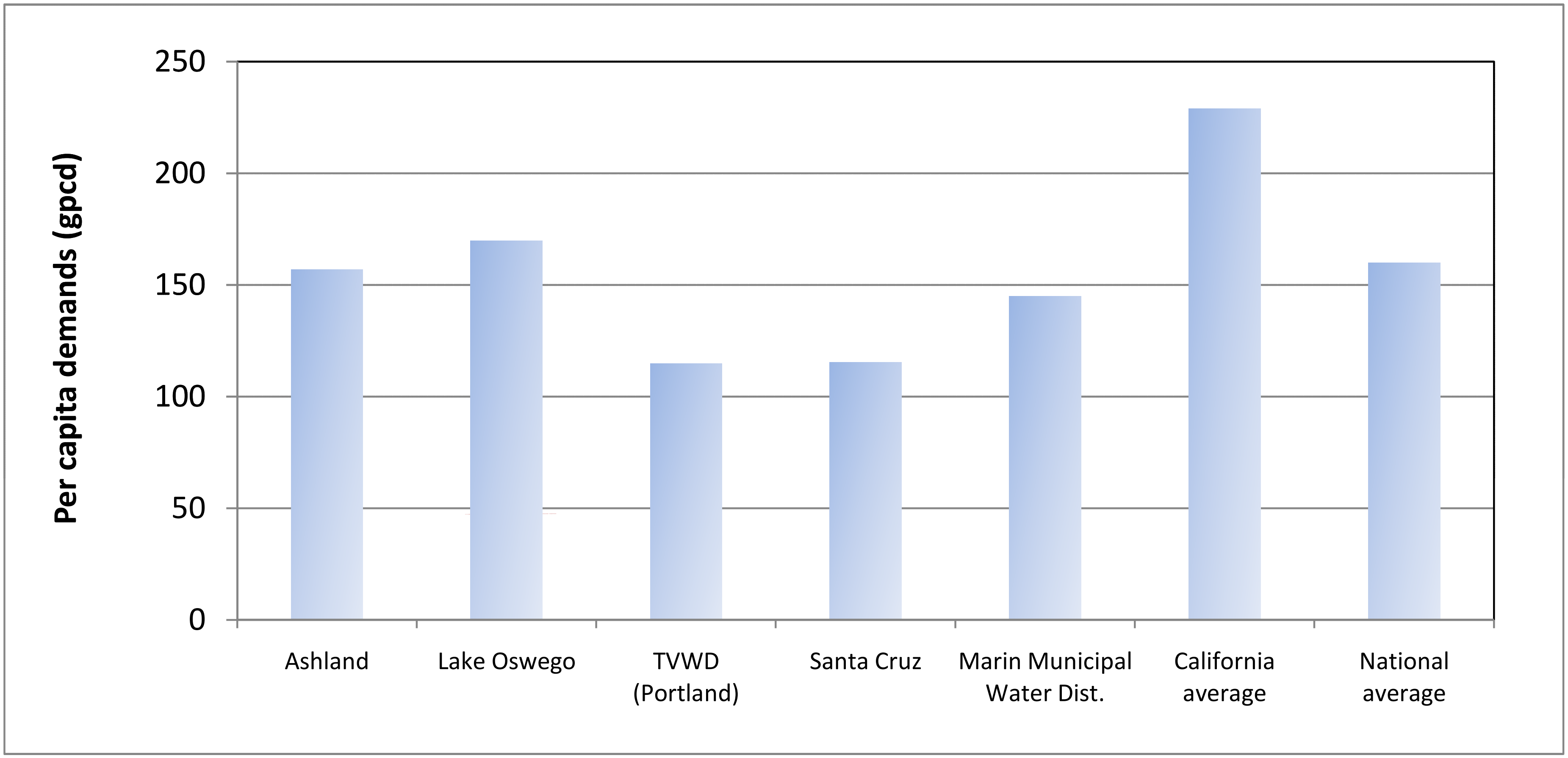

Figure 4.6
COMPARISON OF PER CAPITA DEMANDS
WCRS and CWMP
City of Ashland

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Table 4.5 Historical Residential Per Capita Demands

Year	Estimated Supply-Based per capita Residential Demands[1]	Billings-Based Per Capita Residential Demands[2]
2005	107	96
2006	107	99
2007	102	95
2008	102	95
2009	93	92
Average[3]	**105**	**96**

Notes:
1. Calculated by adding each year's UFW percentage from Table 4.3.
2. Billing data from City staff.
3. The average does not include data from 2009 because of voluntary and mandatory curtailments in that year.

For comparison, the residential water use in a typical single-family American household is 101 gpcd, and Ashland's average at 105 gpcd is just a little over that. However, residential water use also varies considerably by region, climate, and socioeconomic factors. For instance, the residential average varies from approximately 65 gpcd in Boston, to 75 gpcd in Seattle, to 100 gpcd in Tampa, to 220 gpcd in Phoenix[1].

4.8 CONSERVATION AND CURTAILMENT GOALS

4.8.1 Conservation Goals

The City considered three increasing levels of conservation to help meet its projected demands. The three levels are 5, 10, and 15 percent reduction in existing per capita demands, beyond the level of conservation already being achieved in the City. Table 4.6 shows the per capita consumption rates and average day demand projections assuming the City achieves 5, 10 and 15 percent reductions. It was assumed that the targeted conservation levels would be reached over a 20-year period (2030), with half of the targeted conservation achieved by 2020.

[1] Source: Handbook of Water Use and Conservation by Amy Vickers.

Table 4.6 Projected Average Day Demands with Varying Levels of Conservation

Year	5 percent reduction		10 percent reduction		15 percent reduction	
	Per capita Demand[1]	Total Demand[2]	Per capita Demand[1]	Total Demand[2]	Per capita Demand[1]	Total Demand[2]
2010	157.0	3.38	157.0	3.38	157.0	3.38
2020	153.1	3.50	149.2	3.41	145.2	3.32
2030	149.2	3.69	141.3	3.49	133.5	3.30
2060	149.2	4.52	141.3	4.29	133.5	4.05

Notes:
1. In gallons per capita per day.
2. In million gallons per day

4.8.1.1 Monthly Demands with Varying Conservation Levels

Based on discussions with City conservation staff and historical water use patterns, it was assumed that 75 percent of the desired reductions by volume would be achieved through outdoor use and 25 percent through indoor use. Because of the planned reductions in outdoor use, the monthly demand curve is projected to be flatter, with a smaller peak in the summer, due to most outdoor demands currently being exerted in the peak months of May through September.

The current monthly trend was developed using 2008 data as it was considered to be a typical year. Refer to Figures 4.3 and 4.5 for current monthly usage trends.

The new monthly usage estimates were calculated as follows, based on an example of 5 percent additional conservation for 2008:

- Total volume of water to be conserved (59.8 MG) was calculated by multiplying the conservation level (5 percent) by total usage (1196.0 MG).
- Indoor savings (14.9 MG) were calculated as 25 percent of total conservation savings (59.8 MG). These savings were divided equally over the 12 months of the year.
- Outdoor savings (44.8 MG) were calculated as 75 percent of the total conservation savings (59.8 MG). This was converted into a 9 percent reduction in outdoor use over the high use period (May through September) by dividing the conserved amount (44.8 MG) by the total outdoor usage over that period (514.7 MG). This percent reduction was then applied to outdoor use in each of those months.
- Total usage under 5 percent additional conservation was then calculated as the sum of the revised indoor and outdoor usage projections.

The resulting monthly demands for each level of conservation are shown in Tables 4.7, 4.8, and 4.9 and presented graphically in Figure 4.7. These values were converted into monthly peaking factors which were applied to future demand projections to estimate future monthly demands with the new conservation levels.

Table 4.7 Monthly Water Demands for 5 percent Conservation, in Million Gallons

Month	Total Current Demands[1]	Indoor Use[2]	Outdoor Use	Reduced Indoor Use	Reduced Outdoor Use	Total Reduced Monthly Use	Reduction %
Jan	53.6	51.3	2.3	50.1	2.3	52.4	2.3
Feb	50.8	46.3	4.4	45.1	4.4	49.5	2.5
Mar	56.7	51.3	5.4	50.1	5.4	55.4	2.2
Apr	65.3	49.6	15.6	48.4	15.6	64.0	1.9
May	114.6	51.3	63.3	50.1	57.8	107.8	5.9
Jun	139.2	49.6	89.5	48.4	81.7	130.1	6.5
Jul	187.5	51.3	136.2	50.1	124.3	174.4	7.0
Aug	177.2	51.3	125.9	50.1	114.9	165.0	6.9
Sept	149.5	49.6	99.8	48.4	91.1	139.5	6.7
Oct	92.6	51.3	41.3	50.1	41.3	91.3	1.3
Nov	57.8	49.6	8.2	48.4	8.2	56.6	2.2
Dec	51.3	51.3	0.0	50.1	0.0	50.1	2.4
Total	1196.0	604.1	592.0	589.1	547.1	1136.2	5.0

Notes:

1. Source: 2008 Water Treatment Plant production data for a typical year for finished water; this number includes Unaccounted for Water.
2. Assumes the minimum daily use in December is representative of indoor uses through the year. Monthly indoor use is calculated by multiplying the minimum daily use with the number of days in the month.

Table 4.8 Monthly Water Demands for 10 percent Conservation, in Million Gallons

Month	Total Current Demands[1]	Indoor Use[2]	Outdoor Use	Reduced Indoor Use	Reduced Outdoor Use	Total Reduced Monthly Use	Reduction %
Jan	53.6	51.3	2.3	48.8	2.3	51.2	4.6
Feb	50.8	46.3	4.4	43.8	4.4	48.3	4.9
Mar	56.7	51.3	5.4	48.8	5.4	54.2	4.4
Apr	65.3	49.6	15.6	47.2	15.6	62.8	3.8
May	114.6	51.3	63.3	48.8	52.3	101.1	11.8
Jun	139.2	49.6		47.2	73.9	121.1	13.0
Jul	187.5	51.3	136.2	48.8	112.5	161.3	14.0
Aug	177.2	51.3	125.9	48.8	103.9	152.8	13.8
Sept	149.5	49.6	99.8	47.2	82.4	129.6	13.3
Oct	92.6	51.3	41.3	48.8	41.3	90.1	2.7
Nov	57.8	49.6	8.2	47.2	8.2	55.3	4.3
Dec	51.3	51.3	0.0	48.8	0.0	48.8	4.9
Total	1196.0	604.1	592.0	574.2	502.3	1076.4	10.0

Notes:

1. Source: Water Treatment Plant production data for a typical year for finished water; this number includes Unaccounted for Water, or losses. Data from 2008 were used.
2. Assumes the minimum daily use in December is representative of indoor uses through the year. Monthly indoor use is calculated by multiplying the minimum daily use with the number of days in the month.

Table 4.9 Monthly Water Demands for 15 percent Conservation, in Million Gallons

Month	Total Current Demands[1]	Indoor Use[2]	Outdoor Use	Reduced Indoor Use	Reduced Outdoor Use	Total Reduced Monthly Use	Reduction %
Jan	53.6	51.3	2.3	47.6	2.3	49.9	7.0
Feb	50.8	46.3	4.4	42.6	4.4	47.0	7.4
Mar	56.7	51.3	5.4	47.6	5.4	52.9	6.6
Apr	65.3	49.6	15.6	45.9	15.6	61.5	5.7
May	114.6	51.3	63.3	47.6	46.8	94.3	17.7
Jun	139.2	49.6	89.5	45.9	66.1	112.0	19.5
Jul	187.5	51.3	136.2	47.6	100.6	148.2	21.0
Aug	177.2	51.3	125.9	47.6	93.0	140.5	20.7
Sept	149.5	49.6	99.8	45.9	73.7	119.6	20.0
Oct	92.6	51.3	41.3	47.6	41.3	88.9	4.0
Nov	57.8	49.6	8.2	45.9	8.2	54.1	6.5
Dec	51.3	51.3	0.0	47.6	0.0	47.6	7.3
Total	1196.0	604.1	592.0	559.2	457.4	1016.6	15

Notes:

1. Source: Water Treatment Plant production data for a typical year for finished water; this number includes Unaccounted for Water, or losses. Data from 2008 were used.
2. Assumes the minimum daily use in December is representative of indoor uses through the year. Monthly indoor use is calculated by multiplying the minimum daily use with the number of days in the month.

4.8.1.2 Maximum Day Demands

In *Chapter 3 – Population and Demand Projections*, maximum day demands were calculated based on projected average day demands and the historical peaking factor of 2.06. However, under the proposed additional conservation scenarios peak usage will be reduced, reducing the ratio of the maximum day demand to the average day demand. To account for this reduced peak, projected maximum day demands were projected as follows, using 5 percent additional conservation for 2060 as an example:

- The projected maximum day demand without conservation was calculated based on the historical peaking factor (2.06).
- The ratio of the peak month under 5 percent conservation (174.4 MG) to the peak month with no additional conservation (187.5 MG) was calculated yielding a ratio of 0.93.
- This ratio (0.93) was then multiplied by the projected 2060 maximum day demand without additional conservation (10.1 mgd) to yield the projected 2060 maximum day demand with 5 percent additional conservation (9.4 mgd).

The resulting projected maximum day demands are presented in Table 4.10. As noted above, it is assumed that the targeted conservation level would be achieved by 2030, with half the targeted conservation level achieved by 2020.

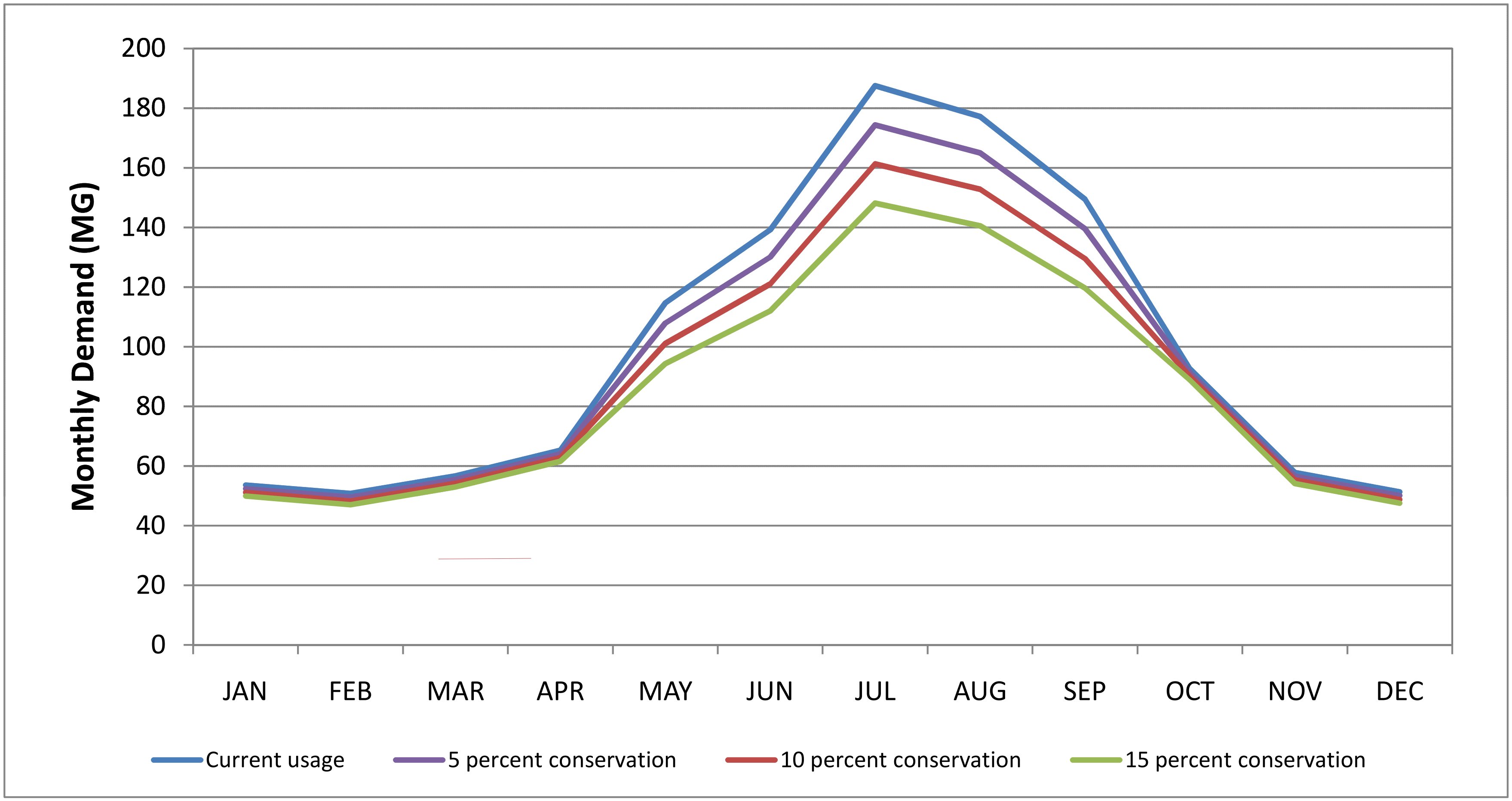

Figure 4.7
MONTHLY DEMAND PROJECTIONS
WCRS and CWMP
City of Ashland

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Table 4.10 Projected Maximum Day Demands with Varying Levels of Conservation

Year	Projected Demands (million gallons per day)					
	5 percent reduction		10 percent reduction		15 percent reduction	
	ADD	MDD	ADD	MDD	ADD	MDD
2010	3.38	7.14	3.38	7.14	3.38	7.14
2020[1]	3.50	7.59	3.41	7.32	3.32	7.04
2030[2]	3.69	8.00	3.49	7.40	3.30	6.79
2060	4.52	9.36	4.29	8.66	4.05	7.95

Notes:
1. Assumes half of the targeted additional conservation level is achieved by 2020.
2. Assumes the targeted additional conservation level is achieved by 2030.

4.8.2 Curtailments

During drought conditions, water consumption is typically curtailed to conserve supply. As documented in *Chapter 2 – Level of Service Goals,* the AWAC established a level of service goal of accepting 45 percent curtailments under extreme drought conditions (the estimated 1 in a 100-year drought with projected climate change impacts). The 45 percent curtailment was applied as follows, using 5 percent additional conservation and 2060 demands as an example:

- It was assumed that maximum month flows projected for the appropriate conservation level would be further reduced by 45 percent. For example, for 5 percent additional conservation for 2060, the projected maximum month demand (258.3 MG) was reduced by 45 percent to yield a curtailed supply volume of 142.0 MG for the maximum month.
- For all remaining months where the projected demand exceeds 142 mgd, the demand was assumed to be the curtailment volume (142.0 MG). For months with projected usage less than the curtailment volume, demands were unaffected.

The resulting projected monthly usage volumes in MG are shown in Figure 4.8.

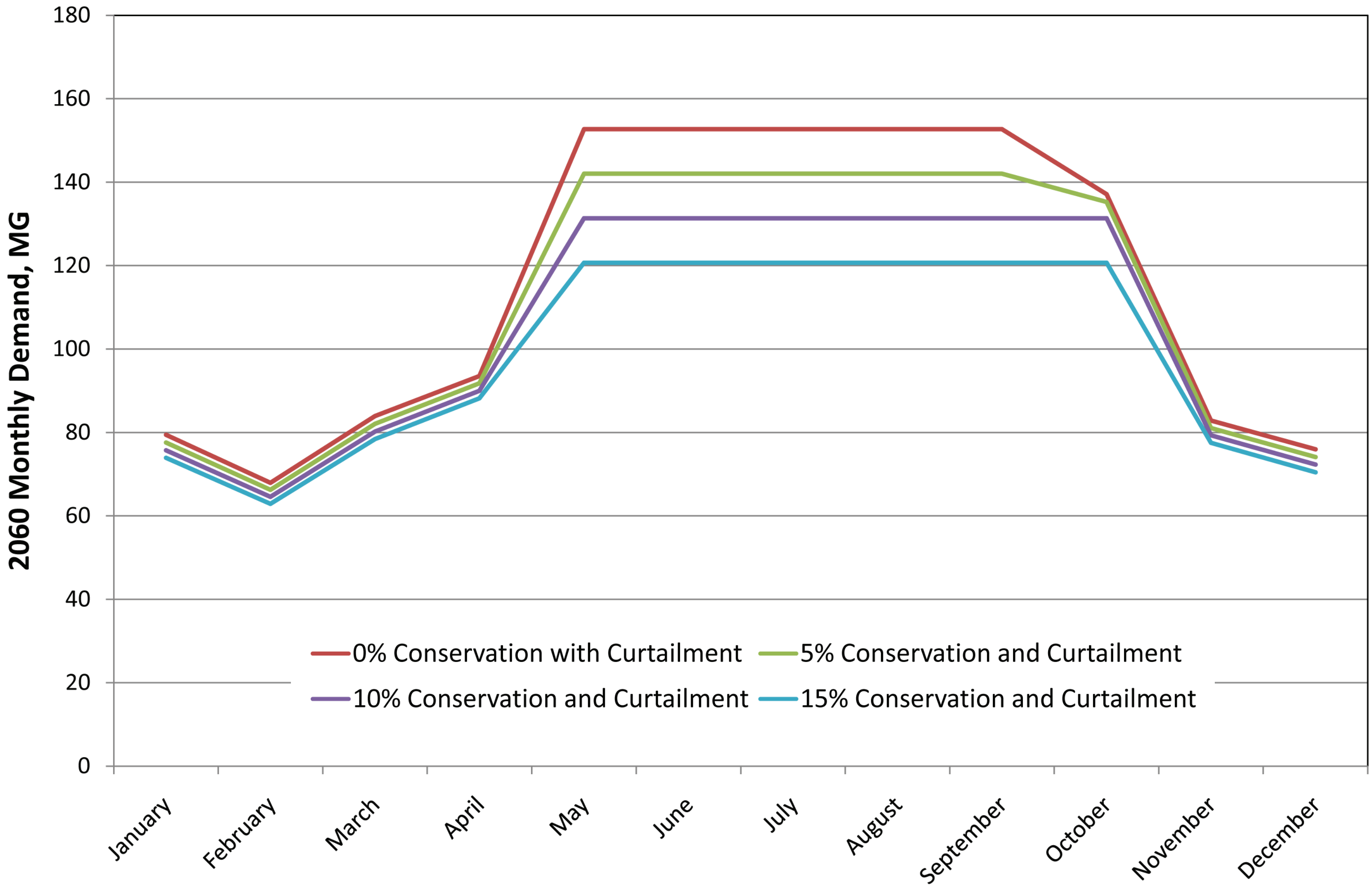


Figure 4.8
PROJECT 2060 MONTHLY USAGE BASED ON 45 PERCENT CURTAILMENT
WCRS and CWMP
City of Ashland

4.9 POTENTIAL NEW CONSERVATION PROGRAMS

In order to achieve the conservation goal selected, additional programs will need to be implemented to conserve more water than the City is already conserving with its existing programs. There are several utilities that have implemented aggressive conservation programs, and Ashland could style its new conservation program inspired by the successes of others. Table 4.11 documents some of the measures that are being implemented by other utilities. The utilities chosen for comparison are the following:

- East Bay Municipal Utility District (EBMUD), Oakland, California.
- Denver Water, Denver, Colorado.
- Eugene Water and Electricity Board (EWEB), Eugene, Oregon.
- City of Santa Barbara, California.
- City of Corvallis, Oregon.

4.10 RECOMMENDATIONS

Meeting the 15 percent conservation target identified by the AWAC will required significant expansion of the City's current conservation efforts, including additional staffing and funding for programs. The next step is for the City to conduct a detailed Water Conservation Study to evaluate the various potential measures to identify the costs and implementation issues associated with them, and select those that will most cost-effectively achieve the desired demand reductions.

Until that study is complete, it is recommended that the City continue its existing water conservation programs, and continue to improve public education and awareness on the importance of water conservation.

Table 4.11 Conservation Programs Implemented by Other Utilities

Program	Description	Ashland	EBMUD[1]	Denver Water	EWEB[2]	Santa Barbara[3]	Corvallis[4]
Water audits by staff	Residential indoor and landscape water surveys to help customers identify ways to save water	✓	✓			✓	✓
Self audit kits/ information	Provide “water wise” kits to customers to conduct a self audit on their houses, or information on website on how to conduct a water audit	(8)	✓	✓	✓	✓	✓
Toilet rebates	Customers receive money for upgrading toilets to more efficient models	✓	✓	✓		✓	✓
Clothes washer rebates	Customers receive money for upgrading washers to more efficient models	✓ dishwasher & refrig also	✓	✓		✓	✓
Sub-meter incentives	Multifamily customers receive money for installing sub-meters within the complex to better monitor water use by family	(6)	✓				
Lawn conversion rebate	Customers receive money for converting lawns to water efficient landscaping	(6)	✓				
Irrigation efficiency program	Commercial and large irrigation customers receive money for reducing annual water use by fixed amounts	(5)		✓			
Sprinkler timer rebate	Customers receive money for installing timers on their sprinkler systems	(5)			✓		
Smart irrigation controller rebates	Customers receive money for installing weather-based irrigation controllers	(6)	✓			✓	
Free conserving devices	Customers receive free devices to conserve water such as low flow showerheads, faucet aerators, hose nozzle, toilet flush bag,	✓	✓				
Daily/ weekly irrigation information	Website provides daily/weekly updates on optimum watering for the week, or latest weather information	✓		✓	✓		
Free rain sensors	Customers receive free sensors that shut off irrigation systems during or after a rain event	(5)				✓	
Car wash certification	Based on certain set criteria, car washes are issued “Water Efficiency Certificates”	(5)		✓			
Xeriscape design information	Water efficient landscape design guidelines, plant guides	✓ Updates needed	✓	✓	✓	✓	✓
Watering restrictions	Customers are not allowed to water during certain times of day	Only in curtailment		✓			
Water budget calculator	Provide customers with online tools to help calculate their optimum water use	(6)			✓		
Mulch discount	Provide customers with financial incentives to apply mulch	(6)	✓	✓			
Cooling towers	Provide commercial customers with incentives to improve water efficiency in cooling towers	Part of a package		✓			
Pre-rinse spray nozzles	Provide commercial customers (particularly restaurants and schools) with water efficient spray nozzles	✓	✓				
Water broom rebates	Commercial customers receive money for installing water efficient cleaning devices	(5)	✓				
Rainwater harvesting	Provide customers with information to install rainwater capture systems at home	(8)				✓	
Graywater reuse	Provide customers with information to install graywater systems at home	(8)	✓			✓	

Notes:

1. East Bay Municipal Utility District
2. Eugene Water and Electricity Board
3. City of Santa Barbara
4. City of Corvallis
5. Not recommended by Staff
6. Staff expressed interest in adding
7. Updates recommended
8. Staff recommends Information Only

CHAPTER NO. 5

DISTRIBUTION SYSTEM ANALYSIS

5.1 INTRODUCTION

The purpose of this chapter is to evaluate the capacity of the City of Ashland's (City's) existing distribution system to serve future demands. This chapter includes evaluation of the following system components:

- Finished Water Storage Volume;
- Pump Station Capacity; and
- Pipeline Capacity.

Following the identification of deficiencies, improvement projects and proposed operational changes to address these deficiencies are presented.

5.2 EVALUATION CRITERIA

All evaluations were conducted according to the criteria established in *Chapter 2 – Level of Service Goals* and according to projected demands with 5 percent additional conservation for the years 2010 (current), 2015, and 2030. Tables 5.1 to 5.3 summarize the criteria as established in Chapter 2. The term "service area" refers to a grouping of pressure zones served by a particular facility, such as a reservoir or pump station. The selected service areas are described in Section 5.3.

Table 5.1 Distribution System Criteria

Parameter	Criterion
Minimum Service Pressure under Peak Hour Demand (PHD)	30 psi
Minimum Service Pressure under Maximum Day Demand (MDD) plus Fire Flow	20 psi

Table 5.2 Pump Station Evaluation Criteria

Parameter	Criterion
Capacity for service areas with storage facilities	• Supply MDD assuming the single largest capacity pump is off-line (i.e. firm capacity).
Capacity for service areas with no storage facilities	• Supply PHD and fire flow assuming the single largest capacity pump is off line (i.e. firm capacity).
Power supply	• New pump stations require a main power source and an emergency source. • Secondary power source for new pumps stations to be sized to meet full pump station demands.

Table 5.3 Storage Evaluation Criteria

Parameter	Criterion
Operational Storage	• 0.25 x MDD of the reservoir service area.
Fire Storage	• Provide volume for single most severe required fire flow and duration for the reservoir service area. • System-wide, provide volume for two largest fires.
Emergency Storage	• 0.5 x MDD of the reservoir service area.(1)

Notes:
1. See Section 5.4.5 for further discussion on this storage criterion.

5.3 SERVICE AREAS

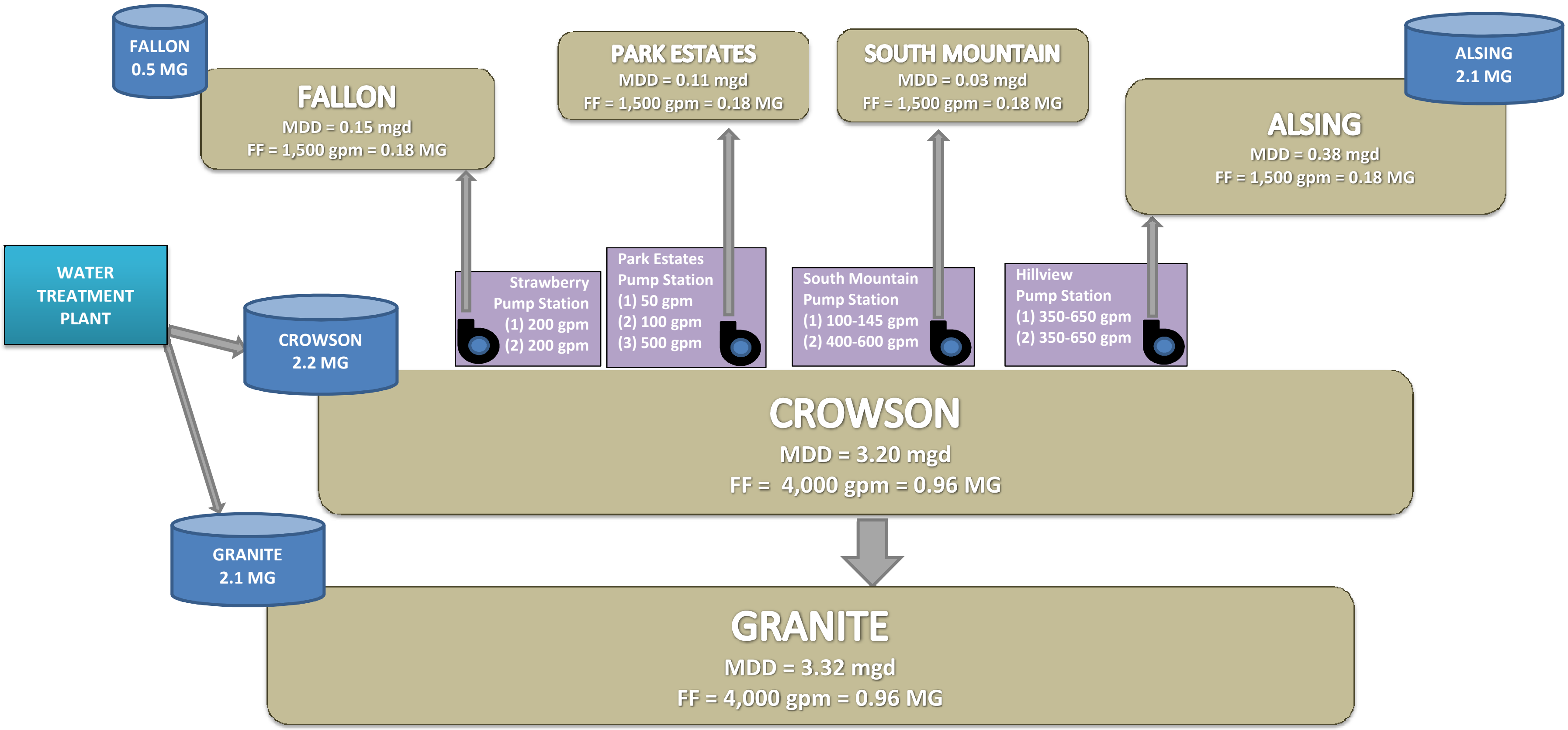
For storage and pumping capacity evaluations, pressure zones are grouped into service areas according to how they are served by the City's four reservoirs and four pump stations. Figure 1.4 in Chapter 1 shows the various pressure zones of the City. These zones have been grouped into service areas as described below, and as shown in Figure 5.1.

- **Granite Service Area** – consisting of Granite Zone 1 (served directly by Granite Reservoir and the water treatment plant) and Granite Zones 2 and 3 (served via Pressure Reducing Valves [PRVs]).
- **Park Estates Service Area** – consisting of the Crowson Zones 7 and 8 (served by the Crowson Reservoir via the Park Estates Pump Station).
- **South Mountain Service Area** – consisting of Crowson Zone 4 (served by the Crowson Reservoir via the South Mountain Pump Station).
- **Crowson Service Area** – consisting of Crowson Zone 1 (served directly by the Crowson Reservoir); Crowson Zones 2, 3, 5, and 6 (served via PRVs).
- **Alsing Service Area** – consisting of Alsing Zone 1 (served directly by the Alsing Reservoir) and Alsing Zone 2 (served via PRVs).
- **Fallon Service Area** – consisting of Fallon Zone 1 (served directly by the Fallon Reservoir) and Fallon Zone 2 (served via PRVs).

In addition to the above service areas, the storage evaluation also reviews the Crowson, Park Estates, and South Mountain Service Areas together as they are all served by the Crowson Reservoir.

5.3.1 Service Area Demands

Both the operational and emergency storage requirements are calculated based on the maximum day demands (MDD) for each service area. These demands were previously determined, as presented in Chapter 3. The MDDs for the reservoir service areas for the years 2011, 2015, and 2030 are summarized in Table 5.4. All values are based on 5 percent additional conservation. The MDD changes little over the 20-year planning period due to low anticipated growth combined with the planned conservation. As discussed above, a subtotal is provided for the three service areas currently served by the Crowson Reservoir.



LEGEND

Service Area	MDD = Maximum Day Demand
	FF = Maximum Required Fire Flow
Reservoir	gpm = gallons per minute
	mgd = millions of gallons per day
Pump Station	MG = Millions of Gallons

carollo

Figure 5.1
Distribution System Schematic - Current (2011)

WCRS & CWMP
City of Ashland

Table 5.4 Maximum Day Demands by Service Area

Service Area	Maximum Day Demand (mgd)[1]		
	2011	**2015**	**2030**
Park Estates	0.11	0.11	0.12
South Mountain	0.03	0.03	0.03
Crowson	3.20	3.24	3.40
Subtotal for area currently served by Crowson Reservoir	***3.34***	***3.38***	***3.55***
Granite	3.32	3.36	3.52
Alsing	0.38	0.38	0.40
Fallon	0.15	0.15	0.16
System-wide total	**7.19**	**7.27**	**7.63**

Notes:
1. All values based on 5 percent additional conservation.

5.4 FINISHED WATER STORAGE

The storage analysis compares the storage volume in the City's existing reservoirs to the storage criteria established above for each service area, and identifies storage deficiencies that will be created as demands increase. The storage criteria include providing enough storage volume to meet operational, emergency, and fire flow storage for each service level. Tables 5.5 through 5.8 summarize these three storage requirements for each reservoir service area, and for the overall system.

5.4.1 Operational Storage

Operational storage requirements were calculated based on the criterion of 0.25 times maximum day demands in units of millions of gallons (MG). Calculated requirements by service area are shown in Table 5.5.

Table 5.5 Operational Storage Requirements by Service Area

Service Area	Operational Storage (MG)[1]		
	2011	**2015**	**2030**
Park Estates	0.03	0.03	0.03
South Mountain	0.01	0.01	0.01
Crowson	0.80	0.81	0.85
Subtotal for area currently served by Crowson Reservoir	***0.84***	***0.85***	***0.89***
Granite	0.83	0.84	0.88
Alsing	0.09	0.10	0.10
Fallon	0.04	0.04	0.04
System-wide total	**1.80**	**1.82**	**1.91**

Notes:
1. Operational storage calculated as 0.25 times maximum day demand.

5.4.2 Fire Flow Storage

The City's fire flow storage criterion is to provide volume for the single most severe required fire flow and duration (one largest fire) for each reservoir service area. System-wide, the City's criterion is to provide volume for two largest fires. Required fire flow rates and durations are summarized in Table 5.6. The corresponding storage requirements by service area are presented in Table 5.7.

Table 5.6 Fire Flow and Duration Requirements

Service Area	Fire Flow Requirements[1]		
	Flow (gpm)	**Duration (hrs)**	**Required Storage (MG)**
Crowson and Granite	4,000	4	0.96
All Others	1,500	2	0.18

Notes:
1. Flow requirements based on feedback from the City of Ashland Fire Marshall.

Table 5.7 Fire Flow Storage Requirements by Service Area

Service Area	Fire Flow Storage (MG) [1]		
	2011	**2015**	**2030**
Park Estates	0.18	0.18	0.18
South Mountain	0.18	0.18	0.18
Crowson	0.96	0.96	0.96
Subtotal for area currently served by Crowson Reservoir[2]	***0.96***	***0.96***	***0.96***
Granite	0.96	0.96	0.96
Alsing	0.18	0.18	0.18
Fallon	0.18	0.18	0.18
System-Wide Total	**1.92**	**1.92**	**1.92**

Notes:
1. Fire flow storage calculated as product of required fire flow rate and duration. The City's criterion is to provide the volume for single most severe required fire flow and duration (largest fire) for each reservoir service area. System-wide, the requirement is for two largest fires.
2. Fire flow for the area served by the Crowson Reservoir is the maximum fire for all service areas (0.96 MG).

5.4.3 Emergency Storage

Emergency storage was calculated as 0.5 times the MDD for each service area. The calculated emergency storage requirements are summarized in Table 5.8. Emergency storage was also calculated using different storage criteria, as discussed in Section 5.4.5.

Table 5.8 Emergency Storage Requirements by Service Area

Service Area	Emergency Storage (MG) [1]		
	2011	**2015**	**2030**
Park Estates	0.06	0.06	0.06
South Mountain	0.02	0.02	0.02
Crowson	1.60	1.62	1.70
Subtotal for area currently served by Crowson Reservoir	***1.67***	***1.69***	***1.77***
Granite	1.66	1.68	1.76
Alsing	0.19	0.19	0.20
Fallon	0.07	0.07	0.08
System-Wide Total	**3.59**	**3.64**	**3.81**

Notes:
1. Emergency storage calculated as 0.5 times maximum day demand for each service area.

5.4.4 Combined Storage Requirements

Table 5.9 summarizes the existing storage, total storage required, and storage excess (or deficiency) in each service area. The total storage required is the sum of the operational, fire, and emergency storage calculated above. Using the emergency storage criterion of 0.5 times MDD results in an overall system current storage deficiency of 0.41 MG increasing to 0.74 MG in 2030. Storage requirements change little over the 20-year planning period due to the low increase in MDD.

Table 5.9 Storage Evaluation Summary

Service Area	Existing Storage (MG)	Storage Required (MG)			Excess (Deficiency) (MG)		
		2011	2015	2030	2011	2015	2030
Park Estates	0	0.26	0.26	0.27	(0.26)	(0.26)	(0.27)
South Mountain	0	0.20	0.20	0.21	(0.20)	(0.20)	(0.21)
Crowson	2.2	3.36	3.39	3.51	(1.16)	(1.19)	(1.31)
Subtotal (1)	***2.2***	***3.47***	***3.50***	***3.62***	***(1.27)***	***(1.30)***	***(1.42)***
Granite	2.1	3.45	3.48	3.60	(1.35)	(1.38)	(1.50)
Alsing	2.1	0.46	0.47	0.48	1.64	1.63	1.62
Fallon	0.5	0.29	0.29	0.30	0.21	0.21	0.20
System-wide Total(2)	**6.9**	**7.31**	**7.38**	**7.64**	**(0.41)**	**(0.48)**	**(0.74)**

Notes:
1. Subtotal for area currently served by Crowson Reservoir. Subtotaled requirements for the area currently served by Crowson are less than the sum of requirements for the Park Estates, South Mountain, and Crowson areas because the subtotal includes only one largest fire.
2. The system-wide total does not equate to the sum of the individual services areas, because the system-wide evaluation assumes two largest fires for fire flow requirements.

5.4.5 Storage Criteria Adjustments

After reviewing the storage results, the City desired to consider the impacts of varying the emergency storage criteria to provide a more conservative amount of storage during a system emergency. The original emergency storage criterion (0.5 x MDD) has been used by the City in all past storage evaluations. It should be noted that historically, the MDD equates to twice the average day demands (ADD) for the City, therefore 0.5 x MDD = 1.0 x ADD. The original criterion may be considered to require too little storage as it only provides enough storage to meet one day of average demands or a half day of maximum demands during a system emergency. For this reason, three other emergency storage criterion were reviewed in addition to the original, as follows:

1. Criterion 1 - Emergency Storage Required = 0.5 x MDD (evaluated above).
2. Criterion 2 - Emergency Storage Required = 1.0 x MDD = 2.0 x ADD.
3. Criterion 3 - Emergency Storage Required = 2.0 x ADD minus Reliable Supply Capacity.

4. Criterion 4 - Emergency Storage Required = 2.0 x ADD minus Reliable Supply Capacity; and the Emergency Storage and Fire Flow Storage are "Nested."

Table 5.10 presents the resulting storage requirements using Emergency Storage Criteria 1 through 3. Table 5.11 presents the storage requirements using Criterion 4. The operational and fire flow storage requirements are unchanged from the original criteria for this evaluation. For current conditions (2011), only Criteria 1 and 2 were evaluated, as additional supply sources are not currently available.

5.4.5.1 Criterion 2 – 1.0 x MDD

The criterion of providing adequate storage to meet one full day of MDD (or two full days of ADD) is fairly conservative and results in much higher storage requirements. As seen in Table 5.10, increasing the emergency criteria from 0.5 of MDD to 1.0 of MDD requires 50 percent more storage. This criterion results in overall system storage deficiencies between 4 and 5 MG.

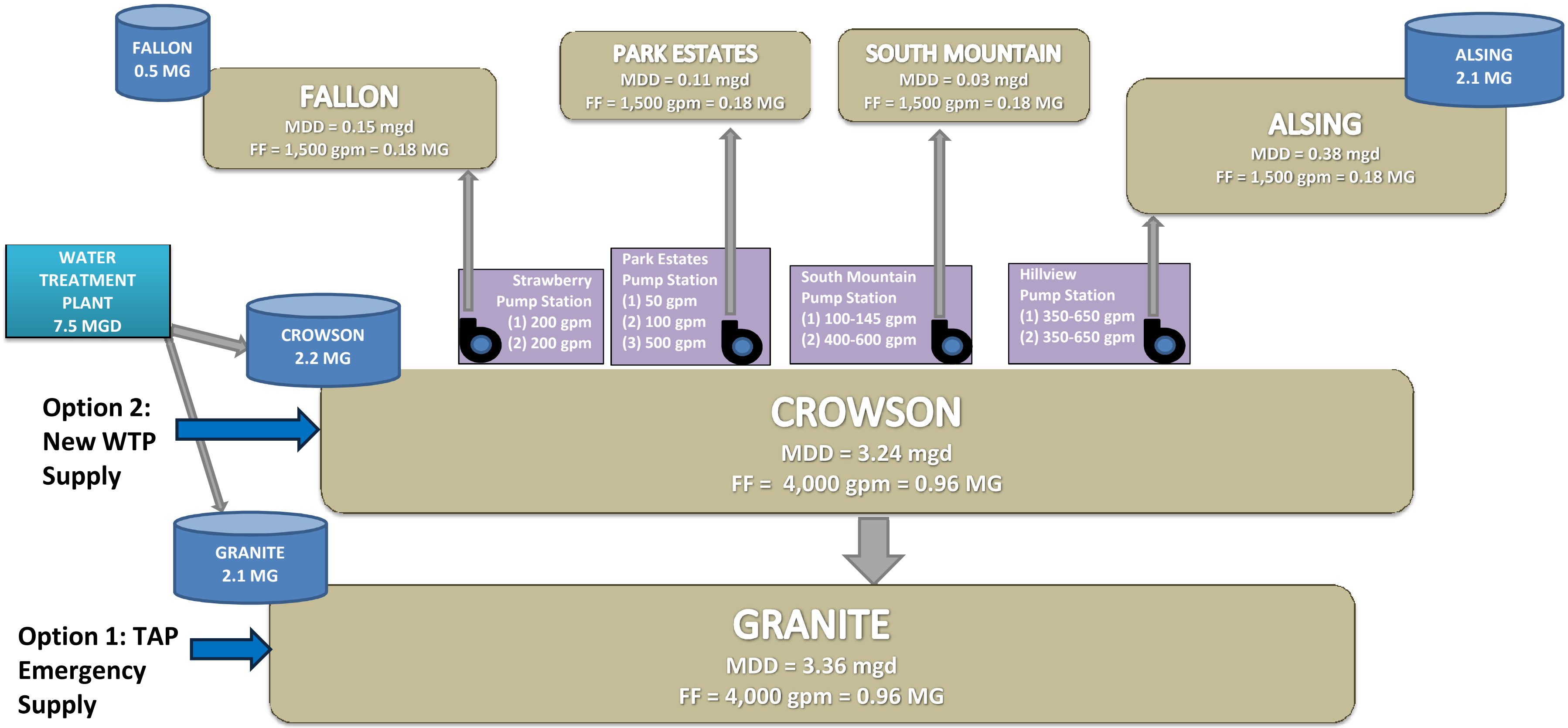
5.4.5.2 Criterion 3 – Reliable Supply Capacity

Criterion 3 applies to water systems with multiple supply sources. It requires adequate storage to provide two average days of supply under an emergency situation where the largest source of supply is unavailable. The term "Reliable Supply Capacity" equates to the sum of all supplies entering the system minus the largest source. Currently, treated water from the existing water treatment plant (WTP) is the only supply source for the City, thus the City has no reliable supply capacity.

The City is considering adding one of two potential new supply sources: the Talent Ashland Phoenix (TAP) emergency connection (1.5 mgd), or a new Water Treatment Plant (WTP) (2.5 mgd). Figure 5.2 presents the distribution system with these two potential supply sources in the year 2015. The potential new WTP would enter the system at the Crowson Service Area. The potential new TAP emergency supply would enter the system at the Granite Service Area.

With one of these new sources online, the City would have two supply sources. The Reliable Supply Capacity would be defined as the sum of the two supplies minus the largest source. Since the existing WTP would be the largest source of supply (7.5 mgd), the Reliable Supply Capacity with these new supply sources would equate to the volume of the new supply, either 1.5 mgd (TAP) or 2.5 mgd (New WTP). To reduce the storage requirements by the Reliable Supply Capacity is in essence reducing the storage volume by the amount of additional supply added to the system for a single day.

Figures 5.3a and 5.3b present the storage requirements for the system in 2015 under these two supply scenarios, assuming Criterion 3 for emergency storage. Table 5.10 also presents the storage requirements for this Criterion in the years 2015 and 2030. As seen in the table for the year 2030, using Criterion 3 reduces the storage requirements from 11.46 MG to 9.96 MG or 8.96 MG (depending on the new supply source). From the table, it is clear that the supply option of a new water treatment plant would further reduce the required storage because it provides a larger amount of reliable supply than the TAP emergency connection.



LEGEND

Service Area

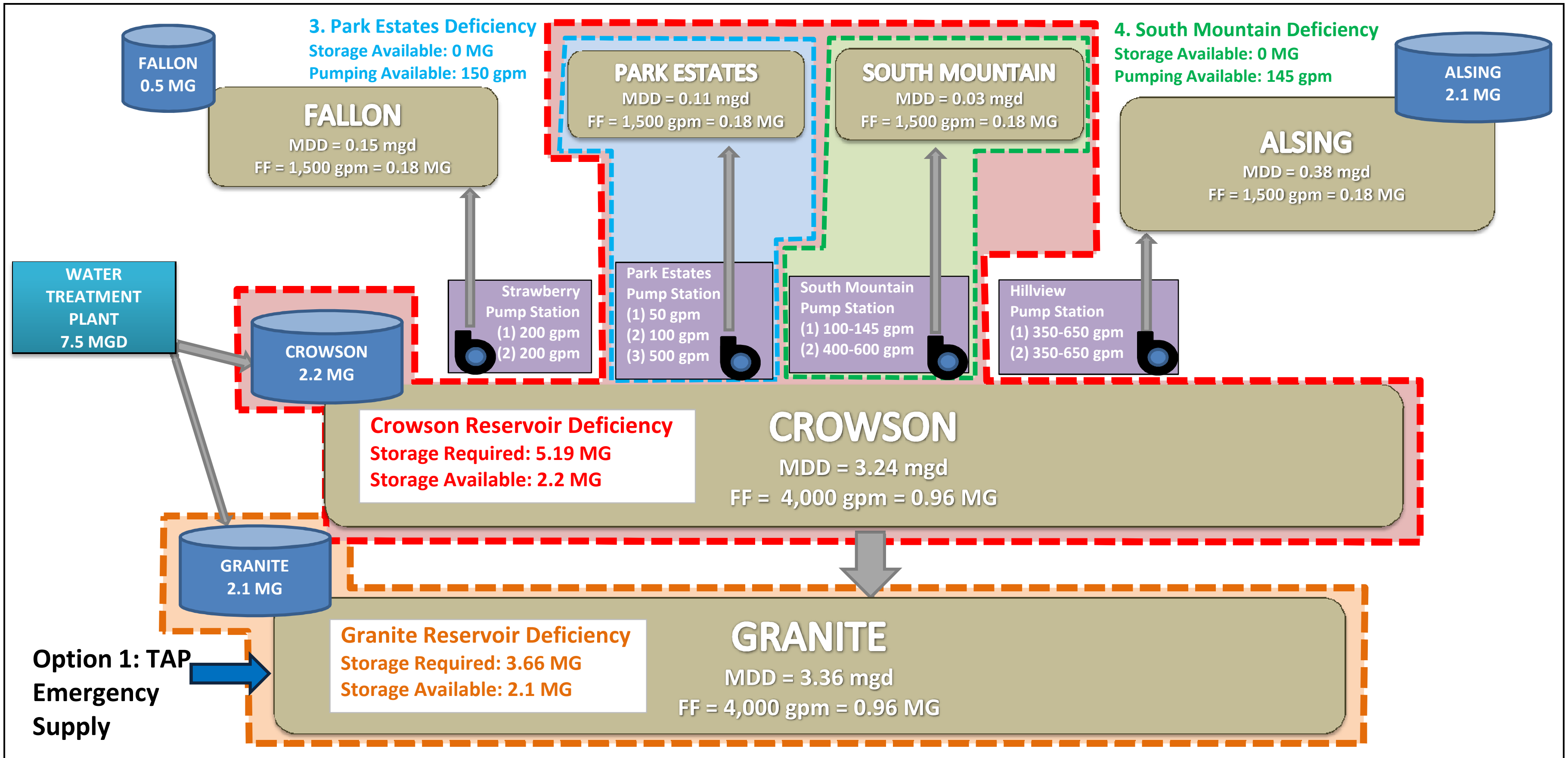
Reservoir

Pump Station

MDD = Maximum Day Demand
FF = Maximum Required Fire Flow
gpm = gallons per minute
mgd = millions of gallons per day
MG = Millions of Gallons

Figure 5.2
Distribution System Schematic - Future (2015)

WCRS & CWMP
City of Ashland



Notes:

Crowson Reservoir serves Crowson, Park Estates, and South Mountain Service Areas

LEGEND

Service Area

Reservoir

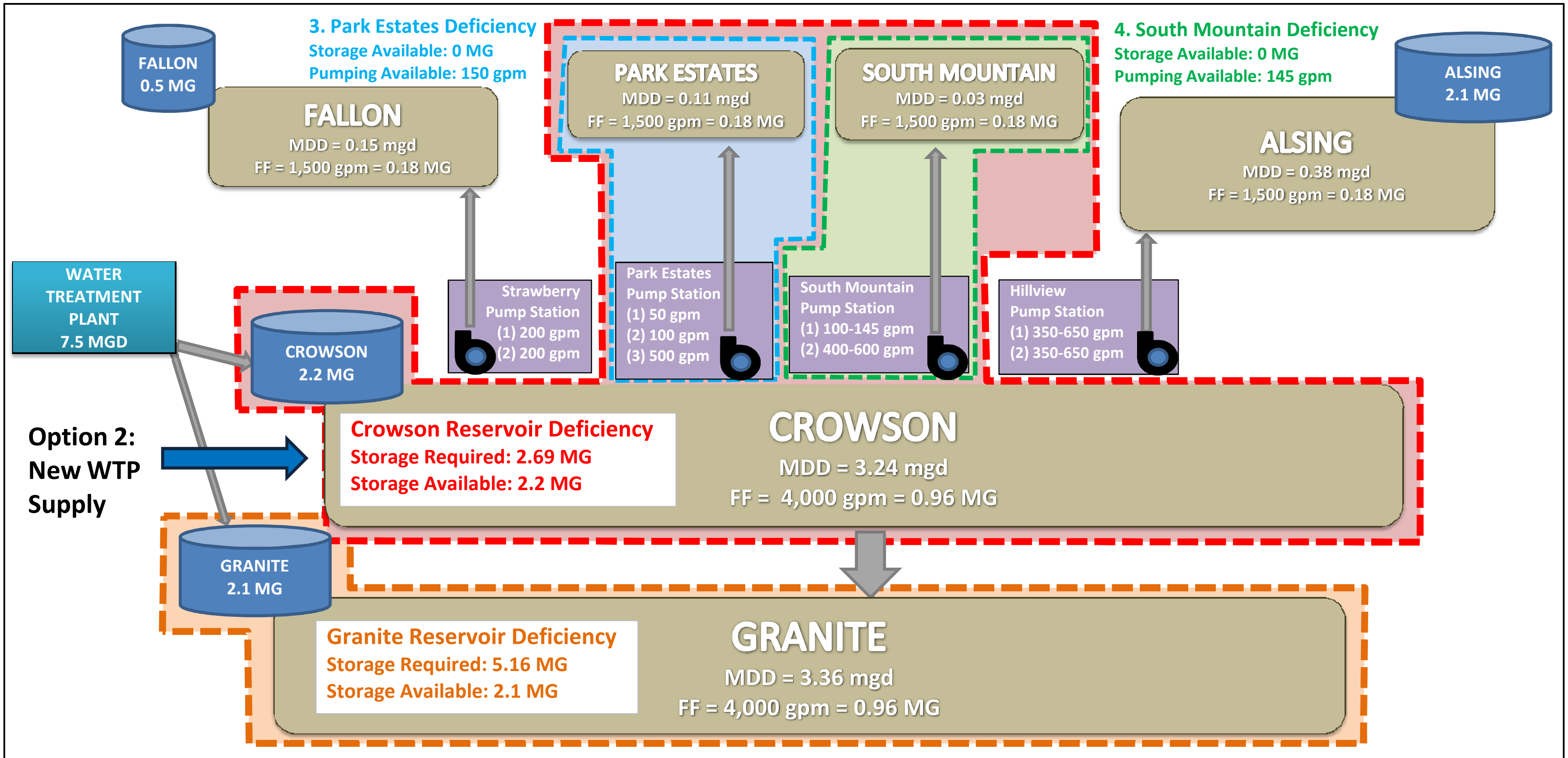
Pump Station

MDD = Maximum Day Demand
FF = Maximum Required Fire Flow
gpm = gallons per minute
mgd = millions of gallons per day
MG = Millions of Gallons

carollo

Figure 5.3a
Distribution System Schematic - 2015 Deficiencies
Supply Option 1 - TAP Supply (1.5 mgd)
WCRS & CWMP
City of Ashland

(Assumes Emergency Criteria 2.0xADD - Reliable Supply)



Notes:

Crowson Reservoir serves Crowson, Park Estates, and South Mountain Service Areas

LEGEND

- Service Area
- Reservoir
- Pump Station

MDD = Maximum Day Demand
FF = Maximum Required Fire Flow
gpm = gallons per minute
mgd = millions of gallons per day
MG = Millions of Gallons

Figure 5.3b
Distribution System Schematic - 2015 Deficiencies
Supply Option 2 - New WTP Supply (2.5 mgd)
WCRS & CWMP
City of Ashland

(Assumes Emergency Criteria 2.0xADD - Reliable Supply)

5.4.5.3 Criterion 4 – Nested Emergency and Fire Flow

The term "nested" refers to providing enough storage volume for the maximum of either the Emergency Storage or Fire Flow Storage. Criterion 4 is based on the assumption that a supply failure and the maximum fire flow will not occur at the same time. Some cities "nest" their emergency and fire flow storage volumes. However, this typically occurs where multiple supply sources are available in each service area (such as multiple groundwater wells). Table 5.11 presents the resulting storage deficiencies using Criterion 4. Nesting emergency and fire flow storage is not recommended for the City before redundant supply sources are available. For this reason, only the scenarios in which a redundant supply is online are evaluated.

Comparing Table 5.11 to Table 5.10 shows that using a criterion based on nesting results in lower storage requirements and therefore reduces the storage deficiency. For the Crowson and Granite Service Areas, which have the largest storage deficits, nesting emergency and fire flow storage decreases the storage requirement by approximately 1 MG each.

5.4.5.4 Summary of Varying Emergency Criteria

From a comparison of the varying emergency criteria, it is recommended that the City use Emergency Storage Criterion 3, providing two average days of demands while the largest supply source is out of service. This recommendation assumes that one of the two secondary supply sources will be constructed.

As the City gets closer to proceeding with any new storage project, it is recommended that the analysis presented herein be re-evaluated in light of the most recent demand data, and whether to consider storage nesting. Nested storage may or many not represent a significant savings to the City in terms of reduced construction cost. This can only be determined during preliminary design of the storage project.

Table 5.10 Storage Evaluation – Using Emergency Storage Criteria 1 through 3 (No Nesting)

		Total Storage Required (MG)									
		2011		2015				2030			
Service Area	**Existing Storage (MG)**	**Criterion 1** 0.5 x MDD	**Criterion 2** 1 x MDD	**Criterion 1** 0.5 x MDD	**Criterion 2** 1 x MDD	**Criterion 3a** 2 x ADD w/TAP(2)	**Criterion 3b** 2 x ADD w/New WTP(3)	**Criterion 1** 0.5 x MDD	**Criterion 2** 1 x MDD	**Criterion 3a** 2 x ADD w/TAP(2)	**Criterion 3b** 2 x ADD w/New WTP(3)
Park Estates	0	0.26	0.32	0.26	0.32	0.32	0.32	0.27	0.33	0.33	0.33
South Mountain	0	0.20	0.22	0.20	0.22	0.22	0.22	0.21	0.22	0.22	0.22
Crowson	2.2	3.36	4.96	3.39	5.01	5.01	2.51	3.51	5.21	5.21	2.71
Subtotal (1)	***2.2***	***3.47***	***5.14***	***3.50***	***5.19***	***5.19***	***2.69***	***3.62***	***5.40***	***5.40***	***2.90***
Granite	2.1	3.45	5.11	3.48	5.16	3.66	5.16	3.60	5.37	3.87	5.37
Alsing	2.1	0.46	0.65	0.47	0.66	0.66	0.66	0.48	0.68	0.68	0.68
Fallon	0.5	0.29	0.36	0.29	0.37	0.37	0.37	0.30	0.38	0.38	0.38
System-wide Total	**6.8**	**7.31**	**10.90**	**7.38**	**11.02**	**9.52**	**8.52**	**7.64**	**11.46**	**9.96**	**8.96**

Notes:

1. Subtotal for area currently served by Crowson Reservoir. Subtotaled requirements for the area currently served by Crowson are less than the sum of requirements for the Park Estates, South Mountain, and Crowson areas because the subtotal includes only one largest fire.
2. The potential TAP Emergency supply of 1.5 mgd is applied to the Granite Service Level.
3. The potential New WTP supply of 2.5 mgd is applied to the Crowson Service Level.

Table 5.11 Storage Evaluation – Using Emergency Storage Criteria 4 (Nested Emergency/Fire Flow)

Service Area	Existing Storage (MG)	Storage Required (MG)			
		2015		2030	
		Criterion 4a 2 x ADD w/TAP(2)	**Criterion 4b** 2 x ADD w/New WTP(3)	**Criterion 4a** 2 x ADD w/TAP(2)	**Criterion 4b** 2 x ADD w/New WTP(3)
Park Estates	0	0.21	0.21	0.21	0.21
South Mountain	0	0.19	0.19	0.19	0.19
Crowson	2.2	4.05	1.77	4.25	1.81
Subtotal (1)	***2.2***	***4.23***	***1.81***	***4.44***	***1.94***
Granite	2.1	2.70	4.20	2.91	4.41
Alsing	2.1	0.48	0.48	0.50	0.50
Fallon	0.5	0.22	0.22	0.22	0.22
System-wide Total	**6.8**	**7.60**	**6.60**	**8.04**	**7.04**

Notes:
1. Subtotal for area currently served by Crowson Reservoir. Subtotaled requirements for the area currently served by Crowson are less than the sum of requirements for the Park Estates, South Mountain, and Crowson areas because the subtotal includesonly one largest fire.
2. The potential TAP Emergency supply of 1.5 mgd is applied to the Granite Service Level.
3. The potential New WTP supply of 2.5 mgd is applied to the Crowson Service Level.

5.4.6 Identification of Storage Deficiencies

Tables 5.12 and 5.13 present the storage requirements and storage deficiencies using the recommended emergency storage criterion (Criterion 3) for the two different secondary supply options. Results for individual service areas include the following:

- Significant deficiencies exist in both the Crowson and Granite Service Areas, which serve the majority of the system demands.
- The total storage requirements in the Park Estates and South Mountain Service Areas are relatively small and are mostly due to fire flow requirements. The City has previously considered several options for addressing deficiencies found in these areas, such as connecting the two service areas, constructing a separate reservoir (Loop Road Reservoir), and increasing the pumping capacity. This area is discussed further in Section 5.5.
- The Alsing Reservoir, which currently serves a very small service area, has a large excess of storage volume. Seventy-five percent of this reservoir is not currently utilized due to the low demands. This reservoir could be used to serve storage needs elsewhere in the system, in particular during an emergency, but is not currently used in that way during normal system operations.
- The Fallon Service Area has a small volume of excess storage; this excess can be used to provide emergency supply in the Granite service area.

Table 5.12 Storage Evaluation Summary – with TAP Emergency Connection

Service Area	Existing Storage (MG)	Storage Required (MG)			Excess (Deficiency) (MG)		
		2011	2015	2030	2011	2015	2030
Park Estates	0	0.32	0.32	0.33	(0.32)	(0.32)	(0.33)
South Mountain	0	0.22	0.22	0.22	(0.22)	(0.22)	(0.22)
Crowson	2.2	4.96	5.01	5.21	(2.76)	(2.81)	(3.01)
Subtotal (1)	***2.2***	***5.14***	***5.19***	***5.40***	***(2.94)***	***(2.99)***	***(3.20)***
Granite(2)	2.1	5.11	3.66	3.87	(3.01)	(1.56)	(1.77)
Alsing	2.1	0.65	0.66	0.68	1.45	1.44	1.42
Fallon	0.5	0.36	0.37	0.38	0.14	0.13	0.12
System-Wide Total3	**6.9**	**10.90**	**9.52**	**9.96**	**(4.00)**	**(2.62)**	**(3.06)**

Notes:

1. Subtotal for area currently served by Crowson Reservoir. Subtotaled requirements for the area currently served by Crowson are less than the sum of requirements for the Park Estates, South Mountain, and Crowson areas because the subtotal includes only one largest fire.
2. TAP Emergency Supply enters the water system at the Granite Service Area, and therefore reduces the emergency storage required for this service area.
3. The system-wide total does not equate to the sum of the individual services areas, because the system-wide evaluation assumes two largest fires for fire flow requirements.

Table 5.13 Storage Evaluation Summary – with New WTP

Service Area	Existing Storage (MG)	Storage Required (MG)			Excess (Deficiency) (MG)		
		2011	2015	2030	2011	2015	2030
Park Estates	0	0.32	0.32	0.33	(0.32)	(0.32)	(0.33)
South Mountain	0	0.22	0.22	0.22	(0.22)	(0.22)	(0.22)
Crowson(1)	2.2	4.96	2.51	2.71	(2.76)	(0.31)	(0.51)
Subtotal (2)	***2.2***	***5.14***	***2.69***	***2.90***	***(2.94)***	***(0.49)***	***(0.70)***
Granite	2.1	5.11	5.16	5.37	(3.01)	(3.06)	(3.27)
Alsing	2.1	0.65	0.66	0.68	1.45	1.44	1.42
Fallon	0.5	0.36	0.37	0.38	0.14	0.13	0.12
System-Wide Total3	**6.9**	**10.90**	**8.52**	**8.96**	**(4.00)**	**(1.62)**	**(2.06)**

Notes:

1. The potential new WTP enters the water system at the Crowson Service Area, and therefore reduces the emergency storage required for this service area.
2. Subtotal for area currently served by Crowson Reservoir. Subtotaled requirements for the area currently served by Crowson are less than the sum of requirements for the Park Estates, South Mountain, and Crowson areas because the subtotal includes only one largest fire.
3. The system-wide total does not equate to the sum of the individual services areas, because the system-wide evaluation assumes two largest fires for fire flow requirements.

5.4.7 Storage Improvements

From the results of the storage evaluation, the following storage improvements are recommended:

- Implement a secondary supply source (either TAP Emergency Connection or new Water Treatment Plant).
- Expand the Alsing Service Area to include some of the Crowson Service Area to utilize more of the available storage in the Alsing Reservoir. Specific projects associated with this improvement are listed in Section 5.4.7.1.
- Add a second reservoir in the Crowson Service Area (Crowson Reservoir II) to provide adequate volume to address both the Crowson Service Area and the Granite Service Area storage deficiencies. Specific projects associated with this improvement are listed in Section 5.4.7.2.
- Address fire flow requirements in the Park Estates and South Mountain Service Areas with a Loop Road Reservoir. Specific projects associated with this improvement are listed in Section 5.5.

Due to the existing storage deficiencies, all of these improvements are recommended for the short-term planning period. The recommendation of a secondary supply source is under evaluation by the City. The remaining three recommendations are evaluated below.

5.4.7.1 Alsing Service Area Expansion

The Alsing Reservoir has a history of poor water turnover, resulting in challenging water quality conditions for City staff to manage. Increasing the demands on this reservoir will increase turnover and thereby improve water quality. Due to the poor water turnover and excess capacity of the Alsing Reservoir, it is recommended that the Alsing Service Area be expanded. As seen in Tables 5.12 and 5.13, the Alsing Reservoir has an excess capacity of 1.42 MG in 2030. Small changes in the distribution system can help utilize this excess storage to decrease the volume of Crowson Reservoir II.

It should be noted that expanding the Alsing Service Area to serve the Crowson Service Area requires additional pumping at the Hillview Pump Station to replenish the Alsing Reservoir. Boosting water to a higher service area and allowing it to drop back to a lower service area is not an ideal configuration.

Using the hydraulic model, the Alsing Service Area expansion was simulated by installing a PRV station near Siskiyou Boulevard, as shown in Figure 5.4. The PRV would connect Alsing Zone 2 to Crowson Zone 1 at the Siskiyou Boulevard and Tolman Creek Road intersection. This connection allows the Alsing Reservoir to serve properties in Crowson Zones 1, 2, and 6. The modeled PRV was set to 100 psi, allowing the Alsing Reservoir to supply these lower zones during regular operations.

The hydraulic model confirms that during maximum day demands under this proposed configuration, the turnover in the Alsing Reservoir is improved, while pumping at the Hillview Pump Station is increased.

Figure 5.4
Alsing Service Area Expansion - New PRV
WCRS & CWMP
City of Ashland

With the proposed configuration, the new PRV is calculated to flow at 236 gpm during a maximum day. In total volume, this equates to 0.34 MG of MDD. If these areas are to be served by the Alsing Reservoir, the reservoir will need to provide operational and emergency storage. The operational storage criterion is 0.25 x MDD and the emergency storage criterion is 1 x MDD (no secondary supplies are planned for the Alsing Service Area). Therefore, the Alsing Reservoir should provide storage for 1.25 x MDD of this additional area, or 0.43 MG (1.25 x 0.34 MG).

While this option does not utilize the full 1.42 MG of additional capacity in the Alsing Reservoir, it improves turnover in the reservoir and reduces the additional storage required in the Crowson Reservoir by 0.43 MG. It is recommended that a new PRV be installed to allow the Alsing Reservoir to serve additional areas. Further, it is recommended that the Hillview Pump Station controls be set to allow the Alsing Reservoir to drain down further than current levels. The following projects are included in the CIP:

- **Tolman Creek Road New PRV** (Tolman Creek Road and Siskiyou Blvd) – Install a new PRV station to connect the Alsing Zone 2 to Crowson Zone 1.

- **Hillview Pump Station Setpoints** – Adjust the pump controls of the Hillview Pump Station to allow further drawdown of the Alsing Reservoir.

5.4.7.2 Crowson Reservoir II

As seen in Tables 5.12 and 5.13, the Crowson Service Level has a future storage deficiency ranging from 0.70 to 3.20 MG, depending on the secondary supply source installed. The Granite Service Area, which can also be served by the Crowson Reservoir, also has a storage deficit. For this reason, a second reservoir in the Crowson Service Area should be designed to meet the future storage deficit of both the Crowson and the Granite Service Areas.

The City has previously evaluated a Crowson Reservoir II in past planning studies. It was previously determined that a 2.2-MG reservoir would meet the City's future storage requirements. However, this estimate was based on providing 0.5 x MDD of emergency storage. To estimate the required volume, the storage of the Crowson and Granite Service Areas must be evaluated together under the new emergency storage criterion. Table 5.14 presents this calculation for the 2030 scenario. As seen in the table, the total future storage requirement is either 7.30 or 8.30 MG, depending on the secondary supply source. Combining the service areas as shown, reduces the total storage required by providing for one 4,000-gpm fire for the combined area.

The combined storage available in the Granite and Crowson Reservoirs is 4.3 MG. Therefore, the 2030 storage deficit is 4.00 or 3.00 MG, depending on the secondary supply source. If the City expands the Alsing Service Area as described above, this volume can be reduced by approximately 0.43 MG, resulting in a reservoir of 3.57 or 2.57 MG, depending on the secondary supply source.

Table 5.14 Crowson & Granite Service Areas 2030 Storage Requirements

Service Area	Operational Storage (MG)	Fire Flow (MG)	Emergency Storage (MG)		Total Storage (MG)	
			TAP Supply	New WTP	TAP Supply	New WTP
Crowson	0.89	0.96	3.55	1.05	5.40	2.90
Granite	0.88	0.96	2.02	3.52	3.87	5.37
Total[1]	**1.77**	**0.96**	**5.57**	**4.57**	**8.30[(1)]**	**7.30[(1)]**

Notes:

1. The total does not equate to the sum of the individual services areas, because the total evaluation assumes only one largest fire (0.96 MG) for both service areas.

Previous studies performed by the City have evaluated the location and estimated construction costs for Crowson Reservoir II, assuming a 2.0-MG tank. The CIP presented in Chapter 7 uses the same assumptions as these previous in-depth studies, adjusting for overall reservoir volume.

The model was used to simulate a second 3.0-MG Crowson reservoir. The tank was set in the location identified in the *Crowson II and Ashland Loop Road Reservoir Siting Study* (2006, Brown and Caldwell). The tank was set at the same elevation as the existing reservoir, and was connected to the WTP finished water transmission pipe with a 24-inch diameter pipe. Adding the reservoir provided minimal impacts on the model during typical operation (i.e. non-emergency). However, the additional storage had a large impact on reducing fire flow deficiencies, as discussed in Section 5.6.3. The following project is included in the CIP:

- **Crowson Reservoir II** – Install new reservoir serving Crowson & Granite Service Areas. Size depends on secondary supply source. Project includes a pre-design study to confirm storage requirements, and evaluate the piping connecting to the Crowson Reservoir.

5.4.7.3 Loop Road Reservoir

The fourth recommendation to address storage deficiencies is to address fire flow requirements in the Park Estates and South Mountain Service Areas. This can be done either through a reservoir or through adequate pumping capacity. Previously, the City has evaluated the option of installing a reservoir on Loop Road to serve these areas (Loop Road Reservoir). The *Crowson II and Ashland Loop Road Reservoir Siting Study* evaluated potential locations for a 0.2-MG reservoir. Two sites were deemed appropriate. Costs for this reservoir were estimated from $1.1 million (M) to $1.7M. These costs have not been updated since 2006.

The current storage deficiency identified above shows that these service areas would require a 0.37-MG tank; however, the City has identified that actual MDD in these areas may be less than the demands used in this evaluation. For this reason, it is recommended that the reservoir and pump station alternatives for this area be further reviewed during preliminary design to determine the appropriate solution. The pump station alternative is discussed further in Section 5.5.3.

5.5 PUMPING CAPACITY

The pumping capacity evaluation reviews the ability of the existing pumping facilities to serve their associated service areas according to the established pump station evaluation criteria. The City has four pump stations: the Park Estates, South Mountain, Hillview, and Strawberry Pump Stations. The service areas served by pump stations include the Park Estates, South Mountain, Alsing, and Fallon, respectively.

The evaluations were based on the criteria of having sufficient firm capacity (capacity remaining with the largest pump out of service) to meet MDD in service areas with reservoirs (i.e., the Alsing and Fallon Service Areas) and peak hour demand (PHD) plus fire flow in service areas without direct reservoir service (i.e. the Park Estates and South Mountain Service Areas). From the City's diurnal curve, peak hour demands are 1.75 x MDD. The following are apparent in Table 5.15, which presents pump station evaluation results:

- The Park Estates and South Mountain Service areas are deficient. The firm capacity of the South Mountain PS is sufficient to meet PHD through 2030; the Park Estates PS is deficient in meeting PHD starting in 2015. Both fall far short of meeting fire flow requirements of 1,500 gpm.
- The capacities of the Hillview and Fallon Pump Stations are sufficient to meet projected MDD.

5.5.1 Pumping Improvements

From the results of the pumping capacity evaluation, the following pumping improvements are recommended:

- Connect the South Mountain and Park Estates Service Areas.
- Increase the pumping capacity of the Park Estates Pump Station to meet the demands and fire flow requirements of both the Park Estates and South Mountain Service Areas.

These recommendations are described below. Figure 5.5 presents a summary of the recommended storage and pumping improvements to be included in the CIP. This figure assumes a new Park Estates Pump Station to resolve the deficiencies in the Park Estates and South Mountain Service Areas.

5.5.2 Connect South Mountain & Park Estates Service Areas

The recommendation to connect the South Mountain and Park Estates Service Areas has been reviewed in previous studies. Connecting these service areas eliminates the need for two pump stations to meet the fire flows of two separate service areas. Once these areas are connected, only one pump station or reservoir will need to provide 1,500-gpm of fire flow. The following pipe projects are required for connecting these service areas and providing adequate flow for fires in both zones. The following projects are included in the CIP:

- **P-1 Ivy Lane New Pipe** (Morton Street to west end of Ivy Lane) – New 1,320-LF 8-inch diameter pipe.
- **P-2 Ivy Lane Pipe Replacement** (South Mountain to FH-16AD-038) – Replace 420-LF of 6-inch diameter pipe with 8-inch diameter pipe.

Table 5.15 Pump Station Capacity Evaluation Summary

Service Area[1]	Existing Firm Capacity (gpm)[2]	Maximum Day Demands (gpm)			Fire Flow (gpm)	Total Capacity Required (gpm)[3]			Excess Capacity (Deficiency) (gpm)		
		2011	2015	2030		2011	2015	2030	2011	2015	2030
Park Estates	150	77	78	81	1,500	1,653	1,655	1,663	(1,503)	(1,505)	(1,513)
South Mountain	145	23	23	24	1,500	1,545	1,546	1,548	(1,400)	(1,401)	(1,403)
Alsing	650	262	266	279	N/A	262	266	279	388	384	371
Fallon	200	102	103	108	N/A	102	103	108	98	97	92

Notes:

1. Alsing Service Area served by Hillview PS; Fallon Service Area served by Strawberry PS.
2. Firm pump station capacity based on largest pump out of service.
3. Total capacity requirements for Park Estates and South Mountain Service Areas based on Peak Hour Demand (PHD) plus fire flow, where PHD was assumed to be equal to MDD times 2.0. For Alsing and Fallon Service Areas, total capacity requirement assumed to be equal to MDD.

5.5.3 New Park Estates Pump Station

Once the Park Estates and South Mountain Service Areas are connected, the combined service area needs adequate water supply and fire protection. Previous studies for this area indicate that the City would like to take the South Mountain Pump Station out of service. The remaining options for meeting demands and providing fire flow to these areas are to construct a larger Park Estates Pump Station or a Loop Road Reservoir.

Given the anticipated demands in this area (as listed in Table 5.4), the Park Estates Pump Station will not have adequate capacity to meet peak hour demands in the year 2015. Previous studies indicate that the suction head on the existing Park Estates pumps are limited by the water elevation in the Crowson Reservoir. This is likely caused by the piping configuration between the reservoir and pump station. Pump Station updates are required for this pump station due to these issues.

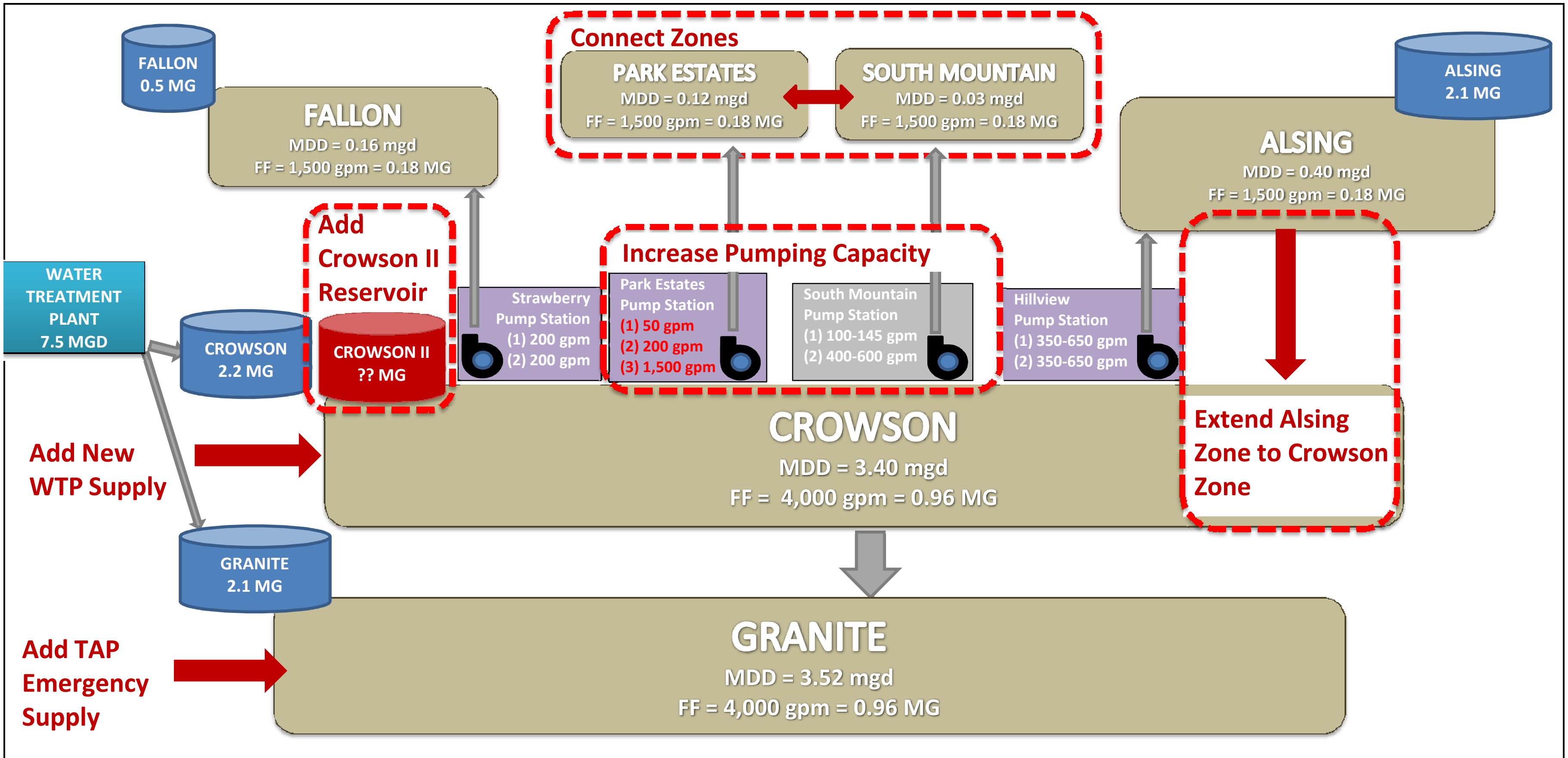
In addition, the pump station could be updated to include a fire pump for meeting the fire flow requirements of these service areas without requiring a Loop Road Reservoir. Replacing the Park Estates Pump Station without a reservoir would require two service pumps and one fire pump. The two service pumps should provide approximately 30 gpm up to 200 gpm to meet both minimum and peak system demands for the two service areas. A 1,500-gpm engine-driven fire pump is recommended to meet fire flows. The new pump should have adequate head to provide flow from the lowest water elevation in Crowson Reservoir to the highest property served in the South Mountain and Park Estates Service Areas.

A pump station predesign report would also be recommended to confirm pumping requirements, evaluate the site, perform a geotechnical evaluation, and evaluate the piping connecting to the Crowson Reservoir. This alternative is included in Chapter 7 – Capital Improvements Plan.

Connecting the service areas and adding a new pump station was simulated in the hydraulic model. A 1,500-gpm fire pump and two service pumps: (1) 50-gpm and (1) 200-gpm pumps replaced the existing Park Estates pumps. The impacts of the new pump station on fire flow are discussed in Section 5.6.3.3.

The following projects are included in the CIP:

- **Park Estates Pump Station Replacement** - Replace existing Park Estates Pump Station to serve South Mountain Service Area and additional areas per project P-16 below. Project includes a predesign study to confirm pumping requirements, evaluate the site, perform a geotechnical evaluation, and evaluate the piping connecting to the Crowson Reservoir. Evaluate this alternative with the option of a Loop Road Reservoir.



LEGEND

Service Area		MDD =	Maximum Day Demand
		FF =	Maximum Required Fire Flow
Reservoir		gpm =	gallons per minute
		mgd =	millions of gallons per day
Pump Station		MG =	Millions of Gallons

Figure 5.5
Recommended Storage
& Pumping Capacity Improvements
WCRS & CWMP
City of Ashland

5.6 DISTRIBUTION SYSTEM PIPING

Sufficiency of the existing distribution system piping was evaluated based on the ability of the system to deliver needed fire flows. The evaluation was conducted using an updated version of the City's Infowater™ hydraulic model. This section includes the following sections:

- Hydraulic model update and calibration; and
- System analysis results.

5.6.1 Hydraulic Model Update and Calibration

The City's hydraulic model was updated as follows:

- **System Demands**. Current (2010), 2015, and 2030 model scenarios were developed based on projected demands with an additional 5 percent conservation. Demands were distributed per the existing model, with the demands at each node scaled according to the increase in overall system demands.
- **New Pipelines**. The City's GIS data were used to identify pipelines not included in the current model. Pipelines with diameters less than 6-inches were included only in areas where system looping was not otherwise provided, and the results affected calibration points.
- **PRV and Pump Station Settings**. Settings were updated to match data provided by the City, as summarized in *Chapter 1 – Existing System*.
- **Reservoir Data**. The base elevations, overflow elevations, and volumes of the City's finished water reservoirs were updated to match City-provided values, as needed.

No changes were made to the diurnal demand curve or the pump curves.

Once the base model was completed, model performance was compared to performance of the actual water system to verify that the model is representative of the system. This verification included comparing system pressures in the model to data collected during field hydrant tests for model calibration. Field data from the water system were collected from hydrant flow tests in which pressure at the hydrant is measured before the test (the "static" pressure), and the flow rate and hydrant pressure ("the residual pressure") are measured during the flow test. The flow rate was measured at a nearby hydrant. The model was then corrected such that predicted pressures were within 10 percent of the field pressures.

Model verification was based on a total of 11 hydrant tests conducted in 2011, as shown in Table 5.16. As time of day and reservoir levels were unavailable for the tests, the average diurnal demands and reservoir levels were used. Upon initial calibration, the results of five hydrant tests did not concur with the model results. The City's GIS database was referenced to further evaluate these areas. Some areas required additional pipe looping that was not previously in the model because the pipes were less than 4-inches in diameter. The GIS data also presented the pipe material and year of installation. This data was used to adjust the pipe roughness coefficients (C-values) to mimic those expected for nearby pipes.

After completing these adjustments, all model results were successfully calibrated to within 10 percent of the field test results, as shown in Table 5.16.

Table 5.16 Hydraulic Model Calibration Results

	Hydrant Info				Static Pressure			Residual Pressure		
Pressure Zone	**Test No.**	**Location**	**Hydrant ID (Flow/Ref)**	**Flow (gpm)**	**Field (psi)**	**Model (psi)**	**Percent Diff.**	**Field(2) (psi)**	**Model (psi)**	**Percent Diff.**
Crowson 6	1	2088 Creek Drive	10DA-004	1,592	150	155	3	108	103	-5
Crowson 2	2	585 Clover Ln	14AA-043	1,233	90	93	3	74	74	0
Granite 1	3	243 N Mountain Ave	09AA-028	1,501	129	131	2	95	98	3
	4	321 Bridge Street	10CB-036	1,186	79	82	4	71	66	-7
WTP Direct	5	550 Thornton Way	05BD-034	1,510	95	101	6	73	66	-10
Granite 1	6	521 Fordyce Street	10BB-032	1,394	120	130	8	95	104	9
Granite 1	7	495 Willow Street & Otis St	04BC-034	1,653	148	154	4	130	132	2
Granite 2	8	330 Coventry Place & Glendower St	04BB-035	1,113	96	99	3	52	51	-2
Crowson 6	9	185 Brooks Lane	11CA-036	1,538	150	156	4	126	115	-9
Crowson 2	10	2910 Wedgewood Ln	13BB-028	1,519	125	133	6	110	121	10
Crowson 1	11	1981 Mohawk Street	15DA-041	1,163	88	92	5	76	69	-9

5.6.2 System Analysis Results

With the calibration complete, the hydraulic model was used to evaluate the existing distribution system capacity. As stated in Table 5.1, the system was evaluated for the ability to provide adequate pressures at peak hour demands and during fire flows at maximum day demands. These two evaluations are described below.

5.6.2.1 Pressure at Peak Hour Demands

The first distribution system evaluation criterion is to provide peak hour demands while maintaining 20 psi throughout the system. The hydraulic model was used to evaluate the system pressures using the estimated demands for the years 2015 and 2030. Figures 5.6 and 5.7 present the resulting pressures under these two scenarios.

As seen in the figures, several nodes with low pressures under the future demand scenarios are located in the higher elevations along the southern border of the City, such as Elkader Street, Emma Street, and Woodland Drive. These areas all lie within the upper elevations of their pressure zones. Other deficiencies exist near the reservoirs, where pressures are low due to the high elevations. No new pressure deficiencies are anticipated during peak hour demands in 2030 compared to 2015.

It is not recommended that pressures to these areas be increased to maintain appropriate pressures during peak hour demands. Rather, it is recommended that higher pressure zones be expanded to incorporate these locations. These options are discussed below as part of the fire flow analysis.

5.6.2.2 Fire Flow Availability

The second evaluation criterion is to provide fire flows during maximum day demands while maintaining 20 psi throughout the system. Figure 5.8 presents the required fire flows throughout the system. The City’s latest Insurance Services Office (ISO) fire report was used to identify fire flow requirements for properties requiring fire flows greater than 2,500 gpm. Fire flows of 3,000 gpm and 4,000 gpm were assigned to nodes in the model representing these properties, as listed in the ISO report. Fire flows of 1,500-gpm were assigned to all other nodes in the model near hydrants, representing residential properties. Storage tanks in the model were set to represent the system at the end of a fire, when water levels are low.

The hydraulic model was then used to evaluate the available fire flow for all nodes while maintaining 20 psi throughout the system. Figures 5.9 and 5.10 presents whether the required fire flow can be met while meeting the criterion for the years 2015 and 2030, respectively. It is important to note that many of the deficient nodes identified in the figures are able to achieve the fire flow required at the node; however, doing so results in pressures dropping below 20 psi for other areas in the system.

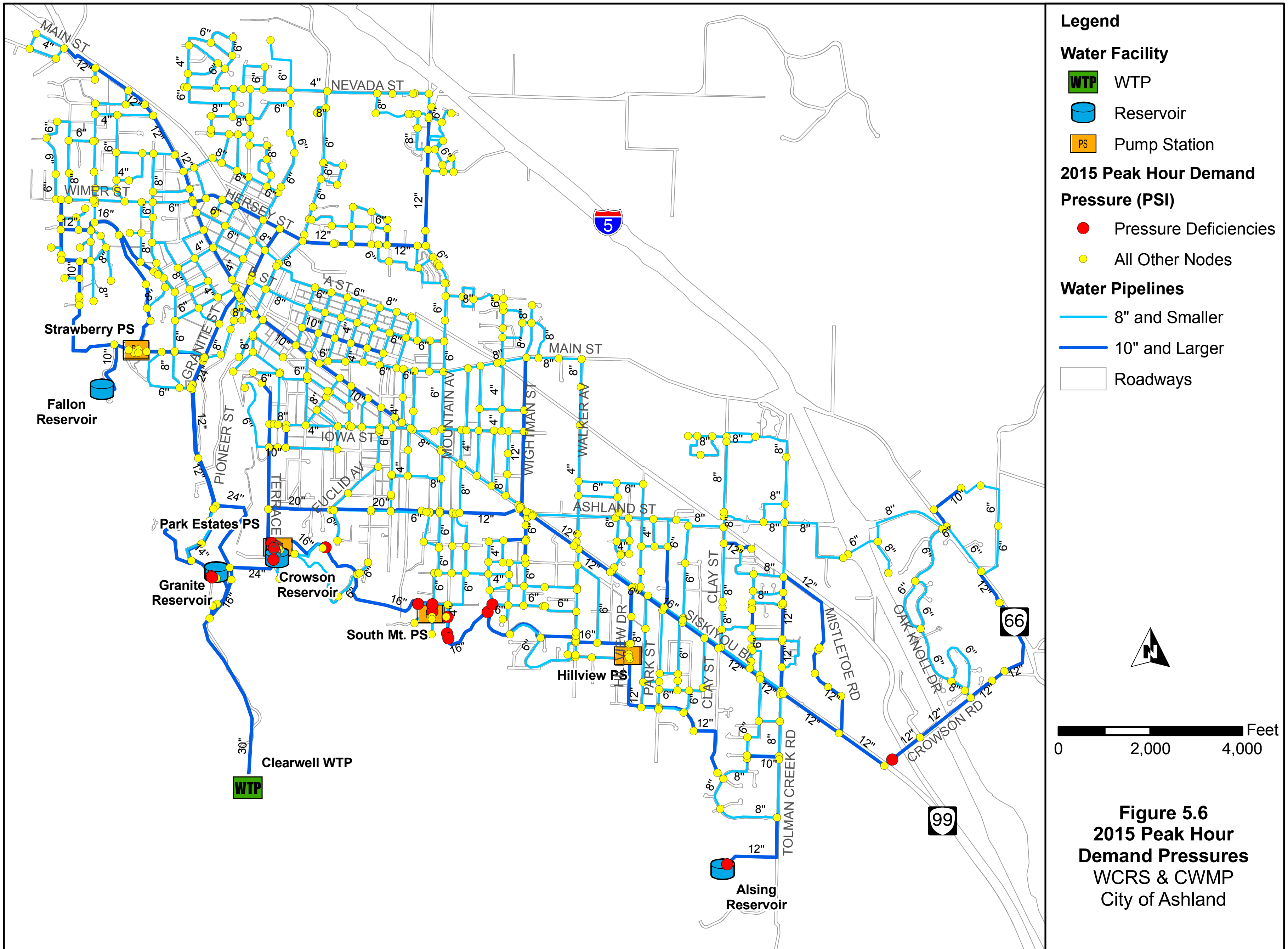


Figure 5.6
2015 Peak Hour Demand Pressures
WCRS & CWMP
City of Ashland

carollo
Engineers...Working Wonders With Water®

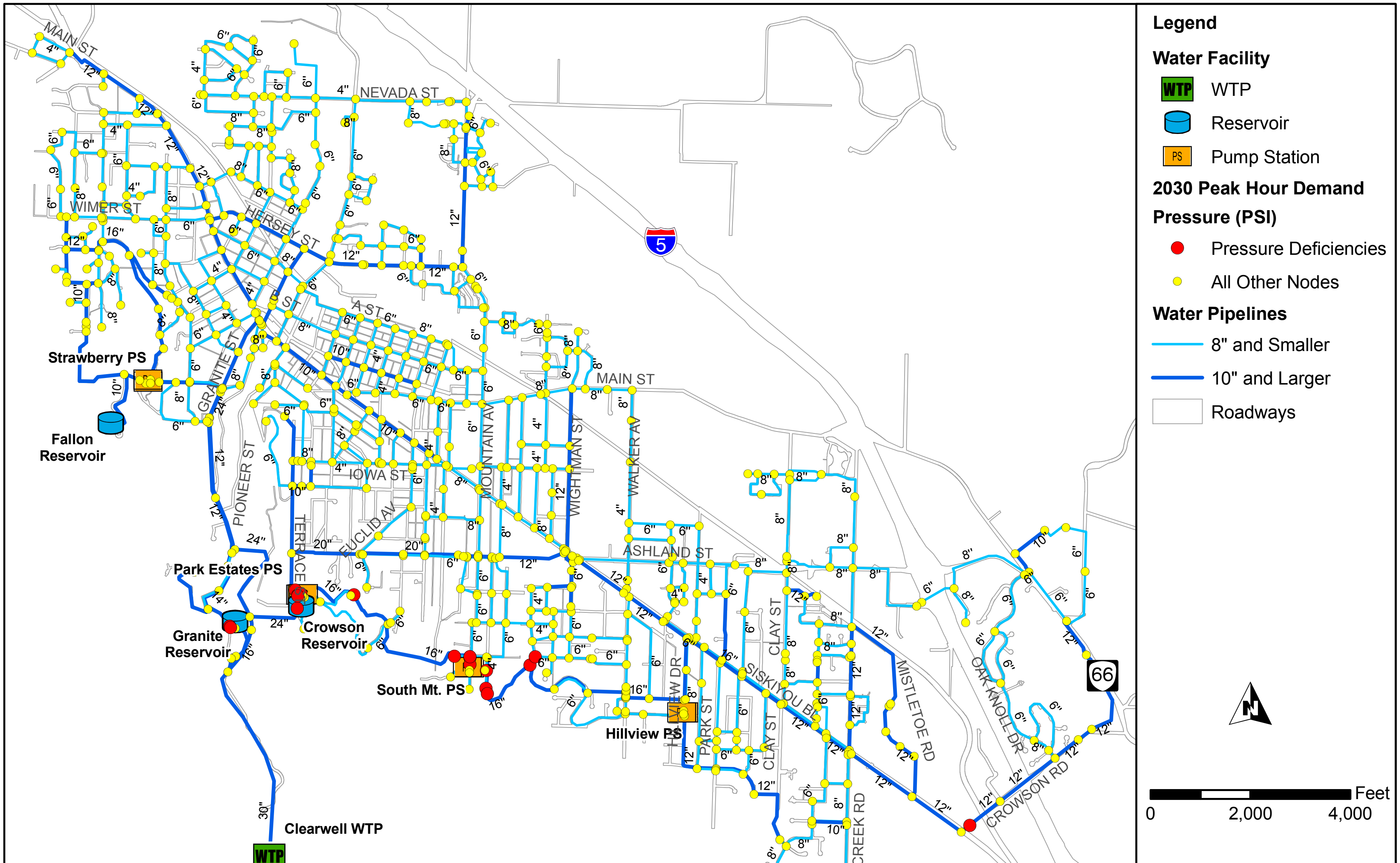


Figure 5.7
2030 Peak Hour Demand Pressures
WCRS & CWMP
City of Ashland

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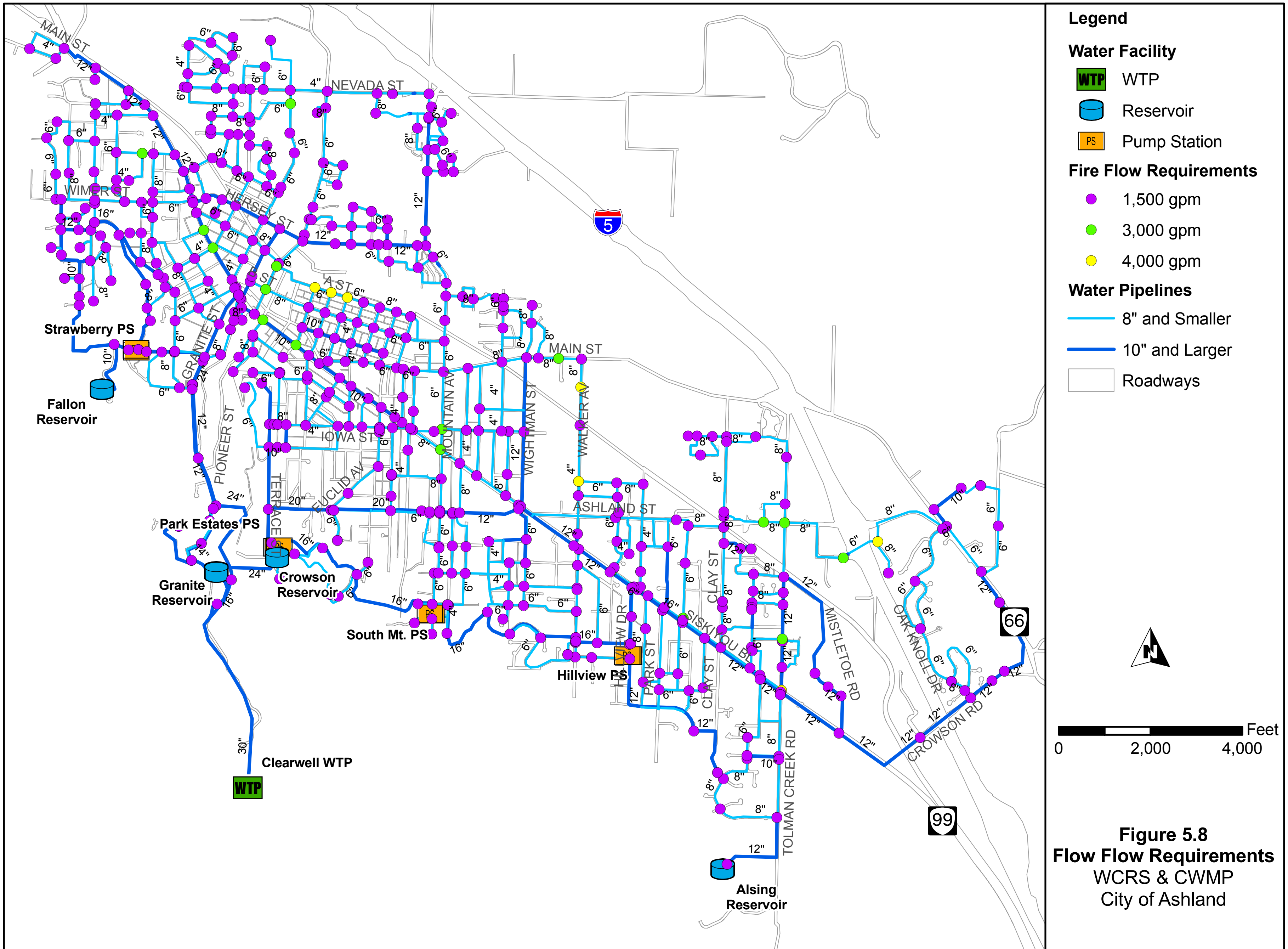
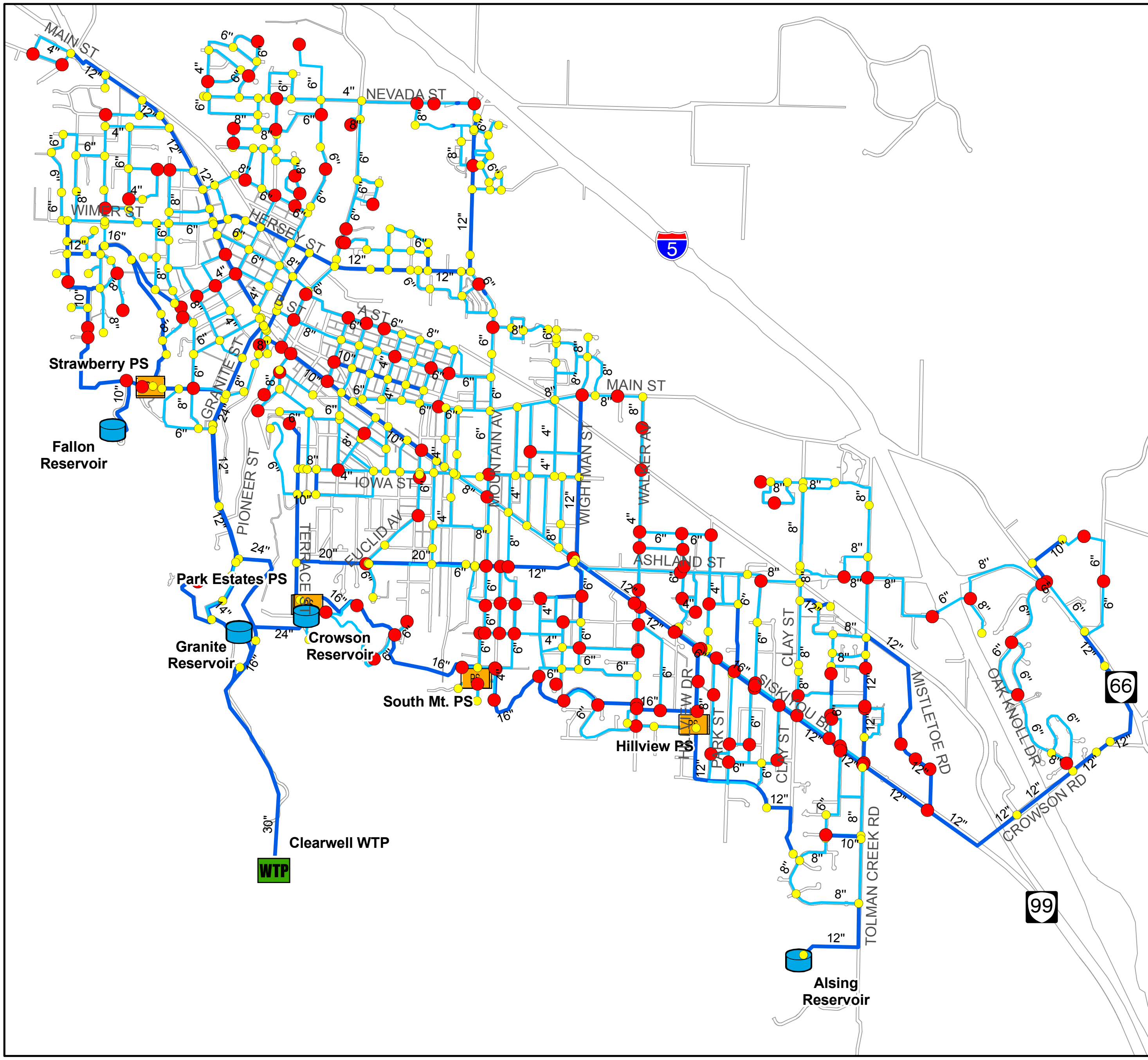


Figure 5.8
Flow Flow Requirements
WCRS & CWMP
City of Ashland



Legend

Water Facility

- WTP
- Reservoir
- Pump Station

2015 Fire Flows

- Fire Flow Deficiency
- Meets Fire Flow Requirement

Water Pipelines

- 8" and Smaller
- 10" and Larger
- Roadways

Feet: 0, 2,000, 4,000

Figure 5.9
2015 Fire Flow Deficiencies
WCRS & CWMP
City of Ashland

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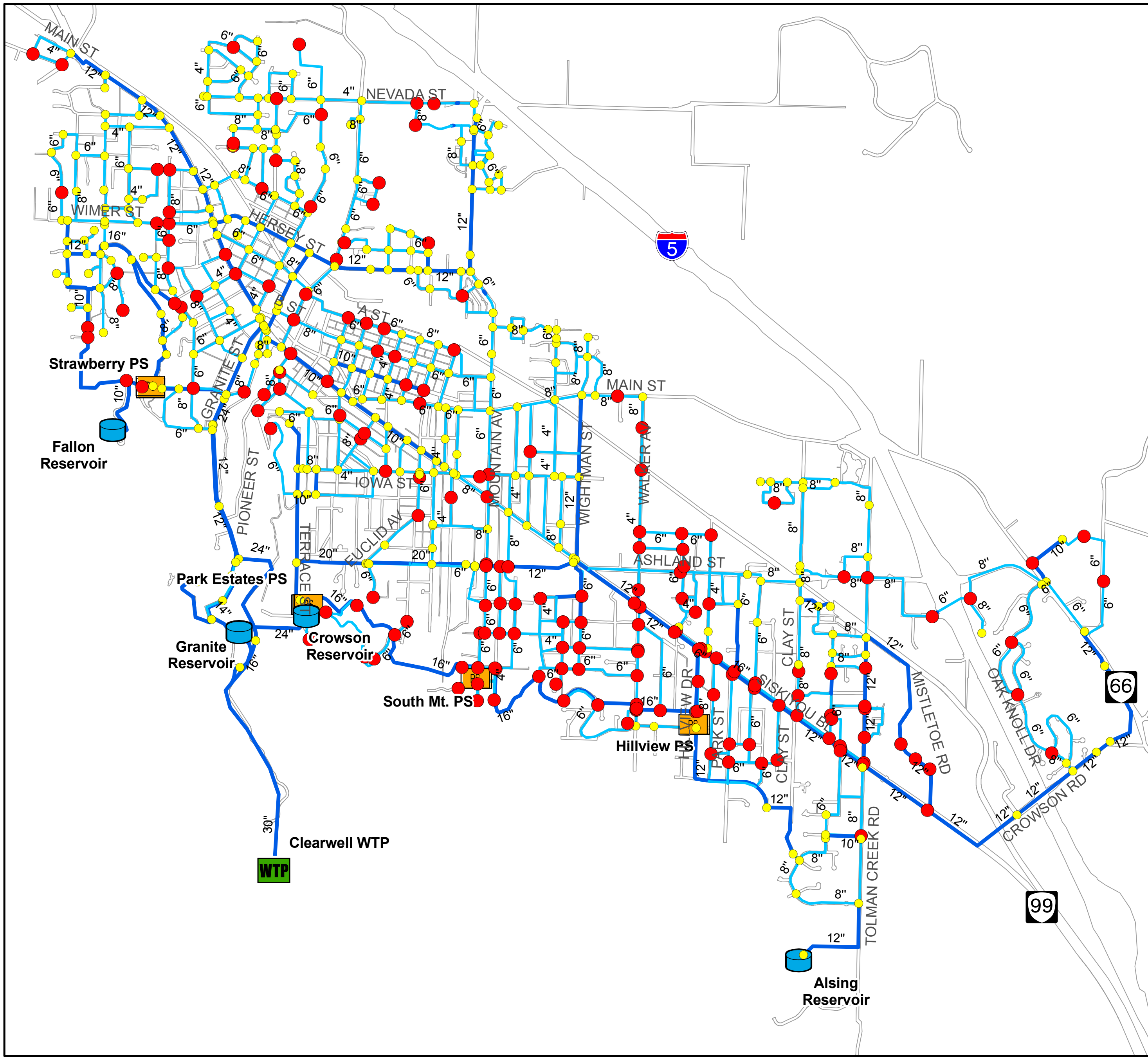

Legend

Water Facility

- WTP
- Reservoir
- Pump Station

2030 Fire Flows

- Fire Flow Deficiency
- Meets Fire Flow Requirement

Water Pipelines

- 8" and Smaller
- 10" and Larger
- Roadways

Feet: 0, 2,000, 4,000

Figure 5.10
2030 Fire Flow Deficiencies
WCRS & CWMP
City of Ashland

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As seen in the figures, fire flow deficiencies occur in most of the Crowson Zone 1 Service Area. This is largely due to the lack of storage available in the Crowson Reservoir. After a 4,000-gpm fire, the Crowson Reservoir is essentially depleted. A second reservoir will provide additional storage for large fires, while maintaining adequate head. Additionally, fire flows are shown to occur in the Park Estates and South Mountain Service Areas. These deficiencies are expected as the Park Estates and South Mountain Pump Stations currently do not have capacity to pump 1,500 gpm.

Fire flow deficiencies also exist on several dead-end pipes. This is a common issue for water systems and can be resolved by providing looping, increasing the pipe diameter, or reducing the fire flow requirements. Fire flow deficiencies are also present in areas served by 4-inch diameter pipe, which is unable to convey 1,500-gpm fire flows.

5.6.3 Recommended Projects

The following projects are recommended to alleviate the pressure deficiencies found during peak hour demands and fire flows. All projects are sized to meet the capacity requirements under the 2030 scenario. If the available fire flow at a node is within 10 percent of the required fire flow, it is assumed to be adequate. This assumption is made due to limitations of the hydraulic model accuracy. Figure 5.11 presents the proposed projects for the system. Operational improvement projects are not shown on Figure 5.11.

5.6.3.1 Crowson Reservoir II

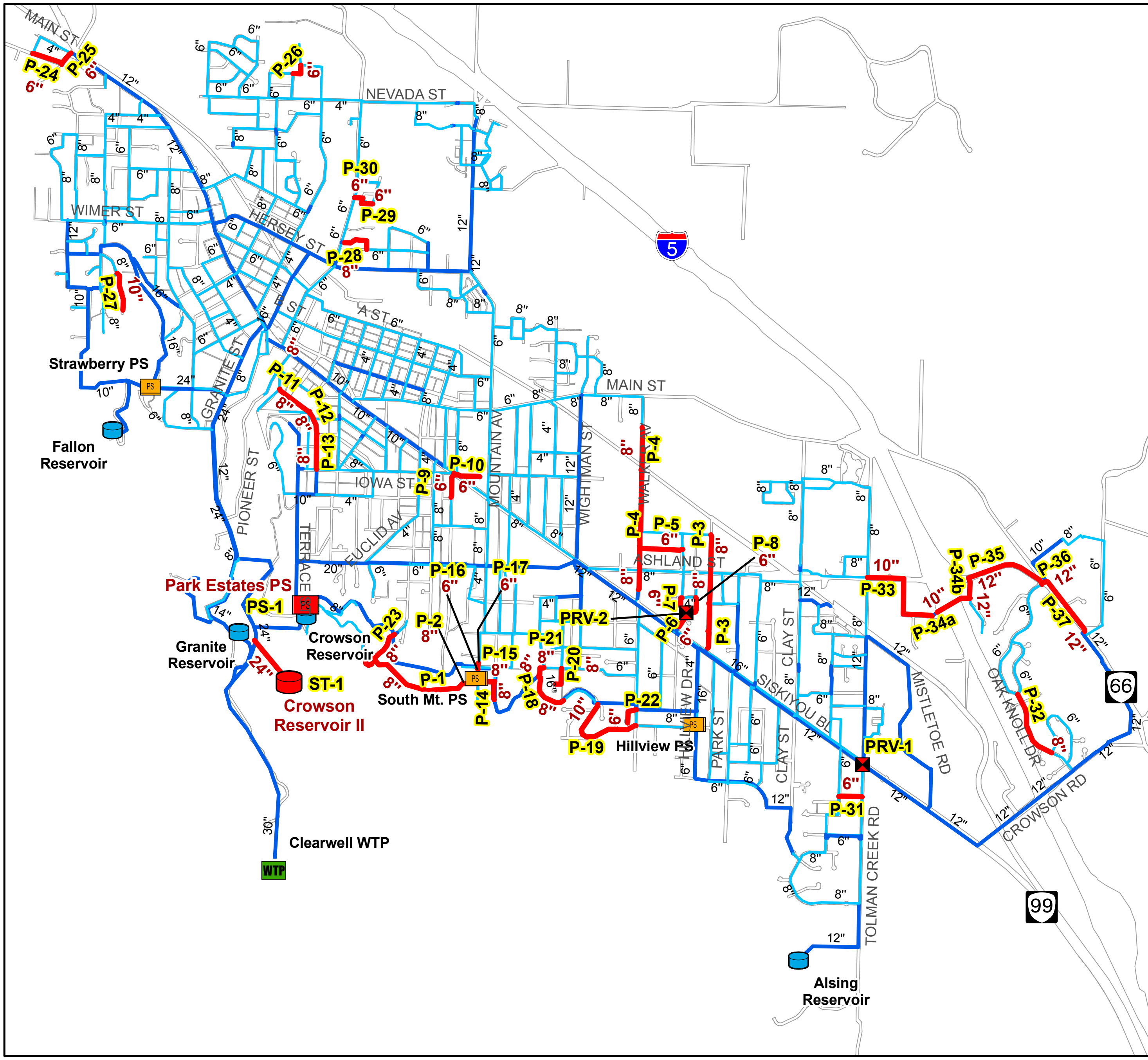
The first recommendation is to install Crowson Reservoir II. The additional storage that this reservoir provides allows for increased pressure in the Crowson pressure zones during the fire flow test. Modeling the system with the second reservoir in place resulted in decreased fire flow deficiencies throughout the system. For the rest of the system analysis, it is assumed that a 3.0-MG new reservoir is part of the system. This project was already identified as ST-1 Crowson Reservoir II.

5.6.3.2 Park Estates Pump Station

The second recommendation is to increase the pumping capacity of the Park Estates Pump Station to provide adequate fire flow to the newly combined Park Estates and South Mountain Service Areas. The new pump station is discussed above in Section 5.5.3. With the modeled pump station in place, fire flows in the Park Estates and South Mountain Service Areas are adequately provided. This project was already identified as PS-1 Park Estates Pump Station Replacement.

5.6.3.3 Pipe Improvement Projects

The following projects are recommended to address the remaining fire flow deficiencies. The capital projects identified are categorized into piping (P), and operational (O). Figure 5.11 presents the general areas of pipe improvements discussed below. The pipe recommendations are grouped according to their general area in the system.



Legend

Proposed Water Facility

- Reservoir
- Pump Station
- PRV
- Proposed Pipeline Improvement

Existing Water Facility

- WTP
- Reservoir
- Pump Station

Existing Water Pipelines

- 8" and Smaller
- 10" and Larger
- Roadways

Figure 5.11
Recommended Improvements
WCRS & CWMP
City of Ashland

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Walker Ave, Homes Ave & Normal Ave

- **P-3 Normal Ave Pipe Replacement** (Siskiyou Blvd to Homes Ave) – Replace 2,240 LF of 4-inch pipe with 8-inch pipe;
- **P-4 Walker Ave Pipe Replacement** (Siskiyou Blvd to Ashland Middle School) – Replace 3,246 LF of 4-inch and 6-inch pipe with 8-inch pipe;
- **P-5 Parker Street Pipe Replacement** (Walker Ave to Lit Way) – Replace 860 LF of 4-inch pipe with 6-inch pipe.
- **PRV-2 Lit Way PRV** - Install new 6-inch PRV Station between Crowson Zone 5 and Granite Zone 1 at intersection of Harmony Lane and Lit Way. Set PRV to open during fire flows (downstream pressure below 30 psi);
- **P-6 Harmony Lane Pipe Replacement** (Siskiyou Blvd to Lit Way) – Replace 340 LF of 4-inch pipe with 6-inch pipe.
- **P-7 Lit Way Pipe Replacement** (Joy Avenue to Ray Lane) – Replace 182 LF of 4-inch pipe with 6-inch pipe.
- **P-8 Ray Lane Pipe Replacement** (Lit Way to Joy Ave) – Replace 284 LF of 4-inch pipe with 6-inch pipe.

Iowa & Siskiyou

- **O-2 FH 09DB-055** - Ensure FH 09DB-055 is connected to 8-inch diameter pipe in Sherman Street not 4-inch pipe in Iowa Street;
- **P-9 Beach Street Pipe Replacement** (Larkin Lane to Iowa Street) – Replace 488 LF of 4-inch pipe with 6-inch pipe;
- **P-10 AHS Property Pipe Replacement** (Fire hydrant in school property) – Replace 480 LF of 4-inch diameter pipe with 6-inch diameter pipe.

Vista Street/Glenview Drive

- **P-11 Vista Street Pipe Replacement** (Fork St to Hillcrest St) – Replace 740 LF of 6-inch pipe with 8-inch pipe;
- **P-12 Vista Street Pipe Replacement** (Intersection of Vista Street, Hillcrest Street, and Glenview Drive) - Replace 22 LF of 6-inch pipe with 8-inch pipe;
- **P-13 Meade Street Pipe Replacement** (Vista St/Hillcrest to Iowa Street) – Replace 1,172 LF of 4-inch pipe with 8-inch pipe.

Ivy Lane/Emma Street (Already in CIP)

- **P-14 Elkader Street Pipe Replacement** (Ivy Lane to Pinecrest Trail) - Replace 359 LF of 6-inch pipe with 8-inch pipe
- **P-15 Ivy Lane Pipe Replacement** (South Mountain Ave to Elkader Street) – Replace 310 LF of 6-inch pipe with 8-inch pipe.
- Extend South Mountain Service Area to Emma Street and south end of Elkader.
    - **O-3 Elkader Street Valve** - Close valve in Elkader Street near Ivy Lane;

- **O-4 Emma Street Valve** - Close valve in Emma Street just east of South Mountain Ave.
- South Mountain Ave (south of Emma Street) –
  i) **O-5 South Mountain Disconnect** - Disconnect 6-inch pipe in South Mountain Ave from 16-inch pipe in Emma Street.
  ii) **P-16 South Mountain Ave New Pipe** - New 30-LF 6-inch pipe connecting 6-inch pipe in South Mountain Ave to 6-inch pipe in Emma Street east of South Mountain Ave.
- **P-17 South Mountain Ave New Pipe to Fire Hydrant** (north of Emma Street) – New 90 LF of 6-inch pipe to serve FH 16AD-043.

<u>Pinecrest/Woodland Drive/Walker Ave</u>

- Extend Alsing Service Area to serve Pinecrest Trail hydrants.
  - **P-18 Pinecrest Trail New Pipe** (Penny Drive to Woodland Drive) - New 880 LF of 8-inch pipe;
  - **P-19 Pinecrest Trail Pipe Replacement** (Walker Ave to Starlight Place) – Replace 1,833 LF of 6-inch pipe with 10-inch pipe;
- **P-20 Penny Drive Pipe Replacement** (Woodland Drive to Weissenback Way) - Replace 413 LF of 6-inch pipe with 8-inch pipe. Fire flow available will be 1,400 gpm.
- **P-21 Woodland Drive Pipe Replacement** (Leonard Street to Pinecrest Trail) – Replace 250 LF of 6-inch pipe with 8-inch pipe.
- **P-22 Hiawatha Place Pipe Replacement** (Walker Ave to end of Hiawatha Place) - Replace 300 LF of 4-inch pipe with 6-inch pipe to FH 15CA-020.

<u>Morton Street</u>

- **P-23 Morton Street Pipe Replacement** (FH 16AC-023 to PRV-12) - Replace 644 LF of 6-inch pipe with 8-inch pipe.

<u>Crestview Drive</u>

- **O-6 Crestview Drive Hydrants** - Ensure hydrants in Crestview Drive are connected to 12-inch pipe not 6-inch pipe.

<u>Ashland Mine Road</u>

- **P-24 Ashland Mine Road Pipe Replacement** (Cedar Way to Fox Street) – Replace 611 LF of 4-inch pipe with 6-inch pipe;
- **P-25 Fox Street Pipe Replacement** (Ashland Mine Road to N. Main Street) – Replace 286 LF of 4-inch pipe with 6-inch pipe.

<u>Dog Park Road</u>

- **P-26 Almeda Drive New Pipe** (West end of street to Dog Park Road) – New 180 LF 6-inch pipe to create a loop.

<u>Skycrest Drive</u>

The fire hydrant at end of street can only provide 1,000 gpm. Improvements increase fire flow to 1,350 gpm (within 10% of criteria).

- **O-7 PRV 11** - Increase PRV 11 (Westwood) setpoint to from 70 psi to 90 psi;
- **P-27 Skycrest Drive Pipe Replacement** (Orchard Street to south end of Skycrest Drive) – Replace 8-inch diameter pipe with 10-inch diameter pipe.

<u>Oak Street</u>

- **P-28 Crispin Street Pipe Replacement** (Oak Street to Patterson Street) – Replace 650 LF of 6-inch pipe with 8-inch pipe;
- **P-29 Oak Lawn Ave Pipe Replacement** (Oak Street to Sylvia Street) – Replace 150 LF of 4-inch pipe with 6-inch pipe;
- **P-30 Sylvia Street Pipe Replacement** (Oak Lawn Ave to FH 04cA-019) – Replace 330 LF of 4-inch pipe with 6-inch pipe.

<u>Tolman Creek Road</u>

- **P-31 Black Oak Way Pipe Replacement** (Tolman Creek Road to Bellview Ave) – Replace 456 LF of 4-inch pipe with 6-inch pipe.

<u>Oak Knoll Drive</u>

- **P-32 Oak Knoll Drive Pipe Replacement** (Twin Pines Creek Drive to Cypress Point Loop) – Replace 1,427 LF of 6-inch pipe with 8-inch pipe.

<u>Washington Street/Jefferson Ave</u>

- **P-33 Ashland Street Pipe Replacement** (Tolman Creek Road to Washington St) – Replace 2,000 LF of 8-inch pipe with 10-inch pipe.

<u>Ashland Street East of Interstate 5</u>

The fire deficiency in this area can be addressed by two alternative projects. These alternatives will be evaluated for cost in the CIP. To alleviate this fire flow deficiency, implement the following project:

- **P-34a I-5 Crossing** - Replace 720 LF of 6-inch pipe with 10-inch pipe across Interstate 5;

or the following projects:

- **P-34b Clover Lane Pipe Replacement** (Ashland Street to FH 14AB-033) – Replace 500 LF of 8-inch pipe with 12-inch pipe;
- **P-35 Ashland Street Pipe Replacement** (Clover Lane to Oak Knoll Drive) – Replace 1,500 LF of 8-inch pipe with 12-inch pipe;
- **P-36 Oak Knoll Drive Pipe Replacement** (Ashland Street to East Main St) – Replace 100 LF of 8-inch pipe with 12-inch pipe;
- **P-37 Highway 66 Pipe Replacement** (Oak Knoll Drive to Dead Indian Memorial Road) – Replace 1,234 LF of 8-inch pipe with 12-inch pipe.

5.6.4 Resulting Deficiencies after Improvements

Figure 5.12 presents the fire flow results after implementing the above improvements. As seen in the figure, all fire flow deficiencies were addressed with the recommended projects. Cost estimates for the above projects are provided in Chapter 7 – Capital Improvements Plan.

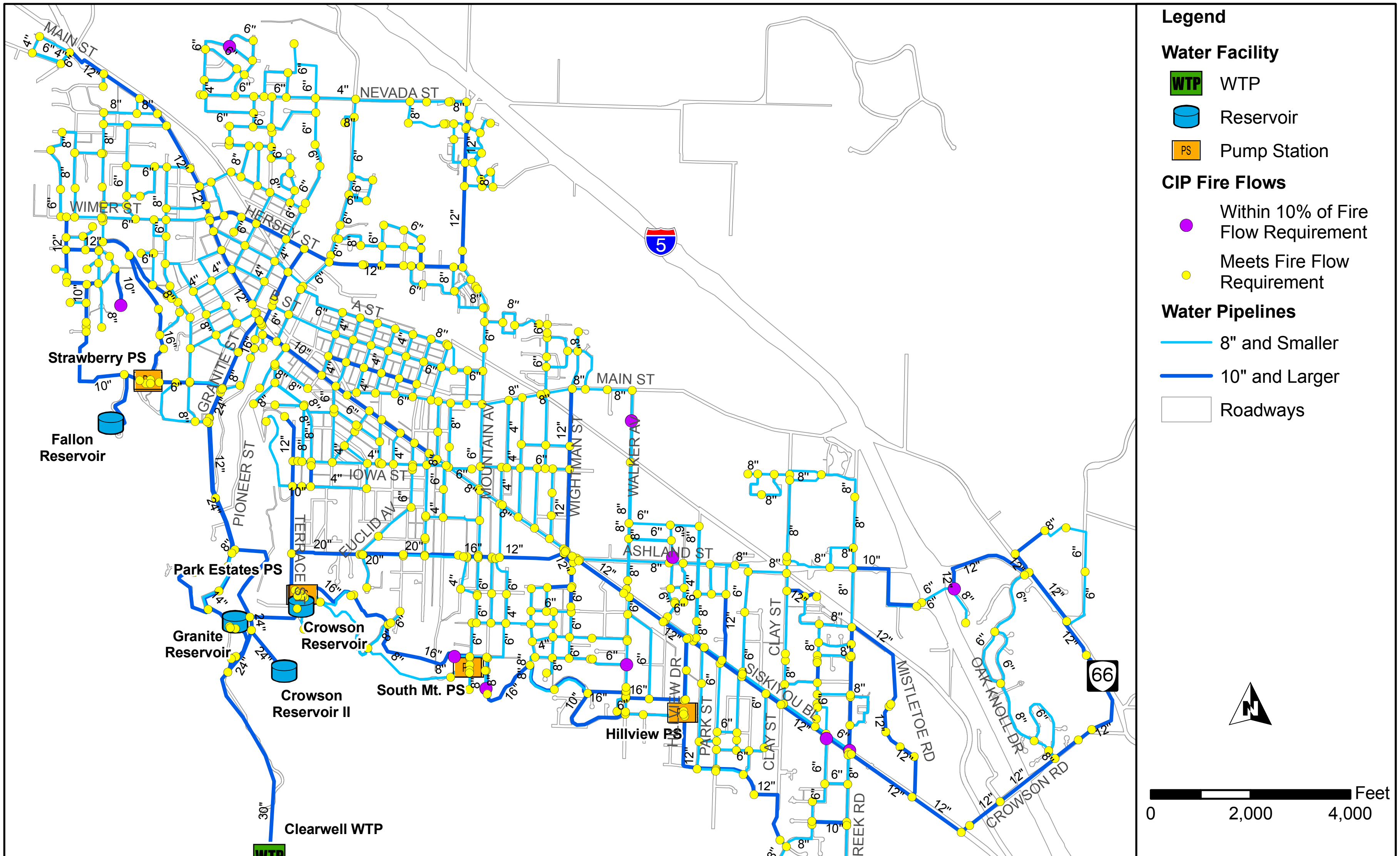

Figure 5.12
Fire Flow Deficiencies after Recommended Pipeline Improvements
WCRS & CWMP
City of Ashland

CHAPTER NO. 6

WATER QUALITY AND TREATMENT

6.1 INTRODUCTION

Under the United States Environmental Protection Agency (USEPA), the City of Ashland (City) is defined as a Community Water System and must comply with the drinking water standards of the federal Safe Drinking Water Act (SDWA) and its amendments, as regulated by the USEPA. The Oregon State Department of Human Services (DHS) Drinking Water Program (DWP) administers and enforces federal and state drinking water quality. The Ashland Water Department is identified as Public Water System Number 00047 under the DHS.

The quality of its drinking water sources is of primary concern to the City. The City's water is tested regularly for the presence of contaminants at frequencies prescribed by DHS regulations. The City is in compliance with all DHS reporting requirements, including publication and distribution of an annual Consumer Confidence Report (CCR) that keeps consumers informed as to the quality of the City's water supply and water delivery systems.

This chapter includes the following components:

- Description of current drinking water quality regulations.
- Summary of current monitoring programs.
- Summary of the City's compliance with EPA and DHS regulations.
- Recommendations.

This chapter utilizes information from the City's annual Consumer Confidence Report for 2010, supported with additional information from the DWP's online database.

6.2 REGULATORY BACKGROUND

The Safe Drinking Water Act (SDWA) of 1974 established primary drinking water regulations designed to ensure the distribution of safe drinking water. These regulations were the first to be implemented at all public water systems (PWSs) in the United States (U.S.), covering both chemical and microbial contaminants. These regulations consisted of standards for 18 parameters, referred to as the National Interim Primary Drinking Water Regulations. They remained in place for over 10 years with minor revisions, including a revised fluoride standard, addition of a total trihalomethanes standard, and interim regulations for radionuclides in potable water.

In 1986, Congress passed widespread amendments to the SDWA, which significantly altered the rate at which the USEPA was to set drinking water standards. These amendments resulted in a three-fold increase in the number of contaminants regulated. Also, at that time, the National Interim and revised Primary Drinking Water Regulations promulgated prior to 1986 were redefined as National Primary Drinking Water Regulations.

The 1996 amendments to the SDWA greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Among others, the 1996 amendments required the USEPA to develop rules to balance risks between microbial pathogens and disinfection by-products (DBP), named the Microbial/Disinfection Byproduct (M/DBP) Rules. Several rules emerged from this requirement, including the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rules (DBPR1 and DBPR2), and the Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rules (LT1ESWTR and LT2ESWTR).

The Oregon State Legislature established the State DHS-DWP in 1981 with the enactment of the Oregon Drinking Water Quality Act through the Oregon Revised Statutes (ORS) 448. Primacy for enforcing the SDWA regulations was granted to the state in 1986, thus making the DHS the primary agency for enforcing federal and state drinking water quality standards. Updates to the Oregon regulations are described in detail below.

6.3 REGULATORY REQUIREMENTS

The SDWA established specific roles for the federal government, state government, and water system purveyors, with respect to water quality monitoring. The USEPA is authorized to develop national drinking water regulations and oversee the implementation of the SDWA. State governments are expected to adopt the federal regulations and accept primacy for administration and enforcement of the Act. States can also regulate contaminants and set advisory levels. Public water system purveyors are assigned the day-to-day responsibility of meeting regulations by incorporating monitoring, record keeping, and sampling procedures into their operation and maintenance programs.

All Oregon drinking water regulations can be found on the DWP website here: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/rules.aspx. A summary of the drinking water regulations is attached as Appendix A. The SDWA regulations and the associated Code of Federal Regulations (CFR) are summarized in Table 6.1. The regulations are divided into those that address source water quality, distribution system water quality, surface water treatment, and reporting requirements, respectively.

The DWP has also recently developed guidelines for algae-related cyanotoxins. The new guidelines are summarized below in Section 6.3.1.

Table 6.1 Drinking Water Regulations

Rule	CFR	Affected Contaminants	Publication Date of Final Rule
SOURCE WATER QUALITY			
National Primary and Secondary Drinking Water Standards	See below	Bacteriological, IOC, VOC, SOC, Asbestos, Radionuclides, THMs, Lead/Copper, Phase II/V	Phases I through V promulgated 1987 through 1992
Radionuclide Rule	40 CFR 141.15 141.25 141.26	Radionuclides	Promulgated April 4, 1997
Arsenic Rule	40 CFR 141.23 141.24 141.16	Arsenic	Promulgated February 2002
Unregulated Contaminants Monitoring Rule 2	40 CFR 141.40	Various contaminants considered for future regulations	UCMR2 promulgated January 4, 2007
Groundwater Rule	40 CFR Subpart S	Fecal indicators in groundwater	Promulgated January 8, 2007
DISTRIBUTION SYSTEM WATER QUALITY			
Total Coliform Rule	40 CFR 141.21 141.63	Total coliform bacteria	Promulgated in 1989
Lead and Copper Rule	40 CFR Subpart I	Lead and Copper	Promulgated January 12, 2000, compliance by January 2003
Stage 1 Disinfectants /Disinfection Byproducts Rule	40 CFR, Parts 9, 141, 142 63 FR 69390	Trihalomethanes, haloacetic acids, chlorite, and bromate	Promulgated February 16, 1999 Compliance by December 1, 2003
Stage 2 Disinfectants/Disinfection Byproduct Rule	40 CFR Subpart V	Trihalomethanes and haloacetic acids	Promulgated January 4, 2006, Effective March 6, 2006
SURFACE WATER TREATMENT RULES			
Information Collection Rule	40 CFR, Part 141, Subpart M	Large Surface Water Systems: Bacteriological, DBP, IOCs	Promulgated June 18, 1996

Table 6.1 Drinking Water Regulations

Rule	CFR	Affected Contaminants	Publication Date of Final Rule
Interim Enhanced Surface Water Treatment Rule	63 FR 69478	Large Surface Water Systems: Bacteriological, incorporate *Cryptosporidium* into watershed plans	Promulgated November 1998
Long Term 1 Enhanced Surface Water Treatment Rule	40 CFR, Parts 9, 141, 142 67 FR 1812	Bacteriological, *Cryptosporidium*	Promulgated February 13, 2002, compliance by March 15, 2005
Long Term 2 Enhanced Surface Water Treatment Rule	Proposed (1)	Bacteriological	Promulgated in 2006
Filter Backwash Recycling Rule	40 CFR Parts 9, 141, 142 66 FR 31086	Bacteriological	Promulgated August 7, 2001, compliance by December 8, 2003
REPORTING REQUIREMENTS			
Consumer Confidence Report Rule	40 CFR 141 Part O	Reporting only	Published August 19, 1998
Public Notification Rule	40 CFR Subpart Q	Reporting only	Promulgated 2000

6.3.1 DWP Cyanobacteria Guidelines

The USEPA has not yet developed any standards for harmful cyanotoxins, such as microcystin, anatoxin-a, and cylindrospermopsin. However, given the potential for these toxins to cause harm, the DWP has developed its own guidelines for Public Water Systems (PWSs) for testing during algal blooms. The steps PWSs are requested to take during an algal bloom in the raw water supply include the following:

- Collect a sample for identification and enumeration from the source waterbody to determine if it is a toxin-producing harmful algae bloom (HAB).
- If it is determined to be a HAB, test the raw water weekly for any toxins associated with the HAB throughout the bloom.
- If toxins are detected in the raw water, start testing the finished water weekly for associated toxins and notify any downstream PWS.
- If toxins are found in finished water, above 1 part per billion (ppb), post a “do not drink” public notice.

The DWP has recognized that weekly testing for toxins is expensive and is attempting to cover the cost of toxin testing and shipping in 2011 though a limited federal drinking water protection grant. In the event of an algal bloom, the City should contact its state regulator for further instructions and information. Further information is available in the DWP bulletin presented in Appendix B.

Both the Reeder Reservoir and Talent Irrigation District (TID) supplies have been affected in the past by algal blooms and would be subject to testing under these new guidelines during such blooms. For TID, testing would only be necessary during periods when the TID water is being treated at the Ashland Water Treatment Plant.

6.4 WATER QUALITY MONITORING

Current monitoring requirements for the City are summarized in Table 6.2. These requirements are based on information from the DWP's on-line database.

Table 6.2 Water Quality Monitoring Requirements

Constituents	No. Samples	Sampling Interval	Notes
Asbestos	1	9 years (Next in 2011)	Sample at location of maximum exposure to AC pipe.
HAA5 and TTHM	4	Quarterly	Reflect 4 samples per WTP.
Lead and Copper	30	3 years (Next in 2011)	Sampling to be conducted between June 1 and Sept 30.
Arsenic	1	9 years (Next in 2011)	Schedule reflects reduced monitoring waiver.
Inorganic Compounds	1	9 years	Schedule reflects reduced monitoring waiver.
Nitrate	1	Annually	
Nitrite	1	9 years (Next in 2011)	Schedule reflects reduced monitoring waiver.
Radionuclides	1	9 years (Next in 2017)	Schedule reflects reduced monitoring waiver.
Synthetic Organic Compounds	2	3 years (Next in 2011)	Requires two consecutive quarterly samples.
Volatile Organic Compounds	1	Annually	

6.5 REGULATORY COMPLIANCE

Based on a review of the City's Consumer Confidence Report (see Appendix C for the most recent CCR), the City is in compliance with all water quality regulations. The only current or future regulatory requirement of concern is the Stage 2 Disinfectants and Disinfection By-products Rule (Stage 2 DBPR), which includes regulation of the disinfection by-products (DBPs) trihalomethanes (THMs) and haloacetic acids (HAAs). The City completed an Initial Distribution System Evaluation and Plan on time (Appendix D).

The next Stage 2 DBPR deadline to be met is to begin compliance monitoring on October 1, 2013. In preparation, the City has begun monitoring at the new compliance locations to determine if there will be more difficulty meeting the new regulations. There was a concern that the City would not be in compliance with the THM and HAA maximum contaminant levels (MCLs) under the Stage 2 DBPR, which are determined based on a locational running annual average (LRAA) of distribution system samples. It is important to note that the City is in compliance with current regulatory requirements; the concern pertains to future compliance.

In July 2010, a preliminary evaluation of THM and HAA levels and potential mitigating actions was completed. The main recommendations were as follows:

- Reduce prechlorination to the extent practical (meaning, reduce it as much as possible without impacting TOC removal or filter performance).
- Achieve all CT compliance after filtration. Use the CT calculator to determine the needed post-filtration chlorine dose depending on the water quality characteristics and the plant flow rate at the time.

Since these recommendations were made, WTP staff reduced the prechlorination concentration at the WTP. This action resulted in a significant decrease in THM and HAA levels. From August 2010 to August 2011, the maximum THM and HAA levels reported to the Oregon DHS were 0.061 mg/L and 0.044 mg/L, respectively, which are well with the maximum contaminant levels of 0.08 mg/L for THMs and 0.06 mg/L for HAAs.

However, a recent sample at one of the new Stage 2 DBPR compliance sites had a HAA level of 0.053 mg/L, which is almost 90 percent of the MCL. This indicates that the City has very little margin to comply with the new regulation. As such, the City will need to continue to take proactive operations steps to control DBP production, and implement those CIPs that will aid DBP control such as the modifications to the permanganate and chlorine systems at the WTP.

6.6 WATER TREATMENT PLANT EVALUATION

The City's Water Treatment Plant (WTP) is located along Ashland Creek, approximately one mile below Reeder Reservoir. Figure 6.1 provides a schematic of the WTP process. The WTP has a capacity of approximately 7.5 mgd, based on the plant's historical performance and input from operations staff. As discussed in Chapter 1, the WTP is a direct filtration plant with the following processes: rapid mix, mechanical flocculation, granular media filtration, and chlorination. The plant meets all current regulatory requirements. The following sections discuss challenges at the WTP and recommended actions.

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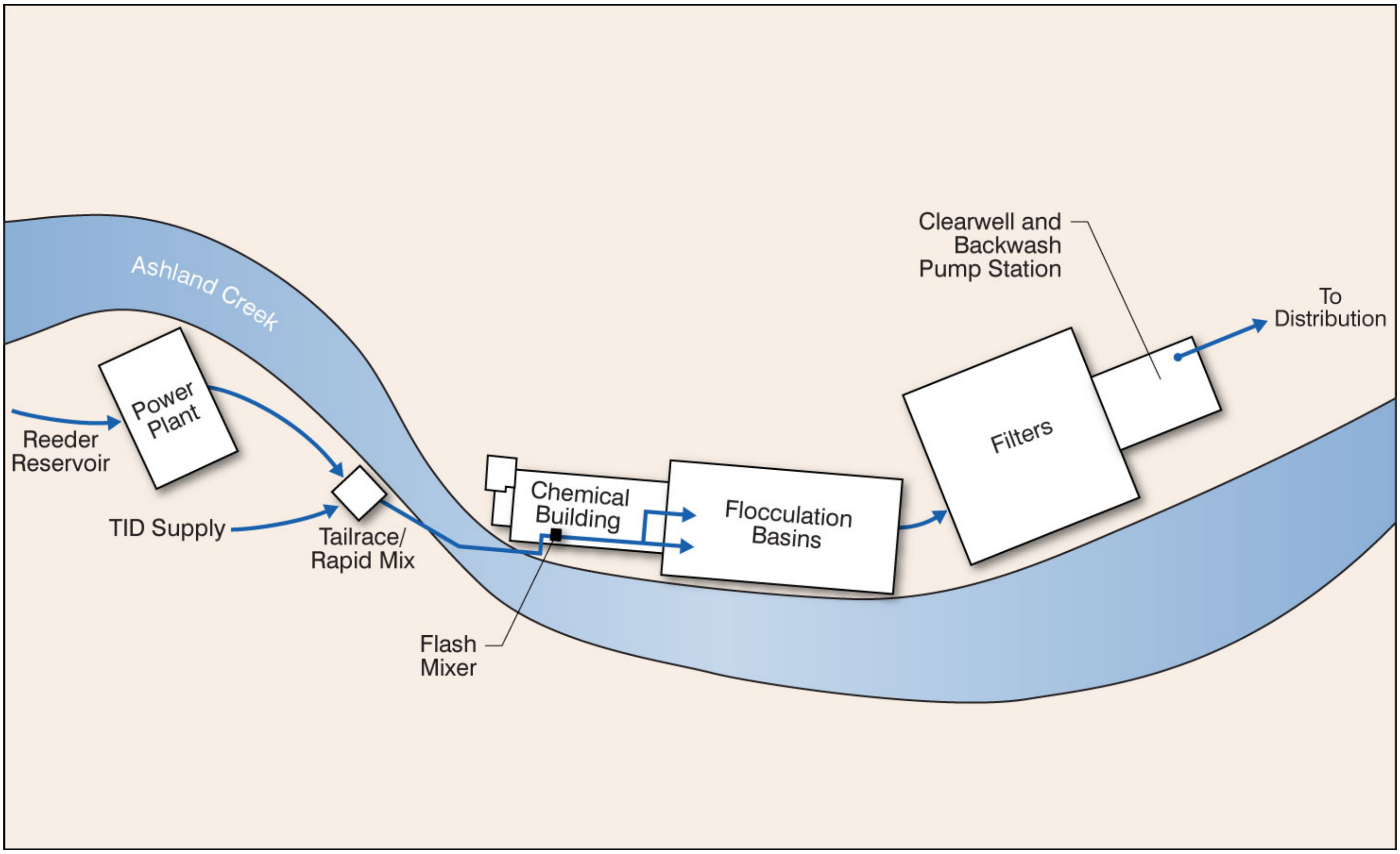


Figure 6.1
Water Treatment Plant
Schematic
WCRS & CWMP
City of Ashland

6.6.1 Chlorination

The Ashland WTP has very limited clearwell capacity, with chlorination contact time mainly achieved in the transmission pipeline between the WTP and the City. The limited contact time necessitates higher chlorine residuals to meet disinfection requirements. In the past, WTP staff has used contact time through the flocculation and filtration processes to help meet disinfection requirements, which has contributed to high DBP levels in the distribution system. As discussed above, WTP staff has reduced use of prechlorination to reduce DBP levels.

To limit the required residual chlorine concentration (thereby managing DBP levels), the following actions are recommended:

- **Continue reduced prechlorination doses**. Further reductions in prechlorination are recommended if they can be achieved while maintaining treatment effectiveness and appropriate control of algae growth in the basins.
- **Refine chlorine contact time between the WTP and the first customer**. The City's main transmission line from the WTP to the distribution system splits into two lines before the first customer is reached, with very little flow going down the line to the first customer. The City's current CT calculator is conservative, as it calculates the detention time to the first customer assuming the entirety of the finished water flow goes through the pipes directly to that location. The chlorine contact could be more accurately determined by separately metering the flow in each line. The required meters are in place but non-functional; repair of these meters is recommended.

6.6.2 Taste and Odor Control

Taste-and-odor-causing (T&O) compounds contribute to finished water aesthetics and customer perception, but are not regulated. The main T&O compounds of concern are MIB (2-methylisoborneol) and geosmin; both are produced by algae in raw water supplies. The City does not normally monitor the concentration of T&O causing compounds in either the raw or finished water. However, there have been past problems, based on customer complaints, with both the Ashland Creek and TID supplies. The City is also concerned that more frequent use of the TID supply will lead to increased future T&O problems.

The Ashland WTP process includes addition of both potassium permanganate (permanganate, an oxidant) and powdered activated carbon (PAC) for taste and odor control. Both compounds are added at the rapid mix, at the same location as chlorine and coagulant. Adding these compounds at the same time is not ideal, as PAC can react with both chlorine and permanganate. Addition of permanganate and PAC at the WTP has helped mitigate taste and odor events, but does not completely eliminate them.

One alternative for addressing T&O would be to add a new treatment process. Treatment processes that destroy T&O causing compounds include (1) ozone and (2) ultraviolet (UV) light with peroxide addition. Addition of either process would present challenges: the processes cannot be accommodated within the existing plant site at an appropriate hydraulic gradeline within the treatment train, and either process would add a new, hazardous chemical at the site, likely increasing the operator certification requirements for the plant.

Finally, either process would have a significant capital cost. As such, neither of these processes is recommended.

For the Ashland Creek supply, the City has been evaluating algae management alternatives for Reeder Reservoir, including the *2010 Reeder Reservoir Water Quality Assessment* conducted as part of the Water Conservation and Reuse Study. The City has had success adding an algaecide called GreenCleanPRO (active ingredient is sodium carbonate peroxyhydrate) to the reservoir. It is recommended that the City continue algae mitigation in the reservoir as the most effective approach for mitigating tastes and odors from the Ashland Creek source. Recommendations from the 2010 Assessment have been included in the Capital Improvement Plan.

By treating algae at the source, the City is taking the most proactive approach possible in addressing taste and odor issues. Since the City does not have control over the management of Hyatt and Howard Prairie reservoirs, it must address the quality of the water supplied by the TID. Indeed, when the City recently checked with the TID regarding the management of the lake water quality, it was noted that the reservoirs are not treated in any way to manage algae or plant growth.

Still, the City can use its permanganate and PAC systems to address seasonal taste and odor episodes from the TID. Unfortunately, given the limited space at the plant, the two chemicals are added at essentially the same location, which it not ideal. It would be preferable to dose the permanganate as far upstream as possible to allow it to react with the taste and odor causing organics before reaching the plant. This longer reaction time would also allow for proper reduction of the permanganate and prevent raising the magnesium level in the finished water. In addition, when added at the same location, the permanganate can simply act on the PAC (instead of on the organics) thus reducing the effectiveness of both taste and odor control processes.

An option to address this situation would be to locate a permanganate feed facility at the Terrace Street Pump Station. This would allow the pipeline between the pump station and the treatment plant to provide the time for the permanganate to oxidize the organics in the raw water. PAC would still be added at the plant to address the remaining organics. Some relatively minor piping modifications at the plant would be needed to make sure the water treated with permanganate does not flow over the weir into Ashland Creek.

This option, dosing permanganate in the raw water pipeline upstream of the water treatment plant, is not as readily available for the Ashland Creek supply. Water that flows from Reeder Reservoir passes through the generator and into the tailrace before flowing into the treatment plant. Some of the water in the tailrace is released to Ashland Creek to maintain downstream water rights. It is not desirable to have water treated with permanganate released to the creek. Thus, providing this option for the Ashland Creek supply would require constructing a pipeline or some other form of contactor separate from the water that is sent to the tailrace. This might not be feasible given the space constraints at the treatment plant site, and it is likely to be very expensive. As such, it is recommended that the City continue with its practice of treating Reeder Reservoir to control algae blooms as its method to control taste and odor events from Ashland Creek water.

6.6.3 Treating Seasonal Cold and Turbid Water

The Ashland WTP is a direct filtration plant, meaning that the water receives coagulation, flocculation, filtration, and disinfection prior to distribution. In this configuration, only the filters remove solids from the raw water. During most of the year, the treatment process is adequate for processing the raw water. When the water is cooler and more turbid, however, the filters require more frequent backwashing, and the operators must pay closer attention to chemical feed rates to maintain proper filter performance.

Reviewing the WTP design criteria shows that the processes are adequately sized to treat low temperature water. One of the main challenges in treating cooler water is to provide enough flocculation time to agglomerate the particles such that they can be efficiently removed in the filters. At the maximum flow of 7.5 mgd, there is approximately 40-minutes of detention time in the flocculation basins. Assuming proper coagulation and adequate mixing in the flocculation basins, this is plenty of time for proper flocculation of cold waters.

During high turbidity events, however, the WTP performance will decrease because the filters are the only process that actually removes solids (turbidity). WTPs that treat highly turbid waters on a regular basis are typically equipped with sedimentation basins, a process between the flocculation and filtration processes that allows the water to slow down and for much of the solids to settle out before the water passes onto the filters.

There is no room at the Ashland WTP to install sedimentation basins. As such, the WTP will remain limited in its capacity during the winter. For the near term, this is not a problem due to low wintertime demands. As overall demands increase in the future, this will be more of a challenge that will be remedied by the implementation of a new potable water source: either the new water treatment plant, or the connection to TAP.

6.6.4 Water Treatment Following Wild Fires

Following a fire in the watershed, there could be several water quality challenges to the WTP. The immediate impact might be from fire retardant overspray into the raw water. Second could be ash in the raw water after the fire has been put out. Finally, the loss of vegetation can lead to increased erosion in the watershed during the winter storms, which raises the raw water turbidity. Each of these potential impacts is discussed below.

Studies have found that both fire retardants applied and washed into raw water supplies, and ash remaining in watersheds increase phosphorous and nitrate levels in runoff. Fire retardants such as Phos-Chek contain phosphates and ammonium. Following application, these chemicals may act as fertilizer to help the watershed recover following a fire, but they can also pose challenges to the water treatment process. Phosphates can affect the coagulation process making it more difficult to form floc and ultimately to maintain high filtered water quality. Ammonium could persist and exert a chlorine demand at the WTP (requiring significantly increased chlorine feed rates to maintain adequate disinfection), or it could be converted to nitrate in the environment. The WTP is not equipped to remove nitrates, thus this would need to be closely monitored to avoid exceeding the MCL for nitrate.

Watershed erosion as a consequence of a fire can have several serious impacts to the Ashland water supply. If the erosion is severe, it can cause clogging of the water supply facilities limiting the amount of water that can reach the treatment plant. In addition, the increased sediment load from the runoff will cause higher raw water turbidity levels. This will present treatment challenges at the Ashland WTP that were discussed above related to seasonal high turbidity events. The WTP is not properly equipped to handle high-turbidity raw water, and the only way it can process such water is to do so at a lower flow rate.

At this time, we are not recommending any CIPs just to prepare for fires in the watershed. The planned second supply (either a connection to TAP or a second water treatment plant) will greatly improve the City's water supply reliability in case of a fire in the watershed. In addition, the fact that the City has two raw water supply sources (Ashland Creek and TID) helps the City because it is unlikely that a fire will occur in both watersheds at the same time. In the meantime, if there is a fire in either watershed, the WTP operations staff will need to apply best practices to maintain water supply to the City including:

- Additional raw water quality testing to monitor the changing parameters (physical and chemical) and help guide treatment decisions.
- Perform jar tests on the raw water as it continues to change to ensure that the correct levels of treatment chemicals are being applied.
- Closely monitor the filter performance to maintain high filtered water quality.

6.6.5 TID as a Raw Water Source

Though it is a regular source of water for irrigation around the City, TID has only infrequently been used as a raw water source for the WTP. It was most recently used in 2009 due to dropping levels in Reeder Reservoir. Prior to its use in 2009, the City hired Carollo to perform a series of tests on the raw water quality including:

- Taste and odor compounds (geosmin and 2-methylisoborneol [MIB]).
- Algae identification and enumeration.
- Pathogenic protozoa (*Giardia and Cryptosporidium).*
- EPA 525 Semivolatiles (pesticides).
- EPA 300 Nitrate/Nitrite (fertilizers).
- Ammonia Nitrogen.
- EPA 200 ICP Metals.
- Cations, Anions, Bromide, Fluoride.
- Total and Dissolved Organic Carbon.
- Standard Physical Parameters.

The results of this testing revealed that the TID source was acceptable for use as a raw water supply to the WTP (Appendix E) at that time. It was also confirmed that the City could continue to use TID as an intermittent raw water source provided the following (see Appendix F for details):

- That the City notify the DWP in Medford as early as possible prior to its use.
- Determine whether entry point chemical samples representative of a normal emergency TID/Ashland Creek source water blend (approximately 50/50) are current.

The letter from the DHS has an additional recommendation regarding any chemical samples that are non-current, and how to correct that with the DHS prior to using TID as a raw water source.

Last year, a study was conducted on E. coli levels in Ashland Creek (Appendix G). E.Coli levels were found to increase at the TID outfall into Ashland Creek, and TID was identified as a major contributor of bacteria. This study also found that bacteria levels in the TID canal increased within the City limits. This suggests that animal waste (such as dog feces left by people walking their pets along the canal) left along the canal could be a primary source of the bacterial contamination.

The study includes recommendations such as installing dog waste stations along the canal to encourage dog-walkers to clean up after their pets, and piping the canal within the City limits to protect the TID water from this contamination source. The City should implement these measures as soon as practical as the high bacteria levels are undesirable in a source for a water treatment plant. In the meantime, The City will need to follow the ODHS requirements for testing the TID water prior to its use to ensure it is a safe raw water supply for the WTP.

6.6.6 Minor Capital Improvements

The City has also identified a number of systems at the WTP that require minor capital improvements, as follows:

- Raw water bypass:
  - Situation: The City is required to maintain a 0.86-mgd flow of Ashland Creek water to bypass the plant at the tailrace. Currently, there is no gage installed at the tailrace to let the operators know whether this requirement is being met, or whether too much water is bypassing the plant. There is a downstream gage connected to SCADA for continuous measurement. However, that instrument has not been reliable, and there is a substantial delay (about two hours), between the treatment plant and where the flow measurement is taken.
  - Recommendation: Design and install a weir at the tailrace that provides more accurate measurement of the flow bypassing the plant, and more immediate feedback to the operators regarding the flow rate. Repair the downstream flow measurement equipment such that it is more reliable.
- SCADA System:
  - Situation: There are two main challenges related to the existing SCADA system at the WTP. First, the CAT 5 cable used to control the sodium hypochlorite pumps needs to be replaced with a fiber optic system to improve reliability. Second, the SCADA system is powered by the same circuit as the backwash sump pumps. Thus, whenever the sump pumps experience a condition that causes them to trip the circuit breaker, it causes a shutdown of the plant control system.
  - Recommendation: Replace the CAT 5 cable system for the sodium hypochlorite pumps with a fiber optic system, and provide a separate circuit for the SCADA system to increase its reliability.

- Final Chlorine Disinfection:
  - Situation: Chlorine is added downstream of the filters in the clearwell. The flow pattern in the clearwell is such that there is uneven dispersion of the chlorine with the filtered water. This has led to erroneous low-chlorine alarms causing the plant periodically to increase the chorine dose when it is not actually necessary. This can also cause regulatory compliance issues with regard to disinfection requirements (CT).
  - Recommendation: Reconfigure the chlorine feed point and provide mixing in the clearwell prior to the location where the finished water sample is collected.
- WTP Security
  - Situation: The WTP is currently accessible to hikers and people using the trails in the area.
  - Recommendation: Provide fencing and a security camera for improved security and remote monitoring of the WTP facilities.

The above-recommended improvements have been included in Chapter 7 - Capital Improvement Plan.

CHAPTER NO. 7

CAPITAL IMPROVEMENTS PLAN

7.1 INTRODUCTION

This chapter presents a summary of all capital projects outlined in the previous chapters, and creates a cohesive capital improvements plan (CIP) for the City of Ashland (City) to continue consistent, efficient water supply to its water customers. Programs listed in this chapter consider water supply and storage requirements, and improvements to the hydraulic system. System improvements were analyzed according to the policies and criteria described in Chapter 2 – Level of Service Goals. The recommended projects are presented for the Short-Term (2011-2018), and Long-Term (2019-2030).

7.1.1 Cost Estimate Assumptions

Planning-level cost estimates were developed for each of the recommended projects for budgeting purposes. The costs provided herein are planning level estimates only and should be refined during pre-design of the projects. Cost estimates are presented as total project costs in September 2011 dollars. For future budgeting purposes, the latest engineering news record (ENR) Construction Cost Index (CCI) can be used to project current estimates to the year of implementation. The September 2011 ENR 20-City CCI is 9,116.

Cost estimates were developed using a Class 3 budget estimate, as established by the American Association of Cost Estimators (AACE). This level of estimate is used for budgeting and feasibility studies and assumes a 10 percent to 40 percent level of project definition. The expected accuracy range is -30 percent to +50 percent, meaning the actual cost should fall in the range of 30 percent below the estimate to 50 percent above the estimate.

Construction costs apply the following mark-ups to the direct costs: 30 percent contingency, 10 percent general conditions, and 15 percent contractor overhead and profit. Project costs include an additional 20 percent for engineering, legal, and administration costs. Total project costs are used to develop the CIP to ensure adequate funds are available for engineering, legal, and administration costs in addition to construction costs. The CIP cost estimates should be periodically reevaluated to account for changes in inflation.

The costs for specific infrastructure categories were developed as follows:

- *Pipelines* – Estimated costs for all pipeline projects were based on a cost per linear foot, as summarized in Table 7.1. These unit costs assume open-trench construction in improved areas. Costs include pavement cutting, excavation, hauling, shoring, pipe materials and installation, backfill material and installation, and pavement replacement.
- *Pump Stations* – Estimated costs for all pump stations include site work, a structure, mechanical and electrical equipment, and a back-up generator.

- *Storage Reservoirs* – Estimated costs for all storage reservoirs include site work, a structure, mechanical and electrical equipment, and piping to connect the reservoir to the system.
- *Annual Allocations* – Annual allocations were based on general system needs and City staff input.

Acquisition of property, easements, and right-of-way (ROW) may be required for some of the recommended projects. However, for the purpose of this Plan, pipeline corridor or easements are assumed to be in public ROW, and therefore do not require land acquisition. For this reason, land acquisition is not included in the cost estimates.

Table 7.1 Unit Pipeline Upgrade Costs(1)

Diameter	Estimated Cost per Linear Foot
6-inch	$126
8-inch	$134
10-inch	$144
12-inch	$153
16-inch[2]	$185

Notes:
1. Direct costs, not including contingencies.
2. See Project S-15 for details on the TAP pipeline cost estimate.

7.2 CAPITAL PROJECTS

The capital projects identified can be categorized into water supply (S), treatment and storage (T), distribution (D), piping (P), and operational (O). Specific projects are described in the sections below. The CIP projects have been assigned a project identification number (Project ID) and are shown on Figures 7.1 and 7.2.

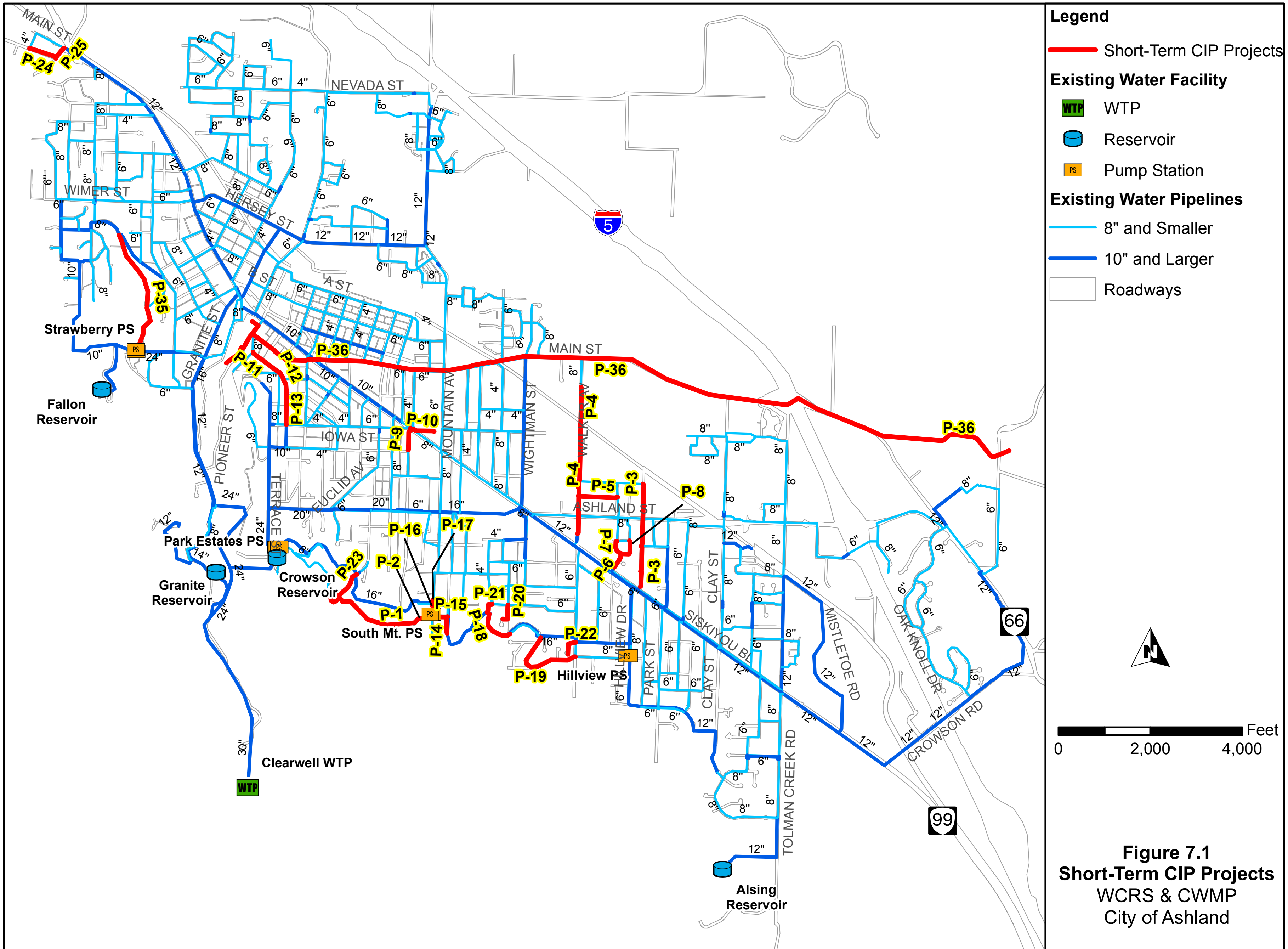


Figure 7.1
Short-Term CIP Projects
WCRS & CWMP
City of Ashland

carollo
Engineers...Working Wonders With Water®

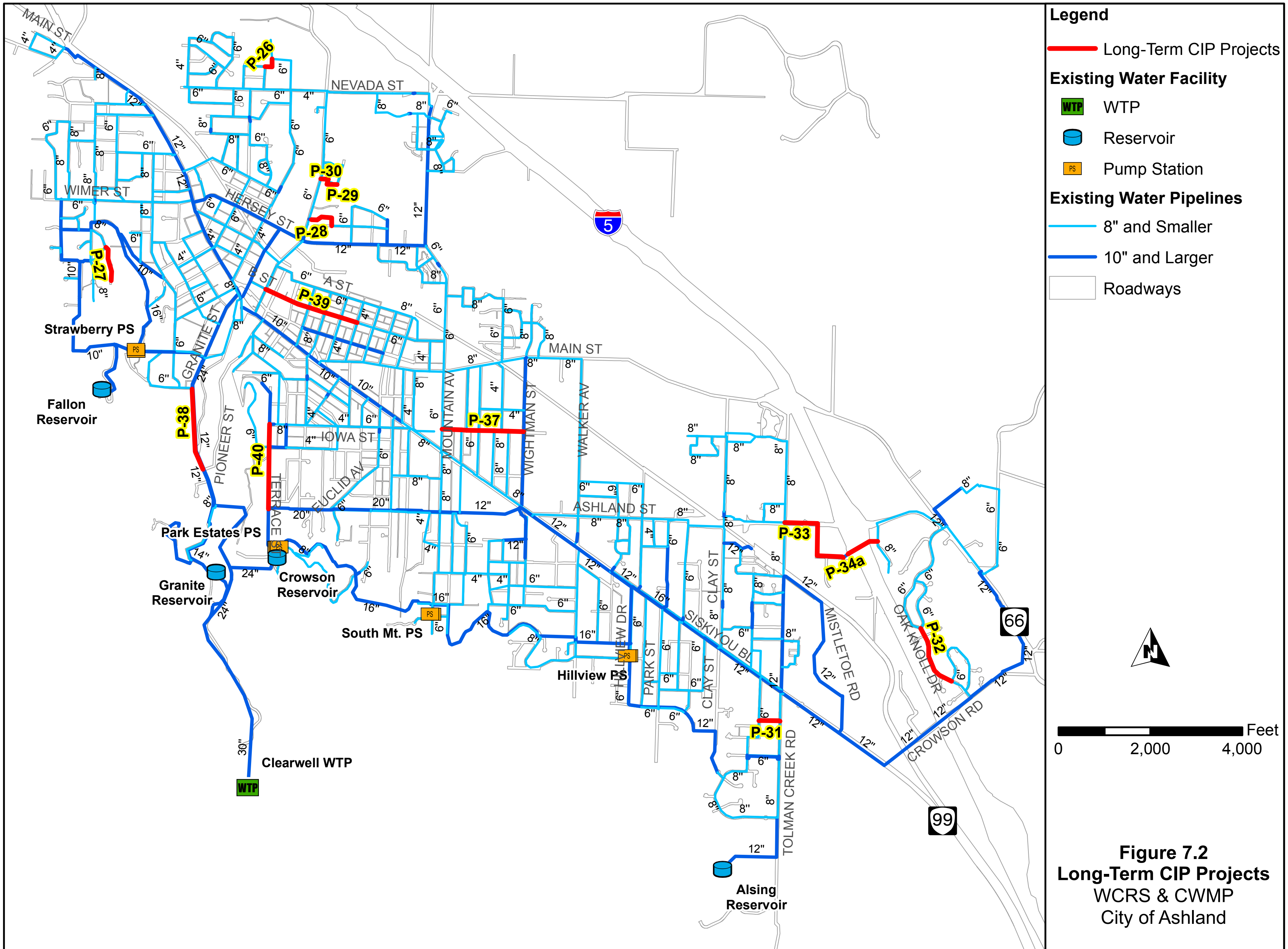


Figure 7.2
Long-Term CIP Projects
WCRS & CWMP
City of Ashland

7.2.1 Water Supply

The City reviewed several future water supply alternatives as part of the 2010 Water Conservation and Reuse Study. The final two options included for review in this Plan are: installing an intertie to the Talent Ashland Phoenix (TAP) pipeline, or constructing a new 2.5-MG water treatment plant (WTP) to supplement and eventually replace the existing WTP. After evaluating these alternatives against the level of service goals and considering financial impacts, the City selected to implement a new water treatment plant and construct an emergency TAP pipeline. The emergency TAP connection is estimated to be less costly than the original supply alternative of using TAP as it does not include a permanent pump station, nor does it require upgrades to the existing WTP. Because the City will be transitioning to a new WTP, expanding and improving the existing WTP is no longer recommended. The secondary supply projects include projects S-15, T-9, and T-10 listed below.

The following is a list of recommended improvements relating to the City's water supply.

S-1 FERC Dam Security and Telemetry Improvements

This project will implement security and telemetry improvements identified in the last FERC Part 12 Inspection. This project is estimated to cost approximately $25,000. This project is planned for completion in FY 2012.

S-2 FERC Dam Spillgate Upgrades

Upgrades to the Hosler Dam spillgate are required to comply with the recommendations in the last FERC Part 12 Inspection. The recommendations included reconstructing the spillway hoists and gate assemblages, as well detailed cleaning of the spillway surface to allow for inspection. This project is estimated to cost approximately $50,000. This project is planned for completion in FY 2012.

S-3 FERC Structural Stability Analysis

A structural stability analysis of Hosler Dam was also identified in the last FERC Part 12 inspection as a need to analyze post-earthquake base shear structural stability at the contact between the dam and bedrock. This project is estimated to cost approximately $90,000. This project is planned for completion in FY 2012.

S-4 FERC Part 12 Hosler Dam Safety Inspection

An inspection of Hosler Dam is required every five years in accordance with the Federal Energy Regulatory Commission (FERC) Part 12 Safety Inspection Guidelines. The Part 12 Inspection includes a review of the structural soundness including a review of seismic stresses, security precautions, and protocols. This project is estimated to cost approximately $40,000 every five years, starting in FY 2014.

S-5 Ashland Creek West Fork Bridge Construction

Access to Reeder Reservoir's East and West Fork Diversions has in the past been severely limited by high water and a washed out west fork creek crossing. This crossing will construct a new bridge over the west fork to ensure access and help to reduce erosion inputs into the

Reservoir. This project is estimated to cost approximately $120,000. This project is recommended for the Short-Term.

S-6 Reeder Reservoir Silt Removal

Oregon DEQ has established a sedimentation total maximum daily load (TMDL) for Reeder Reservoir requiring that no more than 3.62 cubic yards per day shall be added to the Reservoir each day. The City is required to monitor the sediment and prevent excess accumulation. To do this and also preserve the water storage capacity of the reservoir, the City will be removing accumulated sediment every other year from the upper small dam impoundments, in order to prevent it from entering Reeder Reservoir itself. This project is estimated to cost approximately $60,000 every other year.

S-7 Reeder Reservoir Study Implementation

The 2008 Reeder Reservoir Study highlighted the City's need to protect and monitor the water quality more closely at its source. The study recommended that a water quality sampling station be installed, and that several different types of monitoring be carried out in order to develop a model of the nutrient circulation. The goal is to create a management plan that protects water quality as well as minimizing nutrient accumulation and algae production. This project is estimated to cost approximately $30,000. This project is planned for completion in FY 2012.

S-8 Reeder Reservoir Access Road TMDL Compliance

The access road surrounding Reeder Reservoir is considered by DEQ to be a source of sediment into the reservoir. The road is not currently designed to drain in a manner that limits silt loading. This project is estimated to cost approximately $100,000. This project is recommended for the Short-Term.

S-9 Reeder Reservoir Variable Depth Intake

As a result of the Reeder Reservoir Study implementation, the need to be able to draw from different levels during different times in the year has become more likely to be effective. The final reservoir report will confirm or discount the need for this improvement. This project is estimated to cost approximately $100,000. This project is recommended for the Short-Term.

S-10 TID Terrace Street Pump Station Improvements

The recent 2009 curtailment made apparent the need to upgrade the existing pump station used to send water from the TID canal to the Water Treatment Plant during dry years. The pumps and switchgear are in poor condition and concerns have been raised about crew safety in the underground vault where the old equipment is located. This project aims to replace the electrical power supply and pumps with more energy efficient and safer equipment. This project is estimated to cost approximately $220,000. This project is recommended for the Short-Term.

S-11 TID Canal Piping

It is recommended that the City convert the Talent Irrigation District (TID) canal to a piped system from the Starlite Monitoring Station to the Terrace Street Pump Station. This project reduces water losses from evaporation and infiltration, prevents contamination of the TID water along that reach of the canal, and ceases overflows to Ashland Creek. This project is estimated to cost approximately $1.1 million (M). This project is recommended for the Short-Term.

S-12 Test Existing High Capacity Wells

GSI Water Solutions, Inc. performed a Preliminary Groundwater Supply and ASR Evaluation in 2010. The study did not find the groundwater wells to be an adequate supply source; however, additional evaluation of local aquifers may result in different conclusions. The City intends to further evaluate the option of using groundwater wells for supplemental supply. A cost estimate of $50,000 was estimated for additional evaluation of these supply sources.

S-13 Water Conservation Smart Controller Pilot Project

The conservation technical advisory group assembled during the water conservation and reuse study recommended implementation of several ideas that will be initiated through this pilot project, including rebates to customers for installing weather based irrigation controllers, converting lawns to water efficient landscaping, and distribution of free devices to conserve irrigation water. This project is estimated to cost approximately $50,000. This project is recommended for the Short-Term.

S-14 Water Conservation Management Plan

When the City purchased storage water rights in Lost Creek Reservoir, a condition of certification of the water right was to prepare a Water Conservation Management Plan in accordance with Oregon Drinking Water Program standards. This project is estimated to cost approximately $50,000. This project is planned for completion in FY 2012.

S-15 Emergency TAP Pipeline and Pump

This project provides emergency water supply to the City during an interruption of service from the existing water treatment plant. The project includes constructing a connection to the 16-inch diameter TAP pipeline for emergency supplies. The supply would provide an additional 1.5-mgd of emergency water supply, with peaking capacity of 3.0-mgd. The City recently signed an intertie agreement with the City of Talent. The intertie pipeline would follow the route of the proposed TAP pipeline extension, extending approximately two-thirds (14,000 feet) of its total length. It is recommended that the City work with the City of Talent to confirm the capacity and additional infrastructure requirements of the intertie.

The TAP connection will be used for emergency situations only, and a portable pump station will be rented when needed. Revised cost estimates performed by the City indicate that the TAP pipeline project would cost approximately $2,000,000. City staff developed this cost estimate through conversations with manufacturers. This project is scheduled for the Short-term.

7.2.2 Treatment & Storage

The following section summarizes recommendations relating to treatment, as discussed in Chapter 6 – Water Quality and Treatment Evaluation, and storage as discussed in Chapter 5 – Distribution System Analysis.

T-1 Raw Water Bypass Measurement

This project is necessary to ensure the City is allowing adequate stream flows to remain in Ashland Creek during treatment operations. The project includes designing and installing a weir that provides more accurate measurement of the Ashland Creek flow bypassing the plant, and more immediate feedback to the operators regarding the flow rate. This project is estimated to cost approximately $25,000. This project is recommended for the Short-Term.

T-2 SCADA Radio Frequency FCC Compliance

Chapter 6 outlined the need for SCADA improvements at the WTP to address deficiencies noted by operations staff. The recommended improvements are as follows:

- Connect the sodium hypochlorite system to the SCADA system such that the chemical feed pump operational parameters can be monitored and controlled from the central plant control system.
- Reconfigure the power to the SCADA system to increase its reliability and separate it from the cause of frequent disruption (backwash sump pump failure).

This project is estimated to cost approximately $45,000. This project is recommended for the Short-Term.

T-3 Final Chlorine Disinfection Improvements

Chapter 6 recommended improvements to final chlorine disinfection at the WTP. This project includes reconfiguring the chlorine feed point and providing mixing in the clearwell prior to the location where the finished water sample is collected.

This project is estimated to cost approximately $85,000. This project is recommended for the Short-Term.

T-4 Permanganate Feed Facility Study & Implementation

This project would address taste and odor challenges originating from the TID supply consists of locating a permanganate feed facility at the Terrace Street Pump Station. This would allow the pipeline between the pump station and the treatment plant to provide the time for the permanganate to oxidize the organics in the raw water. PAC would still be added at the plant to address the remaining organics.

Costs for this project include an evaluation ($25,000) and construction ($240,000), for a total estimated project cost of $265,000. This project is recommended for the Short-Term.

T-5 WTP Security Upgrades

This project is recommended to improve security at the WTP, including adding fencing and motion-detecting lights. This project is estimated to cost approximately $50,000. This project is recommended for the Short-Term.

T-6 Existing Plant Mechanical and SCADA Upgrades

The current WTP was re-built in 1995. It contains electrical and control systems that will be in need of replacement or are obsolete, as well as mechanical equipment that is nearing the end of its useful life. Since the plant will need to continue to provide peak capacity into the foreseeable future, these components must be replaced.

This project is estimated to cost approximately $1,500,000. This project is recommended for the Long-Term.

T-7 Ozone/ UV Analysis & Disinfection

The 2006 Water Plant Process Improvement report identified the potential benefits from installation of an ozonation system including improved taste and odor, improved flocculation and filtration, reduced chlorine usage, algae control, and the potential to receive credit for cryptosporidium removal, as well as elimination of the potassium permanganate feed system. UV and combined systems show similar potentials. Since new ozone and UV systems have become more energy efficient and smaller and as the economics of operating these systems have improved dramatically in the last 15 years, there is an increasing likelihood that installation of one of these systems will reduce life cycle operating costs. This project is estimated to cost approximately $1,750,000 and is recommended for the Long-term.

T-8 Bear Creek Cu WLA Source Control Study & Implementation

The Bear Creek Cu WLA Source Control Study and Implementation will focus on the effects of the distributed water quality on domestic plumbing systems, specifically corrosion on lead and copper plumbing surfaces. The study will recommend changes in the current corrosion control program to further reduce copper release on domestic plumbing without diminishing the quality of the distributed water. This project is estimated to cost approximately $50,000. This project is recommended for the Long-term.

T-9 2.6-MG Reservoir & Clearwell ("Crowson II")

Install a new reservoir serving the Crowson & Granite Service Areas. The final sizing of the reservoir is recommended to be 2.6 MG. The project cost estimate is provided in Appendix I. The cost for this project was escalated to the mid-point of construction. The total cost is estimated to be $6,746,000. It is recommended that this project be implemented in the Short-Term planning, as current storage deficiencies exist for meeting the City's storage criteria.

T-10 2.5-MGD Water Treatment Plant

This new facility would have an initial capacity of 2.5 mgd and be expandable to eventually replace the existing WTP as it reaches the end of its useful life (ultimate capacity of 10 mgd). The new WTP will be located in a less vulnerable location and will eventually be operated year-round. The estimated project cost for construction of the WTP is $12M; one additional full time employee (FTE) is required to operate the plant.

7.2.3 Distribution

The following improvements summarize the recommendations provided by the City and by Chapter 5 – Distribution System Analysis.

D-1 Telemetry Station at Water Warehouse

The SCADA telemetry system provides automatic and manual monitoring and control of the water facilities. However, at the Water Warehouse where system adjustments are frequently made, operations staff do not have access to system information such as reservoir levels. It is recommended that additional telemetry be installed to provide visual indiction of system data at the Water Warehouse. Costs for this project are estimated at $50,000. This project is recommended for the Short-Term.

D-2 Water Master Plan Updates

It is recommended that the City budget for updating the Water Master Plan every five years, as required by the Oregon State Drinking Water regulations. A cost estimate of $100,000 is estimated for the next Water Master Plan update in 2016, assuming it will not require a full new analysis of the water system. A cost of $200,000 is estimated for the remaining Water Master Plans in the Short- and Long-Term; it is assumed that these Plans will require a more complete analysis of the system.

D-3 Park Estates Pump Station/Loop Road Reservoir Alternatives

This project addresses the estimated fire flow deficiency in the Park Estates and South Mountain service areas assuming their distribution piping has been connected via project P-16 below. The project includes evaluating the alternatives of providing fire flow or fire storage and constructing the selected alternative. As described in Chapter 5, the alternatives include replacing the existing Park Estates Pump Station or constructing a Loop Road Reservoir.

The cost estimate for a pump station includes a predesign study to confirm pumping requirements, evaluate the site, perform a geotechnical evaluation, and evaluate the piping connecting to the Crowson Reservoir. The new pump station was assumed to require one 50-gpm pump, one 200-gpm pump, and an engine-driven 1,500-gpm fire pump. It is assumed that a new structure will be required in the same location as the current pump station. Temporary pumping can be provided by the South Mountain Pump Station after the two service areas have been connected via pipe projects P-1 and P-2. This project is estimated to cost approximately $2.25M, as presented in Appendix I.

Chapter 5 discusses the previous cost estimates for a new Loop Road Reservoir. For the purpose of this CIP, a cost estimate of $2M is included for this project. It is recommended that this project be included in the Short-Term planning period to meet the 2015 fire flow criteria for the Park Estates and South Mountain Service areas.

D-4 Lit Way New PRV

This new PRV is recommended for providing 1,500-gpm of fire flow to the hydrants in Lit Way in the 2015 planning period. The Crowson Zone 5 and Granite Zone 1 are isolated by a closed valve. Replacing this valve with a PRV would allow fire flow to enter the system during a fire. The project includes installing a new 6-inch PRV Station between Crowson Zone 5 and Granite Zone 1 at intersection of Harmony Lane and Lit Way. By using a pressure setting of 30-psi, the PRV should only open during fires.

This project is estimated to cost approximately $341,000. It is recommended that this project be included in the Short-Term planning period; however, it has been delayed to the Long-Term planning period in the CIP.

D-5 Tolman Creek Road New PRV

A new PRV is recommended at the intersection of Tolman Creek Road and Siskiyou Blvd. This PRV connects the Alsing Zone 2 to Crowson Zone 1, thereby expanding the Alsing Reservoir. This project is important for improving turnover and subsequent water quality in the Alsing Reservoir. By utilizing additional storage in the Alsing Reservoir, the volume of a second Crowson Reservoir is reduced. The City's hydraulic model shows that adding this PRV allows approximately 0.34 MG of water from the Alsing Reservoir to the Crowson Zone 1 during summer days (maximum day demands).

This PRV station should be designed for remote control, and should be interlocked with the Hillview pump station. The reason for providing remote control of this valve is that it will require regular (daily at times) adjustment to control the water age in Alsing Reservoir. Providing remote control of a valve that requires regular adjustment reduces operator time and costs associated with this operation, and can facilitate more regular control of the water in Alsing. Interlocking this valve with the Hillview pump station operation will help prevent pumping water that was just drained out of Alsing Reservoir back into it.

A 6-inch PRV is adequate to provide the maximum modeled flow between these zones. The settings should be verified in the system; the set point was set to 100 psi in the hydraulic model. It is recommended that this valve be controlled by SCADA such that during a large fire event, the valve can close to ensure fire volume is supplied by the Crowson Reservoir(s). The cost for this PRV is estimated to be $341,000. It is recommended that this project be included in the Short-Term planning period; however, it has been delayed to the Long-Term planning period in the CIP.

D-6 Pipe Replacement Program

Chapter 8 evaluated the remaining useful life of the City's pipes given their age and material. From this analysis, an annual repair cost was estimated to replace pipes that have exceeded or are near the end of their useful life. An annual cost of $590,000 was estimated. For the Short-Term planning period, several pipe improvement projects were recommended for improving system pressures during fires; no additional pipe projects are assumed to be feasible given the number and cost of these other pipe projects. For the Long-Term planning period, the annual cost was reduced to $370,000 per year to be more realistic with the City's ability to fund these projects. This amount represents approximately one percent of the City's assets, which is a common approach to asset management planning.

D-7 Radio Read Meter Program

This project will replace existing meters with new radio read meters as needed. Radio-read meters are much more efficient for data collection on monthly water use. Until now, the City has not had a continuously implemented program to systematically install this type of meter. It is also recommended that large meters by inspected, maintained, and calibrated annually. Costs for this project are estimated at $96,500 annually. This project is planned to begin in FY 2019.

D-8 Hydrant Replacement Program

This project allocates funds for annual hydrant replacements. All hydrants are inspected, maintained, and replaced if necessary on an annual basis. The annual inspection and maintenance includes the following: pressure check, valve exercise, and inspection for damage. Costs for this project are estimated at $44,000 annually. This project is planned to begin in FY 2019.

D-9 Emergency Response Plan Update

The City's Emergency Response Plan is in need of updating. This project is estimated to cost approximately $20,000. This project is recommended for the Short-Term planning period.

D-10 Cross Connection Control Plan Update

The City's Cross Connection Control Plan is in need of updating. This project is estimated to cost approximately $15,000. This project is recommended for the Short-Term planning period.

D-11 Safety Plan Update

The City's Safety Plan is in need of updating. Costs for this project are estimated at $20,000. This project is recommended for the Short-Term planning period.

D-12 Granite Reservoir Valving

In the event of a prolonged WTP outage, water from the TAP emergency line will be pumped to Granite Reservoir. Since most of the City's water services are served via the Crowson Zone, a temporary pump will need to be placed near Granite Reservoir to pump a portion of the TAP water from Granite Reservoir to Crowson Reservoir. This will require several new valves and a small amount of new piping to be installed. This project is estimated to cost approximately $100,000. This project is recommended for the Short-Term planning period.

7.2.4 Pipelines

Several projects were identified in Chapter 6 – Distribution System Analysis to address capacity deficiencies related to maintaining pressures and providing adequate fire flow. Many of these projects include replacing small diameter pipes that are unable to convey 1,500-gpm of fire flow, which is the City's minimum fire flow criterion. Using the hydraulic model, efforts were made to minimize pipe projects needed to meet the criteria. Cost estimates were developed for pipe replacement projects using the unit costs provided in Table 7.1. These projects and their associated cost estimates are summarized in Tables 7.2 and 7.3.

Ashland Street Fire Flow

An alternative set of projects were identified for supplying adequate fire flow to the hotels on the east side of Interstate 5 (I-5). A fire flow of 4,000-gpm is required for the hotels in this area. The hydrants are served from a 6-inch pipe crossing under the freeway just south of the I-5 Ashland Street bridge, and an 8-inch pipe in Ashland Street coming from the rest of the water system east of I-5. Replacing the 6-inch pipe would require boring under the freeway with a larger pipe casing and new pipe. The model shows that a 12-inch diameter pipe is sufficient for providing the fire flow. Because of the method of construction, this project will be much more costly than other pipe replacements.

For this reason, the project is compared with the alternatives of increasing the capacities of pipes supplying water to these hotels from the east side. Project P-34a (boring under I-5) includes the cost of jacking and receiving pits ($25,000 each), 20-inch casing ($300 per LF including drilling and placement), and the 12-inch diameter pipe. Project P-34a is estimated to cost $794,000. Project P-34b (upsizing pipes in Ashland Street east of I-5) is estimated to cost $767,000.

Additionally, the City has identified the possibility of extending the pipe over the I-5 bridge. The City is further investigating this alternative. For the CIP, a cost of $794,000 was included as a long-term project.

Other Pipe Projects

The City has identified six additional pipe maintenance projects, labeled as P-35 through P-40.

7.3 CIP SUMMARY

Table 7.2 summarizes the short and long-term CIP projects. All project costs shown in the tables are in September 2011 dollars. The total Short-Term projects are estimated to cost $30.6M; the total Long-Term projects are estimated to cost $13.4M.

7.4 OTHER RECOMMENDATIONS

The following recommendations were identified in the previous chapters that are not categorized as capital projects.

- **O-1 Hillview Pump Station Setpoints** – Adjust the pump controls of the Hillview Pump Station to allow further drawdown of the Alsing Reservoir.
- **O-2 FH 09DB-055** - Ensure FH 09DB-055 is connected to 8-inch diameter pipe in Sherman Street not 4-inch pipe in Iowa Street;
- **O-3 Elkader Street Valve** - Close valve in Elkader Street near Ivy Lane;

- **O-4 Emma Street Valve** - Close valve in Emma Street just east of South Mountain Ave.
- **O-5 South Mountain Disconnect** - Disconnect 6-inch pipe in South Mountain Ave from 16-inch pipe in Emma Street.
- **O-6 Crestview Drive Hydrants** - Ensure hydrants in Crestview Drive are connected to 12-inch pipe not 6-inch pipe.
- **O-7 PRV 11** - Increase PRV 11 (Westwood) setpoint to from 70 psi to 90 psi;
- **O-8 Continue reduced prechlorination doses**. Further reductions in prechlorination are recommended if they can be achieved while maintaining treatment effectiveness and appropriate control of algae growth in the basins.
- **O-9 Refine chlorine contact time between the WTP and the first customer**. Repair meters on finished water piping from WTP to first customers. Recalculate chlorine contact time to the first customer once flows are known. $20,000
- **O-10 Additional Water Rights Acquisition.** The WRCS recommended that the City should move aggressively to acquire additional Ashland Creek or TID water rights as they come available.

Table 7.2 Capital Improvements Projects Summary

ID	NAME	Current	Short-Term											Long-Term
		FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2013-2022 Total	FY 2023 – 2032
	SUPPLY													
S-1	FERC Dam Security & Telemetry Impr (50% Electric, 50% Water)	$ 25,000											**$ -**	**$ -**
S-2	FERC Dam Spillgate Upgrades (50% Electric, 50% Water)	$ 50,000											**$ -**	**$ -**
S-3	FERC Structural Stability Analysis (50% Electric, 50% Water)	$ 90,000											**$ -**	**$ -**
S-4	FERC Part 12 Dam Safety Inspection (50% Electric, 50% Water)			$ 40,000				$ 40,000					**$ 80,000**	**$ 80,000**
S-5	Ashland Creek West Fork Bridge Construction		$ 12,000	$ 108,000									**$ 120,000**	**$ -**
S-6	Sediment TMDL in Reeder Resv.	$ 10,000	$ 60,000		$ 60,000		$ 60,000		$ 60,000		$ 60,000		**$ 300,000**	**$ 300,000**
S-7	Reeder Resv Study Implementation	$ 50,000	$ 30,000										**$ 30,000**	**$ -**
S-8	Reeder Resv Access Road TMDL Compliance						$ 10,000	$ 90,000					**$ 100,000**	**$ -**
S-9	Reeder Resv Variable Depth Intake								$ 100,000				**$ 100,000**	**$ -**
S-10	TID Terrace St Pump Station Improvements				$ 20,000	$ 200,000							**$ 220,000**	**$ -**
S-11	TID Canal Piping: Starlite to Terrace Street							$ 1,100,000					**$ 1,100,000**	**$ -**
S-12	Test existing high capacity wells		$ 50,000										**$ 50,000**	**$ -**
S-13	Water Conservation Smart Controller Pilot Project				$ 50,000								**$ 50,000**	**$ -**
S-14	Water Conservation Management Plan (due April 2012)	$ 50,000											**$ -**	**$ -**
S-15	Emergency TAP Pipeline & Pump				$ 2,000,000								**$ 2,000,000**	**$ -**
	Supply Subtotal	**$ 275,000**	**$ 152,000**	**$ 148,000**	**$ 2,130,000**	**$ 200,000**	**$ 70,000**	**$ 1,230,000**	**$ 160,000**	**$ -**	**$ 60,000**	**$ -**	**$ 4,150,000**	**$ 380,000**
	TREATMENT & STORAGE													
T-1	Raw Water Bypass Measurement		$ 25,000										**$ 25,000**	**$ -**
T-2	SCADA Radio Frequency FCC Compliance		$ 45,000										**$ 45,000**	**$ -**
T-3	Final CT Disinfection Improvements		$ 85,000										**$ 85,000**	**$ -**
T-4	Permanganate Feed Facility Study & Implementation				$ 25,000	$ 240,000							**$ 265,000**	**$ -**
T-5	WTP Security Upgrades			$ 50,000									**$ 50,000**	**$ -**
T-6	Existing Plant Mech. Elec. & Scada Upgrades												**$ -**	**$ 1,500,000**
T-7	Ozone /UV Analysis & Disinfection												**$ -**	**$ 1,750,000**
T-8	Bear Creek Cu WLA Source Control Study & Implementation												**$ -**	**$ 50,000**
T-9	2.6-MG Reservoir & Clearwell ("Crowson II")					$ 746,000	$ 3,000,000	$ 3,000,000					**$ 6,746,000**	**$ -**
T-10	2.5 MGD Water Treatment Plant					$ 1,000,000	$ 5,500,000	$ 5,500,000					**$ 12,000,000**	**$ -**
	Treatment Subtotal	**$ -**	**$ 155,000**	**$ 50,000**	**$ 25,000**	**$ 1,986,000**	**$ 8,500,000**	**$ 8,500,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 19,216,000**	**$ 3,300,000**
	DISTRIBUTION													
D-1	Telemetry Station at Water Warehouse			$ 50,000									**$ 50,000**	**$ -**
D-2	Water Master Plan Updates					$ 100,000					$ 200,000		**$ 300,000**	**$ 400,000**
D-3	Park Estates Pump Station/Loop Road Reservoir Alternatives		$ 200,000	$ 1,800,000									**$ 2,000,000**	**$ -**
D-4	Lit Way New PRV												**$ -**	**$ 341,000**
D-5	Tolman Creek Road New PRV												**$ -**	**$ 341,000**
D-6	Pipe Replacement Program												**$ -**	**$ 3,700,000**
D-7	Radio Read Meter Program								$ 96,500	$ 96,500	$ 96,500	$ 96,500	**$ 386,000**	**$ 965,000**
D-8	Hydrant Replacement								$ 44,000	$ 44,000	$ 44,000	$ 44,000	**$ 176,000**	**$ 440,000**
D-9	Emergency Response Plan Update			$ 20,000									**$ 20,000**	**$ -**
D-10	Cross Connection Control Plan Update				$ 15,000								**$ 15,000**	**$ -**
D-11	Safety Plan Update					$ 20,000							**$ 20,000**	**$ -**
D-12	Granite Reservoir Valving							$ 100,000					**$ 100,000**	**$ -**
	Distribution Subtotal	**$ -**	**$ 200,000**	**$ 1,870,000**	**$ 15,000**	**$ 120,000**	**$ -**	**$ 100,000**	**$ 140,500**	**$ 140,500**	**$ 340,500**	**$ 140,500**	**$ 3,067,000**	**$ 6,187,000**

Table 7.2 Capital Improvements Projects Summary

ID	NAME		Current	Short-Term											Long-Term
			FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2013-2022 Total	FY 2023 – 2032
	PIPES	**Project Extents**													
P-1	Ivy Lane	Morton Street to west end of Ivy Lane		$ 35,000	$ 311,000									**$ 346,000**	**$ -**
P-2	Ivy Lane	South Mountain to FH-16AD-038		$ 10,000	$ 84,000									**$ 94,000**	**$ -**
P-3	Normal Ave	Siskiyou Blvd to Homes Ave			$ 50,000	$ 467,000								**$ 517,000**	**$ -**
P-4	Walker Ave	Siskiyou Blvd to Ashland Middle School				$ 75,000	$ 709,000							**$ 784,000**	**$ -**
P-5	Parker Street	Walker Ave to Lit Way					$ 20,000	$ 142,000						**$ 162,000**	**$ -**
P-6	Harmony Lane	Siskiyou Blvd to Lit Way					$ 10,000	$ 55,000						**$ 65,000**	**$ -**
P-7	Lit Way	Joy Avenue to Ray Lane					$ 5,000	$ 30,000						**$ 35,000**	**$ -**
P-8	Ray Lane	Lit Way to Joy Ave					$ 5,000	$ 49,000						**$ 54,000**	**$ -**
P-9	Beach Street	Larkin Lane to Iowa Street						$ 10,000	$ 81,000					**$ 91,000**	**$ -**
P-10	AHS Property	Fire hydrant in school property						$ 9,000	$ 81,000					**$ 90,000**	**$ -**
P-11	Vista Street	Fork St to Hillcrest St							$ 149,000					**$ 149,000**	**$ -**
P-12	Vista Street	Intersection of Vista, Hillcrest, Glenview Dr							$ 5,000					**$ 5,000**	**$ -**
P-13	Meade Street	Vista St/Hillcrest to Iowa Street							$ 235,000					**$ 235,000**	**$ -**
P-14	Elkader Street	Ivy Lane to Pinecrest Trail								$ 72,000				**$ 72,000**	**$ -**
P-15	Ivy Lane	South Mountain Ave to Elkader St								$ 64,000				**$ 64,000**	**$ -**
P-16	South Mountain Ave	S. Mountain Ave to Emma St								$ 6,000				**$ 6,000**	**$ -**
P-17	South Mountain Ave	From S. Mountain Ave to FH 16AD-043								$ 17,000				**$ 17,000**	**$ -**
P-18	Pinecrest Trail	Penny Drive to Woodland Drive									$ 178,000			**$ 178,000**	**$ -**
P-19	Pinecrest Trail	Walker Ave to Starlight Place									$ 396,000			**$ 396,000**	**$ -**
P-20	Penny Drive	Woodland Dr to Weissenback Way										$ 83,000		**$ 83,000**	**$ -**
P-21	Woodland Drive	Leonard St to Pinecrest Trail										$ 52,000		**$ 52,000**	**$ -**
P-22	Hiawatha Place	Walker Ave to FH 15CA-020										$ 58,000		**$ 58,000**	**$ -**
P-23	Morton Street	FH 16AC-023 to PRV 12											$ 130,000	**$ 130,000**	**$ -**
P-24	Ashland Mine Road	Cedar Way to Fox Street											$ 115,000	**$ 115,000**	**$ -**
P-25	Fox Street	Ashland Mine Road to N. Main Street											$ 54,000	**$ 54,000**	**$ -**
P-26	Almeda Drive	Almeda Dr to Dog Park Road												**$ -**	**$ 35,000**
P-27	Skycrest Drive	Orchard St to south end of Skycrest Dr												**$ -**	**$ 162,000**
P-28	Crispin Street	Oak Street to Patterson Street												**$ -**	**$ 131,000**
P-29	Oak Lawn Ave	Oak Street to Sylvia Street												**$ -**	**$ 29,000**
P-30	Sylvia Street	Oak Lawn Ave to FH 04CA-019												**$ -**	**$ 64,000**
P-31	Black Oak Way	Tolman Creek Road to Bellview Ave.												**$ -**	**$ 85,000**
P-32	Oak Knoll Dr	Twin Pines Creek Dr to Cypress Point Loop												**$ -**	**$ 287,000**
P-33	Ashland Street	Tolman Creek Rd to Washington St												**$ -**	**$ 432,000**
P-34	I-5 Crossing	Washington St to Clover Lane												**$ -**	**$ 794,000**
P-35	Ditch Road	Strawberry PS to Grandview Dr				$ 75,000	$ 75,000	$ 75,000						**$ 225,000**	**$ -**
P-36	Lithia	Lithia Water Line							$ 70,000					**$ 70,000**	**$ -**
P-37	Iowa Street	S. Mountain Ave to Wightman St												**$ -**	**$ 640,000**
P-38	Granite Street	Strawberry to Pioneer												**$ -**	**$ 300,000**
P-39	B Street	Oak St to 5th St												**$ -**	**$ 250,000**
P-40	Terrace Street	Iowa to TID Ditch												**$ -**	**$ 350,000**
		Piping Subtotal	**$ -**	**$ 45,000**	**$ 445,000**	**$ 617,000**	**$ 824,000**	**$ 370,000**	**$ 621,000**	**$ 159,000**	**$ 574,000**	**$ 193,000**	**$ 299,000**	**$ 4,147,000**	**$ 3,559,000**
	TOTAL		**$ 275,000**	**$ 552,000**	**$ 2,513,000**	**$ 2,787,000**	**$ 3,130,000**	**$ 8,940,000**	**$ 10,451,000**	**$ 459,500**	**$ 714,500**	**$ 593,500**	**$ 439,500**	**$ 30,580,000**	**$ 13,426,000**

CHAPTER NO. 8

OPERATIONS AND MAINTENANCE

8.1 INTRODUCTION

The purpose of this chapter is to evaluate the City of Ashland's (City's) water utility operation and maintenance systems by documenting existing procedures and identifying areas where improvements could enhance operation.

8.2 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITY

Critical decision-making follows the upward chain of command of the City's water system management, operations, and control structural hierarchy. The Operations Division is located at the Service Center building, located at 90 N Mountain Avenue. The City maintains a current list of all system personnel on file at City Hall.

Proper documentation of the responsibilities of water system managers and operators can increase system performance and improve emergency response time. In emergency situations, critical time can be lost if the correct decision-making personnel are not kept informed. Therefore, an established ranking of decision-making individuals is documented. A list of contact information for all employees is also kept updated, as described in the City's Emergency Response Program.

8.3 WATER SYSTEM STAFFING

The purpose of this section is to evaluate the City's current staffing levels with regards to water treatment plant operations, distribution system operations, water system engineering, and conservation. For each category of employees, this chapter identifies current staffing levels, key activities, and recommendations for future staffing.

8.3.1 Water Treatment Plant Staff

The Ashland Water Treatment Plant (WTP) has been designated by the Oregon Department of Human Services (ODHS) as a Water Treatment Level III Facility. This designation is based on a points system that takes into account the number of people served and the types of chemicals and processes utilized at the facility. A Level III facility requires that a water treatment plant operator certified at Level III or greater be in responsible charge at all times that the system is in operation.

The water treatment plant is currently staffed by one full-time WTP supervisor, two full-time WTP operators, one utility worker, and one substitute operator, as summarized in Table 8.1. The current staffing of the plant by day is summarized in Table 8.2. The plant operates 24 hours per day and is staffed for 10 hours each day (7:00 a.m. through 5:00 p.m.), under normal operation. The current staffing level allows for continuous operation of the plant, as well as required maintenance and reporting activities including monitoring of the watershed and Reeder Reservoir. Specific activities conducted by WTP operations staff are summarized in Table 8.3.

When the TID supply is in use, the WTP must be staffed 24 hours per day. There are only four operators with a Level II or greater certification including the WTP Supervisor and the Substitute WTP Operator; one of these four individuals must be at the WTP at all times. Twenty-four hour operation requires overtime, even without accounting for vacation and sick time, and requires cessation of many regular supervisory and maintenance activities. Hence, it can only be maintained for short periods of time. To date, use of the TID supply at the WTP has been for short periods only and has been accomplished with the current staffing level. However, in future years, the TID supply may be used more frequently and for longer durations.

In addition, if a second WTP were implemented to improve water system redundancy, additional staffing would be required during the summer when both facilities are in operation. This additional effort is estimated at 1.0 FTE.

Table 8.1 Current Staffing – Treatment

Role	Certification Level (1)	FTE
WTP Supervisor	IV(2)	1.0
Senior Operator (Chief)	IV2)	1.0
Operator II	II(2,3)	1.0
Utility Worker I - WTP	I	1.0
Substitute Operators	IV(4)	0.5
Total		4.5

Notes:

1. Certification level requirement for the Ashland system is Water Treatment Level III with Filtration Endorsement. All individuals listed have their Filtration Endorsement.
2. Two individual at this level is eligible for retirement currently or within 2 years.
3. Will be taking the Level III exam in May 2011.
4. Retired, currently working on a contract basis.

Table 8.2 Current Staffing Schedule – Treatment

Name	Mon	Tues	Wed	Thurs	Fri	Sat/Sun
WTP Supervisor	X	X	X	X	X	
Operator (Level III or Greater)	X	X	X	X	X	X
Operator (Level II or Greater)		X	X	X	X	
Water Utility Worker		X	X	X	X	

Notes:

1. Assumes staffing for only the current 7:00 a.m. to 5:00 p.m. operations schedule.

Table 8.3 Summary of Water Treatment Plant Staffing Activities

Function	FTEs Required	Activities	Basis for Determining the Number of FTEs Required
Required Treatment Processes	1	Coagulation, flocculation, rapid sand filtration, chlorination, pretreatment (taste & odor control)	Based on current staffing level and typical utility practices.
Treatment Equipment O&M	1	Testing, repair, and replacement of the mechanical, electrical, and control components of the chemical feeds, pumps, flocculators, meters and other associated appurtenances required.	Based on current staffing level and typical utility practices.
Lab Operations	.35	Testing, monitoring, and control of quantity & quality of finished water.	2008 NEIWPC Guide for lab operations.
Sludge Mgmt.	.15	Sludge Pond maintenance and control	Based on current staffing level and typical utility practices.
Facilities O&M	.75	Miscellaneous building and yard maintenance and repair.	2008 NEIWPC Guide for yard work
Reservoir Mgmt.	0.5	Testing, monitoring, and control of quantity & quality of raw water.	Based on current staffing level and typical utility practices.
Dam & Power Plant Monitoring	0.25	Daily Inspection of Powerhouse as well as Hosler, East, and West Fork Dams	Based on current staffing level and typical utility practices.
Supervision	1.0	First-line supervision to operations, maintenance, and repair of the plant & associated facilities.	Based on current staffing level and typical utility practices.
Total	**5**		

8.3.2 Water Distribution System Staff

The City's distribution system has been designated by the ODHS as a Water Distribution Level III System. This designation is based on the number of people served. A Level III system requires that a distribution system operator certified at Level III or greater be in responsible charge at all times that the system is in operation.

The current staffing is summarized in Table 8.4. Current staffing is 10.0 full-time equivalents (FTE) including one currently open position. Staffing includes the Water Quality Supervisor, two water quality technicians, six distribution operators (including one open position), and a meter reader.

The current activities delivered by water distribution system staff as summarized in Table 8.5 also adds up to 10 FTE. The table includes all of the current operations and maintenance activities, as described in this chapter, including a meter, hydrant, and pipeline replacement programs to address facilities that are undersized or are more expensive to repair than to replace. Due to recent retirements and cutbacks to the CIP due to reduced revenue during the recent recession, the pipe replacement program was interrupted. Re-staffing to resume the program is included in the budget but delayed until the new CIP is approved.

The existing staffing level (9.0 FTE) is almost sufficient to complete all current activities, but would not accommodate increases in private development. It also would not be sufficient to implement the programs recommended (e.g. the flushing program. large meter calibration program, and the pipe, hydrant, and meter replacement programs). Filling the open Water Utility Worker position would allow the City to begin to implement the recommendations listed in Section 8.5 and 8.12.

Table 8.4 Current Staffing – Distribution

Role	Certification Level (1)	FTE
Water Quality Supervisor	IV	1.0
Utility Worker IV – Water Quality Technician	IV (CCI)	1.0
Utility Worker IV – Water Quality Technician	II (CCI)	1.0
Senior Utility Worker / Warehouse-person	II	1.0
Senior Utility Worker / Distribution	IV	1.0
Utility Worker I - Distribution		1.0
Utility Worker I - Distribution		1.0
Utility Worker I - Meter Reader		1.0
Meter Reader/Repairer	II	1.0
Utility Worker I – Distribution (unfilled)		1.0
Total		10

Notes:
1. ODHS requires the City of Ashland to have at least one operator with a Water Distribution III certification at all times. CCI refers to individuals certified as Cross Connection Inspectors.

Table 8.5 Summary of Water Distribution System Staffing Activities			
Function	**FTEs Required**	**Activities**	**Basis for Determining the Number of FTEs Required**
Supervision	1.0	First-line supervision to work crews in construction, maintenance, and repair of water distribution systems, Ashland irrigation system and Lithia water system.	Based on current staffing level and typical utility practices.
Meter Reading	1.0	Regular meter reading and required rereads (assumed to be around 10%).	Equivalent to approximately 250 meters read per day, which is within the industry norm (total of 8671 meters in 2009).
Meter installation and repair	0.2	Repair and replacement of malfunctioning meters, installation of new meters.	Based on 200 meters per year and 2 hours per meter.
Cross-connection Control	0.2	Testing of backflow devices, property surveys, maintenance and testing of City backflow devices, documentation.	Based on current staffing level.
Fire Hydrant Maintenance and Repair	0.2	Annual maintenance of all hydrants in system, repair as needed.	Based on 1,140 fire hydrants with 2 hours per maintenance of each hydrant per year, plus small additional amount for repair.
Service Calls	1.0	Door hangers for customers with unpaid bills, responding to customer complaints, including those pertaining to leaks, water pressure, and water quality.	Based on City's 2010/11 data, which included 635 service calls and monthly delivery of door hangers.
Flushing	0.2	Annual flushing of all dead-ends in the system to maintain water quality.	Based on 140 dead ends and average of 2 hrs per flush. Does not include flushing the entire system on any regular basis.
Fountain Maintenance	0.3	Fountain cleaning, adjustment and repair.	Based on 2010/11 documented hours.
Utility Locates	0.9	Locate utilities.	Based on 2010/11 documented hours.
Mainline Repairs	0.2	Repairs mainline leaks, do tie-ins for new services	Based on 20 leaks per year and 16 hours per leak, plus additional amount for tie-ins and installation based on 2010/11 amounts.
PRV Maintenance and Adjustments	0.1	Bi-annual maintenance of PRVs, adjustment and repairs of PRVs as needed.	Based on 31 PRVs, bi-annual maintenance, and 2 hrs per valve, plus additional amount for repairs/adjustment based on 2010/11 amounts.
Pump Station Maintenance	0.3	Weekly maintenance of the City's water distribution pump stations.	Based on average of 8 hours of maintenance per week, plus additional amount for repairs.

Table 8.5 Summary of Water Distribution System Staffing Activities

Function	FTEs Required	Activities	Basis for Determining the Number of FTEs Required
Water Quality Monitoring	0.4	Collection, analysis and reporting of all distribution system water quality requirements, including BacT, disinfection by-products (DBPs), and lead and copper.	Based on 10 hours per week for BacT sampling plus additional 20 hours per month to meet other sampling/reporting requirements.
Telemetry	0.4	Calibration of on-line analyzers, maintenance of all other distribution system telemetry equipment.	Based on 10 hours per week for calibration of on-line analyzers, plus 4 hours per week for other tasks.
TID System	1.0	Maintenance of Terrace Street Pump Station, ditch operation and maintenance, responding to customer service calls specific to TID system.	Includes 2010/11 documented hours plus additional effort to account for using TID supply at the WTP on a regular basis.
Warehouse Duties	0.6	Maintain the City warehouse.	Based on 2010/11 documented hours.
Existing Service Lines	0.2	Service line locates, repair and maintenance of service lines under City responsibility.	Based on 2010/11 documented hours.
New Services	0.6	Installation of new service lines, subdivision services.	Based on 2010/11 documented hours, increased by factor of 2 to account for current low level of development.
Safety	0.1	Safety training and maintenance of safety programs.	Based on 2010/11 documented hours.
Miscellaneous	0.5	WTP support, fire flow testing, turning off services, project-related work.	Based on 2010/11 documented hours.
Valve exercising program	0.5	Annual exercising of large valves, exercising of remaining valves on a 5-year cycle.	Based on exercising one quarter of the City's 3,294 valves each year, at 10 minutes per valve.
Life Cycle Cost Replacement Program	0.6	Replacement of worn out pipes, valves, hydrants, meters, and components that have become more costly to maintain than replace.	Based on 4-man crew working 8 weeks per year replacing pipe & appurtenances.
Total	**10.0**		

Notes:
1. The documented hours for 2010/11 are based on information provided from the City's work order management system.

8.4 PUBLIC WORKS ADMINISTRATION & ENGINEERING STAFF

Public Works Administration & Engineering resources are allocated approximately equally between the Water, Wastewater, Transportation, and Facilities Enterprise Funds. One minor exception to this allocation is that the GIS analyst position is allocated 50 percent to the City's Electric Utility enterprise fund. The water fund is currently allocated 3.125 FTE.

Current staffing for the City's water system are summarized in Table 8.6, where the need is shown to be 3.625 FTE (a deficit of 3.625-3.125=0.50 FTE).

8.4.1 Staffing Needs

Based on current activities, it is recommended that 0.5 FTE in engineering be added in order to meet currently unmet water regulatory requirements and to most economically administer the projects proposed In the CIP. The current deficiency cannot likely be accommodated by shifting responsibilities to avoid replacement of retiring employees. Delays in project completion and regulatory compliance will increase if private development returns to normal levels. If regulatory requirements and capital program activity also increases as anticipated, the city's ability to meet current requirements will be further decreased.

Table 8.6 Current Staffing – Administration & Engineering

Role	Certifications[1]	FTE
Administrative Assistant	--	1.0
Administrative Supervisor	--	1.0
Engineering Associate	--	1.0
Engineering Associate	EIT	1.0
Engineering Project Manager	--	1.0
Engineering Services Manager	PLS, CWRE	1.0
GIS Analyst (.5 FTE Electric Dept, .5 FTE PW Dept)	--	0.5
GIS Manager	GISP	1.0
GIS Technician		1.0
Office Assistant II	--	1.0
Public Works Director	--	1.0
Public Works Superintendent	--	1.0
Senior Engineer	PE, SE	1.0
Total		**12.5**

Notes:
1. Qualifications listed are those relevant to the respective positions. Certifications include: PLS – Professional Land Surveyor; CWRE – Certified Water Rights Examiner; GISP – GIS Professional; PE – Professional Engineer, SE – Structural Engineer; EIT – Engineer in Training

Table 8.7 Summary of Administration and Engineering Division Staff Activities for the Water Fund

Function	FTEs Required	Activities	Basis for Determining the Number of FTEs Required
Water Project Design & Construction Administration	*0.50**	Project-specific project management of the development, design, and construction of water system CIP and internal capital improvements projects.	Based on an average of $2.5 Million dollars per year of water fund project construction cost with an average of 2% assigned to project administration.
Budgeting & Master Planning	0.10	Periodic updating of the budget, CIP, & master plan to reflect changes in the system conditions.	Based on 0.25 FTE, once every 5 years plus 100 hours/year ongoing.
FERC Regulatory Compliance & Reporting	0.35	Ongoing inspection, testing, and monitoring to satisfy FERC dam safety requirements, including the Emergency Warning System and EAP.	Based on existing work backlog and FERC estimate of 0.25 - 0.5 FTE for other similar systems.
Environmental & Regulatory Compliance & Reporting	0.20	Annual DHS & DEQ reporting of water system improvements, Reeder TMDL implementation, and USFS/ AFR fire protection project source water quality monitoring.	Based on 2010/11 documented hours.
Safety & Emergency Preparedness	0.15	Ongoing safety training, as well as periodic exercises, training, and preparation of operating procedures for various emergency situations (e.g. floods, fires, earthquakes, etc.).	24 hours per year for each staff member, split equally between Water, Wastewater, Transportation, & Facilities.
Professional & Technical Support	0.10	Technical review of emerging issues and problems (e.g. taste & odor issues, radiation risk assessment, curtailment support).	Based on prior three years of documented hours averaged.
Planning, Engineering review, permitting, & Inspection	*0.15**	Water facility engineering design review and construction inspection as part of a city-wide permitting process for public and private development projects	Based on average of past 5 years of development review workload shared equally between water, sewer, and transportation funds.
GIS Mapping	0.375	Updating of Mapping and Water Facility Database.	Based on 5-year average
Water Rights maintenance	0.05	Ongoing reporting and renewal of agreements for TID, BOR, and other City-held water rights	Based on 2010/11 documented hours.

Table 8.7 Summary of Administration and Engineering Division Staff Activities for the Water Fund

Function	FTEs Required	Activities	Basis for Determining the Number of FTEs Required
Public Involvement & Council Support	0.15	Public Presentations, Tours, and Media support as well as staffing of public committees (e.g. Forest Lands Commission, Water Advisory Committee,) and City Council Support.	Based on 2010/11 documented hours.
Miscellaneous	0.25	Database Maintenance, web updating, monthly reporting, service call follow up, and emergency operations support, overdue testing notifications.	Based on 2010/11 documented hours.
Supervision	1.25	Executive, superintendence, administrative, and technical supervision.(PW Director, PW Superintendent, Administrative Supervisor, Engineering Services Manager, GIS Manager)	5 FTE split approximately equally between the Water, Wastewater, Transportation (includes Stormwater) and Facilities (includes Airport, Cemetery, & Building Maintenance Divisions) Enterprise Funds.
Total	***3.625****		

Notes:

1. The documented hours for 2010/11 are based on information provided from timesheets and financial reporting.
2. Functions in bold text can be carried out in part by the currently unfilled technician position if trained for those functions.
3. *Text in italics with * indicate that workload estimate reflects recent period of relatively low level of construction activity.*
4. *Future levels are subject to increase depending on economic conditions in the economy and the funding level of the CIP*

8.4.2 Conservation Staff

The City currently has one full-time staff person who is responsible for all electrical and water conservation activities. Conservation activities and the current level of effort are summarized in Table 8.8. The current level of effort is limited by the available staffing. For example, the residential and commercial audit program has been a highly effective program for the City and could be expanded, if additional staff time were available.

As part of the Water Conservation and Reuse Study, the Ashland Water Advisory Committee (AWAC) established an aggressive conservation target of 15 percent[1] over 20 years. Meeting this goal would require an expansion of conservation programs. Initial plans for expanding the program are summarized in *Chapter 4 – Water Conservation*. The anticipated future levels of effort for existing and new conservation programs are also summarized in Table 8.9.

Expansion of current programs would require an additional half-time conservation staff person. It is anticipated that the full-time staff person would be responsible for expanded residential and commercial audit programs and the rebate programs. A second half-time staff person would be responsible for all remaining tasks, including development of new programs.

[1] A conservation goal of 5 percent was assumed for budgeting purposes to avoid a budget shortfall if the aggressive conservation target of 15 percent is not achieved within the timeframe assumed.

Table 8.8 Summary of Current and Anticipated Conservation Staff Activities				
Function	Level of Effort (FTE)		Activities	Basis for Determining the Number of FTEs Required
	Current	Future		
Residential and commercial water audits by staff	0.3	0.5[2]	Conduct residential and commercial indoor and landscape water surveys to help customers identify ways to save water, including provision of free conserving devices such as water efficient spray nozzles.	Based on typical hours during 2008/2010 period.
Rebate programs	0.5	0.[2]	Administration of program to provide rebates to customers who upgrade toilets, clothes washers, and dishwashers to more efficient models.	Based on typical hours during 2008/2010 period.
Daily/ weekly irrigation information	0.1	0.1[3]	Manage program on website to provide daily/weekly updates on optimum watering for the week and latest weather information.	Based on typical hours during 2008/2010 period.
Irrigation design review and information	0.1	0.1[3]	Review irrigation designs for development plans, maintain information on xeriscape.	Based on typical hours during 2008/2010 period.
Watering restrictions	0.5[(1)]	0.5[1]	During curtailment years, manage water curtailments.	Based on effort during 2010 curtailments.
Development of new conservation programs[2]	-	0.3[3]	Develop new programs listed in Chapter 4, such as a "self-audit" program, sub-meter incentives, lawn conversion rebate, etc.	Estimate based on professional judgment.
Total	**1.0**	**1.5**		

Notes:

1. During curtailment periods, management of the watering restrictions precludes operation of normal conservation program activities.
2. Water audits and rebate programs would be managed by the full time staff person.
3. Remaining programs, including development of new programs, would be managed by the half-time staff person.

8.5 SYSTEM OPERATION, MAINTENANCE AND CONTROL

The City's water system facilities are presented in Chapter 1 Existing System. As discussed in Chapter 1, the City's system is comprised of a water treatment plant, reservoirs, booster pump stations, pressure reducing valve (PRV) stations, and an extensive distribution system. Primary operation of the City's Water System is maintained via the SCADA computerized control system.

The master control of the SCADA system is located at the Ashland Water Treatment Plant. The system cannot be accessed from any other locations, but the proposed CIP includes a project to add viewing capability from the Service Center at 90 N Mountain Ave. The computerized system controls and monitors the entire water system, including levels in the storage facilities and pump station operations. Some programming and logic control features are only accessible locally at the facility.

The City uses a maintenance tracking system known as *Cartegraph* to define and track maintenance activities for the City. This program has been in place since 2000. Keeping accurate and up-to-date maintenance records is important for system evaluations and for scheduling preventative maintenance. As equipment ages and flow demands increase, accurate maintenance records become increasingly important.

The key maintenance programs conducted by water system staff are documented above in Section 8.2. Note, City staff do not currently maintain an in-house pipeline replacement program; all pipeline replacements are performed by outside contractors. Key maintenance programs are listed as follows.

Fire Hydrant Maintenance and Replacement. All hydrants are inspected, maintained and repaired (if necessary) on an annual basis. The annual inspection and maintenance includes the following: pressure check, valve exercise, and inspection for damage.

Meter Installation and Replacement. Existing meters are repaired or replaced as needed. The City does not have a program to systematically calibrate or maintain existing residential or large meters. It is normally recommended that large meters be inspected, maintained, and calibrated annually.

Flushing. The City flushes dead end mains annually. The City does not have a system-wide flushing program, or a unidirectional flushing program.

Valve Exercising. The City exercises all large valves annually, with the remaining valves exercised on a 5-year cycle.

Pump Station Maintenance. Maintenance of all pump stations is conducted weekly, with repairs conducted as necessary. Weekly maintenance includes the following: verification of operational pressures and hours, and lubrication & testing.

Telemetry System Calibration and Maintenance. Calibration and maintenance of all on-line analyzers is conducted weekly. Weekly maintenance includes: visual verification of communication protocols and outputs, ongoing maintenance and calibration of the chlorine analyzers, PH and temperature meters and controllers located throughout the system. Other telemetry equipment is maintained and repaired as needed.

Storage Facilities. Regular reservoir maintenance has varied widely in recent years because several large CIP projects were under construction, but under normal conditions, the City conducts internal inspection and cleaning of reservoirs every three years. Visual inspection for environmental damage and integrity of vents and screens should be done on a seasonal basis. Weekly inspection of the exterior perimeter of foundations, ladders, platforms, lighting, overflows, manholes, vents is conducted to look for leaks, exterior corrosion, vandalism, and damage.

PRV Station Inspection and Repair. PRV stations are inspected every 12 months. The checklist includes cleaning of valves and screens replacing of seats and diaphragms, seasonal adjustments of some valves and fine-tuning. Repair or replacement maintenance, unless very major, is usually performed in house. PRVs are typically rebuilt every 20 to 30 years, except for the CRD, which varies depending on location.

8.5.1 Pipe Replacement Program

The City's existing pipes were assessed for their conditions in order to prepare a pipeline replacement program. The condition assessment focused on identifying the remaining useful life (RUL) of the City's water pipes. The length of time that a pipe is anticipated to remain functional is called the useful life. Useful life depends largely on the pipe material, but can also depend on soil conditions, water constituents, and installation. When a pipe is in service beyond its useful life, the increasing costs of maintenance associated with a failing pipe typically warrant replacement.

Table 8.9 presents the estimated useful life of various types of pipe materials found in the City's pipe data.

Table 8.9 Useful Life of Pipes

Pipe Material	Original Useful Life Assumption (yrs)
Asbestos Cement (AC)	70
Cast Iron Pipe (CIP)	60
Ductile Iron Pipe (DIP)	80
Galvanized Steel Pipe (Galv)	30
High Density Polyurethane Pipe (HDPE)	70
Polyvinyl-Chloride Pipe (PVC)	60
Steel Pipe (Steel)	70
Tile	30
Unknown	70

RUL is defined as the length of time left before a pipe will reach the end of its useful life. Pipe age and material type were used to determine the RUL of the City's pipes. The City's GIS data was used to determine the type of material and year that pipe segments were installed.

Table 8.10 presents the total length of pipe according to the year installed and material type. As seen in the table, the majority of the City's pipes are Cast Iron Pipe (CIP), installed from 1920 to 1980, and Ductile Iron Pipe, installed from the 1970's to today.

The material type of approximately 8 percent of the pipes was unavailable from the City's GIS. Pipes whose material was unknown were assumed to have a useful life of 70 years, which is the weighted average of other known pipe materials. The installation year of approximately 16 percent of the pipes was unavailable from the City's GIS. The RUL of pipes without an installation date is unknown.

The cells of Table 8.10 are color-coded to show the RUL of pipes in that category. For example, the lengths of pipe in the red cells have all reached the end of their useful life (have a remaining useful life of zero). Using these assumptions for known pipes, approximately 128,000 linear feet (LF) of pipe, or 23 percent, of the City's pipes have an RUL of 10 years or less. From the data, approximately 36 percent of the City's pipes are expected to reach the end of their useful lives in the next 20 years.

Figure 8.1 presents the total length of pipe reaching the end of its assumed useful life by year. All pipes that have exceeded their useful life are shown to have reached the end of their useful life today, in 2011. Pipes whose installation date is unknown are shown to the far right of the graph as Not Available "NA." Given a maximum useful life of 80 years for any pipe type, pipes installed today are expected to require replacement in 2090.

It is recommended that the City begin an annual pipe replacement program to target the pipes that have reached the end of their useful life, and to offset the depreciation of this City asset. Annual costs for replacing pipes that have reached the end of their useful life were estimated for each year. The cost estimates assume the same direct cost assumptions of replacing pipes as presented in Chapter 7. All 4-inch diameter pipes were assumed to be replaced with 6-inch diameter pipes as a minimum diameter. The results are shown in Figure 8.2.

As seen in Figure 8.2, a large cost was estimated for the year 2011 ($10.4M); this cost represents replacing all pipes that have reached the end of their useful life to date. Averaging this initial cost and other annual costs over the 80-year period results in an average annual cost of $590,000. To address the pipes reaching the end of their useful life in the next 20 years, an average annual amount of $1.0 million is estimated.

These costs are included in Chapter 7 - Capital Improvements Plan. As discussed in Chapter 7, the annual costs are reduced to account for the 4-inch diameter pipes already recommended for replacement. In addition, the annual amount is reduced to an amount that is more realistic for the City.

Table 8.10 Pipe Length by Decade Installed and Material Type

Material Type	Total Length (ft) by Decade Installed													
	Unknown	**1901-1910**	**1911-1920**	**1921-1930**	**1931-1940**	**1941-1950**	**1951-1960**	**1961-1970**	**1971-1980**	**1981-1990**	**1991-2000**	**2001-2010**	**2010-2020**	**Grand Total**
TILE												19		19
GALV	77								37		440			554
CIP	38,319	9	1,510	23,059	24,986	32,110	32,568	61,313	24,430	4,310	1,231	1,860	91	245,795
PVC	1,225													1,225
STEEL	17,594	1,893	1,267	1,355	553	81		96	286	734				23,860
UNKNOWN	15,063	562	1,087	3,049	1,448	1,289	1,399	4,648	4,647	3,340	5,713	7,599	9	49,851
AC	784			9		13	3,098	4,719			379			9,003
HDPE												1,086		1,086
DIP	29,216			350	389	942	355	2,498	44,070	73,407	88,090	79,171	120	318,609
Total (ft)	**102,279**	**2,464**	**3,864**	**27,822**	**27,377**	**34,435**	**37,420**	**73,274**	**73,469**	**81,791**	**95,853**	**89,735**	**220**	**650,002**

Legend
- Over 20 years of RUL
- Between 10 and 20 years of RUL
- Between 0 and 10 years of RUL
- 0 years Useful Life

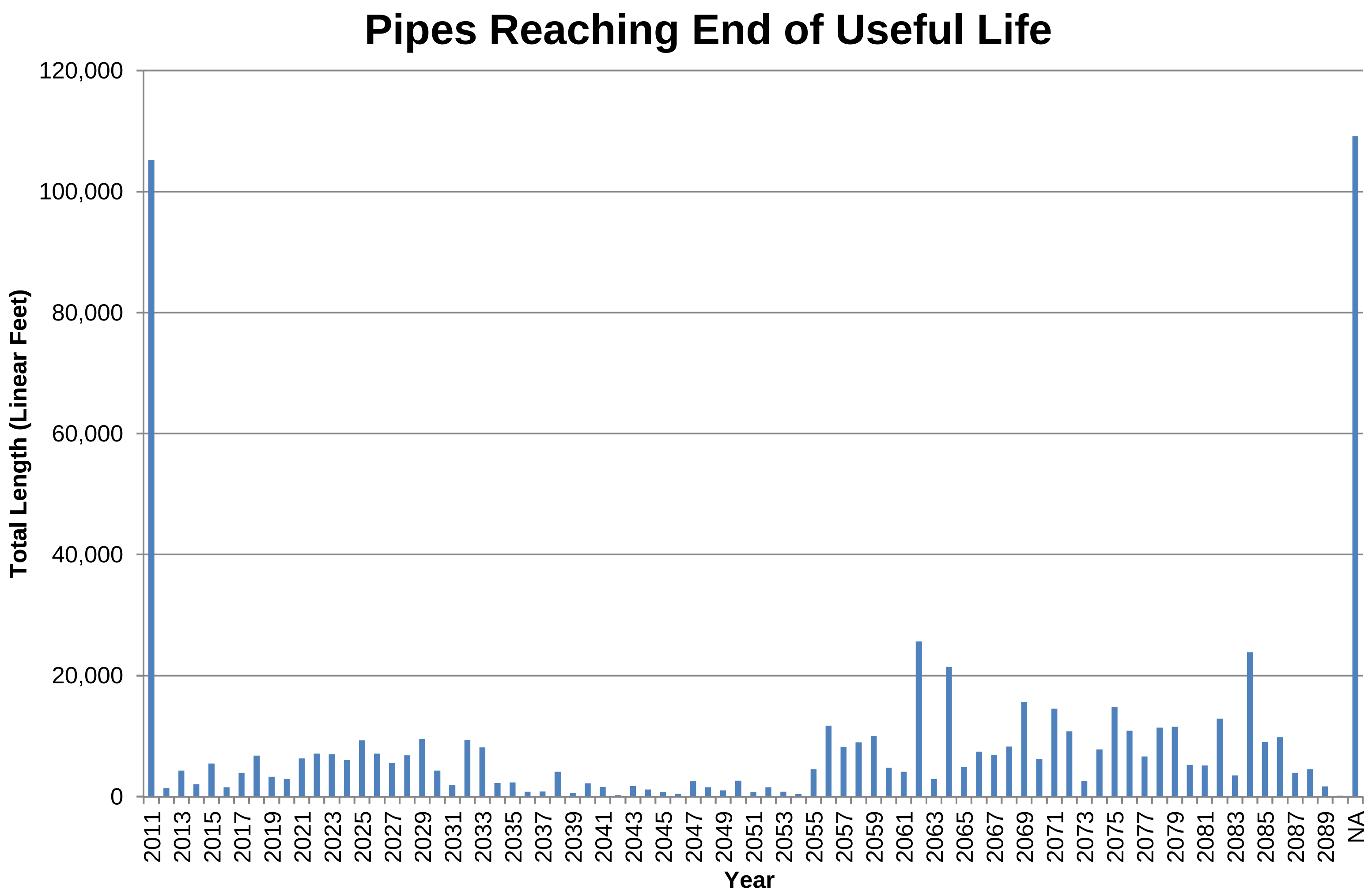


Figure 8.1
Pipes Reaching End of Useful Life
WCRS & CWMP
City of Ashland

pw:\Client\OR\Ashland\8406A00\Data\Costs CIP\PipeRULAnalysis2.xlsx

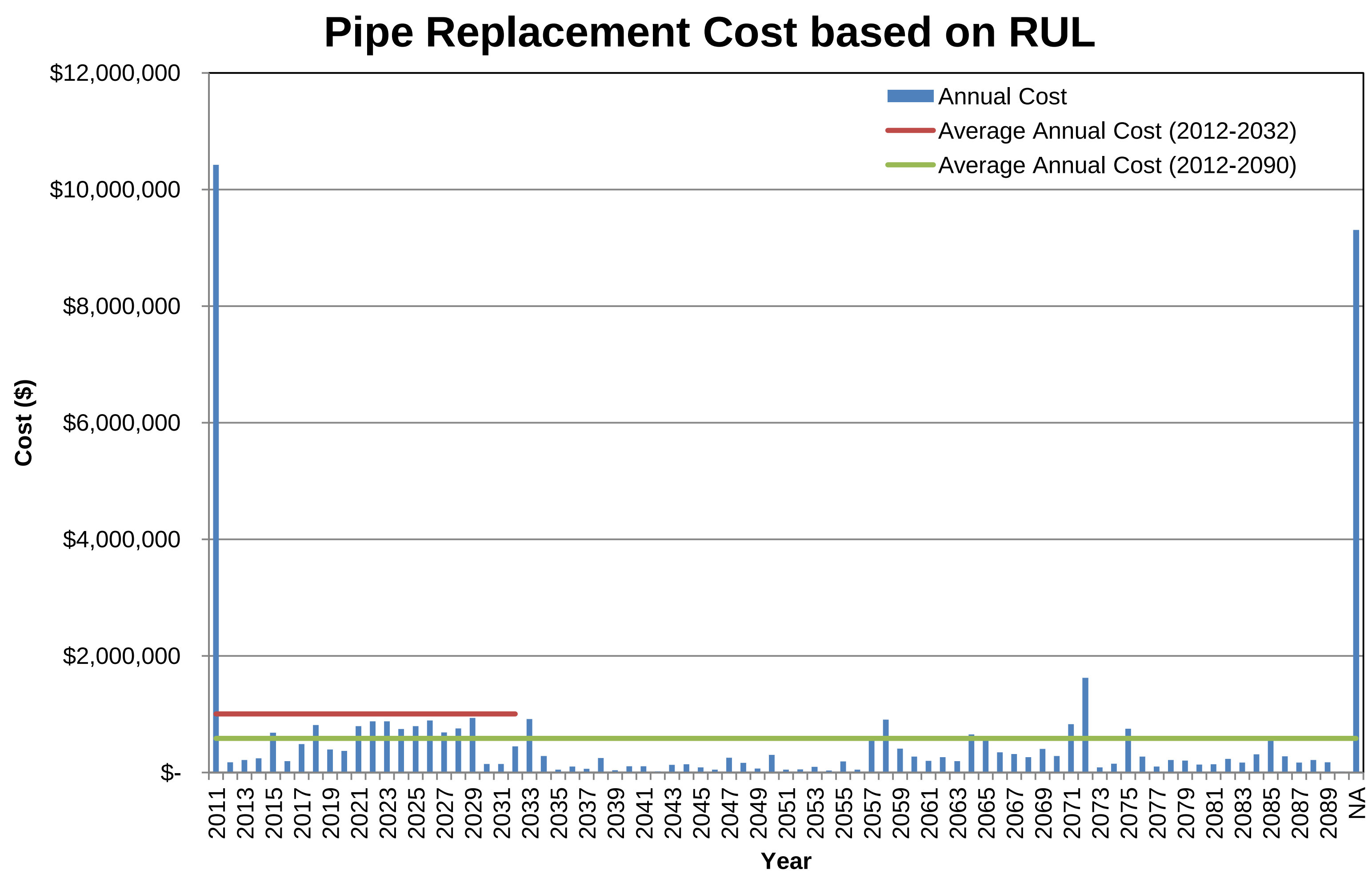


Figure 8.2
Pipe Replacement Cost based on
Remaining Useful Life
WCRS & CWMP

pw:\Client\OR\Ashland\8406A00\Data\Costs CIP\PipeRULAnalysis2.xlsx

8.6 EMERGENCY RESPONSE OPERATIONS

The operation of the water system under emergency conditions is an important responsibility of the City staff. The City's Emergency Response Plan (ERP) was last updated in 2004. The ERP set specific goals for emergency response, summarizes the city systems, identifies the chain of command for response, identifies the types of potential emergencies with varying degrees of severity, and includes lists of local and state emergency contact information. The plan has specific procedures for notification of City staff, the police, customers, news media, and the general public in emergency situations.

8.7 SAFETY

An important consideration of any successful maintenance program is the safety of the employees. The City's Safety Program is in compliance with Oregon State requirements. The Safety Program addresses the situations that employees may encounter during the performance of operation and maintenance tasks. The City's Safety Program consists of monthly in-house staff training sessions. The Safety Program provides information regarding the general safety program policies and responsibilities such as basic safety policies and goals, program responsibilities, reporting responsibilities, training and orientation, emergency medical procedures, and general safety rules. The City also has supplemental safety programs. These include:

1. Respiratory Protection Program;
2. Emergency Procedures;
3. Fall Protection Plan;
4. Hazard Communication Program;
5. First Aid Training, Kits, and Posters;
6. Safe Lifting Procedures;
7. Personal Protective Equipment;
8. Hearing Conservation Program;
9. Confined Space Plan and rescue team ;
10. Trenching and Shoring;
11. Lock Out and Tag Out;
12. MSDS;
13. Monthly Equipment Safety Meetings.

8.8 CROSS-CONNECTION CONTROL PROGRAM

The City's Cross-Connection Control Program, updated in 2008, is included in Appendix H. The City's Municipal Code Section AMC 14.05 addresses cross connections and their prevention. The ordinance and corresponding Municipal Code provide the City's water department the ability to protect the water supply from contamination by prohibiting cross connections, requiring backflow prevention devices, declaring prohibited cross connections to be unlawful, and adopting the City's Cross Connection and Backflow Prevention Manual as the standard. The Cross Connection and Backflow Prevention Manual provides procedures for the abatement of cross connections, the installation of backflow prevention devices, inspection of backflow prevention devices, and termination of water service if a backflow hazard is not addressed in a reasonable amount of time.

The City's Cross Connection Control Program falls under the responsibility of Water Distribution System Staff. The City has a part-time Cross Connection Control Inspector, as well as two additional operators who are certified as Cross Connection Control Inspectors.

8.9 SUPPLIES AND EQUIPMENT

The City maintains an extensive inventory of equipment and supplies necessary to support day-to-day operations. This includes items such as pipe, fittings, and repair clamps for each size and material of distribution main in order to restore service as soon as possible should a break or failure occur. Inventories of various chemicals necessary for the treatment, disinfection, testing, and flushing of water are also maintained. Materials are generally stored in the City's warehouse located at 90 N Mountain Ave. Treatment chemicals are stored in tanks at the City's water treatment plant.

8.10 RECORD KEEPING AND REPORTING

The City maintains records on all aspects of the water system. Because of the increasing volume and need to readily access these records, the City would prefer to maintain them in an electronic version, allowing originals to be archived in a secure location. Unfortunately, a large number of files only exist as original paper copies. Additionally, older records tend to be of lower quality, incomplete, and in rare instances missing. As a result, the City goes to great lengths to ensure that new records are complete, detailed, and stored in multiple formats, increasing the survivability and reproduction quality. Table 8.11 summarizes the types of records, length of time, and format for which they are retained.

Table 8.11 Record Keeping

Record Type	Length of Retention	Retention Format/Location
Project Files	Permanently	Paper and/or Electronic
Construction Drawings	Permanently	Mylar and Electronic
System Maps	Permanently	CAD/GIS data base
Valve and Hydrant Records	Permanently	Paper and/or Electronic
Water Production	Permanently	Paper and Electronic Data Base
Water Sales	Permanently	Electronic Data Base

Table 8.11 Record Keeping

Record Type	Length of Retention	Retention Format/Location
Maintenance and Repair	Permanently	Paper and/or Electronic
Facility Equipment and Testing	Permanently	Paper and/or Electronic
Hydro-geological Reports	Permanently	Paper and/or Electronic
Agreements and System Acquisition	Permanently	Paper and/or Electronic
Water Sampling/Monitoring	5 years	• Paper • Electronic Data Base
Back-flow Assembly Testing	10 years	• Paper • Electronic Data Base
SCADA	Permanently	Electronic Data Base
Regulatory Reports/Correspondence	Permanently	Paper and/or Electronic
Customer Complaints	Permanently	Electronic Data Base

8.11 CUSTOMER SERVICE

The tracking of, and responding to customer inquiries is a shared responsibility between Water Distribution System Operations staff and Finance. Finance generally receives and responds to billing related inquiries, while Water Distribution System Operations staff respond to water quality, pressure, and various other customer inquiries. Customer contact information, location, time/date, and a description of the problem are logged in the work order database. Additional information such as field investigation and remedial action is also logged. Common inquiries/complaints typically relate to water pressures and aesthetics. Other less common inquiries/complaints relate to leaks and chlorine.

8.12 OPERATIONS AND MAINTENANCE RECOMMENDATIONS

The following sections summarize deficiencies identified in the City's operations and maintenance programs, along with recommendations for addressing the deficiencies. The following improvements are recommended to improve the City's maintenance programs. Recommendations are generally based on requirements and suggestions from the American Water Works Association (AWWA) Standards and Manuals, and other industry standards.

Staffing. Based on the above programs, the following changes to water system staffing are recommended:

- **WTP Operations**. Current staffing levels are sufficient assuming no significant increase in use of the TID supply at the WTP. If additional TID use is implemented on an ongoing basis rather than on an emergency basis, an additional full time operator with a Level II or greater certification (Level III preferred) would be required at that point in time. Alternatively, if a second WTP is implemented to provide a redundant water supply, one FTE of additional treatment staff would also be required, because a new WTP would be capable of being operated by one additional FTE, even if TID was the water source.

- **Water Distribution.** It is recommended that the open Water Utility Worker position, which is already budgeted, be filled to allow the City to meet its current maintenance needs and to restart its pipeline replacement program.
- **Administration and Engineering.** Current staffing levels are not sufficient to meet existing regulatory reporting requirements. An additional 0.5 FTE is required to meet current needs and implement the proposed CIP program.
- **Conservation.** Current staffing levels are sufficient to continue the existing conservation program. An additional 0.5 FTE are required to implement an enhanced conservation program.

These changes generally will only accommodate the current level of operations and maintenance activities, except as specifically noted.

Large Meter Calibration. It is recommended that large meters be inspected, maintained, and calibrated annually. It is recommended that the City develop a goal for maintaining a set proportion of the large meters each year. The goal should take into account the total number of large meters and staff availability.

Distribution System Flushing. It is recommended that the City implement a system-wide flushing program, per AWWA standards. The City would establish a goal of flushing a certain percentage of the distribution system each year, based on the total number of hydrants that need to be flushed and availability of crews for flushing operations.

Plan Updates. It is recommended that the City update its Emergency Response Plan, Safety Plan, and Cross Connection Control Plan.

CHAPTER NO. 9

FINANCIAL ANALYSIS

9.1 INTRODUCTION

The City of Ashland (City) is preparing its Water Conservation and Reuse Study and Comprehensive Water Master Plan. At the same time, the City is developing a funding strategy for the resulting capital improvements and operational needs. This funding analysis addresses the level of water rates needed to support these future infrastructure investments along with the operations and maintenance costs of the City's water utility. A twenty year planning model was developed for this project, however, the focus for the rate projections is for the years covering the period fiscal year (FY) 2012 through FY 2022, when the bulk of the capital improvements are to be constructed. A revised water system development charge (SDC) was also prepared which overlays these capital needs and their allocations to growth onto the City's existing SDC methodology.

The two-year process for developing both the Master Plan and the funding strategy supporting these capital and operational needs involved close coordination and review by City staff and the Ashland Water Advisory Committee (AWAC). A number of Master Plan options were developed and four of these strategies were specifically evaluated in terms of potential rate impacts. These strategies included: 1) the TAP supply option, 2) a bridging strategy, 3) new water treatment plant (debt finance as you go), and 4) new water treatment plant (debt finance advance funding). This Chapter summarizes the results of the rate analysis for the final selected option, discussed below.

Also, while the scope of the financial analysis did not include a cost of service analysis, the City requested a review of the revenue volatility being experienced by the utility due to reduced water sales during the summer irrigation months. Based on direction from the City, adjustments to the base portion of the City's water rate were prepared to mitigate this under-recovery of revenue.

The following sections summarize the revenue stability evaluation, the rate structure evaluation for funding the Capital Improvements Plan (CIP), and the SDC update.

9.2 REVENUE STABILITY

The City currently has an increasing block rate structure that is designed to give customers a price incentive to conserve water. Under the City's current system of water rates, separate schedules have been developed for the residential and non-residential customer classes. The adopted fiscal 2011 rate schedule (*Resolution 2011-08 Exhibit A Water Rate Schedule 10% Increase Effective May 1, 2011*) for residential customers is shown in Table 9.1.

Table 9.1 Adopted Fiscal 2011 Residential Rate Schedule	
Current Rates – Resolution No. 2011-08	
Monthly base charge	$14.84
Usage charge:	
Zero to 300 cubic feet (cf) per month	$1.69
301 to 1,000 cf per month	$2.09
1001 to 2,500 cf per month	$2.78
Over 2,500 cf per month	$3.60

Under this rate structure, the City has experienced an under recovery of water revenue. In FY 2011 the shortfall was an estimated to be $466,129, while in the FY 2012 the under recovery was $159,000. These shortfalls result from a pattern of wetter spring and early summer weather with a corresponding reduction in water use for irrigation. In order to mitigate the revenue effects of wetter weather, City staff recommended that water base rates be increased by ten percent (10%) on May 1, 2012. If this rate recommendation is approved, the resulting residential base rate will increase to $16.32 per month, a net monthly increase of $1.48. This increase is proposed before considering rate increases due to the planned capital projects. The updated residential rate schedule is shown in Table 9.2.

Table 9.2 Proposed Fiscal 2012 Residential Rate Schedule with Base Increase of 10%	
Current Rates – Resolution No. 2011-08	
Monthly base charge	$16.32
Usage charge:	
Zero to 300 cf per month	$1.69
301 to 1,000 cf per month	$2.09
1001 to 2,500 cf per month	$2.78
Over 2,500 cf per month	$3.60

As the two tables show, the City charges a uniform monthly base fee per customer, which increases according to meter size. However, the monthly usage fee varies by the amount of water sold. Under the City's current rates, a residential customer that consumes 10 hundred cubic feet (cf) of water in a month (10 cf = 7,480 gallons) will be billed $34.54. Under the proposed base rate increase, the bill would be $36.02. The process of bill calculation over a range of water consumption (i.e., 100 cubic feet up to 3,000 cubic feet) is shown below in Table 9.3.

Table 9.3 Monthly Residential Water Bill Calculations

Monthly Water Bills Over a Range of Consumption												
	Under Existing Rates (Resolution No. 2011-08)						Under Proposed 10% Base Rate Increase					
Units (ccf)	Base Rate	zero to 300 cf	301 to 1000 cf	1001 to 2500 cf	over 2500 cf	Monthly Bill	Base Rate	zero to 300 cf	301 to 1000 cf	1001 to 2500 cf	over 2500 cf	Monthly Bill
1	$ 14.84	$1.69				$ 16.53	$ 16.32	$1.69				$ 18.01
2	$ 14.84	$3.38				$ 18.22	$ 16.32	$3.38				$ 19.70
3	$ 14.84	$5.07				$ 19.91	$ 16.32	$5.07				$ 21.39
4	$ 14.84	$5.07	$2.09			$ 22.00	$ 16.32	$5.07	$2.09			$ 23.48
5	$ 14.84	$5.07	$4.18			$ 24.09	$ 16.32	$5.07	$4.18			$ 25.57
6	$ 14.84	$5.07	$6.27			$ 26.18	$ 16.32	$5.07	$6.27			$ 27.66
7	$ 14.84	$5.07	$8.36			$ 28.27	$ 16.32	$5.07	$8.36			$ 29.75
8	$ 14.84	$5.07	$10.45			$ 30.36	$ 16.32	$5.07	$10.45			$ 31.84
9	$ 14.84	$5.07	$12.54			$ 32.45	$ 16.32	$5.07	$12.54			$ 33.93
10	$ 14.84	$5.07	$14.63			$ 34.54	$ 16.32	$5.07	$14.63			$ 36.02
11	$ 14.84	$5.07	$14.63	$2.78		$ 37.32	$ 16.32	$5.07	$14.63	$2.78		$ 38.80
12	$ 14.84	$5.07	$14.63	$5.56		$ 40.10	$ 16.32	$5.07	$14.63	$5.56		$ 41.58
13	$ 14.84	$5.07	$14.63	$8.34		$ 42.88	$ 16.32	$5.07	$14.63	$8.34		$ 44.36
14	$ 14.84	$5.07	$14.63	$11.12		$ 45.66	$ 16.32	$5.07	$14.63	$11.12		$ 47.14
15	$ 14.84	$5.07	$14.63	$13.90		$ 48.44	$ 16.32	$5.07	$14.63	$13.90		$ 49.92
16	$ 14.84	$5.07	$14.63	$16.68		$ 51.22	$ 16.32	$5.07	$14.63	$16.68		$ 52.70
17	$ 14.84	$5.07	$14.63	$19.46		$ 54.00	$ 16.32	$5.07	$14.63	$19.46		$ 55.48
18	$ 14.84	$5.07	$14.63	$22.24		$ 56.78	$ 16.32	$5.07	$14.63	$22.24		$ 58.26
19	$ 14.84	$5.07	$14.63	$25.02		$ 59.56	$ 16.32	$5.07	$14.63	$25.02		$ 61.04
20	$ 14.84	$5.07	$14.63	$27.80		$ 62.34	$ 16.32	$5.07	$14.63	$27.80		$ 63.82
21	$ 14.84	$5.07	$14.63	$30.58		$ 65.12	$ 16.32	$5.07	$14.63	$30.58		$ 66.60
22	$ 14.84	$5.07	$14.63	$33.36		$ 67.90	$ 16.32	$5.07	$14.63	$33.36		$ 69.38
23	$ 14.84	$5.07	$14.63	$36.14		$ 70.68	$ 16.32	$5.07	$14.63	$36.14		$ 72.16
24	$ 14.84	$5.07	$14.63	$38.92		$ 73.46	$ 16.32	$5.07	$14.63	$38.92		$ 74.94
25	$ 14.84	$5.07	$14.63	$41.70		$ 76.24	$ 16.32	$5.07	$14.63	$41.70		$ 77.72
26	$ 14.84	$5.07	$14.63	$41.70	$3.60	$ 79.84	$ 16.32	$5.07	$14.63	$41.70	$3.60	$ 81.32
27	$ 14.84	$5.07	$14.63	$41.70	$7.20	$ 83.44	$ 16.32	$5.07	$14.63	$41.70	$7.20	$ 84.92
28	$ 14.84	$5.07	$14.63	$41.70	$10.80	$ 87.04	$ 16.32	$5.07	$14.63	$41.70	$10.80	$ 88.52
29	$ 14.84	$5.07	$14.63	$41.70	$14.40	$ 90.64	$ 16.32	$5.07	$14.63	$41.70	$14.40	$ 92.12
30	$ 14.84	$5.07	$14.63	$41.70	$18.00	$ 94.24	$ 16.32	$5.07	$14.63	$41.70	$18.00	$ 95.72

9.3 CAPITAL IMPROVEMENTS PLAN FUNDING

9.3.1 Development of Revenue Requirements

This analytical task determines the amount of revenue needed from water rates. This is driven by water utility cash flow or income requirements, constraints of bond covenants, and specific fiscal policies related to the utility. Based on three years of actual financial records (i.e., FY 2008 through FY 2010), and two years of estimated financial performance (i.e., FY 2011 and FY 2012), multiple Master Plan CIP funding strategies were modeled and presented to the City and the AWAC. Over the course of two years, the number of CIP funding strategies was narrowed to arrive at a “preferred” AWAC recommendation for City Council consideration. The AWAC’s priority was to develop a Master Plan resulting in redundant water supply and treatment along with locating and constructing a new treatment facility that is outside the flood zone of Ashland Creek. The projects that were included in the Committee’s preferred Master Plan option are:

- Build a second water treatment plant to treat raw water and meet the community needs for water during summer months and emergencies. Cost: $12 million.
- Build a water storage tank and pump station for water access for firefighting purposes. Cost: $8.7 million.
- Enclose the water flowing in the Talent Irrigation Ditch (TID) with pipes to prevent water evaporation and contaminated water flowing into Ashland Creek. Cost: $1.1 million.

- Build the Talent/Ashland/Phoenix (TAP) distribution line for access to potable water during emergencies. Cost: $2.1 million.
- Replace aging water pipes and other general projects. Cost: $6.7 million.

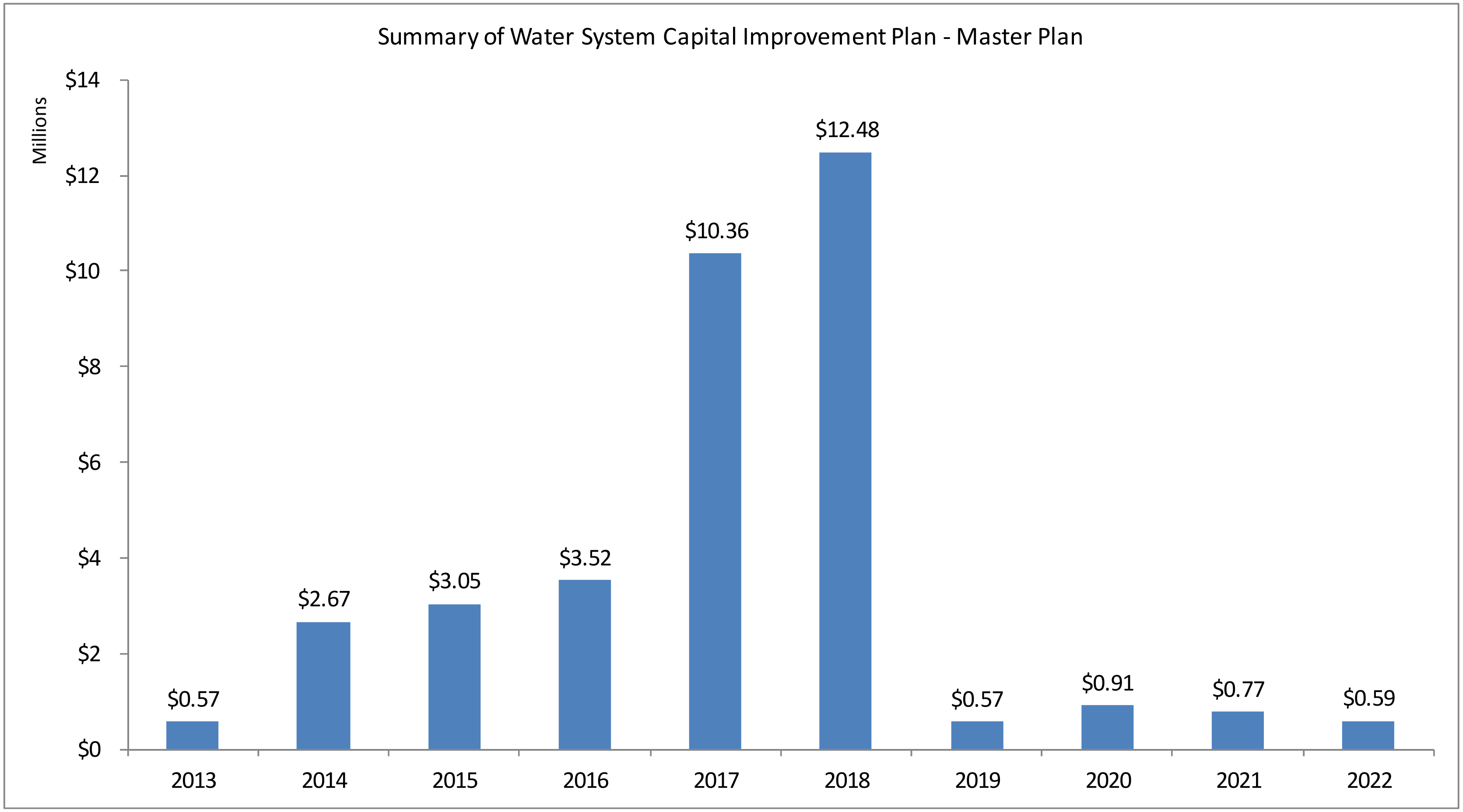
The annual cost (inflated) of capital projects is shown in Figure 9.1.

The total cost of the recommended improvements is $30.6 million ($35.5 million inflated to the time of construction) and will be paid through water rate and system development charge (SDC) revenues. Construction costs will be financed through revenue bonds. The AWAC is recommending the City raise rates immediately (i.e., FY 2012), in advance of building the first project, to develop a cash reserve and reduce the need for large rate increases or spikes particularly at the peak of construction in FY 2017 and FY 2018. While rates will need to be increased in each year of the 10 year construction program at an overall average annual rate of about 6.2 percent, this advance funding approach will allow for some smoothing of these annual increases. The key planning assumptions that were used to model the AWAC preferred water Master Plan alternative are itemized below:

- For the current budget year (FY 2012), it is forecast that the water utility will generate sufficient revenues from rates and charges to meet its obligations and produce an unappropriated ending fund balance in the Water Fund (the operating fund) of $496,909. It is estimated the beginning balance for the operating fund for the current fiscal year is $1,032,656.
- For the forecast of revenue requirements, specific planning assumptions were made based on discussions with City staff. Table 9.4 contains these key planning assumptions:

Table 9.4 Planning Assumptions

Key Planning Assumptions	Planning Value
CIP cost through 2022 – uninflated	$30.580 million
CIP cost through 2022 – inflated	$35.481 million
Labor cost inflation (salaries & benefits)	6.0% per year
Assume City adds 1 FTE in FY13, and 1 FTE in FY18	1 FTE = $80,0000
Other operations & maintenance costs inflation	3.0% per year
Coverage factor on long term debt	1.25
Interest rate on future borrowing (level debt service)	5.00%
Assume debt service reserves funded from borrowings	1 year of debt service
Future annual SDC revenues	$100k per year
Interest earnings rate on fund balances	1.0% per year
Assume Forest Service continues to partially support Forest Interface Division; with remainder paid by the Water Utility	$125k per year



ANNUAL COST (INFLATED) OF CAPITAL PROJECTS

FIGURE 9.1

CITY OF ASHLAND
WATER SYSTEM MASTER PLAN

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Inflation rates for the materials and services and capital outlay line items are also set at 3.0 percent per year. The cumulative effect of these assumptions significantly impacts the resulting growth in future water system revenue requirements. In order to mitigate rate spikes, the project team developed a model scenario herein called "advance funding" that distributes the rate increases. As discussed above, the advance funding strategy is to increase rates in advance of incurring significant debt service costs. This cash would be transferred to a rate stabilization account/fund, where it will be used in the out years of the forecast to support the payment of future debt service on the Master Plan projects. In this scenario, water system revenue requirements are forecast to increase by approximately 10 percent per year for FY'13 through 16. These actions result in building up a cash reserve of approximately $4.5 million by the end of FY'16. Starting in FY'17, the model begins to apply this cash to pay for some of the debt service incurred to fund the larger capital projects in the CIP. This process continues through FY'22. With the support of this rate stabilization cash, the resulting average annual rate increase for FY '17 through 22 is approximately 4 percent per year. The growth and decline in the amount of money held in the rate stabilization account/fund is shown in Figure 9.2.

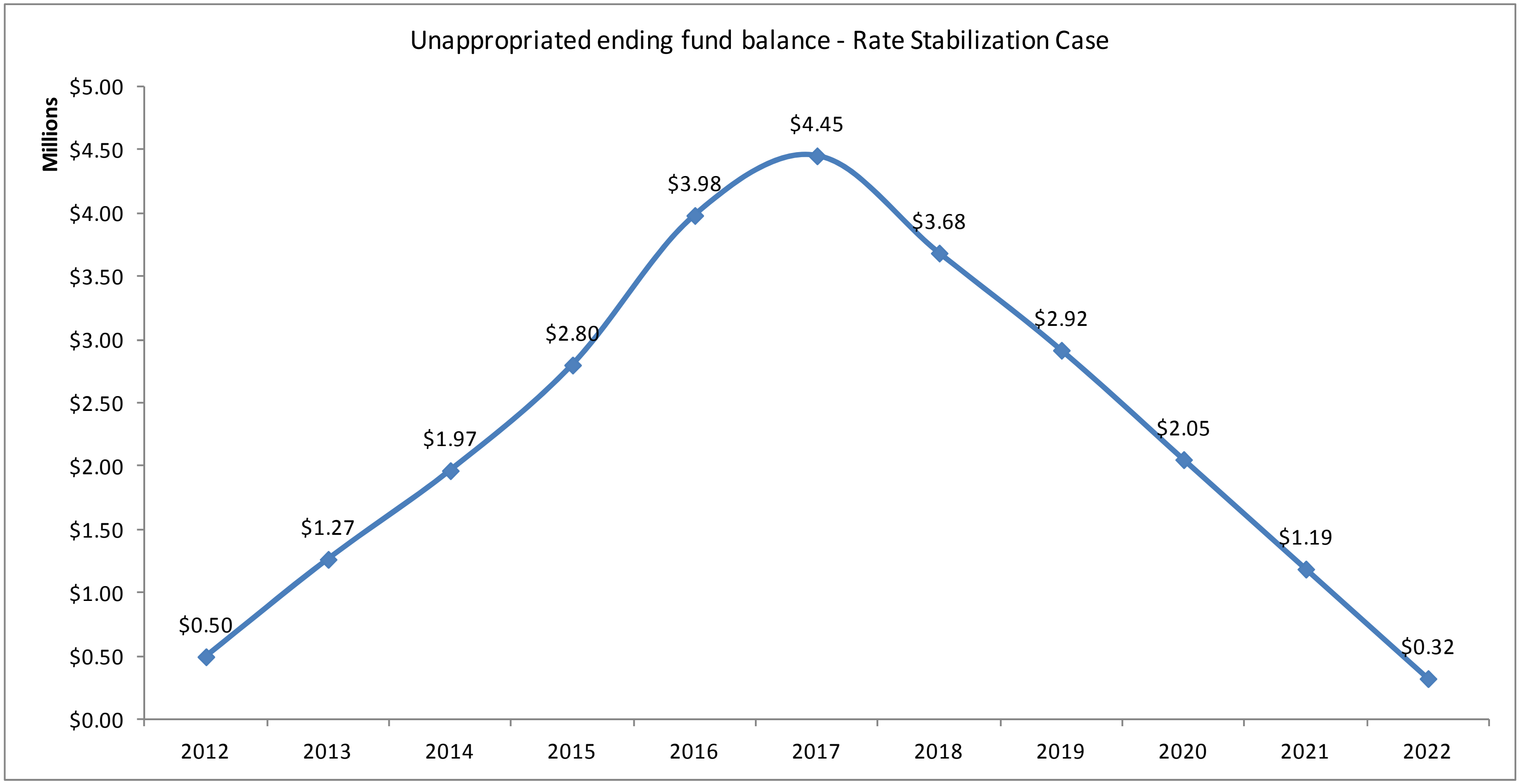
- The following assumptions were included in the analysis: Population growth is taken from the Master Plan at 0.6650 percent per year with a 2009 service area population of 21,505. By 2030, the service area population is forecast to be 24,716.
- Capital Improvement Plan Funding - As stated above, the total cost of the recommended improvements is $30.6 million ($35.5 million inflated to the time of construction) and will be paid through water rate and system development charge (SDC) revenues. Construction costs will be financed through revenue bonds. For the AWAC preferred alternative, modeling assumes the City will issue revenue bonds in each fiscal year 2014 through 2018, and in 2020. The total amount of revenue bonds issued to fund the ten year Master Plan CIP is $34,055,642. The sources and uses of these future borrowings are:

  Total amount borrowed via revenue bonds for fiscal 2013 through 2022 .... $34,055,642

Uses:

Revenue bond issuance costs (legal, underwriting, etc.)	$340,556
Reserve account funding	2,732,713
Revenue bond proceeds available for Master Plan projects	30,982,373
Total uses of revenue bond proceeds	$34,055,642

Of this total amount, $23,899,724 will be borrowed during the 2-year peak construction period of fiscal years 2017 and 2018.



RATE STABILIZATION ACCOUNT/FUND PROJECTED CASH BALANCE

FIGURE 9.2

CITY OF ASHLAND
WATER SYSTEM MASTER PLAN

9.3.2 Revenue Requirements Forecast & Results

All of the above cost elements are contained in the revenue requirements model and provide the foundation for the base case forecast. The base case assumes that the utility will fund the AWAC preferred option as currently phased, in addition to implementing the advance funding approach discussed above. The resulting ten-year forecast of water system revenue requirements is shown in Table 9.5. Based on these revenue requirements, the rate impact of the AWAC preferred alternative on a typical residential customer over the 10-year forecast is shown in Figure 9.3.

9.3.3 Modeling of Water System Revenue Requirements

Revenue requirements reflect the total cost of providing services to utility customers over a specific period of time. These costs include operation and maintenance along with capital costs. Revenue requirements are projected from budgeted expenses, and adjusted based on historical cost trends and the experience of utility staff. Examples of operations costs are chemicals and electricity used at water booster pump stations and water treatment plant(s), skilled labor, and administrative expenses.

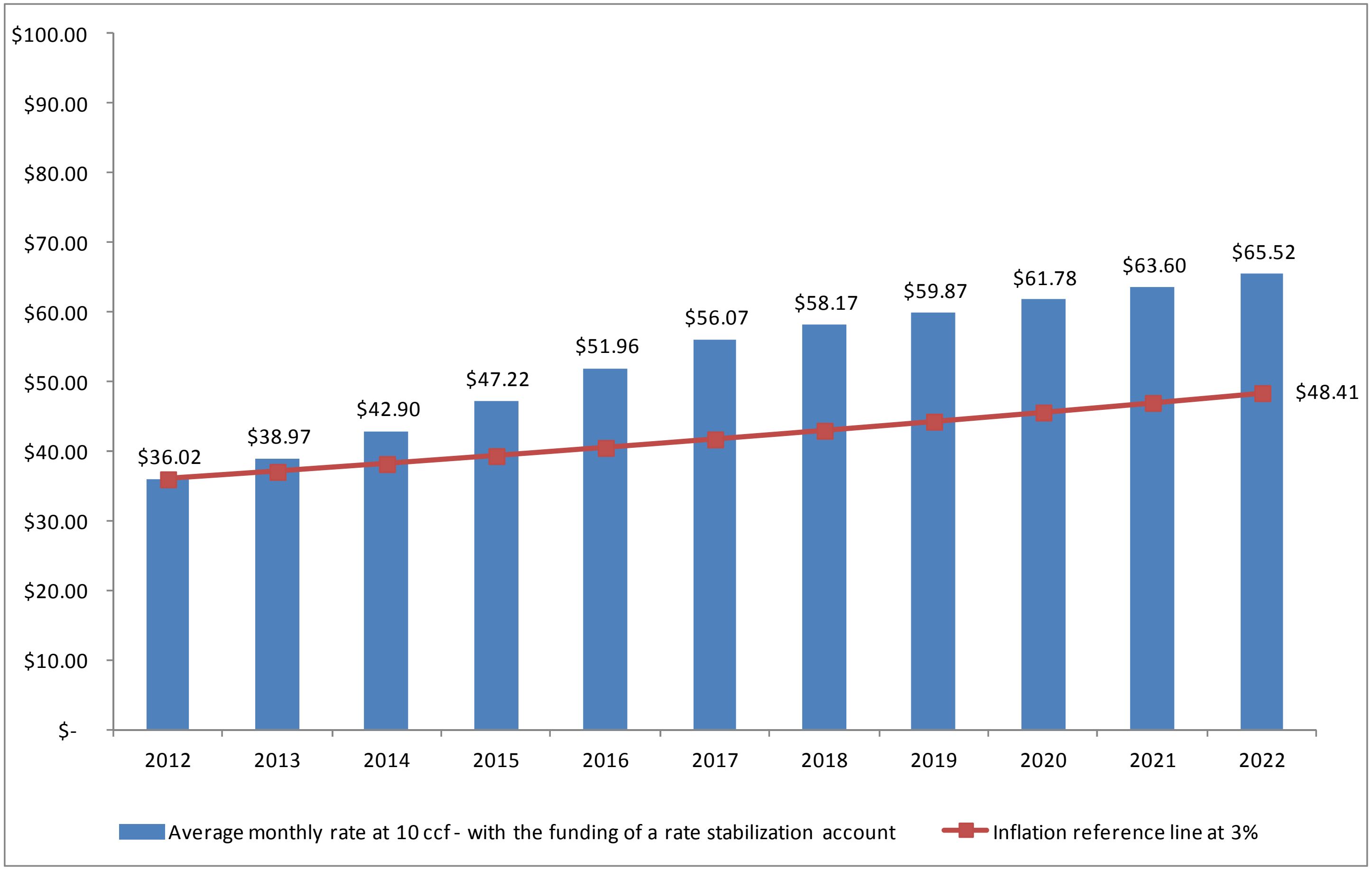
Capital costs, as defined for the purposes of this Master Plan, are the resources used to acquire or construct capital assets. These include current revenue funded improvements, planned annual contributions to funds for such purposes, and ongoing debt service requirements (principal and interest payments on outstanding revenue bonds, loans and other obligations). Capital assets are defined as major assets that benefit more than a single fiscal period. Typical examples are land, improvements to land, easements, buildings, building improvements, vehicles, machinery, equipment, and other infrastructure. Capital costs are projected for the forecast period based on the “preferred” AWAC new treatment plant option, the City’s bond covenants and utility staff experience.

For the current budget year (FY’ 12, it is forecast that the water utility will generate sufficient revenues from rates, charges and SDCs to meet its obligations and produce an unappropriated ending fund balance in the Water Fund (the operating fund) of $496,909. It is estimated the beginning fund balance for the operating fund in this fiscal year was $1.033 million. On May 1, 2011, the City implemented a general rate increase of 10 percent to recover additional revenues due to lower than planned water sales.

The first component of the revenue requirements model is the planning assumptions module. Based on guidance from City staff, the following Summary of Planning Assumptions table (Table 9.6) shows differential inflation factors, revenue growth drivers, and customer profiles that were used for the forecast of operating costs and non-rate revenue line items.

Table 9.5 Base Case Forecast of Water System Revenue Requirements

Line Item Description	Budget 2012	Forecast 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Projection of Cash Flow:											
Revenues:											
Charges for services	4,752,900	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226
Intergovernmental	1,669,965	196,024	211,627	228,055	245,357	263,580	282,776	303,001	324,312	346,770	370,441
Investment income	13,200	13,255	13,152	19,933	28,044	40,305	44,972	37,247	30,368	22,187	13,263
Miscellaneous	31,200	35,179	36,234	37,321	38,441	39,594	40,782	42,005	43,265	44,563	45,900
Taxes	-	104	107	110	114	117	121	124	128	132	136
Interfund loan	-	-	-	-	-	-	-	-	-	-	-
Reimburse operations costs - bond issue	-	-	-	-	-	-	-	-	-	-	-
Total revenues	6,467,265	4,997,462	5,403,098	5,945,215	6,541,403	7,199,661	7,766,388	8,057,391	8,297,205	8,564,152	8,820,966
Expenditures:											
Personal services	1,646,896	1,825,710	1,935,252	2,051,367	2,174,450	2,304,917	2,523,211	2,674,604	2,835,080	3,005,185	3,185,496
Materials and services	3,847,596	2,379,653	2,451,043	2,524,574	2,600,311	2,678,320	2,758,670	2,841,430	2,926,673	3,014,473	3,104,907
Capital outlay	522,000	-	-	-	-	-	-	-	-	-	-
Debt service:											
Existing	783,520	599,742	598,544	600,577	215,362	215,203	214,804	217,759	216,743	215,463	213,893
Future	-	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713
(Use)/Replacement of Operating Fund balance	(332,747)	531,500	592,500	658,500	1,228,000	500,000	(800,000)	(800,000)	(800,000)	(800,000)	(800,000)
Subtotal expenditures	6,467,265	5,336,605	5,812,490	6,338,783	7,014,969	7,369,714	7,411,307	7,648,415	7,911,209	8,167,834	8,437,010
Net Cash	-	(339,143)	(409,392)	(393,568)	(473,566)	(170,053)	355,081	408,976	385,996	396,318	383,956
Net Deficiency/(Surplus)	-	339,143	409,392	393,568	473,566	170,053	(355,081)	(408,976)	(385,996)	(396,318)	(383,956)
Test of Coverage Requirement:											
Operating Revenues:											
Charges for services	4,752,900	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226
Intergovernmental	1,669,965	196,024	211,627	228,055	245,357	263,580	282,776	303,001	324,312	346,770	370,441
System Development Charges	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Transfers (To) From Rate Stabilization Account	-	(531,500)	(592,500)	(658,500)	(1,228,000)	(500,000)	800,000	800,000	800,000	800,000	800,000
Total Operating Revenues	6,522,865	4,517,424	4,861,105	5,329,350	5,346,805	6,719,646	8,580,514	8,878,015	9,123,444	9,397,270	9,661,667
Operating Expenses:											
Personal services	1,646,896	1,825,710	1,935,252	2,051,367	2,174,450	2,304,917	2,523,211	2,674,604	2,835,080	3,005,185	3,185,496
Materials and services	3,847,596	2,379,653	2,451,043	2,524,574	2,600,311	2,678,320	2,758,670	2,841,430	2,926,673	3,014,473	3,104,907
Total Operating Expenses	5,494,492	4,205,363	4,386,295	4,575,941	4,774,761	4,983,237	5,281,881	5,516,034	5,761,753	6,019,658	6,290,404
Net Operating Income	1,028,373	312,062	474,810	753,408	572,044	1,736,409	3,298,633	3,361,980	3,361,691	3,377,612	3,371,263
Nonoperating Income (Expense):											
Interest Income:											
Water fund - Operating	13,200	13,255	13,152	19,933	28,044	40,305	44,972	37,247	30,368	22,187	13,263
Other Nonoperating Income (expense)											
Miscellaneous	31,200	35,179	36,234	37,321	38,441	39,594	40,782	42,005	43,265	44,563	45,900
Taxes	-	104	107	110	114	117	121	124	128	132	136
Reimburse operations costs - bond issue	-	-	-	-	-	-	-	-	-	-	-
Total Nonoperating Income	44,400	48,537	49,493	57,365	66,598	80,016	85,874	79,377	73,761	66,882	59,299
Total Net Revenues Available for Debt Service	1,072,773	360,599	524,303	810,773	638,643	1,816,425	3,384,507	3,441,357	3,435,452	3,444,493	3,430,562
Debt Service:											
Existing	783,520	599,742	598,544	600,577	215,362	215,203	214,804	217,759	216,743	215,463	213,893
New revenue bonds	-	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713
Total Senior Lien Parity Obligations	783,520	599,742	833,695	1,104,341	1,012,209	1,886,477	2,929,426	2,932,380	2,949,456	2,948,176	2,946,606
Senior Lien Parity Obligations Coverage Recognized	1.37	0.60	0.63	0.73	0.63	0.96	1.16	1.17	1.16	1.17	1.16
Senior Lien Parity Obligations Coverage Required	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Senior Lien Coverage Deficiency	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Net Deficiency/(Surplus)	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Projection of Revenue Sufficiency:											
Maximum Deficiency	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Percent Increase Required Over Current Rate Revenues	**0.00%**	**8.19%**	**10.07%**	**10.06%**	**10.06%**	**7.90%**	**3.75%**	**2.92%**	**3.18%**	**2.95%**	**3.01%**
Stormwater rates reconciliation:											
Revenues recognized from current rates	4,752,900	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226
Add revenues from rate increase	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Total revenues recognized from rate increase	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226	8,643,922



PROJECTED SINGLE FAMILY RESIDENTIAL WATER RATES
(ASSUMING 10 CCF OF WATER USE PER MONTH)

FIGURE 9.3
CITY OF ASHLAND
WATER SYSTEM MASTER PLAN

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Table 9.6 Summary of Planning Assumptions

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Inflation Forecast:													
Personal services:													
510 Salaries and wages			6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
520 Fringe benefits			6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Materials and Services:													
601 Supplies			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
602 Rental, repair, maintenance			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
603 Communications			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
604 Contractual services			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
605 Misc. charges and fees			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
606 Other purchased services			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
608 Commissions			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
610 Programs			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
612 Franchises			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Capital Outlay:													
701 Land			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
703 Equipment			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
704 Improvements other than buildings			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Revenue Growth Forecast:													
Intergovernmental			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Investment income			1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Miscellaneous			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Growth Customer Base			0.67%	0.67%	0.67%	0.67%	0.67%	0.67%	0.67%	0.67%	0.67%	0.67%	0.67%
Taxes			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Water meters in service:													
Commercial	634	≈	634	638	642	646	651	655	659	664	668	673	677
Gov't & Municipal	113	≈	113	114	115	115	116	117	118	118	119	120	121
Multi Family	581	≈	581	584	588	592	596	600	604	608	612	616	620
Residential	6,960	≈	6,960	7,007	7,053	7,100	7,147	7,195	7,243	7,291	7,339	7,388	7,437
Irrigation	348	≈	348	351	353	355	358	360	362	365	367	370	372
	8,636	≈	8,636	8,693	8,751	8,809	8,868	8,927	8,986	9,046	9,106	9,167	9,228

9.3.3.1 Capital Improvement Plan (CIP)

Over the course of six months, numerous Master Plan CIP configurations were developed, studied, and modeled. These CIP funding strategies were narrowed down to arrive at a "preferred" AWAC recommendation for City Council consideration. The starting point for the funding strategy for that plan focused on the future cash flow requirements of the AWAC preferred alternative. The total cost of the recommended improvements is $30.6 million ($35.5 million inflated to the time of construction).The Capital Improvement Plan Cash Flow table (Table 9.7) lays out the future capital plan cash flow requirements. The most challenging funding aspect of the AWAC preferred alternative CIP is the "unevenness" of the future capital requirements. Out of the total 10-year future cost of $35.5 million, $22.8 million of that total is projected to be spent in the two forecast years FY 2017 and 2018. This unevenness is shown in the graph that accompanies the Capital Improvement Plan Cash Flow table (Figure 9.4).

9.3.3.2 Capital Improvement Plan Funding Strategy

After the AWAC preferred CIP was put into the revenue requirements model, phased, and adjusted for inflation (by year), the next analytical step was to develop a funding strategy for the plan. Due to the magnitude of the overall future costs of the plan, and the severe cash flow spikes in FY 2017 and 2018, it became clear to City staff and the AWAC that cash financing of the plan was not feasible. The modeling of the AWAC preferred alternative assumes construction costs will be financed through the proceeds of newly issued serial revenue bonds. For the AWAC preferred alternative, modeling indicates the City will issue revenue bonds in FY 2014-2018, and in 2020. The total amount of new revenue bonds issued to fund the ten year Master Plan CIP is $34,055,642. Out of this total, $23,899,724 will be borrowed during the peak construction time of FY 2017-18. The total CIP borrowing pattern is shown below in the Capital Improvement Plan Funding Module (Table 9.8). This module sizes future debt issuances to account for debt issuance costs (i.e., legal, underwriting, trustee fees, and accounting), and for funding of the mandatory debt service reserve account. By the end of the ten-year construction period, the City will have "upsized" cumulative borrowings by $2,732,713 in order to fully fund the debt service reserve account. The debt service that will result from the issuance of these revenue bonds will be paid through water rate and SDC revenues.

The Capital Improvement Plan Funding Module also has the ability to apply free water system cash flow to the CIP funding plan. In all forecast years, every attempt is made to use surplus cash to fund capital improvements before resorting to debt financing. A key component of the funding plan for the AWAC preferred alternative is the "advance funding" strategy. In order to mitigate rate spikes, this strategy increases rates in advance of incurring significant debt service costs. The surplus recognized in early years is transferred to a rate stabilization account/fund, where it will be used in the out years of the forecast to support the payment of future debt service on the water Master Plan projects. This strategy does not generate enough cash to mitigate borrowings, but it does allow for smoothing of future rate increases. Over the ten-year forecast, $4,659,211 in internally generated free cash flow is used to reduce future borrowings. The balance of the surplus cash generated from the advance funding strategy is reserved to buy down rate spikes in the back end of the ten-year forecast.

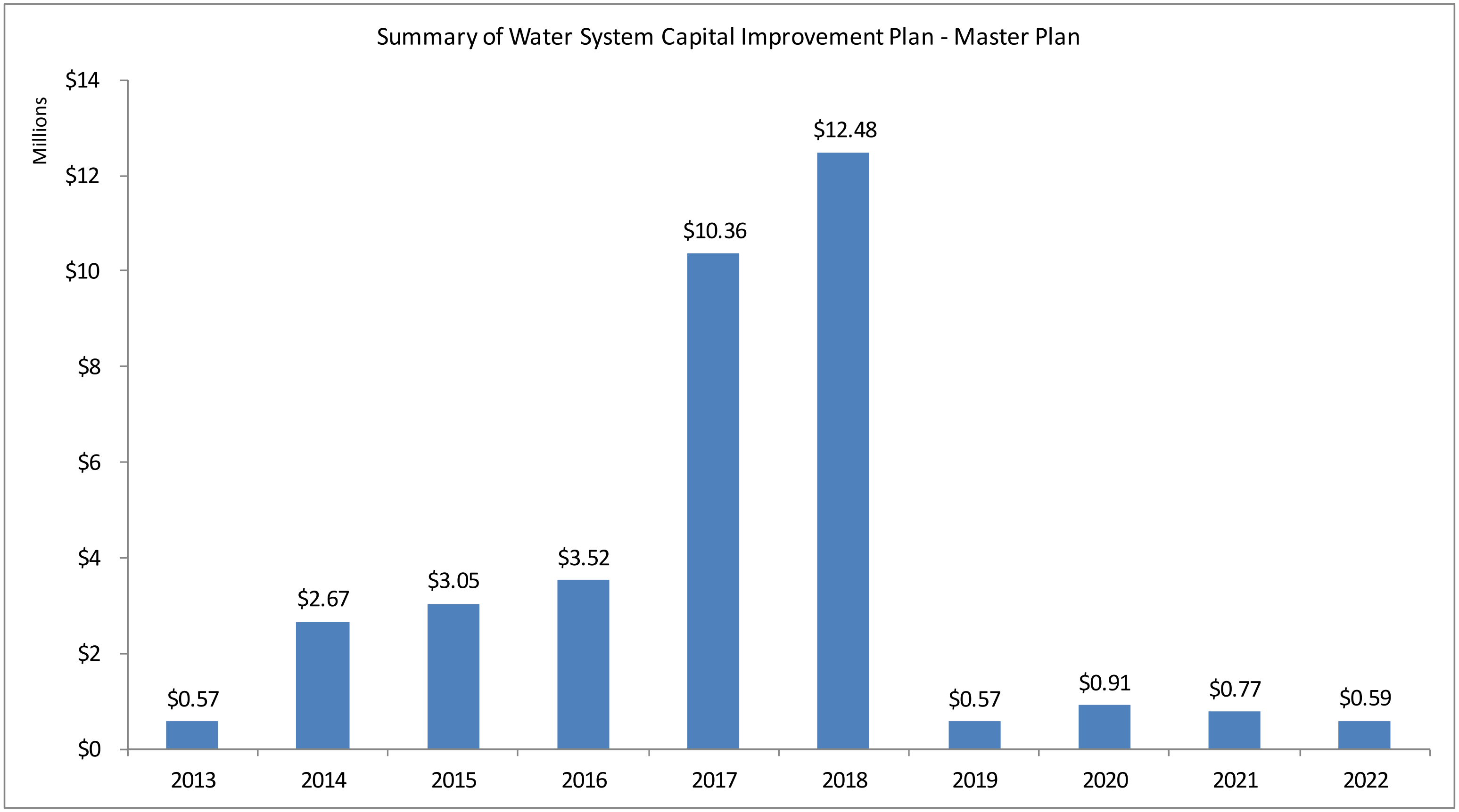
Table 9.7 Capital Improvement Plan Cash Flow

Fiscal Years

MP Rank	Cost in FY 2012	Year	Project	FUTURE COST OF PROJECTS									
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
				-	-	-	-	-	-	-	-	-	-
	552,000	2013	Master Plan CIP November 29, 2011	568,560	-	-	-	-	-	-	-	-	-
	2,513,000	2014	Master Plan CIP November 29, 2011	-	2,666,042	-	-	-	-	-	-	-	-
	2,787,000	2015	Master Plan CIP November 29, 2011	-	-	3,045,430	-	-	-	-	-	-	-
	3,130,000	2016	Master Plan CIP November 29, 2011	-	-	-	3,522,843	-	-	-	-	-	-
	8,940,000	2017	Master Plan CIP November 29, 2011	-	-	-	-	10,363,910	-	-	-	-	-
	10,451,000	2018	Master Plan CIP November 29, 2011	-	-	-	-	-	12,479,041	-	-	-	-
	459,500	2019	Master Plan CIP November 29, 2011	-	-	-	-	-	-	565,127	-	-	-
	714,500	2020	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	905,107	-	-
	593,500	2021	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	774,383	-
	439,500	2022	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	590,651
	988,500	2023	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	2,188,500	2024	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	857,500	2025	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	1,142,500	2026	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	1,364,500	2027	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	1,190,500	2028	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	870,500	2029	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	1,101,500	2030	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	1,120,500	2031	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	2,601,500	2032	Master Plan CIP November 29, 2011	-	-	-	-	-	-	-	-	-	-
	$44,006,000		Net Construction Cost	$568,560	$2,666,042	$3,045,430	$3,522,843	$10,363,910	$12,479,041	$565,127	$905,107	$774,383	$590,651

Notes:

Cost Escalation Rate: 3.00%



CAPITAL IMPROVEMENT PLAN CASH FLOW

FIGURE 9.4

CITY OF ASHLAND
WATER SYSTEM MASTER PLAN

Table 9.8 Capital Improvement Plan Funding Module

Assumptions:	
Fund Earnings %	1.00%
Issuance Cost:	
Short-Term	0.00%
Long-Term:	
Revenue Bonds	1.00%
G.O. Bonds	0.00%

Interim Financing:	
BANs Used? (1=Y,0=N)	0
BAN Interest Rate:	5.00%
Long-Term Financing:	
Revenue Bonds:	
Life of Debt (Years)	20
Interest Rate	5.00%
Coverage Factor Required	1.25
Fund Reserve from Proceeds? (1=Y,0=N)	1
Administration Fee (on Outstanding Bal)	0.0%
General Obligation Bonds:	
Life of Debt (Years)	20
Interest Rate	5.00%
Fund Reserve from Proceeds? (1=Y,0=N)	0

Fiscal Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Type of Long Term Debt Issued (1=Y,0=N):										
Revenue Bonds	1	1	1	1	1	1	1	1	1	1
General Obligation Bonds	0	0	0	0	0	0	0	0	0	0

Capital Improvements Financing	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital Costs to be Funded	568,560	2,666,042	3,045,430	3,522,843	10,363,910	12,479,041	565,127	905,107	774,383	590,651
less: Use of Water Operating Fund Cash Balance	-									
less: System Development Charge Contributions										
less: Use of Water Rate Stabilization Account Cash Balance	568,560	-	-	200,000	450,000	650,000	700,000	700,000	800,000	590,651
less: Contributions From Utility Rates										
Amount to be Financed	-	2,666,042	3,045,430	3,322,843	9,913,910	11,829,041	-	205,107	-	-
Interim Borrowing:										
BANs Issued:	-	-	-	-	-	-	-	-	-	-
less: Borrowing Cost	-	-	-	-	-	-	-	-	-	-
less: Interest Payments	-	-	-	-	-	-	-	-	-	-
plus: Interest Earnings	-	-	-	-	-	-	-	-	-	-
Net Available from BANS	-	-	-	-	-	-	-	-	-	-
Long-term Borrowing:										
Revenue Bonds:										
Amount Borrowed	-	2,930,497	3,347,519	3,652,449	10,897,312	13,002,412	-	225,453	-	-
less: Financing Cost	-	29,305	33,475	36,524	108,973	130,024	-	2,255	-	-
less: Reserve Funding	-	235,151	268,614	293,082	874,428	1,043,347	-	18,091	-	-
less: Refunding of BANs	-	-	-	-	-	-	-	-	-	-
Net Funds from Revenue Bonds	-	2,666,042	3,045,430	3,322,843	9,913,910	11,829,041	-	205,107	-	-
General Obligation Bonds:										
Amount Borrowed	-	-	-	-	-	-	-	-	-	-
less: Financing Cost	-	-	-	-	-	-	-	-	-	-
less: Reserve Funding	-	-	-	-	-	-	-	-	-	-
less: Refunding of BANs	-	-	-	-	-	-	-	-	-	-
Net Funds from G.O. Bonds	-	-	-	-	-	-	-	-	-	-
New Annual Debt Service:										
Principal & Interest Repayment	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713
Administration Fee	-	-	-	-	-	-	-	-	-	-
Total Annual Debt Service	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713

9.3.3.3 Water Operating Fund Cash Flow Management

The City budgets and accounts for the water enterprise via the Water Fund. From a management perspective, this one fund consists of two entities: the operating fund component and the capital fund component. Each component is managed and tracked as if it stood alone, but for reporting and auditing purposes, these two component units are collapsed into one fund. For modeling of the AWAC preferred Master Plan alternative, the project team created forecast modules for both the operating and capital components.

Table 9.9 presents the ten year forecasted impact on the water operating fund component. As the title implies, the operating side of the water fund accounts for the costs to operate and maintain the water system. Rate revenues are deposited in this fund, and costs to pay staff and contractors are accounted for here. The preponderance of current and future debt service is also paid out of this fund. Table 9.9 also accounts for the surplus cash that is accumulated as a result of the advance funding rate strategy. As discussed above, the strategy is to increase rates in advance of incurring significant debt service costs. In this scenario, water system revenue requirements are forecasted to increase by approximately 10 percent per year for FY 13, 14, 15 and 16. These actions result in building up a cash reserve of ~$4.5 million by the end of FY'17. Starting in FY 17, the model begins to apply this cash to pay for debt service incurred to fund the larger capital projects in the CIP. This process continues through FY 22. With the support of this rate stabilization cash, the resulting average annual rate increase for FY 17 to 22 is approximately 4 percent per year. Table 9.9 shows transfers of free cash flow in support of construction. As discussed above, every attempt is made in the model forecast to minimize borrowings with the support of cash. In the AWAC preferred alternative, this cash in support of construction starts to flow in FY 2016, and continues every year through the balance of the ten-year plan.

9.3.3.4 Water Capital Fund Cash Flow

The Water Capital Fund component is managed separately from the operating component for the express purpose of accounting for and the management of construction costs and resources. The principal resources for this capital component are revenue bond proceeds, and system development charges. The model sizes future debt issuances in the capital improvement plan funding module and transfers the net proceeds to this fund (i.e., $30,982,372 in net proceeds over the ten year forecast). With respect to system development charge revenues, the AWAC preferred alternative assumes the City will recognize $100,000 per year in SDC receipts. The City will use this cash in support of current and future debt service. As discussed in the water operating fund analysis, the preponderance of the current and future debt service is paid out of the operating fund, and is a large component of the overall revenue requirement that will have to come from rates. The expenses that are funded from these capital resources are Master Plan construction costs and debt service to be funded from SDCs. Table 9.10 shows the ten year forecasted impact on the water capital fund component.

Table 9.9 Forecast of Water Fund (Operating) Cash Flow

	Budget 2012	Forecast 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sources of Funds:											
Beginning fund balance	$ 1,032,656	$ 690,909	$ 1,265,999	$ 1,966,431	$ 2,800,747	$ 3,981,763	$ 4,452,895	$ 3,684,809	$ 2,917,505	$ 2,053,676	$ 1,189,070
Transfers from other funds											
General fund	-	-	-	-	-	-	-	-	-	-	-
Water fund - Capital	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total transfers from other funds	-	-	-	-	-	-	-	-	-	-	-
Revenues:											
Charges for services	$ 4,752,900	$ 5,141,979	$ 5,659,794	$ 6,229,448	$ 6,856,066	$ 7,397,738	$ 7,675,014	$ 7,899,133	$ 8,150,500	$ 8,391,226	$ 8,643,922
Intergovernmental	1,669,965	196,024	211,627	228,055	245,357	263,580	282,776	303,001	324,312	346,770	370,441
Investment income	4,200	6,909	12,660	19,664	28,007	39,818	44,529	36,848	29,175	20,537	11,891
Miscellaneous	31,200	35,179	36,234	37,321	38,441	39,594	40,782	42,005	43,265	44,563	45,900
Taxes	-	104	107	110	114	117	121	124	128	132	136
Interfund loan	-	-	-	-	-	-	-	-	-	-	-
Reimburse operations costs - bond issue	-	-	-	-	-	-	-	-	-	-	-
Total revenues	6,458,265	5,380,195	5,920,422	6,514,599	7,167,985	7,740,847	8,043,221	8,281,111	8,547,380	8,803,228	9,072,289
Total Sources of Funds	$ 7,490,921	$ 6,071,104	$ 7,186,421	$ 8,481,030	$ 9,968,732	$ 11,722,609	$ 12,496,116	$ 11,965,920	$ 11,464,885	$ 10,856,904	$ 10,261,359
Uses of Funds:											
Expenditures:											
Personal services:											
Total personal services	1,646,896	1,825,710	1,935,252	2,051,367	2,174,450	2,304,917	2,523,211	2,674,604	2,835,080	3,005,185	3,185,496
Materials and Services:											
Total materials and services	3,847,596	2,379,653	2,451,043	2,524,574	2,600,311	2,678,320	2,758,670	2,841,430	2,926,673	3,014,473	3,104,907
Capital Outlay:											
Total capital outlay	522,000	-	-	-	-	-	-	-	-	-	-
Debt Service - Existing:											
Total debt service - existing	783,520	599,742	598,544	600,577	215,362	215,203	214,804	217,759	216,743	215,463	213,893
Debt Service - Future											
801 Debt service - principal	-	-	88,626	194,295	314,469	659,755	1,085,970	1,140,268	1,204,100	1,264,305	1,327,520
802 Debt service - interest	-	-	146,525	309,470	482,377	1,011,519	1,628,652	1,574,354	1,528,613	1,468,408	1,405,193
Total debt service	-	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713
Transfers to other funds:											
General fund	-	-	-	-	-	-	-	-	-	-	-
Water fund - Capital	-	-	-	-	200,000	400,000	600,000	600,000	700,000	700,000	700,000
Other	-	-	-	-	-	-	-	-	-	-	-
Total transfers to other funds	-	-	-	-	200,000	400,000	600,000	600,000	700,000	700,000	700,000
Total Water operating expenses	6,800,012	4,805,105	5,219,990	5,680,283	5,986,969	7,269,714	8,811,307	9,048,415	9,411,209	9,667,834	9,937,010
Contingency	194,000										
Unappropriated ending fund balance - with the fundi	496,909	1,265,999	1,966,431	2,800,747	3,981,763	4,452,895	3,684,809	2,917,505	2,053,676	1,189,070	324,349
Total Uses of Funds	$ 7,490,921	$ 6,071,104	$ 7,186,421	$ 8,481,030	$ 9,968,732	$ 11,722,609	$ 12,496,116	$ 11,965,920	$ 11,464,885	$ 10,856,904	$ 10,261,359

Table 9.10 Forecast of Water Fund (CAPITAL) Cash Flow

	Budget	Forecast									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sources of Funds:											
Beginning fund balance	$ 1,010,428	$ 634,568	$ 49,161	$ 26,903	$ 3,671	$ 48,710	$ 44,259	$ 39,911	$ 119,299	$ 164,984	$ 137,217
Transfers from other funds											
General fund	-	-	-	-	-	-	-	-	-	-	-
Water fund - Capital	-	-	-	-	200,000	400,000	600,000	600,000	700,000	700,000	700,000
Other	-	-	-	-	-	-	-	-	-	-	-
Total transfers from other funds	-	-	-	-	200,000	400,000	600,000	600,000	700,000	700,000	700,000
Revenues:											
Intergovernmental revenue	-	-	-	-	-	-	-	-	-	-	-
Reimbursement SDCs	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Improvement SDCs	-	-	-	-	-	-	-	-	-	-	-
Interest	9,000	6,346	492	269	37	487	443	399	1,193	1,650	1,372
Interfund loan	-	-	-	-	-	-	-	-	-	-	-
Bond proceeds	-	-	2,666,042	3,045,430	3,322,843	9,913,910	11,829,041	-	205,107	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total revenues	109,000	106,346	2,766,533	3,145,699	3,422,879	10,014,397	11,929,483	100,399	306,300	101,650	101,372
Total Sources of Funds	$ 1,119,428	$ 740,914	$ 2,815,694	$ 3,172,602	$ 3,626,550	$ 10,463,108	$ 12,573,742	$ 740,310	$ 1,125,600	$ 966,634	$ 938,589
Uses of Funds:											
Expenditures:											
Capital expenditures											
2010 water master plan projects	-	568,560	2,666,042	3,045,430	3,522,843	10,363,910	12,479,041	565,127	905,107	774,383	590,651
SDC projects:											
Capitalized materials & services	-										
Reimbursement fee projects	110,000	-									
Improvement fee projects	250,000	-	-	-	-	-	-	-	-	-	-
Total capital expenditures	360,000	568,560	2,666,042	3,045,430	3,522,843	10,363,910	12,479,041	565,127	905,107	774,383	590,651
Debt Service - Existing:											
SDC	124,860	123,193	122,750	123,501	54,997	54,938	54,791	55,884	55,508	55,034	54,454
Total debt service - existing	124,860	123,193	122,750	123,501	54,997	54,938	54,791	55,884	55,508	55,034	54,454
Debt Service - Future											
801 Debt service - principal	-	-	-	-	-	-	-	-	-	-	-
802 Debt service - interest	-	-	-	-	-	-	-	-	-	-	-
Total debt service	-	-	-	-	-	-	-	-	-	-	-
Transfers to other funds:											
General fund	-	-	-	-	-	-	-	-	-	-	-
Water fund - Capital	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total transfers to other funds	-	-	-	-	-	-	-	-	-	-	-
Total Water capital expenses	484,860	691,753	2,788,791	3,168,932	3,577,840	10,418,848	12,533,831	621,011	960,615	829,417	645,105
Contingency	-	-	-	-	-	-	-	-	-	-	-
Unappropriated ending fund balance	634,568	49,161	26,903	3,671	48,710	44,259	39,911	119,299	164,984	137,217	293,484
Total Uses of Funds	$ 1,119,428	$ 740,914	$ 2,815,694	$ 3,172,602	$ 3,626,550	$ 10,463,108	$ 12,573,742	$ 740,310	$ 1,125,600	$ 966,634	$ 938,589

9.3.4 Revenue Requirements

Based on the factors described above, a revenue requirements module was constructed to allow the project team to evaluate the funding of the AWAC preferred alternative relative to future rate revenues. The revenue requirements analysis determines the amount of revenue needed from rates. This is related to utility cash flow or income requirements, constraints of bond covenants (i.e., the serial revenue bonds that are such a critical funding component of the plan), and specific fiscal policies related to the Ashland water utility. The revenue requirements model performs two revenue sufficiency tests. The first is for cash flow sufficiency, and the second is for revenue bond coverage and earnings. These tests are performed in each year of the forecast. Annual deficiencies or surpluses are noted and gross rate adjustments are computed each year. The results of these tests are shown below in Table 9.11, Forecast of Revenue Requirements – Projection of Cash Flow, and Table 9.12, Forecast of Revenue Requirements – Test of Revenue Bond Coverage Requirement. Table 9.13 is the Forecast of Revenue Requirements – Projection of Revenue Sufficiency. In this table, the annual maximum deficiencies are extracted, and applied to the current year rate revenue forecast to arrive at a percentage revenue requirement increase to fulfill that year's adjusted revenue requirements.

Figure 9.5 presents the annual percent changes in revenue requirements.

Table 9.11 Forecast of Revenue Requirements – Projection of Cash Flow

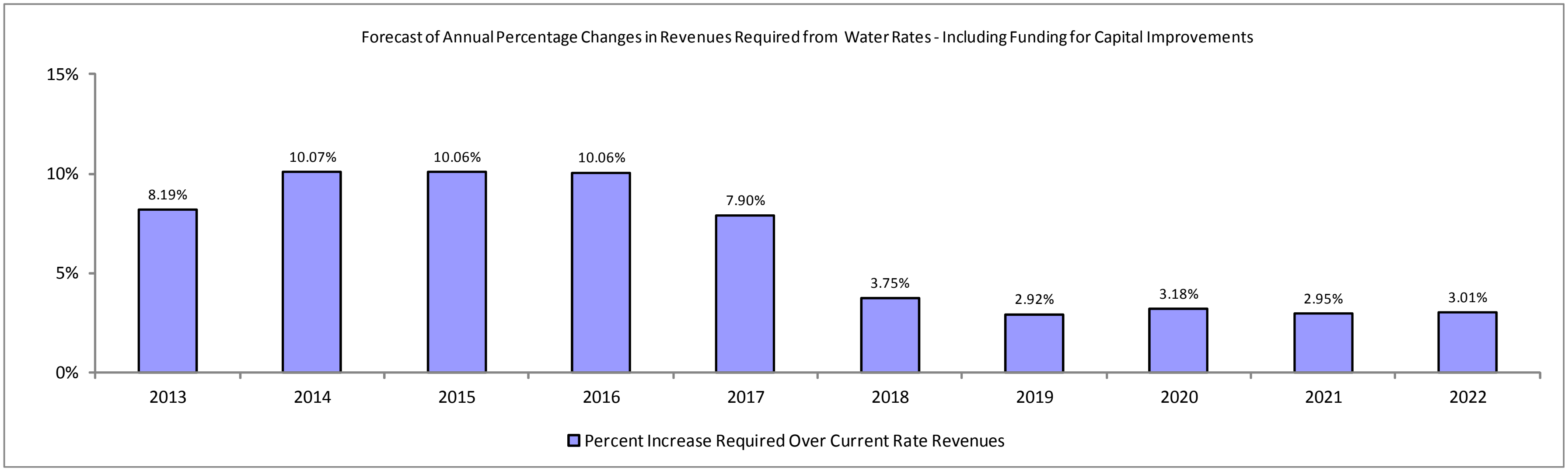
Line Item Description	Budget 2012	Forecast 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Projection of Cash Flow:											
Revenues:											
Charges for services	4,752,900	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226
Intergovernmental	1,669,965	196,024	211,627	228,055	245,357	263,580	282,776	303,001	324,312	346,770	370,441
Investment income	13,200	13,255	13,152	19,933	28,044	40,305	44,972	37,247	30,368	22,187	13,263
Miscellaneous	31,200	35,179	36,234	37,321	38,441	39,594	40,782	42,005	43,265	44,563	45,900
Taxes	-	104	107	110	114	117	121	124	128	132	136
Interfund loan	-	-	-	-	-	-	-	-	-	-	-
Reimburse operations costs - bond issue	-	-	-	-	-	-	-	-	-	-	-
Total revenues	6,467,265	4,997,462	5,403,098	5,945,215	6,541,403	7,199,661	7,766,388	8,057,391	8,297,205	8,564,152	8,820,966
Expenditures:											
Personal services	1,646,896	1,825,710	1,935,252	2,051,367	2,174,450	2,304,917	2,523,211	2,674,604	2,835,080	3,005,185	3,185,496
Materials and services	3,847,596	2,379,653	2,451,043	2,524,574	2,600,311	2,678,320	2,758,670	2,841,430	2,926,673	3,014,473	3,104,907
Capital outlay	522,000	-	-	-	-	-	-	-	-	-	-
Debt service:											
Existing	783,520	599,742	598,544	600,577	215,362	215,203	214,804	217,759	216,743	215,463	213,893
Future	-	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713
(Use)/Replacement of Operating Fund balance	(332,747)	531,500	592,500	658,500	1,228,000	500,000	(800,000)	(800,000)	(800,000)	(800,000)	(800,000)
Subtotal expenditures	6,467,265	5,336,605	5,812,490	6,338,783	7,014,969	7,369,714	7,411,307	7,648,415	7,911,209	8,167,834	8,437,010
Net Cash	-	(339,143)	(409,392)	(393,568)	(473,566)	(170,053)	355,081	408,976	385,996	396,318	383,956
Net Deficiency/(Surplus)	-	339,143	409,392	393,568	473,566	170,053	(355,081)	(408,976)	(385,996)	(396,318)	(383,956)

Table 9.12 Forecast of Revenue Requirements – Test of Revenue Bond Coverage Requirement

Line Item Description	Budget 2012	Forecast 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Test of Coverage Requirement:											
Operating Revenues:											
Charges for services	4,752,900	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226
Intergovernmental	1,669,965	196,024	211,627	228,055	245,357	263,580	282,776	303,001	324,312	346,770	370,441
System Development Charges	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Transfers (To) From Rate Stabilization Account	-	(531,500)	(592,500)	(658,500)	(1,228,000)	(500,000)	800,000	800,000	800,000	800,000	800,000
Total Operating Revenues	6,522,865	4,517,424	4,861,105	5,329,350	5,346,805	6,719,646	8,580,514	8,878,015	9,123,444	9,397,270	9,661,667
Operating Expenses:											
Personal services	1,646,896	1,825,710	1,935,252	2,051,367	2,174,450	2,304,917	2,523,211	2,674,604	2,835,080	3,005,185	3,185,496
Materials and services	3,847,596	2,379,653	2,451,043	2,524,574	2,600,311	2,678,320	2,758,670	2,841,430	2,926,673	3,014,473	3,104,907
Total Operating Expenses	5,494,492	4,205,363	4,386,295	4,575,941	4,774,761	4,983,237	5,281,881	5,516,034	5,761,753	6,019,658	6,290,404
Net Operating Income	1,028,373	312,062	474,810	753,408	572,044	1,736,409	3,298,633	3,361,980	3,361,691	3,377,612	3,371,263
Nonoperating Income (Expense):											
Interest Income:											
Water fund - Operating	13,200	13,255	13,152	19,933	28,044	40,305	44,972	37,247	30,368	22,187	13,263
Other Nonoperating Income (expense)											
Miscellaneous	31,200	35,179	36,234	37,321	38,441	39,594	40,782	42,005	43,265	44,563	45,900
Taxes	-	104	107	110	114	117	121	124	128	132	136
Reimburse operations costs - bond issue	-	-	-	-	-	-	-	-	-	-	-
Total Nonoperating Income	44,400	48,537	49,493	57,365	66,598	80,016	85,874	79,377	73,761	66,882	59,299
Total Net Revenues Available for Debt Service	1,072,773	360,599	524,303	810,773	638,643	1,816,425	3,384,507	3,441,357	3,435,452	3,444,493	3,430,562
Debt Service:											
Existing	783,520	599,742	598,544	600,577	215,362	215,203	214,804	217,759	216,743	215,463	213,893
New revenue bonds	-	-	235,151	503,764	796,846	1,671,275	2,714,622	2,714,622	2,732,713	2,732,713	2,732,713
Total Senior Lien Parity Obligations	783,520	599,742	833,695	1,104,341	1,012,209	1,886,477	2,929,426	2,932,380	2,949,456	2,948,176	2,946,606
Senior Lien Parity Obligations Coverage Recognized	1.37	0.60	0.63	0.73	0.63	0.96	1.16	1.17	1.16	1.17	1.16
Senior Lien Parity Obligations Coverage Required	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Senior Lien Coverage Deficiency	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Net Deficiency/(Surplus)	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695

Table 9.13 Forecast of Revenue Requirements – Projection of Revenue Sufficiency

Line Item Description	Budget 2012	Forecast 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Projection of Revenue Sufficiency:											
Maximum Deficiency	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Percent Increase Required Over Current Rate Revenues	**0.00%**	**8.19%**	**10.07%**	**10.06%**	**10.06%**	**7.90%**	**3.75%**	**2.92%**	**3.18%**	**2.95%**	**3.01%**
Stormwater rates reconciliation:											
Revenues recognized from current rates	4,752,900	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226
Add revenues from rate increase	-	389,079	517,816	569,653	626,618	541,672	277,276	224,119	251,368	240,726	252,695
Total revenues recognized from rate increase	4,752,900	5,141,979	5,659,794	6,229,448	6,856,066	7,397,738	7,675,014	7,899,133	8,150,500	8,391,226	8,643,922



FORECAST OF ANNUAL PERCENTAGE CHANGES IN REVENUE REQUIRED FROM WATER RATES

FIGURE 9.5

CITY OF ASHLAND
WATER SYSTEM MASTER PLAN

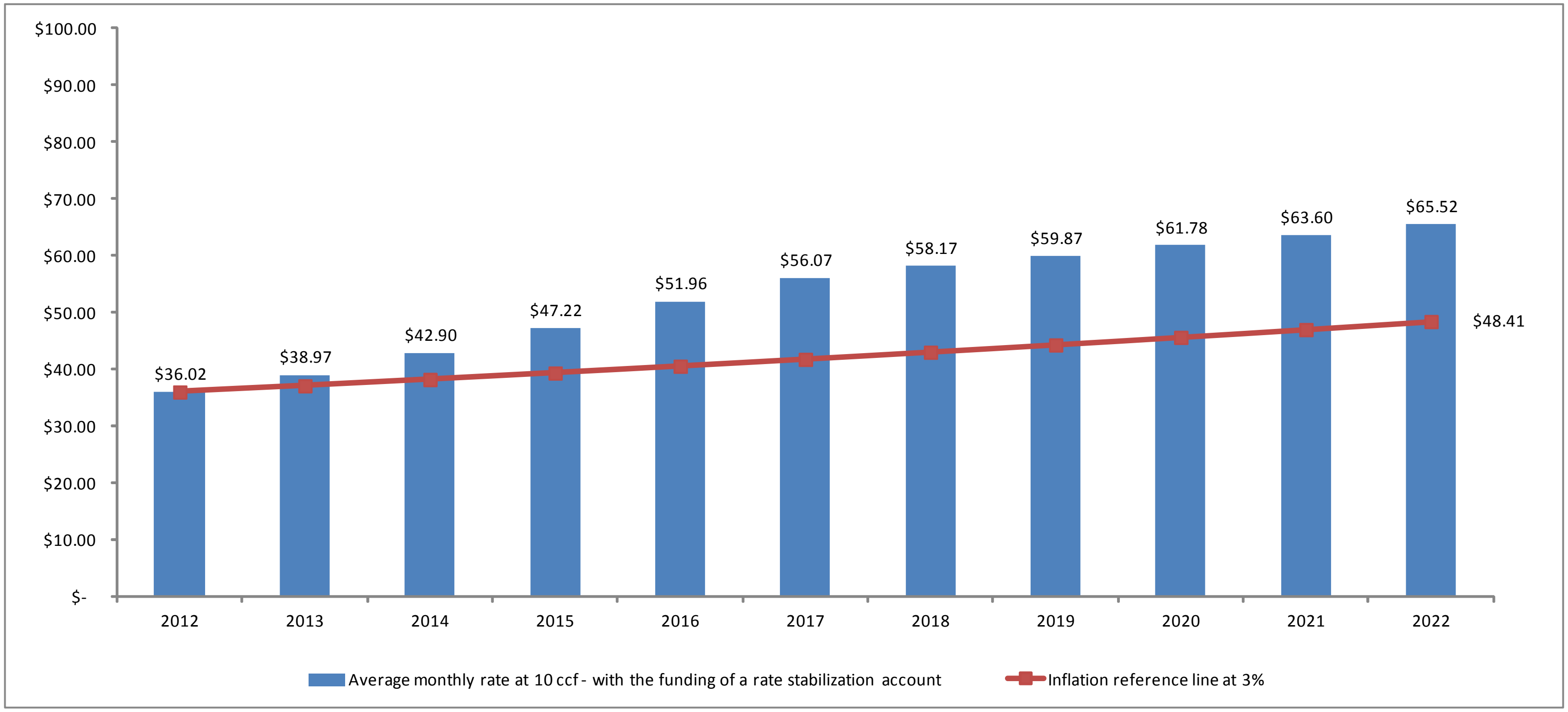
carollo

9.3.5 Water Rate Profile

The financial modeling of the AWAC preferred alternative is limited to an analysis of the impact of the plan's future costs on the water utility's overall system revenue requirements. This analysis should not be construed as a cost of service study that identifies how revenues should be recovered from specific classes of customers. For this project, the stream of future increases in overall system revenue requirements have been applied to the City's current rate structure, and the net impact of those overall increases is used to forecast monthly water bills for an average single family residential customer. The methodology for determining those future single-family residential water bills is shown below in Table 9.14. The reader should note that the monthly base rate used for the start year 2012 has been increased by 10 percent from the currently adopted base rate in anticipation of a proposal pending before the City Council. Figure 9.6 presents the projected water bill for the average residential customer.

Table 9.14 Forecasted Average Residential Monthly Water Bill Based on Changes in Net System Revenue Requirements

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Base	16.32	17.66	19.44	21.40	23.55	25.41	26.36	27.13	27.99	28.82	29.69
Use											
tier 1	1.69	1.83	2.01	2.22	2.44	2.63	2.73	2.81	2.90	2.98	3.07
tier 2	2.09	2.26	2.49	2.74	3.01	3.25	3.37	3.47	3.58	3.69	3.80
tier 3	2.78	3.01	3.31	3.64	4.01	4.33	4.49	4.62	4.77	4.91	5.06
tier 4	3.60	3.89	4.29	4.72	5.19	5.60	5.81	5.98	6.17	6.36	6.55
Average monthly rate at 10 ccf - with the funding of a rate stabilization account	$ 36.02	$ 38.97	$ 42.90	$ 47.22	$ 51.96	$ 56.07	$ 58.17	$ 59.87	$ 61.78	$ 63.60	$ 65.52
Inflation reference line at 3%	$ 36.02	$ 37.10	$ 38.22	$ 39.36	$ 40.55	$ 41.76	$ 43.01	$ 44.30	$ 45.63	$ 47.00	$ 48.41



FORECASTED AVERAGE RESIDENTIAL MONTHLY WATER BILL BASED ON CHANGES IN NET SYSTEM REVENUE REQUIREMENTS

FIGURE 9.6

CITY OF ASHLAND
WATER SYSTEM MASTER PLAN

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pw://Carollo/Documents/Client/OR/Ashland/8406A00/Deliverables/CWMP/CH 09/Fig_9.6.docx

9.4 SDC UPDATE

This update of the City's system development charges (SDC) for water was done in conjunction with the 2012 Water Conservation and Reuse Study and Comprehensive Water Master Plan (Master Plan) prepared by Carollo Engineers.

9.4.1 Background

The City's SDC Ordinance No. 4.20 was originally adopted in 1992 and amended in 1996. The ordinance was designed for compliance with ORS 223.297-.314 (Oregon SDC statute) which mandated that all jurisdictions having SDCs adopt ordinances consistent with this State law.

Actual SDC calculations have been adopted through a series of resolutions including Resolution No. 2000-29 "A Resolution Adopting New Water, Wastewater, and Parks System Development Charge Schedules." This also served to repeal the SDCs set in 1996. For water and wastewater, the 1996 SDCs were based on fixture counts with a single-family home (17 fixtures) paying $2,716 for water and $2,255 for wastewater.

In 2000, this methodology was reviewed by the City through the SDC Committee for purposes of simplifying the calculation and eliminating the perceived or real inequity of a 1,200 square foot (sf) home paying the same SDC as a 3,000 sf home. The objective was to simplify and make the calculation more predictable, easier to administer and to ensure that larger homes paid a proportionately larger SDC over smaller homes. The staff recommendation was to replace, for single family and multi family properties, the use of fixture counts with "habitable square footage" which equals the heated square footage of a house. This figure would be submitted as part of the plan review process and would be clear, easy to administer and charge larger houses more for their SDC. In order to achieve this last objective, the City developed a series of SDC brackets based on ranges of habitable square footage and assigned to these brackets a specific cost per square foot, with the cost per square foot within each bracket going up as the overall square footage increased. This calculation and the resulting brackets were designed to be "revenue neutral" in terms of the overall SDC revenue generated with this calculation vs. the 1996 fixture count approach. Under the revised approach, a "typical" average sized home of 2,000 habitable sf would be charged a water SDC of $3,362 ($2,716 under old SDC).

In 2006, the City's use of "habitable square footage" for its water SDC calculation was again reviewed with the SDC Committee. At that time, it was generally agreed that the use of habitable square footage vs. meter size does run counter to the generally accepted approaches used in Oregon for water SDCs. However, ORS 223 does <u>not</u> mandate any specific calculation approach so long as the allocation methodology selected "promotes that future system users contribute no more than an equitable share to the cost of existing facilities" AND "the cost of projected capital improvements needed to increase the capacity of the systems" is the basis for the charge. The SDC Committee did feel the use of habitable square footage was consistent with the City's objectives for promoting smaller home construction in the City and recommended that it be continued. However, the existing practice of using numerous brackets in applying habitable square footage was considered counterproductive and the Committee recommended a uniform cost per habitable square foot for residential properties. The calculation of the water SDC for non-residential properties would be based on meter size and meter equivalency.

This 2012 update pertains to the water SDC only and applies the same methodology used in 2006 to revised costs related to existing fixed water assets and future capital projects (along with their cost allocations between existing and future water users via the Master Plan). Habitable square footage data was developed in the 2006 analysis and those projections were updated to reflect current growth forecasts (.0665% growth rate) through the 20-year planning period. Current meter and meter equivalency counts were obtained from the City's meters-in-service data.

9.4.2 SDC Calculation

Under ORS 223, there are two elements to an SDC: the reimbursement fee and the improvement fee. These are discussed below.

The reimbursement fee considers the cost of existing facilities, prior contributions by existing users of those facilities, the value of the unused/available capacity, and generally accepted ratemaking principles. The objective is that "future system users contribute no more than an equitable share to the cost of existing facilities." The reimbursement fee can be spent on capital costs or debt service related to the systems for which the SDC is applied.

The following table is based on the City's fixed water asset schedule for June 30, 2011. The book value of these assets (original cost less depreciation) was used as the basis for the reimbursement fee. Consistent with the 2006 methodology, the use of habitable square footage is the basis for the residential fee and meter equivalents remain the basis for the non-residential fee. Also, consistent with the 2006 methodology, the relative number of 3/4-inch meter equivalents serves as the primary allocator of book value costs between residential and non-residential users. Of the 9,802 3/4-inch meter equivalents, 77 percent are residential and 23 percent commercial. These percentages are multiplied by the book value of water system assets along with other SDC cost categories to establish the amount to be applied to each of the two user groups. The reimbursement calculation itself, as in 2006, allocates the book value of the assets based on the total customer base (existing and future) in order to assign to new connections only their proportionate share of these existing water assets.

Table 9.15 Fixed Water Asset Schedule

City of Ashland, Oregon
Water System Plant in Service Balance as of June 30, 2011

	Original Cost	Accumulated Depreciation	Book Value
Land	930,299.00	-	930,299.00
Buildings	24,800.00	24,758.10	41.90
Equipment	212,109.47	177,399.15	34,710.32
Improvements Other Than Buildings	32,760,339.16	15,026,216.84	17,734,122.32
Construction Work in Progress	2,253,108.76	-	2,253,108.76
Total Utility Plant in Service	$ 36,180,656.39	$ 15,228,374.09	$ 20,952,282.30

City of Ashland, Oregon
Calculation of Water System Development Charges

Reimbursement Fee Derivation

	Residential	Commercial & Institutional	Total
Basis for Allocation To Customer Classes:			
Current Equivalent ¾" Meters in Service	7,575	2,227	9,802
Percentages	77%	23%	100%
Calculation of the Value of Capacity Available to Serve Growth:			
Original Cost	27,961,415.29	8,219,241.10	36,180,656.39
less: Accumulated Depreciation	(11,768,910.09)	(3,459,464.00)	(15,228,374.09)
less: Book Value of the Hosler Dam	(43,078.14)	(12,662.79)	(55,740.93)
less: Grants	-	-	-
less: Developer Contributions	-	-	-
less: Principal Outstanding on Long Term Debt			
Series 1997 Flood and Refunding Bonds	(135,244.86)	(39,755.14)	(175,000.00)
Series 2003 Water Revenue Bonds	(2,272,113.59)	(667,886.41)	(2,940,000.00)
Series 2009 Water & Wastewater Bonds (full faith and credit)	(489,626.17)	(143,925.32)	(633,551.49)
Net Rate Payer Investment in Capacity Available to Serve Growth	13,252,442.44	3,895,547.44	17,147,989.88
Calculation of Future Demand:			
Forecasted Residential Habitable Area (Square Feet) in 2032	16,483,431		
Forecasted Non-residential Equivalent Meters in 2032		2,559	
Calculated Water Reimbursement Fee:			
Residential - $/square foot of habitable area ……………………………………….	$ 0.8040		
Commercial/Institutional - $ Equivalent 3/4" meter …………………………………………………….		$ 1,522	

The improvement fee portion of the SDC is based on the cost of planned future facilities that expand the system's capacity to accommodate growth. In developing an analysis of the improvement portion of the fee, each project in the City's Master Plan was reviewed to exclude costs related to correcting existing system deficiencies or upgrading for historical lack of capacity. The following are the criteria used to evaluate these projects for SDC eligibility.

STEPS TOWARD EVALUATING
CAPITAL IMPROVEMENT LISTS FOR SDC ELIGIBILITY

CHAPTER NO. 9*ORS 223*

1. *Capital improvements mean the facilities or assets used for water supply, distribution, and treatment. This definition DOES NOT ALLOW costs for operation or routine maintenance of the improvements.*
2. *The SDC improvement base shall consider the cost of projected capital improvements needed to increase the capacity of the systems to which the fee is related.*
3. *An increase in system capacity is established if a capital improvement increases the "level of performance or service" provided by existing facilities or provides new facilities.*
4. *The facilities in question have been included in a capital improvement plan, public facilities plan, master plan or comparable plan that includes a list of the capital improvements that the local government intends to fund, in whole or in part, with revenues from an improvement fee*

Under this approach, the following rules will be followed:

A. *REPAIR COSTS ARE NOT TO BE INCLUDED;*
B. *REPLACEMENT COSTS WILL NOT BE INCLUDED UNLESS THE REPLACEMENT INCLUDES AN UPSIZING OF SYSTEM CAPACITY AND/OR THE LEVEL OF PERFORMANCE OF THE FACILITY IS INCREASED;*
C. *NEW REGULATORY COMPLIANCE FACILITY REQUIREMENTS FALL UNDER THE LEVEL OF PERFORMANCE DEFINITION AND SHOULD BE PROPORTIONATELY INCLUDED;*
D. *COSTS WILL NOT BE INCLUDED, WHICH BRING DEFICIENT SYSTEM UP TO ESTABLISHED DESIGN LEVELS.*

Based on these SDC eligibility criteria, the Master Plan projects contained in the following table were reviewed and, where indicated, a project-specific allocation to new system connections (growth) was assigned.

Table 9.16 summarized the percentage of each CIP project that is SDC eligible.

Table 9.16 Engineering Capacity Allocations for Growth

Engineering Capacity Allocations for Growth - Water Capital Projects from 2012 Master Plan

		Funding Source (%)				
Capital Project	Total Cost	SDC Eligible	Grants	LIDs	Other	Rates
Supply						
FERC Dam Security & Telemetry Impr (50% Electric, 50% Water)	-	25.00%	0.00%	0.00%	50.00%	25.00%
FERC Dam Spillgate Upgrades (50% Electric, 50% Water)	-	25.00%	0.00%	0.00%	50.00%	25.00%
FERC Structural Stability Analysis (50% Electric, 50% Water)	-	25.00%	0.00%	0.00%	50.00%	25.00%
FERC Part 12 Dam Safety Inspection (50% Electric, 50% Water)	160,000	25.00%	0.00%	0.00%	50.00%	25.00%
Ashland Creek West Fork Bridge Construction	120,000	75.00%	0.00%	0.00%	0.00%	25.00%
Sediment TMDL in Reeder Resv.	600,000	75.00%	0.00%	0.00%	0.00%	25.00%
Reeder Resv Study Implementation	30,000	75.00%	0.00%	0.00%	0.00%	25.00%
Reeder Resv Access Road TMDL Compliance	100,000	75.00%	0.00%	0.00%	0.00%	25.00%
Reeder Resv Variable Depth Intake	100,000	0.00%	0.00%	0.00%	0.00%	100.00%
TID Terrace St Pump Station Improvements	220,000	0.00%	0.00%	0.00%	0.00%	100.00%
TID Canal Piping: Starlite to Terrace Street	1,100,000	100.00%	0.00%	0.00%	0.00%	0.00%
Test existing high capacity wells	50,000	0.00%	0.00%	0.00%	0.00%	100.00%
Water Conservation Smart Controller Pilot Project	50,000	0.00%	0.00%	0.00%	0.00%	100.00%
Water Conservation Management Plan (due April 2012)	-	100.00%	0.00%	0.00%	0.00%	0.00%
Emergency TAP Pipeline & Pump	2,000,000	0.00%	0.00%	0.00%	0.00%	100.00%
Treatment & Storage						
Raw Water Bypass Measurement	25,000	0.00%	0.00%	0.00%	0.00%	100.00%
SCADA Radio Frequency FCC Compliance	45,000	0.00%	0.00%	0.00%	0.00%	100.00%
Final CT Disinfection Improvements	85,000	0.00%	0.00%	0.00%	0.00%	100.00%
Permanganate Feed Facility Study & Implementation	265,000	0.00%	0.00%	0.00%	0.00%	100.00%
WTP Security Upgrades	50,000	0.00%	0.00%	0.00%	0.00%	100.00%
Existing Plant Mech. Elec. & Scada Upgrades	1,500,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ozone /UV Analysis & Disinfection	1,750,000	0.00%	0.00%	0.00%	0.00%	100.00%
Bear Creek Cu WLA Source Control Study & Implementation	50,000	0.00%	0.00%	0.00%	0.00%	100.00%
2.6-MG Reservoir & Clearwell (“Crowson II”)	6,746,000	10.00%	0.00%	0.00%	0.00%	90.00%
2.5 MGD Water Treatment Plant	12,000,000	10.00%	0.00%	0.00%	0.00%	90.00%
Distribution						
Telemetry Station at Water Warehouse	50,000	0.00%	0.00%	0.00%	0.00%	100.00%
Water Master Plan Updates	700,000	100.00%	0.00%	0.00%	0.00%	0.00%
Park Estates Pump Station/Loop Road Reservoir Alternatives	2,000,000	0.00%	0.00%	0.00%	0.00%	100.00%
Lit Way New PRV	341,000	0.00%	0.00%	0.00%	0.00%	100.00%
Tolman Creek Road New PRV	341,000	0.00%	0.00%	0.00%	0.00%	100.00%
Pipe Replacement Program	3,700,000	0.00%	0.00%	0.00%	0.00%	100.00%
Radio Read Meter Program	1,351,000	0.00%	0.00%	0.00%	0.00%	100.00%
Hydrant Replacement	616,000	0.00%	0.00%	0.00%	0.00%	100.00%
Emergency Response Plan Update	20,000	0.00%	0.00%	0.00%	0.00%	100.00%
Cross Connection Control Plan Update	15,000	0.00%	0.00%	0.00%	0.00%	100.00%
Safety Plan Update	20,000	0.00%	0.00%	0.00%	0.00%	100.00%
Granite Reservoir Valving	100,000	0.00%	0.00%	0.00%	0.00%	100.00%
Piping						
Ivy Lane	346,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ivy Lane	94,000	0.00%	0.00%	0.00%	0.00%	100.00%
Normal Ave	517,000	0.00%	0.00%	0.00%	0.00%	100.00%
Walker Ave	784,000	0.00%	0.00%	0.00%	0.00%	100.00%
Parker Street	162,000	0.00%	0.00%	0.00%	0.00%	100.00%
Harmony Lane	65,000	0.00%	0.00%	0.00%	0.00%	100.00%
Lit Way	35,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ray Lane	54,000	0.00%	0.00%	0.00%	0.00%	100.00%
Beach Street	91,000	0.00%	0.00%	0.00%	0.00%	100.00%
AHS Property	90,000	0.00%	0.00%	0.00%	0.00%	100.00%
Vista Street	149,000	0.00%	0.00%	0.00%	0.00%	100.00%
Vista Street	5,000	0.00%	0.00%	0.00%	0.00%	100.00%
Meade Street	235,000	0.00%	0.00%	0.00%	0.00%	100.00%
Elkader Street	72,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ivy Lane	64,000	0.00%	0.00%	0.00%	0.00%	100.00%
South Mountain Ave	6,000	0.00%	0.00%	0.00%	0.00%	100.00%
South Mountain Ave	17,000	0.00%	0.00%	0.00%	0.00%	100.00%
Pinecrest Trail	178,000	0.00%	0.00%	0.00%	0.00%	100.00%
Pinecrest Trail	396,000	0.00%	0.00%	0.00%	0.00%	100.00%
Penny Drive	83,000	0.00%	0.00%	0.00%	0.00%	100.00%
Woodland Drive	52,000	0.00%	0.00%	0.00%	0.00%	100.00%
Hiawatha Place	58,000	0.00%	0.00%	0.00%	0.00%	100.00%
Morton Street	130,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ashland Mine Road	115,000	0.00%	0.00%	0.00%	0.00%	100.00%
Fox Street	54,000	0.00%	0.00%	0.00%	0.00%	100.00%
Almeda Drive	35,000	0.00%	0.00%	0.00%	0.00%	100.00%
Skycrest Drive	162,000	0.00%	0.00%	0.00%	0.00%	100.00%
Crispin Street	131,000	0.00%	0.00%	0.00%	0.00%	100.00%
Oak Lawn Ave	29,000	0.00%	0.00%	0.00%	0.00%	100.00%
Sylvia Street	64,000	0.00%	0.00%	0.00%	0.00%	100.00%
Black Oak Way	85,000	0.00%	0.00%	0.00%	0.00%	100.00%
Oak Knoll Dr	287,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ashland Street	432,000	0.00%	0.00%	0.00%	0.00%	100.00%
I-5 Crossing	794,000	0.00%	0.00%	0.00%	0.00%	100.00%
Ditch Road	225,000	0.00%	0.00%	0.00%	0.00%	100.00%
Lithia	70,000	0.00%	0.00%	0.00%	0.00%	100.00%
Iowa Street	640,000	0.00%	0.00%	0.00%	0.00%	100.00%
Granite Street	300,000	0.00%	0.00%	0.00%	0.00%	100.00%
B Street	250,000	0.00%	0.00%	0.00%	0.00%	100.00%
Terrace Street	350,000	0.00%	0.00%	0.00%	0.00%	100.00%
Capital Improvement Plan Total - % by funding source	100.00%	9.89%	0.00%	0.00%	0.18%	89.93%
Capital Improvement Plan Total - $ by funding source	$ 44,006,000	$ 4,352,100	$ -	$ -	$ 80,000	$ 39,573,900

The improvement SDC is calculated as a function of the estimated number of additional units (habitable square footage and meter equivalents) to be served by the City's new water improvements over the planning period. This calculation is summarized in Table 9.17.

Table 9.17 Improvement Fee Derivation

City of Ashland, Oregon
Calculation of Water System Development Charges
Improvement Fee Derivation

	Residential	Commercial & Institutional	Total
Basis for Allocation To Customer Classes:			
Current Equivalent ¾" Meters in Service	7,575	2,227	9,802
Percentages	77%	23%	100%
Calculation of the Value of Capacity Available to Serve Growth:			
Future Project Costs Attributable to Growth:			
Supply	$ 1,373,701	$ 403,799	$ 1,777,500
Treatment & Storage	1,448,743	425,857	1,874,600
Distribution	540,979	159,021	700,000
Piping	-	-	-
Total Growth Related Costs	$ 3,363,424	$ 988,676	$ 4,352,100
Calculation of Future Demand:			
20 Year Forecasted Growth in Residential Habitable Area (Square Feet)	2,046,408		
20 Year Forecasted Growth in Equivalent Meters		318	
Calculated Water ImprovementFee:			
Residential - $/square foot of habitable area ……………………………………….	$ 1.6436		
Non-residential - $/equivalent 3/4" meter ……………………………………………………………		$ 3,111.76	

9.4.3 Proposed Total Water SDC

The total proposed water SDC combines the reimbursement and improvement elements of the calculation, as shown in Table 9.18.

Table 9.18 Proposed Total Water SDC

City of Ashland
Summary of Proposed Water SDCs

	Reimbursement	Improvement	Total
Residential:			
$/square foot of habitable area	$ 0.8040	$ 1.6436	$ 2.4476
Non-Residential:			
$/equivalent 3/4" meter	$ 1,522.18	$ 3,111.76	$ 4,633.93

City of Ashland
Proposed Schedule of Non-Residential Water SDCs by Meter Size

Water Meter Size	Reimbursement	Improvement	Total
¾" meters	$ 1,522.18	$ 3,111.76	$ 4,633.93
1" meters	2,537	5,186	7,723.22
1.5" meters	5,074	10,373	15,446.45
2" meters	8,118	16,596	24,714.32
3" meters	17,759	36,304	54,062.57
4" meters	30,444	62,235	92,678.69
6" meters	63,424	129,657	193,080.61
8" meters	91,331	186,706	278,036.08

Current - Water SDC is $4,940 for a 3/4- inch meter

Proposed - Water SDC would be $4,895 for a “typical” 2,000 habitable square foot home

Note:

Consistent with the methodology established in 2006, the SDC for non-residential properties will be based on meter size and flow factor equivalency. These factors are based on the *American Water Works Association standard for cold water meters - displacement type, bronze main case; ANSI/AWWA C700-02 Effective January 1, 2003; ANSI approved October 11, 2002.*

Appendix A

DRINKING WATER QUALITY REGULATIONS

City of Ashland

Appendix A
Drinking Water Quality Regulations

City of Ashland

COMPREHENSIVE WATER MASTER PLAN

APPENDIX A
DRINKING WATER QUALITY REGULATIONS

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DRINKING WATER QUALITY REGULATIONS

1.0 INTRODUCTION

Then purpose of this memorandum is to summarize drinking water quality regulations relevant to the Ashland Water Treatment Plant and distribution system. The Safe Drinking Water Act (SDWA) established specific roles for the federal government, state government, and water system purveyors, with respect to water quality monitoring. The United States Environmental Protection Agency (USEPA) is authorized to develop national drinking water regulations and oversee the implementation of the SDWA. State governments are expected to adopt the federal regulations and accept primacy for administration and enforcement of the Act. States can also regulate contaminants and set advisory levels. Public water system purveyors are assigned the day-to-day responsibility of meeting regulations by incorporating monitoring, record keeping, and sampling procedures into their operation and maintenance programs.

The SDWA regulations and the associated Code of Federal Regulations (CFR) are summarized in Table 1. The regulations are divided into those that address source water quality, distribution system water quality, surface water treatment, and reporting requirements, respectively. The table is followed by a summary of each individual rule.

Table 1 Drinking Water Regulations

Rule	CFR	Affected Contaminants	Publication Date of Final Rule
SOURCE WATER QUALITY			
National Primary and Secondary Drinking Water Standards	See below	Bacteriological, IOC, VOC, SOC, Asbestos, Radionuclides, THMs, Lead/Copper, Phase II/V	Phases I through V promulgated 1987 through 1992.
Radionuclide Rule	40 CFR 141.15 141.25 141.26	Radionuclides	Promulgated April 4, 1997
Arsenic Rule	40 CFR 141.23 141.24 141.16	Arsenic	Promulgated February 2002
Unregulated Contaminants Monitoring Rule 2	40 CFR 141.40	Various contaminants considered for future regulations	UCMR2 promulgated January 4, 2007
Groundwater Rule	40 CFR Subpart S	Fecal indicators in groundwater	Promulgated January 8, 2007
DISTRIBUTION SYSTEM WATER QUALITY			
Total Coliform Rule	40 CFR 141.21 141.63	Total coliform bacteria	Promulgated in 1989

Table 1 Drinking Water Regulations			
Rule	**CFR**	**Affected Contaminants**	**Publication Date of Final Rule**
Lead and Copper Rule	40 CFR Subpart I	Lead and Copper	Promulgated January 12, 2000, compliance by January 2003
Stage 1 Disinfectants /Disinfection Byproducts Rule	40 CFR, Parts 9, 141, 142 63 FR 69390	Trihalomethanes, haloacetic acids, chlorite, and bromate	Promulgated February 16, 1999 Compliance by December 1, 2003
Stage 2 Disinfectants/Disinfection Byproduct Rule	40 CFR Subpart V	Trihalomethanes and haloacetic acids	Promulgated January 4, 2006, Effective March 6, 2006
SURFACE WATER TREATMENT RULES			
Information Collection Rule	40 CFR, Part 141, Subpart M	Large Surface Water Systems: Bacteriological, DBP, IOCs	Promulgated June 18, 1996
Interim Enhanced Surface Water Treatment Rule	63 FR 69478	Large Surface Water Systems: Bacteriological, incorporate *Cryptosporidium* into watershed plans	Promulgated November 1998
Long Term 1 Enhanced Surface Water Treatment Rule	40 CFR, Parts 9, 141, 142 67 FR 1812	Bacteriological, *Cryptosporidium*	Promulgated February 13, 2002, compliance by March 15, 2005
Long Term 2 Enhanced Surface Water Treatment Rule	Proposed (1)	Bacteriological	Promulgated in 2006
Filter Backwash Recycling Rule	40 CFR Parts 9, 141, 142 66 FR 31086	Bacteriological	Promulgated August 7, 2001, compliance by December 8, 2003
REPORTING REQUIREMENTS			
Consumer Confidence Report Rule	40 CFR 141 Part O	Reporting only	Published August 19, 1998
Public Notification Rule	40 CFR Subpart Q	Reporting only	Promulgated 2000

2.0 SOURCE WATER QUALITY

2.1 National Primary Drinking Water Standards

The National Primary Drinking Water Standards are currently set for 92 contaminants. Maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) have been established for 83 contaminants, while the remaining nine have treatment technique requirements. A constituent's MCL is generally based on its public health goal (PHG), which is the level of a contaminant in drinking water below which there is no known or expected health risk. Regulated constituents include microbial contaminants, inorganic chemicals (IOCs), volatile organic chemicals (VOCs), synthetic organic chemicals (SOCs), radionuclides, and disinfection by-products (DBPs). Microbial contaminants and their associated regulations are discussed in the surface water treatment section. Regulations affecting DBPs are discussed below in the distribution system water quality section.

The USEPA regulates most of the chemical contaminants through the rules known as Phase I, II, IIb, and V. The USEPA issued the four rules regulating 69 contaminants over a five-year period as it gathered, updated, and analyzed information on each contaminant's presence in drinking water supplies and its health effects. The Phase I Rule was promulgated July 8, 1987 and included eight VOCs. The Phase II and IIb Rules (published January 30 and July 1, 1991) updated or created new limits for 38 contaminants. The Phase V Rule (published July 17, 1992), set standards for 23 additional contaminants. The Oregon DHS has adopted these rules, and additional regulations since the Phase V Rule, such as the Arsenic Rule.

The USEPA has also established secondary standards for 15 contaminants to address the aesthetic quality of drinking water; these secondary standards have also been adopted by the DHS. Because the federal standards primarily address taste and odor, rather than health issues, they are often used only as a guideline.

Current primary and secondary MCLs for inorganic and organic constituents, respectively, are documented in the following subsections.

2.1.1 Inorganic Chemicals

Regulated inorganic chemicals include elemental metals such as mercury, arsenic, and iron. Some non-metallic constituents such as chloride, fluoride, and sulfate are also included in this category. Physical properties of IOCs that affect water quality in this category include turbidity, specific conductivity, total dissolved solids, and color. The primary and secondary MCLs for IOCs are summarized in Tables 2 and 3, respectively. Asbestos samples are collected from the distribution system, as the source of asbestos is asbestos cement pipe, and is discussed below in Section 3.4.

Table 2 Primary MCLs for Inorganic Chemicals	
Chemical	**Primary MCL (mg/L)[(1)]**
Antimony (Sb)	0.006
Arsenic (As)	0.05/0.01
Asbestos	7 million fibers/liter (length > 10 microns)
Barium (Ba)	2.0
Beryllium (Be)	0.004
Cadmium (Cd)	0.005
Chromium (Cr)	0.1
Copper (Cu)	1.3 [(2)]
Cyanide (HCN)	0.2
Fluoride (F)	4.0
Lead (Pb)	0.015 [(2)]
Mercury (Hg)	0.002
Nickel (Ni)	0.1
Nitrate (as N)	10.0
Nitrite (as N)	1.0
Selenium (Se)	0.05
Sodium (Na)	20 [(3)]
Thallium (Tl)	0.002

Notes:

(1) Source: State Department of Health Drinking Water Regulations (246--90), effective July 2008.

(2) Lead and copper have established action levels, rather than MCLs. These are discussed further in the Lead and Copper Rule, under the *Distribution System Water Quality* section.

(3) USEPA has established a recommended level of 20 mg/L for individuals that have restrictions on daily sodium intake. This is not an enforceable standard.

Table 3 Secondary MCLs for Inorganic Chemicals	
Chemical	**Primary MCL (mg/L)[(1)]**
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	Non-corrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Notes:
(1) Source: State Department of Health Drinking Water Regulations (246-290), effective July 2008.

2.1.2 Volatile Organic and Synthetic Organic Compounds

Volatile organic chemicals (VOCs) are manufactured, carbon-based chemicals that vaporize quickly at normal temperatures and pressures. VOCs include many hydrocarbons associated with fuels, paint thinners, and solvents. Organic pesticides are regulated separately as synthetic organic chemicals (SOCs). There are currently 22 regulated volatile organic chemicals (VOCs) and 30 regulated synthetic organic chemicals (SOCs). A list of these compounds and their MCLs is included in Table 4.

Table 4 Regulated Volatile and Synthetic Organic Chemicals					
Organic Chemical	**Federal Regulation**	**Primary MCL (mg/L)(1)**	**Organic Chemical**	**Federal Regulation**	**Primary MCL (mg/L)(1)**
Volatile Organic Chemicals (VOCs)					
Vinyl chloride	Phase I	0.002	Monochlorobenzene	Phase II	0.1
Benzene	Phase I	0.005	Ortho-Dichlorobenzene	Phase II	0.6
Carbon Tetrachloride	Phase I	0.005	Styrene	Phase II	0.1
1,2-Dichloroethane	Phase I	0.005	Tetrachloroethylene	Phase II	0.005
Trichloroethylene	Phase I	0.005	Toluene	Phase II	1
Para-Dichlorobenzene	Phase I	0.075	Trans-1,2-Dichloroethylene	Phase II	0.1
1,1-dichloroethylene	Phase I	0.007	Xylenes (total)	Phase II	10
1,1,1-Trichloroethane	Phase I	0.2	Dichloromethane	Phase V	0.005
Cis-1,2-Dichloroethylene	Phase II	0.07	1,2,4-Trichloro-benzene	Phase V	0.07
1,2-Dichloropropane	Phase II	0.005	1,1,2-Thrichloro-ethane	Phase V	0.005
Ethylbenzene	Phase II	0.7	Chlorobenzene		0.07
Synthetic Organic Chemicals (SOCs)					
Alachlor	Phase II	0.002	Benzo(a)pyrene	Phase V	0.0002
Atrazine	Phase II	0.003	Dalapon	Phase V	0.2
Carbofuran	Phase II	0.04	Di(2-ethylhexyl) adipate	Phase V	0.4
Chlordane	Phase II	0.002	Di(2-ethylhexyl) phthalate	Phase V	0.006
Dibromochloro-propane	Phase II	0.0002	Dinoseb	Phase V	0.007
2,4-D	Phase II	0.07	Diquat	Phase V	0.02
Ethylene dibromide	Phase II	0.00005	Endothall	Phase V	0.1
Heptachlor	Phase II	0.0004	Endrin	Phase V	0.002
Heptachlor epoxide	Phase II	0.0002	Glyphosate	Phase V	0.7
Lindane	Phase II	0.0002	Hexachlorobenzene	Phase V	0.001
Methoxychlor	Phase II	0.04	Hexachloro Cyclopentadiene	Phase V	0.05
Polychlorinated biphenyls (PCBs)	Phase II	0.0005	Oxamyl (vydate)	Phase V	0.2
Pentachlorophenol	Phase II	0.001	Picloram	Phase V	0.5
Toxaphene	Phase II	0.003	Simazine	Phase V	0.004
2,4,5-TP	Phase II	0.05	2,3,7,8-TCDD (dioxin)	Phase V	$3x10^{-8}$

Notes:

(1) 40 CFR 141.61(a) & (c); adopted by State Board of Health, effective April 1999

2.1.3 Radionuclides

In December 2000, the USEPA announced updated standards for radionuclides. This rule became effective December 2003. All community water systems are required to meet the MCLs listed in Table 5, and requirements for monitoring and reporting.

Table 5 Regulated Radionuclides

Radionuclide	MCL[1]
Radium – 226[1]	3 pCi/L
Combined Radium – 226 and 228[1]	5 pCi/L
Uranium[2]	30 μg/L
Gross Alpha (excluding Uranium)[1]	15 pCi/L
Gross Beta[1]	50 pCi/L
Tritium	20,000 pCi/L
Strontium-90	8 pCi/L

Notes:
(1) Department of Health, WAC 246-290-310 (6).

2.1.4 Arsenic Rule

In January 2001, the USEPA promulgated a new standard that requires public water systems to reduce arsenic levels in drinking water. The final rule became effective in 2006 and applies to all community water systems and non-transient non-community water systems, regardless of size. The rule not only established an MCL for arsenic (0.010 mg/L) based on an RAA of quarterly results and an MCGL for arsenic (zero), but also listed feasible and affordable technologies for small systems that can be used to comply with the MCL. However, systems are not required to use the listed technologies in order to meet the MCL. The arsenic rule was adopted by the DHS in 2004.

2.1.5 Groundwater Rule

The USEPA enacted the final Groundwater Rule (GWR) January 8, 2007, for the purpose of providing increased protection against microbial pathogens in public water systems that use untreated groundwater. The GWR will apply to public water systems that serve groundwater as well as to any system that mixes surface and groundwater, if the groundwater is added directly to the distribution system and is provided to customers without treatment. To implement the GWR, the USEPA is taking a risk-based approach to protect drinking water from groundwater sources that have been identified as being at the greatest risk of fecal contamination. As the City does not currently use any groundwater sources, the requirements of this rule do not apply.

2.1.6 Unregulated Contaminant Monitoring Rule

The 1986 amendments to the Safe Drinking Water Act require public water systems to monitor for unregulated contaminants every five years and submit these data to the states. The intent of this program is to gather scientific information on unregulated contaminants to determine if regulations are required to protect human health. Both the 1993 and 1996 amendments to the act added new lists of contaminants, which led EPA to develop a revised program for monitoring. The new program became known as the Unregulated Contaminant Monitoring Regulations (UCMR 1999). The new UCMR program began in 2001, and produces a new list of unregulated contaminants for monitoring every five years. UCMR2 was finalized in January 2007. Under the UCMR program, EPA asks large systems to take two sets of samples for unregulated contaminants at six-month intervals. There are two tiers of contaminants in UCMR2; List 1 - Assessment Monitoring, and List 2 - Survey Screening. List 1 contaminants are sampled by all water systems serving over 10,000 people. There are 10 List 1 contaminants, consisting of flame-retardants and other priority contaminants (EPA Method 527), and some explosives (EPA Method 529). List 2 contaminants are analyzed using less common analytical techniques, and only a portion of the purveyors required to test for List 1 contaminants are required to test for List 2. List 2 contaminants include Acetanilide pesticides and degraded products (EPA Methods 525.2 and 535), and Nitrosoamines/NDMA (EPA Method 521). The SWP is responsible for notifying utilities of UCMR monitoring requirements.

3.0 DISTRIBUTION SYSTEM WATER QUALITY

3.1 Total Coliform Rule

Coliform bacteria describe a broad category of organisms routinely monitored in potable water supplies. Though not all coliform bacteria are pathogenic in nature, they are relatively easy to identify in laboratory analysis. If coliform bacteria are detected, then pathogenic organisms may also be present. Bacterial contamination in a water supply can cause a number of waterborne diseases, therefore these tests are strictly monitored and regulated.

The Total Coliform Rule (TCR) was promulgated in June 1989, and established an MCLG of zero for total and fecal coliforms, and an MCL based on the percentage of positive samples collected during a compliance period. The required number of samples to be collected in a month depends on the number of people served. For systems that collect 40 or more samples per month, the rule allows no more than 5 percent positive samples per month. If a system has greater than 5 percent total coliform-positive (TC-positive) samples in a month, then this is considered a monthly MCL violation, which needs to be reported to the CDHS and to the public in a specific timeframe. All TC-positive samples must be analyzed for the presence of *Escherichia coli* (*E. coli*) or fecal coliforms. If two consecutive samples are TC-positive and one is also fecal coliform or *E. coli*-positive, then this is defined as an acute violation of the MCL; the system must notify the DHS and the public using mandatory language developed by the USEPA and collect repeat samples.

The Total Coliform Rule (TCR) specifies two types of MCL violations, “non-acute” and “acute.” A purveyor is required to notify both DWP and system consumers if either a non-acute or acute MCL violation occurs. A violation of bacteriological MCLs occurs during routine sampling when:

- Coliform is detected in two or more routine samples in a single month, but no follow-up violations occur (Non-acute MCL);

- Coliform is present in any of the repeat samples collected as a follow-up to a sample with fecal coliform or E. coli (acute MCL);

- Fecal coliform or E. coli is present in any of the repeat samples collected as a follow up to a sample with coliform presence (acute MCL).

The TCR also requires secondary disinfection in accordance with the following:

- A minimum disinfectant residual of 0.2 mg/L free chlorine or 0.5 mg/L chloramines measured as free chlorine must be continually present at the entrance of the distribution system, with a detectable chlorine residual maintained throughout the distribution system.

- A sample with heterotrophic plate count (HPCs) less than 500 colony forming units per 100 mL is assumed to carry the required minimum residual.

The TCR is currently under review by the USEPA to initiate possible revisions, as discussed in the *Anticipated and Future Regulations* section.

3.2 Asbestos

Asbestos is the name for a group of naturally occurring, hydrated silicate minerals with fibrous morphology. Included in this group are chrysotile, corcidolite, amosite, and the fibrous varieties of anthophyllite, tremolit, and actinolite. Most commercially-mined asbestos is chrysotile. Historically, the flexibility, strength, and chemical and heat resistance properties of asbestos have adapted it to many uses including building insulation, brake linings, and water pipe.

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

3.3 Stage 1 Disinfectants and Disinfection By-Products Rule

The Stage 1 Disinfectants and Disinfection By-Products Rule (DBPR) was promulgated in December 1998 and is applied to systems that apply a chemical oxidant/disinfectant. The portions of the Stage 1 DBPR relevant to the City are the MCLs for trihalomethanes (THMs) and haloacetic acids (HAAs) of 0.080 and 0.060 mg/L, respectively. The four regulated trihalomethanes are chloroform, bromodichloromethane, dibromochloromethane, and bromoform. The five regulated HAAs are monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid. Compliance with the THM and HAA MCLs is based on a system-wide running annual average (RAA) of quarterly samples taken in the distribution system. The Stage 1 DBPR also introduced a maximum residual disinfectant level (MRDLs) of 4 mg/L for free chlorine, based on an RAA of samples collected concurrent with TCR monitoring.

Stage 1 of the Disinfectants/Disinfection By-Products Rule (Stage 1 D/DBP Rule) was finalized on December 16, 1998 and became effective for public water systems serving more than 10,000 people on January 1, 2002.

The Stage 2 Disinfectants/Disinfection By-Products Rule (Stage 2 DBP Rule) was finalized in December 2005, and published in the Federal Register on January 4, 2006. The Stage 1 D/DBP Rule will remain in effect until compliance monitoring for the Stage 2 Rule begins on October 1, 2013 for systems serving populations of 10,000 to 49,999.

3.3.1 Disinfection

The Stage 1 D/DBP Rule includes a reduction in the MCL for total trihalomethanes (TTHMs), regulation of a new group of disinfection by-products known as haloacetic acids (HAAs), bromate and chlorite, sets maximum residual disinfectant levels and goals (MRDLs and MRDLGs) and places several restrictions on disinfection practices.

The requirements of the Stage 1 D/DBP Rule are summarized in Table 6. Under the Stage 1 D/DBP Rule, the monitoring requirements for TTHMs and HAAs will be the same as is currently required for TTHM compliance under the Total Trihalomethanes Rule[1]. Compliance with the MRDL is based upon a running annual average, computed quarterly.

3.3.2 Disinfection By-Product Precursor Removal

In addition to establishing the MCLs and MRDLs, the Stage 1 D/DBP Rule requires the reduction of DBP precursors. The treatment technique specified is termed enhanced coagulation or enhanced precipitative softening and it uses total organic carbon (TOC) as a surrogate for natural organic matter (a DBP precursor material). Source water TOC concentration of >2.0 mg/L triggers implementation of this treatment technique. The Rule specifies the percentage of influent TOC that must be removed based on the raw water TOC and alkalinity levels, as shown in Table 7.

[1] The total Trihalomethanes Rule was promulgated in 1979 and based upon a running annual average of quarterly measurements of samples taken from the distribution system.

Table 6 Stage 1 D/DBP Rule MCL and MRDL (1)		
Constituent	Concentration (mg/L)	
	MCL	MCL
Total Trihalomethanes (TTHM)	0.080	- - -
Haloacetic Acids (HAA5)(1)	0.060	- - -
Bromate Ion (BrO_3^-)	0.010	- - -
Chlorite Ion (ClO_2^-)	1.0	- - -
Free Chlorine (3)	- - -	4.0
Chloramines(2)	- - -	4.0
Chlorine Dioxide	- - -	0.8

Notes:
1.Annual average compliance basis.
2.Sum of mono-, di-, tri-chloroacetic acids, and mono- and di-bromoacetic acids.
3.As total chlorine.

The removal requirements specified in Table 7 were developed with recognition of the fact that TOC removal tends to become more difficult as source water alkalinity increases and TOC decreases.

Table 7 Stage 1 D/DBP Required Removal of TOC by Enhanced Coagulation			
Raw Water TOC (mg/L)	Source Water Alkalinity (mg/Las $CaCO_3$)		
	0 to 60	>60 to 120	>120
>2.0 - 4.0	35.0%	25.0%	15.0%
>4.0 to 8.0	45.0%	35.0%	25.0%
>8.0	50.0%	40.0%	30.0%

Conventional treatment plants are required to monitor TOC concentrations by taking one “paired sample” per month. A paired sample consists of simultaneously measuring the TOC in a treated water sample (prior to the point of combined filter effluent turbidity monitoring) and the TOC in a source water sample (prior to any treatment). One source water alkalinity sample per month is also taken at the same time and location as the source water TOC sample. Reduced monitoring (per quarter) is permitted if the average annual treated water TOC is <2.0 mg/L for two consecutive years or <1.0 mg/L for one year. Compliance with the TOC requirement is calculated with a running annual average, computed quarterly.

A system can establish compliance with the treatment technology TOC removal requirement if any one of the following compliance criteria alternatives is met:

- Source water TOC <2.0 mg/L. When taken either monthly or computed as a running annual average, sampled quarterly.

- Finished water TOC <2.0 mg/L. When taken either monthly or computed as a running annual average, sampled quarterly.

- Source water Specific Ultraviolet Absorption (SUVA) <2.0 L/mg-m. When taken either monthly or computed as a running annual average, sampled quarterly.

- Finished Water SUVA <2.0 L/mg-m. When taken either monthly or computed as a running annual average, sampled quarterly.

- Source Water TOC <4.0 mg/L; Source Water Alkalinity >60 mg/L as CaCO3; TTHM <0.040 mg/L; HAA5 <0.030 mg/L when computed as a running annual average of quarterly samples.

- TTHM <0.040 mg/L; HAA5 <0.030 mg/L with only free chlorine as primary and secondary disinfectant.

Following a one-year monitoring period, systems that do not satisfy the TOC removal requirements or the alternative compliance criteria must conduct jar testing (Step 2) to determine alternative compliance criteria for TOC removal. Under the Step 2 protocol the alternative compliance criteria for TOC removal are defined either as:

- The dose of coagulant that achieves the percent removal dictated by the TOC removal matrix; or

- The percent TOC removal occurring at the point of diminishing return (PODR) for the coagulant. The PODR is defined as the point on the TOC removal-vs.-coagulant addition plot where the slope changes from >0.3/10 to <0.3/10 and stays at <0.3/10 until the target pH is reached.

3.4 Stage 2 Disinfectants and Disinfection By-Products Rule (2006)

All public water systems (PWS) serving populations greater than 500 people and using a primary disinfectant other than UV are subject to the Stage 2 DBP Rule. The purpose of this Rule is to strengthen the Stage 1 D/DBP Rule requirements and reduce occurrences of disinfection by-products concentration spikes in distribution systems. The MCLs for TTHMs and HAAs remain the same as those in the Stage 1 D/DBP Rule (80 and 60 µg/L respectively), but the manner in which compliance is calculated has changed.

For Stage 2, the MCLs for TTHMs and HAAs must be met as a locational running annual average (LRAA) at each monitoring location, rather than as the running annual average (RAA) of the system as a whole. Furthermore, samples must be taken during peak months of TTHM and HAA occurrence. The new compliance requirements are meant to enforce a reduction of average DBP concentrations at peak locations and peak times. For the compliance calculation, samples are taken at each monitoring location on a quarterly basis, and the LRAA is calculated as the average of the most recent sample and the three preceding samples.

Compliance monitoring under the Stage 2 DBP Rule was preceded by an Initial Distribution System Evaluation (IDSE) study to select site-specific optimal sampling points for capturing peak disinfection by-product concentrations. The City has completed the IDSE Plan and Report phases.

3.5 Lead and Copper

In 1991, the EPA promulgated the Federal Lead and Copper Rule (LCR). The State of Washington adopted this rule in 1995 with minimal changes. The LCR is intended to reduce the tap water concentrations that can occur when corrosive source water causes lead and copper to leach from water meters and other plumbing fixtures. Possible treatment techniques to reduce lead and copper leaching include addition of soda ash or sodium hydroxide to the source water prior to distribution.

The LCR establishes an action level (AL) of 0.015 mg/L for lead and 1.3 mg/L for copper based on 90th percentile level of tap water samples. The most recent revisions (2007) added the following requirements (required as of 12/10/09):

- **Monitoring**. The rule adds a new reduced monitoring requirement, which prevents water systems above the lead action level to remain on a reduced monitoring schedule.
- **Treatment**. Water systems must provide advanced notification and gain the approval of the primacy agency for intended changes in treatment or source water that could increase corrosion of lead.
- **Consumer notification**. All utilities must now provide a notification of tap water monitoring results for lead to owners and/or occupants of homes and buildings who consume water from the taps that are part of the utility’s sampling program.
- **Lead service line replacement**. Utilities must reconsider previously “tested-out” lines when resuming lead service line replacement programs. This provision only applies to systems that have:
  - Initiated a lead service line replacement program;
  - Complied with the lead action level for two consecutive monitoring periods and discontinued the lead service line replacement program; and
  - Subsequently were re-triggered into lead service line replacement.
  - All previously “tested-out” lines would then have to be tested again or added back into the sampling pool and considered for replacement.

An AL exceedance is not a violation but can trigger other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.

Samples must be collected at cold water taps in homes/buildings that are at high risk of lead/copper contamination as identified in 40 CFR 141.86(a). The number of sample sites is based on system size.

4.0 SURFACE WATER TREATMENT RULES

On June 29, 1989, the USEPA promulgated the Surface Water Treatment Rule (SWTR), which became effective on December 31, 1990. Systems using surface water or groundwater under the direct influence of surface water as a potable water source must provide treatment to reduce turbidity, *Giardia lamblia, Legionella*, viruses, and heterotrophic plate count (HPC) bacteria. Specifically, the SWTR establishes treatment and performance standards to provide a minimum reduction of 99.9 percent (3-log) for *Giardia* cysts, and 99.99 percent (4-log) reduction for viruses. The overall reduction of *Giardia* and viruses is to be achieved by multiple treatment barriers involving a combination of physical removal by pretreatment and filtration, and inactivation by disinfection.

The federal SWTR stipulates several specific requirements for turbidity and disinfection for filtration plants. For conventional filtration, the turbidity requirements are as follows:

- The turbidity of representative samples of a system's filtered water must be less than or equal to 0.5 NTU in at least 95 percent of the measurements taken each month.
- The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU.

Well-operated conventional treatment plants, which meet or exceed the 0.5 NTU effluent turbidity standard, are credited with a 2.5-log removal of *Giardia* cysts and a 2-log removal of viruses. Given this, the disinfection treatment must be sufficient to ensure the following:

- The disinfection treatment process achieves at least 0.5-log inactivation of Giardia cysts and at least a 2-log inactivation of viruses. Compliance with the disinfection requirement must be demonstrated by meeting minimum "CT" requirements, where "C" is the residual disinfectant concentration in mg/L, and "T" is the effective contact time in minutes with the disinfectant.
- The residual disinfectant concentration in the water entering the distribution system cannot be less than 0.2 mg/L of free chlorine or 0.5 mg/L of chloramine for more than four hours.
- The residual disinfectant concentration in the distribution system cannot be undetectable in more than 5 percent of the samples taken each month for any two consecutive months. Water in the distribution system with an HPC concentration less than or equal to 500 colony forming units (CFU)/mL is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement.

4.1 Interim Enhanced Surface Water Treatment Rule

Following promulgation of the SWTR in 1989, several waterborne outbreaks of *Cryptosporidiosis* occurred in the United States. In response, the SDWA required the EPA to promulgate an enhanced SWTR by November 1998 to address the risk of chlorine resistant pathogens such as *Cryptosporidium*. However, the rule was to have been based upon information obtained from the Information Collection Rule (ICR) that would not be available until mid-1999.

In order to address these concerns and comply with the 1998 congressional mandate, the USEPA expedited the development and promulgation of the Interim Enhanced Surface Water Treatment Rule (IESWTR) for large systems. The primary purposes of the IESWTR are:

- To improve control of microbial pathogens in drinking water, in particular, Cryptosporidium.
- To guard against significant increases in microbial risk that might otherwise occur when systems implement Stage 1 of the Disinfectants/Disinfection Byproducts Rule.

The IESWTR was final on December 16, 1998 and became effective in December 2001. The Rule built upon the treatment technique requirements of the SWTR with the following provisions:

- A Maximum Contaminant Level Goal (MCLG) of zero for the protozoan genus Cryptosporidium.
  - Surface water systems, like the Ashland WTP, which serve 10,000 or more people and are required to filter under the SWTR, must achieve at least 99 percent (2-log) removal of Cryptosporidium.
- The IESWTR strengthened turbidity performance requirements as measured every 4 hours in the combined filter effluent which include:
  - Average turbidity of < 0.3 NTU in 95 percent of the samples.
  - Maximum allowable turbidity of 1.0 NTU.
- Monitoring of individual filter effluents for process control is required every 15 minutes, with the exception that reporting to the State may be required based on the following criteria:
  - Any individual filter with an effluent turbidity >1.0 NTU based upon two consecutive measurements taken 15 minutes apart.
  - Any individual filter with an effluent turbidity > 0.5 NTU after 4 hours of ripening based on two measurements taken 15 minutes apart.
  - Self assessment in conformance with the EPA published guidelines is required for any filter with an effluent turbidity > 1.0 NTU, based upon two

measurements taken 15 minutes apart at any time in each of three consecutive months.

  - Comprehensive Performance Evaluation (CPE) in conformance with the EPA published guidelines is required for any filter with an effluent turbidity > 2.0 NTU, based upon two measurements taken 15 minutes apart at any time in each of two consecutive months.

- Microbial benchmarking/profiling requirements set forth by the Rule apply to systems which have, based on a one year running annual average of representative systems taken in the distribution system, measured:
  - TTHM levels of at least 80 percent of the MCL (64 µg/L).
  - HAA levels of at least 80 percent of the MCL (48 µg/L).

- Surface water and groundwater under the direct influence of surface water (GWUDI) systems are required to cover all new treated water reservoirs, holding tanks or other storage facilities.

4.2 Long Term 1 Enhanced Surface Water Treatment Rule

The Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was promulgated on January 14, 2002. This rule extended the requirements of the IESWTR to systems serving less than 10,000 people.

4.3 Long Term 2 Enhanced Surface Water Treatment Rule

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) was promulgated in December 2005, and published in the Federal Register on January 4, 2006. This rule applies to systems that use surface water or groundwater under the direct influence of surface water. The purpose of the LT2ESWTR is to reduce illnesses linked with *Cryptosporidium* and other disease-causing microorganisms in drinking water. The rule supplements existing regulations by targeting additional *Cryptosporidium* treatment requirements to higher risk systems.

4.3.1 Requirement 1 - Source Water Monitoring

Both filtered and unfiltered surface water systems were required to conduct a 24-month monitoring survey of their source water for Cryptosporidium. The action bin assignment is based upon sampling the source water for Cryptosporidium, E. coli, and turbidity on a predetermined schedule for 24 months. The Rule required bin determination by October 2010 for systems serving population of 10,000 to 49,999 people.

4.3.2 Requirement 2 - Risk-Based Treatment Requirements

The source water monitoring results will then be used to determine if the system's source is vulnerable to contamination and require additional treatment. Water systems are classified in one of four risk "Bins" (Table 8). If additional treatment is required, systems can choose from a range of options from the “microbial toolbox” (Table 9). It should be noted that under this rule, EPA recognizes that UV disinfection is available and feasible. The LT2ESWTR includes tables specifying UV doses needed to achieve up to 3-log inactivation of *Giardia lamblia*, up to 3-log inactivation of *Cryptosporidium*, and up to 4-log inactivation of viruses.

Following bin determination, the Rule provides a two-year window for treatment installation, and compliance monitoring will begin on October 1, 2013 for systems serving between 10,000 and 49,999 people, with potentially up to a two-year delay for capital improvements.

Additional treatment requirements are based, in part, on the assumption that conventional treatment plants with filtration performance in compliance with the IESWTR achieve an average of 3-log removal of *Cryptosporidium*. Given this, the total *Cryptosporidium* removal requirements for action bins 2 - 4 in Table 8 correspond to total *Cryptosporidium* removals of 4-, 5-, and 5.5-log, respectively.

<table>
<tr><th colspan="4">Table 8 Cryptosporidium Inactivation Requirements(1)</th></tr>
<tr><th rowspan="2">Bin Number</th><th rowspan="2">Average Source Water Cryptosporidium Concentration (oocysts/L)</th><th colspan="2">Additional Treatment Requirements (1)</th></tr>
<tr><th>Conventional filtration, diatomaceous earth filtration, or slow sand filtration</th><th>Direct filtration</th></tr>
<tr><td>1</td><td><0.075</td><td>No Action</td><td>No Action</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">0.075 to <1.0</td><td>1-log</td><td>1.5-log</td></tr>
<tr><td colspan="2">using any or all of the microbial toolbox technologies</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">1.0 to <3.0</td><td>2-log</td><td>2.5-log</td></tr>
<tr><td colspan="2"><u>with at least 1-log of credit earned using any of</u>:
• Bag/cartridge filters
• Bank filtration
• Chlorine dioxide
• Membranes
• Ozone
• UV</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">≥ 3.0</td><td>2.5-log</td><td>3.0-log</td></tr>
<tr><td colspan="2"><u>with at least 1-log of treatment accomplished using any of</u>:
• Bag/cartridge filters
• Bank filtration
• Chlorine dioxide
• Membranes
• Ozone
• UV</td></tr>
</table>

4.3.3 Other Requirements

In addition to the *Cryptosporidium* source water monitoring and removal requirements, the requirements of the LT2ESWTR are intended to ensure that systems maintain adequate protection against microbial pathogens as they take steps to reduce formation of disinfection by-products. Key provisions of the proposed LT2ESWTR relating to this effort include:

- Disinfection profiling and benchmarking to assure continued levels of microbial protection while Public Water Systems (PWS) take the necessary steps to comply with new disinfection by-product standards.
- Covering, treating, or implementing a risk management plan for uncovered finished water reservoirs.

Table 9 Microbial Toolbox Options (CFR 71(3), pp. 684-685)

Toolbox option	Maximum *Cryptosporidium* treatment credit possible
Source Protection and Management	
Watershed control program	0.5-log
Alternative source/ intake management.	No prescribed credit
Prefiltration	
Presedimentation basin with coagulation.	0.5-log
Two-stage lime softening	
Bank filtration	
Treatment Performance	
Combined filter performance	0.5-log
Individual filter performance	0.5-log credit (in addition to 0.5-log combined performance filter credit)
Demonstration of performance	Credit at discretion of the State
Additional Filtration	
Bag and cartridge filters	Up to 2- to 2.5-log
Membrane filtration	Credit at discretion of the State
Second stage filtration	0.5-log
Slow sand filters	2.5-log
Inactivation	
Chlorine dioxide	Log credit based on measured CT in relation to CT table
Ozone	Log credit based on measured CT in relation to CT table
UV	Log credit based on validated UV dose in relation to UV dose table; reactor validation testing required to establish UV dose and associated operating conditions.

4.4 Filter Backwash Recycling Rule

This rule was proposed on April 10, 2000 and promulgated on January 14, 2002 with compliance beginning on March 15, 2002. The purpose of this rule is to minimize *Cryptosporidium* concentrations in the treated water due to the recycling of sludge supernatant and filter backwash wastewater to the head of the treatment plant. The major requirements of this rule are as follows:

- Systems that recycle backwash waste must do so prior to the point of application of primary coagulant.
- Direct Filtration plants could be required to provide detailed recycle treatment information to the State (which could then require modifications).
- Conventional treatment plants that practice direct recycle, employ 20 or fewer filters to meet production requirements during a selected month, and recycle spent filter backwash water, thickener supernatant, and/or liquids from dewatering processes within the treatment process must perform a one month, one-time recycle self assessment. The self-assessment requires hydraulic flow monitoring and that certain data be reported to the State, which may require modifications to recycle practices, are made to protect public health.

5.0 REPORTING REQUIREMENTS

Federal regulations related to reporting requirements are discussed herein.

5.1 Consumer Confidence Report (CCR)

Each July, community water systems must provide an annual report to customers providing information as to the quality of their drinking water supply. These reports are referred to as "Consumer Confidence Reports" (CCR). These reports let customers know whether their water meets state and federal drinking water standards. The CCR includes information on the water source, the regulated and unregulated contaminants that have been detected during the year and their concentrations. The report also provides information on disinfection byproducts or microbial contaminants and the potential health effects of the contaminants at concentrations greater than the MCL. The likely source of the contaminants is identified and a summary of any violations in monitoring, reporting, or record keeping is included. The reports can assist customers with special health needs to make informed decisions regarding their drinking water. CCRs provide references and telephone numbers as to health effects data and available information about the water system in general.

The Consumer Confidence Report Rule was finalized on September 19, 1998. The City issues its annual *Drinking Water Report* prior to every July, as the rule requires. The 2003 through 2008, *Drinking Water Reports* are included in Appendix A.2.

5.2 Public Notification Rule

The Public Notification Rule (PNR) requires that public water systems notify their customers when they violate USEPA or State regulations (including monitoring requirements) or otherwise provide drinking water that may pose a risk to consumers' health. The original public notification requirements were established in the SDWA; the revised PNR was promulgated in 2000 as required by the 1996 SDWA amendments.

The PNE establishes three notification levels:

- **Immediate Notice (Tier 1).** In a situation where there is the potential for human health to be immediately impacted, notification is required within 24 hours.
- **Notice as Soon as Possible (Tier 2)**. In a situation where an MCL is exceeded or water has not been treated properly, but there is no threat to human health, notification is required as soon as possible and within 30 days.
- **Annual Notice (Tier 3)**. In a situation where a standard is violated that does not directly impact human health, notice must be provided within one year, likely within the system's CCR.

6.0 FUTURE REGULATORY REQUIREMENTS

Anticipated future regulatory requirements are summarized in Table 10. This table includes ongoing programs to introduce new regulatory requirements, under the Unregulated Contaminant Monitoring Rule and the Contaminant Candidate List, as well as specific rules and regulations currently under consideration. A brief description of anticipated requirements under each rule is provided herein. Effective and compliance dates were obtained from the Federal Register and EPA's Drinking Water Hotline and represent the best information available as of the date of this report.

Table 10 Future Regulatory Requirements

Proposed Rule	Affected Contaminants	Proposed Publication Date[1]
Unregulated Contaminant Monitoring Regulations	Unregulated Contaminants	UCMR2 anticipated 2012
Contaminant Candidate List	Unregulated Contaminants	CCL3 anticipated mid-2009
Regulatory Determination 3 (based on CCL 3)	Unregulated Contaminants	Proposed rule anticipated in 2012.
VOC Rule	Up to 24 VOCs (including some compounds already regulated)	Proposed rule anticipated in 2012-2013

Table 10 Future Regulatory Requirements		
Proposed Rule	**Affected Contaminants**	**Proposed Publication Date[1]**
Perchlorate	Perchlorate	Regulatory determination anticipated in 2013
Radon Rule	Radon	"To be determined"
Total Coliform Rule Revisions	Coliform Fecal Indicators	Final Rule anticipated in 2012
Lead and Copper Rule Revisions	Lead Copper	Proposed Rule anticipated in 2012-2013

6.1 Unregulated Contaminant Monitoring Rule

The USEPA UCMR is used to collect occurrence data for contaminants suspected to be present in drinking water, but do not yet have health-based standards. The current UCMR was discussed above in the *Source Water Quality* section. The UCMR is updated every five years. UCMR 3 was proposed on March 3, 2011; the final rule is anticipated in 2012. All systems serving greater than 10,000 persons will be required to monitor for List 1 contaminants between January 1, 2013 and December 31, 2015. The UCMR 3 includes 28 contaminants, as follows: seven hormones (17-β-estradiol, 17-α-ethynylestradiol, estriol, equilin, estrone, testosterone and 4-androstene-3,17-dione); six perfluorinated compounds (PFOS, PFOA, PFNA, PFHxS, PFHpA and PFBS); one solvent (1,4-dioxane); nine VOCs (1,2,3-trichloropropane, 1,3-butadiene, chloromethane, 1,1-dichloroethane, n-propylbenzene, bromomethane, sec-butylbenzene, HCFC-22 and halon 1011); four metals (cobalt, molybdenum, strontium and vanadium); and chlorate. USEPA is also considering adding chromium-VI to the list.

6.2 Contaminant Candidate List

The Contaminant Candidate List (CCL) aids in priority setting for the drinking water program. The USEPA conducts research on the following for CCL contaminants: health effects; analytical methods; treatment technologies, effectiveness, and costs; and occurrence. The second CCL (CCL2) included 51 contaminants; a regulatory determination on these contaminants is anticipated in Fall 2009. The third CCL (CCL3) is expected to be published in mid-2009. Neither CCL3 nor the regulatory determinations for CCL2 are anticipated to be an issue for the City.

The EPA uses the Contaminant Candidate List (CCL) to prioritize research and data collection efforts for future regulations. The contaminants on the list are known or anticipated to occur in public water systems, but are currently unregulated. The most recent version of the CCL was published in February 2008. In July 11 contaminants were removed from the list as part of the 2nd Regulatory Determination cycle. The current list includes 95 contaminants, 92 chemicals or chemical groups and 11 microbiological contaminants.

In developing this list, EPA employed a new classification process based on National Drinking Water Advisory Council (NDWAC) recommendations. The process began with the identification of 7,500 potential chemical and microbial contaminants in the "CCL 3 Universe." This list was narrowed to 560 potential contaminants on the preliminary CCL (PCCL) based on potential to occur in public water systems and the potential for public health concern. The PCCL was then pared down to a final list. EPA uses this list of unregulated contaminants to prioritize research and data collection efforts to help us determine whether specific contaminants should be regulated.

6.3 Volatile Organic Compounds Rule

On February 2nd, the Obama administration announced that it would impose limits on permissible levels of perchlorate (discussed above), VOCs, TCEs, and PCEs. This reverses a 2008 finding by the Bush administration that a nationwide standard for the chemical was unnecessary and would do little to reduce risks to human health.

A group of up to 16 carcinogenic VOCs (8 regulated and 8 unregulated) are anticipated to be regulated first (within the next 2 years), followed by nitrosamines. PCE and TCE will be regulated as a group with up to 14 other carcinogenic VOCs. Other candidates for inclusion are six VOCs currently regulated and up to eight VOCs from EPA's 3rd CCL: aniline, benzyl chloride, 1,3-butadiene, 1,1-dichloroethane, nitrobenzene, oxirane methyl, 1,2,3-trichloropropane (TCP), and urethane.

EPA submitted this regulatory decision to the Office of Management and Budget for review in 2010. Once the intent to regulate is published in the Federal Register, the EPA will have up to 24 months to propose an MCL.

6.4 Perchlorate

The USEPA made a preliminary determination in late 2008 to not set an MCL for perchlorate. In the EPA's *Interim Drinking Water Health Advisory for Perchlorate* released in December 2008, it was stated that a perchlorate concentration below 15 ppb would be sufficient to protect subpopulations. However, in February 2011, the USEPA published its official regulatory determination to regulate perchlorate under the SDWA, reversing the earlier decision. This action notifies interest parties of the USEPA's decision to regulate perchlorate, but does not in itself impose any requirements on water systems. The action initiates a process to develop and establish a national primary drinking water standard; a proposal is anticipated in 2013.

6.5 Radon Rule

The first proposed radon MCL of 300 pCi/L was proposed in August 2000. An alternative MCL of 4000 pCi/L with implementation of a Multimedia Mitigation Program targeted at reducing indoor-air risks has also been proposed. Final determination on a regulatory requirement for radon does not appear to be a priority for the EPA, as the major health concerns surrounding radon come from the contaminant being airborne, and not in water. The timing of a final rule is uncertain.

6.6 Total Coliform Rule Revisions

A revision to the Total Coliform Rule is anticipated for 2012. The primary focus of the revision would be to eliminate the total coliform MCL. Positive coliform samples would trigger further assessment for fecal indicators, which would then lead to corrective actions. As the rule stands now, positive coliform samples alone trigger corrective action or notification. The revisions are anticipated to be positive for the City, as it would reduce the probability of requiring public notification for total coliform samples that do not indicate a public health risk.

6.7 Revisions to the Lead and Copper Rule

The USEA continues to explore the possibility of developing long-term revisions to the Lead and Copper Rule (LCR), slated for 2012. Changes under consideration include:

- Modifying the definition of the tiering classifications for monitoring sites:
- Changing the sampling requirements for copper to include sampling for new copper installations;
- Changing the sampling protocol for non-residential buildings (i.e., schools), possibly requiring sampling in school buildings.
- Guidance on partial lead line replacement.

The Center for Disease Control is also reconsidering its level of concern for children which is currently 10 ug lead per dL blood.

Appendix B

OREGON DRINKING WATER PROGRAM CYANOTOXIN PROGRAM INFORMATION

Pipeline

Vol. 26 Issue 2 Spring 2011

OREGON DRINKING WATER NEWS public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.aspx

Oregon Public Health and the Department of Justice work to bring safe water to a Lincoln County public water system

Rose Lodge Water Company in Otis was supplying unsafe drinking water to hundreds of its customers

[The following is a press release issued by the Department of Justice on April 21, 2011.]

The Oregon Public Health Division along with Attorney General John Kroger today announced a Lincoln County Circuit Court ruling ordering the immediate sale of an Otis water company that provided untreated, untested and unfiltered water to about 600 homes in violation of the Oregon Drinking Water Quality Act.

Continued on page 2

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Program update

by Dave Leland

The last several months have been dominated by the Oregon legislative session, the state General Fund budget, and federal budget and deficit reduction.

The Oregon Legislature convened in January. Two specific bills were tracked by the Drinking Water Program. HB 3458, allowed backflow testers to do in-line repairs of backflow assemblies, but failed to gain stakeholder agreement, and so will be considered again next session. SB 693 required the Oregon Health Authority to set standards for and regulate packaged ice. This bill was amended to replace the reference to OHA with the more appropriate reference to the Oregon Department of Agriculture, which is the agency currently regulating packaged ice.

The Governor's Balanced Budget for 2011-2013 was issued in early February, as constitutionally required. The GBB proposed a fund shift for drinking water, replacing all $4 million in current General Fund moneys with fee revenue. Making this work requires new fee authority, and time left in the session is short to make that happen. State agency budgets will be worked on again in late May or early June following the final revenue forecast to be issued in May, so no further news is expected until then.

After many months of continuing resolutions, and a last-minute reprieve from a national

Continued on page 3

Lincoln County Circuit Court Judge Sheryl Bachart has signed an order requiring the appointment of a special master, or supervisory authority, to oversee the immediate sale of Rose Lodge Water Company, Inc., a public water system that supplied untreated surface water that potentially exposed people to numerous harmful pathogens and chemicals.

"We are confident that now the residents of this area will soon have a water system that provides safe drinking water," said Gail Shibley, Administrator of the Oregon Health Authority's Office of Environmental Public Health.

The Oregon Department of Justice worked with the Oregon Health Authority's Environmental Public Health Office to enforce drinking water quality standards. The extensive investigation found that, for at least two years, Rose Lodge Water Company delivered untreated, untested and unfiltered water to its customers. During that time, several consumers experienced illnesses that may have been caused by ingesting the water, including diarrhea, abdominal cramping, flu-like symptoms and extended periods of stomach sickness and digestive problems, according to affidavits in the case.

The court case came after Rose Lodge failed to respond to a series of attempted administrative actions by Oregon Public Health officials, including issuing notices of violations and assessing civil penalties. The action announced today will ensure that Rose Lodge is sold to a responsible party that will improve the systems to provide safe water. The Oregon Office of Environmental Public Health will continue monitoring the system.

"Oregonians should not have to second guess whether their drinking water is safe. There is absolutely no excuse for compromising public health," said Attorney General Kroger.

Senior Assistant Attorneys General Shannon O'Fallon and Stephanie Parent handled the case for the Oregon Department of Justice in conjunction with Joseph Carlson from the Oregon Health Authority.

Attorney General John Kroger leads the Oregon Department of Justice. The Department's mission is to fight crime and fraud, protect the environment, improve child welfare, promote a positive business climate, and defend the rights of all Oregonians.

Public water systems such as Rose Lodge are protected under Oregon's Drinking Water Quality Act, to minimize the public health risk from contaminants in drinking water. The Oregon Drinking Water program emphasizes prevention of contamination through source water protection, provision of technical assistance to water systems, and provides water system operator training so that Oregonians have safe drinking water.

The Oregon Drinking Water program lists all of it inspection and violation data on line. Oregonians can access data about their drinking water system at the Public Health web site.

PWS ID: 00722 ---- BOULDER CREEK WS/ ROSE LODGE: Violations Summary http://170.104.63.9/violsum.php?pwsno=00722

PWS ID: 00482 ---- BEAR CREEK HIDEOUT/ ROSE LODGE: Violations Summary http://170.104.63.9/violsum.php?pwsno=00482

government shutdown, the federal fiscal year 2011 budget is now in place. For drinking water, EPA primacy grants to states remain at current funding levels (Oregon gets about 1.6 percent of the national primacy grant total). However, the EPA drinking water revolving loan fund appropriation was reduced nearly 31 percent from the federal FY 2010 level to a total of just under $1 billion. Oregon currently gets the minimum 1 percent of that national allocation, which works out to about $10 million. We are hopeful that a more thorough and complete infrastructure needs survey, now under way in Oregon and all other states, will lead to an increase in Oregon's share in the future.

Expect a report on the outcomes of the 2011 Legislature in our summer edition!

Dave Leland is manager of the Drinking Water Program / 971-673-0415 or david.e.leland@state.or.us

Congratulations to our Outstanding Performers:

Water system name	County served
Albany Trailer Court	Linn
Ashdown Wood Water Company	Clackamas
Cove, City of	Union
Dietz Air Park Water System	Clackamas
Garibaldi Water System	Tillamook
Gervais Water Department	Marion
Glenmorrie Cooperative Assn	Clackamas
Indian Meadow Water Company	Deschutes
Johnson Creek Water Service	Lincoln
Kingswood Heights Water Co-op	Clackamas
Mount Vernon, City of	Grant
Netarts Water District	Tillamook
North Clackamas County WC	Clackamas
Oaks Mobile Home Park	Lane
Oakwood Water System Inc	Linn
Salmon Valley Water Company	Clackamas
South Fork Water Board	Clackamas
Tollgate Water Company	Deschutes
Wilson River Water District	Tillamook

These are the public water systems that have most recently met the established criteria for outstanding performance. Outstanding performers are systems with no significant deficiencies identified, as well as no unresolved violations. All systems are evaluated during their routine Water System Survey, and those that meet the outstanding performer criteria have their survey frequency (and fee!) reduced from every 3 years to every 5 years. To find out how to qualify, visit http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/osp.aspx.

DWP develops resources for cyanobacteria and drinking water

by Casey Lyon, R.E.H.S.

Cyanobacteria or blue-green algae are some of the smallest creatures on earth, but can cause big problems for public water systems (PWS). Not only do cyanobacteria clog filters, cause taste and odor complaints and are a general mess, cyanobacteria have the unique ability to produce toxins, known as cyanotoxins. Cyanotoxins are harmful to human and animal health. In 1996, 76 people in a kidney dialysis center in Brazil died from exposure to cyanotoxins in the water. Microcystin and cylindrospermopsin were the toxins found in the water that caused the acute liver failures. Microcystin was found at a concentration of 19 ppb; the World Health Organization threshold guideline is set at 1 ppb for microcystin. Laboratory analysis has confirmed that a potent cyanotoxin, called anatoxin-a, has killed dogs for two years in a row in Oregon. In 2009, laboratory analysis of the stomach contents of a dog exposed to cyanotoxins on the North Umpqua near Elkton revealed an anatoxin-a concentration of 10 ppb. In 2010, the stomach contents of a puppy exposed to cyanotoxins near Lawson Bar on the South Umpqua River had a measured anatoxin-a concentration of 100 ppb. Microcystin and anatoxin-a are the primary cyanotoxins of concern in Oregon, cylindrospermopsin is also of growing concern.

The Oregon Drinking Water Program (DWP) has recently made some significant changes regarding cyanobacteria and PWSs. Because the Environmental Protection Agency (EPA) has not yet developed any standards for these harmful cyanotoxins, states, such as Oregon, are developing their own health-protective measures with help from other states, countries and international organizations, such as the World Health Organization. The Oregon DWP is asking PWSs that are affected by cyanobacteria to test their water weekly during an algae bloom and provide public notice if necessary.

The response flow chart on page 5 describes the process a PWS is to follow when there is a suspected cyanobacteria impact to source water:

- First, collect a sample for identification and enumeration from the source waterbody to see if it is a toxin-producing harmful algae bloom (HAB).
- If so, the second thing to do is to test the raw water weekly for any toxins that are associated with the HAB throughout the bloom. Testing the water is the only way to know for sure if the water is safe to drink.
- If toxins are detected in the raw water, start testing the finished water weekly for associated toxins and notify any downstream PWS.
- If toxins are found in finished water, above 1 ppb, post a “DO NOT DRINK” public notice.

Weekly testing for these toxins can be expensive. The Oregon DWP recognizes this challenge and will attempt to cover the cost of toxin testing and shipping in 2011 through use of a limited federal drinking water protection grant. Here is how it works:

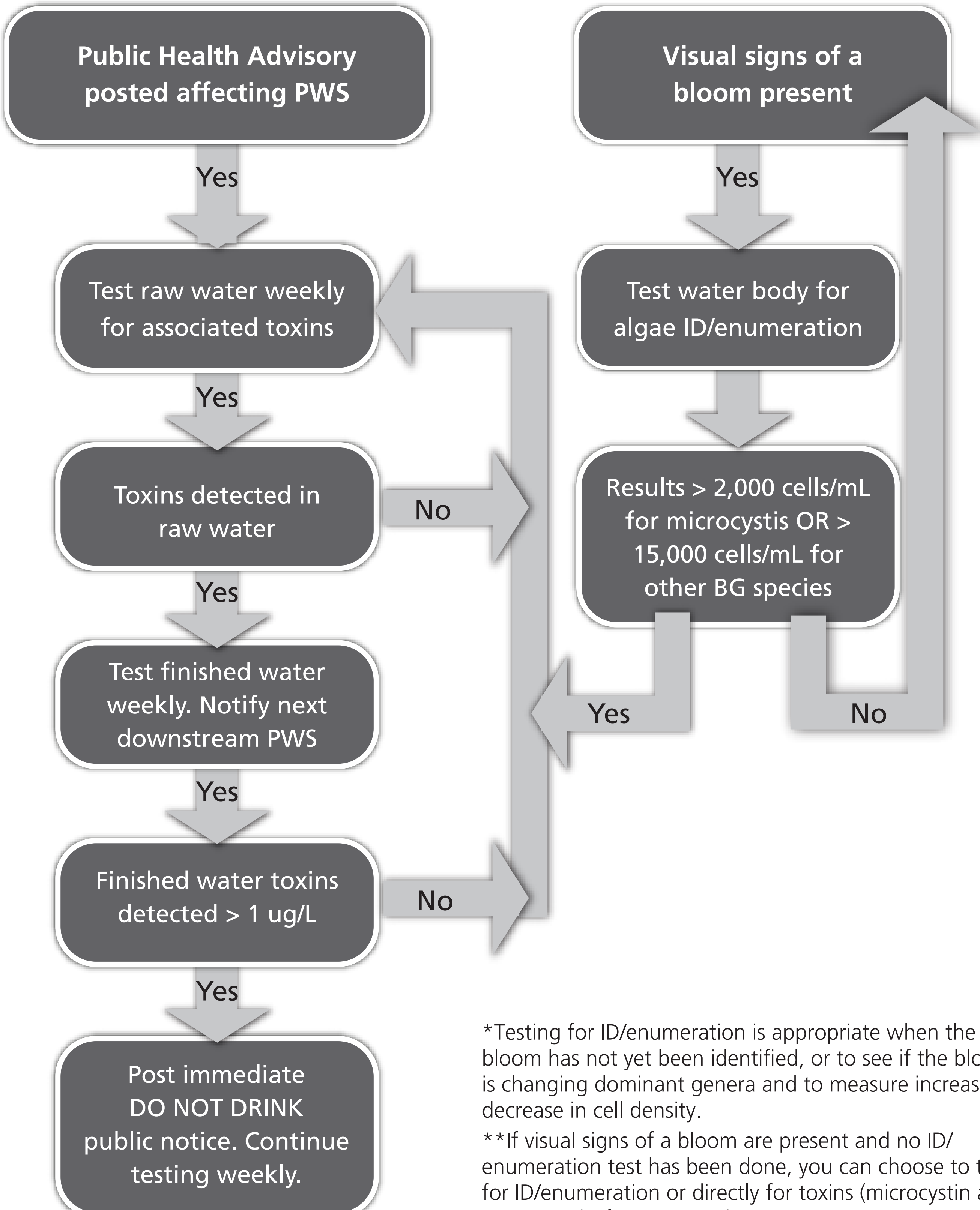
1. The PWS contacts their state regulator to discuss the particular situation in detail regarding an algae bloom and how it is affecting the PWS.

2. Upon approval by the DWP, the PWS will collect and ship the samples to a lab for weekly toxin analysis until the bloom is gone.

3. The PWS will send the invoices and test results from the lab and shipping to the DWP for payment. It is important to stay in communication with your state regulator regarding all test results, any changes in bloom activity and any treatment modifications during the bloom. Please make sure all the test results are sent to the state for record keeping.

Continued on page 6

Harmful algae bloom response flow chart for public water systems



*Testing for ID/enumeration is appropriate when the bloom has not yet been identified, or to see if the bloom is changing dominant genera and to measure increase or decrease in cell density.

**If visual signs of a bloom are present and no ID/enumeration test has been done, you can choose to test for ID/enumeration or directly for toxins (microcystin and anatoxin-a), if turn around time is an issue.

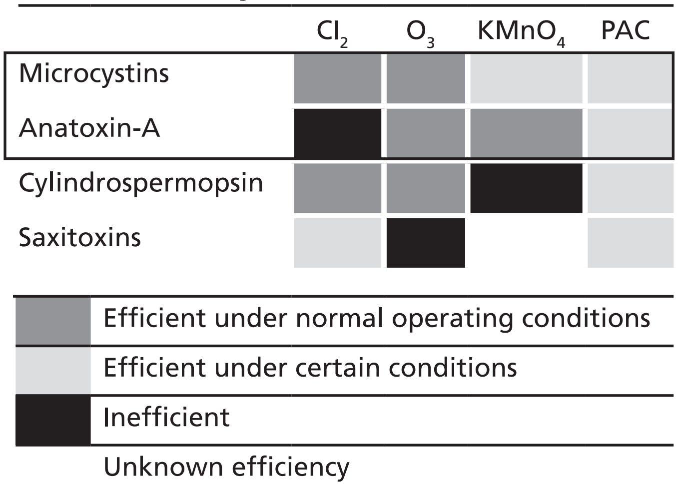
Treatment: There are several types of treatment that can be effective at removing cyanobacteria and their associated toxins. Historically, PWSs have used algaecides, such as copper sulfate, to get rid of the bloom; unfortunately, these types of chemicals and other oxidizing agents essentially break the cells apart releasing toxins into the water. Try to gently remove the intact cells because doing this will also remove most of the toxins as they are stored inside the intact cell. When the bloom is dying off or cells are breaking, the toxins are released and should be at their highest level; toxin levels should then decrease over the next three weeks. Treatment that is effective at removing intact cells are conventional particulate removal (> 90% expected removal) consisting of flocculation, sedimentation and filtration. Membrane filters (> 99% expected removal) and slow sand filtration (> 99% expected removal) are also very good at removing intact cells. Direct filters and cartridge filters are not as effective (> 60 % expected removal) and require frequent backwashing and filter replacements.

Once the intact algae cells are removed or filtered from the water, try to degrade or adsorb any soluble toxins that may be present after filtration. Chlorine can effectively degrade microcystin (>80% expected removal with proper CTs; see CT chart below). Chlorine is not effective against anatoxin-a. Ozone is another strong oxidant that is very effective against both microcystin and anatoxin-a (>98% expected degradation). Activated carbon is good at improving taste and odor and can also remove the toxins. UV light alone has not been very effective at degrading cyanotoxins, although advanced UV with hydrogen peroxide has shown some positive results against microcystin. See the treatment graph below left for more information regarding treatment.

For more information regarding cyanobacteria and water treatment, please go to our new algae Web page at: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/algae.aspx. For more information regarding HAB and cyanobacteria, visit healthoregon.org/hab.

Casey Lyon is a natural resource specialist in the Drinking Water Program / 541-726-2587 ext. 31 or casey.lyon@state.or.us

Known efficiency of unit treatment considered



From Mouchet & Bonnélye, 1998: Newcombe & Nicholson, 2004: Rodriguez et al. 2007.

Chlorine CT values required for reducing microcystin LR concentration to 1 ug/L

Example: If you know the toxin level is 50 ppb and you want to reduce the level down to 1 ppb, with a temperature of 10° C and pH of 7, you will need a CT of 67.7. High pH water takes longer to degrade microcystin.

pH	Microcystin- LR Concentration	CT (mg/l x min)			
		10°C	**15°C**	**20°C**	**25°C**
6	50 µg/l	46.6	40.2	34.8	30.8
	10 µg/l	27.4	23.6	20.5	17.8
7	50 µg/l	67.7	58.4	50.6	44.0
	10 µg/l	39.8	34.4	29.8	25.9
8	50 µg/l	187.1	161.3	139.8	121.8
	10 µg/l	110.3	94.9	82.8	71.7
9	50 µg/l	617.2	526.0	458.6	399.1
	10 µg/l	363.3	309.6	269.8	234.9

Westrick, J. A. (2003). Everything a manager should know about algal toxins but was afraid to ask. JAWWA 95 (9):26-34.

What is your certification number?

by Dottie Reynolds

Quick, what is your certification ID number? It will start with a D or a T

But what are the four digits after that? It is either D-1234 or T-1234. Do not forget the dash. Your certification number is individually assigned to you. And no one else! Your certification number is your personal water industry work number. Why should you bother remembering your certification number? A couple of reasons:

✓You will need your certification number in order to log on for the yearly online renewal and electronic payment, or to change your address or telephone number. Please get used to renewing your certification online.

✓If you are a certified operator, you will need your certification number every time you attend a class, training or conference. It is a requirement to write down your certification number as well as signing the class attendance roster. We did away with asking for Social Security ID numbers and are asking for your certification ID number instead.

Where is your current wallet certificate? Uh hah! Not in your wallet you say? Please always remember to put your wallet certificate in your wallet. You will then always have the number at your disposal.

Where is your current wall certificate? Each time you pass an exam you should receive a new wall certificate with your certification type and level, the program manager signature and the Oregon State Seal. Put the certificate in an 8”x11” frame and attach it on your office wall or next to your work station! Show off your professional certification to others!

Congratulations to the April exam takers! One hundred percent passed their exams!

Dottie Reynolds is the Operator Certification Unit coordinator in the Drinking Water Program / 971-673-0426 or dottie.e.reynolds@state.or.us

Surface water systems – Do you need a tracer study?

by Gregg Baird

Oregon drinking water rules require water systems to conduct a tracer study to determine actual contact time (T) in reservoirs and clearwells that are used for disinfection to treat surface water. A tracer study involves sending a known quantity of a tracer (usually chlorine or fluoride) through the reservoir or clearwell and tracking how long it takes (in minutes) for 10% (also known as T_{10}) to be detected. The contact time is the number that is recorded in the "T" column of the surface water quality report that is submitted monthly to the state. Contact time (T) is multiplied by the concentration of chlorine (C) to determine the actual CTs that a treatment plant is achieving.

You need to do or redo a tracer study if any of the following are true:

- You are a public water system that uses surface water and you have never done a tracer study or you are not sure how the contact time for your system was determined;
- You have added or subtracted a reservoir or clearwell that is used for contact time since the last tracer study;
- You used an estimated peak demand flow or plant flow in your original tracer study. Some older tracer studies used estimates of peak demand flow and this is no longer allowed. Peak demand flow coming out of a reservoir as measured by a flow meter must be used because it may be greater than plant flow;
- You used an estimated baffling factor in order to calculate the contact time;
- The current peak demand flow is more than 10% greater than the peak flow at the time of the last tracer study.

The state Drinking Water Program (DWP) encourages all surface water treatment plant operators to review their last tracer study and make sure it is still valid and that they understand how contact time T was determined. If you are unsure whether your tracer study is still valid, call your DWP representative. Remember: it is a significant deficiency if it is identified during a water system survey that a tracer study needs to be done!

Special note about plug flow: If you know for sure that all the disinfection contact time for your treatment plant is achieved in a transmission pipeline, then a tracer study may not be required. Since water moves as a whole unit through a pipe (plug flow), the contact time (T) can be determined from a calculation based on the volume of the pipe and the flowrate.

Community water systems that serve populations of fewer than 10,000 people are eligible to use the DWP circuit rider, HBH Consulting Engineers, to conduct a tracer study at no cost. To utilize the circuit rider, contact Robert Henry at 503-625-8065 or 1-866-669-6603, or e-mail rhenry@hbh-consulting.com and let him know you want to use the DWP circuit rider program for a tracer study.

If you decide to use your own consultant or use your own staff to do the tracer study in-house, please submit a proposal detailing how the tracer study will be conducted to your DWP representative for review and approval prior to conducting the study. Once the tracer study is complete, submit a copy of the results to the state DWP. After the final tracer study is reviewed and approved, you can begin to use the new contact time (T) to calculate daily CTs achieved on your monthly surface water quality report!

Gregg Baird is an environmental specialist in the Technical Services Unit of the Drinking Water Program / 971-673-0410 or gregg.c.baird@state.or.us

New! DWP offers advanced Small Water System Training Course 201

Operators of community or non-transient non-community small groundwater systems (<150 connections) must recertify every three years. Up to now, there was only one course that these operators could take to meet the recertification requirement — the free Basics for Small Water Systems (SWS) training course, taught in recent years by OAWU, or the equivalent training offered online.

This year, in addition to the basic course, the Oregon Drinking Water Program (DWP) is piloting an **advanced** course for groundwater system operators that have completed the basic SWS training course two or more times. If you meet these criteria, you may prefer to take the new hands-on course that we are calling "SWS 201" for your next recertification training. The advanced course will be taught by DWP staff less frequently than the basic course: only four times a year, at locations that vary throughout the state.

This free one-day course is designed with an interactive format for a smaller group of participants. It will cover topics not addressed in the original Small Water System class, such as:

- The basics of water treatment (calibrating equipment, calculating dosages, maintaining chlorine residual, etc.);
- How to properly disinfect wells, lines, and storage tanks;
- Operator responsibilities under the Ground Water Rule; and
- Determining appropriate management practices to protect the quality of your drinking water source.

As with the original Small Water System operator course, SWS 201 is free, and will provide the required CEUs for operator recertification.

The next SWS 201 class offerings will be:

Sept. 14, 2011 8:30 – 4:30 Register by: August 24	Deschutes Service Building De Armond Room 1300 NW Wall St, Bend, OR 97701
Oct. 26, 2011 8:30 – 4:30 Register by: October 5	Clackamas Community College Gregory Forum Room 108A 19600 Molalla Ave Oregon City, OR 97045

Class size will be limited to allow for the hands-on activities, so register early if possible, and at least by the cutoff date listed at left. The lead time allows our instructors to prepare materials specific to the water systems that will be represented in the classroom. SWS 201 registration will be handled by our DWP Springfield office. Sign up by contacting Drue Edney at 541-726-2587, Ext. 25, or drue.edney@state.or.us.

- **To register, contact Drue Edney at 541-726-2587, Ext. 25, or drue.edney@state.or.us.**
- **For other questions about the new SWS 201 course, call Betsy Parry at 541-726-2587, Ext. 30.**
- **For operator certification questions, see our website (http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/certif.aspx) or call Dottie Reynolds or Lee Keyes at 971-673-0413, or 1-800-422-6012.**

It's coming! Mark your calendars!

by Adam DeSemple

The 2011 Drinking Water State Revolving Loan Fund Letter of Interest will be released in July 2011.

Who is eligible for the Drinking Water State Revolving Loan Fund?

Public water systems that are classified as "community" and/or "non-transient non-community" are eligible to receive funding for projects necessary to comply with public drinking water standards specified within the 1996 Safe Drinking Water Act amendments. A portion of the state revolving funds targets systems serving fewer than 10,000 individuals.

What is offered?

- Loan rates from 1 percent to 4 percent depending on water system type and status; repayment terms from 20 to 30 years;
- Principal forgiveness of equal-to-or-greater-than 30 percent of the loan amount, with an emphasis on "disadvantaged communities," consolidating small or adjacent water systems, and implementing green infrastructure or energy efficiency;
- Loan servicing by Business Oregon (aka: Oregon Business Development Department) — specifically, their newly re-organized section called the Infrastructure Finance Authority;
- Loans tailored to meet the specific funding and repayment requirements of the water system.

What to do?

Submit a Letter of Interest postmarked no later than Sept. 26, 2011. Here's how:

- Go to the Drinking Water SRF website at http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/srlf.aspx.
- When available, a direct link to the 2011 Letter of Interest materials will appear there (anticipated in mid- to late July).
- Complete and return a Letter of Interest, which is the preliminary data collection tool for the State Revolving Fund program. The Letter of Interest packet is designed for easy use and will walk you through the necessary information (mostly check-off boxes and short narrative answers). The Letter of Interest can cover any one phase or a combination of phases for a project (e.g., planning, engineering, construction).
- Drinking Water Program circuit riders can assist eligible water systems with Letters of Interest and other funding applications. Please contact Robert Henry of HBH Consulting Engineers Inc. at 503-625-8065 or 1-866-669-6603, or by e-mail at rhenry@hbh-consulting.com.

Need more information?

It's as easy as:

1. **Visiting** the Drinking Water Program website at http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.aspx;
2. **Calling** our new State Revolving Loan Fund coordinator, Adam DeSemple, at 971-673-0422, or e-mailing him at adam.desemple@state.or.us; or
3. **Contacting** Business Oregon at 503-986-0123, 1-800-233-3306 or online at www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Water-or-Wastewater-Improvement-Project/Safe-drinking-water-revolving-loan-fund/.

Continued on next page

Final note: There are two state agencies involved in the Oregon State Revolving Fund process. Drinking Water Program staff review and rank the incoming Letters of Interest against standard criteria for state revolving funds. Business Oregon's Infrastructure Finance Authority handles "loan servicing." In other words, Infrastructure Finance Authority acts as the "bank" for these loan funds. You may contact either agency using the information listed.

Adam DeSemple is the State Revolving Loan Fund coordinator for the Drinking Water Program / 971-673-0422 or adam.desemple@state.or.us

Bob Ault is the program specialist for Business Oregon / 503-986-0133 or robert.ault@state.or.us

MEETING CALENDAR

Drinking Water Advisory Committee

Oregon Health Authority
Diane Weis / 971-673-0427

July 20, 2011
October 19, 2011

All meetings are held at the Public Utility Commission Office, 550 Capitol St., N.E., Salem, Oregon, 97310

Cross Connection Advisory Board

Go to: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/CrossConnection/Pages/advisoryboard.aspx

Oregon Environmental Services Advisory Council

Go to: www.oesac.org/meeting_schedule.aspx

TRAINING CALENDAR

CEUs for Water System Operators

Check www.oesac.com for new offerings approved for drinking water

OAWU
503-873-8353

Aug.22-25	Summer Classic XVII
Sept.20-22	Water (WT/WD) Certification Review
Sept.27-29	Water (WT/WD) Certification Review

Oregon APWA Training Program
541-994-3201

June 27-29	Sustainability in Public Works Conference

Cross Connection/Backflow Courses

Backflow Management Inc. (B)
503-255-1619

Clackamas Community College (C)
503-594-3345

Backflow Assembly Tester Course

Sept.12-16	Portland (B)

Backflow Assembly Tester Recertification

June 23-24	Oregon City (C)
June 24	Portland (B)
June 24	Redmond (B)
June 29	Portland (B)
June 30	Portland (B)

Cross Connection Inspector Course

June 20-23	Portland (B)

Continued on next page

PUBLIC HEALTH DIVISION
Drinking Water Program
P.O. Box 14450
Portland, OR 97293-0450

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Working to ensure the quality of Oregon's public drinking water, PIPELINE provides useful information on technology, training, and regulatory and policy issues for individuals, organizations and agencies involved with the state's public water systems. PIPELINE may be copied or reproduced without permission provided credit is given.

This document can be provided upon request in alternative formats for individuals with disabilities. Other formats may include (but are not limited to) large print, Braille, audio recordings, Web-based communications and other electronic formats. Call 971-673-0427 to arrange for the alternative format that will work best for you.

Cross Connection Inspector Recertification

June 24	Oregon City (C)

Small Water System Training Course

503-873-8353

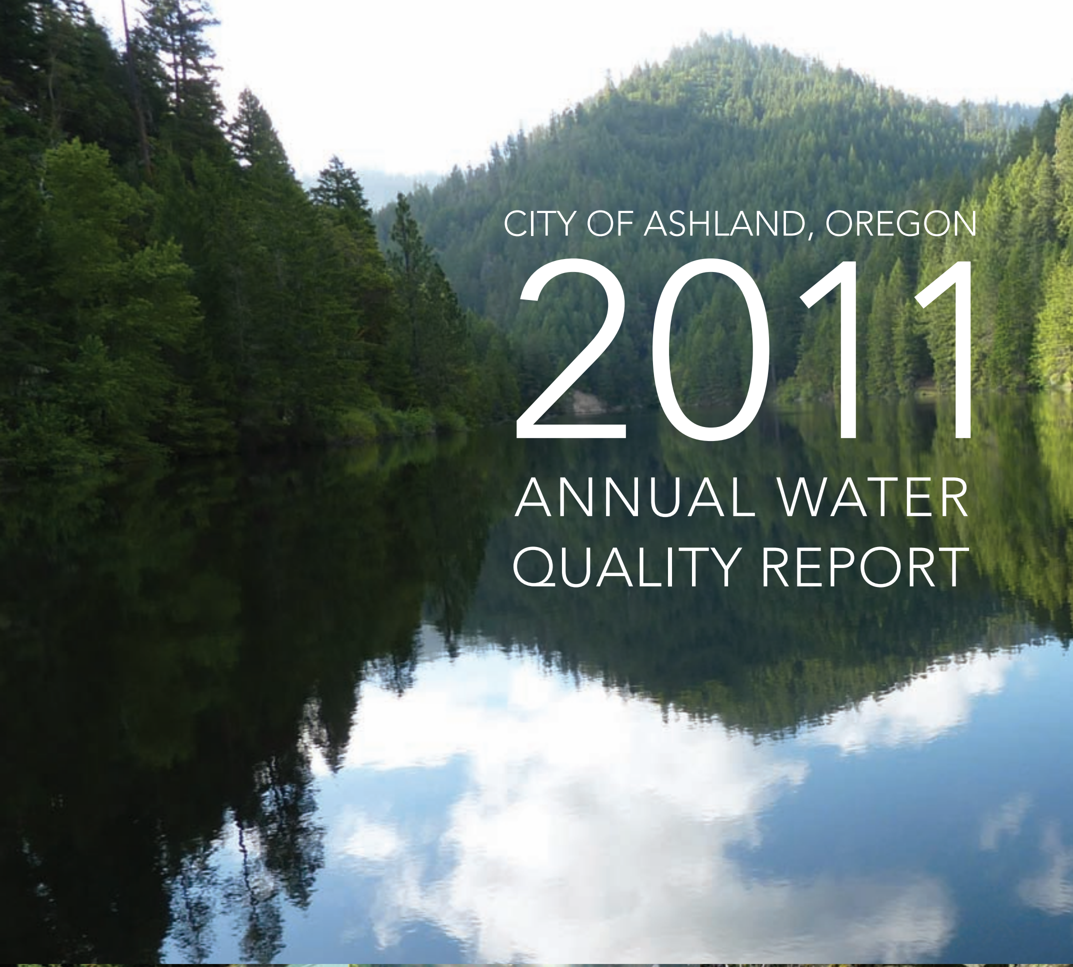
July 13	Newport
July 19	Klamath Falls
Aug. 12	Bend
Aug. 17	Eagle Point
Aug. 22	Seaside
Sept. 13	Independence
Sept. 15	Springfield

Appendix C

2011 WATER QUALITY REPORT

CITY OF ASHLAND, OREGON

2011 ANNUAL WATER QUALITY REPORT



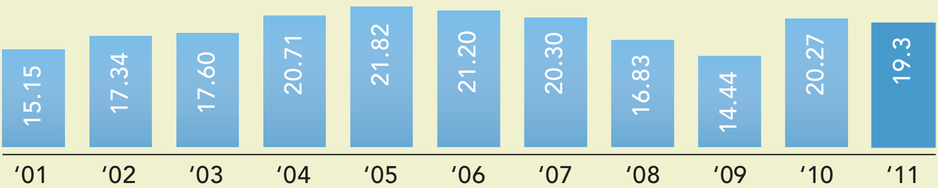
THE CITY OF ASHLAND PROVIDES EXCEPTIONAL WATER FOR YOU!

The City of Ashland vigilantly safeguards its water supplies in order to continue providing safe drinking water for our residents and add to the livability of our great city. Once again, we are proud to report that last year, as in years past, your tap water met all U.S. Environmental Protection Agency (EPA) and state drinking water health standards.

Other than the air we breathe, water is the single most important element in our lives— and is a limited resource. Remember to use only the water you need and keep looking for new ways to conserve water

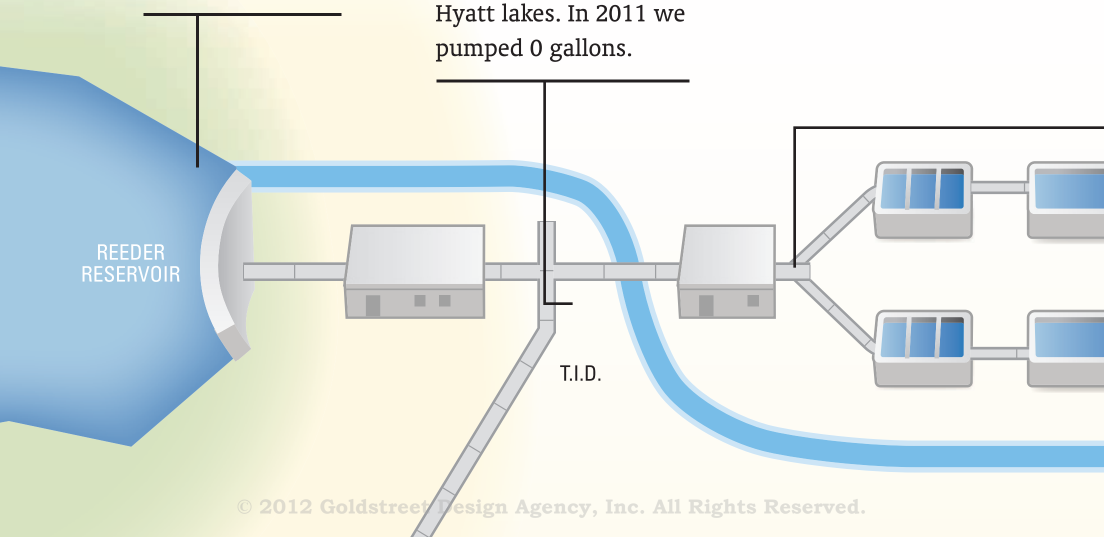
The average snowfall on Mt. Ashland is 263 inches with an average maximum depth of 120 inches. This is based on daily records kept by Mt. Ashland starting in 1983. In drought years such as 2001 and 2009, water can also be taken from the Talent Irrigation District (T.I.D.) canals, which are fed by Howard Prairie Reservoir and Hyatt Lake.

2001-2011 ASHLAND YEARLY RAINFALL
(in inches)



Talent Irrigation District Water (T.I.D.)
During times of drought or water short years, the City supplements Reeder Reservoir with T.I.D. water. The source is Howard Prairie and Hyatt lakes. In 2011 we pumped 0 gallons.

Water Collection
Water collected in Reeder Reservoir is piped to the treatment plant.

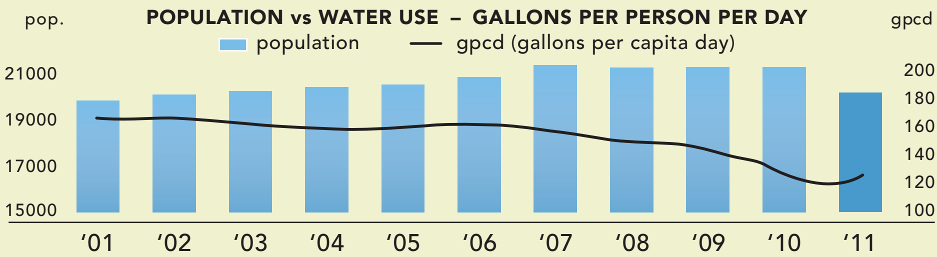


in and around your home. The City of Ashland has numerous water conservation programs. Call 541-552-2062 for more information.

Reeder Reservoir is small in comparison to summer water demands.

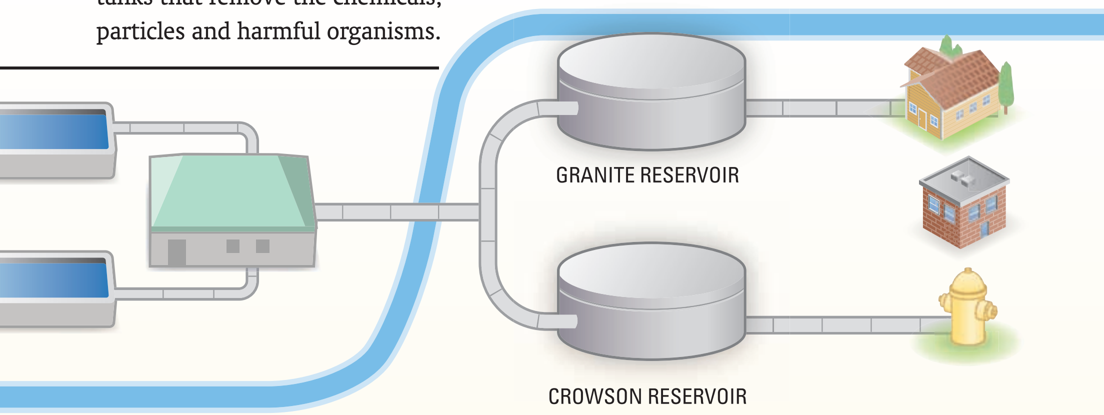
Inflow to the reservoir from the east and west forks of Ashland Creek cannot match this demand. The reservoir water will then begin to reduce in volume.

- Grow your garden
- Water your trees
- Just don't water the gutter please



Water Treatment
Aluminum sulfate, chlorine, and polymers are added to the water. These coagulating chemicals "stick" to impurities and harmful micro organisms. The particles attached to these chemicals are given time to grow by mixing in contact basins. This treated water then flows into filtration tanks that remove the chemicals, particles and harmful organisms.

Water Distribution
Clean water fills both 2.2 million gallon Crowson Reservior and 2.1 million gallon Granite Reservoir. Water is pumped to Alsing and Fallon Reservoirs at the east and west ends of town. From these four reservoirs, water enters the system that feeds Ashland's fire hydrants, homes and businesses.



Water Quality Analysis Results

The US Environmental Protection Agency requires that water systems report annually on contaminants that have been detected in their water supplies. The City of Ashland monitors for over 100 contaminants, including coliform bacteria, micro

Variable	90th percentile values	# of samples exceeding action levels	Action Level	MCLG*	Source of contaminant
Copper (ppm*)	0.6470	0 of 31 samples collected.	Exceeds action level if more than 10% of homes tested have copper levels greater that 1.3ppm	1.3 ppm. Treatment technique required	Corrosion of plumbing systems
Lead (ppm*)	0.002	0 of 31 samples collected.	Exceeds Action Level if 10% of homes tested have lead levels greater than 0.015 ppm	None	Corrosion of plumbing systems

INORGANICS TEST WAS CONDUCTED IN 2004—NEXT DUE IN 2013.

Variable	Ashland's Detected Level	MCL*	MCLG*	Source of contaminant
Barium (ppm*)	0.0051	2	2	Erosion of natural deposits
Nitrates (ppm*)	None	10.0	None	Naturally present in the environment. Also from septic tanks, fertilizers.

CONTROL OF DISINFECTION BY-PRODUCTS TOTAL ORGANIC CARBON (TOC)

TOC Raw (ppm*)	Average: 2.7 Range: 1.8-4.5	Treatment technique	None	Naturally present in the environment.
TOC Finished (ppm*)	Average: 1.2 Range: 0.8-1.9	Treatment technique	None	Naturally present in the environment.

No health effects, however, TOC provides a medium for the formation of Disinfection By-Products (DBP) which may lead to adverse health effects as described under TTHM's and HAA's.

Variable	Maximum Amount Detected	Ashland's Detected Level	MCL*	MCLG*	Source Of Contaminant
Turbidity (NTU*)	0.083	Average 0.02 Range 0.02 - 0.83 99% of the samples within limits	0.30	N/A	Soil erosion and stream sediments

Turbidity is measured in NTUs (Nephelometric Turbidity Units): a measure of the clarity of water. On 6-21-11 the drinking water plant turbidity momentarily reached a 0.83 NTU due to treatment difficulties. The Plant was shut down and changes to the treatment processes were made. Due to the short duration of the high NTU, a few minutes, no violation occurred. Turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses and parasites that can cause symptoms such as nausea, cramps, diarrhea and associated headaches.

organisms, herbicides, organics, inorganics, and pesticides. We collect samples from the watershed, water plant, distribution system, and at customers' taps. Ashland's water supplies meet or surpass federal and state drinking water standards.

SECONDARY TESTING

Variable	Ashland's Detected Level	MCL*	MCLG*	Source of contaminant
Sodium (ppm*)	7.7	No limit	N/A	Erosion of natural deposits and treatment additive for disinfection

Some people who drink water containing asbestos in excess of 7.0 MFL over many years may have an increase of developing intestinal polyps. Asbestos is tested every 9 years. The next test is due in 2012.

DISINFECTION AND DISINFECTION BY-PRODUCTS (DBP)

Variable	Ashland's Detected Level	MCL*	MCLG*	Source of contaminant
Chlorine Residual (ppm*)	Average: 0.39 Range: 0.08-0.64	4.0	N/A	Treatment additive for disinfection
Total Trihalomethanes (ppm*)	Average: 0.034 Range: 0.030- 0.041	0.080	N/A	By-products of chlorination used in water treatment
Haloacetic Acids (ppm*)	Average: 0.032 Range: 0.029- 0.040	0.060	N/A	By-products of chlorination used in water treatment

Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience problems with their liver, kidneys, or central nervous system, and may have an increased risk of getting cancer. Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.

DEFINITIONS

Maximum Contaminant Level Goal (MCLG). The level of contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Maximum Contaminant Level (MCL). The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.**Action Level.** The concentration of a contaminant which, if exceeded, triggers treatment or other requirement which a water system must follow.

Non-Detectable (ND). Not detected at an established minimum reporting level.

Treatment Technique (TT). A required process intended to reduce the level of contaminant in drinking water.

(ppm) Parts per million

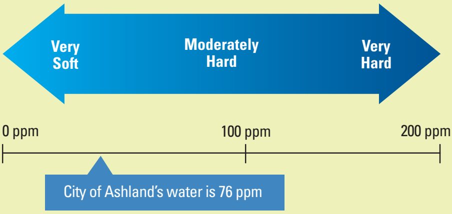
(ppb) Parts per billion

(NTU) Nephelometric Turbidity Units

(MFL) Million Fibers per Liter

MORE FACTS ABOUT ASHLAND'S WATER

Ashland water is very soft. It ranges from 30 to 50 ppm of calcium. Ashland's water has an average pH of 7.2—which is essentially neutral. Ashland does not add fluoride to the water. Parents of young children may want to consult with their dentist about the need for fluoride treatments to prevent tooth decay.



Contact information and resources

Greg Hunter
Water Plant Supervisor
541-488-5345

Mike Morrison
Public Works
Superintendent
541-488-5353

Mike Faught
Public Works Director
541-488-5587

Julie Smitherman
Water Conservation
Specialist
541-552-2062

Oregon Health Authority
971-673-0405

EPA Safe Drinking Hotline
800-426-4791

Jackson County Health Department
541-774-8206

TTY Number (hearing impaired)
800-735-2900

Spanish
800-735-3896

Why Provide A Water Quality Report

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.
- Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- Radioactive contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Therefore, the City of Ashland proudly produces a water quality report each year, so residents can learn about the health information of our water.

Contact information and resources

City Council meetings
541-488-6002
1st and 3rd Tuesdays at 7:00 pm

Budget Committee
541-488-6002
Usually in April and May each year

Talent Irrigation District Board Meetings
541-535-1529

Forest Land Commission
541-552-2066
www.ashland.or.us

Message From The EPA

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791). Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Ashland is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, you may wish to have your water tested.

Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

The City of Ashland
20 East Main St.
Ashland, OR 97520

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Appendix D

DEVELOPMENT OF THE INITIAL DISTRIBUTION SYSTEM EVALUATION PLAN MEMORANDUM

carollo engineers

Route

DRAFT Technical Memorandum

To:	Paula Brown, Pieter Smeenk, Daryl McVey		
From:	Nicki Pozos	**Reviewed by:**	Mark Knudson
Date:	May 25, 2007	**WO#:**	7650A.00 T06
Subject:	City of Ashland Development of the Initial Distribution System Evaluation Plan		

The purpose of this memorandum is to describe the process used to develop the Initial Distribution System Evaluation (IDSE) Plan for the City of Ashland. The IDSE is a requirement of the USEPA Stage 2 Disinfectants and Disinfection By-Products Rule (DBPR), which was promulgated in January 2006. The purpose of the IDSE is to identify new monitoring points representing the range of DBP levels in the City's distribution system, including the highest trihalomethane (THM) and haloacetic acid (HAA) levels.

Compliance Schedule

Based on the City's current population of 21,430 persons, the City is on "Schedule 3" under the Stage 2 DBPR, with the following compliance dates:

- October 1, 2007 - Submit IDSE Plan to USEPA
- September 30, 2009 - Complete standard monitoring. Monitoring may be initiated either once USEPA approval is received, or within one year of submission, if approval is not yet received.
- January 10, 2010 - Submit IDSE Report. The report will identify Stage 2 DBPR compliance sites based on the results of the IDSE monitoring.
- October 1, 2013 - Begin compliance monitoring

IDSE Plan Options and Approach

There are three options available to Ashland for completing an IDSE plan, as follows:

- **40/30 waiver**. Systems with no previous THM and HAA samples greater than 40 and 30 µg/L, respectively, are exempt from the IDSE. The City does not fall under this category.
- **System Specific Study (SSS)**. Systems may use either a distribution system hydraulic model or historical data to conduct an SSS. This option was not selected for the City as

it requires the hydraulic model to meet stringent requirements and has high documentation requirements.

- **Standard Monitoring Plan (SMP).** The SMP is the default option for systems not suited to the other two options and was selected for the City. The SMP uses available information, including hydraulic model results, historical chlorine residual data, and the system configuration, to identify sites likely to have high THM and/or HAA levels.

A fourth option, the very small system waiver, is suitable only for communities serving less than 500 customers and is not applicable to Ashland.

Standard Monitoring Plan Requirements

For communities serving between 10,000 and 49,999 persons, the SMP requires the identification of eight IDSE sample sites, as follows:

- **One Entry Point Site**. Source water entry point sites should be located upstream of the first user.

- **Three High THM Sites**. High THM levels are generally associated with high water age and low chlorine residuals.

- **Two High HAA Sites.** High HAA levels are generally associated with the same factors as high THM levels. However, HAAs may be biodegraded by microorganisms in the distribution system, particularly in areas with very low chlorine residuals. In such systems, high HAA sites will be located in areas that have high water age, but also have at least a moderate chlorine residual.

- **Two Average Residence Time Sites.** The purpose of including the average residence time sites is to capture potentially high HAA sites in systems that have biodegradation. Average residence time sites may be identified using chlorine residuals and a hydraulic model.

The selected IDSE sample sites and the selection process are described in the IDSE Plan. The IDSE Plan also includes the following:

- **Identification of the Peak THM/HAA Month.** The peak THM/HAA month may be determined based on historical THM/HAA data, or alternately may be identified based on the peak temperature month.

- **Proposed IDSE Sampling Schedule.** For systems the size of the City, the IDSE sites must be sampled bimonthly for one year, for a total of 6 rounds of sampling. One of the sampling dates must be during the month of peak THM/HAA formation. Systems must specify the exact week during which they will conduct each sampling. Any deviations from the schedule must be explained in the IDSE Report.

- **Stage 1 DBPR Sampling Schedule**. Systems must specify the exact week during which they will conduct each sampling for Stage 1 DBPR compliance; any deviations must be explained in the IDSE Report.

IDSE Sample Site Selection

The evaluation of IDSE sample sites for the City was based on three sources of information, as summarized in Table 1:

- Water age calculated using the City's hydraulic model, as shown in Figure 1.
- Historical chlorine residual concentrations at Total Coliform Rule (TCR) monitoring locations.
- Historical THM and HAA concentrations at Stage 1 DBPR monitoring sites.

In addition, the sites were selected to provide good geographic representation of the City's distribution system.

Table 1 Total Coliform Rule Monitoring Sites
IDSE Plan
City of Ashland

Sample Site	Calculated Water Age (hrs)[1]	10th Percentile Chlorine Residual (mg/L)[2]	Average THM Level (mg/L)[3]	Average HAA Level (mg/L)[3]
1 - Crowson Reservoir	17	0.51	0.034	0.046
2 - 1221 Ashland Mine	22	0.26	0.039	0.044
3 - 361 Coventry	43	0.14	0.042	0.044
4 - 1275 Greenmeadows	305	0.00	0.044	0.031
5 - 699 Oak Knoll	39	0.26	-	-
6 - 625 Elkader	27	0.39	-	-
7 - 905 N. Mountain	36	0.20	-	-
8 - 440 Normal	32	0.20	-	-
9 - 281 East Main	31	0.44	-	-
Sample Site Average	61	0.27	0.040	0.041
System-Wide Average (4)	49	-	-	-

Notes:
1. Based on 800-hour model simulation run under current average day demand conditions.
2. Based on samples collected weekly between January 2002 and November 2006.
3. Based on quarterly samples collected between February 2002 and October 2006.
4. Based on averaging the age at all nodes in the hydraulic model.

As shown in Table 1, four of the TCR sites are used for Stage 1 DBPR monitoring and cannot be used for the IDSE; these include the sites with the two highest and two lowest water ages of all sites. Average historical THM levels were greatest for the two sites (Nos. 3 and 4) with the highest water age, consistent with expectations. Average historical HAA levels were similar at three of the sites (Nos. 1 through 3), but were significantly lower at Site No. 4. This site also has a much greater water age than the remaining sites and had no detectable chlorine residual in 33 percent of samples. This pattern is consistent with biological degradation of HAAs at this site. The implication of finding biological degradation of HAAs in the City's system is that selected High HAA sites should have a significant chlorine residual (10th percentile chlorine concentration of 0.2 mg/L or greater).

The recommended sites with their rationales are summarized in Table 2. The City will need to enter this information directly into the IDSE forms to be submitted to the USEPA. The recommended sample locations are also shown in Figure 2.

Entry Point Site. A single entry point site is required. The entry point site should be located upstream of the first user and any reservoirs. As no TCR sites met this criterion, it is recommended the City establish a new site or use another existing sample site meeting the criteria.

High THM Sites. Existing TCR Site No. 7 was selected as the first High THM site, as it had the lowest chlorine residuals and second highest water age of the available sites. The two remaining High THM sites were selected to represent areas with high water age that are not represented by the current TCR sites. The calculated water ages throughout the City's system are shown in Figure 1. High water age areas are concentrated in the following areas:

- Alsing Reservoir and service area (represented by Site No. 4)
- Fallon Reservoir and service area (no TCR sites);
- Granite Reservoir (no TCR site); and
- Sub-pressure zones served by Granite Reservoir (represented by Site Nos. 3 and 4).

As there are no TCR sites in the area served by Fallon Reservoir, it is recommended that the City establish a new sample site in this area. It is recommended that the final high THM sample site be located at Granite Reservoir or at the nearest downstream service location. Again, this is a new site that will need to be established by the City.

High HAA Sites. Existing TCR Site Nos. 5 and 8 were selected as the two High HAA sites. These sites had the lowest chlorine residuals and highest water age of the remaining sites. As it is likely that HAA biodegradation is occurring in the City's distribution system, the selected High HAA sites both have a 10th percentile chlorine residual of 0.2 mg/L or greater.

Average Residence Time Sites. The two remaining TCR Site Nos. 6 and 9 were selected as the two Average Residence Time Sites. Though the water age at these sites is somewhat less than the system average, they provide good geographic coverage of the City's system and are representative of "typical" conditions in the City's system.

Table 2 Proposed Standard Monitoring Sites
IDSE Plan
City of Ashland

Proposed Sample Site	Type of Site	Rationale
10 - New Site	Entry Point	New entry point site should be located upstream of the first user and reservoirs.
7 - 905 N. Mountain	High THM	Existing TCR site with lowest 10th percentile chlorine residual (0.20 mg/L) and second highest water age (36 hrs) of sites not used for Stage 1 monitoring.
5 - 699 Oak Knoll	High HAA	Existing TCR site with third lowest 10th percentile chlorine residual (0.26 mg/L) and highest water age (39 hrs) of sites not used for Stage 1 monitoring.
8 - 440 Normal	High HAA	Existing TCR site with lowest 10th percentile chlorine residual (0.20 mg/L) and third highest water age (32 hrs) of sties not used for Stage 1 monitoring.
9 - 281 East Main	Average Residence Time	Existing TCR site with moderately high 10th percentile chlorine residual (0.44 mg/L) and moderate water age (31 hrs). Provides representation of Granite Reservoir service area.
6 - 625 Elkader	Average Residence Time	Existing TCR site with moderately high 10th percentile chlorine residual (0.39 mg/L) and moderate water age (27 hrs). Provides representation of Crowson Reservoir service area.
11 - New Site	High THM	New site located within the Fallon Reservoir service area.
12 - New Site	High THM	New site located at Granite Reservoir or the closest downstream service connection.

Identification of Peak Month

The City's peak month was identified based on historical water temperature data collected daily for CT compliance at the City's Water Treatment Plant between July 2004 and November 2006. The temperature data are summarized below in Table 3. As shown in the table, the peak temperature month is August. As such, the sampling schedule must include sampling within the month of August.

Table 3 Average Monthly Water Temperatures
IDSE Plan
City of Ashland

Month	Average Monthly Temperature (°C)
January	4.3
February	4.5
March	4.9
April	5.9
May	7.0
June	8.3
July	11.1
August	16.9
September	16.0
October	11.9
November	7.7
December	4.8

Next Steps

The following steps are required to complete the IDSE Plan submittal:

1. Confirm sample site selection, including identification of specific locations for required new sites.

2. Select sampling weeks for IDSE standard monitoring and Stage 1 DBPR monitoring. These dates will need to be included in the IDSE Plan submission, with any discrepancies from the planned dates explained in the IDSE Report.

3. Complete the IDSE Plan forms, including attachments consisting of a description of the site selection process and a system figure showing the selected sample sites. Carollo is available to assist the City with completion of the draft forms.

4. Finalize IDSE Plan forms for submission to the USEPA by the City.

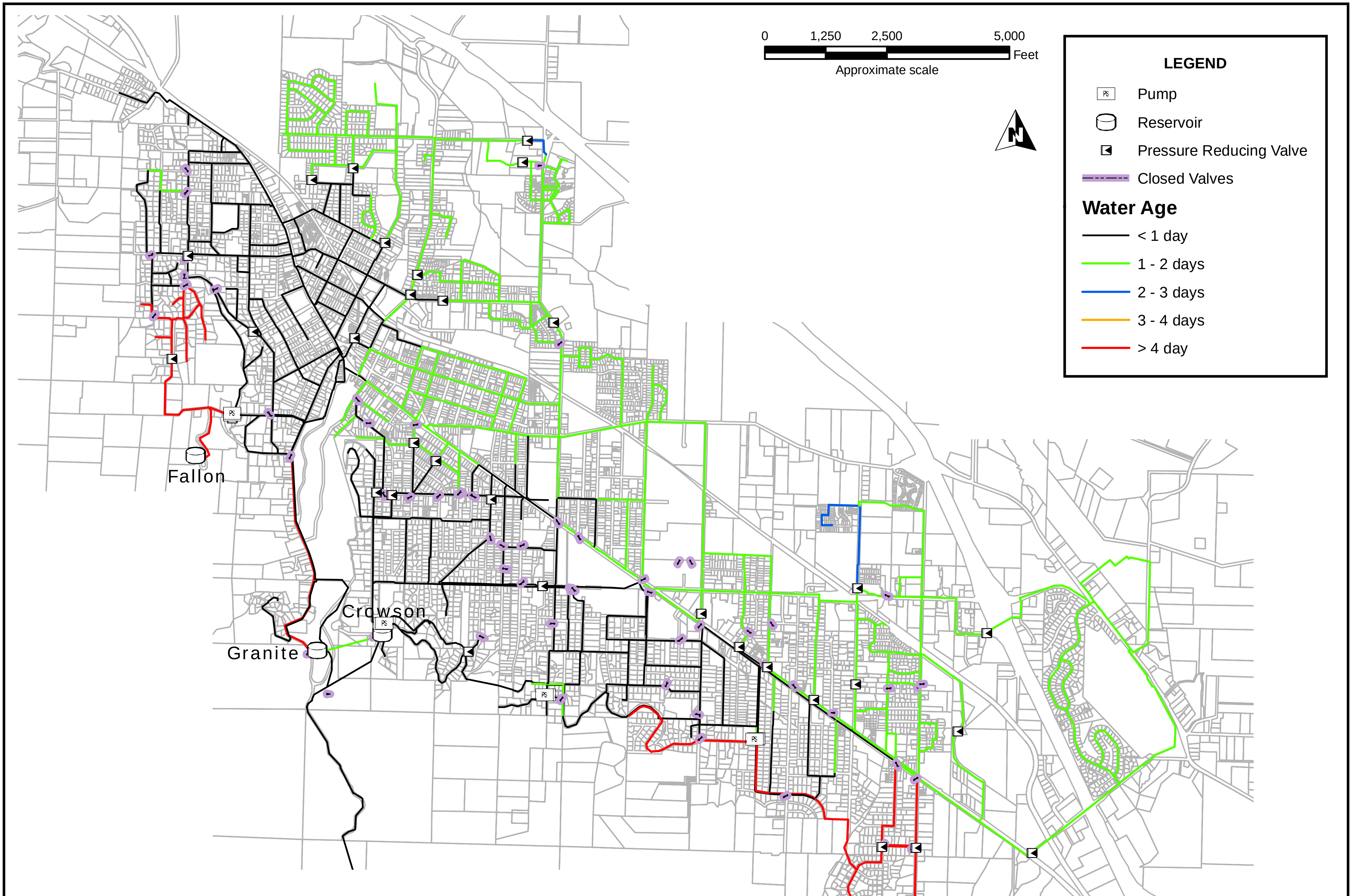

Figure 1
Water Age Analysis
City of Ashland
Water Distribution System

File: waterage.mxd
Date Modified: 24 Apr. 2007

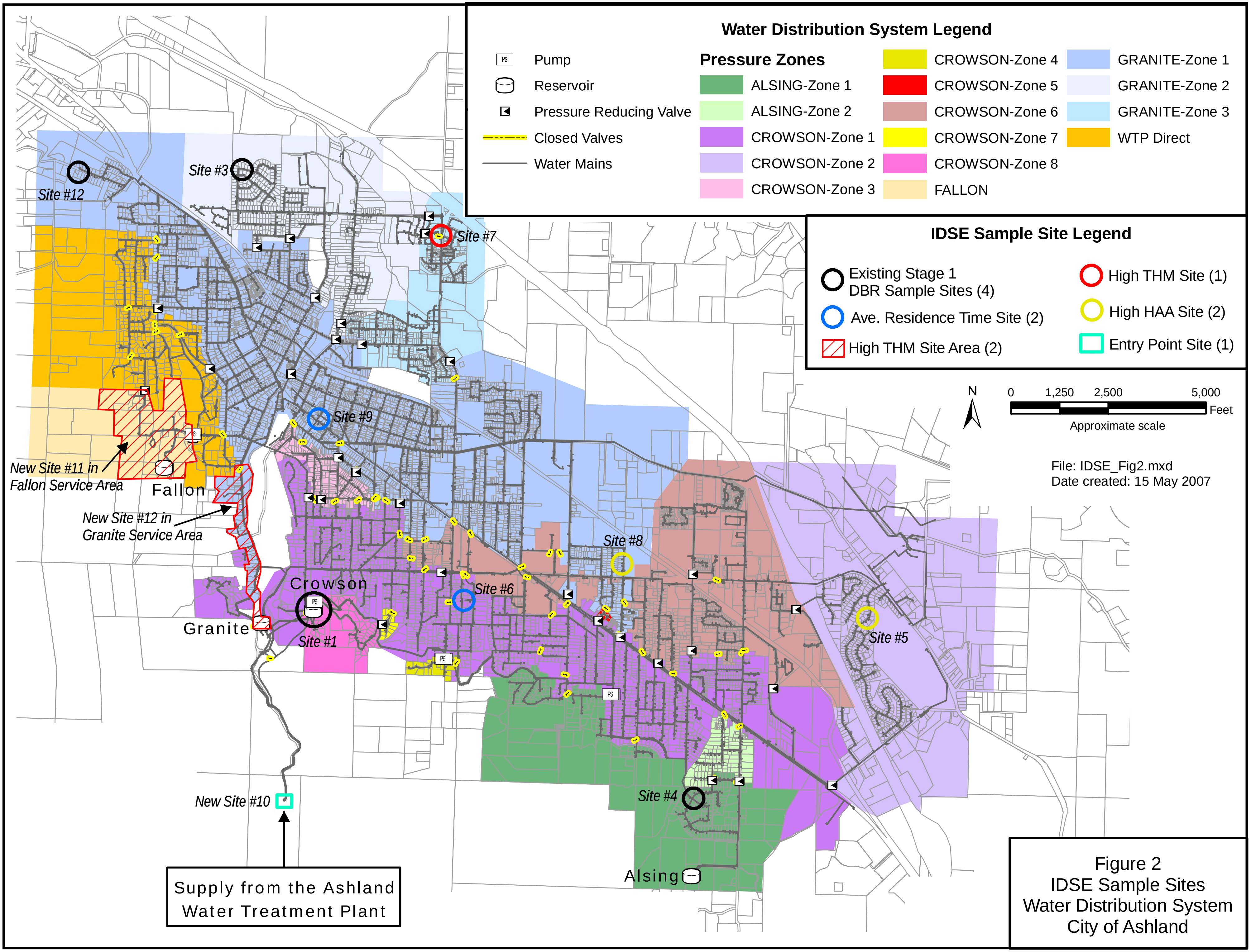

Figure 2
IDSE Sample Sites
Water Distribution System
City of Ashland

Appendix E

TALENT IRRIGATION DISTRICT (TID) WATER QUALITY SAMPLE (08-19-09) RESULTS MEMORANDUM

MWH Laboratories
A Division of MWH Americas, Inc.

750 Royal Oak Dr., Suite 100
Monrovia, California, 91016-3629
Tel: 626 386 1100
Fax: 626 386 1101
1 800 566 LABS (1 800 566 5227)

Laboratory Report

for

City of Ashland Public Works
20 East Main Street
Ashland, OR 97520
Attention: Betsy Harshman
Fax:

Date of Issue
09/11/2009
MWH LABORATORIES

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

Report#: 314072
Project: ASHLANDWTP
Group: ASHLAND-WTP-OR

DEB: Debbie.L.Frank

Project Manager

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Hits Reports, Comments, QC Summary, QC Report and Regulatory Forms. This report shall not be reproduced except in full, without the written approval of the laboratory.

MWH Laboratories

750 Royal Oaks Drive Suite 100, Monrovia, Ca 91016
Phone 626-386-1100/Fax: 626-386-1101

Acknowledgement of Samples Received

City of Ashland Public Works
20 East Main Street
Ashland, OR 97520
Attn: Betsy Harshman
Phone: (541) 488-5587

Customer Code: ASHLANDPW-OR
Group #: 314072
Project #: ASHLANDWTP
Sample Group: ASHLAND-WTP-OR
Project Manager: Debbie.L.Frank
Phone: 626-386-1149

The following samples were received from you on **August 20, 2009**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using MWH Laboratories.

Sample #	Sample Id		Sample Date
200908200254	TID RAW		19-Aug-2009 1010

Apparent Color	Odor at 60 C (TON)	Turbidity
@ANIONS28	@ANIONS48	@ICP
Alkalinity in CaCO3 units	Anion Sum - Calculated	Cation Sum - Calculated
Cation/Anion Difference	PH (H3=past HT not compliant)	Specific Conductance
@1623 Giardia and Cryptosporidium	@525REG	@SPME
Algae Enumeration	Algae Identification	Ammonia Nitrogen
Bromide by 300.0	Dissolved Organic Carbon	Fluoride
Freight - Outbound	Nitrate as Nitrogen by IC	PH (H3=past HT not compliant)
Total Organic Carbon	UV absorbance at 254 nm	

Test Description

@ANIONS28 -- Chloride, Sulfate by EPA 300.0

@ANIONS48 -- Nitrate, Nitrite by EPA 300.0

@ICP -- ICP Metals

@1623 Giardia and Cryptosporidium -- Giardia and Cryptosporidium

@525REG -- Semivolatiles by GCMS

@SPME -- Taste and Odor Compounds

Reported: 09/11/09

314072

313615

MWH Laboratories
A Division of MWH Americas, Inc.

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: 626 386 1100
Fax: 626 386 1101
1 800 566 LABS (1 800 566 5227)

CHAIN OF CUSTODY RECORD

MWH LABS USE ONLY:

LOGIN COMMENTS:

SAMPLES CHECKED AGAINST COC BY: MWD

SAMPLES LOGGED IN BY: MWD

SAMPLE TEMP WHEN REC'D AT LAB: 5°C (Compliance: 4 +/- 2°C)

SAMPLES REC'D DAY OF COLLECTION? [ ] (check for yes)

CONDITION OF BLUE ICE: FROZEN ___ PARTIALLY FROZEN X THAWED ___

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME: CITY OF ASHLAND

PROJECT CODE: 401.89

COMPLIANCE SAMPLES - Requires state forms [ ] *(check for yes)*

NON-COMPLIANCE SAMPLES [X] *(check for yes)*

REGULATION INVOLVED: (eg. SDWA, Phase V, NPDES, FDA....)

Type of samples (circle one): ROUTINE (SPECIAL) CONFIRMATION

MWH LABS CLIENT CODE:

COC ID:

SAMPLE GROUP:

SEE ATTACHED BOTTLE ORDER FOR ANALYSES [X] (check for yes), OR list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLER PRINTED NAME AND SIGNATURE: JIM CLARK [signature]

TAT requested: rush by adv notice only
STD X 1 wk X 3 day ___ 2 day ___ 1 day ___

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	Field Data	Field Data	Algae	SAMPLER COMMENTS
8-19-09	10:10	TID RAW		RSW				

* **MATRIX TYPES:** RSW = Raw Surface Water; RGW = Raw Ground Water; CFW = Chlor(am)inated Finished Water; FW = Other Finished Water; SEAW = Sea Water; WW = Waste Water; BW = Bottled Water; SW = Storm Water; SO = Soil; SL = Sludge; O = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:	[signature]	JIM CLARK	COA	8-19-09	11:30
RECEIVED BY:	[signature]	M. DEWEESE	MWH	8-20-9	1057
RELINQUISHED BY:					
RECEIVED BY:					

C-O-C# ______

PAGE 1 OF 1

a Division of MWH Americas, Inc.
750 Royal Oaks Drive Suite 100
Monrovia, CA 91016 (626) 386-1100 FAX (626) 386-1124

Bottle Order for Carollo Engineers

Group#
Date Sampled
Date Received

Debbie.L.Frank Your MWHL Project Manager

BO #: 8194
Created By: DEB
Order Date: 08/14/2009
Bottle Orders

Sampler: please return this paper with your samples

Client Code: CAROLLO
Project Code: ASHLANDWTP-OR Bottle Orders
Group Name: Ashland Kit
PO# / Job#: 401.89.000

Ship By:
08/04/2009

Ship Sample Kits to
Carollo Engineers
4380 SW Macadam Avenue Suite
Portland, OR 97239
Attn: Sue Schiesser
Phone: 503-227-1885
Fax:

Send Report to
Carollo Engineers
3033 North 44th Street Suite 101
Phoenix, AZ 85018
Attn: Accounts Payable
Phone:
Fax:

Billing Address
Carollo Engineers
5201 Blue Lagoon Drive Suite 950
Miami, FL 33126
Attn: Tom Gillogly
Phone: 786-837-3541
Fax:

# of Samples	Tests	Qteline#	Bottles - Qty for each sample, type & preservative if any	UN DOT #
1	@1623 Giardia and Cryptosporidium		1 10L cubitainer no preservative	
1	@525REG		2 1L amber glass 2ml of 6N HCl	
1	@ANIONS28, @ANIONS48, Fluoride, Nitrate as Nitrogen by IC, PH (H3=past HT not compliant)		1 125ml poly no preservative	
1	@ICP		1 250ml acid rinsed 1ml HNO3 (18%)	
1	@SPME		4 40ml amber glass vial no preservative	
1	Algae Enumeration, Algae Identification		1 500ml poly sterilized no preservative	
1	Alkalinity in CaCO3 units, PH (H3=past HT not compliant), Specific Conductance		1 250ml poly no preservative	
1	Ammonia Nitrogen		1 250ml poly 0.5ml H2SO4 (50%)	
1	Apparent Color, Odor at 60 C (TON), Turbidity – Airspace free		1 500ml amber glass no preservative	
1	Bromide by 300.0		1 60mL poly 0.60mL 5% EDA sol'n	
1	Dissolved Organic Carbon, UV absorbance at 254 nm		1 125ml amber glass no preservative	
1	Total Organic Carbon		1 125ml amber glass 0.5ml H2SO4 (50%)	

Comments

Please pack @1623 in seperate cooler. Include pre paid freight air bill for client to send to: Biovir Labs C/O Liz Barriga, 685 Stone Road Unit #6, Benicia,CA 94510

Code	Status	Date Shipped	Via	Tracking #	# of Coolers	Prepared By

Debbie Frank

From: Thomas Gillogly [TGillogly@carollo.com]
Sent: Thursday, August 20, 2009 9:16 AM
To: James Hein; Debbie Frank
Subject: FW: CAROLLO project ASHLAND-WTP-OR - quote

Jim - As discussed (see email to Aleks below)

Debbie - Welcome back

- Tom
Cell 786-837-3541

From: Thomas Gillogly
Sent: Thursday, August 20, 2009 12:00 PM
To: Aleksandar Tomovich
Cc: Debbie Frank
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

Aleks -

SAMPLES - Just wanted to confirm that the sample(s) should be arriving anytime now.

TAT - Just heard back from the City (again ;-). They'd like to move things along faster than the 7-day TAT. We'd be interested in moving anything up to 3-day TAT that you can, esp for MIB/geosmin. Can you let me know what you can squeeze in there. Sorry for the moving target.

- Tom

From: Aleksandar Tomovich [Aleksandar.D.Tomovich@us.mwhglobal.com]
Sent: Tuesday, August 18, 2009 2:37 PM
To: Thomas Gillogly
Cc: Debbie Frank
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

Hi Tom. Sorry about that, I had a miscommunication on my end over here(That's why Debbie takes care of these things, not me =X). Yes you are right the 1954.50 price is correct and will cover the 7 day TAT.

From: Thomas Gillogly [mailto:TGillogly@carollo.com]
Sent: Tuesday, August 18, 2009 11:14 AM
To: Aleksandar Tomovich
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

Aleks -

Not positive of the question:

As I read your original e-mail, the standard TAT price for all the analyses in the order is $1303. For a 7-day TAT 50% is added for a total price $1,954.5. This is what we want, and what the City has developed a PO for. I'm assuming that whatever Biovir is charging MWH Labs is covered within your quote.

- Tom

From: Aleksandar Tomovich [Aleksandar.D.Tomovich@us.mwhglobal.com]
Sent: Tuesday, August 18, 2009 1:53 PM
To: Thomas Gillogly
Cc: Debbie Frank
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

Hi Tom, I talked to Biovir about the 1623. They said a one week rush would run about $850.00. The original price we listed was for a two week turnaround time. Please let me know how you want to proceed.

From: Thomas Gillogly [mailto:TGillogly@carollo.com]
Sent: Monday, August 17, 2009 12:18 PM
To: Debbie Frank
Cc: Aleksandar Tomovich
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

Aleks:

PROJECT
ASHLAND-WTP-OR

SCHEDULE
Head that there were issues at the WTP. Unlikely that the samples will be collected today. You should, however, have the samples on Wed.

TAT
Want a 7-day TAT on ALL analytes (no 3-day). Hopefully that will take off some of the pressure.

REPORT/INVOICE
The City of Ashland is generating a PO and will pay you folks directly. You can still send them to me and I can forward them on, or if you'd like another name/address I can dig that up. Would still appreciate that the report get sent to me.

- Tom

From: Debbie Frank [Debbie.L.Frank@us.mwhglobal.com]
Sent: Friday, August 14, 2009 4:18 PM
To: Thomas Gillogly
Cc: Aleksandar Tomovich
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

Thanks and Whoopsie.
Everyone is expecting these Tuesday.
Is this a potential, <u>if not</u> we will revise with the ops supervisors and leave it a little more open. (it is always nice for OPS to know a date, some actually go down and ask receiving for the samples so they can get started.)

From: Thomas Gillogly [mailto:TGillogly@carollo.com]
Sent: Friday, August 14, 2009 12:46 PM
To: Debbie Frank
Cc: Aleksandar Tomovich
Subject: RE: CAROLLO project ASHLAND-WTP-OR - quote

DEBBIE:
Thanks.
I'll coordinate with Aleks while you're out next week.

ALEKS:
As soon as I get confirmation of when bodies are heading out to the site to collect water (and thus when the samples should arrive at your door-step, I'll drop you a line.)

- Tom

From: Debbie Frank [Debbie.L.Frank@us.mwhglobal.com]
Sent: Friday, August 14, 2009 2:33 PM
To: Thomas Gillogly
Cc: Aleksandar Tomovich
Subject: CAROLLO project ASHLAND-WTP-OR - quote

1303.00 + 7day TAT add 50% surcharge
3 day TAT add 75% surcharge

DOC will be filtered and preserved upon receipt . TOC/DOC will be a 7dya TAT due to instrumentation
Algae as discussed earlier will be a 7day TAT

If pH and MAJCATA are on the same sample you don't need the second pH

Aleks,
Please change Algae and TOC/DOC TAT to 7 day

From: Aleksandar Tomovich
Sent: Friday, August 14, 2009 11:18 AM
To: Debbie Frank
Subject:

Start

T007166

Main Report

1 /1+ 100%

Print Date: 8/14/2009
Print Time: 11:17:43AM

Quote Summa

Sample Group Name: ASHLAND-WTP-OR
Desired TAT: 7 DAYS ? 3 day
Sample Kits:
Sampling Sevices:
Other Services:

SAMPLES:

Sample #: 002
Plan Name: #WATER
Category: MRL
Client Sample ID:
Flat Price: 1,303.00

TESTS:

Profile	Test Name	Cont. Code
#GP	Odor at 60 C (TON)	0102
#GP	Turbidity	0102
#GP	Apparent Color	0102
#MAJCATA	Alkalinity in CaCO3 units	0076
#MAJCATA	Anion Sum - Calculated	N/A
#MAJCATA	Cation Sum - Calculated	N/A
#MAJCATA	PH (H3=past HT not compliant)	0076
#MAJCATA	@ICP	0140
#MAJCATA	Specific Conductance	0076
#MAJCATA	@ANIONS48	0046
#MAJCATA	@ANIONS28	0046
#MAJCATA	Cation/Anion Difference	N/A
@1623 Giardia and Cryptos	@1623	0037
@525REG	@525	0053
@SPME	@6040D	0093
Algae Enumeration	Algae Enumeration	0109
Algae Identification	Algae Identification	0109
Ammonia Nitrogen	Ammonia Nitrogen	0074
Bromide by 300.0	@DBP_28	0111
Dissolved Organic Carbon	Dissolved Organic Carbon	0041
Fluoride	Fluoride	0046
Freight - Outbound	Freight - Outbound	N/A
Nitrate as Nitrogen by IC	@ANIONS48	0046
PH (H3=past HT not compl	PH (H3=past HT not compliant)	0046
Total Organic Carbon	Total Organic Carbon	0039

MWH Laboratories
A Division of MWH Americas, Inc.

750 Royal Oak Dr., Suite 100
Monrovia, California, 91016-3629
Tel: 626 386 1100
Fax: 626 386 1101
1 800 566 LABS (1 800 566 5227)

Laboratory Comments
Report: #314072

City of Ashland Public Works
Betsy Harshman
20 East Main Street
Ashland, OR 97520

Flags Legend:

H3 - Sample was received and analyzed past holding time. Data not acceptable for regulatory compliance.

L3 - The associated blank spike recovery was above method acceptance limits.

R7 - LFB/LFBD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.

The Comments Report may be blank if there are no comments for this report.

MWH Laboratories
A Division of MWH Americas, Inc.

750 Royal Oak Dr., Suite 100
Monrovia, California, 91016-3629
Tel: 626 386 1100
Fax: 626 386 1101
1 800 566 LABS (1 800 566 5227)

Laboratory
Hits Report: 314072

City of Ashland Public Works
Betsy Harshman
20 East Main Street
Ashland, OR 97520

Samples Received on:
08/20/2009

Analyzed		Analyte	Result	Federal MCL	Units	MRL
		200908200254 **TID RAW**				
08/20/2009	13:01	Algae Enumeration	99		#/ml	1
08/20/2009	13:01	Algae Identification	See Com		Not Appl.	
08/20/2009	18:33	Alkalinity in CaCO3 units	37		mg/L	2
		Anion Sum - Calculated	0.75		meq/L	0.001
08/20/2009	17:16	Apparent Color	20	15	ACU	3
08/26/2009	14:25	Calcium Total ICAP	8.4		mg/L	1
		Cation Sum - Calculated	0.78		meq/l	0.001
08/25/2009	05:55	Cryptosporidium	0.00		Organism/L	
08/21/2009	19:19	Dissolved Organic Carbon	2.7		mg/L	0.3
08/20/2009	14:37	Dissolved UV Abs. at 254 nm	0.050		cm -1	0.009
08/25/2009	05:55	Giardia	0.00		Organism/L	
08/26/2009	14:25	Magnesium Total ICAP	3.0		mg/L	0.1
08/20/2009	11:00	Odor at 60 C (TON)	1	3	TON	1
08/21/2009	18:25	PH (H3=past HT not compliant)	7.6		Units	0.1
08/26/2009	14:25	Sodium Total ICAP	2.8		mg/L	1
08/21/2009	12:25	Specific Conductance, 25 C	78		umho/cm	2
08/21/2009	19:44	Total Organic Carbon	2.9		mg/L	0.3
08/20/2009	19:34	Turbidity	3.2	5	NTU	0.05

SUMMARY OF POSITIVE DATA ONLY

MWH Laboratories
A Division of MWH Americas, Inc.

750 Royal Oak Dr., Suite 100
Monrovia, California, 91016-3629
Tel: 626 386 1100
Fax: 626 386 1101
1 800 566 LABS (1 800 566 5227)

Laboratory Data Report: 314072

City of Ashland Public Works
Betsy Harshman
20 East Main Street
Ashland, OR 97520

Samples Received on: 08/20/2009

TID RAW (200908200254) — **Sampled on 08/19/2009 1010**

Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
				EPA 1623 - Giardia and Cryptosporidium					
	08/25/2009	05:55		(EPA 1623)	Cryptosporidium	0.00	Organism/L		1
	08/25/2009	05:55		(EPA 1623)	Giardia	0.00	Organism/L		1
				SM 1030E - Anion Sum - Calculated					
				(SM 1030E)	Anion Sum - Calculated	0.75	meq/L	0.001	1
				SM 1030E - Cation Sum - Calculated					
				(SM 1030E)	Cation Sum - Calculated	0.78	meq/l	0.001	1
				EPA 350.1 - Ammonia Nitrogen					
	08/24/2009	16:03	521508	(EPA 350.1)	Ammonia Nitrogen	ND	mg/L	0.05	1
				SM 1030E - Cation/Anion Difference					
				(SM 1030E)	Cation/Anion Difference	2.2	%		1
				EPA 200.7 - ICP Metals					
	08/26/2009	14:25	521881	(EPA 200.7)	Calcium Total ICAP	8.4	mg/L	1	1
	08/26/2009	14:25	521881	(EPA 200.7)	Magnesium Total ICAP	3.0	mg/L	0.1	1
	08/26/2009	14:25	521881	(EPA 200.7)	Potassium Total ICAP	ND	mg/L	1	1
	08/26/2009	14:25	521881	(EPA 200.7)	Sodium Total ICAP	2.8	mg/L	1	1
				SM 10900 - Algae Identification					
	08/20/2009	13:01	521054	(SM 10900)	Algae Identification	See Comments	Not Appl.		1
				SM 10200F - Algae Enumeration					
	08/20/2009	13:01	520742	(SM 10200F)	Algae Enumeration	99	#/ml	1	1
				SM5310C/E415.3 - Total Organic Carbon					
	08/21/2009	19:44	521223	(SM5310C/E415.3)	Total Organic Carbon	2.9	mg/L	0.3	1
				SM 5310C - Dissolved Organic Carbon					
	08/21/2009	19:19	521221	(SM 5310C)	Dissolved Organic Carbon	2.7	mg/L	0.3	1
				SM 5910 - Dissolved UV Abs. at 254 nm					
	08/20/2009	14:37	521087	(SM 5910)	Dissolved UV Abs. at 254 nm	0.050	cm -1	0.009	1
				EPA 525.2 - Semivolatiles by GCMS					
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Atrazine	ND	ug/L	0.05	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Benzo(a)pyrene	ND	ug/L	0.02	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Di(2-Ethylhexyl)phthalate	ND (L3,R7)	ug/L	0.6	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Di-(2-Ethylhexyl)adipate	ND	ug/L	0.6	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Hexachlorobenzene	ND	ug/L	0.05	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Hexachlorocyclopentadiene	ND	ug/L	0.05	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Molinate	ND	ug/L	0.1	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Simazine	ND	ug/L	0.05	1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Data
Report: 314072

City of Ashland Public Works
Betsy Harshman
20 East Main Street
Ashland, OR 97520

Samples Received on:
08/20/2009

Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Thiobencarb (ELAP)	ND	ug/L	0.2	1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	1,3-Dimethyl-2-nitrobenzene	97	%		1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Perylene-d12	85	%		1
8/25/2009	08/26/2009	14:56	521875	(EPA 525.2)	Triphenylphosphate	102	%		1
	SM 6040D - Taste and Odor Compounds								
	08/20/2009	18:57	521102	(SM 6040D)	Geosmin	ND	ng/L	3	1
	08/20/2009	18:57	521102	(SM 6040D)	Methylisoborneol	ND	ng/L	5	1
	08/20/2009	18:57	521102	(SM 6040D)	Isobutyl methoxypyrazine	72	%		1
	08/20/2009	18:57	521102	(SM 6040D)	Isopropyl methoxypyrazine	109	%		1
	EPA 300.0 - Nitrate, Nitrite by EPA 300.0								
	08/21/2009	09:57	521365	(EPA 300.0)	Nitrate as Nitrogen by IC	ND	mg/L	0.1	1
	08/21/2009	09:57	521365	(EPA 300.0)	Nitrate as NO3 (calc)	ND	mg/L	0.44	1
	08/21/2009	09:57	521365	(EPA 300.0)	Nitrite Nitrogen by IC	ND	mg/L	0.05	1
	EPA 300.0 - Disinfection ByProducts by 300.0								
	08/21/2009	14:23	521142	(EPA 300.0)	Bromide	ND	ug/L	5	1
	EPA 300.0 - Chloride, Sulfate by EPA 300.0								
	08/21/2009	09:57	521226	(EPA 300.0)	Chloride	ND	mg/L	1	1
	08/21/2009	09:57	521226	(EPA 300.0)	Sulfate	ND	mg/L	0.5	1
	SM 2150B - Odor at 60 C (TON)								
	08/20/2009	11:00	521113	(SM 2150B)	Odor at 60 C (TON)	1 (H3)	TON	1	1
	SM 4500F-C - Fluoride								
	08/21/2009	17:21	521375	(SM 4500F-C)	Fluoride	ND	mg/L	0.05	1
	SM 2320B - Alkalinity in CaCO3 units								
	08/20/2009	18:33	521217	(SM 2320B)	Alkalinity in CaCO3 units	37	mg/L	2	1
	SM4500-HB - PH (H3=past HT not compliant)								
	08/21/2009	18:25	521339	(SM4500-HB)	PH (H3=past HT not compliant)	7.6	Units	0.1	1
	EPA 180.1 - Turbidity								
	08/20/2009	19:34	521316	(EPA 180.1)	Turbidity	3.2	NTU	0.05	1
	SM2510B - Specific Conductance								
	08/21/2009	12:25	521326	(SM2510B)	Specific Conductance, 25 C	78	umho/cm	2	1
	SM 2120B - Apparent Color								
	08/20/2009	17:16	521309	(SM 2120B)	Apparent Color	20	ACU	3	1

Rounding on totals after summation.
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QC Summary: 314072

City of Ashland Public Works

QC Ref # 520742 - Algae Enumeration — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: NWM

QC Ref # 521054 - Algae Identification — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: NWM

QC Ref # 521087 - Dissolved UV Abs. at 254 nm — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: KXS

QC Ref # 521102 - Taste and Odor Compounds — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: DLO

QC Ref # 521113 - Odor at 60 C (TON) — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: SAR

QC Ref # 521142 - Disinfection ByProducts by 300.0 — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: SER

QC Ref # 521217 - Alkalinity in CaCO3 units — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: ANH

QC Ref # 521221 - Dissolved Organic Carbon — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: KXS

QC Ref # 521223 - Total Organic Carbon — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: KXS

QC Ref # 521226 - Chloride, Sulfate by EPA 300.0 — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: SXK

QC Ref # 521309 - Apparent Color — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: SAR

QC Ref # 521316 - Turbidity — **Analysis Date: 08/20/2009**
200908200254 TID RAW — Analyzed by: SAR

QC Ref # 521326 - Specific Conductance — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: NEM

QC Ref # 521339 - PH (H3=past HT not compliant) — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: NEM
200908200254 TID RAW — Analyzed by: NEM

QC Ref # 521365 - Nitrate, Nitrite by EPA 300.0 — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: SXK
200908200254 TID RAW — Analyzed by: SXK

QC Ref # 521375 - Fluoride — **Analysis Date: 08/21/2009**
200908200254 TID RAW — Analyzed by: SAR

QC Ref # 521508 - Ammonia Nitrogen — **Analysis Date: 08/24/2009**
200908200254 TID RAW — Analyzed by: NJR

QC Ref # 521875 - Semivolatiles by GCMS — **Analysis Date: 08/26/2009**
200908200254 TID RAW — Analyzed by: JWC

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QC Ref # 521881 - ICP Metals **Analysis Date: 08/26/2009**

200908200254 TID RAW Analyzed by: CSK

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QC Report: 314072

City of Ashland Public Works

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
QC Ref# 521087 - Dissolved UV Abs. at 254 nm by SM 5910					**Analysis Date: 08/20/2009**				
DUP1_200908200254	UV absorbance at 254 nm	0.050		0.0500	cm -1		(0-15)	15	0.0
LCS1	UV absorbance at 254 nm		0.37	0.406	cm -1	110	(83-121)		
MBLK	UV absorbance at 254 nm			<0.004	cm -1				
MRL_CHK	UV absorbance at 254 nm		0.009	0.00800	cm -1	89	(85-115)		
QC Ref# 521102 - Taste and Odor Compounds by SM 6040D					**Analysis Date: 08/20/2009**				
LCS1	Geosmin		10	11.7	ng/L	117	(75-125)		
LCS2	Geosmin		10	10.6	ng/L	106	(75-125)	20	9.9
MBLK	Geosmin			<3	ng/L				
MRL_CHK	Geosmin		3.0	3.16	ng/L	105	(50-150)		
MS_200908200442	Geosmin	7.1	10	16.5	ng/L	94	(70-130)		
MSD_200908200442	Geosmin	7.1	10	14.9	ng/L	79	(70-130)	20	18
LCS1	Isobutyl methoxypyrazine (I)			86.0	%	86	(50-150)		
LCS2	Isobutyl methoxypyrazine (I)			81.0	%	81	(50-150)		
MBLK	Isobutyl methoxypyrazine (I)			87.0	%	87	(50-150)		
MRL_CHK	Isobutyl methoxypyrazine (I)			108	%	108	(50-150)		
MS_200908200442	Isobutyl methoxypyrazine (I)			102	%	102	(50-150)		
MSD_200908200442	Isobutyl methoxypyrazine (I)			101	%	101	(50-150)		
LCS1	Isopropyl methoxy pyrazine (S)			114	%	114	(70-130)		
LCS2	Isopropyl methoxy pyrazine (S)			116	%	116	(70-130)		
MBLK	Isopropyl methoxy pyrazine (S)			110	%	110	(70-130)		
MRL_CHK	Isopropyl methoxy pyrazine (S)			94.0	%	94	(70-130)		
MS_200908200442	Isopropyl methoxy pyrazine (S)			97.0	%	97	(70-130)		
MSD_200908200442	Isopropyl methoxy pyrazine (S)			124	%	124	(70-130)		
LCS1	Methylisoborneol		10	10.2	ng/L	102	(75-125)		
LCS2	Methylisoborneol		10	9.46	ng/L	95	(75-125)	20	7.5
MBLK	Methylisoborneol			<5	ng/L				
MRL_CHK	Methylisoborneol		3.0	3.21	ng/L	107	(50-150)		
MS_200908200442	Methylisoborneol	7.3	10	19.1	ng/L	118	(70-130)		
MSD_200908200442	Methylisoborneol	7.3	10	20.0	ng/L	127	(70-130)	20	7.3
QC Ref# 521113 - Odor at 60 C (TON) by SM 2150B					**Analysis Date: 08/20/2009**				
DUP1_200908190523	Odor at 60 C (TON)	1		1.00	TON		(0-20)	20	0.0
DUP2_200908200672	Odor at 60 C (TON)	2		2.00	TON		(0-20)	20	0.0
MBLK	Odor at 60 C (TON)			<1	TON				
QC Ref# 521142 - Disinfection ByProducts by 300.0 by EPA 300.0					**Analysis Date: 08/21/2009**				
LCS1	Bromide		100	99.9	ug/L	100	(90-110)		
LCS2	Bromide		100	97.5	ug/L	98	(90-110)	10	2.4
MBLK	Bromide			<5.0	ug/L				

Spike recovery is already corrected for native results.
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(S) Indicates surrogate compound.
(I) Indicates internal standard compound.
RPD not calculated for LCS2 when different a concentration than LCS1 is used
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level)

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QC Report: 314072

City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Bromide		5.0	5.18	ug/L	104	(50-150)		
MS_200908190426	Bromide	ND	50	49.5	ug/L	99	(80-120)		
MS2_200908190436	Bromide	ND	50	49.2	ug/L	98	(80-120)		
MSD_200908190426	Bromide	ND	50	49.3	ug/L	99	(80-120)	15	0.61
MSD2_200908190436	Bromide	ND	50	51.2	ug/L	102	(80-120)	15	3.6
QC Ref# 521217 - Alkalinity in CaCO3 units by SM 2320B					**Analysis Date: 08/20/2009**				
LCS1	Alkalinity in CaCO3 units		100	96.3	mg/L	96	(90-110)		
LCS2	Alkalinity in CaCO3 units		100	105	mg/L	105	(90-110)	20	8.6
MBLK	Alkalinity in CaCO3 units			<2	mg/L				
MRL_CHK	Alkalinity in CaCO3 units		2.0	1.74	mg/L	87	(50-150)		
MS_200908190365	Alkalinity in CaCO3 units	190	100	276	mg/L	88	(80-120)		
MS2_200908190366	Alkalinity in CaCO3 units	130	100	228	mg/L	99	(80-120)		
MSD_200908190365	Alkalinity in CaCO3 units	190	100	284	mg/L	96	(80-120)	20	9.0
MSD2_200908190366	Alkalinity in CaCO3 units	130	100	219	mg/L	90	(80-120)	20	9.8
QC Ref# 521221 - Dissolved Organic Carbon by SM 5310C					**Analysis Date: 08/21/2009**				
LCS3	Dissolved Organic Carbon		5.0	4.95	mg/L	99	(90-110)		
LCS4	Dissolved Organic Carbon		5.0	5.01	mg/L	100	(90-110)	20	0.40
MBLK	Dissolved Organic Carbon			<0.3	mg/L				
MRL_CHK	Dissolved Organic Carbon		0.2	0.189	mg/L	95	(50-150)		
MS_200908240013	Dissolved Organic Carbon	2.8	4.0	10.9	mg/L	101	(80-120)		
MSD_200908240013	Dissolved Organic Carbon	2.8	4.0	10.7	mg/L	99	(80-120)	20	2.4
QC Ref# 521223 - Total Organic Carbon by SM5310C/E415.3					**Analysis Date: 08/21/2009**				
LCS3	Total Organic Carbon		5.0	4.95	mg/L	99	(90-110)		
LCS4	Total Organic Carbon		5.0	5.01	mg/L	100	(90-110)	20	0.40
MBLK	Total Organic Carbon			<0.3	mg/L				
MRL_CHK	Total Organic Carbon		0.2	0.189	mg/L	95	(50-150)		
MS_200908190386	Total Organic Carbon	2.8	4.0	10.9	mg/L	101	(80-120)		
MSD_200908190386	Total Organic Carbon	2.8	4.0	10.7	mg/L	99	(80-120)	20	2.4
QC Ref# 521226 - Chloride, Sulfate by EPA 300.0 by EPA 300.0					**Analysis Date: 08/21/2009**				
LCS1	Chloride		25	25.6	mg/L	103	(90-110)		
LCS2	Chloride		25	26.0	mg/L	104	(90-110)	20	1.6
MBLK	Chloride			<0.5	mg/L				
MRL_CHK	Chloride		0.5	0.439	mg/L	88	(50-150)		
MS_200908240005	Chloride	48	13	73.6	mg/L	102	(90-110)		
MSD_200908240005	Chloride	48	13	73.8	mg/L	103	(90-110)	10	0.98
LCS1	Sulfate		50	51.1	mg/L	102	(90-110)		
LCS2	Sulfate		50	51.8	mg/L	104	(90-110)	20	1.4

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RPD not calculated for LCS2 when different a concentration than LCS1 is used
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level)

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QC Report: 314072

City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Sulfate			<1.0	mg/L				
MRL_CHK	Sulfate		1.0	0.996	mg/L	100	(50-150)		
MRLLW	Sulfate		0.25	0.273	mg/L	109	(50-150)		
MS_200908210083	Sulfate	65	25	119	mg/L	107	(90-110)		
MS_200908240005	Sulfate	46	25	99.4	mg/L	106	(90-110)		
MSD_200908210083	Sulfate	65	25	119	mg/L	107	(90-110)	10	0.0
MSD_200908240005	Sulfate	46	25	99.8	mg/L	107	(90-110)	10	0.94

QC Ref# 521309 - Apparent Color by SM 2120B — **Analysis Date: 08/20/2009**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP_200908200189	Apparent Color	ND		ND	ACU		(0-20)		
DUP1_200908200185	Apparent Color	ND		ND	ACU		(0-20)		
MBLK	Apparent Color			<3	ACU				

QC Ref# 521316 - Turbidity by EPA 180.1 — **Analysis Date: 08/20/2009**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP1_200908200185	Turbidity	0.25		0.254	NTU		(0-10)	10	1.6
DUP2_200908190347	Turbidity	2.1		2.11	NTU		(0-10)	10	0.48
LCS1	Turbidity		20	20.4	NTU	102	(90-110)		
LCS2	Turbidity		20	20.5	NTU	103	(90-110)	20	0.49
MBLK	Turbidity			<0.05	NTU				
MRL_CHK	Turbidity		0.05	0.0520	NTU	104	(50-150)		

QC Ref# 521326 - Specific Conductance by SM2510B — **Analysis Date: 08/21/2009**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP1_200908190527	Specific Conductance	510		505	umho/cm		(0-20)	20	0.99
DUP2_200908200254	Specific Conductance	78		77.0	umho/cm		(0-20)	20	1.3
LCS1	Specific Conductance		1000	994	umho/cm	99	(90-110)		
LCS2	Specific Conductance		1000	995	umho/cm	100	(90-110)	20	0.10
MBLK	Specific Conductance			<2	umho/cm				
MRL_CHK	Specific Conductance		2.0	1.82	umho/cm	91	(50-150)		

QC Ref# 521339 - PH (H3=past HT not compliant) by SM4500-HB — **Analysis Date: 08/21/2009**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP1_200908200479	PH (H3=past HT not compliant)	7.9		7.87	Units		(0-20)	20	0.38
DUP1_200908200668	PH (H3=past HT not compliant)	8.2		8.19	Units		(0-20)	20	0.12
LCS1	PH (H3=past HT not compliant)		6.0	5.99	Units	100	(98-102)		
LCS2	PH (H3=past HT not compliant)		6.0	6.02	Units	100	(98-102)	20	0.50

QC Ref# 521365 - Nitrate, Nitrite by EPA 300.0 by EPA 300.0 — **Analysis Date: 08/21/2009**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Nitrate as Nitrogen by IC		2.5	2.5	mg/L	100	(90-110)		
LCS2	Nitrate as Nitrogen by IC		2.5	2.54	mg/L	101	(90-110)	20	1.6
MBLK	Nitrate as Nitrogen by IC			<0.10	mg/L				
MRL_CHK	Nitrate as Nitrogen by IC		0.05	0.0496	mg/L	99	(50-150)		
MS_200908210083	Nitrate as Nitrogen by IC	ND	1.3	2.62	mg/L	105	(90-110)		

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_200908210220	Nitrate as Nitrogen by IC	10	1.3	12.8	mg/L	96	(90-110)		
MSD_200908210083	Nitrate as Nitrogen by IC	ND	1.3	2.64	mg/L	106	(90-110)	20	0.95
MSD_200908210220	Nitrate as Nitrogen by IC	10	1.3	12.8	mg/L	97	(90-110)	20	0.72
LCS1	Nitrite Nitrogen by IC		1.0	0.972	mg/L	97	(90-110)		
LCS2	Nitrite Nitrogen by IC		1.0	0.975	mg/L	98	(90-110)	20	0.31
MBLK	Nitrite Nitrogen by IC			<0.10	mg/L				
MRL_CHK	Nitrite Nitrogen by IC		0.05	0.0495	mg/L	99	(50-150)		
MS_200908210083	Nitrite Nitrogen by IC	ND	0.5	0.992	mg/L	99	(90-110)		
MS_200908210220	Nitrite Nitrogen by IC		0.5	1.01	mg/L	101	(90-110)		
MSD_200908210083	Nitrite Nitrogen by IC	ND	0.5	0.995	mg/L	100	(90-110)	20	0.30
MSD_200908210220	Nitrite Nitrogen by IC		0.5	1.01	mg/L	101	(90-110)	20	0.0
QC Ref# 521375 - Fluoride by SM 4500F-C						**Analysis Date: 08/21/2009**			
LCS1	Fluoride		1.0	1.06	mg/L	106	(81-116)		
LCS2	Fluoride		1.0	1.06	mg/L	106	(81-116)	20	0.0
MBLK	Fluoride			<0.05	mg/L				
MRL_CHK	Fluoride		0.05	0.0500	mg/L	100	(50-150)		
MS_200908180888	Fluoride	0.68	1.0	1.74	mg/L	106	(73-124)		
MS2_200908180805	Fluoride	0.077	1.0	1.17	mg/L	109	(73-124)		
MSD_200908180888	Fluoride	0.68	1.0	1.74	mg/L	106	(73-124)	20	0.0
QC Ref# 521508 - Ammonia Nitrogen by EPA 350.1						**Analysis Date: 08/24/2009**			
LCS1	Ammonia Nitrogen		1.0	1.03	mg/L	103	(90-110)		
LCS2	Ammonia Nitrogen		1.0	1.02	mg/L	102	(90-110)	20	0.98
MBLK	Ammonia Nitrogen			<0.05	mg/L				
MRL_CHK	Ammonia Nitrogen		0.05	0.0480	mg/L	96	(50-150)		
MS_200908200567	Ammonia Nitrogen	0.20	1.0	1.15	mg/L	95	(90-110)		
MS2_200908200568	Ammonia Nitrogen	0.32	1.0	1.24	mg/L	92	(90-110)		
MSD_200908200567	Ammonia Nitrogen	0.20	1.0	1.14	mg/L	94	(90-110)	20	1.1
QC Ref# 521875 - Semivolatiles by GCMS by EPA 525.2						**Analysis Date: 08/26/2009**			
LCS1	1,3-Dimethyl-2-nitrobenzene (S)			95.4	%	95	(70-130)		
LCS2	1,3-Dimethyl-2-nitrobenzene (S)			96.9	%	97	(70-130)		
MBLK	1,3-Dimethyl-2-nitrobenzene (S)			95.0	%	95	(70-130)		
MRLHI	1,3-Dimethyl-2-nitrobenzene (S)			95.2	%	95	(70-130)		
MRLLW	1,3-Dimethyl-2-nitrobenzene (S)			93.5	%	94	(70-130)		
MRLMD	1,3-Dimethyl-2-nitrobenzene (S)			94.8	%	95	(70-130)		
MS_200908200363	1,3-Dimethyl-2-nitrobenzene (S)			94.2	%	94	(70-130)		
LCS1	2,4-Dinitrotoluene		2.0	2.23	ug/L	112	(70-130)		
LCS2	2,4-Dinitrotoluene		2.0	2.25	ug/L	113	(70-130)	20	0.45

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	2,4-Dinitrotoluene			<0.05	ug/L				
MRLHI	2,4-Dinitrotoluene		0.1	0.117	ug/L	117	(50-150)		
MS_200908200363	2,4-Dinitrotoluene	ND	2.0	2.12	ug/L	106	(70-130)		
LCS1	2,6-Dinitrotoluene		2.0	2.14	ug/L	107	(70-130)		
LCS2	2,6-Dinitrotoluene		2.0	2.16	ug/L	108	(70-130)	20	0.93
MBLK	2,6-Dinitrotoluene			<0.05	ug/L				
MRLHI	2,6-Dinitrotoluene		0.1	0.115	ug/L	115	(50-150)		
MS_200908200363	2,6-Dinitrotoluene	ND	2.0	1.97	ug/L	99	(70-130)		
LCS1	4,4-DDD		2.0	1.87	ug/L	93	(70-130)		
LCS2	4,4-DDD		2.0	1.84	ug/L	92	(70-130)	20	1.6
MBLK	4,4-DDD			<0.05	ug/L				
MRLHI	4,4-DDD		0.1	0.0870	ug/L	87	(50-150)		
MS_200908200363	4,4-DDD	ND	2.0	1.85	ug/L	93	(70-130)		
LCS1	4,4-DDE		2.0	1.81	ug/L	90	(70-130)		
LCS2	4,4-DDE		2.0	1.73	ug/L	87	(70-130)	20	4.5
MBLK	4,4-DDE			<0.05	ug/L				
MRLHI	4,4-DDE		0.1	0.0980	ug/L	98	(50-150)		
MS_200908200363	4,4-DDE	ND	2.0	1.71	ug/L	86	(70-130)		
LCS1	4,4-DDT		2.0	1.98	ug/L	99	(70-130)		
LCS2	4,4-DDT		2.0	1.94	ug/L	97	(70-130)	20	2.0
MBLK	4,4-DDT			<0.05	ug/L				
MRLHI	4,4-DDT		0.1	0.0970	ug/L	97	(50-150)		
MS_200908200363	4,4-DDT	ND	2.0	1.92	ug/L	96	(70-130)		
LCS1	Acenaphthene		2.0	1.84	ug/L	92	(70-130)		
LCS2	Acenaphthene		2.0	1.86	ug/L	93	(70-130)	20	1.1
MBLK	Acenaphthene			<0.05	ug/L				
MRLHI	Acenaphthene		0.1	0.0950	ug/L	95	(50-150)		
MS_200908200363	Acenaphthene	ND	2.0	1.77	ug/L	89	(70-130)		
LCS1	Acenaphthene-d10 (I)			90.3	%	90	(50-150)		
LCS2	Acenaphthene-d10 (I)			91.3	%	91	(50-150)		
MBLK	Acenaphthene-d10 (I)			90.9	%	91	(50-150)		
MRLHI	Acenaphthene-d10 (I)			96.2	%	96	(50-150)		
MRLLW	Acenaphthene-d10 (I)			94.0	%	94	(50-150)		
MRLMD	Acenaphthene-d10 (I)			98.9	%	99	(50-150)		
MS_200908200363	Acenaphthene-d10 (I)			99.5	%	100	(50-150)		
LCS1	Acenaphthylene		2.0	1.82	ug/L	91	(70-130)		
LCS2	Acenaphthylene		2.0	1.8	ug/L	90	(70-130)	20	1.1
MBLK	Acenaphthylene			<0.05	ug/L				
MRLHI	Acenaphthylene		0.1	0.0950	ug/L	95	(50-150)		

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_200908200363	Acenaphthylene	ND	2.0	1.83	ug/L	91	(70-130)		
LCS1	Acetochlor		2.0	2.19	ug/L	109	(70-130)		
LCS2	Acetochlor		2.0	2.16	ug/L	108	(70-130)	20	1.4
MBLK	Acetochlor			<0.05	ug/L				
MRLHI	Acetochlor		0.1	0.105	ug/L	105	(50-150)		
MS_200908200363	Acetochlor	ND	2.0	2.06	ug/L	103	(70-130)		
LCS1	Alachlor		2.0	1.89	ug/L	95	(70-130)		
LCS2	Alachlor		2.0	1.81	ug/L	91	(70-130)	20	4.3
MBLK	Alachlor			<0.025	ug/L				
MRLHI	Alachlor		0.1	0.0980	ug/L	98	(50-150)		
MRLMD	Alachlor		0.05	0.0550	ug/L	110	(50-150)		
MS_200908200363	Alachlor	ND	2.0	1.75	ug/L	88	(70-130)		
LCS1	Aldrin		2.0	1.48	ug/L	74	(70-130)		
LCS2	Aldrin		2.0	1.48	ug/L	74	(70-130)	20	0.0
MBLK	Aldrin			<0.025	ug/L				
MRLHI	Aldrin		0.1	0.0970	ug/L	97	(50-150)		
MRLMD	Aldrin		0.05	0.0480	ug/L	96	(50-150)		
MS_200908200363	Aldrin	ND	2.0	1.47	ug/L	74	(70-130)		
LCS1	Alpha-BHC		2.0	1.94	ug/L	97	(70-130)		
LCS2	Alpha-BHC		2.0	1.88	ug/L	94	(70-130)	20	3.1
MBLK	Alpha-BHC			<0.05	ug/L				
MRLHI	Alpha-BHC		0.1	0.0950	ug/L	95	(50-150)		
MS_200908200363	Alpha-BHC	ND	2.0	1.92	ug/L	96	(70-130)		
LCS1	alpha-Chlordane		2.0	1.94	ug/L	97	(70-130)		
LCS2	alpha-Chlordane		2.0	1.8	ug/L	90	(70-130)	20	7.5
MBLK	alpha-Chlordane			<0.025	ug/L				
MRLHI	alpha-Chlordane		0.1	0.0980	ug/L	98	(50-150)		
MRLMD	alpha-Chlordane		0.05	0.0690	ug/L	138	(50-150)		
MS_200908200363	alpha-Chlordane	ND	2.0	1.72	ug/L	86	(70-130)		
LCS1	Anthracene		2.0	1.76	ug/L	88	(70-130)		
LCS2	Anthracene		2.0	1.76	ug/L	88	(70-130)	20	0.0
MBLK	Anthracene			<0.01	ug/L				
MRLHI	Anthracene		0.1	0.0880	ug/L	88	(50-150)		
MRLLW	Anthracene		0.02	0.0180	ug/L	90	(50-150)		
MRLMD	Anthracene		0.05	0.0430	ug/L	86	(50-150)		
MS_200908200363	Anthracene	ND	2.0	1.2	ug/L	<u>60</u>	(70-130)		
LCS1	Atrazine		2.0	2.01	ug/L	100	(70-130)		
LCS2	Atrazine		2.0	1.97	ug/L	98	(70-130)	20	2.0
MBLK	Atrazine			<0.025	ug/L				

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRLHI	Atrazine		0.1	0.105	ug/L	105	(50-150)		
MRLMD	Atrazine		0.05	0.0560	ug/L	112	(50-150)		
MS_200908200363	Atrazine	ND	2.0	1.91	ug/L	96	(70-130)		
LCS1	Benz(a)Anthracene		2.0	1.81	ug/L	90	(70-130)		
LCS2	Benz(a)Anthracene		2.0	1.75	ug/L	87	(70-130)	20	3.4
MBLK	Benz(a)Anthracene			<0.025	ug/L				
MRLHI	Benz(a)Anthracene		0.1	0.0930	ug/L	93	(50-150)		
MRLMD	Benz(a)Anthracene		0.05	0.0530	ug/L	106	(50-150)		
MS_200908200363	Benz(a)Anthracene	ND	2.0	1.69	ug/L	85	(70-130)		
LCS1	Benzo(a)pyrene		2.0	2.02	ug/L	101	(70-130)		
LCS2	Benzo(a)pyrene		2.0	1.96	ug/L	98	(70-130)	20	3.0
MBLK	Benzo(a)pyrene			<0.01	ug/L				
MRLHI	Benzo(a)pyrene		0.1	0.0840	ug/L	84	(50-150)		
MRLLW	Benzo(a)pyrene		0.02	0.0210	ug/L	105	(50-150)		
MRLMD	Benzo(a)pyrene		0.05	0.0430	ug/L	86	(50-150)		
MS_200908200363	Benzo(a)pyrene	ND	2.0	1.83	ug/L	92	(70-130)		
LCS1	Benzo(b)Fluoranthene		2.0	2.02	ug/L	101	(70-130)		
LCS2	Benzo(b)Fluoranthene		2.0	1.91	ug/L	96	(70-130)	20	5.6
MBLK	Benzo(b)Fluoranthene			<0.01	ug/L				
MRLHI	Benzo(b)Fluoranthene		0.1	0.103	ug/L	103	(50-150)		
MRLLW	Benzo(b)Fluoranthene		0.02	0.0240	ug/L	120	(50-150)		
MRLMD	Benzo(b)Fluoranthene		0.05	0.0500	ug/L	100	(50-150)		
MS_200908200363	Benzo(b)Fluoranthene	ND	2.0	1.98	ug/L	99	(70-130)		
LCS1	Benzo(g,h,i)Perylene		2.0	2.08	ug/L	104	(70-130)		
LCS2	Benzo(g,h,i)Perylene		2.0	2.05	ug/L	102	(70-130)	20	1.5
MBLK	Benzo(g,h,i)Perylene			<0.025	ug/L				
MRLHI	Benzo(g,h,i)Perylene		0.1	0.0870	ug/L	87	(50-150)		
MRLMD	Benzo(g,h,i)Perylene		0.05	0.0430	ug/L	86	(50-150)		
MS_200908200363	Benzo(g,h,i)Perylene	ND	2.0	1.97	ug/L	99	(70-130)		
LCS1	Benzo(k)Fluoranthene		2.0	2.1	ug/L	105	(70-130)		
LCS2	Benzo(k)Fluoranthene		2.0	2.08	ug/L	104	(70-130)	20	0.96
MBLK	Benzo(k)Fluoranthene			<0.01	ug/L				
MRLHI	Benzo(k)Fluoranthene		0.1	0.0900	ug/L	90	(50-150)		
MRLLW	Benzo(k)Fluoranthene		0.02	0.0220	ug/L	110	(50-150)		
MRLMD	Benzo(k)Fluoranthene		0.05	0.0590	ug/L	118	(50-150)		
MS_200908200363	Benzo(k)Fluoranthene	ND	2.0	2.00	ug/L	100	(70-130)		
LCS1	Beta-BHC		2.0	1.91	ug/L	96	(70-130)		
LCS2	Beta-BHC		2.0	1.92	ug/L	96	(70-130)	20	0.52
MBLK	Beta-BHC			<0.05	ug/L				

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRLHI	Beta-BHC		0.1	0.109	ug/L	109	(50-150)		
MS_200908200363	Beta-BHC	ND	2.0	1.93	ug/L	97	(70-130)		
LCS1	Bromacil		2.0	1.84	ug/L	92	(70-130)		
LCS2	Bromacil		2.0	1.77	ug/L	89	(70-130)	20	3.9
MBLK	Bromacil			<0.05	ug/L				
MRLHI	Bromacil		0.1	0.123	ug/L	123	(50-150)		
MS_200908200363	Bromacil	ND	2.0	1.73	ug/L	87	(70-130)		
LCS1	Butachlor		2.0	1.98	ug/L	99	(70-130)		
LCS2	Butachlor		2.0	1.91	ug/L	95	(70-130)	20	3.6
MBLK	Butachlor			<0.025	ug/L				
MRLHI	Butachlor		0.1	0.0940	ug/L	94	(50-150)		
MRLMD	Butachlor		0.05	0.0460	ug/L	92	(50-150)		
MS_200908200363	Butachlor	ND	2.0	1.84	ug/L	92	(70-130)		
LCS1	Butylbenzylphthalate		2.0	1.95	ug/L	98	(70-130)		
LCS2	Butylbenzylphthalate		2.0	1.89	ug/L	95	(70-130)	20	3.1
MBLK	Butylbenzylphthalate			<0.15	ug/L				
MRLHI	Butylbenzylphthalate		0.3	0.287	ug/L	96	(50-150)		
MS_200908200363	Butylbenzylphthalate	ND	2.0	1.93	ug/L	96	(70-130)		
LCS1	Caffeine by method 525mod		2.0	1.62	ug/L	81	(45-137)		
LCS2	Caffeine by method 525mod		2.0	1.6	ug/L	80	(45-137)	20	1.2
MBLK	Caffeine by method 525mod			<0.01	ug/L				
MRLHI	Caffeine by method 525mod		0.1	0.0850	ug/L	85	(50-150)		
MRLMD	Caffeine by method 525mod		0.05	0.0390	ug/L	78	(50-150)		
MS_200908200363	Caffeine by method 525mod	ND	2.0	1.46	ug/L	73	(46-144)		
LCS1	Chlorobenzilate		2.0	1.97	ug/L	99	(70-130)		
LCS2	Chlorobenzilate		2.0	1.88	ug/L	94	(70-130)	20	4.7
MBLK	Chlorobenzilate			<0.05	ug/L				
MRLHI	Chlorobenzilate		0.1	0.0920	ug/L	92	(50-150)		
MS_200908200363	Chlorobenzilate	ND	2.0	1.95	ug/L	97	(70-130)		
LCS1	Chloroneb		2.0	1.92	ug/L	96	(70-130)		
LCS2	Chloroneb		2.0	1.94	ug/L	97	(70-130)	20	1.0
MBLK	Chloroneb			<0.05	ug/L				
MRLHI	Chloroneb		0.1	0.111	ug/L	111	(50-150)		
MS_200908200363	Chloroneb	ND	2.0	1.87	ug/L	94	(70-130)		
LCS1	Chlorothalonil(Draconil,Bravo)		2.0	1.9	ug/L	95	(70-130)		
LCS2	Chlorothalonil(Draconil,Bravo)		2.0	1.84	ug/L	92	(70-130)	20	3.2
MBLK	Chlorothalonil(Draconil,Bravo)			<0.05	ug/L				
MRLHI	Chlorothalonil(Draconil,Bravo)		0.1	0.0870	ug/L	87	(50-150)		
MS_200908200363	Chlorothalonil(Draconil,Bravo)	ND	2.0	1.77	ug/L	88	(70-130)		

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(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Chlorpyrifos (Dursban)		2.0	1.86	ug/L	93	(70-130)		
LCS2	Chlorpyrifos (Dursban)		2.0	1.81	ug/L	91	(70-130)	20	2.7
MBLK	Chlorpyrifos (Dursban)			<0.025	ug/L				
MRLHI	Chlorpyrifos (Dursban)		0.1	0.0830	ug/L	83	(50-150)		
MRLMD	Chlorpyrifos (Dursban)		0.05	0.0460	ug/L	92	(50-150)		
MS_200908200363	Chlorpyrifos (Dursban)	ND	2.0	1.78	ug/L	89	(70-130)		
LCS1	Chrysene		2.0	1.99	ug/L	99	(70-130)		
LCS2	Chrysene		2.0	2.04	ug/L	102	(70-130)	20	2.5
MBLK	Chrysene			<0.01	ug/L				
MRLHI	Chrysene		0.1	0.100	ug/L	100	(50-150)		
MRLLW	Chrysene		0.02	0.0170	ug/L	85	(50-150)		
MRLMD	Chrysene		0.05	0.0530	ug/L	106	(50-150)		
MS_200908200363	Chrysene	ND	2.0	1.91	ug/L	96	(70-130)		
LCS1	Chrysene-d12 (I)			94.0	%	94	(50-150)		
LCS2	Chrysene-d12 (I)			94.1	%	94	(50-150)		
MBLK	Chrysene-d12 (I)			80.8	%	81	(50-150)		
MRLHI	Chrysene-d12 (I)			95.6	%	96	(50-150)		
MRLLW	Chrysene-d12 (I)			86.5	%	87	(50-150)		
MRLMD	Chrysene-d12 (I)			93.5	%	94	(50-150)		
MS_200908200363	Chrysene-d12 (I)			106	%	106	(50-150)		
LCS1	Delta-BHC		2.0	1.78	ug/L	89	(70-130)		
LCS2	Delta-BHC		2.0	1.77	ug/L	88	(70-130)	20	1.1
MBLK	Delta-BHC			<0.05	ug/L				
MRLHI	Delta-BHC		0.1	0.0950	ug/L	95	(50-150)		
MS_200908200363	Delta-BHC	ND	2.0	1.78	ug/L	89	(70-130)		
LCS1	Di(2-Ethylhexyl)phthalate		2.0	2.94	ug/L	147	(70-130)		
LCS2	Di(2-Ethylhexyl)phthalate		2.0	1.92	ug/L	96	(70-130)	20	42
MBLK	Di(2-Ethylhexyl)phthalate			<0.15	ug/L				
MRLHI	Di(2-Ethylhexyl)phthalate		0.3	0.314	ug/L	105	(50-150)		
MS_200908200363	Di(2-Ethylhexyl)phthalate	ND	2.0	1.85	ug/L	92	(70-130)		
LCS1	Di-(2-Ethylhexyl)adipate		2.0	1.86	ug/L	93	(70-130)		
LCS2	Di-(2-Ethylhexyl)adipate		2.0	1.71	ug/L	85	(70-130)	20	8.4
MBLK	Di-(2-Ethylhexyl)adipate			<0.15	ug/L				
MRLHI	Di-(2-Ethylhexyl)adipate		0.3	0.276	ug/L	92	(50-150)		
MS_200908200363	Di-(2-Ethylhexyl)adipate	ND	2.0	1.68	ug/L	84	(70-130)		
LCS1	Di-n-Butylphthalate		4.0	4.35	ug/L	109	(70-130)		
LCS2	Di-n-Butylphthalate		4.0	4.00	ug/L	100	(70-130)	20	8.1
MBLK	Di-n-Butylphthalate			<0.15	ug/L				
MRLHI	Di-n-Butylphthalate		0.3	0.364	ug/L	121	(50-150)		

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Laboratory
QC Report: 314072

City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_200908200363	Di-n-Butylphthalate	ND	4.0	3.96	ug/L	99	(70-130)		
LCS1	Di-N-octylphthalate		2.0	1.87	ug/L	93	(70-130)		
LCS2	Di-N-octylphthalate		2.0	1.79	ug/L	89	(70-130)	20	4.4
MBLK	Di-N-octylphthalate			<0.05	ug/L				
MRLHI	Di-N-octylphthalate		0.1	0.100	ug/L	100	(50-150)		
MS_200908200363	Di-N-octylphthalate	ND	2.0	1.67	ug/L	83	(70-130)		
LCS1	Diazinon (Qualitative)		2.0	1.83	ug/L	92	(70-130)		
LCS2	Diazinon (Qualitative)		2.0	1.81	ug/L	91	(70-130)	20	1.1
MBLK	Diazinon (Qualitative)			<0.05	ug/L				
MRLHI	Diazinon (Qualitative)		0.1	0.0910	ug/L	91	(50-150)		
MS_200908200363	Diazinon (Qualitative)	ND	2.0	1.83	ug/L	92	(70-130)		
LCS1	Dibenz(a,h)Anthracene		2.0	2.08	ug/L	104	(70-130)		
LCS2	Dibenz(a,h)Anthracene		2.0	2.08	ug/L	104	(70-130)	20	0.0
MBLK	Dibenz(a,h)Anthracene			<0.025	ug/L				
MRLHI	Dibenz(a,h)Anthracene		0.1	0.0880	ug/L	88	(50-150)		
MRLMD	Dibenz(a,h)Anthracene		0.05	0.0470	ug/L	94	(50-150)		
MS_200908200363	Dibenz(a,h)Anthracene	ND	2.0	1.95	ug/L	98	(70-130)		
LCS1	Dichlorvos (DDVP)		2.0	1.88	ug/L	94	(70-130)		
LCS2	Dichlorvos (DDVP)		2.0	1.87	ug/L	93	(70-130)	20	0.53
MBLK	Dichlorvos (DDVP)			<0.025	ug/L				
MRLHI	Dichlorvos (DDVP)		0.1	0.0900	ug/L	90	(50-150)		
MRLMD	Dichlorvos (DDVP)		0.05	0.0470	ug/L	94	(50-150)		
MS_200908200363	Dichlorvos (DDVP)	ND	2.0	1.79	ug/L	90	(70-130)		
LCS1	Dieldrin		2.0	1.83	ug/L	92	(70-130)		
LCS2	Dieldrin		2.0	1.73	ug/L	87	(70-130)	20	5.6
MBLK	Dieldrin			<0.05	ug/L				
MRLHI	Dieldrin		0.1	0.100	ug/L	100	(50-150)		
MS_200908200363	Dieldrin	ND	2.0	1.79	ug/L	90	(70-130)		
LCS1	Diethylphthalate		2.0	2.15	ug/L	107	(70-130)		
LCS2	Diethylphthalate		2.0	1.95	ug/L	97	(70-130)	20	9.8
MBLK	Diethylphthalate			<0.15	ug/L				
MRLHI	Diethylphthalate		0.3	0.306	ug/L	102	(50-150)		
MS_200908200363	Diethylphthalate	ND	2.0	1.94	ug/L	97	(70-130)		
LCS1	Dimethoate		2.0	1.48	ug/L	74	(35-100)		
LCS2	Dimethoate		2.0	1.62	ug/L	81	(35-100)	20	9.0
MBLK	Dimethoate			<0.05	ug/L				
MRLHI	Dimethoate		0.1	0.0960	ug/L	96	(50-150)		
MS_200908200363	Dimethoate	ND	2.0	1.29	ug/L	65	(34-111)		
LCS1	Dimethylphthalate		2.0	1.95	ug/L	97	(70-130)		

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**Laboratory
QC Report: 314072**

City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Dimethylphthalate		2.0	1.88	ug/L	94	(70-130)	20	3.7
MBLK	Dimethylphthalate			<0.15	ug/L				
MRLHI	Dimethylphthalate		0.3	0.280	ug/L	93	(50-150)		
MS_200908200363	Dimethylphthalate	ND	2.0	1.85	ug/L	93	(70-130)		
LCS1	Endosulfan I (Alpha)		2.0	1.69	ug/L	84	(70-130)		
LCS2	Endosulfan I (Alpha)		2.0	1.85	ug/L	92	(70-130)	20	9.0
MBLK	Endosulfan I (Alpha)			<0.05	ug/L				
MRLHI	Endosulfan I (Alpha)		0.1	0.0750	ug/L	75	(50-150)		
MS_200908200363	Endosulfan I (Alpha)	ND	2.0	1.74	ug/L	87	(70-130)		
LCS1	Endosulfan II (Beta)		2.0	1.87	ug/L	94	(70-130)		
LCS2	Endosulfan II (Beta)		2.0	1.81	ug/L	91	(70-130)	20	3.3
MBLK	Endosulfan II (Beta)			<0.05	ug/L				
MRLHI	Endosulfan II (Beta)		0.1	0.0960	ug/L	96	(50-150)		
MS_200908200363	Endosulfan II (Beta)	ND	2.0	1.76	ug/L	88	(70-130)		
LCS1	Endosulfan Sulfate		2.0	1.92	ug/L	96	(70-130)		
LCS2	Endosulfan Sulfate		2.0	1.73	ug/L	86	(70-130)	20	10
MBLK	Endosulfan Sulfate			<0.05	ug/L				
MRLHI	Endosulfan Sulfate		0.1	0.0870	ug/L	87	(50-150)		
MS_200908200363	Endosulfan Sulfate	ND	2.0	1.73	ug/L	86	(70-130)		
LCS1	Endrin		2.0	1.95	ug/L	98	(70-130)		
LCS2	Endrin		2.0	1.82	ug/L	91	(70-130)	20	6.9
MBLK	Endrin			<0.05	ug/L				
MRLHI	Endrin		0.1	0.117	ug/L	117	(50-150)		
MS_200908200363	Endrin	ND	2.0	1.81	ug/L	90	(70-130)		
LCS1	Endrin Aldehyde		2.0	1.79	ug/L	90	(70-130)		
LCS2	Endrin Aldehyde		2.0	1.73	ug/L	86	(70-130)	20	3.4
MBLK	Endrin Aldehyde			<0.05	ug/L				
MRLHI	Endrin Aldehyde		0.1	0.100	ug/L	100	(50-150)		
MS_200908200363	Endrin Aldehyde	ND	2.0	1.65	ug/L	83	(70-130)		
LCS1	EPTC		2.0	1.94	ug/L	97	(70-130)		
LCS2	EPTC		2.0	1.89	ug/L	95	(70-130)	20	2.6
MBLK	EPTC			<0.05	ug/L				
MRLHI	EPTC		0.1	0.0950	ug/L	95	(50-150)		
MS_200908200363	EPTC	ND	2.0	1.82	ug/L	91	(70-130)		
LCS1	Fluoranthene		2.0	1.95	ug/L	97	(70-130)		
LCS2	Fluoranthene		2.0	1.93	ug/L	96	(70-130)	20	1.0
MBLK	Fluoranthene			<0.05	ug/L				
MRLHI	Fluoranthene		0.1	0.0920	ug/L	92	(50-150)		
MS_200908200363	Fluoranthene	ND	2.0	1.86	ug/L	93	(70-130)		

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Laboratory
QC Report: 314072

City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Fluorene		2.0	1.94	ug/L	97	(70-130)		
LCS2	Fluorene		2.0	1.89	ug/L	95	(70-130)	20	2.6
MBLK	Fluorene			<0.05	ug/L				
MRLHI	Fluorene		0.1	0.102	ug/L	102	(50-150)		
MRLMD	Fluorene		0.05	0.0490	ug/L	98	(50-150)		
MS_200908200363	Fluorene	ND	2.0	1.85	ug/L	93	(70-130)		
LCS1	gamma-Chlordane		2.0	1.86	ug/L	93	(70-130)		
LCS2	gamma-Chlordane		2.0	1.83	ug/L	92	(70-130)	20	1.6
MBLK	gamma-Chlordane			<0.025	ug/L				
MRLHI	gamma-Chlordane		0.1	0.113	ug/L	113	(50-150)		
MRLMD	gamma-Chlordane		0.05	0.0580	ug/L	116	(50-150)		
MS_200908200363	gamma-Chlordane	ND	2.0	1.75	ug/L	87	(70-130)		
LCS1	Heptachlor		2.0	1.8	ug/L	90	(70-130)		
LCS2	Heptachlor		2.0	1.72	ug/L	86	(70-130)	20	4.5
MBLK	Heptachlor			<0.015	ug/L				
MRLHI	Heptachlor		0.1	0.0860	ug/L	86	(50-150)		
MRLLW	Heptachlor		0.02	0.0240	ug/L	120	(50-150)		
MRLMD	Heptachlor		0.05	0.0490	ug/L	98	(50-150)		
MS_200908200363	Heptachlor	ND	2.0	1.65	ug/L	82	(70-130)		
LCS1	Heptachlor Epoxide (isomer B)		2.0	1.94	ug/L	97	(70-130)		
LCS2	Heptachlor Epoxide (isomer B)		2.0	1.92	ug/L	96	(70-130)	20	1.0
MBLK	Heptachlor Epoxide (isomer B)			<0.025	ug/L				
MRLHI	Heptachlor Epoxide (isomer B)		0.1	0.0950	ug/L	95	(50-150)		
MRLMD	Heptachlor Epoxide (isomer B)		0.05	0.0520	ug/L	104	(50-150)		
MS_200908200363	Heptachlor Epoxide (isomer B)	ND	2.0	1.9	ug/L	95	(70-130)		
LCS1	Hexachlorobenzene		2.0	2.01	ug/L	100	(70-130)		
LCS2	Hexachlorobenzene		2.0	2.00	ug/L	100	(70-130)	20	0.50
MBLK	Hexachlorobenzene			<0.025	ug/L				
MRLHI	Hexachlorobenzene		0.3	0.307	ug/L	102	(50-150)		
MRLLW	Hexachlorobenzene		0.06	0.0650	ug/L	108	(50-150)		
MRLMD	Hexachlorobenzene		0.15	0.162	ug/L	108	(50-150)		
MS_200908200363	Hexachlorobenzene	ND	2.0	1.9	ug/L	95	(70-130)		
LCS1	Hexachlorocyclopentadiene		2.0	1.94	ug/L	97	(70-130)		
LCS2	Hexachlorocyclopentadiene		2.0	1.95	ug/L	97	(70-130)	20	0.51
MBLK	Hexachlorocyclopentadiene			<0.025	ug/L				
MRLHI	Hexachlorocyclopentadiene		0.3	0.243	ug/L	81	(50-150)		
MRLLW	Hexachlorocyclopentadiene		0.06	0.0390	ug/L	65	(50-150)		
MRLMD	Hexachlorocyclopentadiene		0.15	0.112	ug/L	75	(50-150)		
MS_200908200363	Hexachlorocyclopentadiene	ND	2.0	1.82	ug/L	91	(70-130)		

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QC Report: 314072

City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Indeno(1,2,3,c,d)Pyrene		2.0	2.09	ug/L	104	(70-130)		
LCS2	Indeno(1,2,3,c,d)Pyrene		2.0	2.06	ug/L	103	(70-130)	20	1.5
MBLK	Indeno(1,2,3,c,d)Pyrene			<0.025	ug/L				
MRLHI	Indeno(1,2,3,c,d)Pyrene		0.1	0.0930	ug/L	93	(50-150)		
MRLMD	Indeno(1,2,3,c,d)Pyrene		0.05	0.0470	ug/L	94	(50-150)		
MS_200908200363	Indeno(1,2,3,c,d)Pyrene	ND	2.0	1.95	ug/L	97	(70-130)		
LCS1	Isophorone		2.0	1.86	ug/L	93	(70-130)		
LCS2	Isophorone		2.0	1.89	ug/L	94	(70-130)	20	1.6
MBLK	Isophorone			<0.25	ug/L				
MRLHI	Isophorone		0.1	0.0780	ug/L	78	(50-150)		
MS_200908200363	Isophorone	ND	2.0	1.79	ug/L	90	(70-130)		
LCS1	Lindane		2.0	1.99	ug/L	99	(70-130)		
LCS2	Lindane		2.0	1.91	ug/L	96	(70-130)	20	4.1
MBLK	Lindane			<0.02	ug/L				
MRLHI	Lindane		0.1	0.105	ug/L	105	(50-150)		
MRLLW	Lindane		0.02	0.0260	ug/L	130	(50-150)		
MRLMD	Lindane		0.05	0.0500	ug/L	100	(50-150)		
MS_200908200363	Lindane	ND	2.0	1.9	ug/L	95	(70-130)		
LCS1	Malathion		2.0	2.09	ug/L	104	(70-130)		
LCS2	Malathion		2.0	2.00	ug/L	100	(70-130)	20	4.4
MBLK	Malathion			<0.05	ug/L				
MRLHI	Malathion		0.1	0.0910	ug/L	91	(50-150)		
MS_200908200363	Malathion	ND	2.0	2.02	ug/L	101	(70-130)		
LCS1	Methoxychlor		2.0	2.18	ug/L	109	(70-130)		
LCS2	Methoxychlor		2.0	2.08	ug/L	104	(70-130)	20	4.7
MBLK	Methoxychlor			<0.05	ug/L				
MRLHI	Methoxychlor		0.1	0.116	ug/L	116	(50-150)		
MS_200908200363	Methoxychlor	ND	2.0	2.19	ug/L	110	(70-130)		
LCS1	Metolachlor		2.0	2.00	ug/L	100	(70-130)		
LCS2	Metolachlor		2.0	1.92	ug/L	96	(70-130)	20	4.1
MBLK	Metolachlor			<0.025	ug/L				
MRLHI	Metolachlor		0.1	0.0920	ug/L	92	(50-150)		
MRLMD	Metolachlor		0.05	0.0480	ug/L	96	(50-150)		
MS_200908200363	Metolachlor	ND	2.0	1.9	ug/L	95	(70-130)		
LCS1	Metribuzin		2.0	1.82	ug/L	91	(70-130)		
LCS2	Metribuzin		2.0	1.86	ug/L	93	(70-130)	20	2.2
MBLK	Metribuzin			<0.05	ug/L				
MRLHI	Metribuzin		0.1	0.0910	ug/L	91	(50-150)		
MRLMD	Metribuzin		0.05	0.0500	ug/L	100	(50-150)		

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_200908200363	Metribuzin	ND	2.0	1.78	ug/L	89	(70-130)		
LCS1	Molinate		2.0	2.00	ug/L	100	(70-130)		
LCS2	Molinate		2.0	1.95	ug/L	98	(70-130)	20	2.5
MBLK	Molinate			<0.05	ug/L				
MRLHI	Molinate		0.1	0.105	ug/L	105	(50-150)		
MS_200908200363	Molinate	ND	2.0	1.89	ug/L	95	(70-130)		
LCS1	Naphthalene		2.0	1.86	ug/L	93	(70-130)		
LCS2	Naphthalene		2.0	1.88	ug/L	94	(70-130)	20	1.1
MBLK	Naphthalene			<0.05	ug/L				
MRLHI	Naphthalene		0.1	0.111	ug/L	111	(50-150)		
MS_200908200363	Naphthalene	ND	2.0	1.75	ug/L	88	(70-130)		
LCS1	Parathion		2.0	2.38	ug/L	119	(70-130)		
LCS2	Parathion		2.0	2.3	ug/L	115	(70-130)	20	3.4
MBLK	Parathion			<0.05	ug/L				
MRLHI	Parathion		0.1	0.0810	ug/L	81	(50-150)		
MS_200908200363	Parathion	ND	2.0	2.3	ug/L	115	(70-130)		
LCS1	Pendimethalin		2.0	2.02	ug/L	101	(70-130)		
LCS2	Pendimethalin		2.0	2.01	ug/L	100	(70-130)	20	0.50
MBLK	Pendimethalin			<0.05	ug/L				
MRLHI	Pendimethalin		0.1	0.134	ug/L	134	(50-150)		
MS_200908200363	Pendimethalin	ND	2.0	2.01	ug/L	101	(70-130)		
LCS1	Pentachlorophenol		8.0	8.41	ug/L	105	(70-130)		
LCS2	Pentachlorophenol		8.0	7.77	ug/L	97	(70-130)	20	7.9
MBLK	Pentachlorophenol			<0.6	ug/L				
MRLHI	Pentachlorophenol		1.2	1.15	ug/L	96	(50-150)		
MS_200908200363	Pentachlorophenol	ND	8.0	8.16	ug/L	102	(70-130)		
LCS1	Permethrin (mixed isomers)		4.0	3.93	ug/L	98	(70-130)		
LCS2	Permethrin (mixed isomers)		4.0	3.75	ug/L	94	(70-130)	20	4.7
MBLK	Permethrin (mixed isomers)			<0.1	ug/L				
MRLHI	Permethrin (mixed isomers)		0.2	0.202	ug/L	101	(50-150)		
MS_200908200363	Permethrin (mixed isomers)	ND	4.0	3.81	ug/L	95	(70-130)		
LCS1	Perylene-d12 (S)			95.2	%	95	(70-130)		
LCS2	Perylene-d12 (S)			92.3	%	92	(70-130)		
MBLK	Perylene-d12 (S)			80.4	%	80	(70-130)		
MRLHI	Perylene-d12 (S)			84.6	%	85	(70-130)		
MRLLW	Perylene-d12 (S)			76.7	%	77	(70-130)		
MRLMD	Perylene-d12 (S)			82.4	%	82	(70-130)		
MS_200908200363	Perylene-d12 (S)			95.6	%	96	(70-130)		
LCS1	Phenanthrene		2.0	1.78	ug/L	89	(70-130)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
(S) Indicates surrogate compound.
(I) Indicates internal standard compound.
RPD not calculated for LCS2 when different a concentration than LCS1 is used
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level)

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(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Phenanthrene		2.0	1.77	ug/L	89	(70-130)	20	0.56
MBLK	Phenanthrene			<0.02	ug/L				
MRLHI	Phenanthrene		0.1	0.0920	ug/L	92	(50-150)		
MRLLW	Phenanthrene		0.02	0.0200	ug/L	100	(50-150)		
MRLMD	Phenanthrene		0.05	0.0490	ug/L	98	(50-150)		
MS_200908200363	Phenanthrene	ND	2.0	1.7	ug/L	85	(70-130)		
LCS1	Phenanthrene-d10 (I)			97.8	%	98	(50-150)		
LCS2	Phenanthrene-d10 (I)			98.3	%	98	(50-150)		
MBLK	Phenanthrene-d10 (I)			99.8	%	100	(50-150)		
MRLHI	Phenanthrene-d10 (I)			105	%	105	(50-150)		
MRLLW	Phenanthrene-d10 (I)			99.4	%	99	(50-150)		
MRLMD	Phenanthrene-d10 (I)			105	%	105	(50-150)		
MS_200908200363	Phenanthrene-d10 (I)			111	%	111	(50-150)		
LCS1	Propachlor		2.0	1.83	ug/L	92	(70-130)		
LCS2	Propachlor		2.0	1.82	ug/L	91	(70-130)	20	0.55
MBLK	Propachlor			<0.025	ug/L				
MRLHI	Propachlor		0.1	0.0940	ug/L	94	(50-150)		
MRLMD	Propachlor		0.05	0.0520	ug/L	104	(50-150)		
MS_200908200363	Propachlor	ND	2.0	1.8	ug/L	90	(70-130)		
LCS1	Pyrene		2.0	1.86	ug/L	93	(70-130)		
LCS2	Pyrene		2.0	1.83	ug/L	91	(70-130)	20	1.6
MBLK	Pyrene			<0.025	ug/L				
MRLHI	Pyrene		0.1	0.0880	ug/L	88	(50-150)		
MRLMD	Pyrene		0.05	0.0460	ug/L	92	(50-150)		
MS_200908200363	Pyrene	ND	2.0	1.8	ug/L	90	(70-130)		
LCS1	Simazine		2.0	1.97	ug/L	99	(70-130)		
LCS2	Simazine		2.0	1.92	ug/L	96	(70-130)	20	2.6
MBLK	Simazine			<0.025	ug/L				
MRLHI	Simazine		0.1	0.123	ug/L	123	(50-150)		
MRLMD	Simazine		0.05	0.0650	ug/L	130	(50-150)		
MS_200908200363	Simazine	ND	2.0	1.96	ug/L	98	(70-130)		
LCS1	Terbacil		2.0	1.92	ug/L	96	(70-130)		
LCS2	Terbacil		2.0	1.84	ug/L	92	(70-130)	20	4.3
MBLK	Terbacil			<0.05	ug/L				
MRLHI	Terbacil		0.1	0.100	ug/L	100	(50-150)		
MS_200908200363	Terbacil	ND	2.0	1.95	ug/L	97	(70-130)		
LCS1	Terbuthylazine		2.0	2.1	ug/L	105	(70-130)		
LCS2	Terbuthylazine		2.0	2.00	ug/L	100	(70-130)	20	4.9
MBLK	Terbuthylazine			<0.2	ug/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
(S) Indicates surrogate compound.
(I) Indicates internal standard compound.
RPD not calculated for LCS2 when different a concentration than LCS1 is used
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level)

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(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRLHI	Terbuthylazine		0.1	0.0990	ug/L	99	(50-150)		
MS_200908200363	Terbuthylazine	ND	2.0	1.96	ug/L	98	(70-130)		
LCS1	Thiobencarb		2.0	1.88	ug/L	94	(70-130)		
LCS2	Thiobencarb		2.0	1.88	ug/L	94	(70-130)	20	0.0
MBLK	Thiobencarb			<0.1	ug/L				
MRLHI	Thiobencarb		0.1	0.0920	ug/L	92	(50-150)		
MS_200908200363	Thiobencarb	ND	2.0	1.82	ug/L	91	(70-130)		
LCS1	trans-Nonachlor		2.0	1.81	ug/L	90	(70-130)		
LCS2	trans-Nonachlor		2.0	1.74	ug/L	87	(70-130)	20	3.9
MBLK	trans-Nonachlor			<0.025	ug/L				
MRLHI	trans-Nonachlor		0.1	0.0800	ug/L	80	(50-150)		
MRLMD	trans-Nonachlor		0.05	0.0460	ug/L	92	(50-150)		
MS_200908200363	trans-Nonachlor	ND	2.0	1.72	ug/L	86	(70-130)		
LCS1	Trifluralin		2.0	2.08	ug/L	104	(70-130)		
LCS2	Trifluralin		2.0	1.92	ug/L	96	(70-130)	20	8.0
MBLK	Trifluralin			<0.05	ug/L				
MRLHI	Trifluralin		0.1	0.138	ug/L	138	(50-150)		
MS_200908200363	Trifluralin	ND	2.0	1.99	ug/L	100	(70-130)		
LCS1	Triphenylphosphate (S)			102	%	102	(70-130)		
LCS2	Triphenylphosphate (S)			99.5	%	100	(70-130)		
MBLK	Triphenylphosphate (S)			98.6	%	99	(70-130)		
MRLHI	Triphenylphosphate (S)			99.2	%	99	(70-130)		
MRLLW	Triphenylphosphate (S)			100	%	100	(70-130)		
MRLMD	Triphenylphosphate (S)			99.5	%	100	(70-130)		
MS_200908200363	Triphenylphosphate (S)			102	%	102	(70-130)		

QC Ref# 521881 - ICP Metals by EPA 200.7 **Analysis Date: 08/26/2009**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Calcium Total ICAP		50	50.7	mg/L	101	(85-115)		
LCS2	Calcium Total ICAP		50	51.3	mg/L	103	(85-115)	20	1.2
MBLK	Calcium Total ICAP			<1	mg/L				
MRL_CHK	Calcium Total ICAP		1.0	1.03	mg/L	103	(50-150)		
MS_200908270002	Calcium Total ICAP	22	50	70.2	mg/L	96	(70-130)		
MSD_200908270002	Calcium Total ICAP	22	50	70.6	mg/L	97	(70-130)	20	0.83
LCS1	Magnesium Total ICAP		20	21.6	mg/L	108	(85-115)		
LCS2	Magnesium Total ICAP		20	21.7	mg/L	109	(85-115)	20	0.46
MBLK	Magnesium Total ICAP			<0.1	mg/L				
MRL_CHK	Magnesium Total ICAP		0.1	0.106	mg/L	106	(50-150)		
MS_200908270002	Magnesium Total ICAP	22	20	41.8	mg/L	98	(70-130)		
MSD_200908270002	Magnesium Total ICAP	22	20	42.6	mg/L	102	(70-130)	20	4.5
LCS1	Potassium Total ICAP		20	20.8	mg/L	104	(85-115)		

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level)

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City of Ashland Public Works
(continued)

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Potassium Total ICAP		20	20.9	mg/L	105	(85-115)	20	0.48
MBLK	Potassium Total ICAP			<1	mg/L				
MRL_CHK	Potassium Total ICAP		1.0	1.02	mg/L	102	(50-150)		
MS_200908270002	Potassium Total ICAP	ND	20	20.2	mg/L	98	(70-130)		
MSD_200908270002	Potassium Total ICAP	ND	20	20.9	mg/L	102	(70-130)	20	3.9
LCS1	Sodium Total ICAP		50	53.1	mg/L	106	(85-115)		
LCS2	Sodium Total ICAP		50	53.7	mg/L	107	(85-115)	20	1.1
MBLK	Sodium Total ICAP			<1	mg/L				
MRL_CHK	Sodium Total ICAP		1.0	0.963	mg/L	96	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level)

Engineers...Working Wonders With Water™

Technical Memorandum

To:	Mike Faught, Ashland Director of Public Works
Copies To:	Daryl McVey; Terry Ellis; Pieter Smeenk; Nicki Pozos
From:	Jack Henderson/Tom Gillogoly
Reviewed By:	Bob Eimstad
Date:	September 14, 2009 **WO#:**
Subject:	Talent Irrigation District (TID) Water Quality Sample (8-19-09) Results

Attached is the finalized Laboratory Report from MWH Laboratories on the Water Quality Samples taken, as a precautionary measure, to confirm that the TID water could be used to augment water from the Reeder Reservoir as the raw water supply for Ashland's Water Treatment Plant (WTP). The suite of tests performed does not include all regulated constituents but focused on specific analytes that could potentially be problematic for the WTP to treat. Historical problems with Taste & Odor (T&O), the possible presence of pathogenic protazoa and possible contamination from pesticides and fertilizers were considered the most likely problems that may be encountered using TID water. The goal of this testing was to identify potential issues/solutions for treating TID water, not to provide regulatory clearance.

Samples of the TID water were collected on August 19, 2009 and shipped overnight to MWH Laboratories requesting a fast turn around time for targeted analytes of concern under the Safe Drinking Water Act (SDWA). The water quality analysis requested includes:

- T&O (geosmin and 2-methylisoborneol (MIB))
- Algae Identification and Enumeration
- Pathogenic Protozoa (*Giardia* and *Cryptosporidium*)
- EPA 525 Semivolatiles (Pesticides)
- EPA 300 Nitrate/Nitrite (Fertilizer)
- Ammonia Nitrogen
- EPA 200 ICP Metals
- Cations, Anions, Bromide, Fluoride
- Total and Dissolved Organic Carbon
- Standard Physical Parameters (Turbidity, Color, pH, Alkalinity, Specific Conductance)

The results of this testing, as presented in the attached MWH Laboratory Report, indicate that at the time of sampling, the TID water is an acceptable source of water supply to Ashland's WTP. There are no specific water quality issues identified by the testing that would present unanticipated treatment problems that could result in a finished water quality that does not meet the SDWA regulatory requirements.

On August 24, 2008 we confirmed with ORDHS's Scott Curry and Dan Hough that source water quality testing was not required since the TID water supply was already a confirmed source of supply. Dan Hough had previously indicated that source water analysis would be required by the State but **Scott Curry was very clear that the State has no source water jurisdiction or requirements and the City can use TID water at any time as a raw water source for the treatment plant.** Although DHS has no requirement for any special analysis of finished water quality, they suggested additional analysis of finished water quality might be advisable when using TID water due to the greater potential for source water contamination in TID water compared to water from Reeder Reservoir.

The historical use of TID water and the more recent algal blooms in Reeder Reservoir have created raw water conditions that have taxed the ability of the existing Powder Activated Carbon (PAC) system to control T&O. The WTP's existing PAC feed system is the best, short-term tool to address T&O problems from either source. As such, it may be advisable to proactively optimize the PAC system to address the potential for increased T&O problems from either source.

A potential scope for a PAC optimization analysis to define the limits of the existing system to control T&O (geosmin and MIB) could include the following:

1. Review PAC system capacities; WTP layout/points of application; and historical data/interview operations when PAC was fed, to:
    a. Determine how much PAC can physically be fed to the system,
    b. Evaluate benefits of alternative PAC feed locations
    c. Evaluate modifications to hypochlorite and permanganate feed locations to improve PAC performance
    d. Determine if PAC feed historically caused any operational bottlenecks/WQ problems (abbreviated filter run times, PAC breakthrough/gray water/elevated turbidity, Cl2 residual/disinfection problems, residuals management limitations, etc.)
2. Review ability of WTP's PAC capacity to deal with T&O issues:
    a. Determine which type of PAC is currently used
    b. Compare this PAC performance to other commercially available PACs (desktop estimation or empirical confirmation)
    c. Estimate how much T&O control is achievable with the current PAC and existing feed system
    d. Estimate how much additional T&O control could be achieved by switching PAC
3. Recommend changes to the PAC system, if appropriate.

Please feel free to contact us at 503-227-1885 if you have any questions regarding the Laboratory Report results, conclusions or the proposed scope of the PAC optimization analysis.

Appendix F

NOVEMBER 17, 2009 LETTER FROM THE OREGON DHS

Oregon
Theodore R. Kulongoski, Governor

Department of Human Services
Public Health Division
Drinking Water Program
2860 State Street
Medford, OR 97504
(541) 776-6229 Ext. 407
FAX (541) 776-6013

November 17, 2009

Terry C. Ellis
Ashland Public Works Superintendent
90 N. Mountain Avenue
Ashland, OR 97520

Dear Mr. Ellis,

Thank you for taking the time to meet with me on Tuesday November 10th concerning the Ashland Water Department's future use of the Talent Irrigation Ditch (TID) as a raw drinking water source. The Talent Irrigation Ditch is currently inventoried as an emergency water supply. During our meeting you presented me with data clearly characterizing the use of the source as intermittent. In fact, the TID supply has been brought online as a source for approximately five two-month periods since 1990 (1990, 1992, 1994, 2001 and 2009). As such, TID water has represented approximately two percent of Ashland's total raw water supply since 1990 (assuming a 50/50 blend with the permanent source when in use).

During our meeting we concluded that use of the TID source will likely remain intermittent and unpredictable from year-to-year. For this reason the source is most accurately characterized as "emergency" as opposed to "seasonal" and will not be required to follow a routine chemical monitoring schedule. Seasonal sources are typically used consistently, in consecutive years, in a predictable manner.

Emergency sources must receive case-by-case approval from the State Drinking Water Program (DWP) prior to every period of usage. As we concluded during our meeting, use of the TID source will be permitted under the following conditions:

1) Notify the DWP Medford Office as far in advance as is feasible of a known time period that the TID source will be brought online.

2) Determine whether entry point chemical samples representative of a normal emergency TID/Ashland Creek source water blend (approximately 50/50) are current (VOCs within the past year, SOCs within the past three years, IOCs including arsenic within the past nine years, nitrate within the past year and radionuclides within the past nine years). Update all samples that are not current immediately after bringing the TID source online and achieving a normal blending ratio. Submit all current blended sample results directly to the DWP Medford Office. Note that these blended samples cannot be substituted for your normal chemical samples required to be collected at a time representative of exclusive usage of your permanent source. Consider OAR 333-0036(1)(e)(A) and OAR 333-0036(1)(g) as the authority for this requirement which is independent of the amount of time the source is intended to be used.

3) For any chemical samples above recognized as non-current prior to bringing the TID source online, we recommend collecting those chemical samples directly from the TID raw water. These raw samples are not in lieu of the entry point combined samples required for compliance purposes and to be submitted after bringing the TID source online. The raw sampling is only a recommendation for a proactive approach to evaluating the regulated chemical constituents of the TID source prior to its usage. It should be recognized that raw water chemical results cannot be considered completely representative of the finished water but may be useful as a conservative, gross estimate of the TID water quality. This practice could allow for a proactive response to an early warning should there be any detects prior to bringing the source online.

Please note that Consumer Confidence Reports published in years of TID usage should include associated sampling results. Again, only points one and two above are required for the ongoing use of TID water as an emergency source (point three is a recommendation not directly supported by current administrative rules).

Finally, if the usage of the TID source shifts to a more routine (consecutive-year) pattern, we will re-evaluate its current characterization as an emergency supply and likely transition to operating it as a seasonal supply. Please let me know if you have any questions and thank you for your diligence in addressing this matter.

Sincerely,

Daniel Hough, REHS
Natural Resource Specialist
Oregon Department of Human Services
Drinking Water Program

cc: Karen Kelley, DWP Region Two Manager
Scott Curry, Region Two Field Engineer

Appendix G

ASHLAND CREEK *E. coli* BACTERIA STUDY

Ashland Creek *E. coli* Bacteria Study

January 24th 2011

Cover photos (clockwise from upper right): TID outfall discharging into Ashland Creek in Lithia Park; City of Ashland and Rogue Riverkeeper staff collecting water samples from Ashland Creek; Health advisory posted on Ashland Creek in 2009; Rogue Riverkeeper staff and project volunteers conducting water sampling training.

Authors
Forrest English, Water Quality Coordinator, Rogue Riverkeeper
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Megan Plankenhorn, SOU Biology student
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Rogue Riverkeeper works to protect and restore water quality and fish populations in the Rogue Basin and other coastal watersheds through enforcement, field work and community action. www.rogueriverkeeper.org 541-488-5789

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Project Overview

Introduction

The Ashland Creek Bacteria Study is a collaboration between Rogue Riverkeeper (RRK), Southern Oregon University (SOU), The City of Ashland (the City), Oregon Department of Environmental Quality (DEQ), and concerned citizens. While this project was a collaborative effort, Rogue Riverkeeper takes full responsibility for any mistakes or omissions in this document.

Ashland Creek (see Map 3) runs the length of the City of Ashland's Lithia Park, a popular gathering place for tourists and locals, especially in the hot summer months. For five summers, on ten separate occasions, Ashland Creek has been posted with a health notice warning the public about water contact due to elevated *E. coli* levels.

Ashland Creek flows are primarily controlled by releases from Reeder Reservoir, which is located upstream of the City. Reeder Reservoir is the main source of water for the City of Ashland. The Talent Irrigation District (TID) ditch passes through the city approximately two miles below Reeder Reservoir. At most locations TID is an open ditch. At Lithia Park and Ashland Creek, the TID ditch passes into an inverted siphon that conveys the water across the creek valley. At the creek crossing, some water from the TID ditch and siphon system discharges to Ashland Creek (see photo on front cover). The TID discharges to Ashland Creek, in part, to add water to the creek in order to meet water right obligations in Lower Ashland Creek.

Ashland Creek harbors a fluctuating level of *E. coli*. There are insufficient nutrients in Ashland Creek to support growth of *E.coli* or other fecal bacteria, but *E. coli* can survive transiently in the Creek. The presence of *E. coli* indicates the presence of fecal matter. In order to develop management and outreach education strategies to control bacterial pollution we need to determine the source of inputs affecting bacteria levels. Solutions to improve water quality cannot be identified until problematic inputs are identified. There are many potential inputs which include wild and domestic animals, human activity in the creek, storm water drainage, irrigation water that is added to Ashland Creek via a TID ditch, improperly operating septic systems, and illegal dumping.

Due to the numerous potential inputs, determining specific sources of high bacteria levels is complicated. Extensive study of the creek is required, including influences of weather and seasons, to determine accurate estimates of means and variability of water quality parameter readings. It is imperative to understand how recreational use, irrigation, and wild and domestic animals influence water quality before solutions to reduce bacteria problems can be addressed. Rogue Riverkeeper sought to determine if there were consistent locations where fecal matter might enter Ashland Creek by repeatedly testing samples from specific locations on Ashland Creek and the TID ditch outfall to Ashland Creek. The data for the study was gathered between June 16th and October 30th 2010.

Glossary

cfs: Cubic feet per second, a common measurement used for describing the amount of water flowing in a creek or ditch.

Conductivity: Conductivity measures the quantity of ionic material dissolved in water, and its ability to conduct electricity. Conductivity is often used to measure the amount of dissolved solids in water, which may contain more contaminants. Conductivity is measured in micro-Siemens per centimeter (µS/cm). As an example, seawater is 56,000 µS/cm, tap water is around 500 µS/cm, and Ashland Creek is around 100 µS/cm.

E. coli: *Escherichia coli* is used as an indicator for fecal contamination due to having the ability to survive for a time outside of the digestive tract. Some strains of *E. coli* are harmful to human health, but many are benign.

Geometric Mean: Geometric mean differs from is commonly thought of as mean (otherwise known as arithmetic mean). Geometric mean multiplies the values of each sample together and takes the *n*th root (where *n* is the number of samples) as the result. Geometric mean greatly reduces the effect of occasional high sample values and outlier data points that are common in bacteria testing.

Interquartile Range: The interquartile range (or IQR) is the 50% of data that falls between the 25^{th} percentile and the 75^{th} percentile range. IQR is used in presenting our data in boxplot graphs, also shown with min and max values, and the median.

Mean: Otherwise known as arithmetic mean, this is the statistic most people are commonly familiar with as average. An arithmetic mean adds the values of all samples together, and divides by the total number of samples. Arithmetic mean is affected by outliers (very high or low numbers) much more so than geometric mean.

Median: The median divides the distribution of the data in two. Unlike mean which calculates the average value, median is the value that has 50% of the samples on either side of it, regardless of value. For example with a set of data numbering 1, 1, 2, 2 and 10, the median value is 2 with half of the data set on either side.

MPN: The Most Probable Number (MPN) is a statistically determined value used to estimate the concentration of bacteria when they are present at very low concentrations. *E. coli* MPN methods such as the IDEXX quanti-tray method estimate bacterial population size by dividing a water sample into a large number of small samples, incubating the samples and determining how many small samples include a single, viable *E. coli*.

pH: A measure of liquids acidity or alkalinity, pH is measured on a logarithmic scale from 0-14 with 0 being the most acidic, 14 being the most basic and 7 is neutral. A healthy waterway is generally in the 6-8 range. High or low values, or a shift from an established baseline, can represent water pollution issues.

Temperature: The temperature of the water was measured in Celsius.

Turbidity: The measure of suspended matter present in the water, turbidity could include inorganic materials such as soils, or organic materials such as feces. Turbidity is measured in Nephelometric Turbidity Units (NTU) and is measured by the amount of light scattered from suspended particles in the water column. The higher the number, the more material suspended. Ashland Creek hovers near 1 NTU, with the TID ditch being higher, but usually under 10 NTU. Higher numbers will be found with events that mobilize material into the waterway, such as rain events with surface flow or disturbance of the creekbed.

Weighted Mean: Weighted means are used in this report for comparing *E. coli* contributions from a source, weighted by percent of total flow of that source. To compute weighted averages total values are multiplied by percent of total that source makes up. For example (200 MPN)(40 Percent Flow) = 80 MPN weighted mean.

What is E. coli?

Escherichia coli or *E. coli* is a type of fecal coliform bacteria most commonly found in the lower intestine of warm-blooded organisms. There are hundreds of strains of *E. coli*, the majority of which are harmless to humans, but some can cause severe gastrointestinal problems that are primarily a risk to the elderly, children, and people with a compromised immune system. These harmful strains are often in the news, with outbreaks found in milk, meat and sometimes drinking water supplies.

E. coli has the ability to survive for a short time outside of the body, making them a widely used indicator when testing for recent fecal contamination. Testing methods used in this study and in most water quality analysis are unable to distinguish between harmful strains and benign strains of *E. coli.*

Growth of *E. coli* in natural waterways is dependent on the presence of abundant mineral and organic nutrients and warm temperatures. Treated or untreated municipal wastewater can sometimes provide sufficient nutrients for *E. coli* growth, but unpolluted stream water with less than 5 parts per million organic carbon cannot support *E. coli* growth (Hendricks, 1972; Camper et al, 1991). The optimal temperature for *E. coli* growth is the body temperature of warm-blooded animals, typically 37 degrees Celsius. Natural waterways at temperatures of less than 20 degrees Celsius are considered to be “dead-ends” for *E. coli* due to sub-optimal temperature and lack of nutrients (Winfield and Groisman, 2003; Raghubeer and Matches, 1990). *E. coli* in the TID ditch or Ashland Creek water would not be predicted to exhibit any significant growth due to limiting nutrients and low temperature.

Water Quality Standards

The United States Environmental Protection Agency (EPA) sets baseline health standards for water quality, but they delegate to each state to provide water quality standards for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water where applicable. The agency largely responsible for water quality in Oregon is the Oregon Department of Environmental Quality (DEQ). The Clean Water Act of 1972 states that navigable waters of the U.S. must be fishable, swimmable, and/or drinkable according to how people commonly use the waterbody, or its “beneficial use.” If water is found to be unsafe for its users or designated beneficial uses, it will be listed under section 303(d) of the Clean Water Act as an impaired waterbody for that contaminant; this is referred to as the 303(d) list. When a waterway is 303(d) listed it must then be investigated by a state’s environmental agency (in our case, DEQ) who will prepare a Total Maximum Daily Load (TMDL), which designates how much of a pollutant may be discharged and still meet water quality standards. Ashland Creek is covered under the Bear Creek TMDL.

The State of Oregon’s health standards for *E. coli* levels in waterways is below 406 most probable number of organisms per 100 milliliters of water (MPN/100mL) for any single sample, and under 126 MPN/100mL 30 day geometric mean with at least 5 samples (OAR 340-041-0009). The Oregon standard for single sample exceedance is one of the numerically highest in the nation. For comparison most of California uses a 235 MPN/100mL as the single sample maximum, with some states applying an even more stringent standard, such as Vermont with 77 MPN/100mL for a single sample (USEPA, 2003).

Ashland Creek E. coli History

The City of Ashland has been collecting and testing water samples for the presence of *E.coli* during the summer months since September of 2003 for the purpose of posting public heath notices on Ashland Creek when the *E. coli* levels exceed Oregon health standards. Since the City began collecting samples, *E. coli* has exceeded the 406 MPN/100mL single sample level 10 times. Public health notices have been posted in Lithia Park every year except 2008 and 2010. This issue has received regular coverage in the local media outlets.

Regional Bacteria Problems

Far from being a problem specific to Ashland Creek, high levels of *E. coli* and/or coliform bacteria is a concern throughout the Rogue River Basin. According to DEQ data there are 589 miles of streams in the Rogue Basin that exceed Oregon State health standards for *E. coli* bacteria, 177 miles of which are on the Clean Water Act’s 303(d) water quality impaired list for *E. coli* pollution (GIS layers for Oregon's 2004/2006 Streams and Lakes Water Quality), the rest have been removed from the 303(d) list as a TMDL was developed for the watershed.

In addition to Ashland Creek, 34 other waterways in the Rogue Basin have at least part of their length listed as exceeding health standards for *E. coli* (126 *E. coli* MPN/100mL 30 day geometric mean with 5 sample minimum or 406 *E. coli* MPN/100mL in any one sample). Listed streams include the Rogue River, Illinois River, Applegate River, Little and Big Butte Creeks, Bear Creek, and numerous smaller tributaries.

See Map 1, which shows waterways in exceedance of health standards for *E. coli* in the Rogue Basin.

Thanks

Rogue Riverkeeper had a tremendous amount of assistance from many folks to bring this project to completion. We would like to thank the following people for doing everything from water sample collection, to loaning us equipment, and reviewing drafts of this report.

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Methods

Existing City of Ashland Sampling Sites

In 2010, the City of Ashland Public Works Department tested Ashland Creek for *E. coli*, temperature, conductivity, turbidity, and pH. The City's sampling locations are at the playground, above and below the TID ditch outfall, the beach of the swimming reservoir, and just above the diversion structure upstream of the swimming reservoir (see Map 2 and 3 for location of overlapping City sampling sites).

Site Selection

For this study, we chose to augment testing at some existing City sampling sites, as well as add locations intended to isolate and evaluate various potential sources. The initial set of sampling sites was chosen before the start of our study with the idea that the study would adapt and add or remove sites as the season progressed.

In selecting our sites we attempted to isolate the contributions that might be made from the stormwater system, the TID ditch, and human and canine use at or above the swimming reservoir on upper Granite Street. We later added additional sites along the TID ditch that flows along the south edge of Ashland, and sites further above popular human use areas on Ashland Creek.

For maps of site locations please see Map 2 ("Project Overview"), Map 3 ("Ashland Creek Detail'), Map 4 ("TID Ditch Detail") and Map 5 ("Stormwater Features Detail").

Photos of all sites are included in the Ashland Creek Bacteria Study Volunteer Handbook, which is included in the appendix.

Ashland Creek Sites 1-7 (Map #3), Started June 16

Sampling started in June with the following 7 sites, which were tested 3 times a week. In addition, the City tested 4 of the 7 sites once a week. Samples were taken Wednesday AM (City only), Wednesday PM, Saturday AM and Saturday PM. A split sample was collected from the City (Wednesday AM) as part of our quality assurance/quality control (QA/QC) plan.

Site 1: Below Nutley Storm Drain Outfall
Site 1 is located on the west side of Ashland Creek near the playground, at the SW corner of the bridge foundation. This location was selected because it is downstream of the largest storm drain basin above the playground.

Site 2: Above Nutley Storm Drain Outfall
Site 2 is located approximately 200' upstream of Site 1, directly across from Nutley Street. Access to the site is immediately south of the guardrail along the sidewalk, down a stack of boulders to the creek. This location was selected because it is upstream of the Nutley storm drain, so that we could evaluate the storm drain's contribution to the creek. This location is the same as the City's sampling site #1.

Site 3: Below TID Outfall
Site 3 is located approximately 200' downstream of the TID ditch outfall on the creek. This site is close to the second parking area on Granite Street after the Ashland Parks office. From the parking area, it is across the bridge and downstream approximately 100'. This location was selected because it is downstream of the TID ditch outfall, allowing us to isolate the TID ditch contribution to the creek. This location is the same as the City's sampling site #2.

Site 4: TID Outfall
Site 4 is located across the bridge from the parking area described above. The site is accessed by crossing the bridge and heading upstream approximately 50'. This sample is taken directly from the TID ditch outfall and is not taken from the creek.

Site 5: Above TID Outfall
Site 5 is located on the west bank of the creek, approximately 50' upstream of the TID ditch outfall. The site is accessed just upstream of the parking area's SE corner. This location was selected to evaluate *E. coli* levels in Ashland Creek before it mixes with TID ditch water. This location is the same as the City's sampling site #3.

Site 6: Below Swimming Reservoir
Site 6 is located on the roadside of the creek bank, opposite the large concrete water storage structure, downstream from the swimming reservoir. Access to site 6 is from a small parking spot just downstream of the water storage structure. This location was selected to determine if bathers and animals in the swimming reservoir have an impact on *E. coli* levels. The City samples directly from the swimming reservoir (City site #4).

Site 7: Above Swimming Reservoir (Above Diversion)
Site 7 is located upstream of the swimming reservoir (across the road), and just upstream of an unused city diversion structure. This site can be accessed near the road, from the large rocks on the creek bank. This location was selected to compare *E.coli* levels with site 6, below the swimming reservoir. This location is the same as the City's sampling site #5.

TID Ditch Sites (Map #4), Started July 14

Data from June and early July indicated that TID ditch water (Ashland Creek site #4) was high in *E. coli* as compared to other sampling sites on Ashland Creek. Therefore, we added 6 sites to better understand *E. coli* contributions made by the TID ditch. The 6 additional sites on the TID ditch inside Ashland city limits stretched from Tolman Creek Road to where the TID ditch discharges to the creek. The TID sites are laid out roughly equidistant from each other as the TID ditch courses through the southeast side of town, and were not selected to evaluate any particular input sources on the ditch. TID ditch sample sites were tested once a week in the morning.

TID Site A: Herbert Street
Site A is accessed from Herbert St. along a trail that heads uphill until it reaches the TID ditch. The sampling site is across the bridge and to the right. The footing is precarious, and sandals or rubber boots are recommended for sampling from this location. This TID

ditch site is the closest to the outfall to Ashland Creek.

TID Site B: Morton Street
Site B can be accessed starting from the street near 707 Morton. The TID ditch is on the left of the driveway at 707 Morton. Sampling was done from the stairs. This site is shortly after the TID ditch is reopened from the piped off section beginning at Elkader Street.

TID Site C: Elkader Street
Site C is near 895 Elkader St.; the ditch is on the opposite side of the road from the house. Water was sampled from the ditch right before it goes underground next to the street. This sample site is directly before the longest piped off area of the TID ditch before the creek.

TID Site D: Pinecrest Terrace
Site D is near 1435 Pinecrest Terrace; the TID ditch is very obvious and there is a large, wide trail. The sampling site is East on the trail approximately 300', at the pinch point in the ditch made from concrete, just before the board structure.

TID Site E: Park Street
Site E is uphill from the corner of Park St. and Crestview Dr. There is an obvious trail near the ditch. The sampling site is approximately ¼ of a mile up the trail, at a headgate structure with a wheel coming up out of it. The adjacent TID ditch trail ends shortly ahead with a gate displaying private property signs.

TID Site F: Tolman Creek Road
Site F is past 1492 Tolman Creek Rd., along an access road near a gravel area just in front of an "authorized entry only" sign. The TID ditch is located over a blackberry patch, which can be circumvented by going back to the road. Samples were taken from on top of the concrete cover structure. This TID ditch site marks approximately where TID water enters the City of Ashland; it was our southernmost site and the furthest from Ashland Creek.

Ashland Creek Sites 8 & 9 (Map #3), Started August 18th

Sporadic high levels of *E. coli* at Ashland Creek Site 7 (above the swimming reservoir) during late July and early August prompted the addition of sampling locations further upstream of Lithia Park, above a popular recreation area called the "fairy ponds." The fairy ponds are a series of small pools in Ashland Creek that have been augmented by small hand built rock and log dam structures. This area gets regular use by people and dogs swimming in the water, and our sampling teams have seen people washing clothes in the creek at this location. A sampling point was also added just downstream of the tailrace of the hydro-power facility near the City's drinking water treatment plant. These two additional sites were sampled once a week on Wednesday afternoons due to access conditions requiring City personnel to escort RRK staff to sample from the tailrace.

Site 8: Above Fairy Ponds
The sampling site is accessed by parking at the very top of Granite Street, just to the right

of the gate leading to the City of Ashland's water treatment plant, and walking upstream along a trail on the west side of the creek. This location was selected midway into the study in an attempt to evaluate the water quality upstream of a highly used area of the creek that was above Ashland Creek sample site 7.

Site 9: Below Tailrace
Sample site 9 is located near the City of Ashland drinking water treatment plant, and just downstream of the power plant tailrace. The site was accessed by special permission and escort from the City of Ashland. This location was selected as the highest upstream baseline before the TID ditch outfall, municipal stormwater and potential inputs from dogs and humans.

Sampling Methods & Quality Assurance/Quality Control

E. Coli.

Water samples were collected from creek and TID ditch locations with swift running water free of sediment. 120 mL was collected in sterile IDEXX bottles containing sodium thiosulfate. Upon collection sample containers were immediately placed in a cooler containing ice. Samples were kept at 4°C until laboratory processing at Southern Oregon University within 24 hours of sampling time. Sampling protocols conformed to Oregon DEQ volunteer water quality monitoring guidelines (Oregon DEQ Quality Assurance Project Plan, http://www.deq.state.or.us/lab/wqm/volmonresources.htm).

At least 10% of water samples were collected and tested in duplicate. Typically, this meant one duplicate sample per sample survey. We collected a total of 67 duplicates and found that the *E. coli* MPN/100ml result for each was within 0.6 $\log_{10}$. In addition, one sample per week was split with an independent testing lab, Neilson laboratory in Medford, Oregon. The 16 split samples all gave results within 0.6 $\log_{10}$ of each other. In addition, two sterile water samples were processed and yielded values of <1 *E. coli* MPN/100mL. The maximum value that we can yield from our testing methods is 2420 MPN/100mL, so any value of 2420 should read as >2420. Our results indicated that our protocols gave accurate, reproducible results at the DEQ "A" level standard.

Temperature

Temperature was taken using a conductivity meter issued by DEQ and recorded on field sheets at each location. The temperature meter was compared against a thermometer on a monthly basis and would be recalibrated should the variance become greater than 1˚C.

Conductivity

Conductivity was measured using an YSI 30/10 FT meter issued by DEQ. The meter's probe was rinsed with distilled water before placing in the creek for readings and also after removal from the creek. The meter was compared against prepared Oregon DEQ low and high conductivity standards (147 µS/cm and 1412 µS/cm) before each outing. Standards were replaced if variance from standards was above 10%.

Turbidity

Grab samples were taken from the creek directly in a reading bottle, or in a Nalgene vessel and brought back to vehicle for measurement. Sample collection bottles were rinsed in the creek three times before use. Turbidity was measured using a HACH 2100P meter, issued by DEQ and calibrated according to the HACH manual using a StablCal calibration set for the 2100P. Prior to each sampling, the unit's accuracy was tested using the turbidity standards kit. The meter was recalibrated if variance was above 15%.

pH

A HACH HQ11d field meter device was used for pH testing. Prior to each sampling event, the unit's accuracy was tested using three HACH standards (4.01, 7 and 10.01). Standards were replaced with fresh samples if variance went over 10%.

Lab Methods

The IDEXX Colilert EPA-approved Quanti-Tray/2000 method was used to determine *E. coli* concentrations (U.S. EPA, 2003). Water samples were taken to the lab, and colilert reagent was added to approximately 100 mL water sample, according to standard protocol (IDEXX Quanti-Tray/2000 product insert http://www.idexx.com/view/xhtml/en_us/water-microbiology.jsf). Quanti-Trays were filled, sealed, and incubated at 35°C. After incubation results were read. Fluorescent yellow wells indicate the metabolism of the substrate 4-methyl-umbelliferyl–β-flucuronidase (MUG) by the enzyme ®-glucuronidase and were considered positive for *E. coli*. If the fluorescence or yellow color was questionable it was compared to the Quanti-Tray reference comparator, which indicates the minimum fluorescence and yellow color that may still be considered positive. The total number of wells that were both yellow and fluorescent in the Quanti-Tray were counted and the data was recorded. Number of *E. coli* per 100 mL is determined using most probable number (MPN) tables.

Flow Estimation

A Solinst Levellogger® Model LT F15/M5 level and temperature data logger (generously on loan from the Bear Creek Watershed Council) was placed in Ashland Creek just off Water Street. The gauge station was located on the upstream (south) side of the culvert that passes beneath the Lithia Way viaduct. The data logger was placed in a perforated 1.5-inch diameter black ABS plastic standpipe which was anchored on the east bank, approximately 5 feet from the south edge of the culver. The stand pipe was fitted with a locking cap to prevent tampering. The gauge station datum (i.e. the reference elevation for gauge readings) was set at of 4.00 feet at the flat surface on the top of the concrete foundation adjacent to the gauge stand pipe.

The data logger collected water level and temperature readings every 5 minutes from 6/25 to 11/8, with a gap from 9/18 to 10/22 due to removal and re-installation of the data logger after the stand pipe was displaced by vandals. Manual measurements of the creek water height were periodically obtained to allow the level readings to be converted to gauge station height.

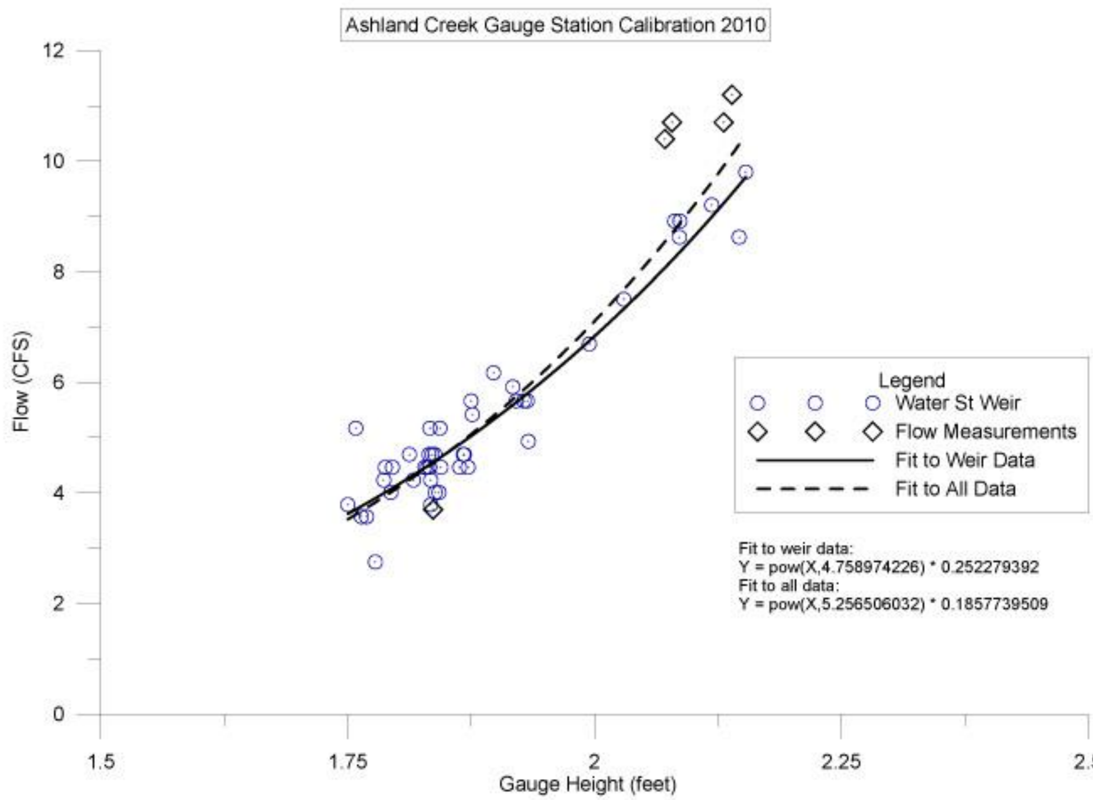
Since the data logger unit is sealed (i.e. not vented to the atmosphere), the data recorded represents the sum of the pressure due to the height of the water in the creek plus changes in barometric (i.e. atmospheric) pressure. The raw level data were corrected for barometric pressure fluctuations using hourly data for the Medford airport (NOAA, 2010). The level data were also converted to an elevation relative to the gauge datum of 4.00 feet using the manual level measurements and minimizing the residual sum of squares of the difference between the manual and data logger elevation values.

Additionally, we used City data collected at a weir before TID water flows into outfall pipe, and from a Weir on Water Street, which records daily values. The City weir is a notched weir that is unable to measure flow through that notch above 11.8 cfs. Therefore, for flows above this amount we used only the data from the level logger that we placed.

Creek flow rates were estimated by creating channel cross sections, dividing each cross section into five equal segments, measuring velocity and depth over each segment, and then summing the total flow. Flow measurements were obtained using a Global Water FP101 impeller flow meter operating in averaging mode. Flow measurements were collected at the gauge station, at the wading pool below Site 1, at the TID pipe crossing near Site 4, and at the diversion structure below site 7. We then calibrated our flow measurements with the combined channel measurements and the City's weir measurements (see Figure 1).

The City's weir is located downstream of the culvert where the gauging station was located. As shown on Figure 1, flow measurements above approximately 11.8 cfs, or a gauge height of approximately 2.2 feet, were not available. At this height, flow passes above the v-notch portion of the City's weir and flows across the entire drop structure. Also, the flow meter was not available during periods of higher water levels in late June and early July. Consequently, flows above 11.8 cfs were approximated using the Manning equation for open channel flow, and thus higher flows should be considered estimates.

Figure 1. Calibrating Ashland Creek flow based on level logger data and City weir data.



Results

A Note on Data in Figures and Tables

Throughout the report there are several types of graphs. Bar, box plot and line graphs are all used.

For many of the calculations in this report the data was transformed to a $\log_{10}$ scale. This was done to better allow parametric statistical analysis on the bacteria data, which generally are not normally distributed (as opposed to a normal distribution; i.e. a "bell curve"). Performing a $\log_{10}$ transform on the data makes the data more closely resemble a normal distribution, and allows a better fit for parametric analysis. All calculations using $\log_{10}$ transformed data (geometric mean, geometric standard deviation), has then had an inverse log function applied to the results to bring it back into the original scale and unit of the data. Arithmetic calculations used original scales.

Arithmetic mean and standard deviation are included in many of the tables as a point of reference. Geometric standard deviation can be difficult to interpret, so we have included arithmetic standard deviation to give a real idea of how much fluctuation there was in the data set.

Line and bar graphs are used to depict *E. coli* MPN, temperature, water level and cfs. All *E. coli* data used in these graphs is geometric mean and cfs data uses arithmetic mean.

Box plot graphs are used to depict *E. coli* MPN. Box plot graphs show the maximum sample value as the top bar, the interquartile range (IQR) of the data as a hollow box (25^{th} to 75^{th} percentile), the median as a bar within the IQR, and the minimum sample value as the bar at the bottom. All box plot graphs use original sample data that were not $\log_{10}$ transformed.

2420 MPN is the highest value that our *E. coli* testing equipment and methods could return, so it is possible that any value of 2420 was actually higher than that.

E. coli Levels in Ashland Creek

The results shown in Table 1 indicate an increasing trend in *E. coli* levels from the uppermost sample location (site 9) to the lowest sample location (site 1) (see Map 2). In addition, the mean *E. coli* concentration in TID ditch outfall water (site 4) was higher than the mean *E. coli* concentration in Ashland Creek water. *E. coli* levels increased in Ashland Creek downstream from the point where TID ditch water entered the creek. A comparison of sites 5 and 3 (upstream and downstream of the TID ditch outfall) demonstrate the effect that the TID ditch outfall has on Ashland Creek.

Table 1. *E. coli* MPN/100mL, geometric mean, geometric standard deviation, arithmetic mean and standard deviation for all Ashland Creek sites and the TID ditch outfall for duration of project.

Site and sample size	*E. coli* MPN/100mL geometric mean	Geometric standard deviation	*E. coli* MPN/100mL, arithmetic mean	Arithmetic standard deviation
1 (n=62)	68.0	3.4	187.5	447.3
2 (n=79)	54.5	3.3	152.2	393.5
3 (n=78)	40.6	3.6	123.7	361.1
4 (n=53)	163.7	2.9	308.8	492.0
5 (n=79)	16.5	3.1	26.8	24.1
6 (n=61)	23.3	3.7	51.7	118.1
7 (n=78)	16.6	5.2	53.8	139.8
8 (n=14)	12.1	2.1	18.3	17.8
9 (n=8)	1.4	2.4	1.5	0.5

The data in Table 1 were calculated using samples collected during rain storms and during dry days. The data are somewhat biased because we purposefully collected samples whenever it rained in order to study potential effects of rain on *E. coli* levels. It rarely rains in Ashland during the summer; six rainy day water samples were collected during the summer months and three more were collected during October. It was noted that *E. coli* levels were higher during summer rain storms (see storm water section below). To better analyze trends in the data without including spikes in *E. coli* due to rain, *E. coli* geometric means for non-rainy days in early summer (June 10-July 15), mid-summer (July 16-Aug. 15), late summer (Aug. 16-Sept 15), early Fall (Sept. 16-Oct 13), and post irrigation season (Oct. 14-Oct. 30) were computed and graphed as shown in Table 2 and Figure 2.

Table 2. Geometric mean *E. coli* MPN/100mL during "no rain" days at Ashland Creek Sampling locations. "n" refers to the number of independent samples that were used to compute the geometric means (NS for not sampled).

Sampling Dates	Site 9	Site 8	Site 7	Site 6	Site 5	Site 4 (TID outfall)	Site 3	Site 2	Site 1
6/10 - 7/15	NS	NS	3.2 n=19	5.2 n=14	4.7 n=19	246.0 n=14	14.6 n=19	21.1 n=19	20.6 n=14
7/16 - 8/15	NS	NS	37.2 n=18	52.7 n=14	42.3 n=18	95.1 n=14	55.0 n=17	67.9 n=18	73.0 n=14
8/16 - 9/15	1.7 n=4	9.8 n=6	51.1 n=15	42.0 n=13	25.3 n=16	127.1 n=13	73.2 n=16	57.1 n=16	60.6 n=12
9/16 - 10/13	1.0 n=2	8.7 n=3	27.2 n=11	25.1 n=7	20.6 n=11	164.0 n=7	71.9 n=11	83.7 n=10	116.5 n=7
10/14 - 10/30	1.4 n=2	9.2 n=2	19.4 n=7	14.4 n=6	17.8 n=7	Off	17.8 n=7	35.3 n=6	34.9 n=6

The data from Table 2 were graphed as shown in Figure 2 below.

Figure 2. Geometric mean *E. coli* MPN/100mL at sampling locations on Ashland Creek on no rain sampling days.

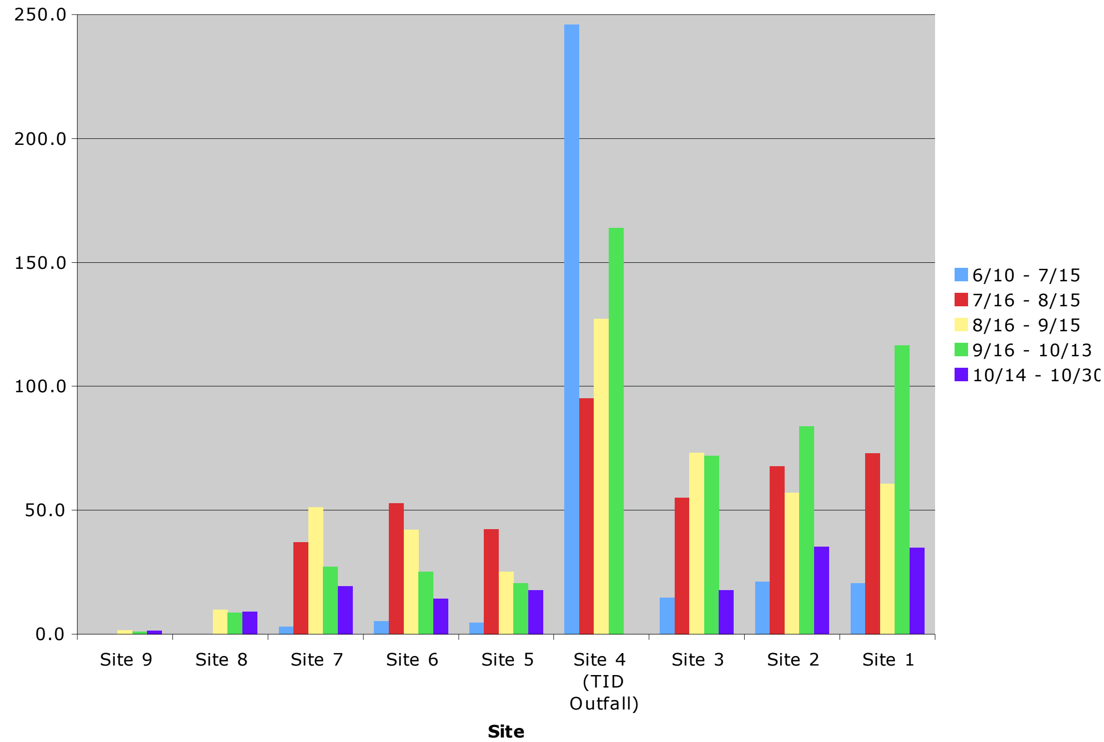


Figure 2 indicates that *E. coli* levels tended to decrease or stay relatively constant from site 7 to site 5 and then increase downstream from site 5. During early summer (June 10-July 14, blue bars) and post irrigation season (Oct 14-Oct. 30, purple bars) *E. coli* levels were the lowest. The periods from July 16 to Oct 13 showed the highest levels of *E. coli* (red, yellow and green bars). This is consistent with previous years' data from the City of Ashland that indicated that *E. coli* levels increase as summer progresses. The amount of water in upper Ashland Creek decreases during the summer and reaches a low point by late September.

A comparison of *E. coli* levels at sites 5 (upstream of TID ditch outfall) and 3 (downstream of TID ditch outfall) reveals the impact that TID water had on Ashland Creek. During the period from June 10 through August 15, TID water had only a slight, possibly insignificant effect on *E. coli* levels in Ashland Creek, and *E. coli* levels were in the "safe" zone for water contact. From August 18 through Oct. 13, TID water had a significant impact on *E. coli* levels in Ashland Creek. During late summer, water from TID comprised over one third of the water in Ashland Creek below the TID ditch outfall.

Figure 2 indicates that *E. coli* levels tended to increase downstream of site 3. This was evident during the sampling period from September 18 through October 13, when water levels were at their lowest, but was not consistently observed throughout the summer. In addition, our data suggest that fecal matter is entering Ashland Creek upstream of site 7, but below site 9. Further sampling at these locations is needed to determine the significance of this observation.

For further comparison, Figure 3 shows box plots of all of the Ashland Creek sampling site data taken on non-rain days, and Figure 4 shows both rain and non-rain days. These data have not been log transformed; they represent the actual spread of data collected. On Figure 4, the scale has been kept the same as Figure 3, and all 4 sites that are shown going off the charts are equal to 2420 as the maximum value.

Figure 3. *E. coli* box plots for Ashland Creek sites for all data collected on non-rain days.

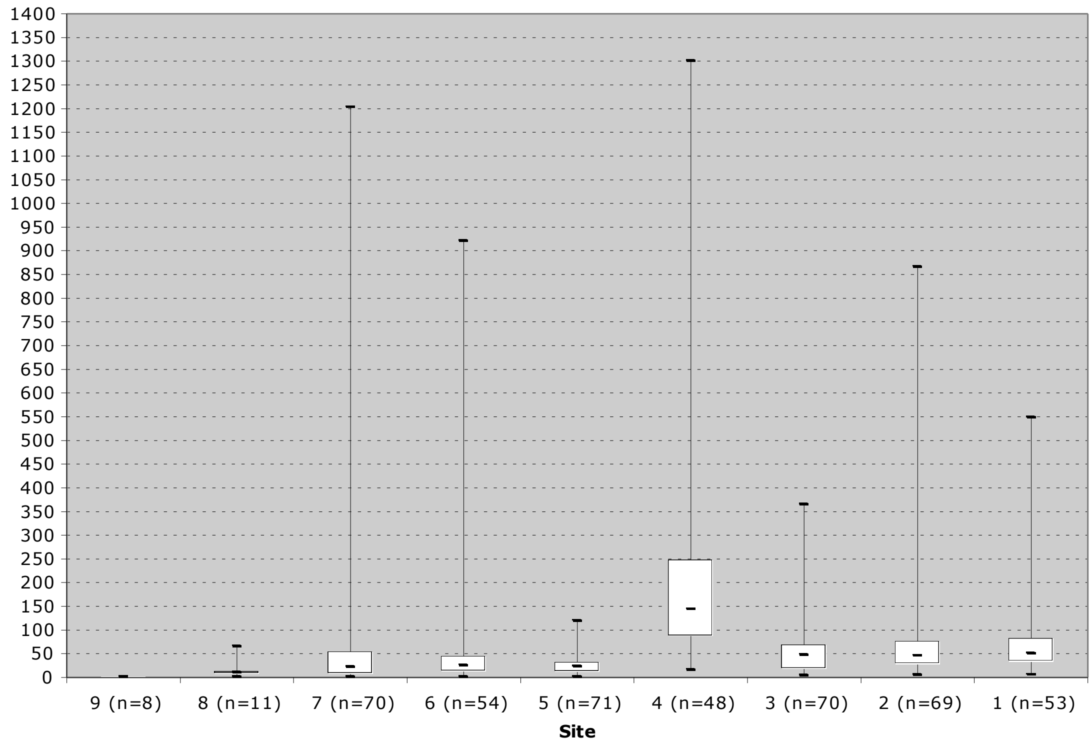
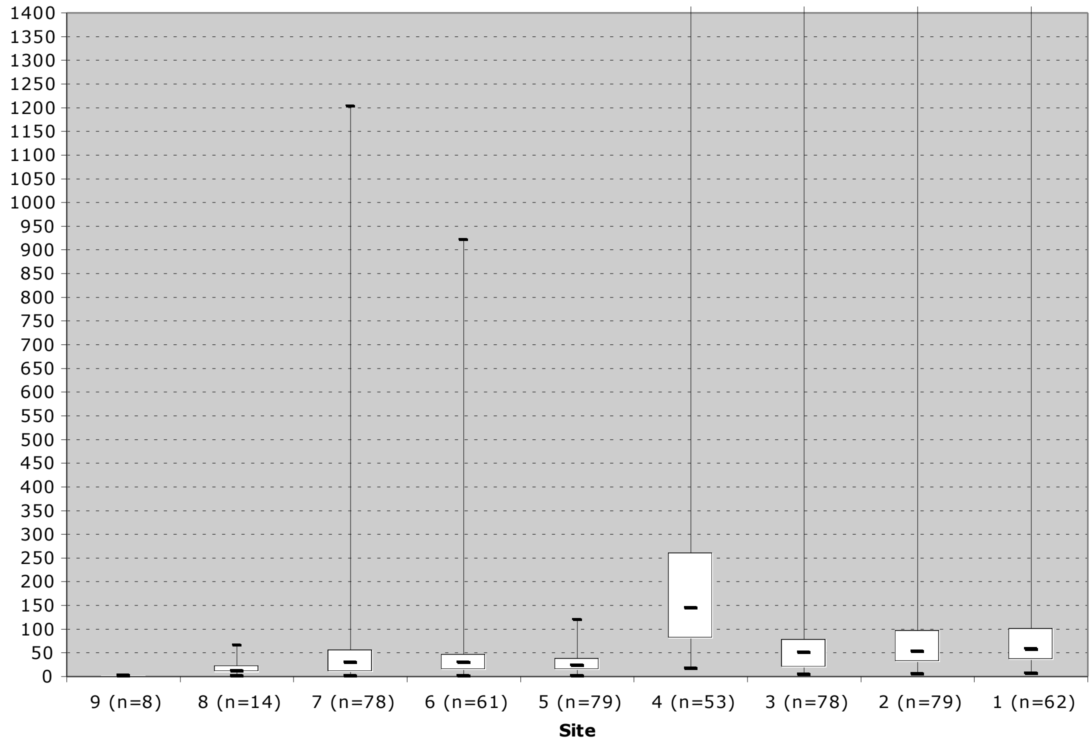


Figure 4. ***E. coli*** **box plots for Ashland Creek sites for all data collected on rain and non-rain days (all sites that are shown going off the charts are equal to 2420 as the maximum value).**



E. coli levels in Talent Irrigation District (TID) Ditch

The TID ditch is an integral part of the Ashland community. It provides irrigation water for those who live in Ashland and the nearby town of Talent, and it contributes a significant amount of water to Ashland Creek, especially in late summer. Because the TID ditch contributes a large volume of water to Ashland Creek each year it was important to evaluate it as a possible source of *E. coli*.

The water that flows though the TID ditches in Ashland originates in the Klamath Basin. The Klamath Basin supplies many reservoirs including Howard Prairie, Lake Hyatt Reservoir, and Emigrant Lake. These reservoirs then supply the Bear Creek Watershed, including the TID, Medford Irrigation District, and Rogue River Valley Irrigation District. The TID ditch operates from approximately April to October and is used for farm and rangeland irrigation, primarily outside of city limits, irrigation of urban land within city limits and during some years supplies supplemental drinking water supply for the City of Ashland. During 2010, the TID irrigation season was extended to October 15.

As discussed earlier the TID ditch passes into an inverted siphon that conveys the water across the Ashland Creek. At the creek crossing, some water from the TID ditch and siphon system discharges to Ashland Creek (see photo on front cover). The TID discharges to Ashland Creek, in part, to add water to the creek in order to meet water right obligations in Lower Ashland Creek.

Because we observed that the TID ditch was a likely contributor of *E. coli* to Ashland Creek during the month of June, 2010, we expanded our study to determine if the source of *E. coli* in the TID ditch originates outside of city limits, possibly from creek access by grazing animals, or inside city limits from human, dog, and/or wildlife contributions. Within city limits the TID ditch flows through many neighborhoods. TID ditches are mostly open to public access and many people, dogs, and wildlife frequent accessible and adjacent trails. The most popular trails are in the vicinity of Park Street to Pinecrest Terrace and Morton Street to Herbert Street. Some sections of the TID ditch are piped as shown on Map 4.

Figure 5. Geometric *E. coli* MPN/100mL for sites 3, 4 and 5, below the TID ditch outfall, the TID ditch outfall, and above the TID ditch outfall, combined data for duration of study.

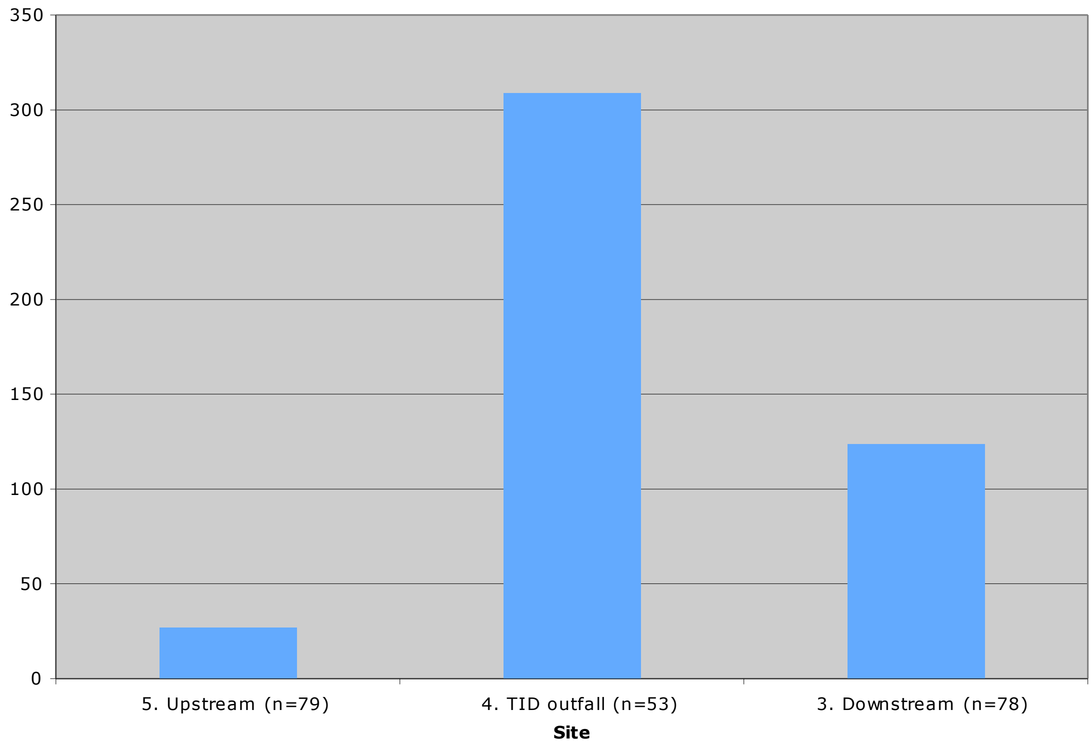


Table 3. Means and standard deviation for *E. coli* above the TID ditch outfall (site 5), the TID ditch outfall (site 4), and below the TID ditch outfall (site 3) Data from water samples from rainy days and non-rainy days June 10 through Oct. 13 were included in the calculations.

	Above TID (Site 5)	TID Outfall (Site 4)	Below TID (Site 3)
Geometric mean	16.5	163.7	40.6
Geometric standard deviation	3.1	2.9	3.6
Mean (MPN/100mL)	26.8	308.8	123.7
Standard deviation (±MPN/100mL)	24.1	492.0	361.1
Sample size	n=79	n=53	n=78

Figure 5 and Table 3 show that *E. coli* from the TID outfall (site 4) significantly increases the *E. coli* concentration below the TID in Ashland Creek (site 3). This can been clearly seen by comparing the geometric mean or arithmetic mean *E. coli* MPN/100mL at each site. The effect of TID water on E. coli levels in Ashland Creek was even more evident during rain storms (see box plots in Figure 8 below).

Figure 6. Geometric mean *E. coli* MPN/100mL for TID sample sites and TID outfall to Ashland Creek (all sample days).

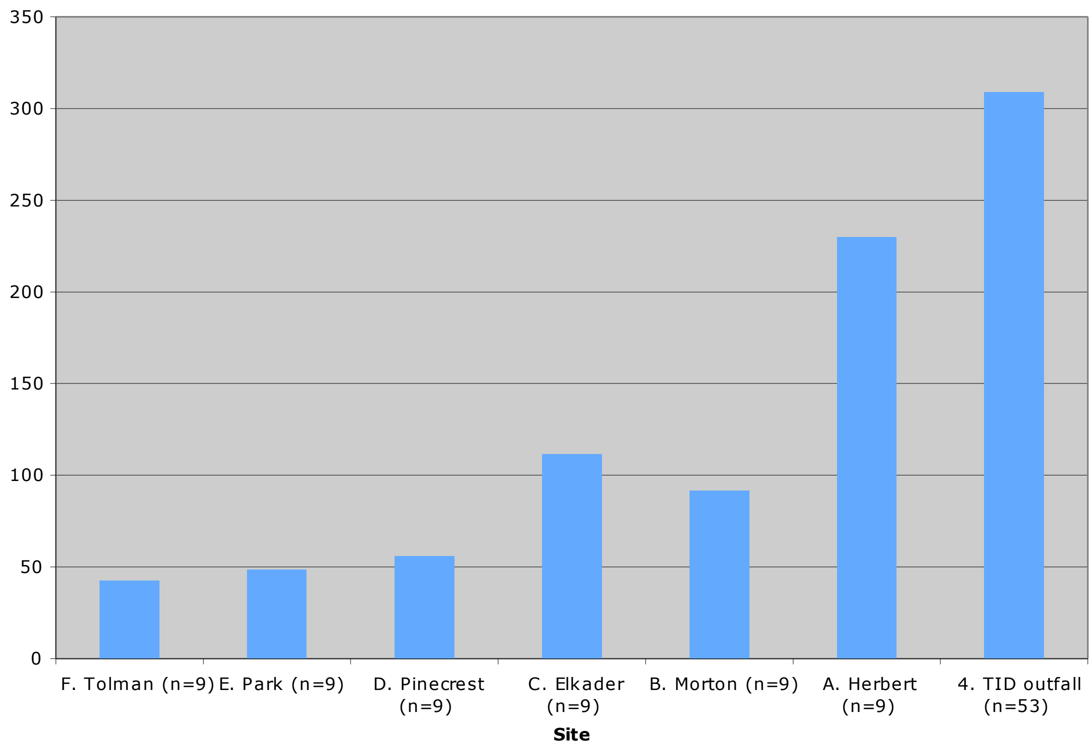
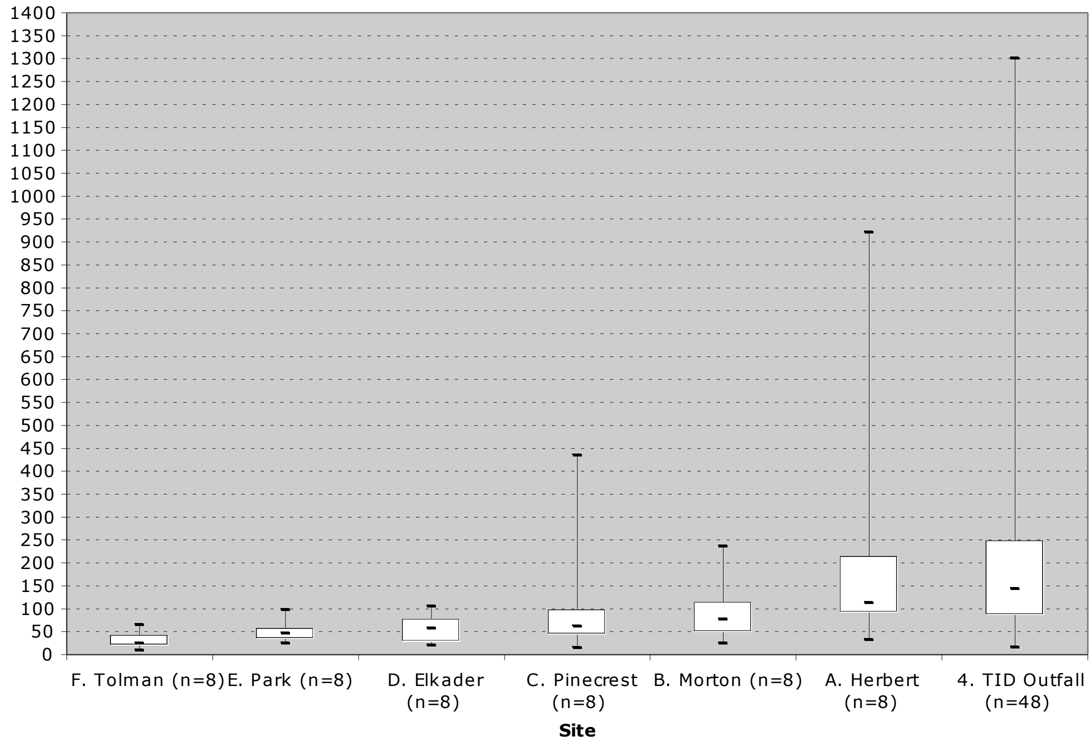


Figure 7. *E. coli* box plots for TID sites for all data collected on non-rain days.



The increase in *E.coli* as water in the TID ditch flowed from site F to site A was highly significant based on the non-overlap of IQR boxed data between sites F and A. This indicates that fecal contamination is entering TID ditches within the City of Ashland.

Table 4. Means and standard deviations for *E. coli* at all TID ditch sites and the TID ditch outfall (all sample days.

	Tolman Creek (Site F)	Park (Site E)	Pinecrest (Site D)	Elkader (Site C)	Morton (Site B)	Herbert (Site A)	TID Outfall (Site 4)
Geometric mean (MPN/100mL)	32.1	44.8	48.1	73.7	74.8	143.6	163.7
Geometric standard deviation (±MPN/100mL)	2.2	1.5	1.8	2.6	2	2.7	2.9
Mean (MPN/100mL)	42.4	48.6	55.9	111.6	91.8	229.9	308.8
Standard deviation (±MPN/100mL)	36.4	22.0	29.9	127.5	64.1	279.3	492.0
Sample size	n=9	n=9	n=9	n=9	n=9	n=9	n=53

Figures 6, 7 and Table 4 demonstrate that *E. coli* counts increased from Tolman Creek, on the east side of town, to the TID outfall into Ashland Creek, on the west side of town. Given the small sample size, it is not possible to pinpoint locations along the TID canals that are primarily responsible for *E. coli* input. What is clear is that there was a significant increase in *E. coli* as TID water traveled through the South side of Ashland

Effects of Storm Drain Effluent and Storm Events

Storm events have been shown to cause increases in bacterial contamination in waterways (Busse & Gannon, 1989). City data shows there 19 storm drains that discharge into Ashland Creek above the playground wading area (see Map 5) and they may convey fecal matter to the creek.

Of the storm drains that lead into Ashland Creek within our study area, the Nutley storm drain is the largest. The Nutley storm drain collects urban runoff from a dense residential area that covers 49.3 acres. It is, by far, the largest area covered by any of the drains, see Map 5 for stormwater basins and drain locations. Each of the stormwater basins displayed on Map 5 collects all stormwater inside the polygon, and discharges it at an outfall connected to the basin by a pipe. The other basins to the west of Ashland Creek are all of smaller size, and contain less housing density.

The significance of the Nutley storm drain *E. coli* contribution was determined by comparing geometric mean *E. coli* MPN/100mL at sample sites above and below the Nutley drain (sites 2 and 1) during rain events. The amount of water that is released to Ashland Creek via the Nutley drain was minimal during this study. The drain was dry except during rain, and even during a relatively heavy rainstorm, the flow from the drain was estimated at 0.5 gallons per minute. Other storm drains that lead to Ashland Creek within our study area were also observed to contribute minimal water to the creek during rain events.

Table 5. *E. coli* MPN/100mL from sites 1 and 2 during rain events. Sample size, precipitation and geometric mean MPN/100mL are included.

Date	Site 2: above drain (MPN/100mL)	Site 1: below drain (MPN/100mL)	Precipitation (in.)
8/17/10	261	248	0.05
8/30/10	53	68	0.11
9/8/10 AM	72	99	0.13
9/8/10 PM	214	272	Rain in AM
9/17/10 7 PM Sample #1	2420	2420	0.16
9/17/10 9 PM Sample #2	2420	2420	0.16
10/23/10 AM	980	980	0.95
10/23/10 PM	167	204	0.95
10/24/10	1046	816	0.58
Sample size	9	9	--
Geometric mean	391.0	467.8	--

Table 5 shows that there was only a slight, likely insignificant difference in the amount of *E. coli* in Ashland Creek above and below the Nutley storm drain during the rain events studied in the summer and fall of 2010.

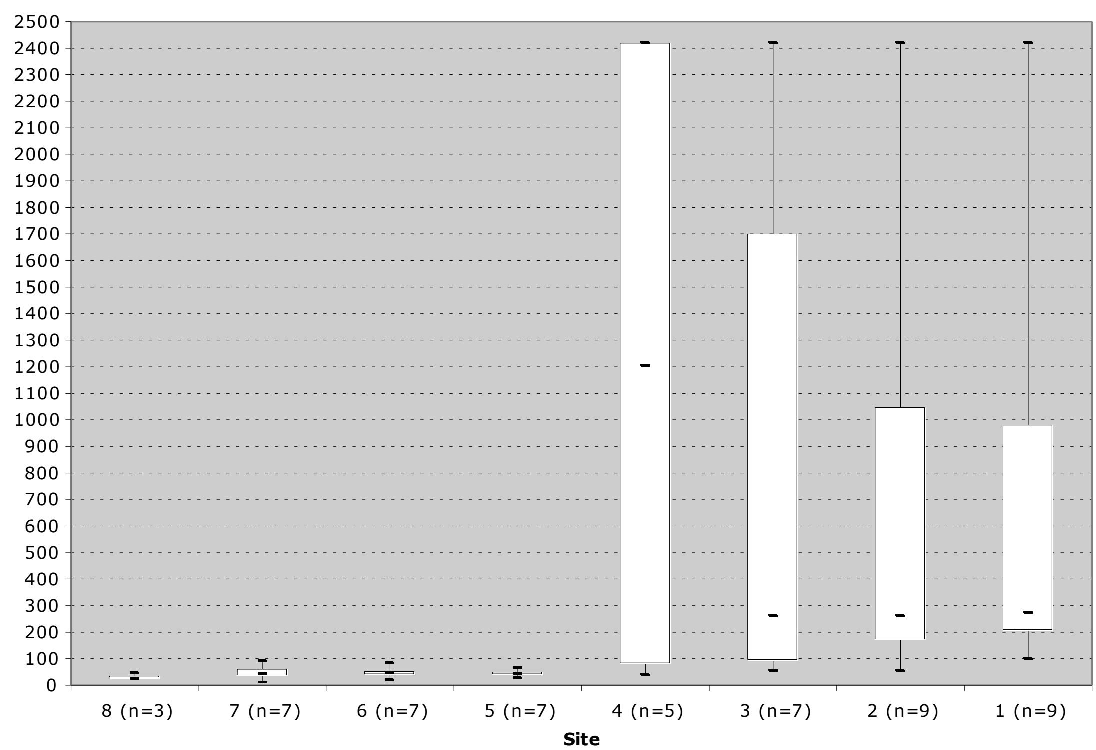
Although the Nutley storm drain did not appreciably affect Ashland Creek *E. coli* levels, we did observe significantly higher *E. coli* levels during rainy days as compared to dry days at the downstream sites in our Ashland Creek study area.

Table 6. Geometric mean *E. coli* MPN/100mL on rain and non-rain events for sites 1, 2 and 3 on Ashland Creek.

	Site 3: below TID	Site 2: above drain (MPN/100mL)	Site 1: below drain (MPN/100mL)
Geometric mean *E. coli* MPN/100mL dry days	38.2 n=70	46 n=69	49 n=53
Geometric mean *E. coli* MPN/100mL rainy days	360.2 n=7	391 n=9	467.8 n=9

Table 6 compares geometric mean *E. coli* MPN/100 ml at Ashland Creek sites 1, 2, and 3 during rainy and non-rainy days. It is evident that *E. coli* contamination increases significantly during rain events. A comparison of geometric means indicates that for *E. coli* MPN/100mL from upstream sites 5, 6, and 7 on rainy and dry days did not reveal any significant effect of rain flushing fecal matter out of the storm drain system (see Figure 8 for box plot graphs of all sites on days with precipitation).

Figure 8. *E. coli* box plots for Ashland Creek sites for all data collected on rain days.



Given that storm drains appear to contribute too little water to make a difference in *E. coli* during rain events, it is likely that non-drain associated storm water is a greater contributor to *E. coli* in Ashland Creek in summer than storm water discharging to the creek through drains. The summer storms appear to wash animal fecal matter into the TID ditch. This causes large temporary increases in *E. coli* being discharged into Ashland Creek from the TID outfall during storm events.

Creek Flow

The levels, temperature and gauge height shown in Figure 9 represent the data gathered from the water level logger placed in Ashland Creek. Noticeable gaps in data collection are the result of vandalism of the gauge installation (late September to late October) or when the gauge was removed download data (mid August).

Water temperatures increased steadily peaking in late August, then steadily dropped back down. Flow started high in June, dropping rapidly and flattening out by August. The flow started to steadily rise, with November starting out approximately half the flow that was present in late June.

Figure 9. Ashland Creek Flow, Temperature and Gauge Height for duration of study.

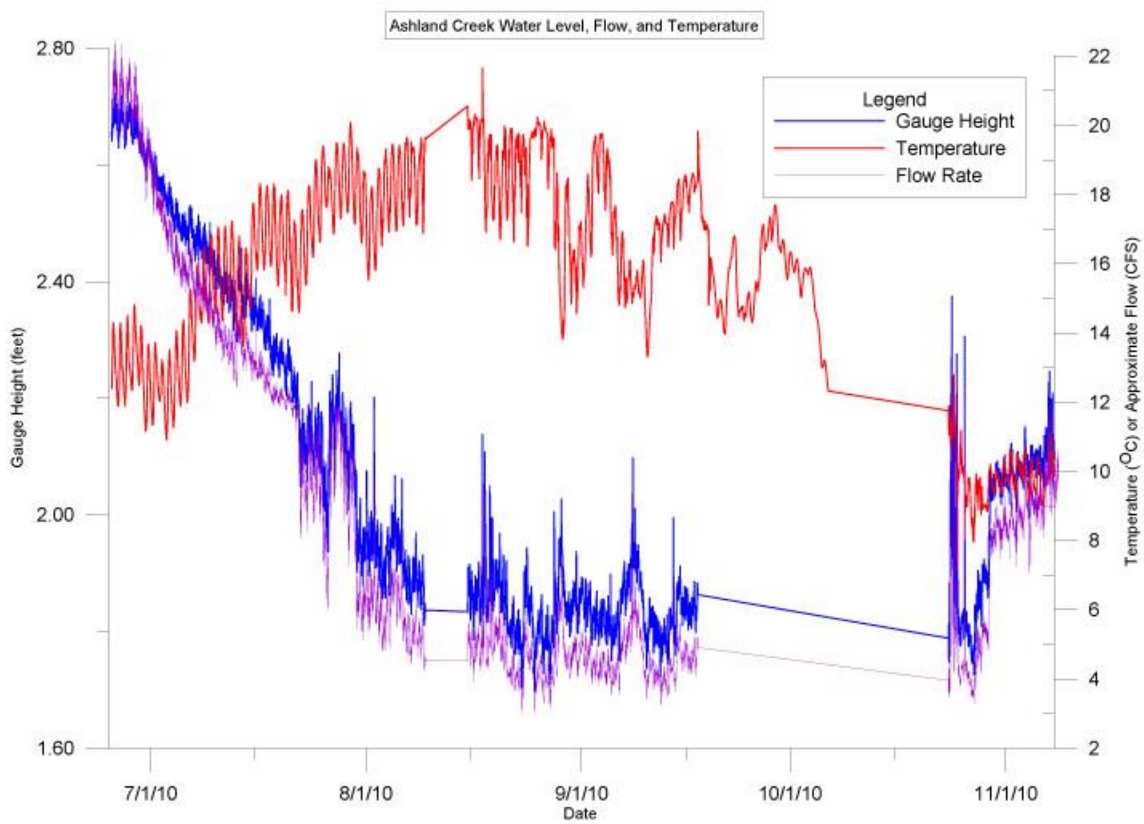


Figure 10 shows a one-week period from July 1st to July 7th, and displays the daily temperature and flow fluctuations.

Figure 10. Ashland Creek Flow, Temperature and Gauge Height for July 1st through July 7th.

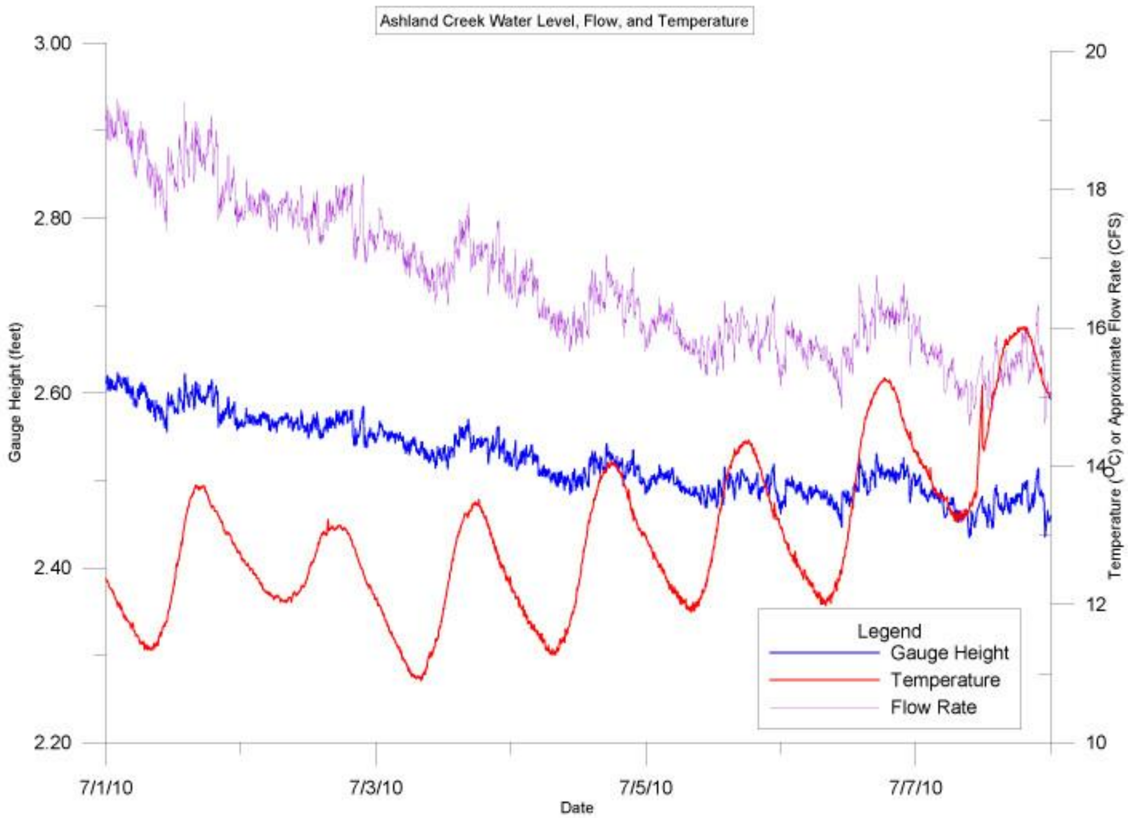


Figure 11 displays flow measured at the City of Ashland's weir on Water Street, flow measured from the level logger, and flow measured by a weir on the TID discharge to the creek. This gives us a visual representation of how much of the flow in Ashland Creek is from the TID ditch throughout the summer months.

Figure 11. Ashland Creek Flow at Water St Weir, TID Outfall and RRK Gauge Station.

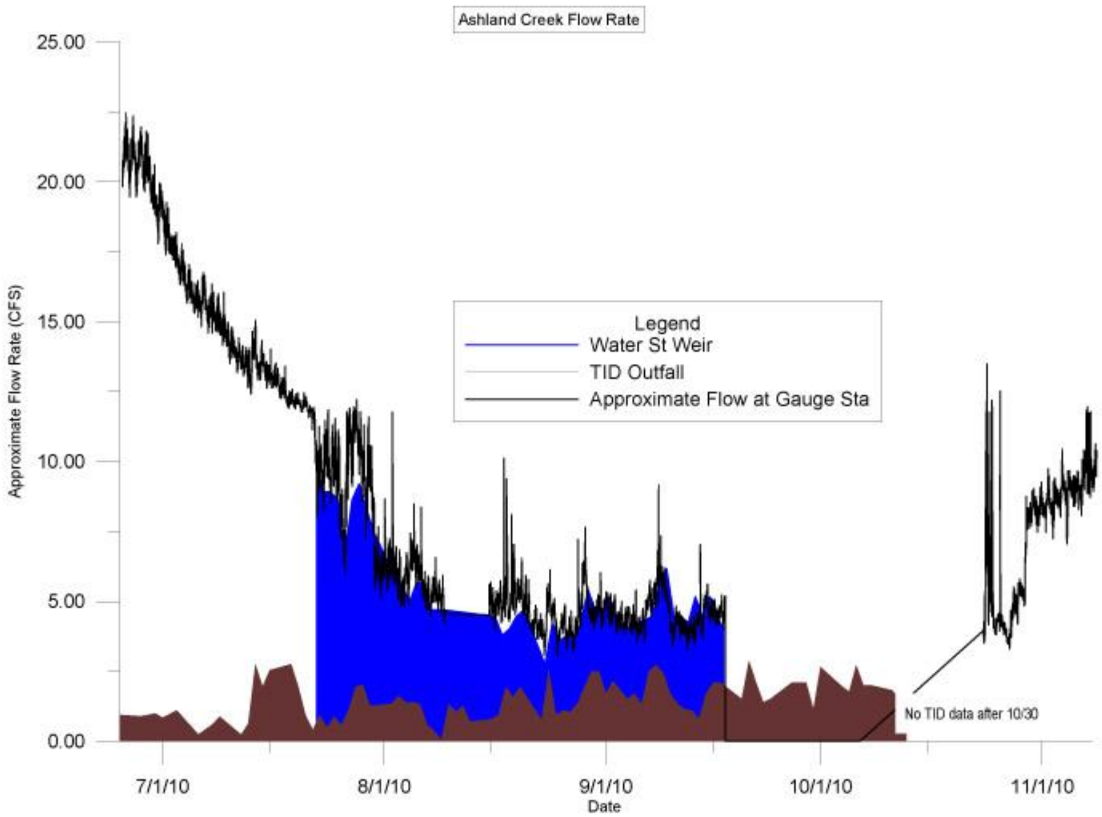


Table 7. Percent of Ashland Creek flow that is from the TID ditch by date.

Dates	Creek flow mean in cfs	TID flow mean in cfs	Percent of creek that is from TID outfall	Source of creek flow data
6/25 – 6/30	20.4	0.94	4.6%	RRK Gauge
7/1 – 7/15	15.2	1.03	6.8%	RRK Gauge
7/16 – 7/31	10.5	1.37	13%	RRK Gauge
8/1 – 8/15	5.04	1.04	20.6%	City Weir
8/16 – 8/31	4.17	1.56	37.4%	City Weir
9/1 – 9/15	4.83	1.71	35.4%	City Weir
9/16 – 9/30	4.85	1.89	39%	City Weir
10/1 – 10/13	4.97	1.98	39.8%	City Weir

The majority of the daily flow data used in the calculations for Table 7 was collected at the City weir. During periods where the water levels were higher than the weir's ability to measure them (above 11.8 cfs) it was from the level data recorded at the gauge station. The level logger was installed within 50' upstream of the City weir. The level logger was installed on Ashland Creek on 6/25, and immediately began collecting data. The final date of data collection on the logger was 10/13 (the last day we have data for the TID ditch outfall). Data was averaged in 15-day blocks starting on 7/1. From mid-August to mid-October, the TID ditch outfall accounts for 35-40% of the total flow of Ashland Creek.

Figure 11 shows total *E. coli* amount that TID water is contributing to the system rises substantially later in the summer, rising up until irrigation water was turned off on (last sample on 10/13). The weighted means of total *E. coli* were calculated using the percent of total creek flow data from Table 8, and the geometric means of *E. coli* measurements for sites 4 and 5 (TID ditch outfall and the creek upstream from TID ditch outfall) for the specified date segments. In early August TID water made up 20.6% of the total flow of Ashland Creek, and the *E.* coli levels were high enough in that amount of water to be contributing 11.6 MPN/100mL after adjusting for volume diluting into the creek (compared to the 36 MPN/100mL from the creek itself). In early September TID water made up 35.4% of the creek flow, with a weighted TID mean of 78.9 MPN/100mL to the creek with a weighted mean of 20.9 MPN/100mL. By mid October just before the TID ditch was turned off TID water made up 39.8% of the water volume, with a weighted TID mean of 104.3 to the weighted mean for the creek of 9 MPN/100mL. See Table 8 for more details, and Figures 3, 4 and 7 for boxplot information that covers sites 3, 4 and 5 (upstream, TID outfall and downstream).

Figure 12. Creek Flow and TID ditch outfall flow shown with weighted mean *E. coli* for sites 4 and 5 (weighted mean calculated using geometric mean of E. coli data).

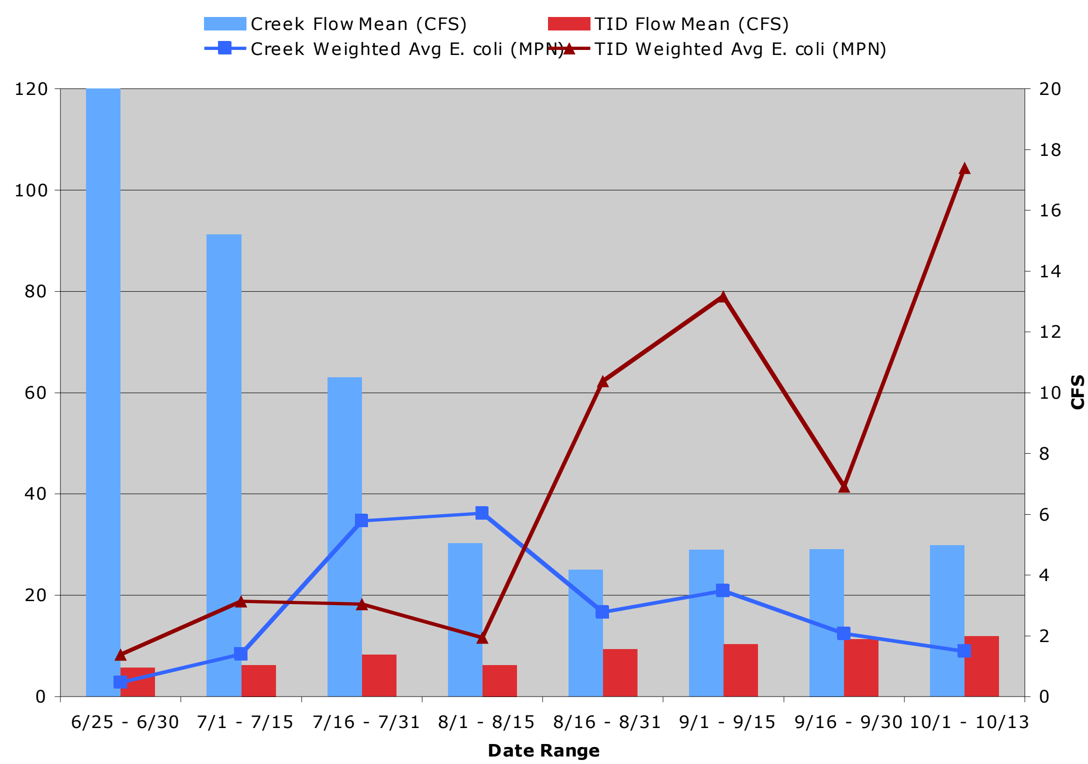


Table 8. Weighted mean of *E. coli* from Ashland Creek and TID sources calculations.

	Flow in cfs		% of Flow in creek from		Geometric *E. coli* means at Site in MPN/100mL			Weighted *E. coli* mean in MPN/100mL	
Dates	**Creek**	**TID**	**Creek upstream**	**TID**	**5**	**4**	**3**	**Creek**	**TID**
6/25 - 6/30	20.4	0.94	94.4	4.6	2.94	179.95	7.62	2.81	8.28
7/1 - 7/15	15.2	1.03	93.2	6.8	8.96	277.12	17.68	8.35	18.84
7/16 - 7/31	10.5	1.37	87	13	39.88	140.75	49.42	34.70	18.30
8/1 - 8/15	5.04	1.04	79.4	20.6	45.57	56.45	64.13	36.19	11.63
8/16 - 8/31	4.17	1.56	62.6	37.4	26.66	166.45	105.55	16.69	62.25
9/1 - 9/15	4.83	1.71	64.6	35.4	32.35	223.10	131.40	20.90	78.98
9/16 - 9/30	4.85	1.89	41	39	20.36	106.36	73.86	12.42	41.48
10/1 - 10/13	4.97	1.98	40.2	39.8	22.30	262.15	69.35	8.97	104.33

Temperature, Conductivity, Turbidity and pH

Monitoring conductivity, turbidity, temperature, and pH at nine sites along the creek was included for this study in order to know what the baseline for these parameters is throughout the summer. We wanted to know how and if the parameters vary from month to month, as well as if there were any correlations between these parameters and *E. coli* levels. This baseline information is useful for comparisons in any future studies or monitoring projects on Ashland Creek.

Most of the sites were sampled four times a week for all the parameters, although there were occasional variations due to technical or logistical complications. Sites 8 and 9 have much smaller sample sizes because they were not part of the original study, but were added as additional sites in the middle of August. Once those sites were added as part of the study they were only sampled once a week. Sites 1 and 4 show consistently smaller sample sizes because they were not part of the City's Wednesday morning samples, so instead of four times a week they were sampled three times a week. Site 4 has a much smaller sample size relative to the other parameters for 9/16/10 – 10/30/10 because the TID ditch was shut off after the first week in October.

Conductivity (see Table 9) steadily increased at most sites throughout the duration of the study. The main exception was site 4 (TID ditch outfall), which remained relatively constant.

Table 9. Conductivity Mean and Standard Deviation for Ashland Creek.

Conductivity (microsiemens per centimeter) mean, standard deviation and sample size	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
6/16 – 10/30/10	83.7 ± 20 .3 n = 50	83 2 ± 20.8 n = 66	77.6 ± 18.1 n = 60	83.7 ± 3.2 n = 42	79.1 ± 20.1 n = 60	74.0 ± 17.4 n = 66	73.5 ± 17.1 n = 69	87.8 ± 5.5 n = 11	84.3 ± 5.2 n = 9
6/16 - 7/15/10	53.1 ± 1.2 n = 12	53.4 ± 5.8 n = 17	50.6 ± 3.4 n = 17	87.3 ± 3.7 n = 12	49.6 ± 1.5 n = 17	49.0 ± 1.6 n = 17	48.5 ± 1.2 n = 17	N/A	N/A
7/16 - 8/15/10	81.4 ± 11.0 n = 12	81.9 ± 10 .9 n = 16	75.8 ± 9.4 n = 16	81.9 ± 1.4 n = 12	75.1 ± 11.3 n = 16	71.4 ± 9.4 n = 16	70.6 ± 9.9 n = 16	N/A	N/A
8/16 – 9/15/10	96.5 ± 5.3 n= 10	96.3 ± 4.0 n = 14	88.9 ± 4.3 n = 14	81.8 ± 1.3 n = 10	93.1 ± 3.5 n = 14	84.4 ± 2.8 n =14	82.6 ± 3.9 n = 14	84.2 ± 5.5 n =5	81.7 ± 7.2 n= 4
9/16 – 10/30/10	100.5 ± 8.6 n = 16	101.3 ± 9.7 n = 19	93.3 ± 5.8 n = 21	83.4 ± 5.8 n = 8	96.8 ± 5.7 n = 21	91.1 ± 4.1 n = 19	89.7 ± 4.2 n = 22	90.8 ± 3.4 n = 6	86.3 ± 1.9 n = 5

The study results for turbidity indicate that sample site 4 (TID ditch outfall) consistently had the highest turbidity levels (see Table 10). During the period from 7/16/10 – 8/15/10 turbidity readings at site 4 were at the highest levels, several times higher than any other site. Right below the TID ditch input, at site 3, the turbidity level average was often somewhat higher than the averages for the rest of the creek. Whatever effect the TID ditch input had on site 3 seemed to diminish due to dilution as the flow reached site 2, although sites 1 and 2 were still a bit higher than the sites above 4 (TID ditch outfall), which consistently indicated the lowest turbidity levels.

Table 10. Turbidity Mean and Standard Deviation for Ashland Creek.

Turbidity (NTU) mean, standard deviation and sample size	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
6/16 – 10/30/10	1.6 ± 0.5 n = 50	1.6 ±0.4 n = 62	2.1 ±0.9 n = 68	6.0 ± 6.9 n = 45	1.1 ±0.4 n = 68	1.1 ±0.5 n = 66	1.1 ±0.5 n = 68	0.8 ± 0.2 n = 11	1.0 ±0.5 n = 8
6/16 - 7/15/10	1.3 ± 0.2 n = 12	1.3 ±0.3 n = 17	1.2 ± 0.2 n = 17	4.5 ± 1.3 n = 12	1.2 ±0.4 n = 17	1.3 ±0.6 n = 17	0.9 ± 0.2 n = 17	N/A	N/A
7/16 - 8/15/10	1.8 ± 0.5 n = 12	1.8 ±0.5 n = 12	2.3 ± 0.7 n= 16	9.1 ± 12.7 n = 12	1.1 ±0.4 n = 16	1.1 ±0.5 n = 16	1.3 ±0.6 n = 16	N/A	N/A
8/16 – 9/15/10	1.6 ± 0.3 n = 10	1.7 ± 0.5 n = 14	2.7 ± 0.6 n = 14	4.4 ± 0.9 n = 10	0.9 ± 0.3 n = 14	1.1 ± 0.3 n = 14	0.9 ± 0.2 n = 14	.8 ± 0.1 n = 5	.8 ± 0.2 n = 4
9/16 – 10/30/10	1.5 ± 0.6 n = 16	1.5 ± 0.5 n = 19	2.2 ± 1.1 n = 21	5.6 ± 1.0 n = 11	1.1 ± 0.4 n = 21	1.0 ± 0.3 n = 19	1.1 ± 0.6 n = 21	0.9 ± 0.2 n = 6	1.2 ± 0.7 n = 4

Temperature monitoring revealed very little fluctuation from site to site looking at overall averages, as well as within each time frame, except for site 4 (TID ditch outfall), which always exceeded average temperatures of the sites along the creek each month (see Table 11).

The temperatures for site 4 were the highest from 7/16 to 8/15/10, which correlated with the overall pattern for the creek. However, the TID ditch outfall temperatures ranged from 13.7° C in October to 23.7 ° C in July/August, whereas the range for the rest of the sites was 10° C in October to 19.2°C in July/August.

Table 11. Temperature Mean and Standard Deviation for Ashland Creek.

Temperature (°C) mean, standard deviation and sample size	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
6/16 - 10/30/10	14.9 ± 3.0 n = 50	14.7 ± 2.9 n = 66	14.7 ± 3.2 n = 68	19.3 ± 3.3 n = 43	14.1 ± 2.9 n = 68	14.2 ± 2.8 n = 66	13.7 ± 2.6 n = 67	14.0 ± 2.4 n = 11	13.7 ± 2.3 n = 9
6/16 - 7/15/10	12.9 ± 2.1 n =12	12.6 ± 2.0 n = 17	12.4 ± 2.0 n = 17	19.4 ± 3.6 n = 12	12.1 ± 2.1 n =17	12.0 ± 1.9 n = 17	11.8 ± 1.8 n =17	N/A	N/A
7/16 - 8/15/10	18.0 ± 1.2 n =12	17.7 ± 1.3 n =16	17.8 ± 1.9 n = 16	22.1 ± 1.6 n = 12	17.0 ± 1.3 n = 16	16.9 ± 1.4 n = 16	16.3 ± 1.2 n = 16	N/A	N/A
8/16 – 9/15/10	16.9 ± 1.5 n = 10	16.5 ± 1.5 n = 14	17.0 ± 1.9 n = 14	18.9 ± 2.3 n =10	16.0 ± 1.5 n = 14	16.3 ± 1.4 n =14	15.4 ± 1.2 n= 14	15.9 ± 1.2 n = 5	15.8 ± 0.8 n = 4
9/16 - 10/30/10	12.7 ± 2.3 n =16	12.7 ± 2.2 n = 19	12.6 ± 2.5 n=21	15.7 ± 2.0 n =9	12.2 ± 2.1 n =21	12.5 ± 2.0 n =19	12.0 ± 2.0 n = 20	12.3 ± 1.8 n = 6	12.1 ± 1.5 n = 5

The results for pH are remarkably consistent throughout the study (see Table 12), with nearly all sites having a mean of 7.6, with a standard deviation on all sites no higher than 0.2. The exception again is site 4 (TID) as it has a very different set of factors contributing to its water quality.

Table 12. pH Mean and Standard Deviation for Ashland Creek.

pH mean, standard deviation and sample size	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
6/16 – 10/30/10	7.6 ± 0.1 n = 50	7.6 ± 0.1 n = 66	7.7 ± 0.1 n = 68	7.9 ± 0.2 n = 42	7.6 ± 0.1 n = 68	7.6 ± 0.1 n = 66	7.6 ± 0.1 n = 67	7.6 ± 0.1 n = 12	7.5 ± 0.2 n = 9
6/16 - 7/15/10	7.6 ± 0.2 n = 12	7.6 ± 0.1 n = 17	7.7 ± 0.1 n =17	8.0 ± 0.2 n = 12	7.6 ± 0.1 n = 17	7.7 ± 0.1 n = 17	7.6 ± 0.2 n = 17	N/A	N/A
7/16 - 8/15/10	7.5 ± 0.1 n = 12	7.6 ± 0.1 n = 16	7.7 ± 0.1 n = 16	7.9 ± 0.1 n= 12	7.6 ± 0.2 n = 16	7.5 ± 0.1 n = 16	7.6 ± 0.1 n = 16	N/A	N/A
8/16 – 9/15/10	7.6 ± 0.1 n = 10	7.6 ± 0.1 n = 14	7.7 ± 0.1 n = 14	7.9 ± 0.2 n = 10	7.6 ± 0.1 n = 14	7.5 ± 0.1 n = 14	7.7 ± 0.1 n = 14	7.6 ± 0.1 n = 5	7.7 ± 0.2 n = 4
9/16 - 10/30/10	7.6 ± 0.1 n = 16	7.6 ± 0.1 n = 19	7.7 ± 0.1 n = 21	7.6 ± 0.2 n =8	7.6 ± 0.1 n = 21	7.5 ± 0.1 n = 19	7.6 ± 0.1 n = 20	7.6 ± 0.2 n = 7	7.4 ± 0.1 n = 5

Discussion

Ashland Creek

The *E. coli* levels tended to be highest from mid-July to mid-September when temperatures were highest, with little or no rain, and when overall creek flow was lowest. The data collected from points on Ashland Creek itself (sites 1-9) generally showed that the *E. coli* levels increased as water travels further downstream, with a major increase in *E. coli* below the TID ditch outfall (see "Results: *E. coli* levels in Ashland Creek" section). The exception appeared to be site 7, which showed elevated *E. coli* levels compared to the immediately downstream site (site 6) from July onward.

Site 7 is located just upstream of an unused diversion structure which could be used to divert water around the swimming reservoir at the top of Granite Street. The sampling location was right off the road in an area with a lot of large rocks and logs, which is an easy access point to the creek for dogs and people. Site 8, approximately ¼ mile upstream, consistently had lower *E. coli* levels.

Site 8 is accessed from the top of Granite Street and is located a short distance upstream of the old Ashland police shooting range, just outside of city limits. The area has multiple trails running through it, and is most commonly accessed from a parking area on the west side of the creek, in close proximity to the gated access road to the municipal water treatment plant. On most days for the duration of our study one would find 2-6 cars parked here, and a couple of groups or individuals strolling, picnicking or walking their dogs along the creek. Commonly seen in this area were piles of dog feces in close proximity to the creek. On occasion tents and campers were seen next to the creek and one individual was seen doing their laundry in the creek. The highest human use area of the creek in this region is located between sites 7 and 8.

While this study does not address the type of animal, or animals, responsible for the *E. coli* levels in Ashland Creek, data suggests that there might be a connection between increased human and dog use of the creek and higher amounts of *E. coli*. Wildlife is present in this area, but likely no more than anywhere upstream or downstream.

Talent Irrigation District (TID) Ditch

Our data shows that water in TID is the major contributor of *E. coli* into Ashland Creek. The TID ditch results showed that this contamination is occurring within city limits. *E coli* increases in concentration from Tolman Street to the TID outfall to Ashland Creek. A limited data set prevents a more accurate assessment of each location. Possible sources of the *E. coli* in TID water may include pet dogs, wild animals, or other possible human influences.

There is a trail open to the public that follows the TID ditch from approximately ¼ of a mile east of Park Street and continuing west to and following Pinecrest Terrace. This trail stops at residential areas near the end of Pinecrest Terrace and then goes through private property. Joggers and dog walkers frequent this trail, especially between Park Street and up to Pinecrest Terrace. During the testing period there were often sightings of animal feces, mostly dog, along the trails. If these feces entered the TID ditch, they would be a major contributor to *E. coli* levels.

There was a significant increase in the concentration of *E. coli* from Morton Street to the TID ditch outfall at Ashland Creek suggesting that there was major contributor of *E. coli* along the TID ditch from Morton Street to the outfall. There are trails open to the public that follow from Morton Street to the TID ditch above Herbert Street. This area is a mix of residential and some open woodland following this stretch of the TID ditch. Wildlife is certainly a potential source of fecal matter that may be entering the TID canal. Also, people and pets are known to walk these trails. Our data do little to narrow down the animal source of *E. coli*, but the observation of dog feces along trails that follow TID ditches casts suspicions in that direction.

The City does not allow new septic systems to be installed, but older systems may still be operating in that vicinity. Some homes uphill from the TID ditch are outside Ashland city limits and could have recent septic systems, but could be plumbed into the City sewer system. Further study of City and County records would be needed to evaluate the presence of septic systems near the TID ditch, and to investigate if some might be leaking. However, if *E. coli* were entering the TID from an improperly operating septic system or leaking sewer pipe we would expect to see consistent and sharp increases in the *E. coli* levels along the ditch, then leveling off past the source of contamination. Additionally according to EPA TMDL documents (USEPA 2001, Cude 2005) the daily amount of raw sewage required to cause the levels we are seeing in Ashland Creek, would need to between 8 and 33 gallons.

So while the possibility of leaking septic systems cannot be ruled out, the results that we would expect to see in this situation do not correspond to our results. Should additional study be done this would be an area that could use additional scrutiny.

Lastly, it is important to note that the TID ditch evaluation only contained 9 samples through the dates of July 14th - October 13th. This is small compared to the Ashland Creek evaluation, which contained approximately 80 samples through the dates of June 10th – October 30th.

The Nutley Storm Drains and Storm Events

Our results indicate that the contribution to the *E. coli* concentration by the Nutley storm drain during rain events of summer 2010 is negligible. Given that the total precipitation during each of the rainfall events observed during the summer of 2010 was 0.16 inch or less, the possibility that summer storm events contribute greater amounts in some years cannot be ruled out.

E. coli concentrations increased at all sample sites along the creek during rain events, but the effect was most dramatic downstream of the TID ditch outfall. This increase along the creek could be due to urban runoff from the surrounding residential areas as well as runoff from the banks of the creek carrying fecal matter from wildlife.

Creek Flow

Our results indicate that the weighted mean of *E. coli* in Ashland Creek from TID water started out only slightly higher than the weighted mean of *E. coli* in the creek from sites upstream of the TID ditch outfall. The amount of *E. coli* contributed by TID dropped below the upstream sites in July and early August, then rose above and stayed much higher than the creek until the TID ditch was shut off in October.

The increases in mid summer are beyond the levels that a reduction of total water volume would give assuming that the *E. coli* remained constant. Based on this it would appear that there are other sources of *E. coli* present in summer months that do not appear to be present at other times of the year.

Towards the end of the summer, water from the TID ditch outfall constitutes nearly 40% of the total flow of the creek and up to 90% of the *E. coli* in some stretches of the creek.

Temperature, Conductivity, Turbidity and pH

There did not appear to be any correlation between temperature, conductivity, turbidity or the pH levels in Ashland Creek and *E. coli* levels. Site 4 (TID ditch outfall) had levels for most of these variables that were different than Ashland Creek. Considering that the water is sourced from different watersheds, is partially composed of irrigation return water, and is transported in an open ditch, it is not surprising that the values differ from Ashland Creek, which comes out of a steep heavily forested watershed with almost no development.

Conductivity levels increased steadily in the creek, which would be consistent with an increase as a percentage of flow of groundwater contribution versus surface water as the dry season progresses. Groundwater would have a higher mineral content, and thus higher conductivity readings.

Turbidity was consistently low as one would expect in an almost relatively undeveloped watershed (with the exception of the Mt Ashland Ski area, some logging roads and trails). The exception again was site 4 (TID ditch outfall), but given that it is partially composed of irrigation returns (water that that may have flowed across pasture land and accumulated particulate matter) this seems unremarkable.

Temperature remained what we would expect going through the hottest months of the year. The temperature of TID ditch water was consistently warmer than that of Ashland Creek. At times in July and August, TID water raised the creek temperatures downstream up to 1 degree Celsius. The temperatures should not have been high enough to allow for growth of *E. coli* within the creek or the TID ditch.

Potential Impact of Animal Waste on Ashland Creek Water Quality

According to recent research, non-human (animal) waste represents a significant source of bacterial contamination in rural/urban watersheds and in several instances has been found to contribute the vast majority of non-point source fecal coliform load to surface waters (Alderserio et al., 1996, Trail et al. 1993).

In 1991, the U.S. Environmental Protection Agency (USEPA, 1991) identified pet waste as a "nonpoint source of pollution" to be regulated in the same category as oil and toxic waste. To comply with these regulations, States must identify the source of contaminants impacting surface water quality, develop TMDLs, and implement measures to address the source of the contamination and meet water quality standards. In the case of water quality impacts from pet waste, state, regional and local programs throughout the country have been established to educate the public on the proper methods for management and disposal of pet waste, particularly dog waste. Some local programs include fines to offset some of the costs associated with setting up "pet waste stations," postings and public education.

Pet waste is raw sewage and contains a variety of bacteria and pathogens including (but not limited to) *Escherichia coli* (*E. coli*), *Salmonella spp*., *Giardia spp*., *Cryptosporidium*, and *Psuedonomas aureginosa* (Watershed Protection Techniques, 1999). These pathogens are transported through runoff and surface waters into streams and rivers and may persist in feces, soil or water for weeks to months and in some cases, even years. Once in the waters they pose risks to humans through skin contact and ingestion of water. Although all forms of animal waste may impact water quality, it is interesting to note that the waste from animals whose diet includes meat (such as cats and dogs) tends to be more pathogenic than wastes from grass and grain eaters, including most livestock (Puget Sound Restoration Fund).

The *E. coli* levels that we are seeing in Ashland Creek between October 13th and October 13th could have been caused by as few as a single dog, cat or cow's daily fecal amount (USEPA 2001, Cude 2005). These numbers are very rough and assume all bacteria from an organism for 1 day go into the water, and that there is no die-off of bacteria in the stream. So while we cannot say with any confidence precisely how many animals, it does suggest that the quantity of fecal matter required to pose a health risk is very small.

In addition to the risk these pathogens pose to human health, animal wastes also contain nutrients that promote weed and algae growth (eutrophication) causing harm to aquatic organisms and degrading river health.

Recommendations

Concentrated human activities often result in an increase of bacteria to adjacent waterways (human waste, pet waste, livestock management, etc.). This study indicates that the outfall from the TID ditch discharges a considerable amount of bacteria to Ashland creek. Our data also indicate that bacteria levels increase along the TID ditch inside of City limits. In addition, there are smaller bacteria contributions above Lithia Park. While the source(s) of *E. coli* in Ashland Creek remain elusive, preventative measures aimed at lowering *E. coli* levels in the TID ditch and Ashland Creek can be implemented.

1. Education of public that TID water flows into Ashland Creek
One of the most important and first steps that should be taken is community awareness. Many residents are unaware that the TID is a major contributor of water in Ashland Creek in the summer months. Much like the street labeling of storm drains with "No dumping, drains to stream," people may be more inclined to keep contaminants out should they know where it ends up. With increased awareness people will be more careful about what they and their pets might contribute to TID water and take more care when walking along the trails that border the TID ditch.

2. Dog waste stations along TID ditch and at use areas above Lithia Park
We propose that the City set up 'doggy bag stations' in hopes that people will be more likely to clean up after their pets. The City of Ashland already maintains many such stations at popular dog walking locations throughout town and it could only help to reduce pet waste found regularly on the trail along TID, as well as in and around the creek just above Lithia Park at the top of Granite Street.

3. Pipe the TID ditch within Ashland city limits
A long-term goal to improve the overall water quality of Ashland Creek and TID water, while at the same time conserving water resources, would be to pipe the TID canal. Piping the ditch inside Ashland city limits will prevent the infiltration of any additional bacteria for its entire length in Ashland, regardless of source.

4. Further study focusing on the TID ditch and use areas above Lithia Park
As the study did not initially focus on the TID ditch or areas along Ashland Creek above Lithia Park, a limited data set is available for these areas from which to draw conclusions. It would benefit future studies to collect a greater quantity of samples from the TID ditch and to collect samples from the time the TID ditch is turned on in April, to when it is turned off in late September or early October. While this study indicates that the TID ditch is a conveyance for bacteria, the source of the bacteria remains unknown. Further study is warranted to enable more confident identification of locations and sources for *E. coli* entering Ashland Creek.

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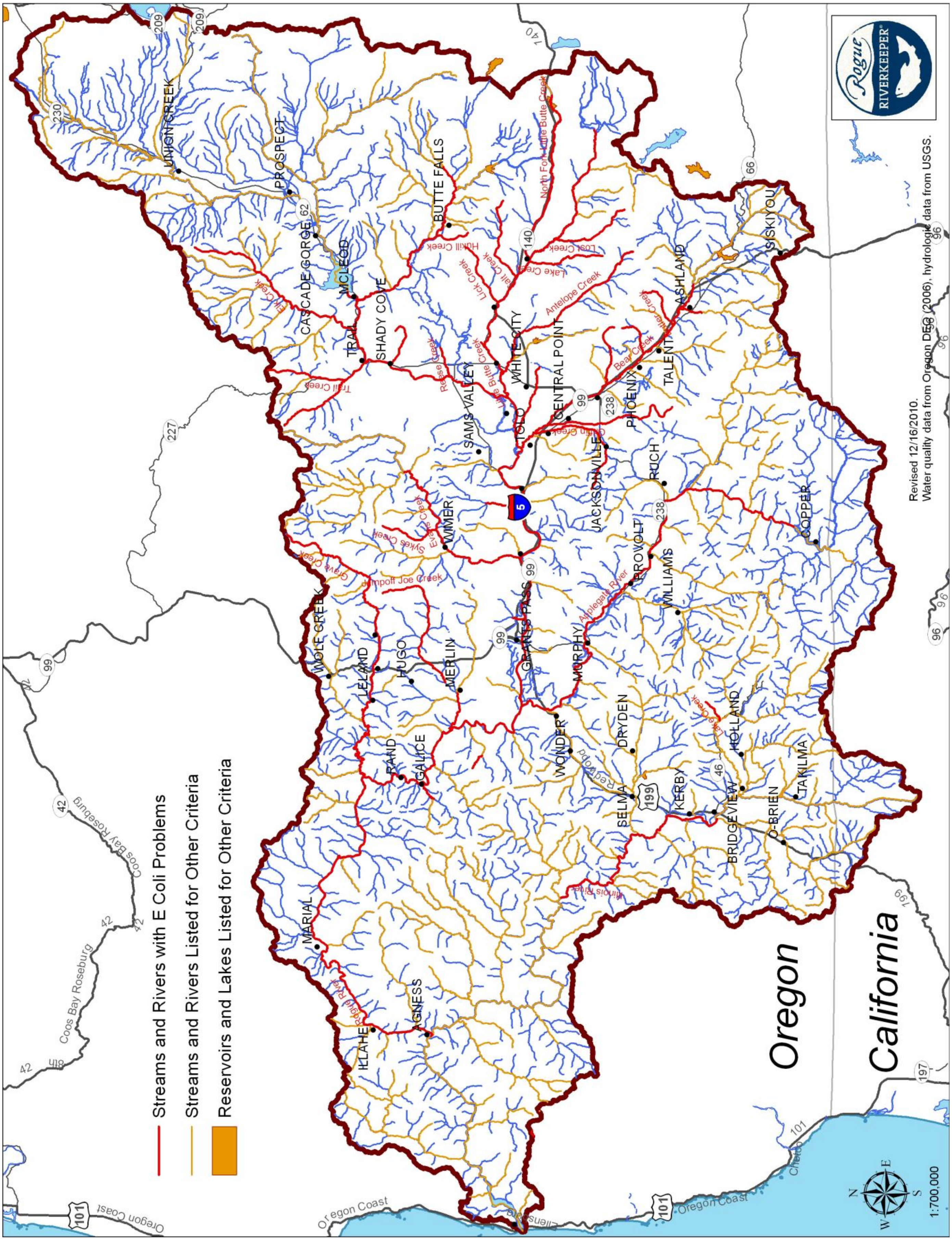
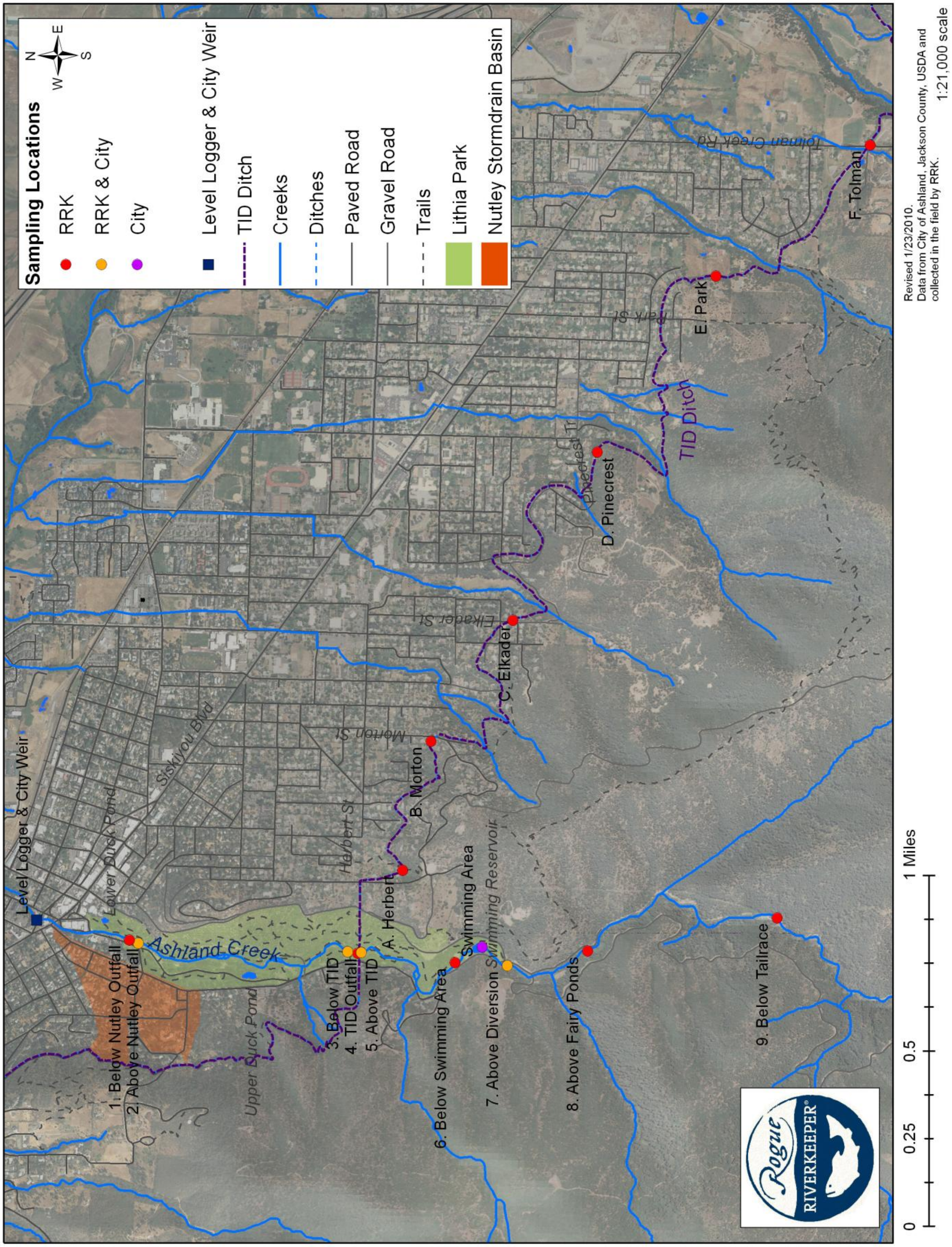
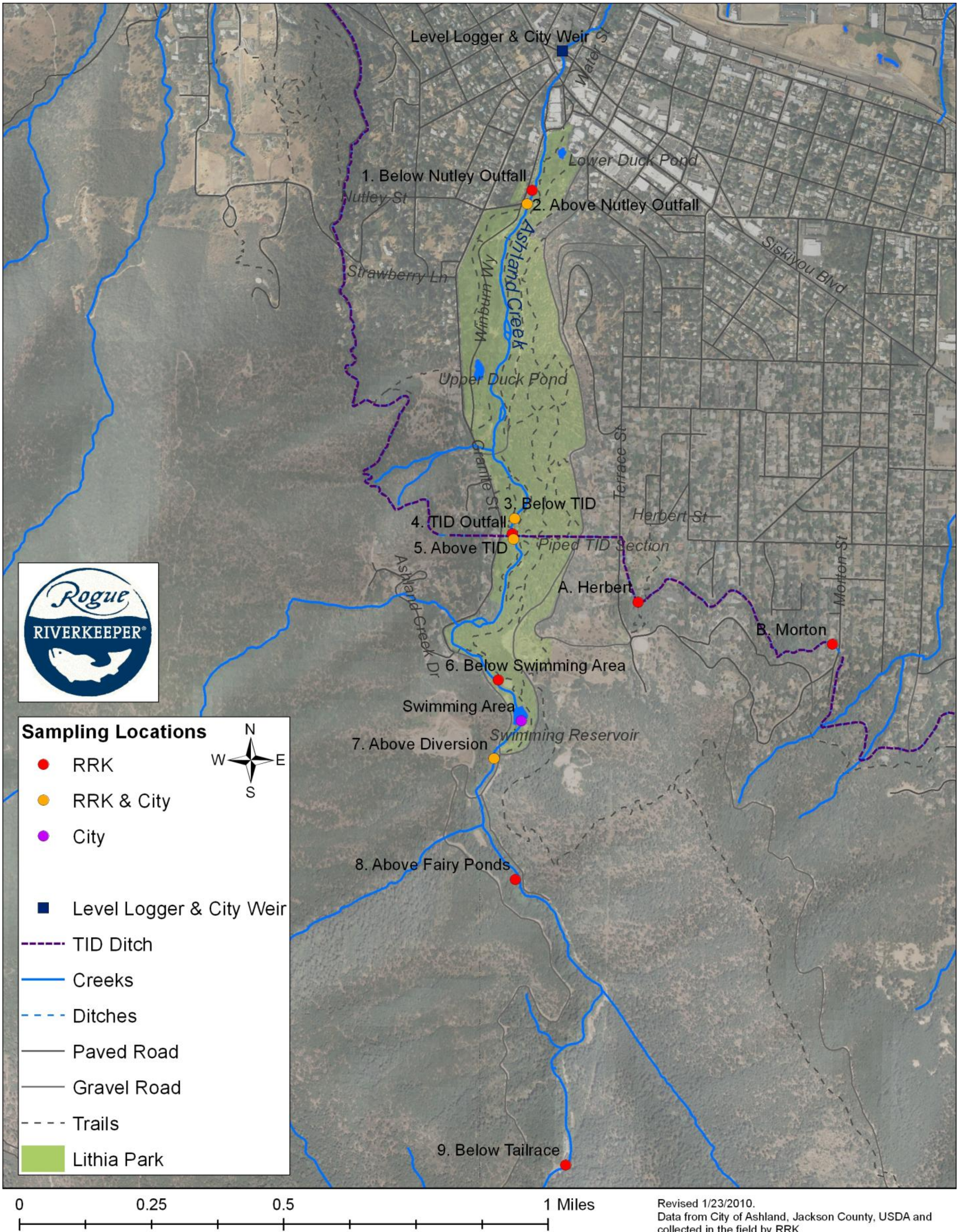
Map 1. Rogue River Watershed *E. coli* Problems



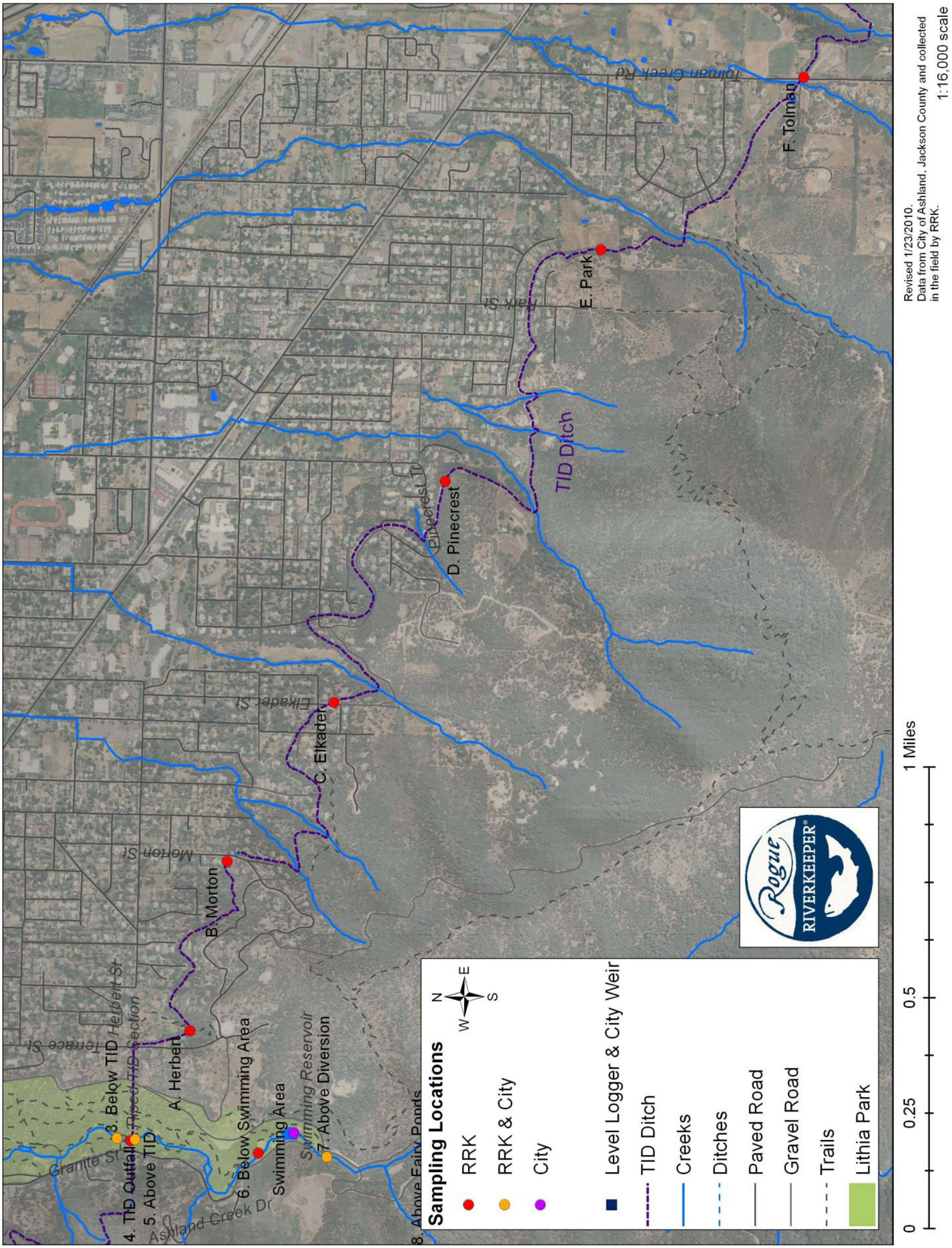
Map 2. Project Overview



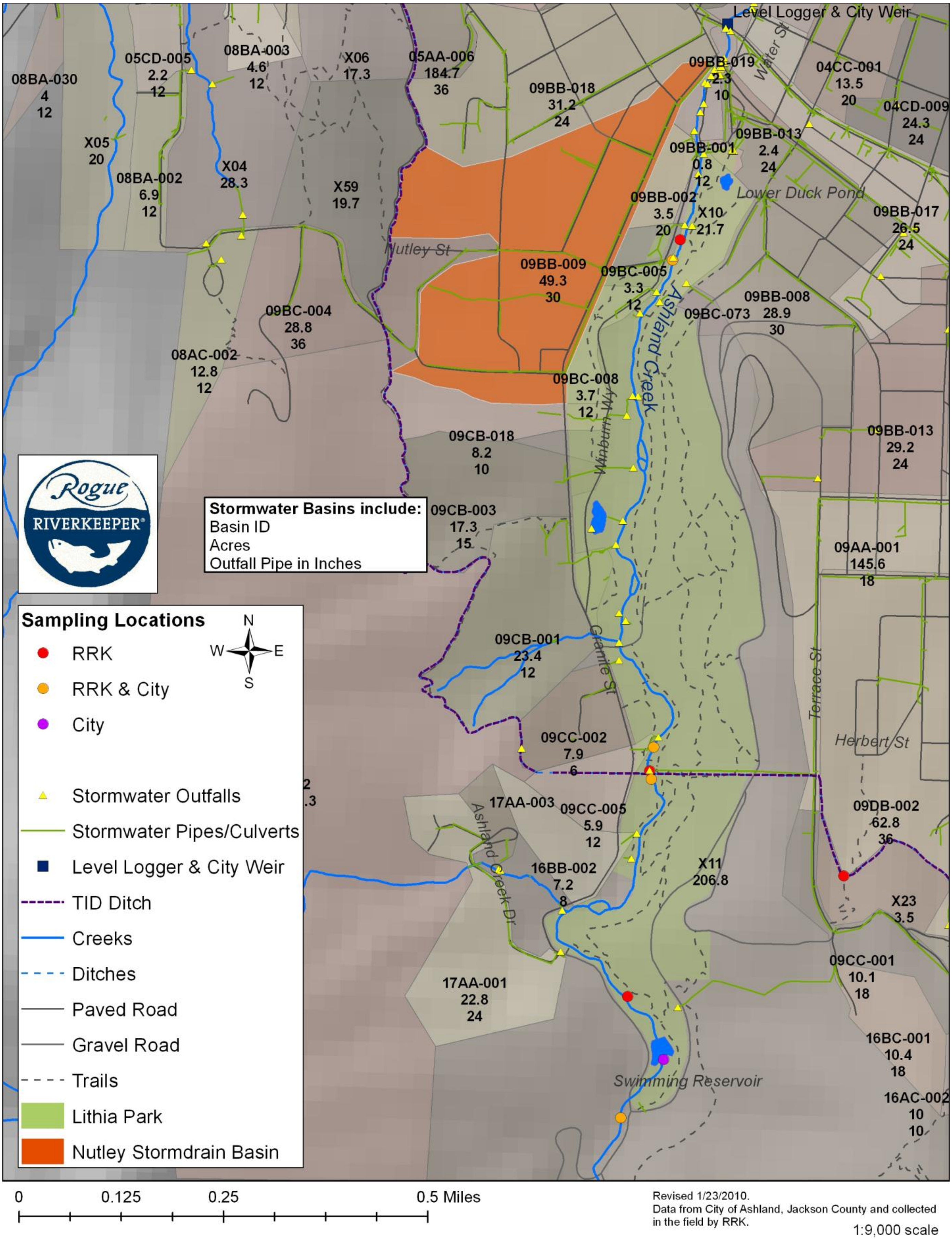
Map 3. Ashland Creek Detail



Map 4. TID Ditch Detail



Map 5. Stormwater Features Detail



Appendix H

CROSS CONNECTION CONTROL PROGRAM

CITY OF
ASHLAND

Cross-Connection Control Program

A. PURPOSE

The purpose of the Cross Connection Control Program is to protect customers of the City of Ashland's water system by eliminating potential sources of contamination resulting from illegal cross connections. Guidelines established in this program, ensure the requirements are met as identified in the City of Ashland's Municipal Code Chapter 14.05- Water Regulation and Cross Connection. This program shall also comply with the Federal Safe Drinking Water Act (P.L. 93-*523)* and the Oregon Administrative Rules (Chapter 333-061-0070) as they pertain to cross connections with the public water supply.

B. POLICY

City of Ashland Municipal Code Chapter 14.05- Water Regulation and Cross Connection addresses requirements for restricting and controlling potential cross connections to the City of Ashland's water system. The City of Ashland shall review this section of the Municipal Code from time to time to assure compliance with current requirements of the State of Oregon Administrative Rules relative to cross connections. All revisions to the City's Cross Connection Control Program shall be reviewed and approved by the City's Public Works Director and, if required by the City Council.

The City of Ashland shall maintain a database of potential direct cross connections with auxiliary water sources used for irrigation such as private wells, streams, and Talent Irrigation (TID) services within the City limits. The database shall be reviewed at least semi-annually. These auxiliary water services will need to be surveyed at least once every five years to monitor potential for direct cross connection to the City water supply.

All other City of Ashland residential property will be surveyed at least once every eight years.

City of Ashland non-residential properties will be surveyed every three years, or when the property is sold or changes managers/owners.

City of Ashland Cross Connection Specialists will conduct inspections for cross connection compliance.

The City of Ashland Water Department shall maintain all records of inspections for cross connection program compliance. The City of Ashland Water Department shall establish and maintain information describing assemblies and procedures suitable for eliminating potential cross connections to the City of Ashland's water supply system. Depending on the "Degree of Hazard", any property found to be in violation of the current requirements of the City of Ashland Municipal Code for cross connections shall be given an

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appropriate amount of time to correct the violation. Enforcement of the Cross Connection Control Program shall be under the authority of the City of Ashland Public Works Director, or his designee.

All new residential, commercial and industrial construction plans within the City of Ashland shall be reviewed by the City of Ashland Building Division for compliance with the Cross Connection Control Program. Existing properties shall be identified according to section "C" of this document.

C. EXISTING PROPERTY ASSESSMENT

The City of Ashland understands that to get this phase of the program started, we need information. We have elected to acquire this through a survey. A survey shall be sent out to each resident, property owner or tenant within the City of Ashland. This will include customers outside the city limits, but within the urban growth boundary, that are served by our water system.

Due to the population of the City of Ashland and our limited staffing, we understand that we could get overwhelmed with information if we did a mass mailing to every customer within our system. In order to insure that this does not happen, we have decided to take a phased approach and use the existing twenty-seven (27) water meter routes within the City of Ashland. The initial process will start with areas that we consider "higher risk". These would include areas with known or suspected auxiliary water sources for irrigation, such as Talent Irrigation Water (TID), wells, or streams.

Information shall be kept in our files, located at 90 North Mountain Avenue, Ashland, Oregon. We will record all information gathered from the returned surveys and prioritize each property based on "Degree of Hazard" according to Section D of this document. Each customer shall then be notified in writing of the status of their property. This notice shall include a timeline for resolving any issues that may be found during the survey or inspection.

D. DEGREE OF HAZARD AND APPROVED ASSEMBLIES

Degree of Hazard and Approved Assemblies

The City of Ashland recognizes that varying degrees of hazard are caused by different cross-connections. The conditions that identify the "Degree of Hazard" are classified as either a contamination hazard or pollution hazard. A "contaminant" is defined as any physical, chemical, biological, or radiological substance or matter in water that creates a health hazard; and, a "pollutant" is defined as a substance that creates an impairment of the quality of the water to a degree which does not create a hazard to the public health, but which does adversely affect the aesthetic qualities of the water.

The University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research publishes the Manual of Cross-Connection Control 10th Edition. USC-FCCCHR also issues "Certificates of Approval" to backflow prevention assemblies that meet manufacturing standards and pass their laboratory and field tests. A list of approved assemblies is available at the City of Ashland's Public Works Department. The assemblies, which are permitted, for use in each class of hazard and a description of the classes are as follows:

A. Low Degree of Hazard (Non-health hazard due to pollution)

If backflow were to occur, the resulting health significance would be limited to minor changes in the aesthetic quality such as taste, odor or color. The foreign substance must be non-toxic and non-bacterial in nature with no significant health effects. The allowed assemblies are: Air gap, non-pressure type vacuum breaker, pressure type vacuum breaker, double check valve assembly and reduced pressure assembly. The City of Ashland may allow up to 90 days for installation of an approved assembly.

B. High Degree of Hazard (Health hazard due to contamination)

If backflow were to occur, the resulting effect on the water supply could cause illness or death if consumed by humans. The foreign substance may be toxic to humans either chemically, bacteriological or radiological. Toxicity may result from either short or long-term exposure. The City of Ashland shall notify customer that the cross connection shall be disconnected or removed immediately.

At the discretion of the inspector, if an irrigation hazard is identified at the end of an irrigation season and shall not be used until the next irrigation season, the inspector may give additional time to remedy the situation, as long as the hazard is eliminated prior to use of the irrigation service during the next irrigation season. (Example- TID service that will not get used until the following year)

See the following "Table 48" and "Table 49"from the Oregon Administrative Rules 333-061-0070, Cross Connection Control requirements for further clarification on what devices are approved for installation. All facilities shown on Table 48 are classified as areas with a High "Degree of Hazard".

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TABLE 48

PREMISES REQUIRING ISOLATION BY AN APPROVED AIR GAP *OR* REDUCED PRESSURE PRINCIPLE TYPE OF ASSEMBLY HEALTH HAZARD
1. Agricultural (e.g. farms, dairies)
2. Beverage bottling plants**
3. Car washes
4. Chemical plants
5. Commercial laundries and dry cleaners
6. Premises where both reclaimed and potable water are used
7. Film processing plants
8. Food processing plants
9. Medical centers (e.g., hospitals, medical clinics, nursing homes, veterinary clinics, dental clinics, blood plasma centers)
10. Premises with irrigation systems that use the water supplier's water with chemical additions (e.g., parks, playgrounds, golf courses, cemeteries, housing estates)
11. Laboratories
12. Metal plating industries
13. Mortuaries
14. Petroleum processing or storage plants
15. Piers and docks
16. Radioactive material processing plants and nuclear reactors

17. Wastewater lift stations and pumping stations
18. Wastewater treatment plants
19. Premises with piping under pressure for conveying liquids other than potable water and the piping is installed in proximity to potable water piping
20. Premises with an auxiliary water supply that is connected to a potable water supply
21. Premises where the water supplier is denied access or restricted access for survey
22. Premises where the water is being treated by the addition of chemical or other additives

* Refer to OAR 333-061-0070(8) premise Isolation Requirements.

** A Double Check Valve Backflow Prevention Assembly could be used if the water supplier determines there is only a non-health hazard at a beverage bottling plant.

TABLE 49

Backflow Prevention Methods Used For Premise Isolation	
Degree of Identified Hazard	
Non-Health Hazard (Pollutant)	**Health Hazard (Contaminant)**
BACKSIPHONAGE OR BACKPRESSURE	BACKSIPHONAGE OR BACKPRESSURE
Air Gap (AG)	Air Gap (AG)
Reduced Pressure Principle Backflow Prevention Assembly (RP)	Reduced Pressure Principle Backflow Prevention Assembly (RP)
Reduced Pressure Principle-Detector Backflow Prevention Assembly (RPDA)	Reduced Pressure Principle-Detector Backflow Prevention Assembly (RPDA)
Double Check Valve Backflow Prevention Assembly (DC)	

E. ELIMINATION OF CROSS CONNECTIONS

When potential cross connections are found to exist, the owner, his agent, occupant, or tenant will be notified in writing to eliminate and/or disconnect the same within the time limit established by the City of Ashland. Degree of protection required and maximum time allowed for compliance will be based upon the "Degree of Hazard" to the public water supply system. (See appendix A- Partial List of Plumbing Hazards; Appendix B-Illustrations of Backsiphonage; Appendix C- Illustrations of Backpressure)

a. Based upon recommendation from the City of Ashland, the consumer, or his qualified contractor, is responsible for installing sufficient internal isolation backflow prevention assemblies and/or methods (i.e., air gap, pressure vacuum breakers, reduced pressure principle backflow prevention assembly, double check valve assembly).

b. The owner, his agent, occupant, or tenant shall be required to obtain a Plumbing permit for installation of the required cross connection control assembly.

c. In the event that a City of Ashland Cross Connection Specialist does not have sufficient access to every portion of a private water system (i.e., classified research and development facilities; federal government property) to allow a complete evaluation of the "Degree of Hazard" associated with such auxiliary water systems, an approved reduced pressure principle assembly or approved air gap shall be required as a minimum of protection.

d. No person shall fill special use tanks or tankers containing pesticides, fertilizers, other toxic chemicals or their residues from the public water system except at a location equipped with an air gap or an approved reduced pressure principle backflow prevention assembly properly installed on the public water supply.

F. THERMAL EXPANSION NOTIFICATION

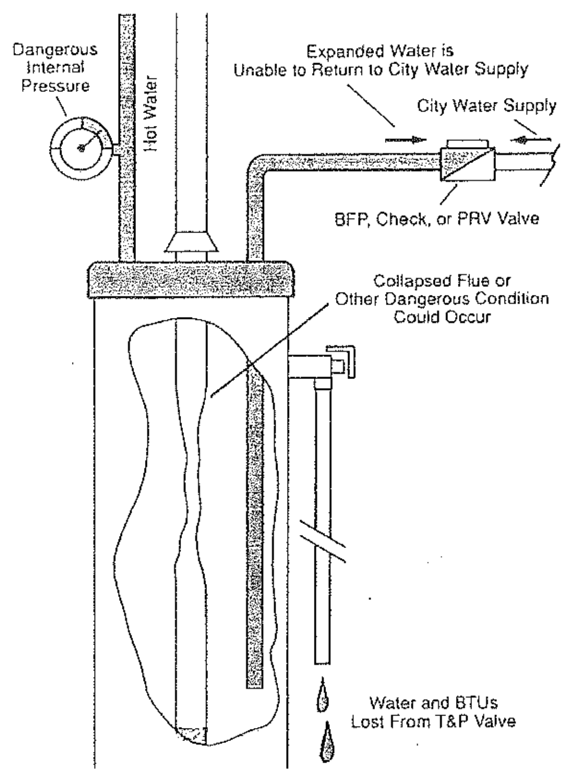
Installation of backflow assemblies is required to eliminate potential cross connections due to possible pollution or contamination problems. Installation of these backflow assemblies can, however cause another potential hazard with the customers hot water heater. Water heaters are installed with a temperature and pressure valve (T&P) which is designed to relieve excessive water temperature or pressure. Also aiding in control of excessive heat and pressure is a condition known as "thermal expansion". Thermal expansion allows extremely hot water to backflow into water main lines, mixing with cold water and dissipating the heat. However, when a backflow prevention assembly is installed on a household water service line, the water cannot go back into the water system. This leaves the T&P valve as the only release route for the overheated water.

If the thermostat in the hot water heater becomes defective and allows the water temperature to increase to more than 212 degrees Fahrenheit, and the T&P valve fails, the domestic water can become "overheated". Overheated water can cause water heaters to explode or can allow scalding steam to be released from faucets upon personal use.

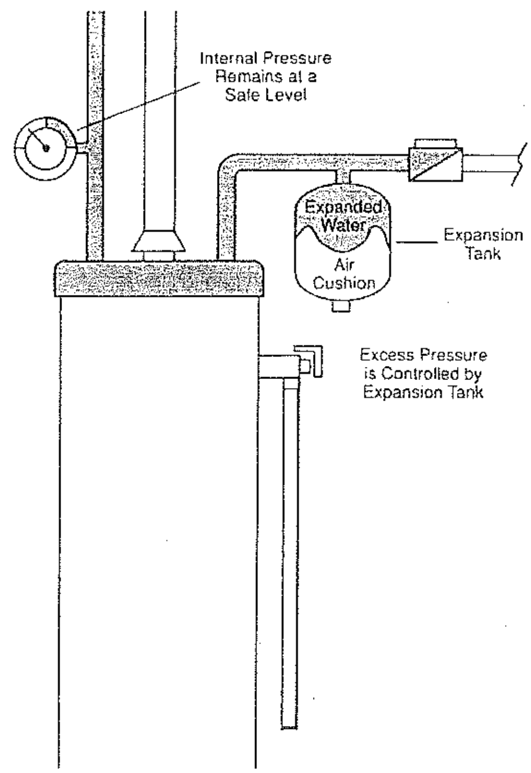
This condition is rare, because the hot water heater thermostat and the T&P valve must both malfunction simultaneously. However, with the backflow prevention assembly in place, the potential hazard exists.

The City of Ashland shall notify customers installing backflow prevention assemblies of this potential hazard and, also recommends that the T&P valve be inspected periodically. A licensed plumber can inspect, or replace the T&P valve to ensure customer safety and assist with other methods of protection such as thermal expansion chambers and pressure relief toilet ball cock assemblies. The schematic on the left shows what can happen in the water heater if the excess pressure builds up. One solution to the problem is using an expansion tank as shown in the second schematic.

The Problem



The Solution



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G. TESTING

All properties that require installation of a backflow assembly shall have said assembly tested annually by a State or Oregon certified tester. It is the responsibility of the property owner to contract with a State certified tester and have the results submitted to the City of Ashland annually. Test results may be submitted either by the certified tester or by the customer. All RPBA, RPDA, DCVA, DCDA, PVBA, and SVB's assemblies are required to be tested as follows:

A) Immediately when installed
B) Annually (based on the anniversary date of installation)
C) When assembly is repaired
D) When assembly is relocated

Backflow assemblies may also be required to be tested more frequently than annually for approved backflow prevention assemblies that repeatedly fail, or are protecting health hazard cross connections, as determined by the water supplier.

H. ENFORCEMENT

1. The owner, manager, supervisor, or person in charge of any installation found not to be in compliance with the provisions of the Water Regulation and Cross Connection Ordinance shall be notified in writing with regard to the corrective action(s) to be taken. The time for compliance shall be in accordance with the "Degree of Hazard" identified.

2. The owner, manager, supervisor, or person in charge of any installation which remains in non-compliance after the time prescribed in the initial notification ~~as~~ outlined in this Policy, shall be considered in violation of the Cross Connection Ordinance. The City of Ashland may discontinue water service to the said property.

3. If, in the judgment of the City of Ashland, any owner, manager, supervisor, or person in charge of any installation found to be in non-compliance with the provisions of the Water Regulation and Cross Connection Ordinance, neglects their responsibility to correct any violation, ~~it~~ may result in discontinuance of water service until compliance is achieved.

4. Failure of a certified backflow prevention assembly tester to submit any record required by the Water Regulation and Cross Connection Ordinance or the submission of falsified reports and/or records may result in the City of Ashland taking the necessary actions to remove said tester from the City of Ashland's list of qualified testers for backflow prevention assemblies within the potable water system for a time period not to exceed one (1) year. If, after one (1) year, the tester wishes to be reinstated as a qualified tester within the City of Ashland, the tester shall submit in writing a request to do so.

Customers who submit falsified reports shall be subject to discontinuance of their water service.

5. Enforcement of this program shall be administered by the City of Ashland Public Works Director or his authorized representative.

6. Requests for extension of time shall be made in writing to the Public Works Director or his authorized representative.

7. In the event that the Public Works Director or his authorized representative denies an extension for any reason, customer may appeal such denial to the City Administrator for review.

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Appendix A

Partial List of Plumbing Hazards

Fixtures with Direct Connections

Description

Air conditioning, air washer
Air conditioning, chilled water
Air conditioning, condenser water
Air line
Aspirator, laboratory
Aspirator, medical
Aspirator, weedicide and fertilizer sprayer
Autoclave and sterilizer
Auxiliary system, industrial
Auxiliary system, surface water
Auxiliary system, unapproved well supply
Boiler system
Chemical feeder, pot-type
Chlorinator
Coffee urn
Cooling system
Dishwasher
Fire standpipe or sprinkler system
Fountain, ornamental
Hydraulic equipment
Laboratory equipment
Lubrication, pump bearings
Photostat equipment
Plumber's friend, pneumatic
Pump, pneumatic ejector
Pump, prime line
Pump, water operated ejector
Sewer, sanitary
Sewer, storm
Swimming pool

Fixtures with Submerged Inlets

Description

Baptismal fount
Bathtub
Bedpan washer, flushing rim
Bidet
Brine tank
Cooling tower
Cuspidor
Drinking fountain
Floor drain, flushing rim
Garbage can washer
Ice maker
Laboratory sink, serrated nozzle
Laundry machine
Lavatory
Lawn sprinkler system
Photo laboratory sink
Sewer flushing manhole
Slop sink, flushing rim
Slop sink, threaded supply
Steam table
Urinal, siphon jet blowout
Vegetable peeler
Water closet, flush tank, ball cock
Water closet, flush valve, siphon jet

Appendix B

Illustrations of Backsiphonage

The following illustrates typical plumbing installations where backsiphonage is possible.

Backsiphonage

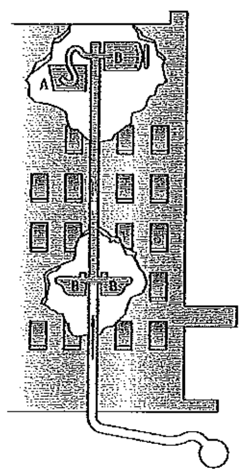
Case I (Fig. 44)

A. Contact Point: A rubber hose is submerged in a bedpan wash sink.

B. Causes of Reversed Flow: (1) A sterilizer connected to the water supply is allowed to cool without opening the air vent. As it cools, the pressure within the sealed sterilizer drops below atmospheric producing a vacuum which draws the polluted water into the sterilizer contaminating its contents. (2) The flushing of several flush valve toilets on a lower floor which are connected to an undersized water service line reduces the pressure at the water closets to atmospheric producing a reversal of the flow.

C. Suggested Correction: The water connection at the bedpan wash sink and the sterilizer should be provided with properly installed backflow preventers.

FIGURE 44.
Backsiphonage (Case 1).



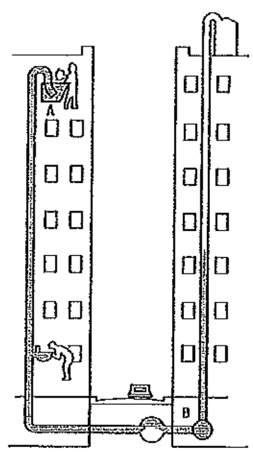
Backsiphonage

Case 2 (Fig. 45)

A. Contact Point: A rubber hose is submerged in a laboratory sink.

B. Cause of Reversed Flow: Two opposite multi-story buildings are connected to the same water main, which often lacks adequate pressure. The building on the right has installed a booster pump.

FIGURE 45.
Backsiphonage (Case 2).



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When the pressure is inadequate in the main, the building booster pump starts pumping, producing a negative pressure in the main and causing a reversal of flow in the opposite building.

C. Suggested Correction: The laboratory sink water outlet should be provided with a vacuum breaker. The water service line to the booster pump should be equipped with a device to cut off the pump when pressure approaches a negative head or vacuum.

Backsiphonage

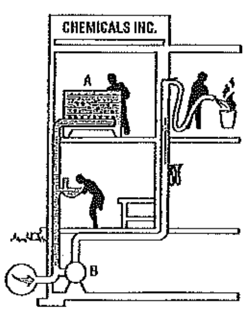
Case 3 (Fig. 46)

A. Contact Point: A chemical tank has a submerged inlet.

B. Cause of Reversed Flow: The plant fire pump draws suction directly from the city water supply line which is insufficient to serve normal plant requirements and a major fire at the same time. During a fire emergency, reversed flow may occur within the plant.

C. Suggested Correction: The water service to the chemical tank should be provided through an air gap.

FIGURE 46.
Backsiphonage (Case 3).



Backsiphonage

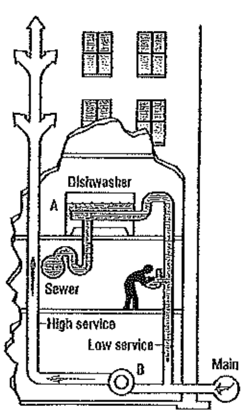
Case 4 (Fig. 47)

A. Contact Point: The water supply to the dishwasher is not protected by a vacuum breaker. Also, the dishwasher has a solid waste connection to the sewer.

B. Cause of Reversed Flow: The undersized main serving the building is subject to reduced pressures, and therefore only the first two floors of the building are supplied directly with city pressure. The upper floors are served from a booster pump drawing suction directly from the water service line. During periods of low city pressure, the booster pump suction creates negative pressures in the low system, thereby reversing the flow.

C. Suggested Correction: The dishwasher hot and cold water should be supplied through an air gap and the waste from the dishwasher should discharge through an indirect waste. The booster pump should be equipped with a low-pressure cutoff device.

FIGURE 47.
Backsiphonage (Case 4).

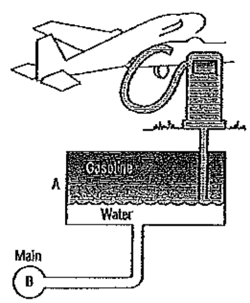


Backsiphonage

Case 5 (Fig. 48)

A. Contact Point: The gasoline storage tank is maintained full and under pressure by means of a direct connection to the city water distribution system.

FIGURE 48.
Backsiphonage (Case 5).



B. Cause of Reversed Flow: Gasoline may enter the distribution system by gravity or by siphonage in the event of a leak or break in the water main.

C. Suggested Correction: A reduced pressure principle backflow preventer should be installed in the line to the gasoline storage tank or a surge tank and pump should be provided in that line.

Backsiphonage

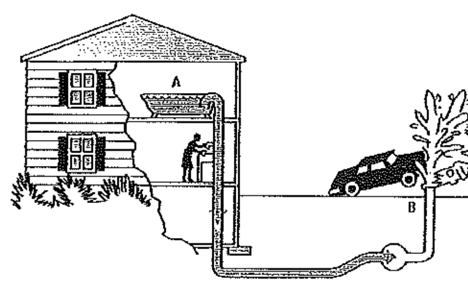
Case 6 (Fig. 49)

A. Contact Point: There is a submerged inlet in the second floor bathtub.

B. Cause of Reversed Flow: An automobile breaks a nearby fire hydrant causing a rush of water and a negative pressure in the service line to the house, sucking dirty water out of the bathtub.

C. Suggested Correction: The hot and cold water inlets to the bathtub should be above the rim of the tub.

FIGURE 49.
Backsiphonage (Case 6).



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Illustrations of Backpressure

The following presents illustrations of typical plumbing installations where backflow resulting from backpressure is possible.

Backflow

Case I (Fig. 50)

A. Contact Point: A direct connection from the city supply to the boiler exists as a safety measure and for filling the system. The boiler water system is chemically treated for scale prevention and corrosion control.

B. Cause of Reversed Flow: The boiler water recirculation pump discharge pressure or backpressure from the boiler exceeds the city water pressure and the chemically treated water is pumped into the domestic system through an open or leaky valve.

C. Suggested Correction: As minimum protection two check valves in series should be provided in the makeup waterline to the boiler system. An air gap separation or reduced pressure principle backflow preventer is better.

FIGURE 50.
Backflow (Case 1).

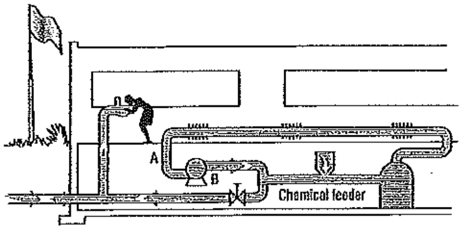
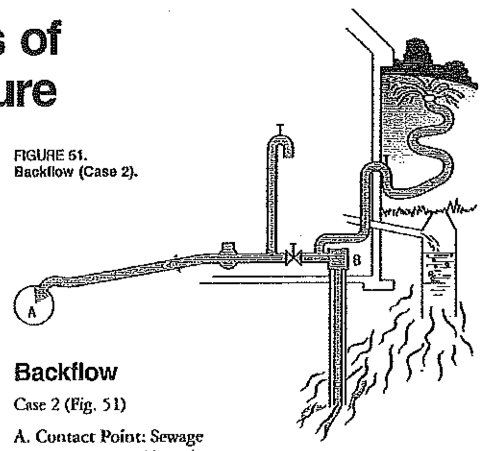


FIGURE 51.
Backflow (Case 2).



Backflow

Case 2 (Fig. 51)

A. Contact Point: Sewage seeping from a residential cesspool pollutes the private well which is used for lawn sprinkling. The domestic water system, which is served from a city main, is connected to the well supply by means of a valve. The purpose of the connection may be to prime the well supply for emergency domestic use.

B. Cause of Reversed Flow: During periods of low city water pressure, possibly when lawn sprinkling is at its peak, the well pump discharge pressure exceeds that of the city main and well water is pumped into the city supply through an open or leaky valve.

C. Suggested Correction: The connection between the well water and city water should be broken

Backflow

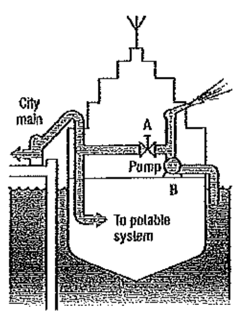
Case 3 (Fig. 52)

A. Contact Point: A valve connection exists between the potable and the non potable systems aboard the ship.

B. Cause of Reversed Flow: While the ship is connected to the city water supply system for the purpose of taking on water for the potable system, the valve between the potable and nonpotable systems is opened, permitting contaminated water to be pumped into the municipal supply.

C. Suggested Correction: Each pier water outlet should be protected against backflow. The main water service to the pier should also be protected against backflow by an air gap or reduced pressure principle backflow preventer.

FIGURE 52.
Backflow (Case 3).



Backflow

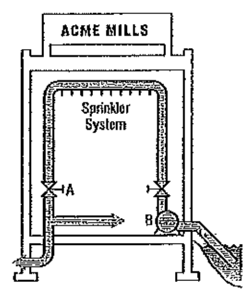
Case 4 (Fig. 53)

A. Contact Point: A single-valved connection exists between the public, potable water supply and the fire-sprinkler system of a mill.

B. Cause of Reversed Flow: The sprinkler system is normally supplied from a nearby lake through a high-pressure pump. About the lake are large numbers of overflowing septic tanks. When the valve is left open, contaminated lake water can be pumped to the public supply.

C. Suggested Correction: The potable water supply to the fire system should be through an air gap or a reduced pressure principle backflow preventer should be used.

FIGURE 53.
Backflow (Case 4).



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Appendix I

CIP COST ESTIMATES

CITY OF ASHLAND
COMPREHENSIVE WATER MASTER PLAN
CAPITAL IMPROVEMENTS PROGRAM

3/16/2012

CIP INPUT

General Assumptions

Secondary Supply Source	New WTP
Year that secondary supply is online	2018

Cost Estimate Assumptions

Notes:

1 All costs are in 2011 dollars
2 Engineering News Report (ENR) U.S. 20-City Construction Cost Index for September 2011 is 9116
3 Cost Estimates do not include costs for land acquisition, easements or ROW acquisition
4 Cost per foot of pipe before contingencies are as follows

Pipeline Diameter	Cost per LF
6	$ 126
8	$ 134
10	$ 144
12	$ 153
16	$ 185
24	$ 244

Other Unit Costs

Concrete Reservoir	$ 0.92	per Million Gallons
Building	$ 300	per SF
Jack & Bore Pit	$ 25,000	each
Drilling & 20-inch diameter Casing	$ 300	per LF
6-inch PRV in Christy Box	$ 36,000	each

Adjustment Factors

Contingency	30%	%
General Conditions	10%	%
General Contractor Overhead	15%	%
Engineering/Legal/Admin	20%	%

Level Four Cost Estimate Disclaimer:

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary form the costs presented as shown.

City of Ashland

Pipe Projects

Project ID Number	Street	Description	Location	Length	Existing Diameter	Proposed Diameter	Unit Cost	Direct Cost + Contingency	General Conditions & Overhead	Engineering, Legal, Admin	Project Cost
P-1	Ivy Lane	New Pipe	Morton Street to west end of Ivy Lane	1320	-	8	$ 134	$ 230,000	$ 58,000	$ 58,000	$ 346,000
P-2	Ivy Lane	Pipe Replacement	South Mountain to FH-16AD-038	420	6	8	$ 134	$ 62,000	$ 16,000	$ 16,000	$ 94,000
P-3	Normal Ave	Pipe Replacement	Siskiyou Blvd to Homes Ave	2240	4	8	$ 134	$ 345,000	$ 86,000	$ 86,000	$ 517,000
P-4	Walker Ave	Pipe Replacement	Siskiyou Blvd to Ashland Middle School	3246	4,6	8	$ 134	$ 522,000	$ 131,000	$ 131,000	$ 784,000
P-5	Parker Street	Pipe Replacement	Walker Ave to Lit Way	860	4	6	$ 126	$ 108,000	$ 27,000	$ 27,000	$ 162,000
P-6	Harmony Lane	Pipe Replacement	Siskiyou Blvd to Lit Way	340	4	6	$ 126	$ 43,000	$ 11,000	$ 11,000	$ 65,000
P-7	Lit Way	Pipe Replacement	Joy Avenue to Ray Lane	182	4	6	$ 126	$ 23,000	$ 6,000	$ 6,000	$ 35,000
P-8	Ray Lane	Pipe Replacement	Lit Way to Joy Ave	284	4	6	$ 126	$ 36,000	$ 9,000	$ 9,000	$ 54,000
P-9	Beach Street	Pipe Replacement	Larkin Lane to Iowa Street	488	4	6	$ 126	$ 61,000	$ 15,000	$ 15,000	$ 91,000
P-10	AHS Property	Pipe Replacement	Fire hydrant in school property	480	4	6	$ 126	$ 60,000	$ 15,000	$ 15,000	$ 90,000
P-11	Vista Street	Pipe Replacement	Fork St to Hillcrest St	740	6	8	$ 134	$ 99,000	$ 25,000	$ 25,000	$ 149,000
P-12	Vista Street	Pipe Replacement	Intersection of Vista, Hillcrest, Glenview Dr	22	6	8	$ 134	$ 3,000	$ 1,000	$ 1,000	$ 5,000
P-13	Meade Street	Pipe Replacement	Vista St/Hillcrest to Iowa Street	1172	4	8	$ 134	$ 157,000	$ 39,000	$ 39,000	$ 235,000
P-14	Elkader Street	Pipe Replacement	Ivy Lane to Pinecrest Trail	359	6	8	$ 134	$ 48,000	$ 12,000	$ 12,000	$ 72,000
P-15	Ivy Lane	Pipe Replacement	South Mountain Ave to Elkader St	310	6	8	$ 134	$ 42,000	$ 11,000	$ 11,000	$ 64,000
P-16	South Mountain Ave	New Pipe	S. Mountain Ave to Emma St	30	-	6	$ 126	$ 4,000	$ 1,000	$ 1,000	$ 6,000
P-17	South Mountain Ave	New Pipe	From S. Mountain Ave to FH 16AD-043	90	-	6	$ 126	$ 11,000	$ 3,000	$ 3,000	$ 17,000
P-18	Pinecrest Trail	New Pipe	Penny Drive to Woodland Drive	880	-	8	$ 134	$ 118,000	$ 30,000	$ 30,000	$ 178,000
P-19	Pinecrest Trail	Pipe Replacement	Walker Ave to Starlight Place	1833	6	10	$ 144	$ 264,000	$ 66,000	$ 66,000	$ 396,000
P-20	Penny Drive	Pipe Replacement	Woodland Dr to Weissenback Way	413	6	8	$ 134	$ 55,000	$ 14,000	$ 14,000	$ 83,000
P-21	Woodland Drive	Pipe Replacement	Leonard St to Pinecrest Trail	250	6	8	$ 134	$ 34,000	$ 9,000	$ 9,000	$ 52,000
P-22	Hiawatha Place	Pipe Replacement	Walker Ave to FH 15CA-020	300	4	6	$ 126	$ 38,000	$ 10,000	$ 10,000	$ 58,000
P-23	Morton Street	Pipe Replacement	FH 16AC-023 to PRV 12	644	6	8	$ 134	$ 86,000	$ 22,000	$ 22,000	$ 130,000
P-24	Ashland Mine Road	Pipe Replacement	Cedar Way to Fox Street	611	4	6	$ 126	$ 77,000	$ 19,000	$ 19,000	$ 115,000
P-25	Fox Street	Pipe Replacement	Ashland Mine Road to N. Main Street	286	4	6	$ 126	$ 36,000	$ 9,000	$ 9,000	$ 54,000
P-26	Almeda Drive	New Pipe	Almeda Dr to Dog Park Road	180	-	6	$ 126	$ 23,000	$ 6,000	$ 6,000	$ 35,000
P-27	Skycrest Drive	Pipe Replacement	Orchard St to south end of Skycrest Dr	747	8	10	$ 144	$ 108,000	$ 27,000	$ 27,000	$ 162,000
P-28	Crispin Street	Pipe Replacement	Oak Street to Patterson Street	650	6	8	$ 134	$ 87,000	$ 22,000	$ 22,000	$ 131,000
P-29	Oak Lawn Ave	Pipe Replacement	Oak Street to Sylvia Street	150	4	6	$ 126	$ 19,000	$ 5,000	$ 5,000	$ 29,000
P-30	Sylvia Street	Pipe Replacement	Oak Lawn Ave to FH 04CA-019	330	4	6	$ 126	$ 42,000	$ 11,000	$ 11,000	$ 64,000
P-31	Black Oak Way	Pipe Replacement	Tolman Creek Road to Bellview Ave.	456	4	6	$ 126	$ 57,000	$ 14,000	$ 14,000	$ 85,000
P-32	Oak Knoll Dr	Pipe Replacement	Twin Pines Creek Dr to Cypress Point Loop	1427	6	8	$ 134	$ 191,000	$ 48,000	$ 48,000	$ 287,000
P-33	Ashland Street	Pipe Replacement	Tolman Creek Rd to Washington St	2000	8	10	$ 144	$ 288,000	$ 72,000	$ 72,000	$ 432,000
P-34	I-5 Crossing	Pipe Replacement	Washington St to Clover Lane	720	6	12					$ 794,000
P-35	Ditch Road	Previous CIP: Pipeline Replacement	Strawberry PS to Grandview Dr								$ 225,000
P-36	Lithia	Previous CIP: Pipeline Replacement	Lithia Water Line								$ 70,000
P-37	Iowa Street	Previous CIP: Pipeline Replacement	S. Mountain Ave to Wightman St	1780	6	12					$ 640,000
P-38	Granite Street	Previous CIP: Pipeline Replacement	Strawberry to Pioneer								$ 300,000
P-39	B Street	Previous CIP: Pipeline Replacement	Oak St to 5th St								$ 250,000
P-40	Terrace Street	Previous CIP: Pipeline Replacement	Iowa to TID Ditch								$ 350,000

City of Ashland
PRV Projects

PRV-1 Lit Way

Install new 6-inch PRV Station between Crowson Zone 5 and Granite Zone 1 at intersection of Harmony Lane and Lit Way. Set PRV to open during fire flows (downstream pressure below 30 psi)

Item	Quantity	Units	Unit Cost	Subtotal	Direct Cost
Valve & Valve	1	LS	$ 36,000	$ 36,000	
Installation	1	LS	$ 145,000	$ 145,000	
			Total Direct Cost		**$ 181,000**
			Contingency	30%	$ 54,000
			Subtotal		**$ 235,000**
			General Conditions & Contractor Overhead	25%	$ 59,000
			Subtotal		**$ 294,000**
			Engineering, Legal, Admin	20%	$ 47,000
			TOTAL PROJECT COST		**$ 341,000**

City of Ashland
Pipe Crossing Under I-5 Cost Estimate

P-34a Washington Street to Clover Lane, crossing under I-5

Item	Quantity	Units	Unit Cost	Subtotal	Direct Cost
Jack & Bore Pit	2	Each	$ 25,000	$ 50,000	
20-inch casing	720	LF	$ 300	$ 216,000	
12-inch Pipe	720	LF	$ 153	$ 110,000	
			Total Direct Cost		**$ 376,000**
			Contingency	30%	$ 113,000
			Subtotal		**$ 489,000**
			General Conditions & Contractor Overhead	25%	$ 122,000
			Subtotal		**$ 611,000**
			Engineering, Legal, Admin	30%	$ 183,000
			TOTAL PROJECT COST		**$ 794,000**

City of Ashland
Crowson Reservoir II Cost Estimate

Secondary Supply Source New WTP

ST-1 Crowson Reservoir I Reservoir Volume 2.6

Cost update from 2007 Siting Study October 2006 CCI **7883**

	Quantity	Unit	2006 Unit Cost	2011 Unit Cost	Subtotal	Total
Sitework						
Access Road	1	LS	$ 75,000	$ 87,000	$ 87,000	
Fencing and Security	1	LS	$ 15,000	$ 17,000	$ 17,000	
Landscaping	1	LS	$ 25,000	$ 29,000	$ 29,000	
Excavation & Backfil	1	LS		$ 300,000	$ 300,000	
Subtotal Site Work						**$ 433,000**
Concrete						
Valve Vault	1	EA	$ 25,000	$ 29,000	$ 29,000	
Circular Reservoir, Including	2,600,000	gal	1,840,000	$ 0.92	$ 2,392,000	
Tank-related piping to within 10-f						
Appurtnenances (ladders, hatches, etc.						
Subtotal Concrete						**$ 2,421,000**
Mechanical						
24-inch DIP Inlet/Outlet	1500	LF	$ 205	$ 237	$ 355,500	
24-inch DIP Drain/Overflow	1500	LF	$ 205	$ 237	$ 355,500	
24-inch BF Valve Isolation	1	EA	$ 7,200	$ 8,000	$ 8,000	
Misc. Valve & Piping	1	LS	$ 50,000	$ 58,000	$ 58,000	
Subtotal Mechanical						**$ 777,000**
Electrical						
Electrical Instrumentation and Contro						
Subtotal Electrical						**$ 150,000**
Total Direct Cost						**$ 3,781,000**
Construction Contingency			30%	20%		$ 756,000
Subtotal						**$ 4,537,000**
General Conditions & Contractor Overhea				15%		$ 681,000
Subtotal						**$ 5,218,000**
Engineering, Legal, Admin			15%	20%		$ 1,044,000
TOTAL PROJECT COST						**$ 6,262,000**
Escalation to Midpoint (5 years; 1.5%						**$ 6,746,000**

ID	NAME		Current	Short-Term										
			FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2013-2022 Total
	SUPPLY													
S-1	FERC Dam Security & Telemetry Impr (50% Electric, 50% Water)		$ 25,000											$ -
S-2	FERC Dam Spillgate Upgrades (50% Electric, 50% Water)		$ 50,000											$ -
S-3	FERC Structural Stability Analysis (50% Electric, 50% Water)		$ 90,000											$ -
S-4	FERC Part 12 Dam Safety Inspection (50% Electric, 50% Water)				$ 40,000				$ 40,000					$ 80,000
S-5	Ashland Creek West Fork Bridge Construction			$ 12,000	$ 108,000									$ 120,000
S-6	Sediment TMDL in Reeder Resv.		$ 10,000	$ 60,000		$ 60,000		$ 60,000		$ 60,000		$ 60,000		$ 300,000
S-7	Reeder Resv Study Implementation		$ 50,000	$ 30,000										$ 30,000
S-8	Reeder Resv Access Road TMDL Compliance							$ 10,000	$ 90,000					$ 100,000
S-9	Reeder Resv Variable Depth Intake									$ 100,000				$ 100,000
S-10	TID Terrace St Pump Station Improvements					$ 20,000	$ 200,000							$ 220,000
S-11	TID Canal Piping: Starlite to Terrace Street								$ 1,100,000					$ 1,100,000
S-12	Test existing high capacity wells			$ 50,000										$ 50,000
S-13	Water Conservation Smart Controller Pilot Project					$ 50,000								$ 50,000
S-14	Water Conservation Management Plan (due April 2012)		$ 50,000											$ -
S-15	Emergency TAP Pipeline & Pump					$ 2,000,000								$ 2,000,000
	Supply Subtotal		**$ 275,000**	**$ 152,000**	**$ 148,000**	**$ 2,130,000**	**$ 200,000**	**$ 70,000**	**$ 1,230,000**	**$ 160,000**	**$ -**	**$ 60,000**	**$ -**	**$ 4,150,000**
	TREATMENT & STORAGE													
T-1	Raw Water Bypass Measurement			$ 25,000										$ 25,000
T-2	SCADA Radio Frequency FCC Compliance			$ 45,000										$ 45,000
T-3	Final CT Disinfection Improvements			$ 85,000										$ 85,000
T-4	Permanganate Feed Facility Study & Implementation					$ 25,000	$ 240,000							$ 265,000
T-5	WTP Security Upgrades				$ 50,000									$ 50,000
T-6	Existing Plant Mech. Elec. & Scada Upgrades													$ -
T-7	Ozone /UV Analysis & Disinfection													$ -
T-8	Bear Creek Cu WLA Source Control Study & Implementation													$ -
T-9	2.6-MG Reservoir & Clearwell ("Crowson II")						$ 746,000	$ 3,000,000	$ 3,000,000					$ 6,746,000
T-10	2.5 MGD Water Treatment Plant						$ 1,000,000	$ 5,500,000	$ 5,500,000					$ 12,000,000
	Treatment Subtotal		**$ -**	**$ 155,000**	**$ 50,000**	**$ 25,000**	**$ 1,986,000**	**$ 8,500,000**	**$ 8,500,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 19,216,000**
	DISTRIBUTION													
D-1	Telemetry Station at Water Warehouse				$ 50,000									$ 50,000
D-2	Water Master Plan Updates						$ 100,000					$ 200,000		$ 300,000
D-3	Park Estates Pump Station/Loop Road Reservoir Alternatives			$ 200,000	$ 1,800,000									$ 2,000,000
D-4	Lit Way New PRV													$ -
D-5	Tolman Creek Road New PRV													$ -
D-6	Pipe Replacement Program													$ -
D-7	Radio Read Meter Program									$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 386,000
D-8	Hydrant Replacement									$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 176,000
D-9	Emergency Response Plan Update				$ 20,000									$ 20,000
D-10	Cross Connection Control Plan Update					$ 15,000								$ 15,000
D-11	Safety Plan Update						$ 20,000							$ 20,000
D-12	Granite Reservoir Valving								$ 100,000					$ 100,000
	Distribution Subtotal		**$ -**	**$ 200,000**	**$ 1,870,000**	**$ 15,000**	**$ 120,000**	**$ -**	**$ 100,000**	**$ 140,500**	**$ 140,500**	**$ 340,500**	**$ 140,500**	**$ 3,067,000**
	PIPES	**Project Extents**												
P-1	Ivy Lane	Morton Street to west end of Ivy Lane		$ 35,000	$ 311,000									$ 346,000
P-2	Ivy Lane	South Mountain to FH-16AD-038		$ 10,000	$ 84,000									$ 94,000
P-3	Normal Ave	Siskiyou Blvd to Homes Ave			$ 50,000	$ 467,000								$ 517,000
P-4	Walker Ave	Siskiyou Blvd to Ashland Middle School				$ 75,000	$ 709,000							$ 784,000
P-5	Parker Street	Walker Ave to Lit Way					$ 20,000	$ 142,000						$ 162,000
P-6	Harmony Lane	Siskiyou Blvd to Lit Way					$ 10,000	$ 55,000						$ 65,000
P-7	Lit Way	Joy Avenue to Ray Lane					$ 5,000	$ 30,000						$ 35,000
P-8	Ray Lane	Lit Way to Joy Ave					$ 5,000	$ 49,000						$ 54,000
P-9	Beach Street	Larkin Lane to Iowa Street						$ 10,000	$ 81,000					$ 91,000
P-10	AHS Property	Fire hydrant in school property						$ 9,000	$ 81,000					$ 90,000
P-11	Vista Street	Fork St to Hillcrest St							$ 149,000					$ 149,000
P-12	Vista Street	Intersection of Vista, Hillcrest, Glenview Dr							$ 5,000					$ 5,000
P-13	Meade Street	Vista St/Hillcrest to Iowa Street							$ 235,000					$ 235,000
P-14	Elkader Street	Ivy Lane to Pinecrest Trail								$ 72,000				$ 72,000
P-15	Ivy Lane	South Mountain Ave to Elkader St								$ 64,000				$ 64,000
P-16	South Mountain Ave	S. Mountain Ave to Emma St								$ 6,000				$ 6,000
P-17	South Mountain Ave	From S. Mountain Ave to FH 16AD-043								$ 17,000				$ 17,000
P-18	Pinecrest Trail	Penny Drive to Woodland Drive									$ 178,000			$ 178,000
P-19	Pinecrest Trail	Walker Ave to Starlight Place									$ 396,000			$ 396,000
P-20	Penny Drive	Woodland Dr to Weissenback Way										$ 83,000		$ 83,000
P-21	Woodland Drive	Leonard St to Pinecrest Trail										$ 52,000		$ 52,000
P-22	Hiawatha Place	Walker Ave to FH 15CA-020										$ 58,000		$ 58,000
P-23	Morton Street	FH 16AC-023 to PRV 12											$ 130,000	$ 130,000
P-24	Ashland Mine Road	Cedar Way to Fox Street											$ 115,000	$ 115,000
P-25	Fox Street	Ashland Mine Road to N. Main Street											$ 54,000	$ 54,000
P-26	Almeda Drive	Almeda Dr to Dog Park Road												$ -
P-27	Skycrest Drive	Orchard St to south end of Skycrest Dr												$ -
P-28	Crispin Street	Oak Street to Patterson Street												$ -
P-29	Oak Lawn Ave	Oak Street to Sylvia Street												$ -
P-30	Sylvia Street	Oak Lawn Ave to FH 04CA-019												$ -
P-31	Black Oak Way	Tolman Creek Road to Bellview Ave.												$ -
P-32	Oak Knoll Dr	Twin Pines Creek Dr to Cypress Point Loop												$ -
P-33	Ashland Street	Tolman Creek Rd to Washington St												$ -
P-34	I-5 Crossing	Washington St to Clover Lane												$ -
P-35	Ditch Road	Strawberry PS to Grandview Dr				$ 75,000	$ 75,000	$ 75,000						$ 225,000
P-36	Lithia	Lithia Water Line							$ 70,000					$ 70,000
P-37	Iowa Street	S. Mountain Ave to Wightman St												$ -
P-38	Granite Street	Strawberry to Pioneer												$ -
P-39	B Street	Oak St to 5th St												$ -
P-40	Terrace Street	Iowa to TID Ditch												$ -
	Piping Subtotal		**$ -**	**$ 45,000**	**$ 445,000**	**$ 617,000**	**$ 824,000**	**$ 370,000**	**$ 621,000**	**$ 159,000**	**$ 574,000**	**$ 193,000**	**$ 299,000**	**$ 4,147,000**
	TOTAL		**$ 275,000**	**$ 552,000**	**$ 2,513,000**	**$ 2,787,000**	**$ 3,130,000**	**$ 8,940,000**	**$ 10,451,000**	**$ 459,500**	**$ 714,500**	**$ 593,500**	**$ 439,500**	**$ 30,580,000**

ID											Long-Term
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY2031	FY 2032	FY 2023 – 2032
S-1											$ -
S-2											$ -
S-3											$ -
S-4	$ 40,000					$ 40,000					$ 80,000
S-5											$ -
S-6	$ 60,000		$ 60,000		$ 60,000		$ 60,000		$ 60,000		$ 300,000
S-7											$ -
S-8											$ -
S-9											$ -
S-10											$ -
S-11											$ -
S-12											$ -
S-13											$ -
S-14											$ -
S-15											$ -
Supply Subtotal	**$ 100,000**	**$ -**	**$ 60,000**	**$ -**	**$ 60,000**	**$ 40,000**	**$ 60,000**	**$ -**	**$ 60,000**	**$ -**	**$ 380,000**
T-1											$ -
T-2											$ -
T-3											$ -
T-4											$ -
T-5											$ -
T-6		$ 1,500,000									$ 1,500,000
T-7										$ 1,750,000	$ 1,750,000
T-8	$ 50,000										$ 50,000
T-9											$ -
T-10											$ -
Treatment Subtotal	**$ 50,000**	**$ 1,500,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,750,000**	**$ 3,300,000**
D-1											$ -
D-2				$ 200,000					$ 200,000		$ 400,000
D-3											$ -
D-4								$ 341,000			$ 341,000
D-5										$ 341,000	$ 341,000
D-6	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 370,000	$ 3,700,000
D-7	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 96,500	$ 965,000
D-8	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 44,000	$ 440,000
D-9											$ -
D-10											$ -
D-11											$ -
D-12											$ -
Distribution Subtotal	**$ 510,500**	**$ 510,500**	**$ 510,500**	**$ 710,500**	**$ 510,500**	**$ 510,500**	**$ 510,500**	**$ 851,500**	**$ 710,500**	**$ 851,500**	**$ 6,187,000**
P-1											$ -
P-2											$ -
P-3											$ -
P-4											$ -
P-5											$ -
P-6											$ -
P-7											$ -
P-8											$ -
P-9											$ -
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P-20											$ -
P-21											$ -
P-22											$ -
P-23											$ -
P-24											$ -
P-25											$ -
P-26	$ 35,000										$ 35,000
P-27	$ 162,000										$ 162,000
P-28	$ 131,000										$ 131,000
P-29		$ 29,000									$ 29,000
P-30		$ 64,000									$ 64,000
P-31		$ 85,000									$ 85,000
P-32			$ 287,000								$ 287,000
P-33				$ 432,000							$ 432,000
P-34					$ 794,000						$ 794,000
P-35											$ -
P-36											$ -
P-37						$ 640,000					$ 640,000
P-38							$ 300,000				$ 300,000
P-39								$ 250,000			$ 250,000
P-40									$ 350,000		$ 350,000
Piping Subtotal	**$ 328,000**	**$ 178,000**	**$ 287,000**	**$ 432,000**	**$ 794,000**	**$ 640,000**	**$ 300,000**	**$ 250,000**	**$ 350,000**	**$ -**	**$ 3,559,000**
TOTAL	**$ 988,500**	**$ 2,188,500**	**$ 857,500**	**$ 1,142,500**	**$ 1,364,500**	**$ 1,190,500**	**$ 870,500**	**$ 1,101,500**	**$ 1,120,500**	**$ 2,601,500**	**$ 13,426,000**