PUBLIC HEALTH DIVISION
Center for Health Protection, Drinking Water Services
Kate Brown, Governor

Oregon Health Authority

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http://healthoregon.org/dwp

April 16, 2015

Geoff Wullschlager, City Manager
City of Wheeler
P.O. Box 177
Wheeler, OR 97147

Re: City of Wheeler Water Master Plan (PWS #00942; PR #54-2015)
Concurrence of Findings

The Oregon Drinking Water Services (DWS) received a copy of the City of Wheeler Water Master Plan – February 2015 from the City on April 9, 2015. The plan review fee was submitted on your behalf by Bill Pavlich of Pace Engineers, Inc on April 6, 2015. Upon review of the Plan, it appears the criteria listed in OAR 333-061-0060(5) have been met.

The City of Wheeler Water Master Plan represents a 20-year planning year period extending through 2034. The plan includes a description and evaluation of the existing water system, future demand estimates, hydraulic modeling (EPANET), recommended system improvements, a Capital Improvement Plan (CIP), and a discussion of financing options. The CIP prioritizes the recommended improvement projects, and provides 2014 cost estimates.

Note that OAR 333-061-0060 contains plan submission and review requirements for major additions, or modifications to public water systems. Most of the High, Medium and Low Priority projects presented in the Master Plan would require plan review. Construction plans must be submitted to and approved by DWS before construction begins.

If you have questions, please contact me at 971.673.0406, or via email at fred.n.kalish@state.or.us.

Sincerely,

Fred Kalish, P.E.
Regional Engineer

Cc: Bill Pavlich, PE, Pace Engineers, Inc., 5000 Meadows Road, Suite 345, Lake Oswego, OR 97035-2232
Annette Pampush, Tillamook County

CITY OF WHEELER

WATER MASTER PLAN

FEBRUARY 2015 - FINAL

PACE
An Engineering Services Company

CITY OF WHEELER

WATER MASTER PLAN

PROJECT NO. 13821

FEBRUARY 2015 - FINAL

Completed by:

PACE Engineers, Inc.
5000 Meadows Road, Suite 345
Lake Oswego, OR 97035
(503) 597-3222
www.paceengrs.com

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EXECUTIVE SUMMARY

BACKGROUND AND NEED

The City of Wheeler is a coastal community located in Tillamook County approximately 22 miles north of the City of Tillamook. Wheeler owns and operates a municipal water system that provides water to a current population of 415 persons.

Master planning for the City was last conducted in 1993. Significant changes have occurred since the adoption of the 1993 Plan. Comprehensive water system improvements were completed in 2003. The surface water sources were discontinued and a well source was developed that provides water to the Joint Water System, of which Wheeler and Manzanita are the two principal partners. Wheeler receives water from the Joint Water System through a master meter. Wheeler participates financially in the water supply system, but Manzanita owns and operates the constructed facilities.

A new master plan is needed to meet Oregon Health Authority (OHA) requirements for a current master plan as well as to provide a current evaluation of the City's needs. The new Plan also includes a current capital improvements program (CIP) that can provide the basis for system development charges modifications.

PLANNING PERIOD

This Plan uses a 20 year planning period (through the year 2034).

POPULATION PROJECTIONS

Population projections for Wheeler are shown in Table E1. These are based, in part, on Oregon Office of Economic Analysis (March 28, 2013) revised long-term population forecast for Oregon counties.

Table E1: City of Wheeler Population Projections (0.70% Average Annual Growth Rate)

Year	Population (Persons)	Percent Increase Over Year 2013
2013	415	-
2019	433	4.3
2024	448	8.0
2029	464	11.8
2034	481	15.9

LEVEL OF SERVICE GOALS

"Level of service" ultimately refers to the quality of the water service provided to the customer, but the phrase also has implications for the City staff that are responsible for operating, maintaining, and administering the utility and for elected officials who are ultimately responsible for the support and political will to champion the mission and needs of the utility. The provision of clean, healthy drinking water is one of the most important services a City provides and, consistent with this importance, the City of Wheeler should endeavor to provide a relatively high level of service.

One of the primary objectives for a water system is the protection of public health and welfare. For utilizing and expanding a water system, it is also important to minimize adverse environmental impacts. Various agencies have promulgated rules that ultimately support these objectives and, at a minimum, every water system must comply with these rules and requirements.

GENERAL GOALS AND REQUIREMENTS

General level of service goals and requirements include:

- **Conveyance and delivery (goal):** adequate, consistent, and reliable delivery of water under all anticipated service conditions; capacity for system to deliver maximum day demand (MDD) plus fire flow (FF).
- **Pressurization (requirement):** a minimum of 20 psi system pressure must be maintained at all times (OAR 333-061-0025). The 20 psi minimum system pressure requirement extends to the customer water meter.
- **Water quality (requirements):** comply with all Oregon Health Authority (OHA) requirements. Water quality also includes aesthetic considerations that may or may not be related to specific regulatory concerns. Efforts to maintain or improve the aesthetic quality of the water provided is a goal consistent with the provision of a high level of service.

- **Reliability (goals):** reliability as a goal is the ability of the water system and City staff to avoid or circumvent problems that adversely impact system performance. Reliability is enhanced by routine and timely maintenance and replacement, good design and construction, providing adequate water supply, providing alternate or backup facilities or equipment, and having a contingency plan for efficiently handling specific problems.

CURRENT AND PROJECTED MASTER METER WATER DEMAND

Water from the wells is supplied to the City via a master meter. Projected water (master meter) demands for the Wheeler water system are shown in Table E2.

Table E2: Projected Master Meter Water Demand (in gallons per day)

Year	2013	2019	2024	2029	2034	2064
Population	415	433	448	464	481	593
EDUs[1]	313	326	338	350	362	447
Average Day	61,000	63,600	65,900	68,200	70,600	87,000
Maximum Day	91,000	94,900	98,300	101,700	105,400	129,900

[1] *Equivalent dwelling units*

METERED CUSTOMER USAGE AND UNACCOUNTED-FOR WATER

Metered customer water usage for the period January 2013 to December 2013 is summarized in Table E3. Residential and general commercial usage constitutes the bulk (87.2 percent) of total metered use. Total metered usage, based on a resident population of 415 persons in 2013, averaged 91.8 gallons per capita per day.

Table E3 also includes recent estimates of unaccounted-for water (approximately 24 - 36%).

The City had completed a leak survey of the water distribution system in April 2012 and has implemented repairs based on the survey. The City is following up on the recent 36% figure by collecting additional data with which to recalculate losses to ensure that there was not an error in the data used for the previous calculation. If losses exceed 10%, a new leak detection survey should be scheduled.

Table E3: Unaccounted-for Water

Year	Metered Usage[1] (gallons)	Other Usage[2] (gallons)	Accounted-for Water[3] (gallons)	Master Meter Demand (gallons)	Unaccounted-for Water (gallons)	(%)
2013	13,901,290	146,636	14,047,926	21,986,000	7,938,074	36.1
2012	14,981,000	1,600,000	16,581,000	21,825,000	5,244,000	24.0
2011	13,402,110	501,800	13,903,910	18,657,000	4,753,090	25.5

Notes: [1]Service meter data. Includes sold water and metered (but not-sold) water.
[2]Other estimated usage includes: known leaks and overflows, fire-related operations, or maintenance and system flushing.
[3]Sum of "metered" and "other" totals.

WATER QUALITY AND TREATMENT

The current source (well) water has been classified as groundwater by OHA; consequently, filtration is not required. The associated treatment facility is owned and operated by the City of Manzanita. Wheeler participates financially in accordance with provisions of the intergovernmental agreement with Manzanita. Treatment is currently limited to disinfection and corrosion control.

The City is in compliance with all water quality related regulatory requirements. However, the raw water provided by the wells has elevated CO_2 levels which can cause corrosion and may result in pH violations if not controlled. The City of Manzanita has coordinated the study and pre-design efforts associated with assessing and addressing the high CO_2 levels. Wheeler is working with Manzanita to address the issue.

WATER SOURCE AND WATER RIGHTS

The well source, located near the Nehalem River, is currently the City's only developed source. This source provides water to the Joint Water System and has adequate permitted capacity to provide for more than the 20-year planning horizon.

RESERVOIR STORAGE

Total reservoir storage is 500,000 gallons and capacity is adequate through the planning period. Both reservoirs were recently cleaned and inspected and are in very good condition. Recommendations include relocation of the electrical service at Jarvis Reservoir (budget $5,000) and checking both reservoir's cathodic protection systems (budget $5,000).

DISTRIBUTION

An assessment of Wheeler's distribution system and the resulting improvement recommendations were based on map review, review of previous plan recommendations and implemented projects, fire flow needs, modelling, and information from staff on problem areas. Recommendations are included in the capital improvement plan.

SCADA AND TELEMETRY

The existing radio based SCADA and telemetry system has been increasingly problematic and unreliable. The entire SCADA, telemetry, and central computer system needs to be replaced. Estimated cost including a new computer and software is $27,000.

CAPITAL IMPROVEMENT PLAN

Recommended capital improvements are shown on the plan, and in the associated table, at the end of the executive summary.

OPERATIONS AND MAINTENANCE (O&M)

Most of the recommended capital improvements will not result in increased O&M costs; however, O&M costs are subject to inflationary pressures, so annual increases are typically required. Budgets and water rates are typically adjusted to take recent or anticipated changes into account; however, system deficiencies that have not been addressed can increase O&M costs. This may occur in ways and to an extent not easily foreseen; and may take the form of emergency (overtime) call outs and extra cost, interim measures that may be needed until the problem can be addressed correctly, and un-budgeted emergency projects of potentially significant expense. Over time, such costs can add significantly to the overall utility budget.

WATER RATES

City of Wheeler water rates are based on a base monthly service charge associated with a customer class and further adjusted according to meter size. To the base charge is added water usage rate of $0.0028 per gallon. Base charge for residential and general commercial (less than 1" meter) is $20.70.

With the current rate structure, this yields an average, residential account, monthly billing of $33.34 ($20.70 base plus $12.64 usage). Funding agencies often evaluate a City's rates based on a per EDU residential monthly billing associated with 7,500 gallons); for Wheeler, this billing would be $41.70. For the fiscal year ending June 30, 2013, total rate revenue was $119,511.

Rates provide approximately 2/3 of the overall water utility revenue with the other approximate 1/3 provided through property taxes.

Based on a review of the Operating Fund budgets, the City needs to increase rates. The rate increase should cover both existing needs and provide for debt service on planned improvements (to the extent that they will be funded with loans). A water rate study is recommended. Estimated cost for the rate study is $12,000.

CURRENT SYSTEM DEVELOPMENT CHARGE (SDC)

Wheeler's current Water SDC is $3,670 for a standard residential or small commercial water meter (5/8" x ¾"). The City should consider revising the SDC after the Water Master Plan has been adopted. Estimated cost for a water SDC update is $8,000.

CAPITAL IMPROVEMENT FINANCE

Major capital improvements are typically too expensive to fund exclusively with accumulated reserves. Such projects are often most economically financed through programs offered by various State and Federal agencies, or a mix of public and local financing. Potential sources of financing that appear promising, and for which the City is likely eligible, include two programs available through Business Oregon – Infrastructure Finance Authority: the Safe Drinking Water Revolving Loan Fund and the Water/Wastewater Financing Program; and one federal program, USDA Rural Development. Minor projects can be financed with City resources or included in a larger project financed through one or more of the funding agencies.

CAPITAL IMPROVEMENT RATE IMPACTS

Table E4 includes debt service and rate impacts on a per equivalent dwelling unit (EDU) basis for projects funded through the programs identified in the Plan. ***Note: Table E4 is for general planning purposes only. Actual interest rates, terms, and availability of funds through any given source may vary and are not locked in until an offer of funding is accepted by the City.***

Table E4: Example Debt Service and Rate Impacts (per EDU basis)

	Annual Debt Service	Monthly Per EDU Rate Increase	Annual Debt Service	Monthly Per EDU Rate Increase	Annual Debt Service	Monthly Per EDU Rate Increase	Annual Debt Service	Monthly Per EDU Rate Increase
Interest Rate (%):	3.25		3.39		4.24		6.5	
Term (years):	40		25		25		25	
Reserve (%):	10							
EDUS:		313		313		313		313
Loan Total($)								
$100,000	$4,953.07	$1.32	$5,995.19	$1.60	$6,564.60	$1.75	$8,198.15	$2.18
$200,000	$9,906.15	$2.64	$11,990.38	$3.19	$13,129.20	$3.50	$16,396.30	$4.37
$300,000	$14,859.22	$3.96	$17,985.58	$4.79	$19,693.80	$5.24	$24,594.44	$6.55
$400,000	$19,812.29	$5.27	$23,980.77	$6.38	$26,258.40	$6.99	$32,792.59	$8.73
$500,000	$24,765.37	$6.59	$29,975.96	$7.98	$32,823.00	$8.74	$40,990.74	$10.91
$600,000	$29,718.44	$7.91	$35,971.15	$9.58	$39,387.60	$10.49	$49,188.89	$13.10
$700,000	$34,671.51	$9.23	$41,966.34	$11.17	$45,952.20	$12.23	$57,387.04	$15.28
$800,000	$39,624.59	$10.55	$47,961.53	$12.77	$52,516.80	$13.98	$65,585.18	$17.46
$900,000	$44,577.66	$11.87	$53,956.73	$14.37	$59,081.40	$15.73	$73,783.33	$19.64
$1,000,000	$49,530.73	$13.19	$59,951.92	$15.96	$65,646.00	$17.48	$81,981.48	$21.83

IMPLEMENTATION

Capital improvements can be implemented over the planning period according to the nature of the projects, the relative prioritization of the project, and other financial and practical considerations that the City may have. Several of the projects are high priority and should be addressed as soon as practicable. Because of the high costs, funding agency participation will likely be needed. Once the City has determined which projects to include, the City should contact IFA to set up a One- Stop Meeting in Salem to discuss potential project funding. Representatives of potential funding agencies attend the meeting and can assist in developing an optimal funding approach.

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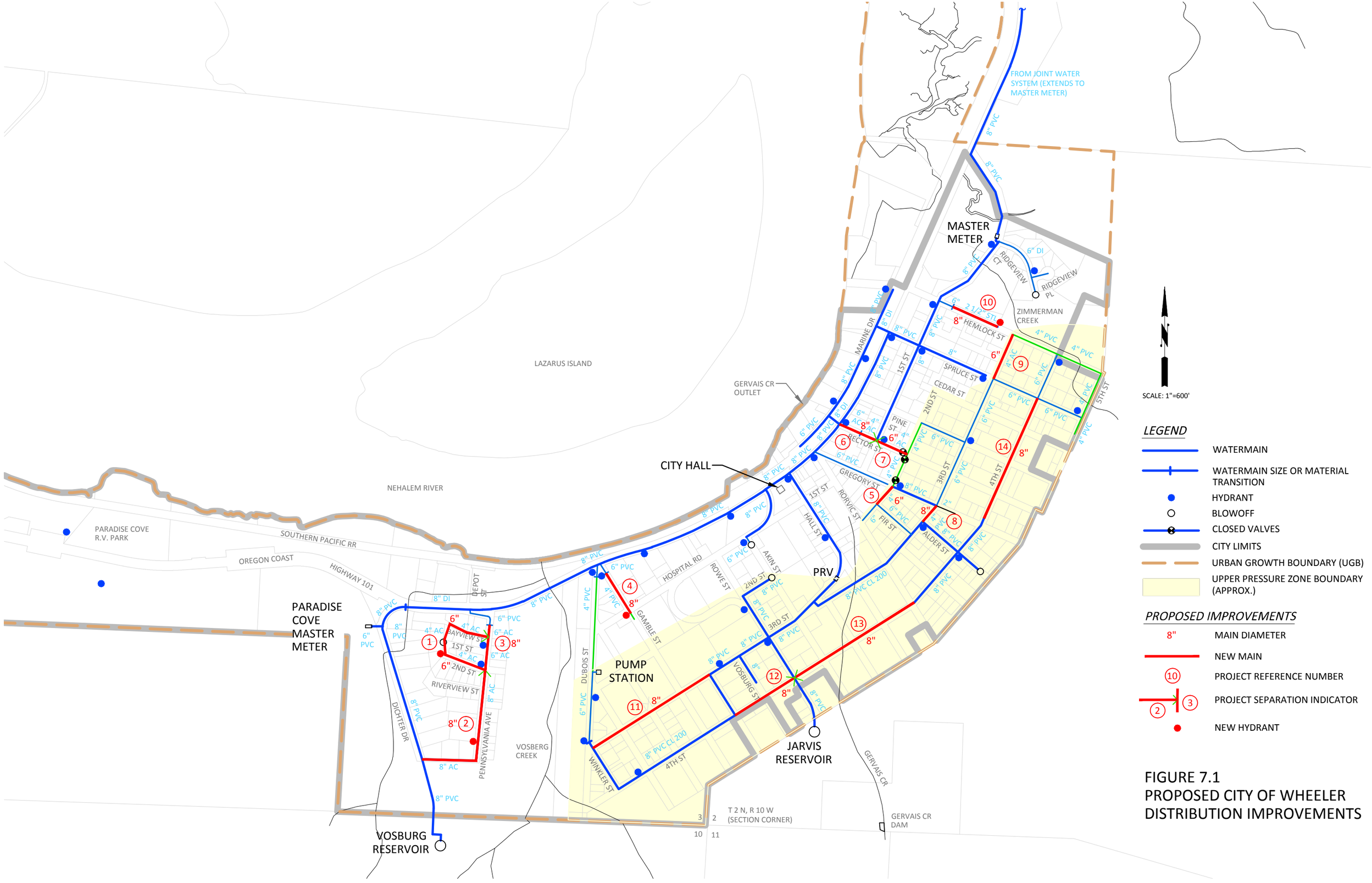

FIGURE 7.1
PROPOSED CITY OF WHEELER
DISTRIBUTION IMPROVEMENTS

Table 7.1: City of Wheeler CIP (All costs in current dollars) | **Reference September 2014 ENR CCI:** 9870 | **Current ENR CCI: (September 2014)** 9870 | **City of Wheeler Water System Master Plan 2014** | **Distribution Improvements**

Unit Costs Sep 2014 ($/LF)	Project Priority	Project Reference Number	Project Name (Description)	New Diameter (in.)	Length (LF)	Unit Cost ($/LF)	Construction Cost ($)	Total Cost ($)	Implementation (LF and Total Cost) 2015 (LF)	2015 ($)	2016 (LF)	2016 ($)	2017 (LF)	2017 ($)	2018 (LF)	2018 ($)	2019 (LF)	2019 ($)	2020-25 (LF)	2020-25 ($)	2026-34 (LF)	2026-34 ($)	CIP Totals Length (LF)	CIP Totals Cost ($)
$130	H	1	**Bayview Loop**	6	**880**	$130	$114,400	**$165,880**	880	$165,880		$0		$0		$0		$0		$0		$0	880	$165,880
			Project replaces old 4" AC mains on Bayview Street and 2nd Street, west of Pennsylvania Ave. with new 6" line and hydrant. New line will complete loop and connect to new lines on Pennsylvania Ave. (Ex. 4" valves don't work; lots of breakage on old AC line.)																					
140	H	2	**Pennsylvania Ave. (South)**	8	**1,080**	$140	$151,200	**$219,240**	1,080	$219,240		$0		$0		$0		$0		$0		$0	1,080	$219,240
			Replace old 8" AC line on Pennsylvania Ave. between Dichter Dr. and 2nd Street. (Lots of breakage on old AC line.) New hydrant provides fire protection.																					
140	H	3	**Pennsylvania Ave. (North)**	8	**330**	$140	$46,200	**$66,990**	330	$66,990		$0		$0		$0		$0		$0		$0	330	$66,990
			Replace old 6" AC line along Pennsylvania Ave. between 2nd Street and existing 6" PVC line north of Bayview Street.																					
140	M	4	**Gamble Street**	8	**340**	$140	$47,600	**$69,020**		$0		$0		$0		$0		$0	340	$69,020		$0	340	$69,020
			Replace 4" PVC with " line and fire hydrant. Provides better fire protection to homes in the vicinity.																					
130	M	5	**2nd Street (Fir - Gregory)**	6	**180**	$130	$23,400	**$33,930**		$0		$0		$0		$0		$0	180	$33,930		$0	180	$33,930
			Replace existing 4" line with 6". Improves local hydraulics.																					
140	H	6	**Rector Street (West)**	8	**300**	$140	$42,000	**$60,900**	300	$60,900		$0		$0		$0		$0		$0		$0	300	$60,900
			Replace old 4" and 6" AC lines on Rector Street between Hwy 101 and 1st Street.																					
130	H	7	**Rector Street (East)**	6	**220**	$130	$28,600	**$41,470**	220	$41,470		$0		$0		$0		$0		$0		$0	220	$41,470
			Replace old 4" AC line on Rector Street between 1st Street and 2nd Street..																					
140	M	8	**3rd Street (Alder - Gregory)**	8	**170**	$140	$23,800	**$34,510**		$0		$0		$0		$0		$0	170	$34,510		$0	170	$34,510
			Replace 4" PVC along 3rd Street with 8" between Alder Street and Gregory Street. Improves local hydraulics.																					
130	H	9	**3rd Street (Spruce - Hemlock)**	6	**350**	$130	$45,500	**$65,975**	350	$65,975		$0		$0		$0		$0		$0		$0	350	$65,975
			Replace old 4" AC line along 3rd Street between Spruce Street and Hemlock Street.																					
140	H	10	**Hemlock Street**	8	**370**	$140	$51,800	**$75,110**	370	$75,110		$0		$0		$0		$0		$0		$0	370	$75,110
			Replaces old 2-1/2" steel main with 8" lineand terminal hydrant. Improved service and fire protection.																					
140	L	11	**3rd Street (Winkler - East)**	8	**1,000**	$140	$140,000	**$203,000**		$0		$0		$0		$0		$0		$0	1,000	$203,000	1,000	$203,000
			Proposed main for upper pressure zone loop completion and expanded service. Along 3rd Street from Winkler Street, east to existing 8". Area currently undeveloped. Anticipate construction by developer. No current development plan.																					
140	M	12	**4th Street (Rowe - West)**	8	**500**	$140	$70,000	**$101,500**		$0		$0		$0		$0		$0	500	$101,500		$0	500	$101,500
			New 8" line along 4th Street from Rowe Street, west to the existing 8" line on 4th Street. Enhances fire flow and service to vicinity of Hospital. Also part of planned larger diameter loop in the upper pressure zone.																					
140	M	13	**4th Street (Rowe - East)**		**1,530**	$140	$214,200	**$310,590**		$0		$0		$0		$0		$0	1,530	$310,590		$0	1,530	$310,590
			Proposed main for upper pressure zone loop completion and expanded service. Along 4th Street from Rowe Street, east to existing 8" line. Area currently undeveloped. Anticipate construction by developer. No current development plan.																					
140	M	14	**4th Street (South of Spruce)**	8	**950**	$140	$133,000	**$192,850**		$0		$0		$0		$0		$0	950	$192,850		$0	950	$192,850
			Proposed main for upper pressure zone loop completion and expanded service. Along 4th Street from Spruce Street, south to existing 8" line. Area currently undeveloped. Anticipate construction by developer. No current development plan.																					
			Distribution Totals		**8,200**		**$1,131,700**	**$1,640,965**	**3,530**	**$695,565**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**3,670**	**$742,400**	**1,000**	**$203,000**	**8,200**	**$1,640,965**

Miscellaneous

Constr. Costs Oct 2013 ($/LF)	Total Costs Oct 2013 ($/LF)	Project Priority	Project Name (Description)	Plan Section # Reference	ENR Ratio	Construction Cost ($)	Total Cost ($)	Implementation (% and Total Cost) 2015 (LF)	2015 ($)	2016 (LF)	2016 ($)	2017 (LF)	2017 ($)	2018 (LF)	2018 ($)	2019 (LF)	2019 ($)	2020-25 (LF)	2020-25 ($)	2026-34 (LF)	2026-34 ($)	CIP Totals (%)	CIP Totals Cost ($)
$0	$5,000	H	**Jarvis Reservoir Electrical Service**	**6.7.2.3**	1.000	$0	$5,000	100	$5,000		$0		$0		$0		$0		$0		$0	100	$5,000
			Fix building that houses the reservoir's electrical service or relocate service.																				
	$5,000	H	**Reservoir Cathodic Protection**	**6.7.2.3**	1.000	$0	$5,000	100	$5,000		$0		$0		$0		$0		$0		$0	100	$5,000
			Check cathodic protection at reservoirs. Budget may need adjusting based on findings and follow up work needed.																				
	$27,000	H	**SCADA and Telemetry Improvements**	**6.7.5**	1.000	$0	$27,000	100	$27,000		$0		$0		$0		$0		$0		$0	100	$27,000
			Replaces old Plan that is out-of-date.																				
	$12,000	H	**Water Rate Study**	**8**	1.000	$0	$12,000	100	$12,000		$0		$0		$0		$0		$0		$0	100	$12,000
			Prepare a new water rate study.																				
	$8,000	H	**System Development Charge Study**	**8**	1.000	$0	$8,000	100	$8,000		$0		$0		$0		$0		$0		$0	100	$8,000
			Prepare a new water SDC study and methodology.																				
	$50,000	L	**Water Master Plan Update**	**6.8.1**	1.000	$0	$50,000		$0		$0		$0		$0		$0	100	$50,000		$0	100	$50,000
			Periodic update of Plan. Actual budget should be adjusted as needed to reflect theanticipated level of effort required.																				
			Miscellaneous Totals			**$0**	**$107,000**		**$57,000**		**$0**		**$0**		**$0**		**$0**		**$50,000**		**$0**		**$107,000**
			CIP Total			**$1,131,700**	**$1,747,965**	**$3,530**	**$752,565**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$3,670**	**$792,400**	**$1,000**	**$203,000**	**$8,200**	**$1,747,965**

SECTION 1 | INTRODUCTION

1.1 BACKGROUND AND NEED

The City of Wheeler is a coastal community located in Tillamook County approximately 22 miles north of the City of Tillamook. Wheeler owns and operates a municipal water system that provides water to an estimated year 2014 service area population of 415 persons.

Master planning for the City was last conducted in 1993 (Water Facilities Master Plan, March 1993, Lee Engineering, Inc.). At that time, major concerns included the presence of two unfiltered surface water sources, the need for an adequate and reliable water supply, and widespread distribution system deficiencies. The Plan was adopted by the City and approved by the State.

Significant changes have occurred since adoption of the 1993 Plan. Comprehensive water system improvements were completed in 2003. The surface water sources were discontinued and a well source was developed that provides water to the Joint Water System (JWS) of which Wheeler and Manzanita are the two principal partners. Wheeler receives water from JWS through a master meter. Wheeler participates financially in the water supply system, but Manzanita owns and operates the constructed facilities.

A new master plan is needed that will meet Oregon Health Authority (OHA) master planning requirements as well as provide a current evaluation of the City's needs. The new Plan will also include a current capital improvements program (CIP) that can provide the basis for SDC modifications.

1.2 PURPOSE AND SCOPE

This Water Master Plan is intended to provide the City of Wheeler with a comprehensive planning document consistent with State requirements. A key objective is the development of an updated CIP.

The scope of work for this Plan includes all elements required for State approval. An update of the City's Water Management and Conservation Plan was not included in the scope of work.

1.3 PLANNING PERIOD

This Plan uses a 20 year planning period (through the year 2034).

1.4 AUTHORIZATION AND FUNDING

The City of Wheeler authorized PACE Engineers, Inc. to prepare this Water System Master Plan on October 15, 2013. This project has been funded entirely by the City of Wheeler.

SECTION 2 | AREA CHARACTERISTICS

2.1 PLANNING AREA

Wheeler's water system currently serves the area within the City's urban growth boundary (UGB); the area defined by the City's UGB constitutes the primary planning area. Areas outside the UGB are also included for planning purposes insofar as they relate to the City's water supply. The UGB is shown in Figure 3.1.

2.2 PHYSICAL CHARACTERISTICS

2.2.1 Climate

Wheeler's climate is moist, marine, and temperate. Summers are cool and winters are mild, largely due to the moderating influence of the Pacific Ocean. Westerly winds from the ocean predominate over the coastal areas and inland into the Coast Range. Western Regional Climate Center data for Tillamook (Station: 358494 Tillamook 1 W), for the period 1948 – 2010, indicate an average annual precipitation total of 89.07 inches with 76 percent occurring in the six month period November – April. Average daytime temperatures are 50.9°F in winter and 66.8°F in summer; average nighttime temperatures are 36.5°F in winter and 48.8°F in summer. Recorded temperature extremes range from 1°F (January 31, 1950) to 102°F (July 11, 1961, and August 9, 1981). Extreme daily precipitation is 5.22 inches (January 23, 1982). The area is subject to severe winter storms that can bring high precipitation totals and high winds, at times exceeding 100 miles per hour.

The following information on climate change that may be applicable to the Wheeler area is derived from *Climate Ready Communities, A Strategy for Adapting to Impacts of Climate Change on the Oregon Coast,* prepared by Department of Land Conservation and Development, January 2009. Projections indicate that winter precipitation will increase while summers will be drier with an increase in the duration of the summer "dry" period. Implications for coastal streams are more frequent winter flooding and reduced streamflow during the summer.

2.2.2 Land Resources

2.2.2.1 Landscape and Topography

Wheeler is situated on the southeast bank of Nehalem Bay and the lower slopes of the coastal hillsides that extend upwards to an elevation of approximately 1,300 feet. Areas west of Highway 101 are relatively flat; while the remaining areas are predominantly hillsides with gentle to moderate slopes. There are several small creeks and drainways. Some creek relocations and landscape modifications (to facilitate development) have occurred.

2.2.2.2 Soil Characteristics

Information for this section is based on the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) Soil Survey for Tillamook County, Oregon.

The area west of the railroad and adjacent to the Nehalem River, that includes the marina and vacant land to the north, is on imported fill over tidal flats. The current NRCS classification of this soil is: *100B Urban land-Udorthents complex, 0-7 percent slopes*.

The remaining developed part of the City is primarily *29D Templeton-Klootchie complex, 5 to 30 percent slopes*. The soil is well drained, with moderately high subsurface permeability, very high available water capacity, moderate erosion potential, high organic content, and very strongly acidic. Soft, fractured siltstone typically occurs at depths of 50-77 inches.

Areas south and east of the NCRS 29D soil complex consist primarily of *29E Templeton-Klootchie complex, 30 to 60 percent slopes*. These soils are similar in characteristics to the 29D soil complex, except basalt bedrock typically occurs at depths of 30-48 inches.

The undeveloped northwest part of the City includes an area of tidal marsh. Soil associated with this area is *2A Fluvaquents-Histosols complex, 0 to 1 percent slopes*. The soil is very poorly drained and subject to frequent ponding and flooding (due to river and tidal influence).

2.2.3 Water Resources

Water resources in the area include: Pacific Ocean, Nehalem River (and Bay), and from north to south: Zimmerman Creek, Gervais Creek (also known as Jarvis Creek), Vosburg Creek, and an unnamed creek near Dichter Drive.

Vosburg Creek was once a source of City drinking water. Recently, the impoundment was removed and the stream restored to provide improved fish habitat.

Riparian areas extend along the streams and extend to tidal marshes near the stream mouths.

2.2.4 Natural Hazards

Natural hazards in the area notably include earthquakes, tsunamis, landslides, and floods. Wheeler is located near the Cascadia Subduction Zone and could potentially sustain a magnitude 9 earthquake. Recurrence interval on very large quakes along the Oregon coast is approximately 300 – 800 years.

Most of the City lies on hillsides above Nehalem Bay and is thereby largely protected from tsunami impacts. Oregon Department of Geology and Mineral Industries (DOGAMI) recently updated tsunami maps for the area that show that most areas north and west of Highway 101 could be affected, as well as the downtown core, lower Zimmerman Creek area, and lower Vosberg Creek along Dubois Street.

Landslides (including slumps and slow moving landslides) are not uncommon in the area and are often triggered during periods of high rainfall or storm conditions.

Flooding, when it occurs in Wheeler, tends to be confined to a fairly close proximity of the affected stream. The 100-year flood elevation is 10 feet (NGVD) in Wheeler and primarily affects areas north and west of Highway 101 and the railroad, plus the tidal areas associated with Zimmerman Creek and Vosburg Creek.

Gervais Creek was diverted underground in the downtown area in the early 1900s. The 36-inch piped diversion of Gervais Creek passes under the Wheeler Station Building and causes basement flooding periodically when both stream flow and tides are high. Gervais Creek has potential to flood the eastern part of Rorvik Street if the pipe intake becomes obstructed.

2.3 SOCIO-ECONOMIC CHARACTERISTICS

2.3.1 Selected Demographic Characteristics

Selected population and housing demographic characteristics for the City of Wheeler from Census 2000 and Census 2010 data are shown in Table 2.1. Population increased by 5.9 percent over the 10 year period. Median age of the population increased to an average of 57.4 years. Housing units increased by 18.4 percent – higher than the percent increase in population. As a result, average household size dropped to 1.87 persons per household.

Table 2.1: Census Demographic Characteristics

Characteristic	Census 2000	Census 2010
Population		
Total	391	414
Median age (years):	50	57.4
65 years and over:	108	130
Housing		
Housing units (total):	244	289
Occupied:	176	197
Vacant:	68	92
Owner occupied:	108	113
Renter occupied:	68	84
Persons per household:	1.98	1.87

2.3.2 Population

2.3.2.1 Historic Population

Decennial census population figures for the City of Wheeler, City of Manzanita, and Tillamook County are presented in Table 2.2. Data is from the U.S. Census Bureau. Average annual growth rate (AAGR) for the City of Wheeler was 0.87 percent for the 30-year period ending in 2010.

Table 2.2: Historic Population

	City of Wheeler	City of Manzanita	Tillamook County
Census Total (persons)			
1980	319	443	21,259
1990	335	513	21,638
2000	391	564	24,287
2010	414	598	25,260
Average Annual Growth Rate (AAGR%)			
1980-1990	0.49	1.48	0.18
1990-2000	1.56	0.95	1.16
2000-2010	0.57	0.59	0.39
1980-2010	0.87	1.01	0.58

2.3.2.2 Recent Population

The Population Research Center at Portland State University (PSU) prepares annual (July 1) population estimates for Oregon counties and municipalities. Recent population estimates for the City of Wheeler are shown in Table 2.3. The population has held steady, with the lack of growth reflecting possible local impacts of the recent economic recession.

Table 2.3: City of Wheeler Recent Population

Year	Population PSU July 1 Estimate	Percent Increase Over Previous Year
2010	414	-
2011	415	0.24
2012	415	0.00
2013	415	0.00

Official population figures are for residents only and do not include consideration of visitors and seasonal occupants. 60 of the City's 289 housing units (or 21%) are associated with seasonal, recreational, or occasional use (source: 2010 Census). In addition, Wheeler is located on US Highway 101, providing ready access for tourists and others. Non-resident population peaks in the summer, typically in July.

2.3.2.3 Current Year (2014) Population

The current year (2014) population estimate is: 405 persons within the City of Wheeler city limits.

This is a "Preliminary Population Estimate" prepared for by Portland State University on November 15, 2014 for data reflecting July 1, 2014. PSU does not certify the results until December 15, 2014. This water master plan was started in late 2013 and largely completed prior to the release of the 2014 figure; it uses 2013 population data as the basis for projections and analyses.

2.3.2.4 Population Projections

Population projections for the City of Wheeler are shown in Table 2.4.

Table 2.4: City of Wheeler Population Projections (0.70% AAGR)

Year	Population (Persons)	Percent Increase Over Year 2013
2013	415	-
2019	433	4.3
2024	448	8.0
2029	464	11.8
2034	481	15.9

The Office of Economic Analysis (OEA), State of Oregon recently (March 28, 2013) issued a revised long-term population forecast for Oregon counties. Table 2.4 reflects an allocation of Tillamook County's forecasted growth based on the highest relative percentage of Wheeler's population to that of the County in each year 1980, 1990, 2000, and 2010. Wheeler's percentage ranged from a low in 1980 (1.51%) to a high in 2010 (1.64%). Tillamook County's 2035 OEA population forecast is 29,485 persons. 1.64% of this figure (Wheeler's share) is 484 persons, representing an average annual growth rate (AAGR) since 2013 of 0.70%. Table 2.4 reflects 0.70% population growth.

The total projected year 2034 population is 481 persons based on an average annual growth rate of 0.70%.

The 1993 Plan included a saturation population estimate (also known as ultimate buildout population or UBO) that reflects the potential future population if the City were to be fully developed according to the total area and maximum allowable densities associated with each zoning classification – with deductions for non-buildable areas (such as right-of-way). The computed UBO for Wheeler was 4,946 persons. The UBO figure can be important in evaluating future water supply requirements, but more typically it is used to demonstrate that a planning document's recommendations are not excessive. Projected growth in Wheeler is modest and well within the estimated UBO.

2.3.3 Land Use

2.3.3.1 Current Land Use

Land between the Nehalem River and Highway 101 includes the marina and associated commercial and light industrial development. Core commercial development is located in the downtown area near and along Highway 101. Residential development is primarily located on the hillsides south and east of Highway 101. Residential development densities vary and many areas have limited or no development due to topographical constraints.

Forest and recreational uses predominate in areas nearby, but outside, the UGB.

2.3.3.2 Current Zoning

Zoning Ordinances for the City of Wheeler can be found in the *City of Wheeler, Oregon Zoning Ordinance, adopted December 1979 with Amendments through September 2012*. Zoning codes and mapping for the City are included in Appendix 2.1.

2.3.3.3 Future Development

Residential development on the upper hillsides was very active prior to the recession and can reasonably be expected to resume as the economy recovers. The City is in the process of acquiring land along the Nehalem River in the north part of town for use as a City park. The City has also been an active participant in the Salmonberry Coalition that is seeking to develop a world-class bicycle and multi-use path from Banks to Tillamook. Wheeler's location on the trail could provide significant commercial development opportunities associated with an increase in tourism.

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SECTION 3 | EXISTING WATER SYSTEM

3.1 INTRODUCTION

The City of Wheeler owns and operates a municipal water system that currently provides service to areas within the City limits. In 2013, there were 255 metered water connections, 228 of which were residential.

The water system dates back to the early 1900s. A small (8 feet high by 75 feet long) diversion dam was constructed above the City (overflow elevation 316.1 feet) on Gervais Creek (also known as Jarvis Creek) in 1913. A second, smaller dam (5 feet high by 40 feet long) was constructed downstream around 1930. By 1980, construction had been started on a diversion dam above town (overflow elevation 290.5 feet) on Vosburg Creek. At some point, a 3,000 gallon tank and chlorinator was added to the Gervais supply system and a 10,000 gallon tank and chlorinator to the Vosburg system. Several projects were undertaken in the 1980s to replace undersized pipes, old wood stave pipes, and old steel pipes. Water meters were installed in 1992.

The City's most recent water master plan was prepared in March 1993 ("City of Wheeler Water Facilities Master Plan", Lee Engineering, Inc., March 1993). The Plan included recommendations for replacing the surface water sources (which were inadequate from a quantity and reliability standpoint as well as not complying with Safe Drinking Water Act requirements for surface water treatment) with groundwater from a proposed regional water system, as well as comprehensive water system improvements. The City applied for water rights on a site near the Nehalem River in 1993. A water right permit for the well source was obtained in 1995.

An intergovernmental agreement (IGA) between the City of Wheeler and the City of Manzanita was signed and adopted on October 24, 2000 that applied to the proposed regional water system, known as the "Joint Water System". Details related to the IGA are included in Section 4.6.

Comprehensive water system improvements for the City of Wheeler, including: two new reservoirs, a pump station, a master meter, SCADA, new lines, and AC line replacement, were completed in 2003. The City of Manzanita concurrently undertook a large improvement project that included a new surface water treatment plant, development of the

"Wheeler" well supply and transmission mains to connect the wells to both Cities' systems. The City of Manzanita had initially depended on its surface water source, but in recent years it has largely switched to the more economical well water. Currently, the wells supply water to both cities. The City of Wheeler no longer utilizes its surface water sources.

Section 3 inventories and describes elements of the existing water system in the subsections that follow. The existing water system is shown in Figure 3.1. Figure 3.2 shows a schematic of the water system that shows the major facilities (wells, master meter, reservoirs, pump station, and telemetry) and their relationship within the system. Figure 3.2 also includes selected elements of the Joint Water System and member systems. Photographs of the Jarvis Reservoir, Vosburg Reservoir, Master Meter, and Pump Station are included at the back of Section 3.

3.2 MAPPING AND DOCUMENTATION

Mapping and system documentation for this plan were obtained primarily from the prior water master plan, the 2002 water system improvement plans, City provided maps and documents, supplemented with staff interviews and limited site visits. Water system documentation in some areas is poor or even lacking; consequently, the City's mapping should be considered a work in progress. Elevation data is from a variety of sources and may not be on the same datum. Accuracy of the mapping and elevation data is assumed to be sufficient for general planning purposes; however, critical elements and elevations should be verified prior to, or as part of, any design work.

3.3 SOURCE

3.3.1 Water Rights

Water rights are regulated by the Oregon Water Resources Department (OWRD). OWRD maintains extensive records; copies of permits and certificates are readily available through their website (http://www.oregon.gov/owrd/). For convenience, copies are included in the Appendices.

3.3.1.1 City of Wheeler Water Rights

Water rights for the City of Wheeler are summarized in Table 3.1. Copies of permits and certificates are included in Appendix 3.1. Appendix 3.1 also includes a map showing the general location of the well site, and other current and historic water sources associated with the City of Wheeler and the City of Manzanita.

Table 3.1: Water Rights

Source/Type[1]	Permit No.	Certificate No.	Priority Date	Quantity
Wells (G)	G-12196	-	7/29/1993	3.6 cfs
(Joint Water System Source)				
Gervais Creek (S)	1455	2440	1/24/1913	3.0 cfs
(Upper Gervais Creek)				
Gervais Creek (S)	9558	9250	3/14/1930	0.28 cfs
(Lower Gervais Creek)				
Vosburg Creek (S)	39355	-	8/15/1974	4.0 cfs
(West Branch)				

[1]Source type: (S) Surface Water, (G) Groundwater, (R) Reservoir

Permit G-12196 is the water right currently used by the City, and other Joint Water System members, for municipal water production.

Certificates 2440 and 9250, and Permit 39355, are for surface water sources that are not currently being utilized.

3.3.1.2 Local Instream Water Rights

Local instream water rights, that may affect utilization of the well source, are shown in Table 3.2. Both of the instream water rights predate the City's water right. Copies of the instream water rights are included in Appendix 3.2.

Table 3.2: Local Instream Water Rights

	Nehalem River	Peterson Creek
Certificate No.	59752	72503
Priority Date	5/9/1973	11/30/1
Flow (cfs)		
January	270	12.2
February	270	10.8
March	270	8.51
April	270	4.05
May	200	1.45
June	150	1.13
July	100	0.52
August	100	0.23
September	100	0.18
October 1-15	200	0.45
October 16-31	270	0.45
November	270	5.98
December	270	10.90

3.3.2 Historic Sources

Gervais Creek and Vosberg Creek were utilized prior to development of the wells in 2003. The diversion dam and impoundment on Gervais creek is still maintained by the City. The diversion dam and impoundment on Vosberg Creek were recently removed as part of a stream rehabilitation project.

3.3.3 Current Source (Wells)

The City's current source consists of two developed wells located above the north bank of the Nehalem River approximately five miles by road from the City of Wheeler (see Appendix 3.1 for well field location maps – *note: some maps show additional proposed wells or test well locations*). Well logs for the well field are included in Appendix 3.3. Key well elevations and settings are shown in Figure 3.2. The wells were drilled in July 1996, constructed in December 2002, and brought online in March 2003.

Well data is summarized in Table 3.3.

Table 3.3: Well Data Summary

	Well No. 1	Well No. 2
Drilled	5/24/1996	5/25/1996
Constructed	12/2002	12/2002
Online	3/2003	3/2003
Finished Depth	50 ft.	60 ft.
Casing Diameter	12 in.	12 in.
Screen		
Diameter	12 in.	12 in.
Length	2.0 ft.	15.5 ft.
Well Pump		
Type	Submersible	Submersible
Drive	Variable Frequency	Variable Frequency
Manufacturer	Goulds	Goulds
Model	SV9RCHC-7STG	SV9RCHC-7STG
Horsepower	50 Hp	50 Hp
Capacity	520 gpm	525 gpm
@ TDH	296 ft.	296 ft.
Flowmeter		
Type	Magnetic	Magnetic
Manufacturer	Dan Foss	Dan Foss
Model	Mag 3100 Water	Mag 3100 Water
Serial Number	031129T172	18329T222

Simplex (one pump at a time) operation is typical. Rated pump capacity is 525 gpm at 296 feet TDH (total dynamic head) for each pump, but actual data for Well No.1 indicates a maximum of 520 gpm. Duplex (both pumps on) capacity is approximately 750 gpm. Pumping capacity has diminished in recent years. In 2013, the average of the highest pumping rates achieved each day was 426 gpm; the highest capacity measured on one day was 501 gpm. The loss of pumping capacity has been studied by others and attributed to impellor corrosion caused by high CO_2 concentration in the groundwater.

Well related infrastructure is owned and operated by the City of Manzanita. Wheeler participates financially in accordance with provisions of the intergovernmental agreement with Manzanita.

3.4 TREATMENT

The current source (well) water has been classified as groundwater by OHA; consequently, filtration is not required. Treatment is currently limited to disinfection (MIOX mixed oxidant onsite disinfection system) and corrosion control (pH adjustment with caustic soda).

The well building includes the chemical generation, storage, and feed components; electrical panels; flowmeters, turbidimeter, chlorine analyzer, and a standby power generator.

The facility is owned and operated by the City of Manzanita. Wheeler participates financially in accordance with provisions of the intergovernmental agreement with Manzanita.

3.5 STORAGE RESERVOIRS

Wheeler has two existing ground-level, treated water reservoirs. These are described individually in the following subsections. Telemetry is also discussed, and a general discussion of Wheeler's telemetry system is provided in Section 3.9.

3.5.1 Vosburg Reservoir

Location:	South of Dichter Drive; outside UGB
Pressure Zone:	Lower
Volume:	250,000 gallons
Construction Date:	2003
Material:	Welded steel
Cathodic Protection:	Yes
Base elevation (approximate):	215.5 feet
Height (to overflow):	24 feet
Diameter:	40.8 feet
Telemetry and control:	
Telemetry:	Radio
Communicates with:	Master Meter via City Hall SCADA (open/close control valve)
Level control:	Pressure transducer
Level settings:	
High alarm	23.5'

Control Valve off	23.0’
Control Valve on	17.0’
Low alarm	15.0’

Comments. The radio telemetry has been problematic in recent years and is currently being replaced.

The exterior coating is in good to excellent condition. The outside was pressure washed approximately 1 ½ years ago; ladders, vents, and interior are reported by staff to be in good condition.

3.5.2 Jarvis Reservoir

Location:	South of Rowe Street; outside UGB
Pressure Zone:	Higher
Volume:	250,000 gallons
Construction Date:	2003
Material:	Welded steel
Cathodic Protection:	Yes
Base elevation (approximate):	304.5 feet
Height (to overflow):	20 feet
Diameter:	40.8 feet

Telemetry and control:

Telemetry:	Radio
Communicates with:	Booster Pump Station (start/stop pumps) via City Hall SCADA
Level control:	Pressure transducer
Level settings:	
High alarm	23.5’
Pump Station off	23.0’
Pump Station on	17.0’
Low alarm	15.0’

Comments. The radio telemetry has been problematic in recent years and is currently being replaced.

The exterior coating is in good to excellent condition. The outside was pressure washed approximately 1 ½ years ago; ladders, vents, and interior are reported by staff to be in good condition.

3.6 PUMP STATION

Wheeler has one existing pump station. It is described in the following subsection. Note: elevation data is approximate and is based on pressure readings and estimates. Key elevations should be verified prior to design. Telemetry is also discussed in the following subsection; a general discussion of Wheeler's telemetry system is included in Section 3.9.

3.6.1 Booster Pump Station 1 & 2

Location:	Dubois Street
Elevation:	30 feet (estimate)
Construction Date:	2003
Pumps from:	Lower Pressure Zone
Pumps to:	Upper Pressure Zone (and Jarvis Reservoir)

Pump #1:	Peerless C610 AM End Suction Pump 5 Hp, 3500 rpm, 110 gpm +/-
Pump #2:	Peerless C610 AM End Suction Pump 5 Hp, 110 gpm +/-

Telemetry and Control:

Telemetry:	Radio
Communicates with:	Jarvis Reservoir via City Hall SCADA
Operational control:	Water levels in Jarvis Reservoir
Alarms:	Low flow, high flow, pump fail

Comments. The pump station works well with few problems. The main problem has been false alarms (false intrusion alarms sometimes when it's rainy and windy; and false rapid loss alarms at Vosburg Reservoir).

3.7 TRANSMISSION AND DISTRIBUTION

Mains in the City range from 2-inch to 8-inch diameter. The larger mains include both transmission and distribution functions. Material is primarily PVC, but older asbestos cement (AC) pipe is still present in several locations. A few sections of old 2-1/2 inch steel pipe are also present.

The 8-inch transmission main from the Joint Water System source delivers water to the City via the master meter located at the north end of the City. The master meter installation includes: an 8" butterfly valve with an electric actuator, an 8" magnetic flowmeter, an air release valve, and telemetry connections to Wheeler City Hall and to Manzanita's SCADA system that controls well operation.

The system is largely dendritic (characterized by deadend lines) in layout with some interior looping of mains. The dendritic character is functionally mitigated in some areas (of the lower pressure zone) by the ability to flow water from either the Joint Water System via the master meter or from Vosburg Reservoir.

The City has developed data tables for hydrants and valves in the distribution system. These tables are included in Appendix 3.4 for general reference.

In 2013 there were 255 water meters, 209 of which were single-family residential.

A map of the water system is provided as Figure 3.1.

3.8 SERVICE AREAS AND PRESSURE ZONES

Because of the City's varying topography and the magnitude of elevation differences, the water system is divided into two pressure zones and service areas. System pressure in each service area/zone is largely determined by the associated reservoir: lower zone – Vosburg Reservoir (and alternatively Manzanita's base level reservoir); upper zone – Jarvis Reservoir.

The pressure zones are connected via a pressure reducing valve (PRV) located on Hall Street. The PRV is a 6" Cla-Val combination pressure reducing and pressure sustaining valve Model 692-01 set to 78 psi upstream and 37 psi downstream. This is paired, in parallel, with a 1 1/2" screw end Cla-Val combination pressure reducing and pressure sustaining valve set to 78 psi upstream and 39 psi downstream.

Most customers in Wheeler have pressures of approximately 40-80 psi. In general, areas with high pressures (on the order of 80 psi or more) have individual pressure reducing valves on the service lines. A few lines may have service connections that approach the regulatory minimum pressure (as measured at the customer's meter) of 20 psi.

The approximate areal extent of the service areas (pressure zones) is shown in Figure 3.1; key elements, elevations, and connections are shown in Figure 3.2.

3.9 SCADA AND TELEMETRY

Wheeler's SCADA and telemetry system is radio based. A general description from the City's Operating Manual is provided below:

> "The water system is automated by measuring critical elements of the system, using programmed logic to interpret the data and make decisions, then control devices to keep the reservoirs at predetermined levels. This control network is possible by using remote sites linked together using radios to network all the physically separated pumps, valves, instrumentation, and control to a central point where everything is coordinated. The control system major components include the well pumps (controlled by Manzanita), the master flow station flow meter, valve, control, and radio telemetry, the booster pumps, flow meter, controls, and radio telemetry, the Vosburg level, controls, and radio telemetry, the Jarvis level, controls, and radio telemetry, the City hall master controls, and radio telemetry, and the system control, data collection, and reporting computer.
>
> The Manzanita system is controlled from Wheeler using separate radio telemetry and a PLC inside the flow station telemetry panel. The radio is tuned to and the PLC is polled by the Manzanita master. The power status, valve open switch, and flow rate are also transmitted to Manzanita. The Pump is turned on by setting a register in the PLC to 1. The Vosburg reservoir low level activates this signal and the high level removes this signal. As long as the master station has power, the valve is fully open, and communication is active, the Manzanita system will turn the pump on until requested to be turned off.
>
> The master flow station controls the valve and measures the flow of water and as stated above requests Manzanita to operate the well pump. The site consists of the flow meter, the valve, a PLC, and radio telemetry. The flow meter reading is totalized for gallons of water. The local PLC performs control of the valve and returns measurements to the master PLC at City Hall. The station has battery backup to allow continuous running for a while without AC power. The enclosure and telemetry panel have security measures to indicate whether access has occurred.
>
> The Booster Pump station controls water delivery to the Jarvis reservoir. The site consists of a Pump Package which includes two pumps, a flow meter, and switches to indicate a flow problem, a PLC, and radio. The Jarvis low level is transmitted to the Booster station and the pumps are automatically turned on to fill the reservoir. The Jarvis High level is transmitted to stop the pumps. The flow measurement is totalized locally and sent to the master PLC at City Hall. The enclosure and telemetry panel have security measures to indicate whether access has occurred.
>
> The two reservoirs (Jarvis and Vosburg) have pressure transmitters that continuously measure the level of the tanks. The sites consist of a PLC and radio telemetry and transmit the levels to the master PLC at City Hall. The telemetry panels have security measures to indicate whether access has occurred."

Initial water system setpoints are included in Appendix 3.5.

Information transmitted from the remote sites to City Hall includes:

Master Meter: flows, valve open/closed, and security breach

Pump Station: flows, low suction pressure, low discharge pressure, loss of power, pump #1 running, pump #2 running, and security breach

Reservoirs: reservoir water levels and security breach

The SCADA and telemetry system are at the end of their design life and need to be replaced. The City has implemented some recent (limited) improvements to keep the system functional until the Water System Master Plan is completed and the City is ready to undertake a more comprehensive replacement of the SCADA and telemetry system.

3.10 WATER USE

Water use and water demands are discussed in detail in Section 5. Current annual average water demand, as measured at the master meter, is 61,000 gpd.

3.11 WATER QUALITY AND REGULATORY STATUS

3.11.1 Regulatory Overview

Drinking water quality is regulated at the federal level through the 1974 Safe Drinking Water Act and subsequent amendments. States have the flexibility to develop more stringent requirements in addition to the minimum established by the federal regulations. In Oregon, the Oregon Health Authority (OHA), Drinking Water Program is responsible for administering federal and state regulations of public water systems. Oregon Administrative Rules (OAR) Chapter 333 Division 61 includes the rules for public water systems. The complete rules and related data and materials are available directly through OHA's website: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.asx or through an internet search: "OHA drinking water program".

3.11.2 Water Quality

Water quality discussed in this section is based on recent data from the well source as sampled from appropriate locations in the water system. Data is from OHA, City of Manzanita, and City of Wheeler records.

Water quality is generally excellent[1] with all chemical concentrations well within regulated maximum contaminant limits (MCLs). Most of the tested-for chemical concentrations result in no detections. Detected constituents in recent years include the following:

Nitrates. For the most recent period reviewed (April 1, 2009 – September 19, 2013) five samples averaged 1.14 mg/l with the highest concentration of 1.5 mg/l (April 22, 2010). MCL for Nitrate is 10 mg/l.

Radionuclides. A Gross Alpha Particle concentration of 1.00 pCi/l was measured in December 2003. MCL for Gross Alpha is 15 pCi/l. A Combined Uranium concentration of 0.0000062 mg/l was measured in December 2003. MCL for Combined Uranium is 0.03 mg/l.

Disinfection Byproducts. This includes Total Ttrihalomethanes (TTHM) and Haloacetic Acids (HAA5). For the most recent period reviewed (November 2006 – September 2013) there were no detections of TTHM in five samples from Wheeler's distribution system. MCL for TTHM is 0.080 mg/l. For the most recent period reviewed (November 2006 – September 2013) there was only one detections of HAA5 in five samples. HAA5 was measured at 0.0014 mg/l in October 2010. MCL for HAA5 is 0.060 mg/l.

Lead and Copper. Results for 2013 testing show no detection for lead and 0.1228 mg/l for copper (highest sample result). MCL for Lead is 0.0155 mg/l. MCL for Copper is 1.35 mg/l.

---

[1] *With the notable exception of relatively high CO_2 levels – see Section 3.11.4 for discussion*

Operations staff keeps daily records of turbidity (raw and finished water), pH, temperature, and chlorine residual. Recent data for these parameters are summarized in Table 3.4.

Table 3.4: Turbidity, pH, Temperature, and Chlorine Residual at the Well

Parameter	Maximum	Average
Turbidity (NTUs)[1]		
2013	.06	.06
2012	.14	.03
2011	.11	.03
(Finished) pH (units)		
2013	7.96	7.4
2012	7.11	6.7
2011	7.12	6.8
Chlorine Residual (mg/l)		
2013	1.79	0.94
2012	1.29	0.92
2011	1.26	0.91

[1]For finished (but unfiltered) water, the turbidity limits are: 1 NTU in 95% of samples, and 5 NTU at any one time.

3.11.3 Regulatory Status

The City is in compliance with all water quality related regulatory requirements. OHA classified the well source as groundwater so only disinfection (4-log virus removal) is required for treatment. Water production and treatment, prior to entering Wheeler's water system at the master meter, is the responsibility of the City of Manzanita. Wheeler participates financially and is involved with any decisions to add or otherwise modify the treatment process, both in accordance with the intergovernmental agreement with Manzanita. Wheeler is responsible for water quality issues within its own water system.

3.11.4 CO_2 Issues

The raw water provided by the wells has elevated CO_2 levels. "Elevated" in this case means high enough to be problematic. Measurements of total CO_2 in October 2011

ranged from 32-56 mg/l. Associated pH ranged from 6.20-7.45. More recently, CO_2 levels have increased and raw water pH has dropped as low as 5.6. These recent extremes have been associated with the very low river levels in late summer 2014. The City of Manzanita has coordinated the study and pre-design efforts associated with assessing and addressing the high CO_2 levels. The report, recent updates, and recommended actions are included in Appendix 3.6.

VOSBURG RESERVOIR

JARVIS RESERVOIR

MASTER METER

PUMP STATION

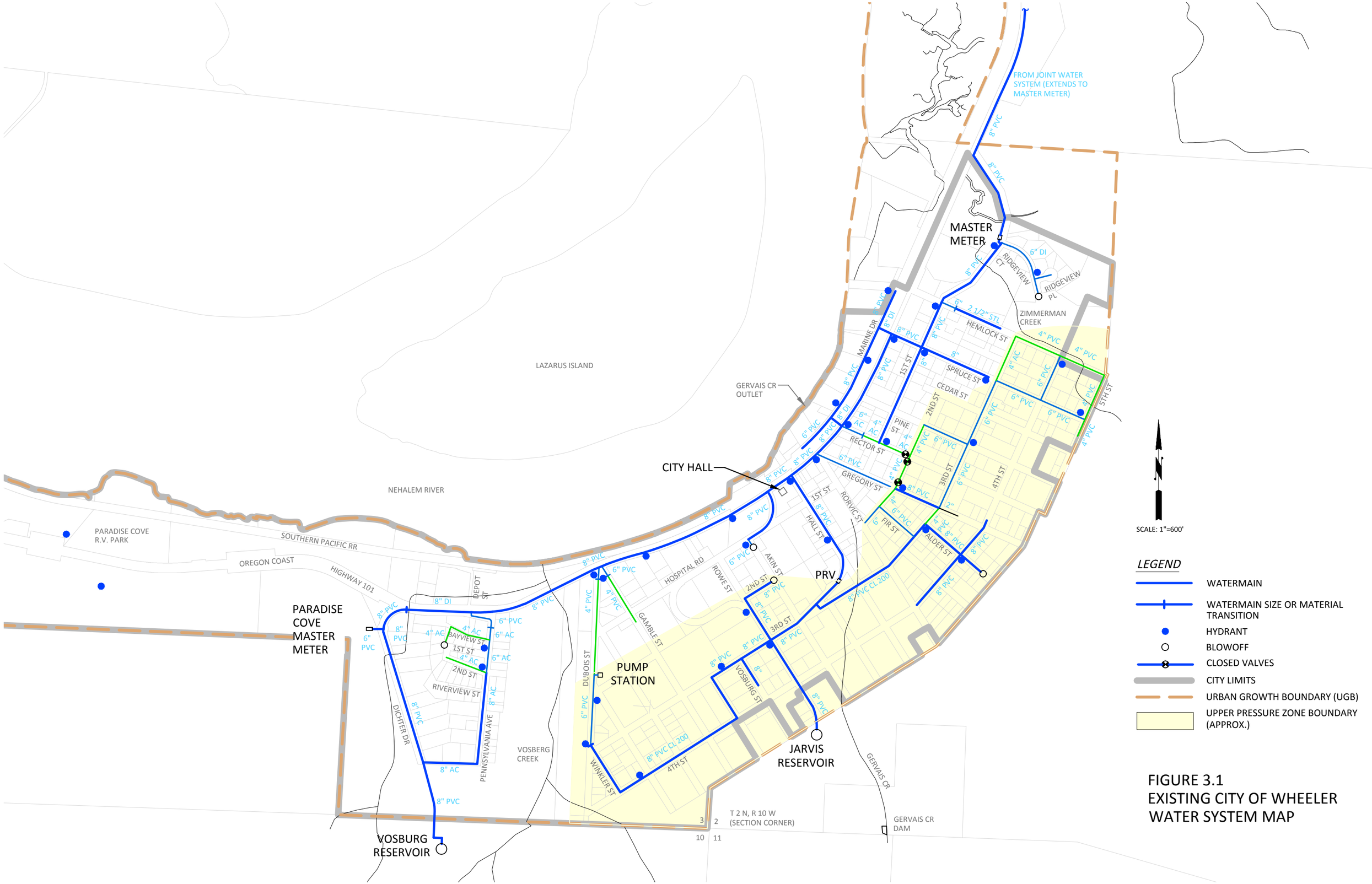
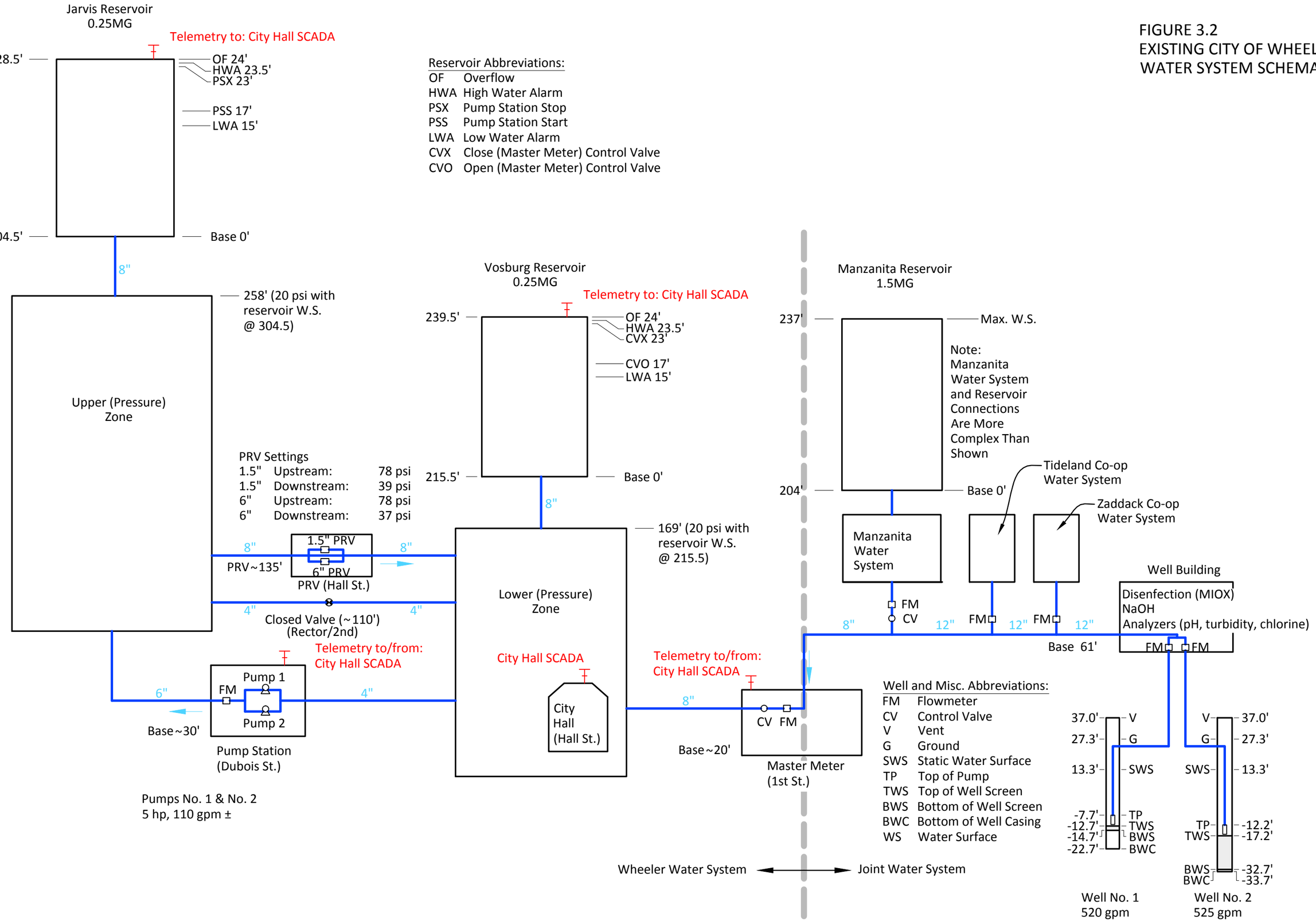


FIGURE 3.1
EXISTING CITY OF WHEELER
WATER SYSTEM MAP

FIGURE 3.2
EXISTING CITY OF WHEELER WATER SYSTEM SCHEMATIC



SECTION 4 | LEVEL OF SERVICE GOALS

4.1 INTRODUCTION

"Level of service" ultimately refers to the quality of the water service provided to the customer, but the phrase also has implications for the City staff that are responsible for operating, maintaining, and administering the utility and for elected officials who are ultimately responsible for the support and political will to champion the mission and needs of the utility. The provision of clean, healthy drinking water is one of the most important services a City provides and, consistent with this importance, the City of Wheeler should endeavor to provide a relatively high level of service.

One of the primary objectives for a water system is the protection of public health and welfare. For utilizing and expanding a water system, it is also important to minimize adverse environmental impacts. Various agencies have promulgated rules that ultimately support these objectives and, at a minimum, every water system must comply with these rules and requirements.

4.2 GENERAL GOALS AND REQUIREMENTS

General level of service goals and requirements include:

- **Conveyance and delivery (goal):** adequate, consistent, and reliable delivery of water under all anticipated service conditions; capacity for system to deliver maximum day demand (MDD) plus fire flow (FF).
- **Pressurization (requirement):** a minimum of 20 psi system pressure must be maintained at all times (OAR 333-061-0025); customer services must have individual pressure reducing valves if system pressures exceed 80 psi. Generally, a goal of a minimum of 40 psi under normal (non-fire flow) conditions is preferable if practicably achievable. The 20 psi minimum system pressure requirement extends to the customer water meter.
- **Water quality (requirements):** comply with all Oregon Health Authority (OHA) requirements (see Section 3.11.1 for discussion). Water quality also includes aesthetic considerations that may or may not be related to specific regulatory concerns. Efforts to maintain or improve the aesthetic quality of the water provided is a goal consistent with the provision of a high level of service.
- **Fire protection (goal):** provide fire protection consistent with American Water Works Association (AWWA), Insurance Services Office (ISO),

Oregon Fire Code, and local fire department requirements, recommendations, and standards.

- **Reliability (goals):** reliability as a goal is the ability of the water system and City staff to avoid or circumvent problems that adversely impact system performance. Reliability is enhanced by routine and timely maintenance and replacement, good design and construction, providing adequate water supply, providing alternate or backup facilities or equipment, and having a contingency plan for efficiently handling specific problems.

4.3 SPECIFIC GOALS

4.3.1 Water Supply

The water supply components (intake or wells, treatment plant, and transmission) should be sized to provide the maximum daily demand (MDD) within a 24-hour period. Sizing should also incorporate consideration of the planning period, design life, economics, and plans for future utilization and demands.

4.3.2 Treatment

In addition to meeting current regulatory requirements, treatment recommendations should consider and potentially incorporate, or facilitate incorporation in the future, measures to address anticipated regulatory changes (if applicable).

4.3.3 Fire Protection

Fire protection capabilities are typically based on the ability to deliver a minimum specified flow for a minimum specified duration. Recommended fire flows and durations for the City of Wheeler are provided in Table 4.1.

Table 4.1: Fire Flow Goals

Land Use	Fire Flow Rate (gpm)	Fire Flow Duration (min.)	Equivalent Volume (gal.)
Residential			
Single Family/Duplex	1,000	60	60,000
Multi-Family	1,500	120	180,000
Commercial	2,000	120	240,000
Industrial	2,000	120	240,000

Actual fire flow requirements are building specific and alternatives may be developed to provide some of the requisite protection. Examples might include an engineered building

sprinkler system or an onsite fire pump drawing from a surface water source. In some areas, typically small, peripheral service areas, fire protection may not be available via the water system. Fire protection to these areas is typically provided by a fire department equipped with tankers and other equipment for fighting rural fires. Appendix 4.1 includes current fire-flow requirements for buildings.

From a fire protection perspective, more fire flow capability is always better; however, no specified capability can guarantee protection from all fire-related scenarios.

Fire hydrant spacing for new construction should comply with requirements of the 2010 Oregon Fire Code (Appendix 4.1).

4.3.4 Storage Reservoirs

Oregon has no requirement for the provision of finished water storage (reservoirs), but the State does have a requirement (OAR 333-061-0025) for maintaining a minimum system pressure of 20 psi at all times. Reservoirs are one of the most practical and economical means of meeting the pressurization requirement. For purposes of this water master plan, reservoir sizing is based on the standard design provision of three times the average daily flow plus fire flow reserve (3xADD+FF). Provision of needed storage capacity is best provided with two or more reservoirs (per service area) in order to facilitate service when one reservoir is off-line. Generally, more capacity is better from a reliability standpoint; however, too much capacity can result in lost chlorine residuals and formation of disinfection byproducts.

4.3.5 Pump Stations

Pump stations (to service areas with reservoirs) should be designed to provide MDD with the largest pump out of service. Pump stations (to service areas without reservoirs) should provide PHD with the largest pump out of service. High service (fire) pumps may be provided in cases where they are consistent with the fire protection goals and plans in the affected service area. Pump stations serving areas with no reservoirs or with inadequate reservoir capacity should be provided with emergency power generators (or designed to facilitate connection to a portable generator).

4.3.6 Transmission and Distribution

Transmission and distribution mains should be sized according to anticipated hydraulic requirements that may include the provision of fire flow. Line velocities are generally 5 fps

(feet per second) or less to reduce headloss. Reduction of headloss reduces pumping cost and pressure losses; consequently, proper sizing can reduce system operational costs and improve fire flow capabilities. Systems designed to provide fire protection typically utilize an 8-inch minimum main size except for parts of a grid with lengths of less than 600 feet where 6-inch mains may be acceptable. AWWA and ISO do not recognize lines of less than 6-inch as providing fire protection.

Hydraulics, reliability, and water quality are generally enhanced with a "looped" water main configuration that minimizes the occurrence of single-feed or deadend lines. Nevertheless, single-feed lines are commonly used for reservoir transmission mains and supply transmission mains. Deadend mains should be avoided, but may be practicably unavoidable because of topography and existing development.

4.3.7 Telemetry

Telemetry should be provided for each key facility including intake pumps, treatment plant, pump stations, and reservoirs. Telemetry provides alarm notification at a minimum. Important additional functions may include data acquisition and operational control.

4.4 DESIGN LIFE

Design life (or useful life) refers to the anticipated service life of an item or system component. Typical design life values are expressed in terms of "years of service" and reflect typical design, material, and construction standards associated with municipal water system infrastructure. Actual years of service may vary greatly according to the service demands and conditions – as well as the level of maintenance provided. Typical design lives, selected from *Asset management: A Handbook for Small Water Systems, September 2003 (EPA 816-R-03-016)*, are summarized below:

Wells and Springs	25-35 years
Intake Structures	35-45 years
Treatment and Chlorination Equipment	10-15 years
Storage Tanks (Reservoirs)	30-60 years
Pumps	10-15 years
Buildings	30-60 years
Electrical Systems	7-10 years
Computers	5 years

Transmission and Distribution Mains	35-40 years
Valves	35-40 years
Meters	10-15 years
Service Laterals	30-50 years
Hydrants	40-60 years

As a concept, "design life" is primarily used for planning and budgeting for replacement or significant rehabilitation. As such it is an important consideration in asset management. The values are only a starting point and should be adjusted and refined to reflect local conditions and experience.

4.5 CITY STANDARDS

Ordinance No. 81-4 (adopted October 20, 1981) established policies and regulations for the City's water system (Appendix 4.2). The ordinance is fairly comprehensive in scope, but more limited in detail. For example, the minimum pipe size is simply indicated as "must meet City approval". City policies for water related public facilities are addressed in the *City of Wheeler Comprehensive Plan, adopted December 1979 with Amendments through January 2010* (Appendix 4.2). Item 7 under "Policies" is notable in requiring that "Large developments or heavy water users shall make equitable contributions to improvement of the water system and shall pay all costs associated with extension of water lines."

The City Standards reflect the City's desire for a relatively high level of service from all new water system related construction within its jurisdiction. City standards can also be used to specify makes and models in order to simplify operations and maintenance and the stocking of spare parts. In such cases, the specification of two or more makes/models will allow for competitive bidding.

4.6 INTERGOVERNMENTAL AGREEMENT (IGA)

An intergovernmental cooperative agreement between the City of Wheeler and the City of Manzanita, and related to the Joint Water System, was signed and adopted by both parties on October 24, 2000. A second, and related, intergovernmental agreement related to the designation of a person in direct responsible charge (for operation of the water system) was signed on March 9, 2005. Both documents are included in Appendix 4.3.

The "Joint System" is defined to include "the well field, wells, disinfection plant, the transmission line from the wells to the intersection of Highway 101 and Highway 53, and two (2) master meters."

Wheeler owns the well field, the access easement to the wells, the wells, and a telemetry monitoring station. Manzanita owns the disinfection plant, telemetry system, the transmission line from the wells to the junction with Highway 101, and the two master meters. The transmission main along Highway 101 between Highway 53 and Hemlock Street is owned by Manzanita but maintained by Wheeler. Water rights, certificates, and permits are owned by Wheeler.

The intergovernmental agreements also provide for allocation of costs, operations and maintenance requirements, and administration of the Joint System.

Decisions on major changes to the Joint System are subject to the approval of both city councils. "Major changes" includes, among other definitions, the addition or discontinuation of a water treatment process; and an increase in the number or capacity of the existing wells.

The term of the initial IGA is 40 years from the date of the Rural Utilities Service (RUS) loan award and cannot be terminated without written consent of RUS.

4.7 CONFORMANCE AND IMPLEMENTATION

As a general guideline, water systems should be in conformance with the most current requirements and standards. However, as a practical matter many do not, simply because the requirements and guidelines have become more stringent over time. Many requirements – typically those associated with the Safe Drinking Water Act (SDWA) and Amendments and State (OHA) rules – do require immediate action to correct identified deficiencies. Other deficiencies, such as system configuration, material condition, or hydraulic deficiencies, may not trigger a regulatory mandate but still reflect a lower level of service because of compromised reliability or performance. The condition of mechanical, electrical, and telemetry components will also not typically trigger a regulatory mandate, but could cause severe problems or hardship to the City if failure occurs.

The promptness with which a community addresses known deficiencies and implements needed improvements is itself a measure of the level of service provided.

5.1 INTRODUCTION

This section focuses on water demands and usage for the City as a whole. Water is delivered to the City via a master meter and connection to the Joint Water System owned and operated by the City of Manzanita. The analysis focuses on the water needs of the City of Wheeler over the planning period and does not include an assessment of the demands associated with the Joint Water System.

Water demand analysis uses certain terms and abbreviations with considerable frequency. These terms are summarized below for convenience.

Average Daily Demand (ADD): total usage or production for the year divided by the number of days in the year.

Maximum Month Demand (MMD): total usage or production for the month with the highest total demand during the year, divided by the number of days in the month.

Maximum Day Demand (MDD): total usage or production for the day with the highest demand during the year. This may also be known or referred to as peak day demand.

Peak Hour Demand (PHD): total usage or production for the one-hour period with the highest demand during the year.

The demand parameters defined above are typically and variously expressed as:
Gallons per day (gpd)
Millions of gallons per day (mgd)
Gallons per capita per day (gpcd)

5.2 RECENT METERED WATER USAGE

Metered water usage for the period January 2013 to December 2013 is summarized by City billing (customer) categories in Table 5.1. Residential and general commercial (5/8" meter) usage constitutes the bulk (87.2 percent) of total metered use. Total metered usage, based on a resident population of 415 persons in 2013, ranged from 68.6 gpcd (in January/February) to 144.4 gpcd (in July/ August) with an annual average of 91.8 gpcd.

Table 5.1: Recent Metered Water Usage (January 2013 - December 2013)

A. Residential and general commercial (5/8" meter)

Period	Usage (gal)	Usage (gpd)	Percent of Overall Total Use	Number of Connections (Billed)	Number of Connections (Zero use)	Usage Billed Per Connection (gal/2 months)	Usage Billed Per Connection (gpd)
Jan-Feb	1,506,130	25,528	89.7	218	19	6,909	117
Mar-Apr	1,639,120	26,871	88.2	225	13	7,285	119
May-Jun	2,095,790	34,357	84.6	223	13	9,398	154
Jul-Aug	3,105,640	50,091	83.6	228	7	13,621	220
Sep-Oct	2,102,870	34,473	90.6	228	10	9,223	151
Nov-Dec	1,669,840	27,374	90.3	220	18	7,590	124
Jan-Dec	**12,119,390**	**33,204**	**87.2**	**224**	**13**	**9,031**	**148**

B. Multi-family and larger commercial

Period	Usage (gal)	Usage (gpd)	Percent of Overall Total Use	Number of Connections (Billed)	Number of Connections (Zero use)	Usage Billed Per Connection (gal/2 months)	Usage Billed Per Connection (gpd)
Jan-Feb	167,840	2,845	10.0	11		15,528	259
Mar-Apr	209,740	3,438	11.3	11		19,067	313
May-Jun	219,170	3,593	8.8	10	1	21,917	359
Jul-Aug	510,040	8,226	13.7	10		51,004	823
Sep-Oct	205,390	3,367	8.8	11		18,672	306
Nov-Dec	152,320	2,497	8.2	10	1	15,232	250
Jan-Dec	**1,464,500**	**4,012**	**10.5**	**11**	**0**	**23,246**	**382**

C. Other (turned off; collections/moved away; no charge)

Period	Usage (gal)	Usage (gpd)	Percent of Overall Total Use	Number of Connections (Billed)	Number of Connections (Zero use)	Usage Billed Per Connection (gal/2 months)	Usage Billed Per Connection (gpd)
Jan-Feb	4,470	76	0.3	4	2	1,118	19
Mar-Apr	10,220	168	0.5	8		1,278	21
May-Jun	163,060	2,673	6.6	9		18,118	297
Jul-Aug	99,660	1,607	2.7	10	1	9,966	161
Sep-Oct	13,140	215	0.6	3	6	4,380	72
Nov-Dec	26,850	440	1.5	4	2	6,713	110
Jan-Dec	**317,400**	**870**	**2.3**	**6**	**2**	**8,353**	**137**

D. Total metered usage

Period	Usage (gal)	Usage (gpd)	Usage (gpcd)
Jan-Feb	1,678,440	28,448	68.5
Mar-Apr	1,859,080	30,477	73.4
May-Jun	2,478,020	40,623	97.9
Jul-Aug	3,715,340	59,925	144.4
Sep-Oct	2,321,400	38,056	91.7
Nov-Dec	1,849,010	30,312	73.0
Jan-Dec	**13,901,290**	**38,086**	**91.8**

5.3 RECENT MASTER METER WATER DEMAND

Wheeler's master meter records provide water demand data for the portion of water originating at the wells and used by Wheeler's water system. It reflects metered (described in Section 5.2) and unmetered usage, and losses, associated with the City's water system. Recent master meter water demand is summarized in Table 5.2 and Figure 5.1. Current master meter water demand averages 60,236 gpd; the peak day in 2013 was 90,000 gallons.

Table 5.2: Recent Master Meter Water Demand - City of Wheeler

Month	Daily Minimum (gpd)	Daily Maximum (gpd)	Monthly Average (gpd)	Monthly Total (gal)	Year Total (gal)
2011					
January	29,323	48,871	37,328	1,157,000	
February	27,952	55,810	41,179	1,153,000	
March	27,763	60,437	41,774	1,295,000	
April	31,665	54,560	45,333	1,360,000	
May	51,407	72,248	63,065	1,955,000	
June	40,350	61,740	55,566	1,667,000	
July	47,639	68,916	59,097	1,832,000	
August	42,965	63,752	55,793	1,730,000	
September	47,192	74,222	66,633	1,999,000	
October	39,146	61,777	53,969	1,673,000	
November	36,472	54,461	47,467	1,424,000	
December	37,330	57,546	45,548	1,412,000	*18,657,000*
2012					
January	46,146	62,408	51,348	1,592,000	
February	35,961	64,220	53,393	1,495,000	
March	40,180	65,777	56,129	1,740,000	
April	37,225	76,974	58,000	1,740,000	
May	38,264	66,037	55,097	1,708,000	
June	44,909	75,888	51,233	1,537,000	
July	67,777	90,000	74,839	2,320,000	
August	51,257	83,806	69,585	2,157,000	
September	69,660	76,180	73,834	2,215,000	
October	56,054	77,225	68,355	2,119,000	
November	49,348	60,987	52,933	1,588,000	
December	49,596	64,354	52,065	1,614,000	*21,825,000*

Month	Daily Minimum (gpd)	Daily Maximum (gpd)	Monthly Average (gpd)	Monthly Total (gal)	Year Total (gal)
2013					
January	44,070	62,408	57,581	1,785,000	
February	35,931	60,757	58,357	1,634,000	
March	40,180	65,777	63,000	1,953,000	
April	58,533	85,000	67,533	2,026,000	
May	38,264	66,037	56,226	1,743,000	
June	37,745	75,888	67,000	2,010,000	
July	64,684	90,000	80,419	2,493,000	
August	66,400	77,889	70,548	2,187,000	
September	51,892	63,171	59,233	1,777,000	
October	40,412	55,999	48,742	1,511,000	
November	39,826	49,894	44,333	1,330,000	
December	39,029	66,424	49,581	1,537,000	*21,986,000*

Year	Daily Minimum (gpd)	Daily Maximum (gpd)	Max. Monthly Average (gpd)	Annual Average (gal)	Year Total (gal)
2011	27,763	74,222	63,065	51,115	18,657,000
2012	35,961	90,000	74,839	59,795	21,825,000
2013	35,931	90,000	80,419	60,236	21,986,000

Figure 5.1: Recent Master Meter Water Demand - City of Wheeler (Jan 2011- Dec 2013)

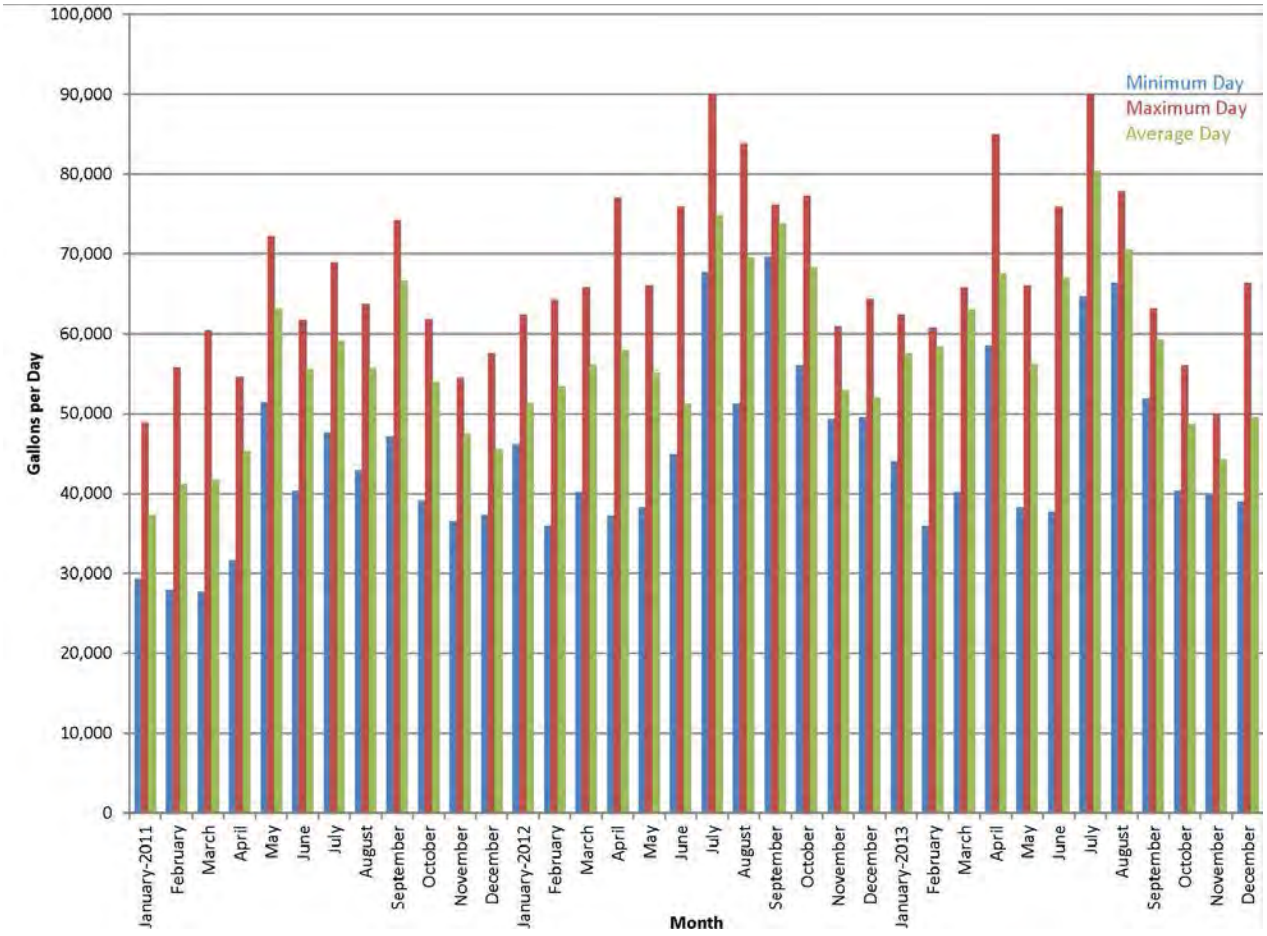


Table 5.3 shows master meter demand versus well production for the period January 2013 – December 2013. On an annual basis, Wheeler uses 20.4 percent of the total well production. The percent of total well production drops in summer when Manzanita is more heavily impacted with tourists and non-resident homeowners.

Table 5.3: City of Wheeler Master Meter Demand vs. Well Production
(January 2013 – December 2013)

Month	Well Production (gal)	Master Meter (gal)	Master Meter Percent of Total
January	7,380,100	1,785,000	24.2
February	6,654,130	1,634,000	24.6
March	8,428,402	1,953,000	23.2
April	7,280,715	2,026,000	27.8
May	8,709,028	1,743,000	20.0
June	9,678,376	2,010,000	20.8
July	14,465,300	2,493,000	17.2
August	13,209,392	2,187,000	16.6
September	9,237,231	1,777,000	19.2
October	7,275,097	1,511,000	20.8
November	8,128,175	1,537,000	18.9
December	**107,585,395**	**21,986,000**	**20.4**

5.4 UNACCOUNTED–FOR WATER

City staff maintain records of all water use (metered and sold, metered but not-sold, contractor use, Fire Department use, and estimates of water use or losses associated with Public Works activities). These known uses are subtracted from the overall master meter water totals to determine how much water is unaccounted-for or lost. A certain amount of loss is inevitable and depends on many factors such as total pipe length, water usage, and water pressure. OAR 690-086-0150 (4)(e) requires a regularly scheduled and systematic leak detection program if an annual water audit indicates that leakage exceeds 10 percent.

Table 5.4 includes recent estimates of unaccounted-for water. Recent unaccounted-for water is approximately 24 - 36%.

The City completed a leak survey of the water distribution system in April 2012. Estimated leakage in the system was 464,000-745,000 gallons per month (approximately 11-17 gpm). The master meter total for the (same) month of April 2012 was 1,740,000 gallons; the estimated leakage for the month was therefore 27-43 percent. This is consistent with the 36.1% average unaccounted-for water figure for 2013. The City has implemented

repairs; however, reducing or even maintaining unaccounted-for water percentages require a sustained level of effort. In addition, the computation is highly reliant on complete and accurate data. Any numbers that are utilized in the computation, especially those transcribed or copied from other sources, should be double-checked to ensure that transcription errors have not occurred.

Table 5.4: Unaccounted-for Water

Year	Metered Usage[1] (gal)	Other Usage[2] (gal)	Accounted-for Water[3] (gal)	Master Meter Demand (gal)	Unaccounted-for Water (gal)	(%)
2013	13,901,290	146,636	14,047,926	21,986,000	7,938,074	36.1
2012	14,981,000	1,600,000	16,581,000	21,825,000	5,244,000	24.0
2011	13,402,110	501,800	13,903,910	18,657,000	4,753,090	25.5

Notes: [1]*Service meter data. Includes sold water and metered (but not-sold) water.*
[2]Other estimated usage includes: known leaks and overflows, fire-related operations, or maintenance and system flushing.
[3]Sum of "metered" and "other" totals.

5.5 CURRENT WATER DEMANDS

Current (year 2013) water demands are conservatively estimated from recent master meter data primarily to establish a basis for projecting future water demands. Average day demand (ADD) is estimated at 61,000 gpd. Maximum month demand (MMD) is estimated at 81,000 gpd based on the observed July 2013 demand of 80,419 gpd. Maximum day demand (MDD) is estimated at 91,000 gpd (0.14 cfs) based on recorded maximum day demands of 90,000 gpd in July 2012 and July 2013.

Demand parameters are often expressed in several different ways. One expression that may not be intuitively clear is the term "gallons per day per equivalent dwelling unit", abbreviated as gpd/EDU. Generally the term refers to the amount of water used by a typical residential unit in one day. Non-residential water consumption or demand can be characterized by dividing the non-residential use by the typical residential use to determine the number of residential equivalents. The total number of EDUs for a city includes both the number of residential units and the number of residential equivalents (for the non-residential customers or uses). The actual methodology for calculating EDUs may vary from year to year and community to community. The City of Manzanita and the City

of Wheeler have determined the number of EDUs for each city for use in allocating costs associated with the Joint Water System. The Well Site Records for 2012-2013 note 313 EDUs for Wheeler.

Peak hourly demand (PHD) is estimated based on an empirical formula (source: *Water System Design Manual, Washington State Department of Health, 2001*):

PHD = (MDD/1440)[(C)(N)+F]+18
Where: PHD = Peak hourly demand (gpm)
C = Coefficient associated with ranges of EDUs
N = Number of EDUs
F = Factor associated with ranges of EDUs
MDD = Maximum day demand (gpd/EDU)

Current EDUs (equivalent dwelling units): 313
For a range of N (251 – 500): C = 1.8 and F = 125
MDD = 91,000 gpd/313 EDUs = 290.7 gpd/EDU
PHD = (290.7/1440)[(1.8)(313)+125]+18 = 157.0 gpm = 226,000 gpd

Estimated current (year 2013) master meter water demand and associated peaking factors are summarized in Table 5.5. The peaking factors are relatively low. This could be the effects of relatively low summer irrigation use and modest visitor/tourist impacts, or relatively high system water losses.

Table 5.5: Estimated Current (Year 2013) Master Meter Water Demand

Parameter	Demand (gpd)	Demand (gpcd)[1]	Demand (gpd/EDU)[2]	Peaking Factor
ADD	61,000	147	195	1.0
MMD	81,000	195	259	1.3
MDD	91,000	219	291	1.5
PHD	226,000	545	722	3.7

Notes: [1]*415 persons.*
[2]313 EDUs.

5.6 WATER CONSERVATION

The City's Water Conservation Management Plan (*City of Manzanita/City of Wheeler Water Management and Conservation Plan*, HGE, Inc., Architects, Engineers, Surveyors & Planners 2005 – updated April 2010 by John Handler, City of Manzanita) was prepared in conformance with the OAR 690-86-140 rules that were current at the time. The Water

Management and Conservation Plan (WMCP) has not been updated since then. The original WMCP was not formally reviewed and approved by Oregon Water Resources Department (OWRD), but was placed on administrative hold pending completion of the water right extension process for the well field (Permit G-12196). The updated Plan was also never reviewed; the permit extension process is still ongoing. After the permit extension is granted, the City in conjunction with Manzanita will need to update and submit a revised, current WMCP to OWRD. A copy of the most recent update is included in Appendix 5.1.

For general planning purposes, no additional reductions in water demand or unaccounted-for water are incorporated into the projections for future water demand. Continued reductions, however, will reduce the City's impact on the available water supply capacity associated with the Joint Water System and will defer the need to develop additional source capacity farther into the future.

5.7 PROJECTED WATER SYSTEM GROWTH

Projected water system growth is anticipated to approximately match that of projected population growth. A 0.7 % average annual growth rate (AAGR) is used throughout.

5.8 PROJECTED WATER DEMAND

Projected water (master meter) demands for the Wheeler water system are shown in Table 5.6. All parameters noted, except PHD, increase by 0.7% per year for general planning purposes and represent an average over the planning period. Actual system growth may be much more rapid, or slower, at times and as such could impact timing of critical improvements. PHD is calculated according to the equation included in Section 5.5.

Table 5.6: Projected Master Meter Water Demand

Year	2013	2019	2024	2029	2034	2064
Population	415	433	448	464	481	593
EDUs	313	326	338	350	362	447
ADD (gpd)	61,000	63,600	65,900	68,200	70,600	87,000
MDD (gpd)	91,000	94,900	98,300	101,700	105,400	129,900
PHD (gpd)	226,000	233,100	239,100	245,400	251,900	296,000
ADD (cfs)	0.09	0.10	0.10	0.11	0.11	0.13
MDD (cfs)	0.14	0.15	0.15	0.16	0.16	0.20

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6.1 INTRODUCTION

This section of the Water Master Plan assumes the reader is familiar with the previous sections. Focus of this section is on evaluations and analyses of the water utility with a goal of developing an understanding of current and future needs and developing strategies and improvements to address those needs and level of service goals. Costs, insofar as discussed, generally reflect considerations discussed in Section 7.2.

6.2 WATER DEMANDS

Water usage and demands are discussed in detail in Section 5. Current and projected water demands for design purposes are summarized in Table 5.6.

The resulting water demand projections are probably conservative based on the projected 0.7% average annual growth rate (AAGR) and the assumption, for planning purposes, that conservation considerations will not be used to reduce projected water demands. Metered customer demand is reasonable, but unaccounted-for water losses are relatively high; consequently, continued efforts at leak detection and correction are needed. Water conservation associated with the correction of water system deficiencies could result in significant reductions in water demand as measured at the master meter. Water losses tend to increase over time; consequently, some level of effort is required just to maintain the current levels.

6.3 SOURCE AND WATER RIGHTS – RECOMMENDATIONS

6.3.1 Well Source

The well source, near the Nehalem River, provides relatively high quality water (see Section 6.4 for discussion) and is currently the City's only developed source. This source provides water to the Joint Water System and has adequate permitted capacity (3.6 cfs) to provide for more than the 20-year planning horizon. Year 2034 MDD for Wheeler is 105,400 gpd (0.16 cfs).

For approximately 10 years now, the City of Manzanita and the City of Wheeler have been seeking a water rights extension for the wells (Permit #G-12196) that provide water to the Joint Water System that serves both cities. The Cities have also been pursuing

changes to the Permit that would provide more certainty with regard to permitted use – specifically, minimizing the impact of potential water curtailment requirements.

An application for Extension of Time for Permit #G-12196 was submitted to the Oregon Water Resources Department (OWRD) in 2004. A Water Management and Conservation Plan (WMCP) was prepared and submitted to OWRD in 2005 consistent with conditions and requirements included in Permit G-12196. The WMCP was placed on temporary hold in 2006; since the permit extension had not yet been issued, placing the WMCP on hold would prevent the Cities from having to resubmit the plan and review fees. The primary delay in the extension was associated with a requirement, from new legislation, that the Oregon Department of Fish and Wildlife (ODFW) participate in the review process. Part of the problem was a lack of concurrence on what exactly that meant and how to implement the requirement.

There have been numerous discussions between the Cities and the agencies regarding the status of the extension as well as possible modifications of the permit conditions. The WMCP was updated by Manzanita staff in 2010 and submitted to OWRD. The next update will technically be due in 2015.

The process appears to be approaching a tentative resolution. ODFW has prepared draft calculations for their Fish Persistence review that include water curtailment requirements associated with Nehalem River levels. The calculations are based in part on stream and aquifer modelling by OWRD. The model shows a time lag and associated diminution of the well withdrawal impact on Nehalem River flows. The effect diminishes with sustained pumping of the well; consequently, the effect has practical application primarily in averaging out the effects of very high withdrawals (occurring over say a holiday weekend) on the Nehalem River. Averaging withdrawals over several days as a basis for permit compliance could reduce the impact of potential curtailment on water usage by the Cities. ODFW's advice to OWRD will likely include some reference to this effect.

OWRD will use the ODFW advice to develop fish persistence conditions (as it relates to use and curtailment requirements) that will be included in the Proposed Final Order (PFO). The PFO will be issued with a 45-day protest period. An extension Final Order (FO) will be issued afterward. The FO will likely include a requirement for a new WMCP to be completed within 3 years of the FO date.

The only certainty associated with future use and expansion of the well supply is that some measure of uncertainty is likely to continue. Curtailment requirements will be included in the permit extension. Whether or not it will be possible to mitigate the curtailment affects so as to minimize the impact to local water supply remains to be determined. Climate change, shorter-term weather patterns, and resulting streamflows will continue to be variables. Recently (summer 2014), streamflow in the Nehalem dropped below 100 cfs and some of the smaller local streams were largely dry.

On the positive side, peak day withdrawals typically occur on or around the 4th of July, a time when, because of typically adequate river flows, curtailment is unlikely. Water demands drop off significantly in September, potentially minimizing curtailment affects associated with lower late-Summer and early-Fall flows – except when those flows are below the senior instream flows. In addition, current use is only a fraction of the permitted capacity.

Permit # G-12196 is junior to the Nehalem instream water right; consequently, the well permit includes a requirement that when "senior instream requirements are not met, use will be curtailed for all use except human consumption and livestock watering until the instream water rights are met." Instream requirements increase from 100cfs (July 1st - September 30th) to 200cfs on October 1st and to 270 cfs on October 16th. These dates often do not correlate with the advent of the first storms and higher streamflows.

The regional water system concept that was the basis for the wells included eventual extensions of service to the City of Rockaway Beach and other communities in the region. Costs of connecting those communities is potentially high and the potential water use restrictions that would likely overlap with periods of high demand could discourage at least some future connections. On the other hand, the regional system may serve as a lifeline to those communities if their local sources go dry – however temporarily.

Recommendations:

- Wait to receive the PFO.
- Review the PFO and consider requesting a hold. The hold allows the Cities to develop additional data, information, approaches, etc. that could be used as a basis for modifying the conditions of the permit. The hold must be for a defined period and purpose.
- Determine what action or activities the Cities will undertake. This could include proposed modifications to the curtailment methodology. If the Cities want to pursue

negotiations that involve other water rights and uses as a way of ensuring minimal restrictions on well utilization, they should retain qualified legal assistance.
- Work with OWRD to implement the Final Order.
- Be prepared for change and uncertainty. Water rights and water law are continually evolving and what seems certain today may not be tomorrow.
- Consider pursuing partial perfection of the water right.

6.3.2 Historic Sources

The City's historic sources, Gervais Creek and Vosburg Creek, may have some potential for future non- potable development to supply water for construction or other purposes (such as park irrigation). The sources could also be used as an emergency water supply in the event of contamination or catastrophic damage (possibly associated with a tsunami or a Cascadia Subduction Zone earthquake) to the well source.

Vosburg Creek was recently restored for fish habitat. The work included removal of the water supply impoundment, but the City did not cancel its water right and does not construe the work as signaling intent to abandon its water right for the Vosburg source. The City does not have a certificate for the Vosburg water right – only a permit. Currently, the City needs a permit extension of time for its Vosburg Creek Permit No. 39355.

Other possibilities for future source development include groundwater development within a quarter mile of Gervais Creek or Vosburg Creek in order to potentially utilize the stream water right through a transfer process. The viability of groundwater sources in this area has not be determined, but is a possibility that could be researched if the need or desire should arise.

Water diverted under the Gervais or Vosburg water rights could be used to supplement potable water from the well source if curtailment requirements associated with use of the well water become too onerous. Development of these sources would be costly relative to the quantity of water available since treatment will be required if a surface water withdrawal is developed; treatment may also be required if an alternative groundwater withdrawal (well) is developed.

Recommendations:

- Apply to OWRD for a permit extension for the Vosburg permit (No. 39355).

6.4 WATER QUALITY

In general, water quality in Wheeler is excellent (see Section 3.11 for discussion). The only notable deficiency is the relatively high CO_2 levels in the well water. pH in the raw well water has recently dropped as low as 5.6. The State requires a minimum pH of 7.2; consequently, significant additions of Caustic Soda are needed to adjust the pH. Costs associated with the chemical addition constitute a large portion of the O&M budget ($32,800 for caustic soda for the period February 2011 to March 2012). Manzanita has experienced water quality problems attributed to the CO_2 and Caustic Soda additions. This includes: elevated copper levels in the system attributable to corrosion of copper service lines; large, but localized increases in pH in parts of the distribution system; and aesthetic complaints. The problem has been studied; the report and recommendations are included in Appendix 3.6.

Wheeler has not experienced water quality problems to the extent that Manzanita has, but Wheeler contributes its proportional share in paying the high cost of chemical additions used to adjust the pH. Also, high levels of CO_2 tend to be corrosive regardless of pH; consequently, it would be prudent for the City to work toward resolving the CO_2 issue.

Recommendation:

- Work with Manzanita to address the CO_2 issue.

6.5 CAPACITY

6.5.1 General

In a very general sense, capacity of Wheeler's water system is adequate for the planning period. Capacity, as it pertains to specific elements (supply, distribution, pumping, and storage), is discussed in Section 6.7.

6.5.2 Hydraulic Model

A hydraulic model of the water system was developed primarily to assess general capacity and capabilities of the water system. The model was created using EPANET software. Both the software and the manual are available free on the EPA website (http://www.epa.gov/nmrl/wswrd/dw/epanet.html).

The model includes 65 pipes, 54 nodes, 1 PRV valve, and 2 storage reservoirs (Jarvis, and Vosburg). The model is an update of the City's previous model and includes new

construction; main lengths were re-measured and selected node elevations were determined or estimated based on City records, the previous model, and Tillamook County GIS topographic mapping. The model schematic and basic data are included in Appendix 6.1.

6.6 VULNERABILITIES

This section focuses on major vulnerabilities of the water system as a whole; specific deficiencies and consequent, or associated, vulnerabilities are discussed elsewhere as applicable.

6.6.1 Climate Change

Climate change forecasts call for increased winter rains and storms, and hotter, drier summers. In addition, sea-level increases of 6-inches to several feet are forecast to occur over the next 50 years. Sources vary considerably on the projections based on the models and assumptions utilized. Increased duration and intensity of winter precipitation could result in increased flooding in affected areas and increased slide potential that could impact water system facilities and infrastructure. Sea-level increases and associated salt water migration upstream on the Nehalem River are a future possibility; whether or not this is a real concern for the aquifer associated with the wells is unknown at this time. A hydrogeological study will be needed if sodium levels show a trend upwards.

6.6.2 Slides

Slides and slumps are not uncommon in the area and some areas are known to be problematic. The southwest half of the upper pressure zone includes several areas where ground movement has caused repeated main breaks and repairs. The 8" line on 4th Street east of Winkler has been notably problematic, as has the 8" line that crosses Gervais Creek. The latter is especially notable since all upper zone service north and east of Gervais Creek is dependent on the integrity this line.

Avoidance of known problem areas is the obvious solution but may not be possible based on local service requirements, limited alternatives for infrastructure location, and limited knowledge of the slide potential in any given area. Engineered solutions may be possible, but will require geotechnical evaluations of the sites in question. Slides often occur on a geological time scale; consequently, problems may not occur until well into the constructed life of the infrastructure.

6.6.3 Earthquakes

As noted in Section 2.2.4, the area could be subject to the full force of a Cascadia subduction zone earthquake. Effects of such a quake were recently examined in the "Oregon Resilience Plan" prepared by the Oregon Safety Policy Advisory Committee, February 2013. General findings for the Oregon Coast suggest that under current conditions, it will take 3-6 months to restore electrical service and 1-3 years to restore drinking water service. Recent studies in Washington County (near Portland) suggest extensive damage (breaks) would occur in the distribution system and that earthquake mitigation efforts should focus on the water supply.[1]

Critical facilities are designed to meet seismic code requirements, but no amount of engineering or expense can guarantee service after an earthquake of the magnitude discussed above.

6.6.4 Infrastructure Deficiencies

This is a very broad category with most of the specifics more appropriately discussed elsewhere (Section 6.7). Some general comments are warranted here. Older systems often have elements that are functional but of an obsolete design and utilized well beyond the intended design life. These elements can be problematic and costly to maintain, and may harbor undetectable material deficiencies that could result in unforeseen and catastrophic failures. For Wheeler, the older elements of the system that are likely fail include the telemetry system and the AC mains.

6.6.5 Security

All water systems have particular susceptibilities to security issues, and these issues are typically addressed in a vulnerability assessment and emergency response plan. System security has not been evaluated as part of this master plan; the City should review its emergency response plan and update it as appropriate. Proposed new water system facilities typically include basic security elements (fencing, lighting, locks, and alarms). Additional elements can be developed as warranted during the preliminary design phase of project development.

6.7 INFRASTRUCTURE

6.7.1 Water Supply

Capacity of the water supply system is adequate for Wheeler during the planning period. Growth in Manzanita, or the addition of new communities to the Joint Water System, could

require an expansion of the water supply system during the planning period. Opportunities for expanding the well capacity may arise if the well pumps need to be replaced or as part of the CO_2 removal project. Depending on the wording of the permit extension associated with the wells, it may also be beneficial to increase the system capacity and proceed with a partial perfection of the water right.

Infrastructure associated with the water supply system is owned and operated by the City of Manzanita per the IGA. The City of Wheeler should anticipate that system upgrades or modifications, including capacity expansions to meet overall system needs, may be needed from time to time. Wheeler pays a proportionate share of all costs associated with the supply system, but also receives a share of revenues from communities connected to the Joint Water System. Near-term improvements are focused on a CO_2 removal project. Manzanita and Wheeler are currently discussing the merits and costs involved.

The master meter has had problems with rats getting into the enclosure. Efforts to date to keep the rats out have not been successful; nevertheless, the City should continue to look for ways to keep the rats out. Advice/assistance from an experienced exterminator could be helpful.

6.7.2 Storage

6.7.2.1 Capacity Analysis

Total storage capacity of the existing reservoirs is **500,000 gallons** (Table 6.1).

Table 6.1: Existing Reservoir Storage Capacity

Existing Reservoirs	Volume (gallons)
Vosburg	250,000
Jarvis	250,000
Total	**500,000**

For the water system as a whole the recommended storage capacity is three times the average day demand (3xADD) plus fire flow (FF). Recommended FF is 2,000 gpm for 2 hours (240,000 gallon reserve). Table 6.2 projects storage capacity for the City as a whole. Capacity is adequate throughout the planning period.

Table 6.2: Projected City Reservoir Capacity Needs

	Average Day Demand (ADD) (mgd)	3x ADD (mgd)	Reservoir Volume Needed at 3xADD + FF (MG)	Existing Reservoir Volume (MG)	Additional Volume Needed (MG)
City Total 2013	0.061	0.183	0.423	0.50	-0.077
City Total 2019	0.064	0.192	0.432	0.50	-0.068
City Total 2024	0.066	0.198	0.438	0.50	-0.062
City Total 2029	0.068	0.204	0.444	0.50	-0.056
City Total 2034	0.071	0.213	0.453	0.50	-0.047

The computations above are for the City as a whole; particular service areas (pressure zones) have specific requirements according to the size and type of development as well as level of fire protection provided. Wheeler has one higher level service area (see Figure 3.1). Storage requirements for this area are much less: 60,000 gallons fire reserve (residential 1,000 gpm for one hour) plus 3 x ADD (where ADD is conservatively estimated at 25,000 gpd). Using the methodology reflected in Table 6.4 results in a current storage requirement of 135,000 gallons. Projected Year 2034 requirements for fire flow plus 3 x ADD , based on 0.7% average annual growth rate of the ADD, is 147,000 gallons. Both are well within the capacity of the existing 250,000 gallon reservoir. The Clinic located in the higher service area has an engineered fire suppression system that requires 650 gpm at 20 psi. This is easily provided by the water system. The upper pressure zone also provides water to the lower zone via the PRV; consequently, storage capacity in the upper pressure zone is available to satisfy storage requirements associated with the lower pressure zone.

6.7.2.2 Deficiencies

The reservoirs were recently cleaned and inspected and are in very good condition with few notable deficiencies.

The electrical services for both reservoirs were installed in small buildings associated with the old surface water treatment facilities. More recently, the buildings have deteriorated and become rat infested with the rats urinating and defecating on the

electrical equipment as well as everywhere else. City staff were able to successfully eradicate the rats from the building near the Vosburg Reservoir and rehabilitate the building. The other building near the Jarvis Reservoir was renovated, but the rats were not successfully eradicated and have returned, causing considerable damage to the interior. Additional efforts to locate and eliminate the rat's means of entering/ exiting may be considered; or, preferably, relocation of the service. The building is approximately 20 feet outside of the reservoir's security fence. Ideally, the relocated service would be within the security fence.

Cathodic protection systems for both reservoirs should be checked by a qualified corrosion control specialist to make sure they are working correctly and to identify deficiencies that may need to be addressed.

Issues with telemetry are discussed in Section 6.7.5.

6.7.2.3 Recommendations

- Address electrical issues associated with the Jarvis Reservoir. Budget $5,000. This will require coordination with both the electrician and the utility.
- Have both reservoirs' cathodic protection systems checked. Budget $5,000. Follow up and budget for recommendations to correct deficiencies.

6.7.3 Distribution

6.7.3.1 General

An assessment of Wheeler's distribution system was developed primarily through map review, review of recent construction and improvements, modelling (see Section 6.5.2), and information from staff on problem areas. Much of the system was upgraded and replaced as part of the 2003 improvement project. Older mains are predominantly PVC and AC. The PVC mains are generally in good condition except where land movement has resulted in breaks and repairs. Local soils are generally very acidic and contribute to the degradation of the AC mains; the remaining AC mains have been troublesome (breaks) and should be replaced. There is also an old, undersized section of 2-1/2 inch steel pipe that needs to be replaced.

The area that includes Pennsylvania Avenue and adjacent Bayview Street and 2nd Street has had many AC main breaks. Valves on the 4-inch mains no longer function and meter connections are failing due to excessive corrosion.

The 8-inch PVC main that runs along 4th Street just east of Winkler Street has had several breaks and repairs due to ground movement. Addressing the issue would require a geotechnical evaluation to determine how best to stabilize the area or mitigate the effects. No specific actions are recommended at this time, but may be necessary if the area becomes notably more active.

Another area to watch for ground movement is the line along 3rd Street that crosses Gervais Creek. This main has also experienced many main breaks and repairs.

Modelled results for selected locations in the existing system are indicated in Table 6.3 below. Results for the future system that includes recommended improvements (see Figure 6.1) are shown in Table 6.4.

Table 6.3: Existing Water System Model Runs

Run No.	Node	Location	Zone	Target Fire Flow (gpm)	Residual Pressure (psi)	Limiting Pressure (psi)	Limiting Pressure @Node	Maximum Velocity (fps)	Maximum Velocity @Pipe
1	13	4th St., west of Vosburg St.	Upper	1,000	54.4	23.7	29	6.5	P20, P21
2	23	2nd St. and Fir St.	Upper	1,000	80.6	13.1	29	8.5	P40
3	23	2nd St. and Fir St.	Upper	500	96.9	25.0	29	4.3	P40
4	28	4th St. and Alder St.	Upper	1,000	28.8	9.7	29	6.4	P44
5	28	4th St. and Alder St.	Upper	500	39.1	24.0	29	3.2	P44
6	47	4th St. and Hemlock St.	Upper	1,000	21.6	2.2	48	14.3	P42
7	47	4th St. and Hemlock St.	Upper	500	71.6	24.9	29	7.2	P42
8	6	Pennsylvania Ave. and Baywood St.	Lower	1,000	61.5	26.2	3	5.1	P7
9	19	Hwy 101 and Hall St.	Lower	2,000	68.5	26.7	3	9.0	P7
						12.7	29		
10	19	Hwy 101 and Hall St.	Lower	1,000	77.0	21.5	14	4.5	P26
11	32	Hwy 101 and Rector St.	Lower	2,000	61.1	12.7	29	12.9	P16
						17.2	14		
						17.8	41		
12	32	Hwy 101 and Rector St.	Lower	1,000	81.1	24.9	29	6.5	P16
13	23	Hwy 101 and Rector St.	Lower	2,000	68.3	17.0	29	11.0	P16
						18.7	14		
						25.5	41		
14	50	Ridgeview Ct. and Ridgeview Pl.	Lower	1,000	48.6	24.9	29	11.4	P60

Model: Existing System: Vosberg Res. @ 11'; Jarvis Res. @ 14'; Master Meter off; Pump Station off; 2034 MDD

Note #1: for Run #13 only, add 300 gpm via master meter.

Table 6.4: Future Water System Model Runs

Run No.	Node	Location	Zone	Target Fire Flow (gpm)	Residual Pressure (psi)	Limiting Pressure (psi)	Limiting Pressure @Node	Maximum Velocity (fps)	Maximum Velocity @Pipe
15	13	4th St., west of Vosburg St.	Upper	1,000	59.6	26.2	29	6.5	P21
16	23	2nd St. and Fir St.	Upper	1,000	94.0	23.4	29	5.4	P40
17	28	4th St. and Alder St.	Upper	1,000	38.1	22.9	29	3.4	P64, P46
18	47	4th St. and Hemlock St.	Upper	1,000	79.6	23.1	29	4.2	P45

Model: Future System; Vosberg Res. @ 11'; Jarvis Res. @ 14'; Master Meter off; Pump Station off; 2034 MDD
(Existing model pipes opened: P5,P6, P37, P62, P63, P64, P65)
(Existing model pipe diameter changes: P7: 8"; P12: 8"; P36: 6"; P32: 8"; P33: 8"; P42: 8"; P53: 6"; P58: 8")

In general, the model was run with conservative assumptions that the master meter and pump stations were off and that tank levels were approximately half full (+/-). Actual system operation would typically provide the system with approximately 350 gpm via the master meter and 110 gpm via the pump station. The PRV was operational in the model and provided water from the upper system to fire flows modelled in the lower system.

Water systems are required to maintain a minimum system pressure at all times of 20 psi (as measured at the customer service meters). Node 29 represents the high point terminus of the line that extends up Alder Street. Difficulty in achieving targeted fire flows in selected areas of the City is indicated by the low residual pressures associated with this node. Adequate residual pressure at node 29 was achieved at half the desired fire flow for some runs. Adding the master meter flow for run #13 made a significant improvement, but was still shy of the 20 psi minimum. The recommended improvements (see Figure 6.1) result in adequate residual pressures at node 29 for all modelled fire flows.

Unaccounted-for water losses currently total 36.1% and suggest that the water system may have excessive losses. Previous losses were approximately 24% and the City conducted a comprehensive leak detection program and addressed the noted deficiencies. Data for calculating the losses are, in part, transcribed from other

sources. It is possible that a transcription error occurred, resulting in the high figure. The City should carefully assemble and check the relevant data for an upcoming 6 month period to allow recalculation of the loss percentage. If the losses are in excess of 10%, the City should plan and budget for a new round of leak detection. Follow up replacement of leak-prone lines should also reduce water losses as well as O&M costs associated with emergency main repairs.

6.7.3.2 Recommendations

- Recommended distribution improvements are included in Table 7.1 and shown in Figure 6.2. Improvements numbered 11, 12, 13, and 14 are for loop completion in the upper pressure zone. These improvements are intended as a guide for potential future development in these areas so that any proposed main construction is consistent with overall water system objectives and not just the more limited needs associated with a particular development. Some of the areas involved have issues with ground movement that may require additional provisions that could significantly increase the feasibility and costs of construction. Project 13 is notable in providing an alternate feed across Gervais Creek.
- Check unaccounted-for water losses and budget $5,000 for leak detection if losses exceed 10%.

6.7.4 Pumping

The booster pump station has generally functioned well and is in very good condition. Problems have been limited to occasional false intrusion alarms associated with high wind and rain events. There are no capacity issues.

6.7.5 SCADA and Telemetry

The existing radio based SCADA and telemetry system has been increasingly problematic and unreliable. City staff have implemented some short-term fixes, but the entire SCADA, telemetry, and central computer system needs to be replaced. Conversations with Manzanita staff indicate a high degree of satisfaction with a new Swampfox installation. A new Swampfox system was also recently purchased by the Neah-Kah-Nie Water District. Neah-kah-Nie's system is very similar to what Wheeler would need: four remote units and one central unit. Estimated cost including a new computer and software is $27,000. Product literature for the Swampfox system is included in Appendix 6.2.

6.8 WATER SYSTEM MANAGEMENT

6.8.1 Planning

The City's ***Water Conservation Management Plan*** (WMCP) was completed in 2005 and updated in 2010 (see discussion in Section 5.6). The Plan will need to be updated as part a follow up to the well permit extension of time application. The WMCP is for the Joint Water System; Wheeler will be responsible for its share of the costs per the IGA. Scope and cost for the updated WMCP will depend on wording of the proposed final order for the permit extension, whether or not Manzanita has completed a recent update of its water system master plan, and if additional studies (such as environmental or hydrologic) are not needed for OWRD approval of the final document.

A general recommendation is to update the Water Master Plan every 5- 10 years depending on the extent of changes to the community and water system. The next update should be undertaken by year 2024. Budget $50,000 - actual cost may vary according to issues and level of detail desired.

6.8.2 Asset Management

The City should consider developing an asset management program. Asset management is a proactive approach that estimates when critical upgrades or replacement of infrastructure is needed based on condition and design life. It allows the utility to plan well in advance of need and therefore budget more effectively. It also helps minimize management by crisis or urgent need. Initial efforts can be quite labor intensive, since a detailed inventory that includes each component in the water system must be made along with an evaluation of the assets condition and remaining life.

Periodic leak detection surveys of the water system are recommended as general practice to maintain or possibly reduce overall system water losses. It can also provide data for an asset management program for refining the design life estimates for local conditions, and for prioritizing replacement projects. Many communities have found the costs of leak detection to be largely offset by the savings in cost associated with the otherwise lost water.

6.8.3 Operations and Maintenance (O&M)

Most of the recommended capital improvements will not result in increased O&M costs; however, O&M costs are subject to inflationary pressures, so annual increases are typically required. Budgets and water rates are typically adjusted to take recent or anticipated

changes into account; however, system deficiencies that have not been addressed can increase O&M costs. This may occur in ways and to an extent not easily foreseen; and may take the form of emergency (overtime) call outs and extra cost, interim measures that may be needed until the problem can be addressed correctly, and un-budgeted emergency projects of potentially significant expense. Over time, such costs can add significantly to the overall utility budget.

From an O&M standpoint, there are additional tasks that the City could and should be doing:

- Valve exercising (once per year on main lines and once every 3-4 years on other lines).
- Hydrant exercising (once per year) and repairs as needed.
- Periodic flushing of deadend lines.

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SECTION 7 | CAPITAL IMPROVEMENT PLAN (CIP)

7.1 INTRODUCTION

This section focuses on recommended capital improvements. The CIP is not exhaustive and does not include many smaller projects or elements that would be more properly characterized as general O&M.

7.2 OPINIONS OF PROBABLE COST (OPCs)

7.2.1 Introduction

Opinions of probable cost (OPCs) developed in the Water Master Plan are preliminary in nature and based on the level and extent of planning completed. It will be necessary to update costs as specific projects proceed and a more detailed understanding of the issues and opportunities is developed.

For general planning purposes, contingencies, engineering, and administration costs are determined on a percentage-of-construction cost basis (see Sections 7.2.3-7.2.5). This is generally most accurate for larger projects. Smaller projects, undertaken independently, may have additional costs associated with mobilization and/or economics of scale.

7.2.2 Construction Cost

Construction costs in the Plan are based on preliminary layouts and design parameters developed, construction bids for similar work, published cost guides, and the author's experience within the State of Oregon. It is common practice to relate the costs to a specific index that tracks changes in the national economy. A commonly referenced index is the Engineering News Record (ENR) Construction Cost Index. All costs in this Plan are referenced to the September 2014 ENR Construction Cost Index of 9870. Costs in the Plan can be updated in the future by multiplying the Plan cost by the current index value and dividing by 9870. This approach is generally valid for a 2 to 3 year period, after which the costs should be updated by an engineer. Construction bids and consequent costs can vary markedly according to the actual and perceived market and economic trends, level of competition, project size, etc; this is particularly the case during periods of economic uncertainty or volatility.

Since the Engineer has no control over the cost of labor, materials, equipment or services furnished by others, or the future contractor's methods for determining prices or competitive bidding or marketing conditions, the Engineer's opinion of probable "total project cost and construction cost" provided herein is made on the basis of the Engineer's experience and qualifications and represents the Engineer's best judgment as an experienced and qualified professional engineer familiar with the construction industry as it relates to water system improvements. The Engineer cannot and does not guarantee that proposals, bids, or actual total project or construction costs will not vary from the opinion of probable costs prepared herein.

7.2.3 Construction Contingencies

The Plan includes a contingency factor of 20 percent of the construction cost to allow for variables associated with the bid and construction process, consistent with the level of planning included.

7.2.4 Engineering, Construction Observation, & Construction Management Costs

The Plan includes a general planning allowance of 20-25 percent of the construction cost for engineering, construction observation, and construction management. The higher percentage is typically associated with more complex mechanical and electrical work.

7.2.5 Legal and Administrative Costs

An allowance of 5 percent of the construction costs is included for legal and administration costs.

7.2.6 Other Costs

Other costs may include specialized studies, property or right-of-way acquisition, specific equipment or supplies, fees, and other items that are not part of the specific categories discussed above.

Typically, these other costs are listed individually in the OPC.

7.3 CAPITAL IMPROVEMENTS

Recommended capital improvements are summarized in Table 7.1. Table 7.1 includes (referenced) Section and Figure numbers - where projects are described or shown in more detail. The table was created in Microsoft Excel; a copy of the spreadsheet file has been provided to the City. It allows staff to modify the CIP implementation schedule and update costs by entering a current Engineering News Record (ENR) Construction Cost Index. The

spreadsheet uses the ratio of the current ENR, and the October 2013 reference ENR, to update costs. All costs in the table are referenced to the October 2013 ENR; annual updates of the CIP costs can facilitate project budgeting, planning, and implementation. The table also allows the work and costs for any project to be allocated to any year or even several years according to main length or percentage of the project to be undertaken.

Note some recommended projects are not entered in the table because an alternative needs to be selected or an evaluation needs to be completed. The CIP table can be updated as project details are developed.

Near-term projects that may be entered in the table as the project timing, scope, and cost become more defined include:

- Water right permit extension for the wells
- CO_2 removal project
- Water Management and Conservation Plan

These projects are associated with the Joint Water System and as such Wheeler's cost is based on the cost share provisions of the IGA. Only Wheeler's share of the cost should be entered in the CIP.

All projects should include a pre-design element that verifies any critical project requirement or data need such as key elevations, pipe size/material/location, operation characteristics, etc.

7.4 PROJECT PRIORITIZATION

Some projects are noted as high priority in Table 7.1; the high priority designation is based on current condition or current lack of capacity. Ideally, these projects will be addressed as soon as possible, possibly as one large, or several smaller, project(s). Deferral of these projects will result in a lower level of service and, depending on the particular projects, leave the City vulnerable to system or equipment failures. Project prioritization should ultimately be reflected in the CIP scheduling.

City staff provided input on project prioritization (primarily for water main improvements) in relative terms of "low, medium, or high" priorities. A more precise assignment to specific

years was not provided. There are some current developments and concerns that could affect the scheduling; consequently, a tentative CIP is offered that provides for:

High Priority Projects (implementation year 2015-2019)
Medium Priority Projects (implementation year 2020-2025)
Low Priority Projects (implementation year 2026-2034)

For high priority projects, all projects are entered under year 2015 – though it is understood that implementation will actually occur between 2015 and 2019. The CIP table, as previously noted, is in a spreadsheet format that can be readily updated or modified as needed by the City. The CIP and any subsequent modifications will need to be adopted by the City prior to use for SDC purposes.

7.5 FINANCING AND IMPLEMENTATION

Implementation and financing are discussed in Section 8.

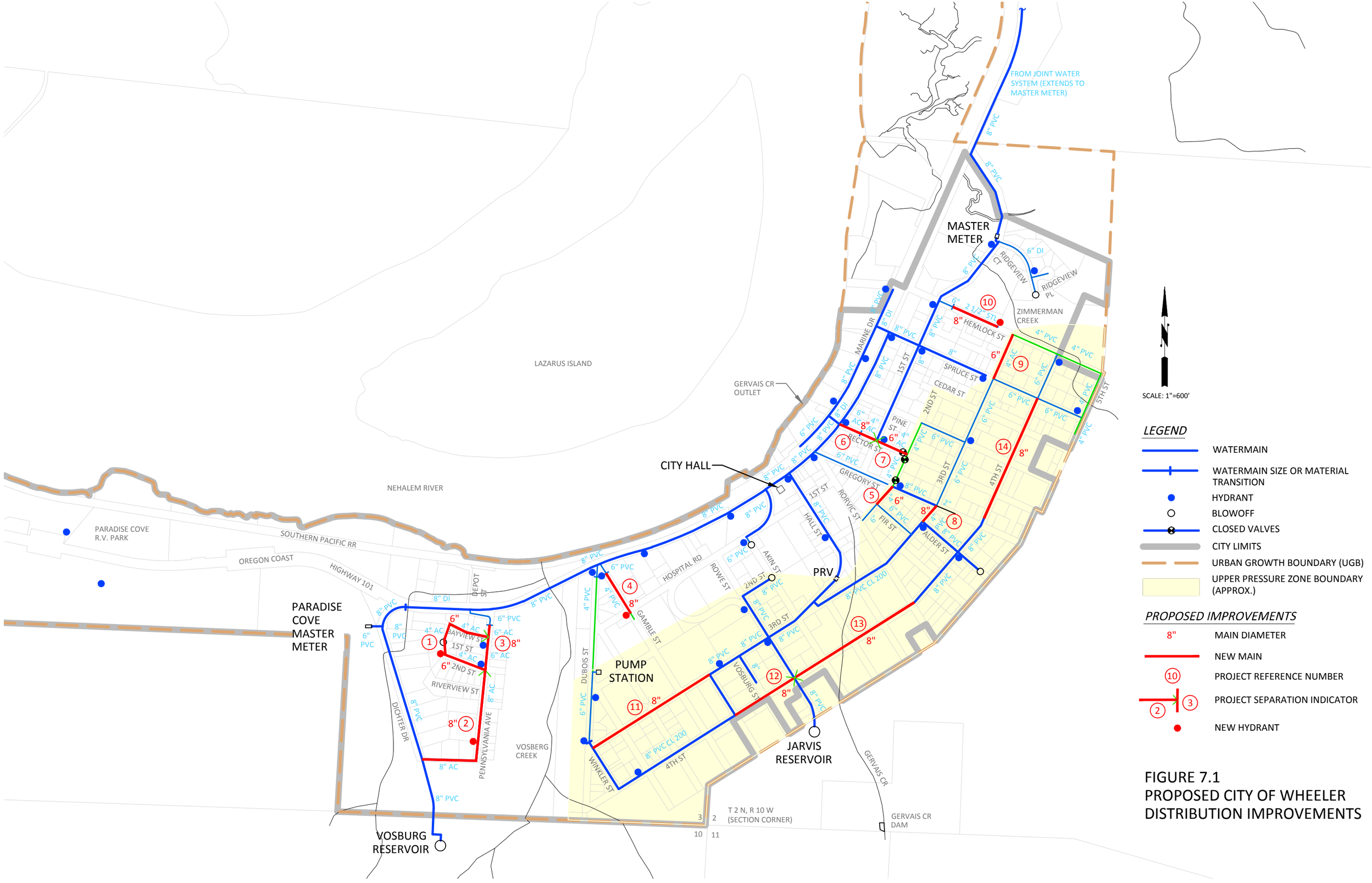


FIGURE 7.1
PROPOSED CITY OF WHEELER
DISTRIBUTION IMPROVEMENTS

Table 7.1: City of Wheeler CIP (All costs in current dollars) | **Reference September 2014 ENR CCI:** 9870 | **Current ENR CCI: (September 2014)** 9870 | **City of Wheeler Water System Master Plan 2014** | **Distribution Improvements**

Unit Costs Sep 2014 ($/LF)	Project Priority	Project Reference Number	Project Name (Description)	New Diameter (in.)	Length (LF)	Unit Cost ($/LF)	Construction Cost ($)	Total Cost ($)	Implementation (LF and Total Cost) 2015 (LF)	2015 ($)	2016 (LF)	2016 ($)	2017 (LF)	2017 ($)	2018 (LF)	2018 ($)	2019 (LF)	2019 ($)	2020-25 (LF)	2020-25 ($)	2026-34 (LF)	2026-34 ($)	CIP Totals Length (LF)	CIP Totals Cost ($)
$130	H	1	**Bayview Loop**	6	**880**	$130	$114,400	**$165,880**	880	$165,880		$0		$0		$0		$0		$0		$0	880	$165,880
			Project replaces old 4" AC mains on Bayview Street and 2nd Street, west of Pennsylvania Ave. with new 6" line and hydrant. New line will complete loop and connect to new lines on Pennsylvania Ave. (Ex. 4" valves don't work; lots of breakage on old AC line.)																					
140	H	2	**Pennsylvania Ave. (South)**	8	**1,080**	$140	$151,200	**$219,240**	1,080	$219,240		$0		$0		$0		$0		$0		$0	1,080	$219,240
			Replace old 8" AC line on Pennsylvania Ave. between Dichter Dr. and 2nd Street. (Lots of breakage on old AC line.) New hydrant provides fire protection.																					
140	H	3	**Pennsylvania Ave. (North)**	8	**330**	$140	$46,200	**$66,990**	330	$66,990		$0		$0		$0		$0		$0		$0	330	$66,990
			Replace old 6" AC line along Pennsylvania Ave. between 2nd Street and existing 6" PVC line north of Bayview Street.																					
140	M	4	**Gamble Street**	8	**340**	$140	$47,600	**$69,020**		$0		$0		$0		$0		$0	340	$69,020		$0	340	$69,020
			Replace 4" PVC with " line and fire hydrant. Provides better fire protection to homes in the vicinity.																					
130	M	5	**2nd Street (Fir - Gregory)**	6	**180**	$130	$23,400	**$33,930**		$0		$0		$0		$0		$0	180	$33,930		$0	180	$33,930
			Replace existing 4" line with 6". Improves local hydraulics.																					
140	H	6	**Rector Street (West)**	8	**300**	$140	$42,000	**$60,900**	300	$60,900		$0		$0		$0		$0		$0		$0	300	$60,900
			Replace old 4" and 6" AC lines on Rector Street between Hwy 101 and 1st Street.																					
130	H	7	**Rector Street (East)**	6	**220**	$130	$28,600	**$41,470**	220	$41,470		$0		$0		$0		$0		$0		$0	220	$41,470
			Replace old 4" AC line on Rector Street between 1st Street and 2nd Street..																					
140	M	8	**3rd Street (Alder - Gregory)**	8	**170**	$140	$23,800	**$34,510**		$0		$0		$0		$0		$0	170	$34,510		$0	170	$34,510
			Replace 4" PVC along 3rd Street with 8" between Alder Street and Gregory Street. Improves local hydraulics.																					
130	H	9	**3rd Street (Spruce - Hemlock)**	6	**350**	$130	$45,500	**$65,975**	350	$65,975		$0		$0		$0		$0		$0		$0	350	$65,975
			Replace old 4" AC line along 3rd Street between Spruce Street and Hemlock Street.																					
140	H	10	**Hemlock Street**	8	**370**	$140	$51,800	**$75,110**	370	$75,110		$0		$0		$0		$0		$0		$0	370	$75,110
			Replaces old 2-1/2" steel main with 8" lineand terminal hydrant. Improved service and fire protection.																					
140	L	11	**3rd Street (Winkler - East)**	8	**1,000**	$140	$140,000	**$203,000**		$0		$0		$0		$0		$0		$0	1,000	$203,000	1,000	$203,000
			Proposed main for upper pressure zone loop completion and expanded service. Along 3rd Street from Winkler Street, east to existing 8". Area currently undeveloped. Anticipate construction by developer. No current development plan.																					
140	M	12	**4th Street (Rowe - West)**	8	**500**	$140	$70,000	**$101,500**		$0		$0		$0		$0		$0	500	$101,500		$0	500	$101,500
			New 8" line along 4th Street from Rowe Street, west to the existing 8" line on 4th Street. Enhances fire flow and service to vicinity of Hospital. Also part of planned larger diameter loop in the upper pressure zone.																					
140	M	13	**4th Street (Rowe - East)**		**1,530**	$140	$214,200	**$310,590**		$0		$0		$0		$0		$0	1,530	$310,590		$0	1,530	$310,590
			Proposed main for upper pressure zone loop completion and expanded service. Along 4th Street from Rowe Street, east to existing 8" line. Area currently undeveloped. Anticipate construction by developer. No current development plan.																					
140	M	14	**4th Street (South of Spruce)**	8	**950**	$140	$133,000	**$192,850**		$0		$0		$0		$0		$0	950	$192,850		$0	950	$192,850
			Proposed main for upper pressure zone loop completion and expanded service. Along 4th Street from Spruce Street, south to existing 8" line. Area currently undeveloped. Anticipate construction by developer. No current development plan.																					
			Distribution Totals		**8,200**		**$1,131,700**	**$1,640,965**	**3,530**	**$695,565**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**3,670**	**$742,400**	**1,000**	**$203,000**	**8,200**	**$1,640,965**

Miscellaneous

Constr. Costs Oct 2013 ($/LF)	Total Costs Oct 2013 ($/LF)	Project Priority	Project Name (Description)	Plan Section # Reference	ENR Ratio	Construction Cost ($)	Total Cost ($)	Implementation (% and Total Cost) 2015 (LF)	2015 ($)	2016 (LF)	2016 ($)	2017 (LF)	2017 ($)	2018 (LF)	2018 ($)	2019 (LF)	2019 ($)	2020-25 (LF)	2020-25 ($)	2026-34 (LF)	2026-34 ($)	CIP Totals (%)	CIP Totals Cost ($)
$0	$5,000	H	**Jarvis Reservoir Electrical Service**	**6.7.2.3**	1.000	$0	$5,000	100	$5,000		$0		$0		$0		$0		$0		$0	100	$5,000
			Fix building that houses the reservoir's electrical service or relocate service.																				
	$5,000	H	**Reservoir Cathodic Protection**	**6.7.2.3**	1.000	$0	$5,000	100	$5,000		$0		$0		$0		$0		$0		$0	100	$5,000
			Check cathodic protection at reservoirs. Budget may need adjusting based on findings and follow up work needed.																				
	$27,000	H	**SCADA and Telemetry Improvements**	**6.7.5**	1.000	$0	$27,000	100	$27,000		$0		$0		$0		$0		$0		$0	100	$27,000
			Replaces old Plan that is out-of-date.																				
	$12,000	H	**Water Rate Study**	**8**	1.000	$0	$12,000	100	$12,000		$0		$0		$0		$0		$0		$0	100	$12,000
			Prepare a new water rate study.																				
	$8,000	H	**System Development Charge Study**	**8**	1.000	$0	$8,000	100	$8,000		$0		$0		$0		$0		$0		$0	100	$8,000
			Prepare a new water SDC study and methodology.																				
	$50,000	L	**Water Master Plan Update**	**6.8.1**	1.000	$0	$50,000		$0		$0		$0		$0		$0	100	$50,000		$0	100	$50,000
			Periodic update of Plan. Actual budget should be adjusted as needed to reflect theanticipated level of effort required.																				
			Miscellaneous Totals			**$0**	**$107,000**		**$57,000**		**$0**		**$0**		**$0**		**$0**		**$50,000**		**$0**		**$107,000**
			CIP Total			**$1,131,700**	**$1,747,965**	**$3,530**	**$752,565**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$3,670**	**$792,400**	**$1,000**	**$203,000**	**$8,200**	**$1,747,965**

8.1 RECENT WATER FUND BUDGETS

The City's Water Operating Fund is funded primarily through water user fees (water rates). Recent budgets for the fund are shown in Table 8.1.

Table 8.1: Water Operating Fund Budgets

Description	Actual Fiscal Year 2010-2011	Actual Fiscal Year 2011-2012	Actual Fiscal Year 2012-2013	Actual Fiscal Year 2013-2014
Resources				
Beginning Total	$82,563	$111,204	$80,808	$65,319
Transfers In	$30,000	$0	$0	$0
Revenue				
User Fees	$128,920	$116,501	$119,511	$119,868
Other	$15	$879	$796	$732
Revenue Total	$128,935	$117,380	$120,307	$120,600
Resources Total	*$241,498*	*$228,584*	*$201,115*	*$185,919*
Expenses				
Transfers Out	$44,520	$38,000	$38,000	$23,000
Expenditures				
Personal Services	$16,043	$18,700	$19,892	$21,405
Materials and Services	$66,623	$91,076	$77,904	$87,945
Capital Outlay	$3,108	$0	$0	$0
Expenditures Total	$85,774	$109,776	$97,796	$109,350
Expenses Total	*$130,294*	*$147,776*	*$135,796*	*$132,350*
Revenue - Expenditures	$43,161	$7,604	$22,511	$11,250
Resources - Expenses	$111,204	$80,808	$65,319	$53,569

For the four fiscal years shown, "Resources minus Expenses" show a steady decline indicating insufficient resources and signaling a need to raise water rates.

8.1.1 Water Capital Improvement Fund

The City's Water Capital Improvement Fund is funded primarily through system development charges (SDCs) and transfers in from other sources. Recent budgets for the fund are shown in Table 8.2.

Table 8.2: Water Capital Improvement Fund Budgets

Description	Actual Fiscal Year 2010-2011	Actual Fiscal Year 2011-2012	Actual Fiscal Year 2012-2013	Actual Fiscal Year 2013-2014
Resources				
Beginning Total	$116,636	$146,156	$163,466	$183,922
Transfers In	$89,520	$20,000	$20,000	$5,000
Revenue				
SDCs	$0	$0	$0	$0
Other	$0	$420	$457	$946
Revenue Total	$0	$420	$457	$946
Resources Total	*$206,156*	*$166,576*	*$183,923*	*$189,868*
Expenses				
Transfers Out	$60,000	$0	$0	$0
Expenditures				
Materials and Services	$0	$0	$0	$29,222
Capital Outlay	$0	$3,111	$0	$0
Expenditures Total	$0	$3,111	$0	$29,222
Expenses Total	*$60,000*	*$3,111*	*$0*	*$29,222*
Revenue - Expenditures	$0	-$2,691	$457	-$28,276
Resources - Expenses	$146,156	$163,465	$183,923	$160,646

The Capital Improvement Fund budget appears healthy. A total beginning balance of $160,646 is available for fiscal Year 2015.

8.1.2 Water Debt Service Fund

The City's Water Capital Improvement Fund is funded primarily through property taxes and transfers in from other sources. Recent budgets for the fund are shown in Table 8.3.

Table 8.3: Water Debt Service Fund Budgets

Description	Actual Fiscal Year 2010-2011	Actual Fiscal Year 2011-2012	Actual Fiscal Year 2012-2013	Actual Fiscal Year 2013-2014
Resources				
Beginning Total	$3,499	$6,188	$9,328	$12,650
Transfers In	$4,000	$4,000	$4,000	$3,000
Revenue				
Property Taxes	$60,414	$60,765	$60,861	$61,053
Other	$0	$100	$185	$187
Revenue Total	$60,414	$60,865	$61,046	$61,240
Resources Total	$67,913	$71,053	$74,374	$76,890
Expenses				
Transfers Out	$0	$0	$0	$0
Expenditures				
Debt Service	$61,725	$61,725	$61,724	$61,725
Expenditures Total	$61,725	$61,725	$61,724	$61,725
Expenses Total	$61,725	$61,725	$61,724	$61,725
Revenue - Expenditures	-$1,311	-$860	-$678	-$485
Resources - Expenses	$6,188	$9,328	$12,650	$15,165

The Water Debt Service Fund appears healthy with a limited amount of transfers in to supplement the slightly inadequate property tax totals. Property taxes in fiscal year 2014 were $61,053.

8.2 CURRENT WATER RATES

8.2.1 Rate structure

The City of Wheeler's current (effective January 1, 2006) water rate schedule is included in Appendix 8.1. Rates are based on a base monthly service charge associated with a customer class and further adjusted according to meter size. To the

base charge is added water usage rate of $0.0028 per gallon. Base charge for residential and general commercial (less than 1" meter) is $20.70.

8.2.2 Rate Revenue

For the fiscal year ending June 30, 2013, total rate revenue was $119,511.

For approximately the same timeframe, the City averaged 224 residential and general commercial (5/8" meter) accounts with an average of 4,516 gallons per account per month (computed from figures in Table 5.1). With the current rate structure, this yields an average, residential account, monthly billing of $33.34 ($20.70 base plus $12.64 usage). Funding agencies often evaluate a City's rates based on a per EDU residential monthly billing associated with 7,500 gallons); for Wheeler, this billing would be $41.70.

8.2.3 Comments

Based on a review of the Operating Fund budgets, the City needs to increase rates. The rate increase should cover both existing needs and provide for debt service on planned improvements (to the extent that they will be funded with loans). A water rate study is recommended. Estimated cost for the rate study is $12,000.

Rates provide approximately 2/3 of the overall water utility revenue with the other approximate 1/3 provided through property taxes. State and Federal funding agencies take property taxes into account as well as rates when determining a communities' eligibility for grants and more favorable terms.

8.3 CURRENT SYSTEM DEVELOPMENT CHARGE (SDC)

Wheeler's current Water SDC is $3,670 for a standard residential or small commercial water meter (5/8" x ¾"). The SDC increases with increasing meter size. SDCs were last reviewed in "Proposed Water System Development Charges", October 19, 1999 by Lee Engineering, Inc. (see Appendix 8.2). SDCs utilize an approved capital improvements plan as the basis for the SDC cost computation. As SDCs are based in part on anticipated project costs, the City should consider revising the SDC after the Water Master Plan has been adopted. Estimated cost for a water SDC update is $8,000.

8.4 O&M CONSIDERATIONS

The recommended capital improvements will not result in increased O&M costs; however, O&M costs are subject to market changes and inflationary pressures, so

annual increases are typically required. Budgets and water rates are typically adjusted to take recent or anticipated changes into account; however, system deficiencies that have not been addressed can increase O&M costs in ways and to an extent not easily foreseen. This may take the form of emergency (overtime) call outs and extra cost, interim measures that may be needed until the problem can be addressed correctly, and un-budgeted emergency projects of potentially significant expense. Over time, such costs can add significantly to the overall utility budget.

8.5 CAPITAL IMPROVEMENT FINANCE

8.5.1 Introduction

Major capital improvements are typically too expensive to fund exclusively with accumulated reserves. Such projects are often most economically financed through programs offered by various State and Federal agencies, or a mix of public and local financing. The following discussion identifies potential sources of that funding.

8.5.2 Public Works Funding Sources

This section includes a brief description of several funding programs that are likely to best meet Wheeler's needs. Additional programs are described in Appendix 8.3 which includes an excerpt from the Rural Community Assistance Corporation's (RCAC) most recent edition of "Oregon Water & Wastewater Funding and Resource Guide" last updated in April 2014.

Safe Drinking Water Revolving Loan Fund (SDWRLF) is funded by EPA grants and from the (Oregon) Water/Wastewater Financing Program. The program is managed by Oregon Health Authority (OHA); the loans are managed by Infrastructure Finance Authority (IFA), a part of Business Oregon, a state agency. The program provides up to $6,000,000 per project with a 25-year term. The interest rate was 3.39% (September 2014 – the rate changes quarterly and is based on 80% of the state/local bond interest rate). The application process includes an initial letter of interest which is used by the state to rate and rank projects to determine which applicants will be invited to submit complete applications.

Water/ Wastewater Financing Program (W/WW) is capitalized primarily through Oregon Lottery funds and loan repayments. The program is managed by IFA and the focus is on the design and construction of public works infrastructure to ensure compliance with Safe Drinking Water Act and the Clean Water Act. The program

provides up to $9,000,000 per project with a 25-year term. The interest rate was 4.24% (September 2014 – the rate changes quarterly). Grants of up to $750,000 are possible with equivalent matching loans; however, grant eligibility is determined on a case by case basis. The application process includes submittal of a Project Notification and Intake Form (PNIF). Qualified applicants are then invited to submit a complete application.

Special Public Works Fund (SPWF) is capitalized primarily through Oregon Lottery funds and loan repayments. The program is managed by IFA and the focus is on infrastructure projects that support economic growth and job creation. The program provides up to $10,000,000 per project with a 25-year term. The interest rate was 4.24% (September 2014 – the rate changes quarterly). Grants of up to $500,000 (or 85% of project cost, whichever is less) are possible; however, grants are typically based on up to $5,000 per family wage job created or retained; grant eligibility and extent, for the project, is determined on a case by case basis. If the project is strictly for capacity building, then no grant is awarded. The application process includes submittal of a Project Notification and Intake Form (PNIF). Qualified applicants are then invited to submit a complete application.

USDA Rural Development (RD) provides funding through the Water & Waste Disposal Direct Loan and Grant Program, and other programs (see Appendix 8.2 for information on other programs). The program provides funding for water and waste projects in communities of up to 10,000 persons with priority given to those communities with less than 5,500 persons. Loan terms are up to 40 years with a recent (September 2014) interest rate (for Wheeler) of 3.25% (rates change quarterly). The 3.25% rate is based on the City having a median household income (MHI) of less than 80% of the statewide MHI of $52,855 (Wheeler's MHI is $27,045 based on the 2006-2010 American Community Survey 5-Year Estimate, US Department of Commerce, US Census). Grants are possible but are generally lower than the agency guidelines suggest and typically require that a City raise their water rates to the state average for communities undertaking comparable projects; the agency will determine how much grant will be included. Applications for funding must include a preliminary engineering report (PER) – or equivalent - and an environmental report (ER).

IFA also considers the affordability rate for a City in determining grant eligibility. The affordability rate is computed by taking 1.25% of the MHI and dividing by 12 months – for Wheeler this rate would currently be $28.17. This is a per EDU per month figure with an associated usage of 7,500 gallons per month. As noted in Section 8.2.2, Wheeler's current water billing under this definition would be $41.70 so Wheeler meets the eligibility criteria.

It is important to understand that funding programs change over time. Interest rates, fund availability, relative grant participation, and eligibility requirements are common areas of change; consequently, the figures and opportunities presented here may not be applicable at the time of funding application and award.

8.5.3 Local Financing Sources

Commonly used local financing sources include:

General obligation (GO) bonds are backed by the full faith and credit of the issuer who is authorized to levy ad valorem (property) taxes for payment. The issuer can use other revenue for payment if desired. A term of 20 years is typical unless RD purchases the bonds (40 year term for RD funding).

Revenue bonds are backed by the City's pledge to operate the water system in a manner that will generate sufficient revenue to meet the financial obligations of the bond issue. These are generally paid with water rate revenue.

Sinking funds basically refer to a process of saving a budgeted amount over a period of time until enough funds have been accrued to undertake the project. This approach is generally viable for lower cost projects or ones with long lead times. It can be a significant tool in asset management where future projects are anticipated based on remaining design lives; however, it may result in significant near-term rate or fee increases that could be politically challenging to adequately implement for large capital improvement budgets. The City's water system replacement fund (SRF) is an example of the sinking fund approach.

Ad valorem tax or property tax is often used to pay all or part of a GO bond. Property taxes can provide an alternative way of distributing project costs and minimizing financial impacts on homeowners with lower property valuations.

Water rates are a typical source of monies for debt service on loans from the state and federal funding agencies. Water rates can also be used for sinking funds. Water rate revenue increases with community growth and, as such, may help offset the effects of inflation on O&M costs. The assumption of rate revenue growth, for debt repayment, carries some risk insofar as the projected growth may not occur; it also entails greater attention to water rate increases since the added revenue associated with growth no longer buffers the inflationary costs associated with the annually increasing O&M budget.

System development charges (SDCs) provide monies for improvements that add capacity to the water system for new growth. SDCs are an important source of financing and in rapidly growing cities, can provide substantial revenues. Accumulated SDCs are typically not adequate for the funding of major projects since they are often used when available and not allowed to accumulate. The assumption of future SDCs for debt service payment carries risk insofar as the projected growth may not occur.

8.6 CAPITAL IMPROVEMENT RATE IMPACTS

Table 8.4 includes debt service and rate impacts on a per EDU basis for projects funded through the programs identified in Section 8.5.2, plus a computation using a 6.5% interest rate. Very large projects often require funding through multiple sources; rate impacts for multiple funding sources are simply added together. ***Note: Table 8.4 is for general planning purposes only. Actual interest rates, terms, and availability of funds through any given source may vary and are not locked in until an offer of funding is accepted by the City.***

Table 8.4: Example Debt Service and Rate Impacts (per EDU basis)

	Annual Debt Service	Monthly Per EDU Rate Increase	Annual Debt Service	Monthly Per EDU Rate Increase	Annual Debt Service	Monthly Per EDU Rate Increase	Annual Debt Service	Monthly Per EDU Rate Increase
Interest Rate (%):	3.25		3.39		4.24		6.5	
Term (years):	40		25		25		25	
Reserve (%):	10							
EDUS:		313		313		313		313
Loan Total($)								
$100,000	$4,953.07	$1.32	$5,995.19	$1.60	$6,564.60	$1.75	$8,198.15	$2.18
$200,000	$9,906.15	$2.64	$11,990.38	$3.19	$13,129.20	$3.50	$16,396.30	$4.37
$300,000	$14,859.22	$3.96	$17,985.58	$4.79	$19,693.80	$5.24	$24,594.44	$6.55
$400,000	$19,812.29	$5.27	$23,980.77	$6.38	$26,258.40	$6.99	$32,792.59	$8.73
$500,000	$24,765.37	$6.59	$29,975.96	$7.98	$32,823.00	$8.74	$40,990.74	$10.91
$600,000	$29,718.44	$7.91	$35,971.15	$9.58	$39,387.60	$10.49	$49,188.89	$13.10
$700,000	$34,671.51	$9.23	$41,966.34	$11.17	$45,952.20	$12.23	$57,387.04	$15.28
$800,000	$39,624.59	$10.55	$47,961.53	$12.77	$52,516.80	$13.98	$65,585.18	$17.46
$900,000	$44,577.66	$11.87	$53,956.73	$14.37	$59,081.40	$15.73	$73,783.33	$19.64
$1,000,000	$49,530.73	$13.19	$59,951.92	$15.96	$65,646.00	$17.48	$81,981.48	$21.83

8.7 CAPITAL IMPROVEMENT IMPLEMENTATION

Capital improvements can be implemented over the planning period according to the nature of the projects, the relative prioritization of the project, and other financial and practical considerations that the City may have. Several of the projects are high priority and should be addressed as soon as practicable.

Because of the high costs associated with implementation of the recommendations, funding agency participation will likely be needed. Once the City has determined which projects to include, the City should contact IFA to set up a One- Stop Meeting in Salem to discuss potential project funding. Representatives of potential funding agencies attend the meeting and can assist in developing an optimal funding approach.

It should be noted that most of the recommended projects are based on current deficiencies and needs. The prioritization reflects a relative importance between the projects as well

as a concession to the practicalities or possible preference of the City with regard to implementation. Most of the proposed improvements are water main projects. These projects typically have a very long design life; consequently, there is little benefit to deferral if it is at all practicable to pursue all the projects as one large project. Potential benefits of one large project over several smaller ones are primarily related to having to go through the various aspects of project development once rather than multiple times. These aspects include the public/political process, seeking and obtaining funding, bidding and award, loan/grant administration, environmental review (if needed), permitting, construction observation and administration, and closeout. Larger projects generally draw more contractors and competitive bids than smaller ones; consequently, it is likely that construction costs for the larger project will be lower on a per-lineal foot constructed basis. The larger project will result in a greater near-term rate impact; however, over the long term, the larger project will have less rate impact than phased construction of smaller projects.

Projects 8, 11, 12, 13, and 14 are associated with loop creation in the upper zone. Modelling indicates that implementation of these projects will improve the hydraulic performance of the upper zone in particular and the overall water system in general. The proposed upper zone looping eliminates the problem (when system fire flow goals are met) with Alder Street where system pressures may fall below the required regulatory minimum of 20 psi. In addition, Project 13 provides an alternative for providing service across Gervais Creek to the upper zone on the northeast side of the creek. The City should consider implementing these projects sooner for the benefits provided rather than waiting for sufficient developer initiated main construction to occur in order to create the proposed looping. If the City does consider moving forward on Project 13, it may want to consider an alternate route to avoid the very steep hillside on the southwest side of the creek. The alternate route ("Project 13b") would run from 2nd and Akin to 3rd and Akin, then north along Hall to the 2nd Street right-of-way, then northeast along 2nd to tie into the existing main. The project length is comparable to that of Project 13, but avoids construction on the steep hillside. Project 13, by itself, could have additional costs associated with slope stabilization and construction that would typically be included in the cost of site development; these costs would need to be determined and added in to the Table 7.1 costs if the City were to pursue Project 13 on their own (prior to developer involvement and instead of "Project 13b" discussed above).

Project 11 is an exception to the discussion above, in that (currently) it would provide little benefit to the system as a whole due to limited development in the area. Project 11 passes through an area of demonstrated geological instability and should not be constructed until a thorough geotechnical evaluation has been prepared – presumably by a future developer interested in the site.

Appendix 2.1

City of Wheeler Zoning Map

(Source: Tillamook County GIS)

Land Use Category Definitions

(Source: City of Wheeler Comprehensive Plan, adopted December1979 with Amendments through January 2010)

LAND USE CATEGORY DEFINITIONS

1. General Commercial (GC). The intent is to provide for a wide range of general retail and service business needs.

2. Residential 1 (R-1). The intent is to provide for residential development consisting of conventional structures and manufactured homes.

3. Residential 2 (R-2). The intent is to provide residential development consisting of conventional structures and manufactured homes. RV Parks and campgrounds on tracts of 10 acres or more may be permitted as Conditional Uses.

4. Water-Related Commercial (WRC). The intent is to provide for marine oriented commercial uses.

5. Water-Related Industrial (IND). The intent is to provide for marine oriented industrial and commercial uses which are compatible with the community's setting and natural values. In addition, certain non-water oriented uses may be permitted.

6. Public Lands (P). The intent is to protect certain publicly owned lands.

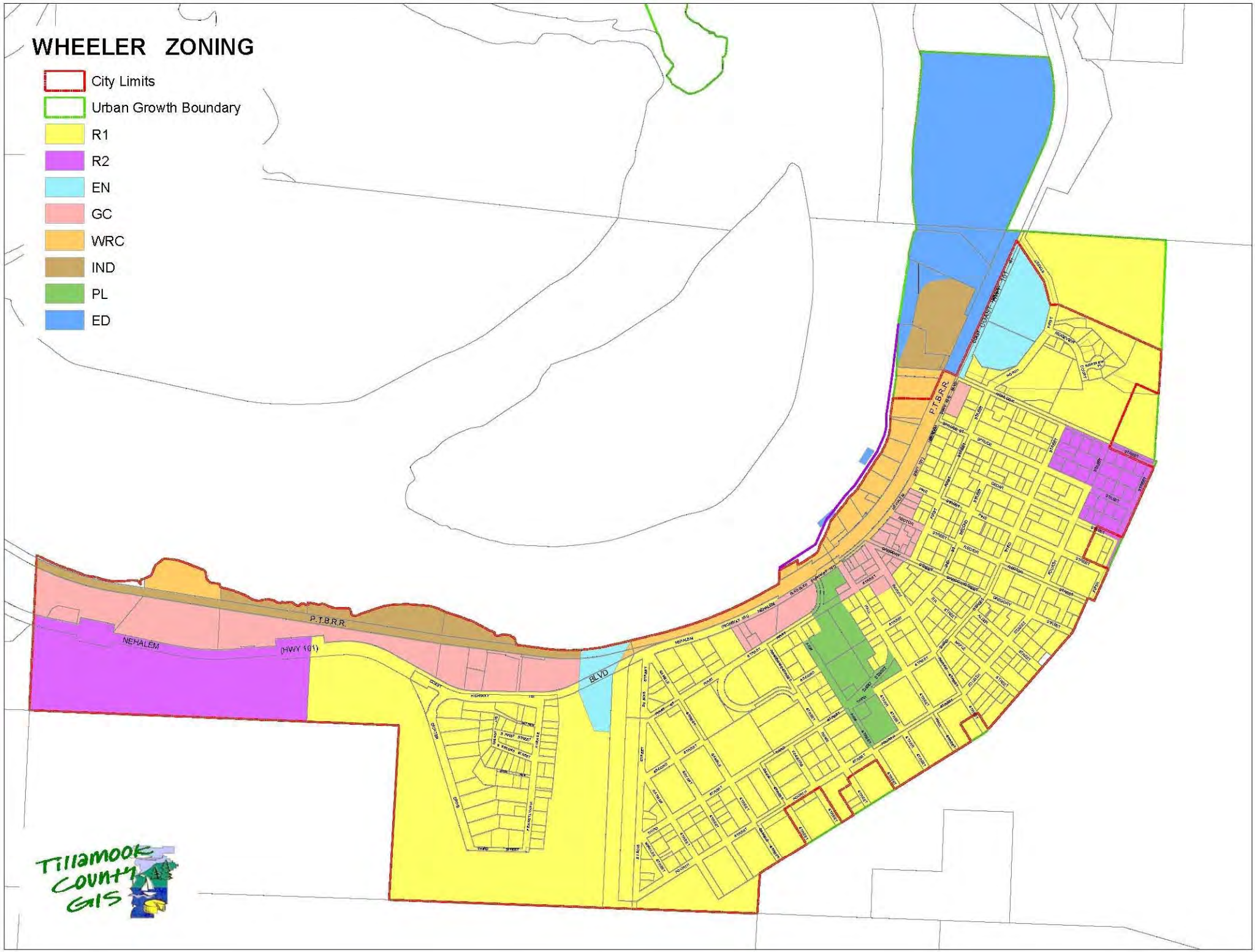
7. Estuarine Natural (EN). The purpose is to provide for preservation and protection of significant fish and wildlife habitats and other areas which make an essential contribution to estuarine productivity or fulfill scientific, research or educational needs.

8. Estuarine Development (ED). The purpose is to provide for long-term maintenance, enhancement, expansion or creation of structures or facilities for navigational or other water-dependent commercial, industrial, or recreational uses. Other commercial, industrial, or recreational facilities may be allowed subject to certain criteria.

9 Mitigation Site Protection (MP). The purpose of the Mitigation Site Protection zones is to protect identified mitigation sites from incompatible and preemptive uses that may prevent their ultimate restoration or addition to the estuarine ecosystem.

WHEELER ZONING

- City Limits
- Urban Growth Boundary
- R1
- R2
- EN
- GC
- WRC
- IND
- PL
- ED

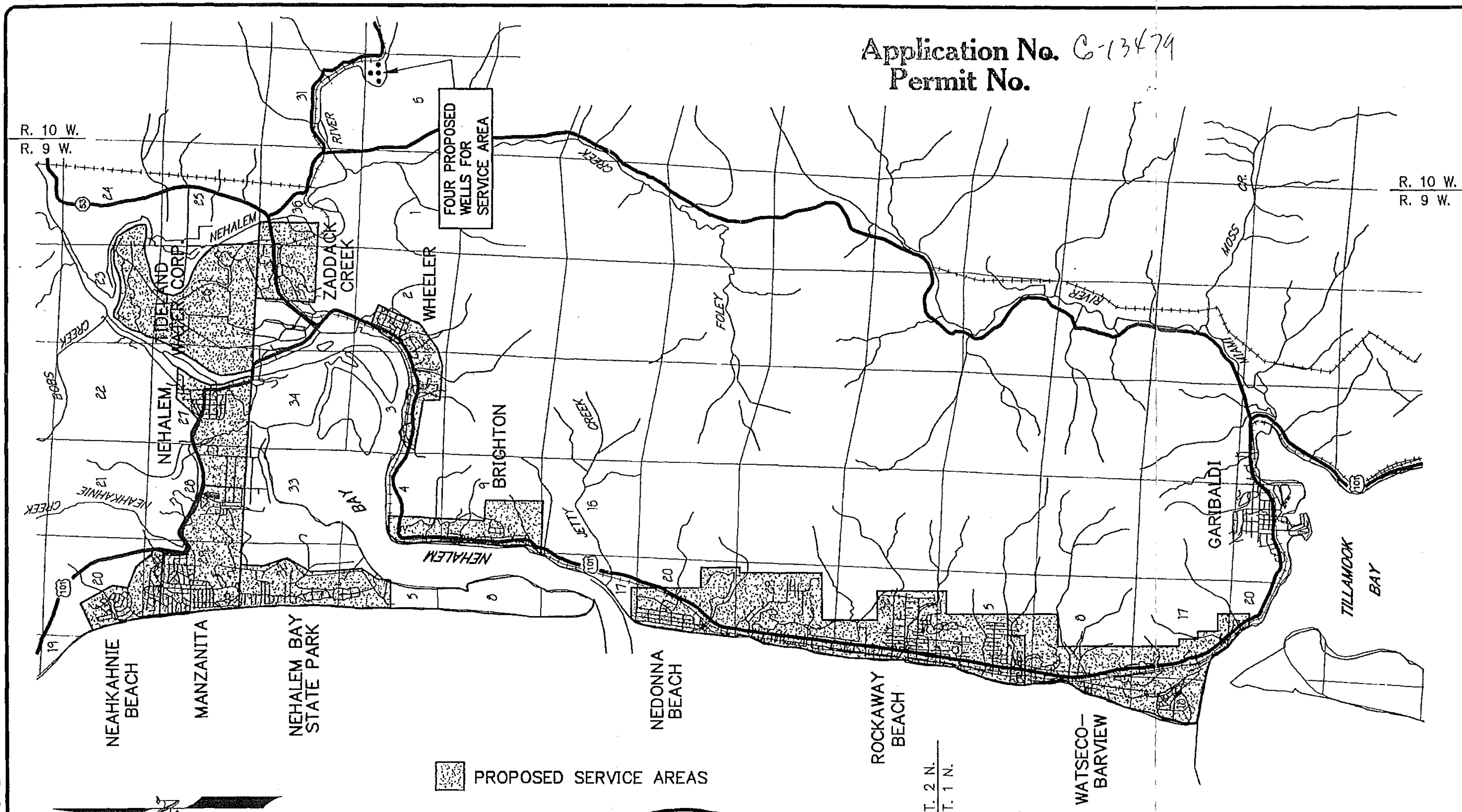


Tillamook County GIS

Appendix 3.1

Water Rights

Application No. G-13479
Permit No.



0 ¼ ½ 1 2
SCALE IN MILES

T. 3 N.
T. 2 N.

THIS MAP IS FOR THE PURPOSE OF IDENTIFYING THE LOCATION OF POINT(S) OF DIVERSION AND PLACE(S) OF USE OF THE WATER RIGHTS ONLY AND IS NOT INTENDED TO PROVIDE LEGAL DIMENSIONS OF THE PROPERTIES ILLUSTRATED HEREIN.

Certified Water Right Examiner
#279 WRE
F. Duane Lee
May 30, 1991
STATE OF OREGON
7/29/93

OWNER:
CITY OF WHEELER

LEE ENGINEERING, INC.
1300 JOHN ADAMS ST.
OREGON CITY, OR, 97045

DWG TITLE:
N. TILLAMOOK CO. REGIONAL WATER STUDY
AREAS INCLUDED IN WATER RIGHTS APPLICATION

DATE: 12/29/92
FILE NO: 1307S03
REVISED:

FIGURE 1

73122
G

STATE OF OREGON

COUNTY OF TILLAMOOK

PERMIT TO APPROPRIATE THE PUBLIC WATERS

THIS PERMIT IS HEREBY ISSUED TO

CITY OF WHEELER
PO BOX 177
WHEELER, OREGON 97147

The specific limits for the use are listed below along with conditions of use.

APPLICATION FILE NUMBER: G-13479

SOURCE OF WATER: Wells #4, #6, #13, and #10 within the Nehalem River Basin

PURPOSE OR USE: Municipal use

Rate of use: 3.6 CFS

Period of allowed use: The period of allowed use under this permit is year round, however, if senior instream water rights are not met, water use will be curtailed for all use except human consumption and livestock watering until those instream water rights are met.

DATE OF PRIORITY: July 29, 1993.

POINTS OF DIVERSION LOCATION:

NE 1/4 NW 1/4, SECTION 5, T 2 N, R 9 W, W.M.: WELL #4 - 989.22 FEET SOUTH AND 2204.31 FEET EAST; WELL #6 - 1087.73 FEET SOUTH AND 2214.81 FEET EAST; WELL #13 - 1055.75 FEET SOUTH AND 2547.09 FEET EAST; WELL #10 - 905.91 FEET SOUTH AND 2543.69 FEET EAST; ALL FROM THE NW CORNER OF SECTION 5

THE PLACE OF USE IS LOCATED AS FOLLOWS:

WITHIN THE SERVICE AREA OF THE PROPOSED NORTH TILLAMOOK COUNTY REGIONAL WATER SUPPLY, TOWNSHIPS 1, 2 AND 3 NORTH, RANGE 10 WEST, W.M.

Measurement, recording and reporting conditions:

A. Before water use may begin under this permit, the permittee shall install a meter or other suitable measuring device as approved by the Director. The permittee shall maintain the meter or measuring device in good working order, shall keep a complete record of the amount of water used each month and shall submit a report which includes the recorded water use measurements to the Department annually or more frequently as may be required by the Director. Further, the Director may

require the permittee to report general water use information, including the place and nature of use of water under the permit.

B. The permittee shall allow the watermaster access to the meter or measuring device; provided however, where the meter or measuring device is located within a private structure, the watermaster shall request access upon reasonable notice.

If substantial interference with a senior water right occurs due to withdrawal of water from any well listed on this permit, then use of water from the well(s) shall be discontinued or reduced and/or the schedule of withdrawal shall be regulated until or unless the Department approves or implements an alternative administrative action to mitigate the interference. The Department encourages junior and senior appropriators to jointly develop plans to mitigate interferences.

Within one year of formation of the Regional Water Supply Authority, the permittee shall submit a water management and conservation plan consistent with OAR Chapter 690, Division 86.

STANDARD CONDITIONS

The wells shall be constructed in accordance with the General Standards for the Construction and Maintenance of Water Wells in Oregon. The works shall be equipped with a usable access port, and may also include an air line and pressure gauge adequate to determine water shall be limited when it interferes with any prior surface or ground water rights.

Prior to receiving a certificate of water right, the permit holder shall submit the results of a pump test meeting the department's standards, to the Water Resources Department. The Director may require water level or pump test results every ten years thereafter.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

Prior to receiving a certificate of water right, the permit holder shall submit the results of a pump test meeting the department's standards, to the Water Resources Department. The Director may require water level or pump test results every ten years thereafter.

Failure to comply with any of the provisions of this permit may result in action including, but not limited to, restrictions on the use, civil penalties, or cancellation of the permit.

This permit is for the beneficial use of water without waste. The water user is advised that new regulations may require the use of best practical technologies or conservation practices to achieve this end.

By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan.

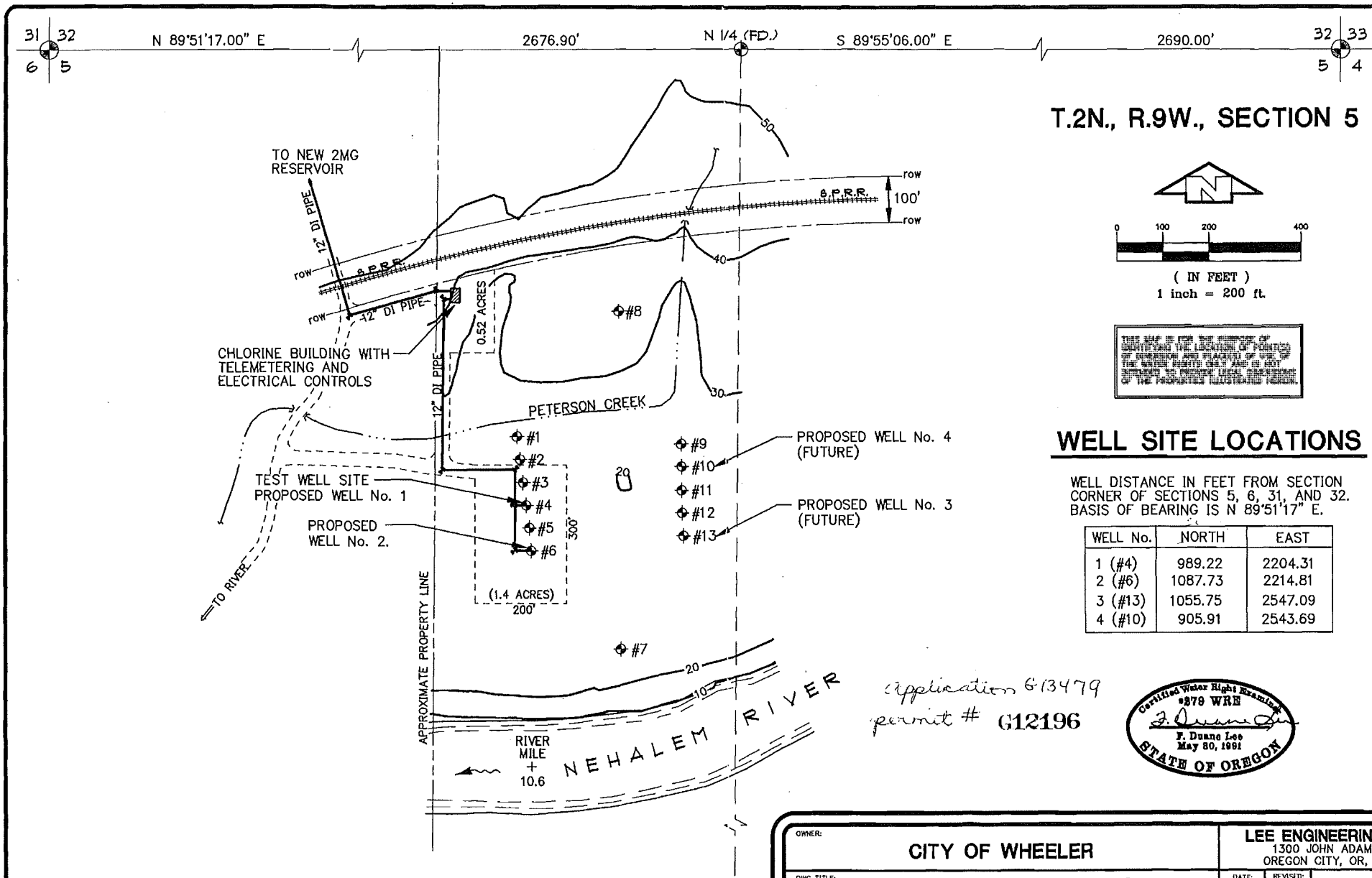
The use of water shall be limited when it interferes with any prior surface or ground water rights.

The Director finds that the proposed use(s) of water described by this permit, as conditioned, will not impair or be detrimental to the public interest.

Actual construction of the wells shall begin within one year from permit issuance, and shall be completed on or before October 1, 1997. Complete application of the water to the use shall be made on or before October 1, 1999.

Issued this date, November 6, 1995

Water Resources Department
for Martha O. Pagel
Director



WELL SITE LOCATIONS

WELL DISTANCE IN FEET FROM SECTION CORNER OF SECTIONS 5, 6, 31, AND 32. BASIS OF BEARING IS N 89°51'17" E.

WELL No.	NORTH	EAST
1 (#4)	989.22	2204.31
2 (#6)	1087.73	2214.81
3 (#13)	1055.75	2547.09
4 (#10)	905.91	2543.69

application G13479
permit # G12196

Certified Water Right Examiner
#279 WRE
F. Duane Lee
May 30, 1991
STATE OF OREGON

OWNER: CITY OF WHEELER

DWG TITLE: GROUND WATER APPLICATION G-13479 WELL LOCATIONS

LEE ENGINEERING, INC.
1300 JOHN ADAMS ST.
OREGON CITY, OR, 97045

DATE: 10/31/94
FILE NO: 1384S01
REVISED:

FIGURE 1

STATE OF OREGON.

Water Division No. 1. County of Tillamook.

CERTIFICATE OF WATER RIGHT

(For rights perfected under original or secondary permits)

THIS IS TO CERTIFY, That THE CITY OF WHEELER of Wheeler, State of Oregon, has made proof to the satisfaction of the STATE WATER BOARD of Oregon, of a right to the use of the waters of West Branch of Gervais Creek, a tributary of Nehalem Bay, for the purpose of municipal supply, including domestic and general water system under Permit No. 1455 of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon and duly confirmed by order of the STATE WATER BOARD of Oregon, made and entered of record in the Record of Proceedings of said Board, at Salem, in Volume 1, at page 340, on the 19th day of November, 1919; that the priority of the right hereby confirmed dates from January 24, 1913; that the amount of water to which such right is entitled and hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 3. cubic feet per second.

A description of the lands under such right, and to which the water hereby confirmed is appurtenant, or, if for other purposes, the place where such water is put to beneficial use, is as follows: The City of Wheeler, in Tillamook County, Oregon.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described.

Rights to the use of water for power purposes are limited to a period of forty years from the date of priority of the right as herein set forth, subject to a preference right of renewal under the laws existing at the date of the expiration of the right for power purposes as hereby confirmed and limited.

WITNESS the seal and signature of the STATE WATER BOARD, affixed this 4th day December, 1919.

STATE WATER BOARD

(SEAL OF STATE WATER BOARD)

By Percy A. Cupper,
State Engineer, President.

Attest... R. W. Potter.....
Secretary.

Recorded in State Record of Water Right Certificates, Volume 3, Page 2440.

Vol. 1 Page 643

1455

Permit No. 1455

CERTIFICATE NO. 2440

APPLICATION FOR A PERMIT TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

I, Frank A Rowe (Name of Applicant.)

of Wheeler (Postoffice), County of Tillamook

State of Oregon, do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, subject to existing rights:

If the applicant is a corporation, give date and place of incorporation.....

1. The source of the proposed appropriation is ..... (Name of stream)
West Branch of Gervais Creek

2. The amount of water which the applicant intends to apply to beneficial use is (3)
Three cubic feet per second.

3. The use to which the water is to be applied is ..... (Irrigation, power, mining, manufacturing,
Municipal Supply including Domestic supplies and general water system
domestic supplies, etc.)

4. The point of diversion is located 1202.36' N 79° 57' E of corner of Sections 2 - (Give distance and bearing to section corner)
3 - 10 and 11

being within the SW¼ of SW¼ (Give smallest legal subdivision) of Sec. 2, Tp. 2 N (No. N. or S.)
R. 10 W (No. E. or W.), W. M., in the county of Tillamook

5. The pipe line (Main ditch, canal or pipe line) to be 2979.3 ft. miles in length, terminating in the SW¼ of NW¼ (Smallest legal subdivision) of Sec. 2, Tp. 2 N (No. N. or S.), R. 10 W (No. E. or W.),
W. M., the proposed location being shown throughout on the accompanying map.

6. The name of the ditch, canal or other works is .....

DESCRIPTION OF WORKS

Diversion Works—

7. (a) Height of dam 8 feet, length on top 75 feet, length at bottom 50 feet; material to be used and character of construction ..... (Loose rock, concrete,
Timber crib with wasteway over dam
masonry, rock and brush, timber crib, etc., wasteway over or around dam)

(b) Description of headgate Timber 1 gate 6" diameter (Timber, concrete, etc., number and size of openings)

*A different form of application is provided where an appropriation is to be made by the enlargement of existing works, or where storage works are contemplated. These forms can be secured without charge, together with instructions, by addressing the State Engineer, Salem, Oregon.

Canal System—

8. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: Width on top (at water line)_____feet; width on bottom _____feet; depth of water_____feet; grade_____feet fall per one thousand feet.

(b) At_____miles from headgate: Width on top (at water line)_____ _____feet; width on bottom_____feet; depth of water_____feet; grade_____feet fall per one thousand feet.

FILL IN THE FOLLOWING INFORMATION WHERE THE WATER IS USED FOR:

Irrigation—

9. The land to be irrigated has a total area of_____acres, located in each smallest legal subdivision, as follows:

(Give area of land in each smallest legal subdivision which you intend to irrigate)

(If more space required, attach separate sheet)

Power, Mining, Manufacturing, or Transportation Purposes—

10. (a) Total amount of power to be developed_____theoretical horsepower.

(b) Total fall to be utilized_____feet.
(Head)

(c) The nature of the works by means of which the power is to be developed_____

(d) Such works to be located in_____of Sec._____
(Legal subdivision)

Tp._____, R._____, W. M.
(No. N. or S.) (No. E. or W.)

(e) Is water to be returned to any stream?_____.
(Yes or No.)

(f) If so, name stream and locate point of return _____ _____, Sec._____, Tp._____, R._____, W. M.
(No. N. or S.) (No. E. or W.)

(g) The use to which power is to be applied is _____

(h) The nature of the mines to be served_____

Municipal Supply—

11. *To supply the city of* Wheeler *County, having a present population of* 350 *, and an estimated population of* 1000 *in 19*14

(Name of)

(Answer questions 12, 13, 14, and 15 in all cases)

12. *Estimated cost of proposed works, $* 5,000.00

13. *Construction work will begin on or before* Now under construction

14. *Construction work will be completed on or before* July 1, 1913

15. *The water will be completely applied to the proposed use on or before* July 1, 1913

Duplicate maps of the proposed ditch or other works, prepared in accordance with the rules of the Board of Control, accompany this application.

Frank A Rowe
(Name of applicant)

Signed in the presence of us as witnesses:

(1) ..... (Name), ... (Address of witness)

(2) ..... (Name), ... (Address of witness)

Remarks: .....

STATE OF OREGON,
County of Marion } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion, as follows: .....

In order to retain its priority, this application must be returned to the State Engineer, with corrections, on or before ....., *19*.....

WITNESS my hand this .....*day of* ....., *19*.....

State Engineer.

1455(c)

Application No. 2754

Permit No. 1455

PERMIT

TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

Division No. 1 District No. _____

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 24 *day of* Jan., *19* 13, *at* 3:00 *o'clock* P *M.*

Returned to applicant for correction

Corrected application received

Approved

Mar 14 1913

Recorded in Book No. 6 *of Permits on Page* 1455

John H Lewis

1 map CES PAC 8.°° *State Engineer.*

STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions:

The priority date of this permit is January 24, 1913

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 3.00 *cubic feet per second.* or its equivalent in case of rotation

Actual construction work shall begin on or before March 14, 1914

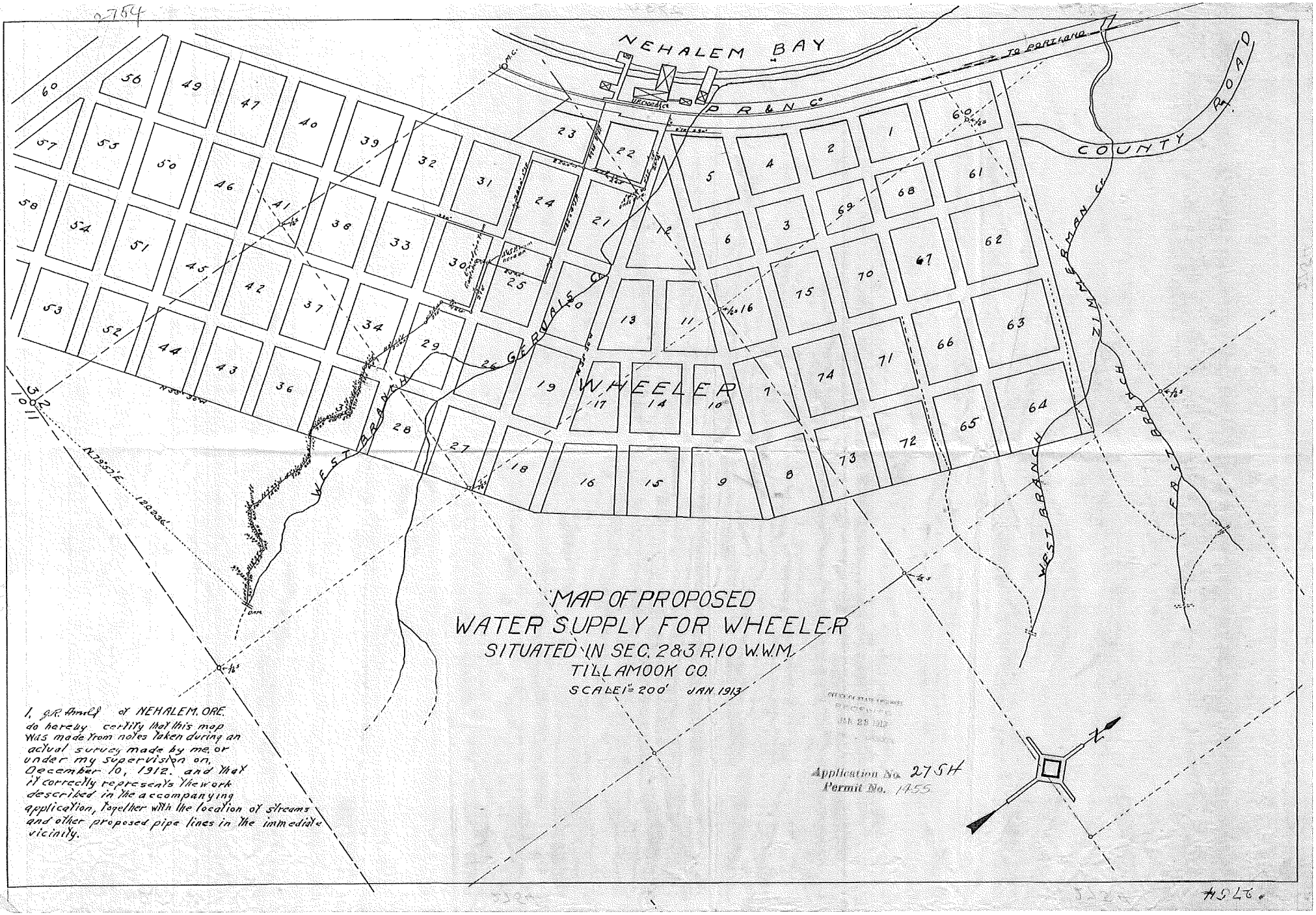
and shall thereafter be prosecuted with reasonable diligence and be completed on or before March 14, 1915

Complete application of the water to the proposed use shall be made on or before March 14, 1918

WITNESS my hand this 14th *day of* March, *19* 13

John H Lewis
State Engineer.

This form approved by the Board of Control March 11, 1909.



MAP OF PROPOSED WATER SUPPLY FOR WHEELER

SITUATED IN SEC. 28 & 33 R.10 W.W.M.
TILLAMOOK CO.
SCALE 1" = 200' JAN. 1913

I, G.R. Arnold of NEHALEM, ORE. do hereby certify that this map was made from notes taken during an actual survey made by me, or under my supervision on, December 10, 1912. and that it correctly represents the work described in the accompanying application, together with the location of streams and other proposed pipe lines in the immediate vicinity.

Permit—C-8770—900—5-27

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

This is to Certify, *That* CITY OF WHEELER

of Wheeler *, State of* Oregon *, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of* Jarvis Creek *a tributary of* Nehalem Bay *for the purpose of* Domestic and manufacturing *under Permit No.* 9558 *of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* March 14, 1950;

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.28 cubic foot per second.

The point of diversion is located in the NW¼SW¼ *of Section* 2 *, Township* 3N *, Range* 10W *, W. M. The use hereunder for irrigation shall conform to such reasonable rotation system as may be ordered by the proper state officer.*

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to one-eightieth of one cubic foot per second per acre, or its equivalent in case of rotation.

A description of the lands irrigated under the right hereby confirmed, and to which such right is appurtenant (if for irrigation or any other purpose), is as follows: Lot 5 (SW¼NW¼), Section 2, Township 3 North, Range 10 West, Willamette Meridian, in Tillamook County, Oregon.

The right to the use of the water for any purpose is restricted to the lands or place of use herein described.

After the expiration of fifty years from the date of this certificate or on the expiration of any federal power license issued in connection with this right, and after not less than two years notice in writing to the holder hereof, the State of Oregon, or any municipality thereof, shall have the right to take over the dams, plants and other structures and all appurtenances thereto which have been constructed for the purpose of devoting to beneficial use the water rights specified herein, upon condition that before taking possession the State or municipality shall pay not to exceed the fair value of the property so taken, plus such reasonable damages, if any, to valuable, serviceable and dependable property of the holder of this certificate, not taken over, as may be caused by the severance therefrom of the property taken in accordance with the provisions of section 5728, Oregon Laws.

WITNESS the signature of the State Engineer, affixed this 28th *day of* October *,* 1931

CHAS. E. STRICKLIN

State Engineer.

Recorded in State Record of Water Right Certificates, Volume 9 *, page* 9250

Permit No. 9558

CERTIFICATE NO. 9250

*APPLICATION FOR A PERMIT

To Appropriate the Public Waters of the State of Oregon

I, City of Wheeler Oregon
(Name of applicant)

of _____ (Postoffice), County of Tillamook,

State of Oregon, do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, subject to existing rights:

If the applicant is a corporation, give date and place of incorporation May 7, 1913 at Tillamook, Oregon

1. The source of the proposed appropriation is Jarvis Creek - Where it Forks
(Name of stream)
_____, a tributary of Nehalem Bay

2. The amount of water which the applicant intends to apply to beneficial use is .28 cubic feet per second. _____
(If water is to be used from more than one source, give quantity from each)

3. The use to which the water is to be applied is Domestic and manufacturing
(Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4. The point of diversion is located _____ ft. (N. or S.) and _____ ft. (E. or W.) from the corner of _____
(Section or subdivision)
S 31° - 37' W 1845.6 ft. to the SW corner of Section 2, T. 3 N., R. 10 W., W. M.
(If preferable, give distance and bearing to Sec. Cor.)
27 ?
(If there are more than one points of diversion, each must be described. Use separate sheet if necessary)
27 ?

being within the NW¼ of the SW¼ (Give smallest legal subdivision) of Sec. 2, Tp. 3 N (No. N. or S.), R. 10 W (No. E. or W.), W. M., in the county of Tillamook.

5. The pipe line (Main ditch, canal or pipe line) to be 1200 ft (No. miles or feet) in length, terminating in the Lot 5 ($SW\frac{1}{4}NW\frac{1}{4}$) (Smallest legal subdivision) of Sec. 2, Tp. 3 N (No. N. or S.), R. 10 W (No. E. or W.), W. M., the proposed location being shown throughout on the accompanying map. Place of use in City of Wheeler

6. The name of the ditch, canal or other works is _____

DESCRIPTION OF WORKS

DIVERSION WORKS—

7. (a) Height of dam 5 Ft. feet, le ngth on top 40 feet, length at bottom 40 feet; material to be used and charact er of construction _____
(Loose rock, concrete, masonry, rock and brush, timber crib, etc., wasteway over or around dam)
Timber crib

(b) Description of headgate _____
(Timber, concrete, etc., number and size of openings)

* A different form of application is provided where storage works are contemplated. These forms can be secured without charge, together with instructions, by addressing the State Engineer, Salem, Oregon.

CANAL SYSTEM OR PIPE LINE

8. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(b) At ..... miles from headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(c) Length of pipe, ... ft.; size at intake, ... in.; size at ..... ft. from intake ..... in.; size at place of use ..... in.; difference in elevation between intake and place of use, ... ft. Is grade uniform? ..... Estimated capacity, ... sec. ft.

FILL IN THE FOLLOWING INFORMATION WHERE THE WATER IS USED FOR IRRIGATION—

9. The land to be irrigated has a total area of ..... acres, located in each smallest legal subdivision, as follows: .....

Township	Range	Section	Forty-acre Tract	Number Acres to be Irrigated

(If more space required, attach separate sheet)

(a) Character of soil .....

(b) Kind of crops raised .....

POWER OR MINING PURPOSES—

10. (a) Total amount of power to be developed ..... theoretical horsepower.

(b) Quantity of water to be used for power ..... sec. ft.

(c) Total fall to be utilized ..... feet. (Head)

(d) The nature of the works by means of which the power is to be developed .....

.....

(e) Such works to be located in ..... of Sec. ....., (Legal subdivision)

Tp. ....., (No. N. or S.) *R. .....,* (No. E. or W.) *W. M.*

(f) Is water to be returned to any stream? ..... (Yes or No)

(g) If so, name stream and locate point of return .....

....., Sec. ....., Tp. ....., (No. N. or S.) *R. .....,* (No E. or W.) *W. M.*

(h) The use to which power is to be applied is .....

.....

(i) The nature of the mines to be served .....

.....

MUNICIPAL SUPPLY—

11. To supply the city of Wheeler

County, having a present population of 600

(Name of)

and an estimated population of 1000 *in 192* 40

(Answer questions 12, 13, 14, and 15 in all cases)

12. Estimated cost of proposed works, $ 760

13. Construction work will begin on or before June 1930

14. Construction work will be completed on or before Sept. 1930

15. The water will be completely applied to the proposed use on or before Sept. 1930

City of Wheeler
(Name of applicant)

J.L. Vosburg, Mayor

C. Wiebe, Recorder

Signed in the presence of us as witnesses:

(1) Chas. E. Stephens (Name), Wheeler, Oregon (Address of witness)

(2) N.H. Muhr (Name), " " (Address of witness)

Remarks: A small timber dam is to built with a 4" pipe line and a 50 ft. head, the length of the pipe to be 1300 ft.

STATE OF OREGON,
County of Marion, } *ss.*

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before , *192*

WITNESS my hand this day of , *192*

STATE ENGINEER

Application No. 13321

Permit No. 9558

PERMIT

TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

Division No. ..... *District No.* .....

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 14th *day of* March, *19*30 *at* 8:00 *o'clock* A. *M.*

Returned to applicant:

Corrected application received:

Approved:

April 21, 1930

Recorded in book No. 32 *of Permits on page* 9558

RHEA LUPER
STATE ENGINEER

1 p 5 b $10.00

STATE OF OREGON, } ss.
County of Marion, }

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 0.28 cubic feet per second, or its equivalent in case of rotation with other water users, from Jarvis Creek, tributary of Nehalem Bay for domestic and manufacturing purposes

The use to which this water is to be applied is Domestic and manufacturing purposes

If for irrigation, this appropriation shall be limited to ..... of one cubic foot per second or its equivalent for each acre irrigated and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is March 14, 1930

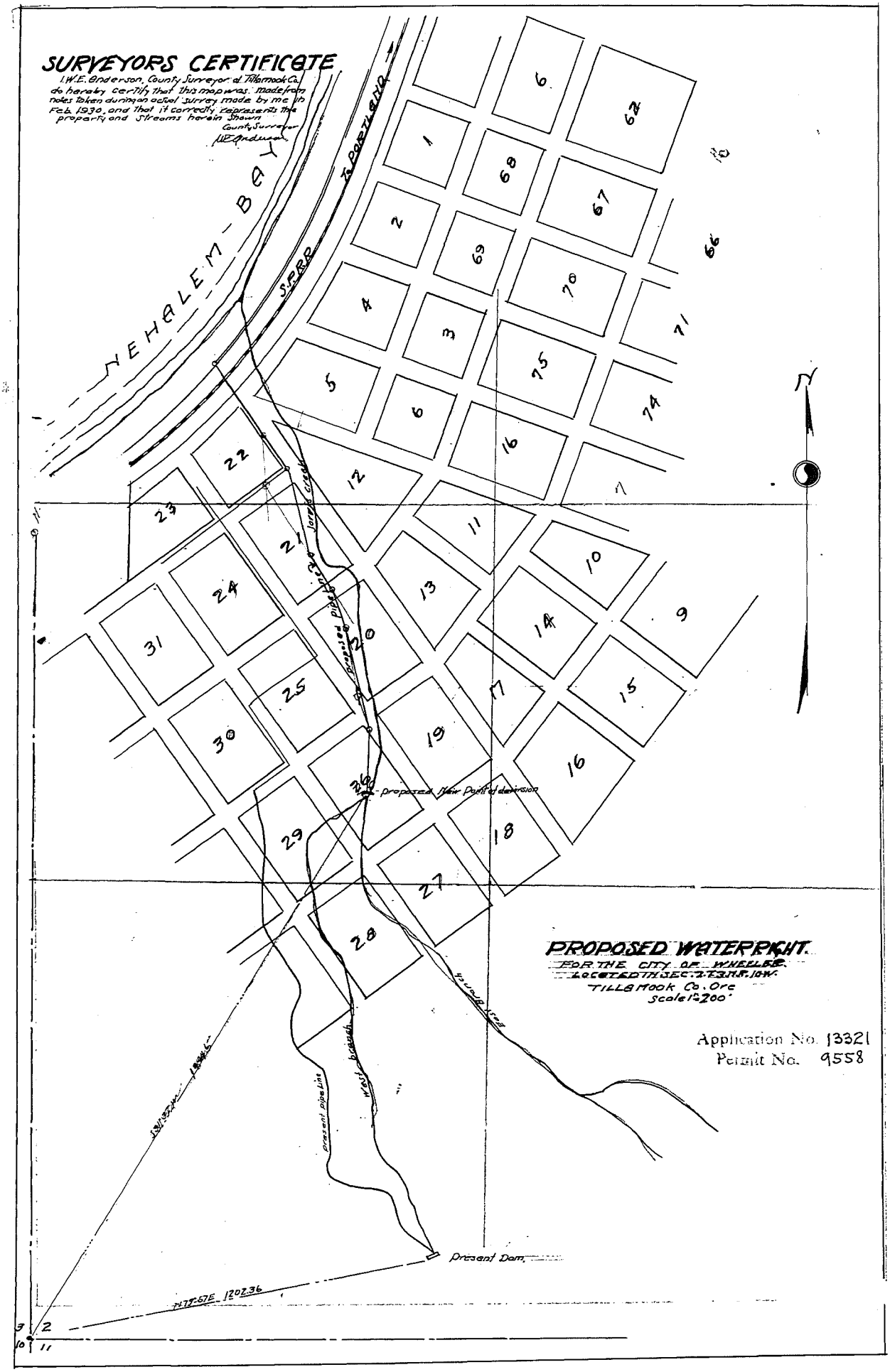
Actual construction work shall begin on or before April 21, 1931 and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 1932

Complete application of the water to the proposed use shall be made on or before October 1, 1933

WITNESS my hand this 21st day of April, 19*3*0

RHEA LUPER
STATE ENGINEER

Permits for power development are subject to the limitation of franchise as provided in section 5728, Oregon Laws, and the payment of annual fees as provided in section 5803, Oregon Laws.


SURVEYORS CERTIFICATE
I, W.E. Anderson, County Surveyor of Tillamook Co. do hereby certify that this map was made from notes taken during an actual survey made by me in Feb. 1930, and that it correctly represents the property and streams herein shown
County Surveyor
W.E. Anderson
NEHALEM BAY
S. FERR
To PORTLAND
Jones Creek
Present Pipe Line
West branch
Present Dam
PROPOSED WATER RIGHT
FOR THE CITY OF WHEELER
LOCATED IN SEC. 2 T.3 N. R.10 W.
TILLAMOOK Co. Ore
Scale 1"=200'
Application No. 13321
Permit No. 9558

RECEIVED
AUG 15 1974
STATE ENGINEER
SALEM, OREGON

Permit No. 39355

*APPLICATION FOR PERMIT

To Appropriate the Public Waters of the State of Oregon

I, City of Wheeler
(Name of applicant)

of P. O. Box 177, Wheeler, Oregon 97147
(Mailing address),

State of Oregon, do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, SUBJECT TO EXISTING RIGHTS:

If the applicant is a corporation, give date and place of incorporation June 4, 1913

1. The source of the proposed appropriation is Vosburg Creek (West Branch) ~~and City Holding Reservoir No. 1~~
(Name of stream), a tributary of Nehalem River and Bay

2. The amount of water which the applicant intends to apply to beneficial use is 4 cubic feet per second.
(If water is to be used from more than one source, give quantity from each)

**3. The use to which the water is to be applied is Municipal
(Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4. The point of diversion is located 1284 ft. S (N. or S.) and 800 ft. W (E. or W.) from the SW corner of Section 2, Township 2N, Range 10 West of W.M.
(Section or subdivision)

(If preferable, give distance and bearing to section corner)

(If there is more than one point of diversion, each must be described. Use separate sheet if necessary)

being within the NE¼ of the NE¼ (Give smallest legal subdivision) of Sec. 10, Tp. 2N (N. or S.), R. 10W (E. or W.), W. M., in the county of Tillamook

5. The Main pipeline (Main ditch, canal or pipe line) to be 3500 Ft. (Miles or feet) in length, terminating in the SW¼ of the SE¼ (Smallest legal subdivision) of Sec. 3, Tp. 2N (N. or S.), R. 10W (E. or W.), W. M., the proposed location being shown throughout on the accompanying map.

DESCRIPTION OF WORKS

Diversion Works—

6. (a) Height of dam ..... feet, length on top ..... feet, length at bottom ..... feet; material to be used and character of construction .....
(Loose rock, concrete, masonry, rock and brush, timber crib, etc., wasteway over or around dam)

(b) Description of headgate .....
(Timber, concrete, etc., number and size of openings)

(c) If water is to be pumped give general description .....
(Size and type of pump)

(Size and type of engine or motor to be used, total head water is to be lifted, etc.)

*A different form of application is provided where storage works are contemplated.

**Application for permits to appropriate water for the generation of electricity, with the exception of municipalities, must be made to the Hydroelectric Commission. Either of the above forms may be secured, without cost, together with instructions by addressing the State Engineer, Salem, Oregon.

Canal System or Pipe Line—

7. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(b) At ..... miles from headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(c) Length of pipe, ... ft.; size at intake, ... in.; size at ..... ft. from intake ..... in.; size at place of use ..... in.; difference in elevation between intake and place of use, ... ft. Is grade uniform? ..... Estimated capacity, ... sec. ft.

8. Location of area to be irrigated, or place of use .....

Township North or South	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
~~2N~~	~~10W~~	~~2~~	~~SW¼ and the NW¼~~	
~~2N~~	~~10W~~	~~3~~	~~SW¼ and the SE¼~~	
2N	10W	2	NW¼ NW¼ SW¼ NW¼	
2N	10W	2	NE¼ NW¼ SE¼ NW¼	
2N	10W	2	NW¼ SW¼ SW¼ SW¼	
2N	10W	2	NE¼ SW¼	
2N	10W	3	NW¼ SE¼ SW¼ SE¼	
2N	10W	3	NE¼ SE¼ SE¼ SE¼	
2N	10W	3	NW¼ SW¼ NE¼ SW¼	
2N	10W	10	NW¼ NE¼ NE¼ NE¼	

(If more space required, attach separate sheet)

(a) Character of soil .....

(b) Kind of crops raised .....

Power or Mining Purposes—

9. (a) Total amount of power to be developed ..... theoretical horsepower.

(b) Quantity of water to be used for power ..... sec. ft.

(c) Total fall to be utilized ..... (Head) feet.

(d) The nature of the works by means of which the power is to be developed .....

.....

(e) Such works to be located in ..... (Legal subdivision) of Sec. ....., Tp. ..... (No. N. or S.), R. ..... (No. E. or W.), W. M.

(f) Is water to be returned to any stream? ..... (Yes or No)

(g) If so, name stream and locate point of return .....

....., Sec. ....., Tp. ..... (No. N. or S.), R. ..... (No. E. or W.), W. M.

(h) The use to which power is to be applied is .....

(i) The nature of the mines to be served .....

39355

Municipal or Domestic Supply—

10. (a) To supply the city of Wheeler, Oregon

Tillamook (Name of) County, having a present population of 265

and an estimated population of 525 in 19 95

(b) If for domestic use state number of families to be supplied

(Answer questions 11, 12, 13, and 14 in all cases)

11. Estimated cost of proposed works, $

12. Construction work will begin on or before Has been started

13. Construction work will be completed on or before October 1, 1980

14. The water will be completely applied to the proposed use on or before October 1, 1981

Virgil L. Staben (Signature of applicant) Mayor

Zella C. Shenstone Recorder

Remarks:

STATE OF OREGON, } ss.
County of Marion, }

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for completion

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before December 9, 1974
February 14 75

WITNESS my hand this 9th day of October, 19 74
17th December 74

CHRIS L. WHEELER
STATE ENGINEER

By Wayne J. Overcash
ASSISTANT

RECEIVED
DEC 6 1974
STATE ENGINEER
SALEM, OREGON

RECEIVED
FEB 5 1975
STATE ENGINEER
SALEM, OREGON

39355

PERMIT

STATE OF OREGON, }
County of Marion, } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 4.0 cubic feet per second measured at the point of diversion from the stream, or its equivalent in case of rotation with other water users, from Vosburg Creek

The use to which this water is to be applied is municipal purposes

If for irrigation, this appropriation shall be limited to ..... of one cubic foot per second or its equivalent for each acre irrigated .....

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is August 15, 1974

Actual construction work shall begin on or before January 28, 1977 and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19 77
Extended to Oct. 1, 1982 Extended to October 1987 Extended to October 1, 1990 ; 10-1-95

Complete application of the water to the proposed use shall be made on or before October 1, 19 78
Extended to Oct. 1, 1982 Extended to October 1987 Extended to October 1, 1990 ; 10-1-95

WITNESS my hand this 28th day of January 19 76

James E. Sexton
WATER RESOURCES DIRECTOR STATE ENGINEER FH/B

EXT. BOD

Application No. 53321
Permit No. 39355

PERMIT
TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 15th day of August, 1974, at 11:15 o'clock A. M.

Returned to applicant:

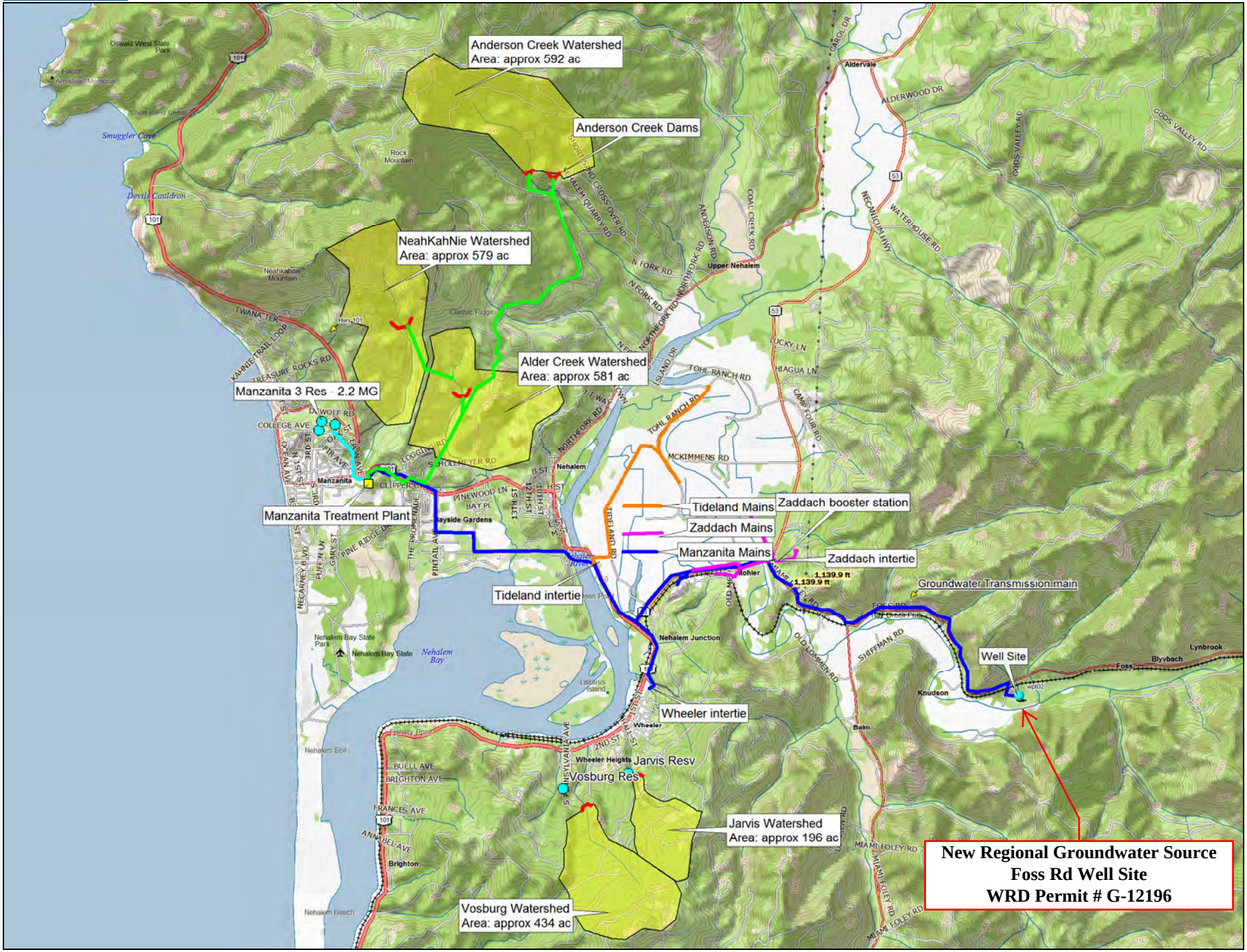
Approved:

Recorded in book No. ..... of Permits on page 39355

STATE ENGINEER

Drainage Basin No. 1 page 12H
Fees $30.00

State Printing 9137



TN

MN (16.8°E)

Scale 1 : 68,750

1" = 1.09 mi

Data Zoom 12-1

Appendix 3.2

Instream Water Rights

STATE OF OREGON

COUNTY OF TILLAMOOK

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

STATE OF OREGON
WATER RESOURCES DEPARTMENT
SALEM, OREGON 97310

confirms the right to use the waters of NEHALEM RIVER, a tributary of NEHALEM BAY, in the NORTH COAST BASIN to maintain an instream flow for the purpose of SUPPORTING AQUATIC LIFE.

The right is for flows to be maintained IN THE NEHALEM RIVER AND ITS TRIBUTARIES FROM THE CONFLUENCE OF COOK CREEK (SW 1/4, SECTION 35, T 3 N, R 9 W, W.M.) TO THE MOUTH OF THE NEHALEM RIVER.

The right is established under Oregon Revised Statutes 537.346.

The date of priority is MAY 9, 1973.

The right is limited to not more than the amounts during the time periods listed below:

Period	Flows (cubic feet per second)
OCT 1 - OCT 15	200
OCT 16- APR 30	270
MAY 1 - MAY 31	200
JUN 1 - JUN 30	150
JUL 1 - SEP 30	100

This instream water right shall not affect the use of water for human consumption, livestock consumption or the use of waters legally released from storage.

Witness the signature of the Water Resources Director affixed this 9th day of JUNE, 1989.

William N. Young
Water Resources Director

Recorded in State Record of Water Right Certificates number 59752.

MF36

STATE OF OREGON

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

Oregon Water Resources Department
158 12th Street NE
Salem, Oregon 97310

The specific limits for the use are listed below along with conditions of use.

Source: PETERSON CREEK tributary to NEHALEM RIVER

County: TILLAMOOK

Purpose: Providing required stream flows for migration, spawning, egg incubation, fry emergence, and juvenile rearing of chum and coho salmon, winter steelhead, and sea-run cutthroat trout.

To be maintained in:

PETERSON CREEK FROM THE HEADWATERS AT RIVER MILE 2.0 (SWSE, SECTION 28, TOWNSHIP 3N, RANGE 9W WM); TO THE MOUTH AT RIVER MILE 0.0 (NWNE, SECTION 5, TOWNSHIP 2N, RANGE 9W WM)

The right is established under Oregon Revised Statutes 537.341.

The date of priority is 11/30/1990.

The following conditions apply to the use of water under this certificate:

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
12.2	10.8	8.51	4.05	1.45	1.13	0.52	0.23	0.18	0.45	5.98	10.9

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water right reporting of the Water Resources Commission.

3. For the purposes of water distribution, this instream right shall not have priority over human or livestock consumption.

4. The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum perennial stream flow.

5. The flows are to be measured at the lower end of the stream reach to protect necessary flows throughout the reach.

Witness the signature of the Water Resources Director, affixed AUGUST 20, 1996.

Martha O. Pagel

Recorded in State Record of Water Right Certificate number 72503.

IS70958

Appendix 3.3

Well Logs

RECEIVED

AUG 20 1996

WATER RESOURCES DEPT.
SALEM, OREGON

Till 50077 Pg 1 of 2

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01907

(START CARD) # 90000

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number #2
Name CITY OF WHEELER
Address P.O. BOX 177
City WHEELER State OR Zip 97147

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.
Explosives used [ ] Yes [X] No Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
18	0	8				
16	8	63				
			NEAT CEMENT	33.5	0	42 SACKS

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from 33.5 ft. to 35 ft. Material BENT. CHIPS & SAND
Gravel placed from 35 ft. to 63 ft. Size of gravel PEA ROCK

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3	45	.250	X		X	
	12	60	63	.250	X		X	
Liner:								

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[X] Screens Type JOHNSON V-WIRE Material SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
45	60	100		12p/s		X	

(8) WELL TESTS: Minimum testing time is 1 hour
[X] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
1025	3.5		24 HOUR

Temperature of water 49° Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County TILLAMOOK Latitude _____ Longitude _____
Township 2N N or S Range 4W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address)
22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:
14 ft. below land surface. Date 7-28-96
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found 16'

From	To	Estimated Flow Rate	SWL
16	32.5	< 15 GPM	14
32.5	44.5	< 100 GPM	14
44.5	63	> 400 GPM	14

(12) WELL LOG:
Ground Elevation _____

Material	From	To	SWL
SAND GREY LOOSE FLOOD DEPOSIT	0	2	
SAND GREY SILTY	2	7	
SAND & GRAVEL SILTY	7	9	
SAND & GRAVEL LESS SILT	9	16	
GRAVEL GREY BRN RED W/SILT	16		
BROWN		19	
GRAVEL & SAND SOME COBBLES	19	26	
GREY BRN 2" MINUS PACKED	26		
GRAVEL BROWN SILTY		30	
GRAVEL COURSE BRN 8" MINUS	30		
SOME SILT SOME SAND		32.5	
GRAVEL RED BRN SEMI CLEAN	32.5	44.5	
GRAVEL GREY BRN 6" MINUS	44.5		
CLEAN LOOSE SOME SAND		50.5	
GRAVEL GREY COURSE 10"	50.5		
MINUS CLEAN LOOSE SOME SAND		58.5	
GRAVEL GREY COURSE TRACE OF	58.5		
SILT		59.0	
GRAVEL GREY COURSE 10" MINUS	59.0		
SEMI LOOSE MORE SAND		63.0	

Date started 7-1-96 Completed 7-25-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1487
Signed _____ Date 7-29-96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 688
Signed Steven N. Stadel Date 7-29-96

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

RECEIVED Till 50077 Pg 2 of 2

AUG 20 1996

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01907

(START CARD) # 90000

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name CITY OF WHEELER

Address P.O. BOX 177

City WHEELER State OR Zip 97147

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:

[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger

[ ] Other

(4) PROPOSED USE:

[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation

[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.

Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E

[ ] Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

[ ] Perforations Method

[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water Depth Artesian Flow Found

Was a water analysis done? [ ] Yes By whom

Did any strata contain water not suitable for intended use? [ ] Too little

[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County TILLAMOOK Latitude Longitude

Township 2N N or S Range 4W E or W. WM.

Section 5 1/4 1/4

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:

ft. below land surface. Date

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation

Material	From	To	SWL
ROCK BROKEN WEATHERED BLUE	63		
GREY		?	

Date started 7-1-96 Completed 7-25-96

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1487

Signed Date 7-29-96

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 688

Signed Steven N. Stadeli Date 7-29-96

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

RECEIVED AUG 20 1996 WATER RESOURCES DEPT. SALEM, OREGON

Till
50076

STATE OF OREGON
WATER SUPPLY WELL REPORT WELL I.D.# L01906
(as required by ORS 537.765)
Instructions for completing this report are on the next page of this form.

(START CARD) # 89998

(1) OWNER: Well Number 1
Name CITY OF WHEELER
Address P.O. BOX 177
City WHEELER State OR Zip 97147

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.
Explosives used [ ] Yes [X] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
18	0	8				
16	8	63				
			NEAT CEMENT	33.5	0	59 SACKS

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from 33.5 ft. to 35 ft. Material SAND & BENT. CHIPS
Gravel placed from 35 ft. to 55 ft. Size of gravel PEA ROCK

(6) CASING/LINER: 55 63 DRAIN ROCK

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3	43	.250	X		X	
	12	50	55		X		X	
Liner:								

Final location of shoe(s) NONE

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[X] Screens Type JOHNSON V-WIRE Material SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
43	53	100		12" p/s		X	

(8) WELL TESTS: Minimum testing time is 1 hour

[X] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
1012	3.5		24

Temperature of water 49 Depth Artesian Flow Found ____
Was a water analysis done? [X] Yes By whom AGT TECHNOLOGIES
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ____
Depth of strata: ____

(9) LOCATION OF WELL by legal description:
County TILLAMOOK Latitude ____ Longitude ____
Township 2N N or S Range 9W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:
14 ft. below land surface. Date 7-24-96
Artesian pressure 0 lb. per square inch. Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 9'

From	To	Estimated Flow Rate	SWL
9	16	15	
16	23	50	14
42.5	50	500	14

(12) WELL LOG:
Ground Elevation ____

Material	From	To	SWL
SAND GREY LOOSE (overbank dep)	0	2	
SAND GREY SILTY	2	9	
SAND & GRAVEL MED SILTY	9	11	
SAND & GARVEL COURSE SILTY	11	16	
SAND GRAVEL COBBLES 10"MINUS	16		
BRN LOOSE (semi clean)		23	
COBBLES SAND & GRAVEL 10"	23		
MINUS PACKED BRN SOME SILT	BRN	27	
SILT BROWN GRAVELY	27	28	
SAND & GRAVEL SILTY BRN 5"	28		
MINUS SOME COBBLES		31	
GRAVEL BRN COURSE TO FINE	31		
SOME SAND SEMI LOOSE		32.5	
SAND GRAVEL COBBLES 10"	32.5		
MINUS PACKED BRN		34.5	
GRAVEL & COBBLES 8" MINUS	34.5		
BROWN LESS SAND		39	
SAND GRAVEL COBBLES BRN 8"	39		
MINUS MORE SAND SEMI TIGHT		42.5	

Date started 6-21-96 Completed 7-24-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1487
Signed ____ Date 7-29-96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 688
Signed Steven N. Stahl Date 7-29-96

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WATER RESOURCES DEPT.

SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01906

(START CARD) # 89998

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name CITY OF WHEELER

Address P.O. BOX 177

City WHEELER State OR Zip 97147

(2) TYPE OF WORK

[XX] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:

[ ] Rotary Air [ ] Rotary Mud [XX] Cable [ ] Auger

[ ] Other

(4) PROPOSED USE:

[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation

[ ] Thermal [ ] Injection [ ] Livestock [XX] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [ ] No Depth of Completed Well ____ ft.

Explosives used [ ] Yes [ ] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E

[ ] Other

Backfill placed from ____ ft. to ____ ft. Material ____

Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

[ ] Perforations Method

[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water ____ Depth Artesian Flow Found ____

Was a water analysis done? [ ] Yes By whom ____

Did any strata contain water not suitable for intended use? [ ] Too little

[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ____

Depth of strata: ____

(9) LOCATION OF WELL by legal description:

County TILLAMOOK Latitude ____ Longitude ____

Township 2N N or S Range 9W E or W. WM.

Section 5 ____ 1/4 ____ 1/4

Tax Lot ____ Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) ____

22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:

____ ft. below land surface. Date ____

Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:

Depth at which water was first found ____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation ____

Material	From	To	SWL
GRAVEL, GREY 6" MINUS CLEAN	42.5		
SOME SAND		50	
GRAVEL, 8" MINUS BRN SANDY	50		
PACKED		54	
SILT BROWN GRAVELY	54	55	
GRAVEL, BRN SILTY 6" MINUS	55	59.5	
BED ROCK BLUE GREY SOFT	50.5		
BROKEN WEATHERED		63	

Date started 6-21-96 Completed 7-24-96

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1487

Signed ____ Date 7-29-96

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 688

Signed Steven N. Studeli Date 7-29-96

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TILL 51052

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D. # L 01906
START CARD # W143371

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Well Number 1
Name City of Wheeler
Address PO Box 177
City Wheeler State OR Zip 97147

(2) TYPE OF WORK
☐ New Well ☐ Deepening ☒ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other NA

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☒ Other Municipal

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 63 ft.
Explosives used ☐ Yes ☐ No Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method ☐A ☐B ☐C ☐D ☐E
☐ Other _____
Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☐ None
Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS: Not Changed
☐ Perforations Method _____
☐ Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
		Not Changed				☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
	NA		

Temperature of water _____ Depth Artesian Flow Found _____
Was a water analysis done? ☐ Yes By whom _____
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other _____
Depth of strata: _____

(9) LOCATION OF WELL by legal description:
County Tillamook Latitude _____ Longitude _____
Township 2N N or S Range 9W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) 22095 Foss Rd Wheeler, OR

(10) STATIC WATER LEVEL:
16.6 ft. below land surface. 16'9" Date _____
Artesian pressure _____ lb. per square inch Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found NA

From	To	Estimated Flow Rate	SWL
	NA		

(12) WELL LOG:
Ground Elevation _____

Material	From	To	SWL
*			
Installed a 12x6 pitless			
unit on the 12" well casing			
Removed 7' of 12" casing.			
Added 7' combined length			
of 14" Barrol & pitless			
unit.			
Top of casing remains the			
same above ground.			
Placed 3/8" hole plug			
around casing as excavated			
Hole was backfilled			
(12 ea 50lb bags)			

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SALEM, OREGON

Date started 7-19-02 Completed 8-23-02

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1578
Signed _____ Date 9-17-02

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 673
Signed Thomas C. Schweder Date 9/17/02

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WATER RESOURCES DEPT.
SALEM, OREGON

Till 50077 Pg 1 of 2

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01907

(START CARD) # 90000

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number #2
Name CITY OF WHEELER
Address P.O. BOX 177
City WHEELER State OR Zip 97147

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.
Explosives used [ ] Yes [X] No Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
18	0	8				
16	8	63				
			NEAT CEMENT	33.5	0	42 SACKS

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from 33.5 ft. to 35 ft. Material BENT. CHIPS & SAND
Gravel placed from 35 ft. to 63 ft. Size of gravel PEA ROCK

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3	45	.250	X		X	
	12	60	63	.250	X		X	
Liner:								

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[X] Screens Type JOHNSON V-WIRE Material SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
45	60	100		12p/s		X	

(8) WELL TESTS: Minimum testing time is 1 hour
[X] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
1025	3.5		24 HOUR

Temperature of water 49° Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County TILLAMOOK Latitude _____ Longitude _____
Township 2N N or S Range 4W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address)
22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:
14 ft. below land surface. Date 7-28-96
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found 16'

From	To	Estimated Flow Rate	SWL
16	32.5	< 15 GPM	14
32.5	44.5	< 100 GPM	14
44.5	63	> 400 GPM	14

(12) WELL LOG:
Ground Elevation _____

Material	From	To	SWL
SAND GREY LOOSE FLOOD DEPOSIT	0	2	
SAND GREY SILTY	2	7	
SAND & GRAVEL SILTY	7	9	
SAND & GRAVEL LESS SILT	9	16	
GRAVEL GREY BRN RED W/SILT	16		
BROWN		19	
GRAVEL & SAND SOME COBBLES	19	26	
GREY BRN 2" MINUS PACKED	26		
GRAVEL BROWN SILTY		30	
GRAVEL COURSE BRN 8" MINUS	30		
SOME SILT SOME SAND		32.5	
GRAVEL RED BRN SEMI CLEAN	32.5	44.5	
GRAVEL GREY BRN 6" MINUS	44.5		
CLEAN LOOSE SOME SAND		50.5	
GRAVEL GREY COURSE 10"	50.5		
MINUS CLEAN LOOSE SOME SAND		58.5	
GRAVEL GREY COURSE TRACE OF	58.5		
SILT		59.0	
GRAVEL GREY COURSE 10" MINUS	59.0		
SEMI LOOSE MORE SAND		63.0	

Date started 7-1-96 Completed 7-25-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1487
Signed _____ Date 7-29-96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 688
Signed Steven N. Stadel Date 7-29-96

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WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01907

(START CARD) # 90000

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name CITY OF WHEELER

Address P.O. BOX 177

City WHEELER State OR Zip 97147

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:

[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger

[ ] Other

(4) PROPOSED USE:

[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation

[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.

Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E

[ ] Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

[ ] Perforations Method

[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water Depth Artesian Flow Found

Was a water analysis done? [ ] Yes By whom

Did any strata contain water not suitable for intended use? [ ] Too little

[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County TILLAMOOK Latitude Longitude

Township 2N N or S Range 4W E or W. WM.

Section 5 1/4 1/4

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:

ft. below land surface. Date

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation

Material	From	To	SWL
ROCK BROKEN WEATHERED BLUE	63		
GREY		?	

Date started 7-1-96 Completed 7-25-96

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1487

Signed Date 7-29-96

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 688

Signed Steven N. Stadeli Date 7-29-96

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Till
50076

STATE OF OREGON
WATER SUPPLY WELL REPORT WELL I.D.# L01906
(as required by ORS 537.765)
Instructions for completing this report are on the next page of this form.

(START CARD) # 89998

(1) OWNER: Well Number 1
Name CITY OF WHEELER
Address P.O. BOX 177
City WHEELER State OR Zip 97147

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [X] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [X] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 63 ft.
Explosives used [ ] Yes [X] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
18	0	8				
16	8	63				
			NEAT CEMENT	33.5	0	59 SACKS

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from 33.5 ft. to 35 ft. Material SAND & BENT. CHIPS
Gravel placed from 35 ft. to 55 ft. Size of gravel PEA ROCK

(6) CASING/LINER: 55 63 DRAIN ROCK

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3	43	.250	X		X	
	12	50	55		X		X	
Liner:								

Final location of shoe(s) NONE

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[X] Screens Type JOHNSON V-WIRE Material SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
43	53	100		12" p/s		X	

(8) WELL TESTS: Minimum testing time is 1 hour

[X] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
1012	3.5		24

Temperature of water 49 Depth Artesian Flow Found ____
Was a water analysis done? [X] Yes By whom AGT TECHNOLOGIES
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ____
Depth of strata: ____

(9) LOCATION OF WELL by legal description:
County TILLAMOOK Latitude ____ Longitude ____
Township 2N N or S Range 9W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:
14 ft. below land surface. Date 7-24-96
Artesian pressure 0 lb. per square inch. Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 9'

From	To	Estimated Flow Rate	SWL
9	16	15	
16	23	50	14
42.5	50	500	14

(12) WELL LOG:
Ground Elevation ____

Material	From	To	SWL
SAND GREY LOOSE (overbank dep)	0	2	
SAND GREY SILTY	2	9	
SAND & GRAVEL MED SILTY	9	11	
SAND & GARVEL COURSE SILTY	11	16	
SAND GRAVEL COBBLES 10"MINUS	16		
BRN LOOSE (semi clean)		23	
COBBLES SAND & GRAVEL 10"	23		
MINUS PACKED BRN SOME SILT	BRN	27	
SILT BROWN GRAVELY	27	28	
SAND & GRAVEL SILTY BRN 5"	28		
MINUS SOME COBBLES		31	
GRAVEL BRN COURSE TO FINE	31		
SOME SAND SEMI LOOSE		32.5	
SAND GRAVEL COBBLES 10"	32.5		
MINUS PACKED BRN		34.5	
GRAVEL & COBBLES 8" MINUS	34.5		
BROWN LESS SAND		39	
SAND GRAVEL COBBLES BRN 8"	39		
MINUS MORE SAND SEMI TIGHT		42.5	

Date started 6-21-96 Completed 7-24-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1487
Signed ____ Date 7-29-96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 688
Signed Steven N. Stahl Date 7-29-96

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WATER RESOURCES DEPT.

SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D.# L01906

(START CARD) # 89998

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name CITY OF WHEELER

Address P.O. BOX 177

City WHEELER State OR Zip 97147

(2) TYPE OF WORK

[XX] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:

[ ] Rotary Air [ ] Rotary Mud [XX] Cable [ ] Auger

[ ] Other

(4) PROPOSED USE:

[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation

[ ] Thermal [ ] Injection [ ] Livestock [XX] Other MUNICIPAL

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [ ] No Depth of Completed Well ____ ft.

Explosives used [ ] Yes [ ] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E

[ ] Other

Backfill placed from ____ ft. to ____ ft. Material ____

Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

[ ] Perforations Method

[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of water ____ Depth Artesian Flow Found ____

Was a water analysis done? [ ] Yes By whom ____

Did any strata contain water not suitable for intended use? [ ] Too little

[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ____

Depth of strata: ____

(9) LOCATION OF WELL by legal description:

County TILLAMOOK Latitude ____ Longitude ____

Township 2N N or S Range 9W E or W. WM.

Section 5 ____ 1/4 ____ 1/4

Tax Lot ____ Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) ____

22095 FOSS RD., WHEELER, OR

(10) STATIC WATER LEVEL:

____ ft. below land surface. Date ____

Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:

Depth at which water was first found ____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:

Ground Elevation ____

Material	From	To	SWL
GRAVEL, GREY 6" MINUS CLEAN	42.5		
SOME SAND		50	
GRAVEL, 8" MINUS BRN SANDY	50		
PACKED		54	
SILT BROWN GRAVELY	54	55	
GRAVEL, BRN SILTY 6" MINUS	55	59.5	
BED ROCK BLUE GREY SOFT	50.5		
BROKEN WEATHERED		63	

Date started 6-21-96 Completed 7-24-96

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1487

Signed ____ Date 7-29-96

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 688

Signed Steven N. Studeli Date 7-29-96

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

TILL 51052

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D. # L 01906
START CARD # W143371

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Well Number 1
Name City of Wheeler
Address PO Box 177
City Wheeler State OR Zip 97147

(2) TYPE OF WORK
☐ New Well ☐ Deepening ☒ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other NA

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☒ Other Municipal

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 63 ft.
Explosives used ☐ Yes ☐ No Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds

How was seal placed: Method ☐A ☐B ☐C ☐D ☐E
☐ Other _____
Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☐ None
Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS: Not Changed
☐ Perforations Method _____
☐ Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
		Not Changed				☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
	NA		

Temperature of water _____ Depth Artesian Flow Found _____
Was a water analysis done? ☐ Yes By whom _____
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other _____
Depth of strata: _____

(9) LOCATION OF WELL by legal description:
County Tillamook Latitude _____ Longitude _____
Township 2N N or S Range 9W E or W. WM.
Section 5 NE 1/4 NW 1/4
Tax Lot 200 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) 22095 Foss Rd Wheeler, OR

(10) STATIC WATER LEVEL:
16.6 ft. below land surface. 16'9" Date _____
Artesian pressure _____ lb. per square inch Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found NA

From	To	Estimated Flow Rate	SWL
	NA		

(12) WELL LOG:
Ground Elevation _____

Material	From	To	SWL
*			
Installed a 12x6 pitless			
unit on the 12" well casing			
Removed 7' of 12" casing.			
Added 7' combined length			
of 14" Barrol & pitless			
unit.			
Top of casing remains the			
same above ground.			
Placed 3/8" hole plug			
around casing as excavated			
Hole was backfilled			
(12 ea 50lb bags)			

RECEIVED
SEP 23 2002
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 7-19-02 Completed 8-23-02

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1578
Signed _____ Date 9-17-02

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 673
Signed Thomas C. Schweder Date 9/17/02

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

2002-22

Appendix 3.4

City of Wheeler Public Works:

Hydrant Data

Valve Data

City of Wheeler
Hydrant Master List
2014

Hyd. No.	Location	Zone	Make	Year/manu	valved	PSI
H1	N 1st/ridgeview	lower	mueller	1973	yes	
H2	ridgeview pl.	lower	waterous	1999	yes	150
H3	hemlock/1st	lower	clow	2003	yes	250
H4	hemlock/4th	upper	waterous	1988	yes	150
H5	spruce/5th	upper	waterous	1988	yes	150
H6	spruce/4th	upper	clow	2002	yes	250
H7	spruce/3rd	lower	clow	2003	yes	250
H8	spruce/1st	lower	clow	2002	yes	250
H9	marine/hemlock	lower	clow	2003	yes	250
H10	marine/darts	lower	clow	2003	yes	250
H11	marine/tsunami	lower	clow	2003	yes	250
H12	3rd/pine	upper	waterous		yes	150
H13	Fir	upper	kennedy	1995	yes	150
H14	3rd/gregory	upper	kennedy	1971	yes	150
H15	3rd/alder	upper	waterous	1974	no	150
H16	4th/alder	upper	waterous		no	150
H17	2nd/rowe	upper	MH	1945	yes	150
H18	top of hospital	upper	waterous	1993	yes	150
H19	3rd/rowe	upper	clow	2003	yes	250
H20	behind/cc	upper	waterous	1991	yes	150
H21	winkler/dubois	upper	waterous	1992	yes	150
H22	4th/winkler	upper	waterous	1991	yes	150
H23	dubois/oatman	upper	waterous	1992	yes	150
H24	1st/penn	lower	waterous	1974	?	150
H25	2nd/penn	lower	waterous	1974	?	150
H26	para/upper	lower	waterous	1994	yes	150
H27	para/lower	lower	waterous	1989	yes	150
H28	101/dubois	lower	clow	2003	yes	250
H29	101/gamble	lower	kennedy	1971	?	150
H30	101/nettles	lower	clow	2002	yes	250
H31	hospital/akin	lower	clow	2002	yes	250
H32	101/akin	lower	clow	2003	yes	250
H33	101/hall	lower	clow	2003	yes	250
H34	2nd/hall	lower	clow	2003	yes	250
H35	2nd/gregory	lower	kennedy	1972	yes	150
H36	101/rorvik	lower	clow	2003	yes	250
H37	101/rector	lower	clow	2003	yes	250
H38	1st/rector	lower	clow	2003	yes	250
H39	101/spruce	lower	clow	2002	yes	250

Master Valve inventory List]
2014

	A	B	C	D	E	F	G	H	I	J	K	L
1	**valve #**	**location**	**zone**	**isolates**	**valve site**	**type**	**size/inch**	**op nut**	**normal position**	**opens**	**# of turns**	**remarks**
2	V1	Ridgeview/1st	lower	main flow/wheeler side	meter station cab.	wheel/gate	8	stan.	open	counter	24	needs paint
3	V2	Ridgeview/1st	lower		meter station cab.	elctromagnetic	8	stan.	open	counter		needs paint
4	V3	North 1st	lower		grass/lift sta. North	gate	8	stan.	open	counter	24	
5	HV1	North 1st	lower	hydrant@ n. 1st	grass/lift sta. North	gate	6	stan.	open	counter	16	
6	V4	North 1st	lower	ridgeview project	pave/lift sta. north	gate	6	stan.	open	counter	18	
7	V5	N 1st/ridgeview	lower	old valve /ridgeview	gravel/west side 1st	gate	6	stan.	open	counter	18	
8	Hv2	ridgeview place	lower	hydrant@ridgeview pl.	grass	gate	6	stan.	open			valve can broken/ full of material
9	V6	N 1st/ridgeview	lower	not sure		gate	6	stan.	closed	counter	18	closed/ investigate ???
10	V7	1st/hemlock	lower	not sure	pave/ intersection	gate	8	stan.	open	counter	24	operates
11	HV3	1st off hemlock	lower	hydrant@ n.1st/hemlock	pave south of intersecti	gate	6	stan.	open	counter		
12	V8	4th/Hemlock	upper	lower Hemlock from 4th down	pave/	gate	?	stan.	open	counter	19	operates
13	V9	4th/Hemlock	upper	4th from Hemlock	pave/	gate	6	stan.	open	counter	18.5	operates
14	V10	4th/Hemlock	upper	upper Hemlock to 5th st	pave	gate	6	stan.	open	counter	18.5	operates
15	V11	4th st south of Hemlock	upper	?	grave shoulder east	gate	6	stan.	open	counter	18.5	
16	HV4	4th st south of Hemlock	upper	hydrant@ 4th/Hemlock	gravel/west side 4th	gate	6	stan.	open	counter	19	operates
17	V12	top of Hemlock	upper	top of Hemlock to 5th	pave/n shoulder	gate	4	stan.	open	counter	13	operates
18	V13	5th/top of Spruce	upper	5th to Hemlock	pave intersection	gate	4	stan.	open	counter	13.5	operates
19	V14	5th/top of Spruce	upper	upper Spruce 5th to 4th	pave intersection	gate	6	stan.	open	counter	19	operates
20	V15	5th/top of Spruce	upper	5th fromSpruce to Cedar	pave/intersection	gate	4	stan.	open		13.5	full of silt/not operational
21	HV5	5th/top of Spruce	upper	hydrant@5th/Spruce	grass shoulder n side S	gate	6	stan.	open	counter	19	operates
22	HV6	4th/ Spruce	upper	hydrant@4th/Spruce								
23	V16	4th/spruce	upper		pave	gate	6-Jan	stan.	open	counter	19	needs cleaned
24	V17	4th/spruce	upper		pave	gate	6	stan.	open	counter	19	needs cleaned
25	HV7	3rd/spruce	upper	hydrant@3rd/spruce								
26	V18	3rd/spruce	lower	end of line	pave	gate	6	stan.	1			
27	V19	3rd/spruce	lower	does not operate	pave/SE side of inter	gate	4				0	
28	V20	3rd/off Spruce	upper	top of spruce 3rd to 4th	dan ayers yard	gate	4	stan.	open	counter	18	
29	V21	1st/spruce	lower	spruce between1st/3rd	pavement/east in set	gate	8	stan.	open	counter	24	
30	V22	1st/spruce	lower	1st between hemlock/spruce	pave/north in set	gate	8	stan.	open	counter	24	
31	V23	1st/spruce	lower	1st between/rector/spruce	pave/south in set	gate	8	stan.	open	counter	24	
32	HV8	1st/spruce	lower	hydrant@1st/spruce	pave/adjacent	gate	6	stan.	open	counter	24	
33	V24	3rd/hemlock										
34	HV9	hemlock/marine dr	lower	hydrant@hemlock/marine dr	gravel /adjacent	gate	6	stan.	open	counter	18.5	
35	HV10	Marine dr at Darts	lower	Hydrant@marine dr/darts	pave/adjacent	gate	6	stan.	open	counter	18.5	
36	HV11	marine dr at Tsunami	lower	hydrant@marine dr/tsunami	pave/adjacent	gate	6	stan.	open	counter	18.5	
37	V25	marine dr at WFP	lower	marine dr/ Rector to spruce	gravel/ east side	gate	8	stan.	open	counter	24	
38	V26	marine drive at WFP	lower	marine/ rector so. On marine dr	gravel/ west side	gate	8	stan.	open	counter	24	
39	HV12	Pine/3rd		hydrant@Pine/3rd								
40	HV13	Fir str.	upper	hydrant@ Fir								
41	V27	331 pine str.	upper	Pine str to 2nd	3rd and pine	gate	8	stan.	open	counter	24	
42	V28	3rd/rector	upper	3rd str/ rector to fir st.	grass top of hill 3rd str.	gate	8	stan.	open	counter	26	
43	HV14	3rd/Gregory		hydrant@3rd str/Gregory								

Master Valve inventory List]
2014

	A	B	C	D	E	F	G	H	I	J	K	L
44	V29	3rd/ Fir str.	upper							counter	26	
45	V30	Fir str.	upper			gate	6	s	open	counter	18	
46	V31	Gregory/ 2nd	lower	2nd to Pine		gate	8	s	open	counter	24	
47	HV15	3rd/Alder		hydrant@3rd/Alder								
48	HV16	4th/Alder		hydrant@4th/Alder								
49	V32	Gregory/ 2nd	lower	2nd to Fir str.		gate	4	s	open	counter	18	
50	V33	Gregory/ 1st	lower									
51	V34	4th / Alder	upper									
52	V35	Hall str.	lower	3rd str/ from Hall to Fir	pave	gate	8					
53	V36	Upper Park	upper	upper park to Rowe str.	grass	g/blow off	2	stan.	closed	c	20	
54	V37	Top of alder	upper	blow off at top/so side	gravel/ so side of alder	g/blow off	2	stan	closed			
55	HV17	2nd / Rowe	upper	hydrant@2nd/Rowe	gravel on 2nd	gate	6	stan	open	counter		
56	HV18	top of Hospital	upper	hydrant@ hospital top	gravel on 2nd	gate	6					
57	V38	top of Hospital	upper	wm/to clinic	flower bed	gate	2					
58	V39	3rd/ Rowe	upper	3rd str towards hall to 101	pave							
59	V40	3rd/ Rowe	upper	Rowe str from 3rd to reservoir	pave	gate	8	stan	open	counter		
60	V41	3rd/ Rowe	upper	3rd str. towards Vosburg	pave	gate	8	stan	open	counter		
61	HV19	3rd /Rowe	upper	hydrant@3rd/Rowe	pave	gate	6	stan	open	counter		
62	V42	top of 3rd/so of Rowe	upper	units across from clinic	pave	gate	4	stan	open	counter		
63	V43	top of Akin/3rd	upper	west side of 3rd in grass	grass	gate						
64	V44	top of Akin/3rd	upper		grass	gate	8	stan	o			
65	HV20	End of 3rd behind CC	upper	Hydrant@3rd/behindCC								
66	V45	top of Akin/3rd	upper									
67	V46	3rd behind care center	upper	20 yds deep in grassy lane	grass	gate	8	stan	open	counter		
68	V47	4th str so. Of Vosburg	upper	se corner of dill property	grass	gate	8	stan	open	counter		
69	V48	4th str so. Of Vosburg	upper	se corner of dill property	grass	g/blow off	2					
70	HV21	Winkler/Dubois	upper	hydrant@winkler/Dubois								
71	HV22	4th/ Winkler	upper	hydrant@4th/Winkler								
72	V49	Dubois/Oatman	lower									
73	HV23	Dubois/Oatman		hydrant@dubois /Oatmant								
74	V50	Penn/Bayview										
75	HV24	Penn/Bayview		hydrant@Penn/Bayview		gate	6					
76	HV25	Penn/2nd	lower	hydrant@Penn/2nd	grass	gate	4	stan	open	counter		
77	V51	Penn/2nd										
78	V52	1st/Oregon				g/blow off	2					
79	V53	top of Penn		Penn down to 2nd	gravel in road	gate	?					
80	HV26	paradise cove upper		hydrant@paracove/upper								
81	HV27	parsdise cove lower		hydrant@paracove/lower								
82	V54	101/Penn	lower	101\from Penn to Dichter	pave/east	gate	8	stan	open	counter		
83	V55	101/Penn	lower	Penn /up to bayview	pave/west	gate	8	stan	open	counter		
84	HV28	101/Dubois	lower	hydrant@101/Dubois	not found							
85	HV29	101/gamble	lower	hydrant@101/Gamble	not found							
86	V56	101/Dubois	lower	Dubois from 101 dill prop	pave/west	gate	8	stan	open	counter		
87	V57	101/Dubois	lower	dubois to penn	pave/north	gate	8	stan		counter		
88	V58	!01/Gamble	lower	Gamble	pave/west							
89	HV30	101/Nettles	lower	hydrant@101/nettles	sidewalk/adjacent							
90	V59	101/gamble	lower	101/Gamble to Hospital	pave/north	gate	8	stan	open	counter		
91	HV31	Hospital/akin	lower	hydrant@ Hospital/Akin								
92	HV32	101/lower Akin	lower	hydrant@Akin	sidewalk/adjacent	gate	6	stan	open	counter		
93	V60	!01/Hospital Rd	lower	hospital rd	pave	gate	8	stan	open	counter		
94	V61	Hospital/akin	lower	Akin from hospital to 2nd	driveway on south side	gate						
95	HV33	101/hall	lower	hydrant@ 101/Hall	pave	gate	6	stan	open	counter		
96	V62	101/Hall	lower									

Master Valve inventory List]
2014

	A	B	C	D	E	F	G	H	I	J	K	L
97	V63	101/Hall	lower									
98	HV34	Hall/2nd	lower	hydrant@Hall/2nd	pave	gate						
99	V64	101/Hall	lower	hall up to 3rd/Rowe	pave							
100	V65	101/ Gregory	lower	gregory to 1st	pave	gate	8	s	open	counter	19	
101	HV35	2nd/Gregory	lower	Hydrant@2nd/Gregory								
102	V66	101/ Gregory										
103	HV36	101 / Rorvik	lower	hydrant@101/ Rorvik		gate	8		open	counter	19	
104	HV37	101 /Rector	lower	hydrant@101/Rector								
105	V67	101/ Rector south	lower	Rector south to Rector north	pave/east							
106	V68	101/ Rector south	lower	101 from Rector to Gregory								
107	V69	101/ Rector north	lower	Rector from 101 to 1st								
108	V70	1st/Rector	lower	1st from Rector to spruce	pave/north	gate	8	stan	open			
109	V71	1st/Rector	lower	seperates upper zone/lower zone	grass/east	gate	4	stan	closed			
110	HV38	1st/Rector	lower	hydrant@1st/rector	pave/north	gate	?					
111	V72	101/ Spruce	lower	Spruce from 101 to 1st								
112	V73	101/ Spruce	lower	101 from spruce to Rector								
113	V74	101/ Spruce	lower	across 101 from Spruce to Marine								
114	HV39	101/ Spruce	lower	hydrant@101/Spruce								

Appendix 3.5

Initial Water System Setpoints

(Note: annotations reflect current settings.)

8. INITIAL WATER SYSTEM SETPOINTS

	HYDRAULIC CRITERIA	TELEMETRY SETPOINT	TELEMETRY DELAY*
Reservoir Levels			
Jarvis			
Overflow	24 ft		
High-High Alarm	23.5 ft	23.5 ft	60 Sec
Booster Pump Stop	(24') ~~23 ft~~	(24') ~~23 ft~~	60 Sec
Booster Pump Start	(17') ~~19 ft~~	(17') ~~19 ft~~	60 Sec
Low-Low-Alarm	15 ft	15 ft	60 Sec
Hall St. 1.5"&6" Sustain	10 ft		
Vosburg			
Overflow	24 ft		
High-High Alarm	23.5 ft	23.5 ft	60 Sec
Master Valve Close	(24') ~~23 ft~~	(24') ~~23 ft~~	60 Sec
Master Valve Open	(17') ~~19 ft~~	(17') ~~19 ft~~	60 Sec
Low-Low-Alarm	15 ft	15 ft	60 Sec
Hall St. 1.5" Open	10 ft		
Hall St. 6" Open	5 ft		
Flow Rates			
Jarvis			
Rapid Loss**	500 gpm	0.05 ft/min	
Vosburg			
Rapid Loss**	500 gpm	0.05 ft/min	
Master Low Station			
Low Flow	250 gpm	250 gpm	
High Flow	500 gpm	500 gpm	
Booster Pump			
Low Flow	80 gpm	80 gpm	
High Flow	175 gpm	175 gpm	
Master Valve			
Manzanita Pump off signal timeout			10 min
Pump Pressures			
Booster Pump			
Pump 1 low suction	90 psi		60 Sec
Pump 1 low discharge	133 psi		60 Sec
Pump 2 low suction	90 psi		60 Sec
Pump 2 low discharge	133 psi		60 Sec

* The system user adjustable time delay setpoints were set to a standard time. Monitor the system after startup to determine if adjustments are necessary.

** The starting setpoint was requested by the city to monitor fire hydrant usage. Monitor the system after startup and adjust if necessary due to erroneous alarms.

Appendix 3.6

"Carbon Dioxide Removal System Predesign Report"

HBH Consulting Engineers, Revised July 30, 2013

Technical Memorandum

HBH Consulting Engineers, March 27, 2014

Manzanita Council Work Session

HBH Consulting Engineers (Discussion), September 17, 2014

H B H
Consulting
Engineers

2316 Portland Road, Suite H
Newberg, Oregon 97132
503/554-9553 v Fax 503/537-9554

TECHNICAL MEMORANDUM

Date: March 27, 2014 HBH Project Number: 2012-014

To: Dan Weitzel, City of Manzanita

From: Robert Henry PE

RE: Revised AST Design & Cost

The purpose of this Technical Memorandum is to provide the City of Manzanita with an updated probable cost for the installation of an Air Stripping Tower (AST) and associated components at the main control building located on Foss Road. These improvements are necessary to remove carbon dioxide (CO2) from the system's groundwater sources as required for corrosion control thereby allowing the City to significantly reduce or eliminate use of caustic soda.

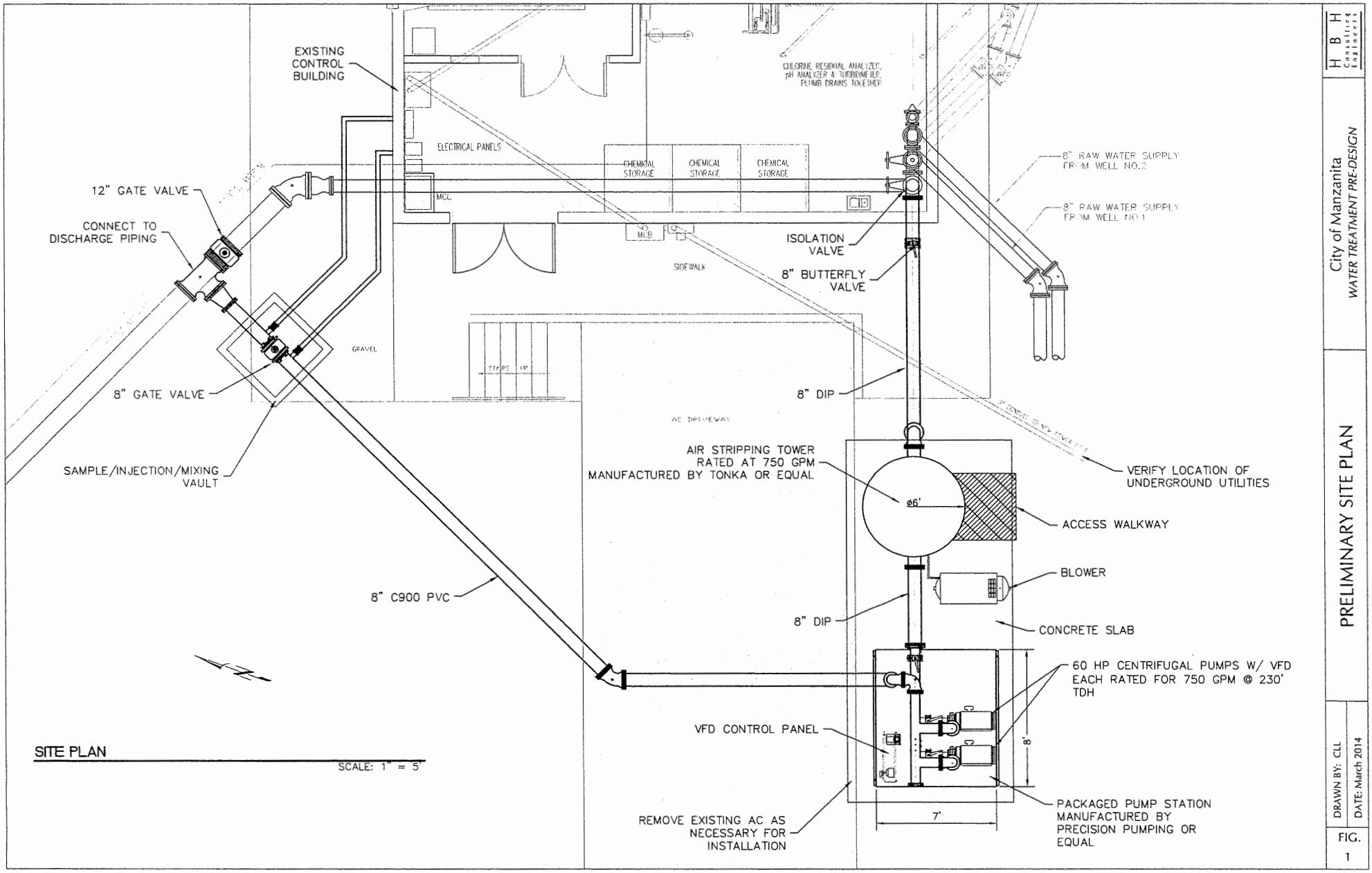
The new AST system design is based on the recommendation of previous studies authorized by the City, including a pilot study conducted by Tonka Equipment in 2011 and a 2013 pre-design report written by HBH Consulting Engineers. Since these studies were completed, several changes have occurred to raw water quality data and performance requirements that will impact the size of recommended equipment as well as layout configuration. In particular, the Oregon Drinking Water Services has requested that the AST system service the entire regional water system. Other factors affecting the estimated cost of the project include recent increases in reported raw water CO2 levels and the City's desire to increase the CO2 removal achieved by the AST system in order to further reduce, and potentially eliminate, use of caustic soda.

A layout of the proposed system improvements is presented in Figure 1. The new AST includes a 6-ft diameter air stripping tower, approximately 28 feet in height. The tower will include approximately 18-ft of packing media as well as a 4-ft deep clearwell. Treated water will be pumped from the clearwell directly into the distribution system using a packaged pump station. New sampling and injection ports with static mixer will be installed in a vault for disinfection as well as caustic soda addition as necessary. Additionally, new electrical components and controls will be required to operate the system. A profile view of the preliminary layout has been provided in Figure 2.

The revised cost estimate for this project is $478,500 and is detailed in the following table. This cost is significantly less than previously estimated for installing an AST system at this site. The primary reason for this decrease is the elimination of the additional building proposed to house the blower, which will be located outside adjacent to the AST based on manufacturer's recommendation. This also decreased the amount of site and electrical work required. It should also be noted that the previous cost estimate included well pump replacement, which has be excluded in the following table.

Table 1 - Estimated Cost for Air Stripping Tower System

Item	Description	Unit	Quantity	Unit Cost	Total
1	Mobilization	LS	1	$ 23,000	$ 23,000
2	Site Work	LS	1	$ 2,500	$ 2,500
3	Foundation	LS	1	$ 25,000	$ 25,000
4	Air Stripping Tower	EA	1	$ 145,000	$ 145,000
5	Packaged Pump Station	EA	1	$ 100,000	$ 100,000
6	Site Piping	LS	1	$ 15,000	$ 15,000
7	Sampling/Injection/Mixing Vault	EA	1	$ 7,500	$ 7,500
8	Electrical & Controls	LS	1	$ 30,000	$ 30,000
			Total		$ 348,000
			Contingency (10%)		$ 34,800
		Construction Subtotal			*$ 382,800*
			Engineering (20%)		$ 76,560
			Legal & Admin (5%)		$ 19,140
		Total Project Cost			**$ 478,500**



SITE PLAN

SCALE: 1" = 5'

H B H Consulting Engineers

City of Manzanita
WATER TREATMENT PRE-DESIGN

PRELIMINARY SITE PLAN

DRAWN BY: CLL

DATE: March 2014

FIG. 1

City of Manzanita
Water System CO2 Stripping Project

City Council Work Session
ITEMS OF DISCUSSION
September 17, 2014

H B H
Consulting Engineers

2316 Portland Road, Suite H
Newberg, Oregon 97132
503/554-9553 ▪ Fax 503/537-9554

The following items will be discussed in the September 17, 2014 City Council Work Session:

1. Project Background and Current Status

   The pH of the wells had continued to fall, necessitating the addition of significant and increasing amounts of caustic soda to provide for the required corrosion control (lead and copper control). The presence of high concentrations of carbon dioxide in the well water lowers the pH. In an effort to reduce the caustic soda amounts, testing was done to determine the levels of pH increase which could be expected with air stripping to remove the CO2.

   A pilot study was completed by Tonka to estimate the effectiveness of air stripping in increasing pH of the water. The results of this study were used to provide for the sizing of the proposed air stripping tower.

   A pre-design report was been completed comparing 3 options for the location of an air stripping tower. A revised layout and cost estimate was created for the option which would have air stripping at the well site.

2. Revised Cost and Site Plan at Well Site

   A revised cost estimate was completed for the well site treatment option. A revised layout was also created based on input from operations staff. The cost was significantly lowered by (a) removing well pump replacement from the cost estimate and (b) eliminating the building that would house the blower (the typically specified blower from the air stripper manufacturer is designed to allow for outdoor installation).

   The revised cost memorandum and well site layout are attached.

3. Effect of Air Stripping on Caustic Soda Use

   Modeling from the Air Stripper manufacturer (Tonka) has shown an increase of pH to 7.0 through air stripping. The Oregon Health Authority mandates a minimum pH of 7.2 for the Wheeler Wells entry point. The target pH is 7.4. Even with the air stripper, caustic soda will need to be added to increase the pH. The amount of caustic soda will be significantly reduced. An exact reduction amount was not modeled by Tonka. Due to common variations in water chemistry, a titration test would need to be completed on the CO2 stripped water to determine exact reduction in caustic soda use. However, based on a standard pH titration curve (see Fig 1), it can be seen that

a significant amount of caustic soda must be added to increase pH from 5.6 to 7.0, especially compared with the addition amount to move from 7.0 to 7.4.

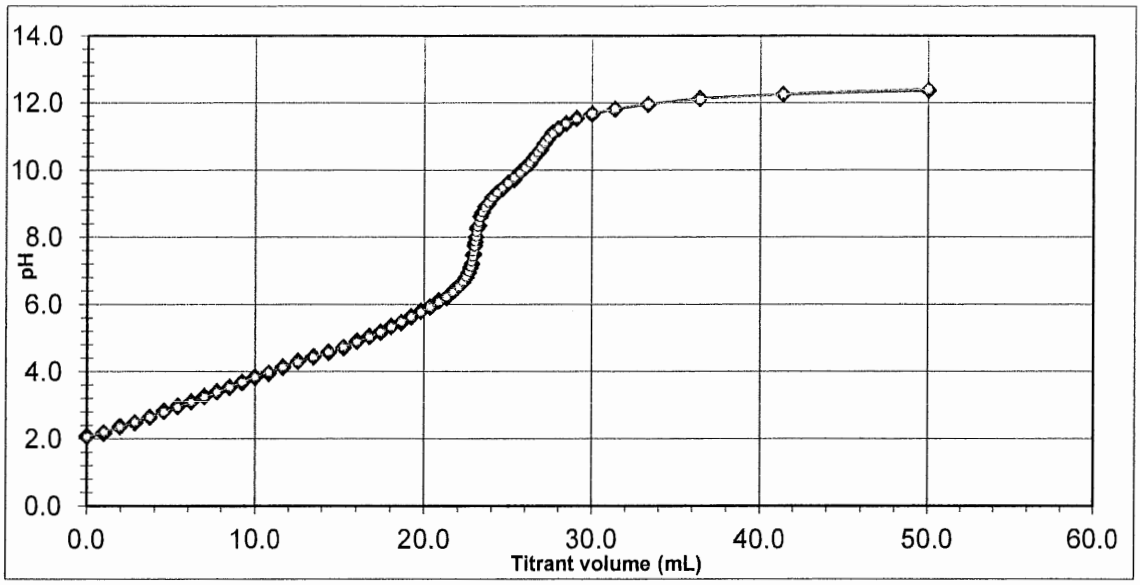


Figure 1 - Sample Titration of Caustic Soda Curve

4. Next Steps

A discussion of the next steps to be taken by the City to move the project forward, if the council decides that the air stripper project is in the best interest of the citizens.

City of Manzanita
Tillamook County, Oregon

Predesign Report
Carbon Dioxide Removal System

EXPIRES: 6/30/2015

July 2013
(Revised 7-30-2013)
Project No. 2012-14

H B H
Consulting Engineers

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Appendix

1.0 INTRODUCTION & BACKGROUND

1.1 Study Area

The City of Manzanita is situated between the Pacific Ocean and Highway 101 in Tillamook County, approximately 27 miles north of the City of Tillamook. Manzanita is part of a regional water system that it jointly manages with the City of Wheeler. The system serves residents living within these cities' urban growth boundaries (UGB) as well as users in the Zaddack Creek Coop, Nehalem Bay State Park, and, to a very limited extent, the City of Nehalem.

Based on online data obtained from the Oregon Health Authority, the total regional water system serves an estimated population of 4,690 through 2,215 connections (Table 1). The City of Manzanita represents approximately 68.2% of this population and nearly 73.3% of the total water connections.

Table 1 - Estimated Population Served by Regional Water System

Service Area	Population	Connections
City of Manzanita	3,200	1,624
City of Wheeler	450	248
Zaddack Creek Coop	75	23
Tideland Water Coop	20	18
Nehalem Bay State Park[2]	945	302
Total	**4,690**	**2,215**

[1] Based on Oregon Health Authority Drinking Water Data Online
[2] Transient, non-community system

1.2 Background

The City of Manzanita maintains several surface water rights, however, the City primarily relies on a groundwater source for its drinking water system. This groundwater supply consists of two wells located east of the City, in Township 2N, Range 9W, Section 5. Although the City of Manzanita is primarily responsible for operating these wells, the water right (G13479) authorizing the groundwater diversions is owned by the City of Wheeler.

The existing groundwater system has been in operation since March 2003. Each of the two wells has a 50 Hp pump equipped with a variable frequency drive (VFD). The maximum pump capacities of Well #1 and Well #2 are 520 gpm and 525 gpm, respectively. The duplex well pumping capacity is approximately 750 gpm.

The City's water system is required by the State to provide corrosion control by maintaining a minimum pH value of 7.2. The groundwater supply has relatively low pH and high alkalinity, which requires

significant chemical addition to achieve this mandate. Currently, the City utilizes caustic soda for pH adjustment, although the system was initially developed using soda ash. The large quantity of chemicals needed to meet State regulations constitutes a high portion of the water system's O&M budget. Between February 2011 and March 2012, the City spent over $32,800 for caustic soda. In addition to the financial burden, the high volume of caustic soda used also generates a number of complaints pertaining to the taste of the City's water.

In 2011 the City and HBH Consulting Engineers, Inc. began investigating options to reduce the quantity of chemical necessary to meet the system's pH requirements. During these investigations, it was discovered that the groundwater supply contains elevated levels of dissolved carbon dioxide(CO_2). This led the City to authorize Tonka Equipment Company to conduct a pilot study to evaluate the effectiveness of air stripping in increasing pH values by removing CO_2 from the groundwater supply.

1.3 Report Purpose & Objectives

In order to address the CO_2 in the system's groundwater supply, the City is considering the installation of a new air stripping tower. The purpose of this *Pre-Design Report* is to provide the City with important design data and to make recommendations based on a cost-benefit analysis. To accomplish these goals, this *Pre-Design Report* has outlined the following objectives:

- Develop several siting and operational alternatives for new air stripping system, including preliminary layouts and cost estimates for each alternative;
- Estimate the O&M savings for each alternative;
- Determine payback period for each alternative;
- Perform matrix evaluation of alternatives; and
- Make final recommendations for system improvements.

2.0 DESIGN ELEMENTS

2.1 Carbon Dioxide

2.1.1 Chemistry

Carbon dioxide is commonly present in most groundwater supplies, typically at concentrations of 50 ppm or less. As shown in the following chemical equation, carbon dioxide ($C0_2$) reacts with water (H_2O) to produce carbonic acid (H_2C0_3), which dissociates to yield hydrogen (H^+) and bicarbonate alkalinity (HCO_3^-). This creates an inverse relationship between pH and CO_2 whereby decreasing the concentration of CO_2 increases the pH of the water.

$$H_20 + CO_2 <===> H_2CO_3 <==> H^+ + HCO_3^-$$

The solubility of carbon dioxide in water is determined by Henry's Law. This law states that at a constant temperature, the amount of a CO_2 gas that dissolves in water is directly proportional to the partial pressure of the CO_2 above the liquid. In mathematical terms, this relationship is described as:

$$p = k_H c$$

Where: p = partial pressure of the solute in the gas above the solution
c = concentration of the solute
k_H = Henry's law constant

A higher Henry's Law constant indicates a greater tendency to volatilize, allowing the dissolved gas to be removed from solution and released into the atmosphere. The Henry's law constant (k_H) for carbon dioxide in water at 77 °F is 29.41 L·atm/mol.

2.1.2 Removal

Air stripping is the most common technology employed to remove carbon dioxide gas from water. In this process, air is brought into contact with water in a controlled manner to permit the transport of volatile contaminants (such as CO_2) from the water into the air. As excess carbon dioxide is removed, the pH of the water rises. The driving force of this process is the difference between the existing and equilibrium concentrations of the carbon dioxide gas in air and water. This process can further be enhanced by turbulence, which promotes gas transfer by reducing the thickness of film at the air-water interface.

Factors that affect treatment performance include:

- Temperature of both water and air
- Physical chemistry of the contaminant (Henry's Constant)
- Concentration of the contaminant
- Ratio of air to water in the process
- Contact time
- Available area for mass transfer
- Pressure of the system

The latter four factors can be controlled in the design of the air stripping system, while the concentration of contaminants is a function of the specific groundwater supply and the nature of the organic chemicals in that supply. Temperature effects can and should be taken into account in the design of air stripping facilities since diffusion of chemicals through water and air decreases in colder waters.

2.2 Pilot Testing

In October 2011, the City contracted Tonka Equipment Company to perform a 13 day pilot test using an aeration stripping column. The objectives of this pilot study included:

- Determining if using an aeration stripping column would be effective at removing CO_2 and increasing the pH of the City's water supply.
- If aerated stripping column is feasible solution, determine sizing, operation, and other parameters for a full-scale system.

The equipment used in the pilot study included a 16-inch diameter PVC column, approximately 3.42 feet tall, with a forced draft blower located in the lower section of the chamber. Raw water was uniformly sprayed at the top of the column over the 1-ft bed of LanPac XL polypropylene packing spheres. A blower supplied 79 cfm of air counter to the flow of water resulting in an air:water ratio of 148 per minute at the design flow rate of 4.0 gpm. Treated water was collected for sampling at the bottom of the chamber. The following table summarizes the results of the pilot test performance.

Table 2 - Results from Aeration Stripping Tower Pilot Study

Flow Rate (gpm)	Temp (°C)	pH	Alkalinity (mgCa/L)	Total CO_2		Free CO_2	
				mg/L	Removed	mg/L	Removed
Well #1 (10/6/2011)							
Raw	10.2	6.20	26	56	---	35	---
4.0	10.9	7.45	24	38	32%	2	94%
3.0	11.2	6.45	30	38	32%	25	29%
2.0	11.1	7.05	28	30	46%	5.9	83%
Well #2 (10/7/2011)							
Raw	9.9	6.22	26	55	---	39	---
4.0	11	6.90	28	32	42%	8.3	79%
3.0	10.9	6.73	28	35	36%	13	67%
2.0	11.3	6.97	32	35	36%	7.2	82%
Well #2 (10/10/2011)							
Raw	9.9	6.45	28	45	---	25	---
4.0	10.1	6.85	30	35	22%	10.7	25%
Well #1 (10/17/2011)							
Raw	10.5	6.57	3	53	---	20	---
4.0[1]	10.9	7.35	36	35	34%	3.9	81%
4.0[2]	10.8	7.14	31	32	40%	5.6	72%

[1] Post Cl_2
[2] Post Blank

The following provides a summary of the findings and recommendation of the pilot study:

1) The removal of CO_2 by the stripping tower exceeded the calculated values (27.3% removal of Free CO_2 and 16.6% of Total CO_2).
2) The resulting pH increase ranged from 0.4 to 1.25 standard units. The majority of the changes were in the range of 0.57 to 0.85 standard units.
3) The full-scale tower is calculated to be 6' diameter with 12½' of LanPac XL packing operating at 750 gpm, loaded at an air to water ratio of 25 ft3/ft3 or 3.5 scfm/gpm.

It should be noted that the pilot test data were somewhat limited due to the relatively short period of the study. However, it is generally agreed that the pilot test verifies that air stripping is a feasible option for the City in removing free CO_2 and thus raising the pH of its drinking water supply. This will allow the City to use considerable less caustic soda to achieve the needed corrosion control levels. A complete summary of the equipment, methods, and results of the pilot test are available in the report provided by Tonka.

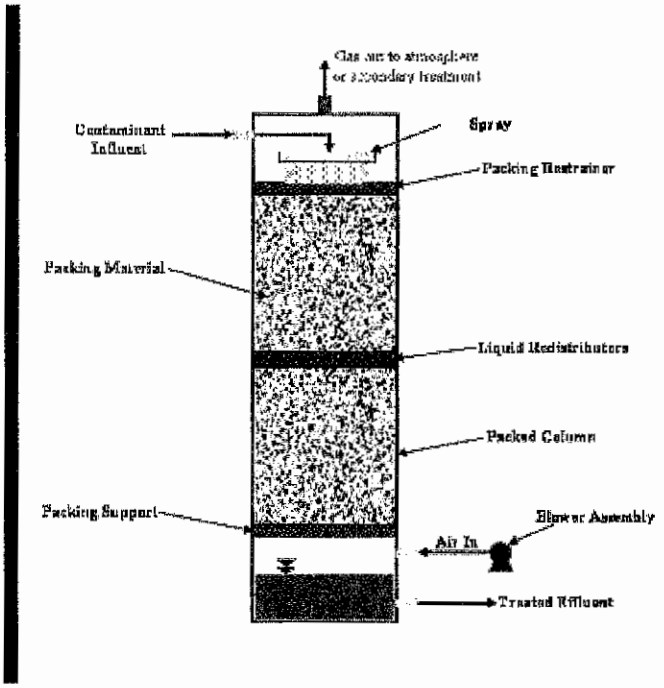
2.3 Design

The design of an air stripping system utilizing a packed tower aeration (PTA) unit is primarily dependent on the following factors:

Henry's Law Constant	The higher the constant, the easier the VOC is removed by air stripping. This determines air flow requirements.
Air:Water	This ratio determines the size of the blower and is a function of water temperature and desired level of contaminant removal. Air-to-water ratios typically range from 30:1 to 100:1.
Height of Packing	Function of the required VOC removal efficiency. In general, an increase in packing height results in higher VOC removal.
Water Loading Rate	The amount of water passing through the column, usually ranges from 25-30 gpm/ft^2.
Column Diameter	Selected to based on the desired flow and loading rates.
Air and Water Temp.	Affects air-to-water ratio. Removal effectiveness usually increases with increased water temperature, however, heating influent water to increase removal effectiveness is not generally cost-effective.

In installations to treat groundwater, the water is generally pumped directly from the wells to the top of the column. Treated water is collected at the bottom of the column in a clearwell, from which it is usually pumped directly to the distribution system. The principal facility elements of a PTA include the following:

Column and internal parts. The column is a tank usually constructed from fiberglass-reinforced plastic, aluminum, stainless steel, or concrete. A demister is usually installed at the top of the tank to prevent objectionable clouds of moisture from coming off the column. Near the top of the column, piping is installed to distribute influent water evenly over the top of the packing material. Commonly used distributor styles are orifice plates, troughs, orifice headers, and spray nozzles. Redistributors are installed at intervals to support the packing material and redirect the water back toward the center of the column.



Packing material. Packing materials are designed to simultaneously provide a low pressure drop for air passing through the column and maximize air-water contact area. They are available in various shapes of ceramic, stainless steel, and plastic materials. Plastic is the most commonly used in water treatment applications because it is durable, lightweight, and cost-effective. Fixed packing comes in prefabricated sheets mounted at intervals inside the column.

Blower. Airflow is provided at the base of the column by centrifugal blower driven by an electric motor. Care must be taken in providing screens and locating the air inlet to prevent insects and airborne contaminants from being blown into the column. Housing this equipment provides increased security, reduced noise, and reduced maintenance.

The following table summarizes the general design elements and specifications for packed tower aeration units as listed by the 10-State Recommended Standards for Water Works (2012 Edition):

Table 3 - Design Standards for Packed Tower Aeration[1]

Design Elements	10-State Standard
Materials of Construction	• The tower can be constructed of stainless steel, concrete, aluminum, fiberglass or plastic. Uncoated carbon steel is not recommended because of corrosion. • Packing materials shall be resistant to the aggressiveness of the water, dissolved gases and cleaning materials and shall be suitable for contact with potable water.
Water Flow System	• Water should be distributed uniformly at the top of the tower using spray nozzles or orifice-type distributor trays that prevent short circuiting. • A mist eliminator shall be provided above the water distributor system. • A side wiper redistribution ring shall be provided at least every 10 feet in order to prevent water channeling along the tower wall and short circuiting. • Sample taps shall be provided in the influent and effluent piping. • The effluent sump, if provided, shall have easy access for cleaning purposes and be equipped with a drain valve. • A blow-off line should be provided in the effluent piping to allow for discharge of water/chemicals used to clean the tower. • The water flow to each tower shall be metered. • An overflow line shall be provided which discharges 12 to 14 inches above a splash pad or drainage inlet. Proper drainage shall be provided to prevent flooding.
Air Flow System	• The air inlet to the blower and the tower discharge vent shall be downturned and protected with a non-corrodible 24-mesh screen to prevent contamination from extraneous matter. • The air inlet shall be in a protected location. • An air flow meter shall be provided on the influent air line or an alternative method to determine the air flow shall be provided. • A positive air flow sensing device and a pressure gauge must be installed on the air influent line. • Means shall be provided to prevent flooding of the air blower.
Other Features	• A sufficient number of access ports with a minimum diameter of 24 inches to facilitate inspection, media replacement, media cleaning and maintenance of the interior. • A method of cleaning the packing material when fouling may occur. • Noise control facilities should be provided on PTA systems located in residential areas.

[1] 10-State Recommended Standards for Water Works (2012 Edition)

2.4 Maintenance

PTA designs must consider the possibility of scaling and fouling of the packing. Fouling gradually causes a decrease in air flow through the column, and if not corrected, can seriously reduce the column's performance. The main causes of fouling are:

1. *Carbonate Scaling* - Can occur when influent water has a relative high calcium carbonate hardness and appears as a brittle, cement-like scale.

2. *Iron Oxidation* - Ferrous iron in groundwater oxidizes easily to form insoluble ferric compounds, primarily iron hydroxide, which accumulates on the packing as a rust- or black-colored gel.

3. *Microbial Action* - Colonies of the bacteria, primarily iron bacteria, can grow on the packing media, forming a slimy material that if not controlled can completely fill all void spaces in the packing.

One method of controlling fouling involves pretreating water with chlorine or permanganate, then filtering to remove oxidized products. If the influent water has a high potential for fouling, the plant must provide facilities and a regular schedule for periodic cleaning of buildup. Cleaning consists of circulating strong chlorine or acid solution through the media.

3.0 ALTERNATIVE ANALYSIS

This *Pre-Design Report* evaluates and assesses three alternatives for CO_2 removal. Each alternative uses a packed tower aerator (PTA) with a maximum capacity of 750 gpm sited at various locations. These alternative locations included siting the new PTA system adjacent to:

- Well Control Building,
- Manzanita Water Treatment Plant, and
- New Regional Reservoir.

The change in site location will impact the costs, operations, and process flow of the new carbon dioxide removal system. A description of each alternative is provided below.

3.1 Design Alternatives

3.1.1 Alternative 1 - CO_2 Removal at Well Site

This alternative consists of constructing a new PTA unit at the existing well site location (see Figure 1). A process flow diagram and preliminary site plan for Alternative 1 are shown in Figure 2 and Figure 3, respectively. A major advantage of this configuration is that the system would strip CO_2 from the entire regional water supply.

Under Alternative 1, groundwater from the wells would be pumped directly to the new PTA. Water delivered from the wells would be uniformly dispersed at the top of the PTA column and flow through the packing material. A 7,500 gallon sump located under the PTA would collect the discharged water.

Even after air stripping, the water may require addition treatment to meet the 7.2 minimum pH requirement. This alternative would allow the existing corrosion control and disinfection systems to be utilized, although piping modifications would be needed. The air stripping process breaks water pressure, therefore a new pump station will be required to pump water from the new sump into the regional distribution system. The new station will have a firm capacity of 750 gpm (~1.0 mgd).

The new PTA can be located outside without cover, however other components, such as pump, blowers, electrical panels, etc. will be installed in a building. The existing well control building does not have sufficient room to house these additional components, therefore a new building will be required. Poor soil conditions in the area will likely require additional geotechnical stabilization for the new building's foundation. As Figure 3 shows, the proposed site has limited available space. The only potential location for the new system is near the southwestern corner of property. This location is in conflict with several underground water and electrical utilities that will need to be relocated as part of this project.

As part of this alternative, new well pumps would need to be installed due the change in operation pressure head. These pumps are currently in poor conditional due to the corrosivity of the groundwater and should be replaced regardless.

The Alternative #1 preliminary cost estimate is presented in Table 4.

Table 4 - Alternative #1 Cost Estimate

Item	Description	Unit	Quantity	Cost	Costs
1	Mobilization, Bonding, & Insurance	LS	1	$ 48,000	$ 48,000
2	Site Work	LS	1	$ 70,000	$ 70,000
3	CO2 Stripping Tower	LS	1	$ 75,000	$ 75,000
4	Pump Station (~ 1.0 mgd)	LS	1	$ 120,000	$ 120,000
5	Building	LS	1	$ 84,000	$ 84,000
6	New Well Pumps	EA	2	$ 30,000	$ 60,000
7	Electrical and Controls	LS	1	$ 75,000	$ 75,000
		Subtotal			$ 532,000
		Contingency (10%)			$ 53,200
		Construction Subtotal			$ 585,200
		Engineering (20%)			$ 117,040
		Legal & Administrative (5%)			$ 29,260
		Total			**$ 731,500**

3.1.2 Alternative 2 - CO_2 Removal at Water Treatment Plant

A second alternative is to construct the new PTA system at the City of Manzanita's existing water treatment plant (WTP) and installation of a small satellite corrosion control system to serve the City of Wheeler (Figure 1). This alternative would not provide corrosion control for users located before the WTP or Wheeler intertie.

A process diagram for this alternative is provided in Figure 4. Water from the wells would be disinfected and pumped into the regional distribution system as currently done, with the exception that corrosion control would no longer be provided. Water supplied to Manzanita would be discharged to the new PTA unit located at the existing WTP site. Additional corrosion control (as needed) and disinfection would be provided using existing system components located in the WTP. Treated water would be discharged to the existing clearwell and then pumped into the City's distribution system using new, high-efficiency pump system with a firm capacity of 350 gpm. These new pumps are needed to replace the existing pumps which require operators to throttle the pumps using valves. This operation is largely inefficient, wasting significant amounts of energy, and increases wear on valves. In addition, the high electricity demand necessary to start pumps resulting in high demand surcharges imposed on the City by the power company. Installing the new high-efficiency pumps with variable frequency drives (VFDs) will provide significant cost savings in electricity (compared to the existing WTP service pumps).

The Manzanita WTP site includes a large building that houses the membrane treatment system, lab, office, and chemical storage. A preliminary site layout for installing the PTA at the existing WTP is shown in Figure 5. The new stripping tower would likely be located on the north side of the build where the raw water line from the wells enters the building. This site would likely require geotechnical stabilization work.

This alternative also includes constructing a new corrosion control system to treat water supplied to the Wheeler service area. The facility will be located on First Street near the Wheeler master meter and will include a building to house the equipment and controls. It is likely that the City will be able to use much of the existing corrosion control components relocated to the new facility. The soils in the proposed location are poor and will require addition earthwork.

The estimated cost for Alternative #2 is provided in Table 5.

Table 5 - Alternative #2 Cost Estimate

Item	Description	Unit	Quantity	Cost	Costs
1	Mobilization, Bonding, & Insurance	LS	1	$ 27,000	$ 27,000
2	Site Work	LS	1	$ 30,000	$ 30,000
3	CO2 Stripping Tower	LS	1	$ 60,000	$ 60,000
4	WTP Modifications	LS	1	$ 5,000	$ 5,000
5	New WTP Pumps (350 gpm each)	EA	2	$ 24,000	$ 48,000
6	Corrosion Control & Building	LS	1	$ 70,000	$ 70,000
7	Electrical	LS	1	$ 60,000	$ 60,000
		Subtotal			$ 300,000
		Contingency (10%)			$ 30,000
		Construction Subtotal			$ 330,000
		Engineering (20%)			$ 66,000
		Legal & Administrative (5%)			$ 16,500
		Total			**$ 412,500**

3.1.3 Alternative 3 - CO_2 Removal at New Reservoir

The third alternative would be to incorporate the new PTA system as part of a new reservoir project serving the regional system. The City's *Water Master Plan (2006)* recommended that a new 500,000 gallon reservoir be constructed to address the following operational concerns:

- Water that flows from Manzanita into the regional transmission line, can, when the wells are turned on, flow back to the water treatment facility where it is re-pumped to the City's reservoirs. This increases electrical costs to the City.
- There is an appearance of more water produced by the City because of the double pumping. This, in turn, gives an appearance of a higher lost or unaccounted-for water percentage when comparing water production and metered consumption figures.
- Small utility water districts, such as Zaddack Creek Coop, do not have water storage.

The proposed location for a new regional reservoir is shown in Figure 1. A process flow diagram of this alternative is provided in Figure 6. Untreated ground water would be pumped from the wells to the PTA located adjacent to the new reservoir. The new PTA would be situated at an elevation to provide sufficient head to allow water to gravity feed from the PTA to the new reservoir without additional pumping. New chemical feed systems would be provided for additional corrosion control (if needed) as well as disinfection. Approximately 2,000 linear feet of piping would be required as part of this alternative.

A preliminary cost estimate for Alternative #3 is shown in Table 6.

Table 6 - Alternative #3 Cost Estimate

Item	Description	Unit	Quantity	Cost	Costs
1	Mobilization, Bonding, & Insurance	LS	1	$ 139,000	$ 139,000
2	Site Work	LS	1	$ 50,000	$ 50,000
3	CO2 Stripping Tower	LS	1	$ 60,000	$ 60,000
5	Corrosion Control & Disinfection Systems	LS	1	$ 30,000	$ 30,000
6	Building	LS	1	$ 75,000	$ 75,000
7	500,000-Gal Reservoir	LS	1	$ 900,000	$ 900,000
8	Piping	LS	1	$ 120,000	$ 120,000
9	Electrical & Controls	LS	1	$ 150,000	$ 150,000
		Subtotal			$ 1,524,000
		Contingency (10%)			$ 152,400
		Construction Subtotal			$ 1,676,400
		Engineering (20%)			$ 335,280
		Legal & Administrative (5%)			$ 83,820
		Land Acquisition (Allowance)			$ 100,000
		Geotechnical Study			$ 20,000
		Total			**$ 2,215,500**

3.2 Alternative Evaluation

3.2.1 O&M Costs

With a new PTA system, the City is expected to realize significant saving from the reduction of caustic soda used for the corrosion control system. However, some of these savings will be offset by increased electrical costs due to additional pumping. Determining the potential for cost savings is an important factor in the City's decision to move forward with implementing CO_2 removal.

Average monthly O&M costs for each alternative were projected in 5-year increments and are presented in Table 7. This analysis focused on savings resulting from reduced caustic soda usage as well as increased electrical costs from additional pumping. Assumptions used in this analysis included:

- Annual water production will increase at an average annual rate of 1.5%
- The proportional water usage between Manzanita and Wheeler will remain constant at 81% and 19%, respectively
- Without CO_2 removal, the average application rate of caustic soda will be 0.12 lb/mgd
- The new PTA system will reduce caustic soda demand of treated water by 70%
- The cost of caustic soda will increase at an average annual rate of 2% compared to the current cost of $6/lb
- The cost of electricity will increase at an average annual rate of 2% compared to the current cost of $0.0865/KW

Table 7 - Average Monthly O&M Costs

Year	Chemical Cost			Additonal Pumping			Total Cost		
	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
2013	$ 843	$ 1,224	$ 843	$ 248	$ 429	$ -	$ 1,091	$ 1,653	$ 843
2018	$ 1,027	$ 1,493	$ 1,027	$ 303	$ 523	$ -	$ 1,330	$ 2,015	$ 1,027
2023	$ 1,252	$ 1,819	$ 1,252	$ 369	$ 637	$ -	$ 1,621	$ 2,457	$ 1,252
2028	$ 1,526	$ 2,218	$ 1,526	$ 450	$ 777	$ -	$ 1,976	$ 2,995	$ 1,526
2033	$ 1,860	$ 2,704	$ 1,860	$ 549	$ 947	$ -	$ 2,409	$ 3,651	$ 1,860

Alternative 3 is projected to have the lowest O&M costs. This is due to the fact that this alternative does not require additional pumping. Since Alternative 2 will not remove CO_2 from the entire water supply, this alternative does not have as high of a reduction in caustic soda costs. Consequently, Alternative 2 has the highest projected O&M costs of the three alternatives.

The following table calculates the projected savings of each alternative compared to the projected monthly O&M costs of the existing corrosion control system. It is anticipated that implementing CO_2 removal will reduce corrosion control costs between 41% and 70%.

Table 8 - Projected Monthly O&M Savings

Year	Costs w/o CO2 Removal	Projected Savings		
		Alt 1	Alt 2	Alt 3
2013	$ 2,809	$ 1,718	$ 1,155	$ 1,966
2018	$ 3,424	$ 2,094	$ 1,408	$ 2,397
2023	$ 4,173	$ 2,552	$ 1,717	$ 2,921
2028	$ 5,087	$ 3,111	$ 2,092	$ 3,561
2033	$ 6,201	$ 3,792	$ 2,551	$ 4,341
Average Reduction		**61%**	**41%**	**70%**

3.2.2 Payback Period

The payback period for each of the proposed alternatives is a key factor in determining if a carbon dioxide removal system would be financially beneficial to the City. The payback period is defined as the period of time required for O&M savings to "repay" the sum of the original capital investment. For this analysis, only the straight payback period for each alternative was calculated, meaning the time value of money was not considered.

The payback period for each alternative is shown in Table 9. Alternative 2 will have the shortest payback period of an estimated 19 years. Alternatives 1 and 3 have payback periods of 22 years and 39 years, respectively.

Table 9 - Calculated Payback Period

Alternative	Payback Period
Alternative 1 - CO2 Removal @ Wells	22 years
Alternative 2 - CO2 Removal @ WTP	19 years
Alternative 3 - CO2 Removal @ New Reservoir	39 years

3.2.3 Matrix Evaluation

The following matrix evaluation and been developed to provide an objective evaluation of the three design alternatives. A brief summary of the criteria used in this analysis is provided below:

Capital Costs (50 pts): This includes the total expected cost of the completed project including installation of new treatment equipment, electrical and control upgrades, building modifications, etc, as well as contingency, engineering, and administration.

O&M Requirements (30 pts): Each alternative was evaluated on the anticipated cost associated with its operations, such as chemical costs, electricity usage, operator oversight requirements, etc.

Payback Period (10 pts): Each alternative was evaluated on the anticipated payback period of the project

Expandability (10 pts): This criteria evaluates the ability of the new system to be expanded with minimal cost aside from cost of new equipment.

Each of the alternatives was evaluated using the criteria listed above. Points were given to each alternative based on its anticipated ability to meet criterions' objective. A maximum score of 100 points is possible.

The results of this matrix evaluation are presented in Table 10. Alternative 2 scored the highest point total with 83.2. This is largely due to the fact that this alternative has the lowest capital costs and shortest payback period. However, this alternative had the lowest score for O&M requirements because of the new satellite corrosion control facility needed for Wheeler. Alternative 2 had the second highest total with 72.0.

Table 10 - Matrix Evaluation

	Maximum Points	Alternative 1 - Well Site	Alternative 2 - WTPSite	Alternative 3 - Reservoir Site
Cost	50	35.8	50.0	7.0
O&M Requirements	30	26.2	17.6	30.0
Payback Period	10	8.9	10.0	2.6
Expandability	10	2.0	10.0	10.0
Total	**100**	**72.9**	**87.6**	**49.6**

3.2.4 Summary of Alternatives

Table 11 provides a summary of the advantages, disadvantages, costs, payback period, and matrix evaluation for each of the three alternatives.

Table 11 - Summary of CO_2 Removal Alternatives

	Alternative 1 CO2 Removal @ Wells	Alternative 2 CO2 Removal @ WTP	Alternative 3 CO2 Removal @ New Reservoir
Advantages	• Removes CO_2 from entire regional water supply • Keeps corrosion control and disinfection system at existing site in-place • Relatively short payback period	• City can utilize existing well pumps • Existing corrosion control and disinfection systems at WTP may be used with limited modifications • Shortest payback period • Lowest capital requirements	• Provides addition storage for the combined regional system • Does not require additional pumping • Removes CO_2 from water supplied to entire regional system • Does not require satellite corrosion control facilities in Wheeler
Disadvantages	• Limited space available • Location in conflict with underground utilities • Additional pumping facility will be required to pump water from PTA to the regional distribution system • Well pumps will need to be replaced due to change in TDH • Does not include regional reservoir for improvement in water management	• Does not remove CO_2 water supplied to Wheeler subsystem • Does not provide any corrosion control to smaller districts • New corrosion control system would be needed for water supplied to Wheeler • Requires new pumps at WTP • Does not include regional reservoir for improvement in water management	• High capital cost for new reservoir and land • High capital cost to provide electrical supply to new site • Requires corrosion control and disinfection system to be moved • Land availability unknown • Highest payback period
Financial Impact			
Est. Capital Cost	**$ 731,500**	**$ 412,500**	**$ 2,215,500**
Est. O&M Savings[1]	**61%**	**41%**	**70%**
Est. Payback Period	**22 Years**	**19 Years**	**37 Years**
Matrix Pts	**72.9**	**87.6**	**49.6**

[1] Average monthly reduction in O&M cost of new carbon removal system compared to existing corrosion control system.

4.0 FINAL DESIGN RECOMMENDATIONS

Based on the analyses performed in Section 3.0, installing a new PTA tower at the Manzanita WTP is the recommended solution for removing carbon dioxide from the City's water supply. A new corrosion control facility will also be provided near the Manzanita/Wheeler intertie to make pH adjustments to the water supplied to the City of Wheeler.

The following table provides a summary of the design criteria for the new carbon dioxide removal system. Design specifications for the new air stripping tower are based on the recommendations provided by Tonka Equipment Company in the October 2011 Pilot Study. Table 12 also provides design criteria for the new pumps required at the WTP, which are needed to replace the extremely inefficient existing service pumps.

Table 12 - Summary of Design Criteria for Air Stripping System

Air Stripper Tower Design	
Manufacturer	Tonka or Equal
Tank Material	Fiberglass
Packing Material	LANPAC XL or equal
Maximum Flow Rate (gpm)	750
Tower Diameter (ft)	6
Packing Height (ft)	12.5
Tower Height (ft)	11
Minimum Air to Water Ratio (ft^3/ft^3)	25
Blower Size (cfm)	2,500
WTP Service Pumps	
Type	High Efficiency, Vertical Turbine
Manufacturer	Cornell or Equal
No. Pumps	2
Maximum Flow Rate (gpm)	350
Total Dynamic Head (ft)	150
Motor	Variable Frequency Drive

In addition to the new air stripping tower and WTP service pumps, other elements to be included as part of the final design of the carbon removal system will include:

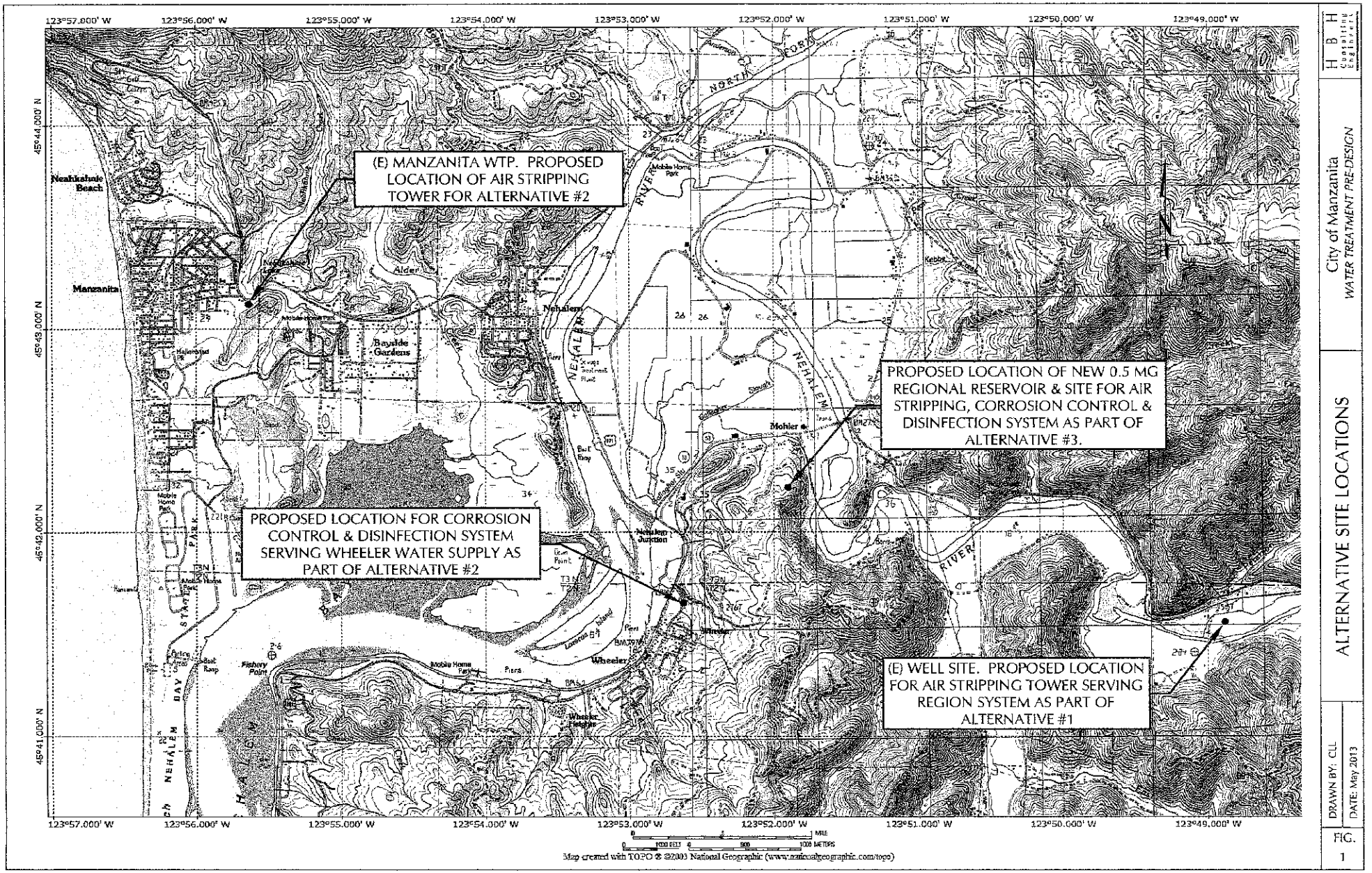
- Site work, including stabilization for air stripping tower foundation
- Exterior piping modifications to re-route raw water through air stripping tower and discharge to WTP clearwell
- Interior piping modifications to change the location of chemical injection points

- Electrical work to install new equipment and controls

As previously noted, the new corrosion control facility to service the City of Wheeler water supply will be located on First Street near the Wheeler master meter. It is anticipated that the new facility will be able to utilize some of the existing chemical feed equipment currently located at the well control building. Items included with the new corrosion control facility will include:

- Site work
- Building and foundation with geotechnical stabilization
- Chemical feed system including feed pump, storage bin, mixer, tubing, and injection equipment
- Lighting, ventilation, eye washing station and other safety measures
- Exterior piping to connect to existing system
- Electrical work for building, equipment and controls

The preliminary engineers estimate for all of the recommended improvements is $412,500. A detailed cost estimate is provided in Table 5.



H B H Consulting Engineers

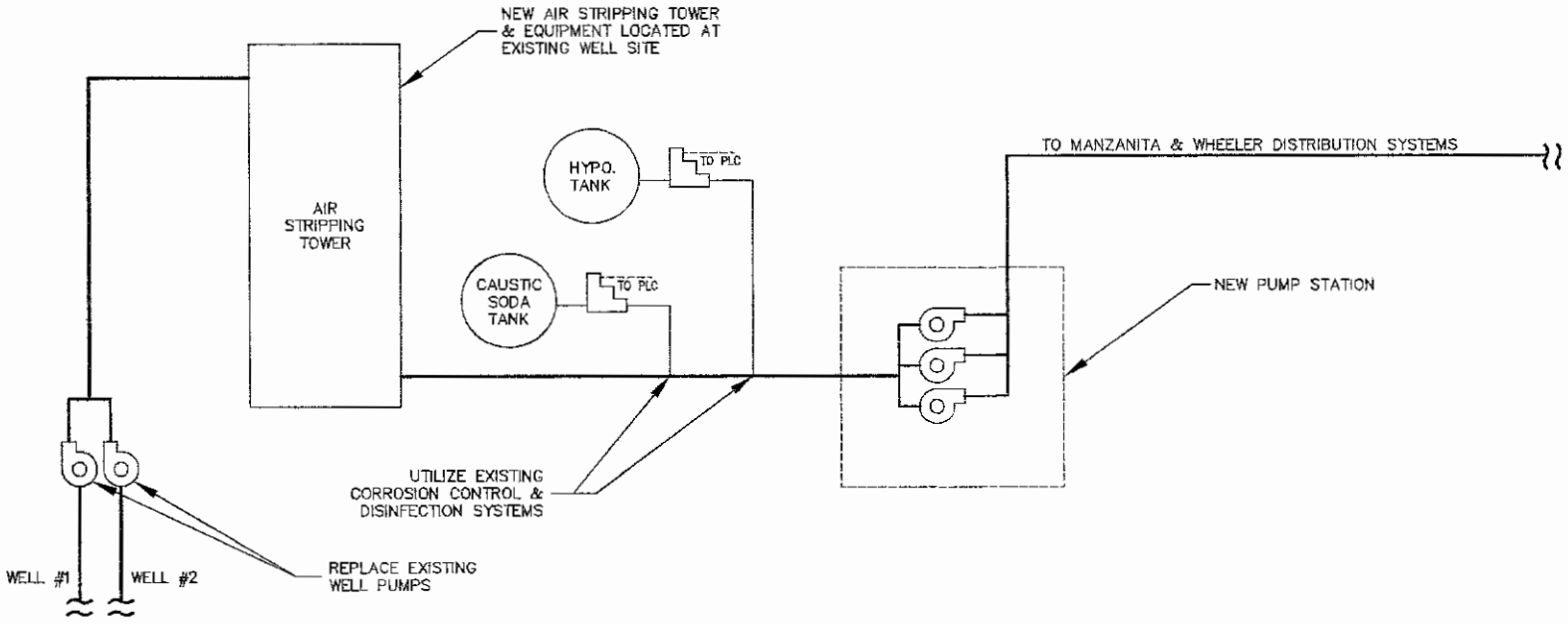
City of Manzanita
WATER TREATMENT PRE-DESIGN

ALTERNATIVE SITE LOCATIONS

DRAWN BY: CLL

DATE: May 2013

FIG. 1



ALTERNATIVE 1 PROCESS FLOW DIAGRAM

NTS

FIG. 2

ALTERNATIVE 1 - PROCESS FLOW DIAGRAM

City of Manzanita

CO2 REMOVAL PRE-DESIGN REPORT

H B H Consulting Engineers

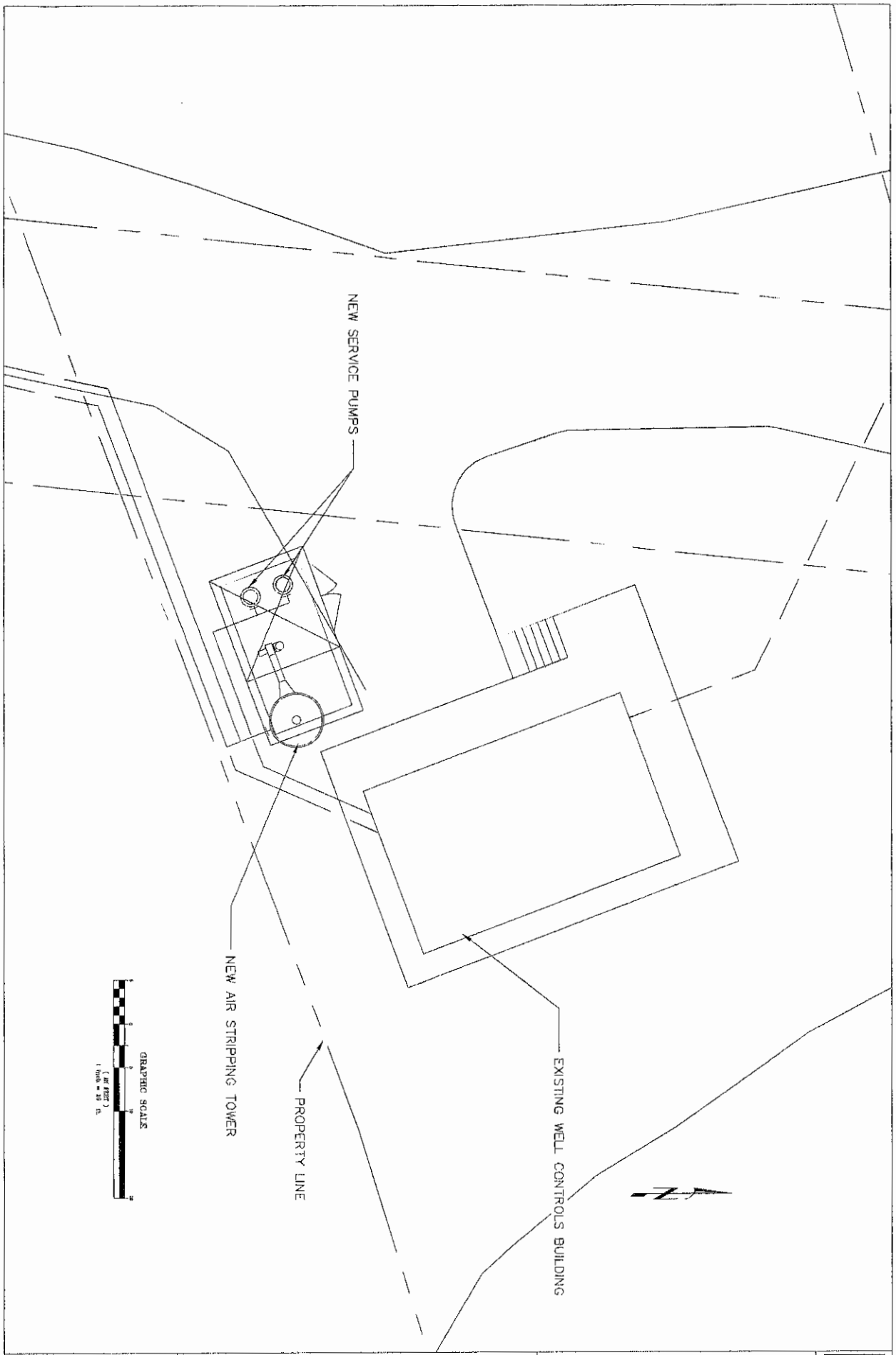
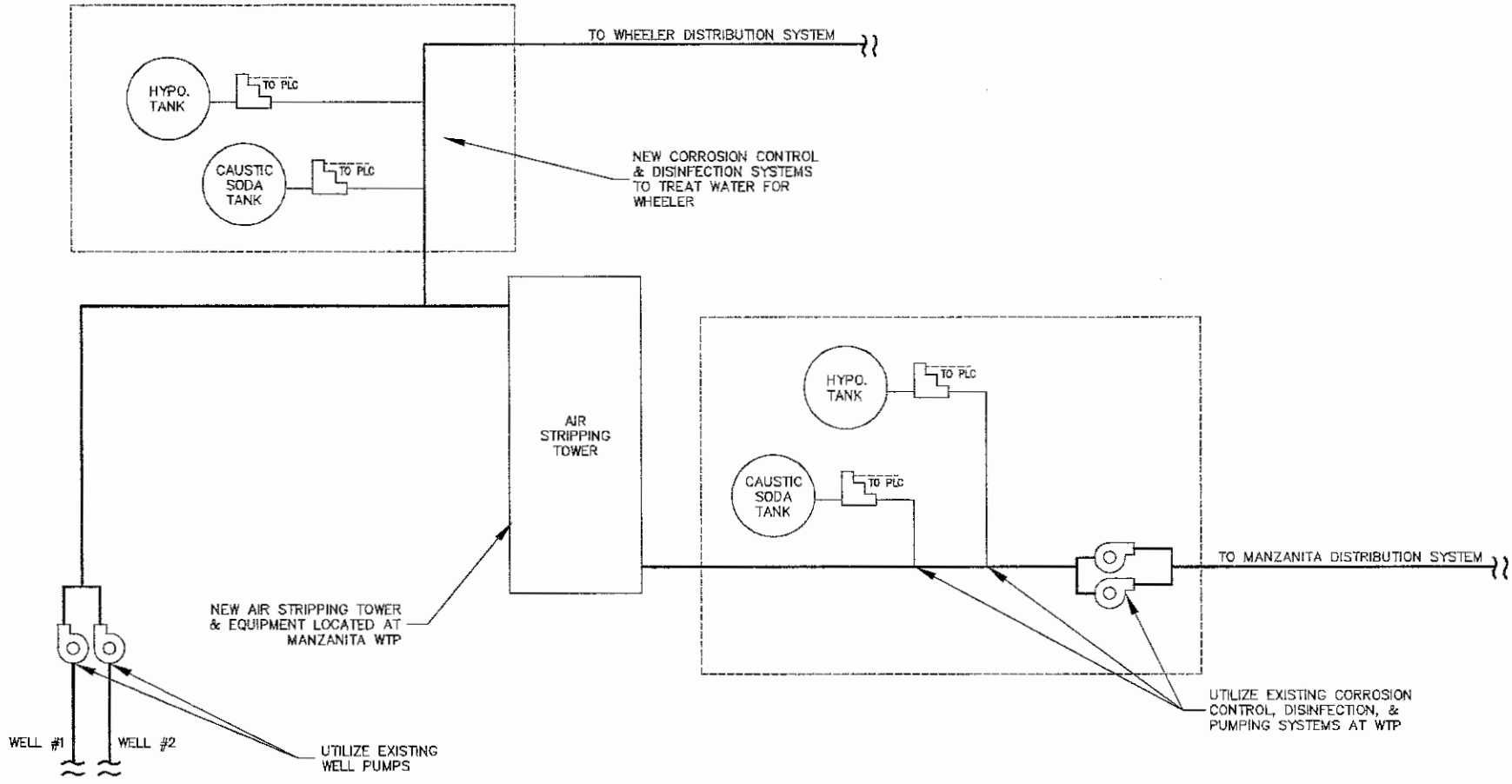


FIG. 3	DRAWN BY: RMH DATE: May 2013	ALTERNATIVE 1 SITE LAYOUT (750 GPM)	City of Manzanita *WATER TREATMENT PRE-DESIGN*	H B H Consulting Engineers



ALTERNATIVE 2 PROCESS FLOW DIAGRAM

NTS

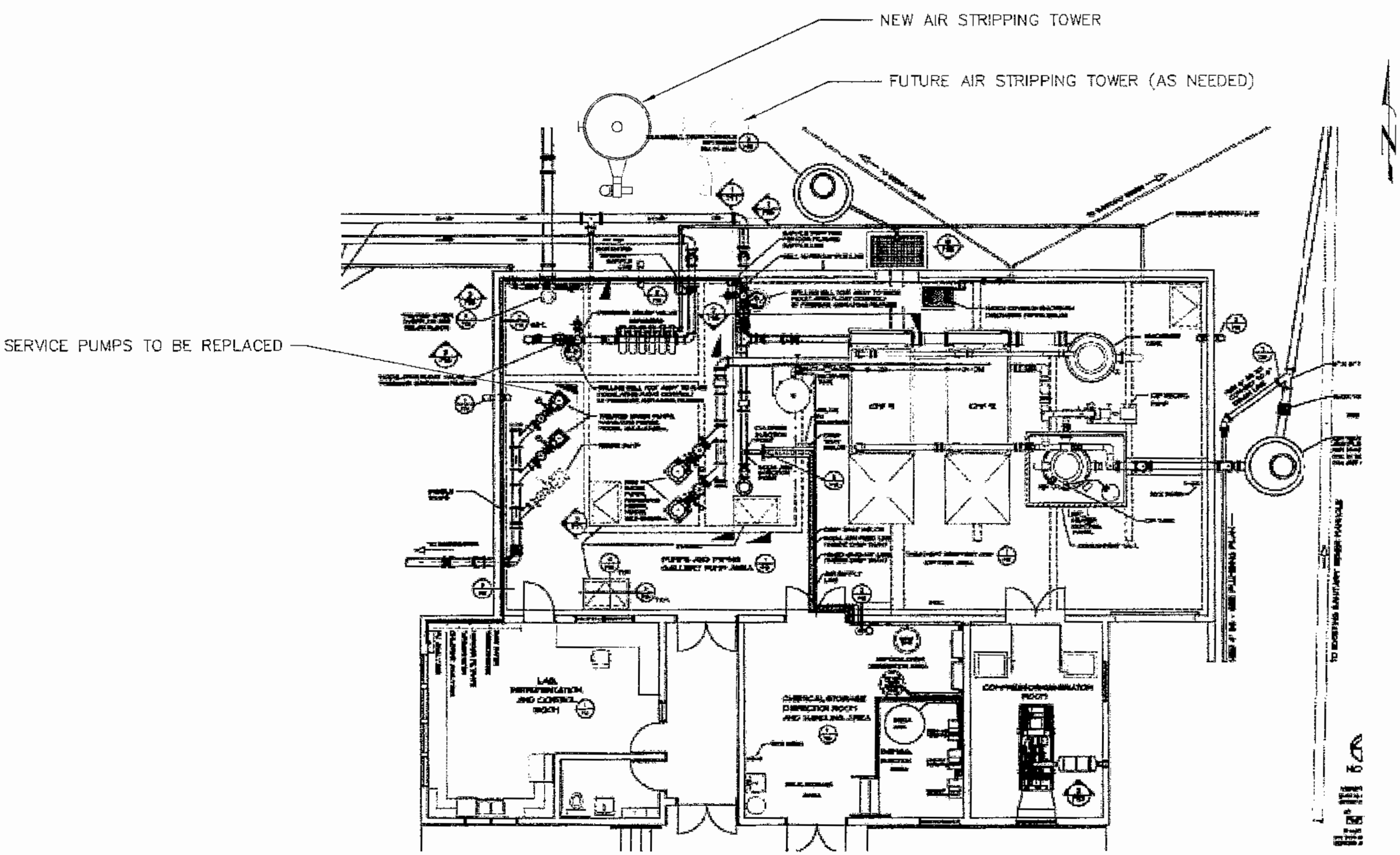
ALTERNATIVE 2 - PROCESS FLOW DIAGRAM

FIG. 4

City of Manzanita

CO2 REMOVAL PRE-DESIGN REPORT

H B H Consulting Engineers



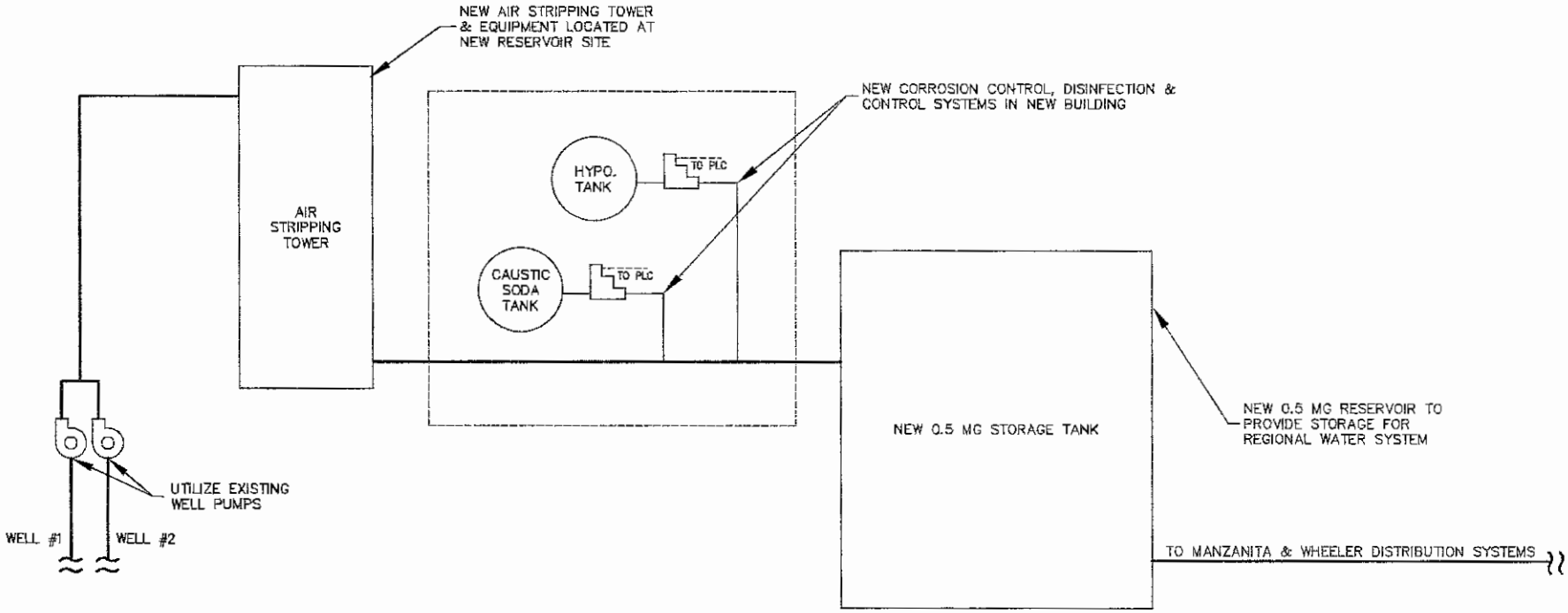
HBH Consulting Engineers

City of Manzanita
WATER TREATMENT PRE-DESIGN

ALTERNATIVE 2 SITE LAYOUT

DRAWN BY: RMH
DATE: May 2013

FIG. 5



ALTERNATIVE 3 PROCESS FLOW DIAGRAM

NTS

FIG. 6

ALTERNATIVE 3 - PROCESS FLOW DIAGRAM

City of Manzanita

CO2 REMOVAL PRE-DESIGN REPORT

H B H Consulting Engineers

Appendix 4.1

2010 Oregon Fire Code

Appendix B: Fire-Flow Requirements for Buildings

Appendix C: Fire Hydrant Locations and Distribution

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are adopted by the State of Oregon.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix and as required by the fire code official. This appendix does not apply to structures other than buildings. Also see ORS 479.200.

> ORS 479.200 is not a part of this code but is reproduced or paraphrased here for the reader's convenience.
>
> ORS 479.200 regulates water supply requirements for certain buildings erected after July 1, 1967, as defined in ORS 479.010(1)(i).

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

OCCUPANCY HAZARD. A classification system based on the classification of occupancies and commodities system specified in NFPA 13.

PROTECTED AREAS. Geographic areas where a service or an agency has been established for the purpose of providing fire suppression services for buildings and other structures. Examples of agencies typically include public fire departments, rural fire protection districts and private fire protection services.

UNPROTECTED AREAS. Geographic areas where no organized service or agency exists to provide fire suppression services for buildings and other structures. Examples of unprotected areas typically included areas where wildland fire protection is provided by federal (USFS, BLM, BIA, etc.) state (ODF), or regional (forest protection associations) organizations and other areas that are generally in remote or rural isolated areas where no structural fire protection service is present.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire code official is authorized to reduce the fire-flow requirements when the development of full fire-flow requirements is impractical based on, but not limited to, the following: type of occupancy, type of construction, location on property, floor area, height and number of stories, yards as defined by the *International Building Code*, fire walls, and the fire-fighting capabilities of the jurisdiction.

B103.2 Increases. The fire code offical is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Limiting. The fire code official is authorized to limit the maximum required fireflow based on, but not limited to, the fire-fighting capabilities of the jurisdiction. Fire-flow limitations shall be in accordance with Section B106 which are in addition to the fire-flow requirements as specified in Section B105.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.2 or B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS IN PROTECTED AREAS WITH ADEQUATE AND RELIABLE WATER SYSTEMS

B105.1 General. The provisions of Section B105 are intended for use by the fire code official in protected areas in which adequate and reliable water systems exist. Refer to Section B106 for additional alternative provisions regarding limiting fire flows.

B105.2 One- and two-family dwellings. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings* having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m^2) shall be 1,000 gallons per minute (3785.4 L/min) at 20 pounds per square inch (138kPa) residual for 1 hour. Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600

square feet (344.5m^2) shall not be less than that specified in Table B105.1 as modified by Section B105.4.

Exceptions:

1. A reduction in required fire-flow of 50 percent is allowed when the building is provided with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.3 (NFPA 13D) of the *Oregon Fire Code*.
2. When there are not more than one each, Group R, Division 3 and Group U occupancies or agricultural buildings, as defined by ORS 455.315, on a single parcel of not less than 1 acre, the requirements of this section may be modified provided, the Group R, Division 3 occupancy does not require a fire flow in excess of 1500 gallons per minute (5678 L/min) and in the opinion of the fire code official, fire fighting or rescue operations would not be impaired.

B105.3 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1, as modified by Sections B105.3 and B105.4.

B105.3.1 Fire-flow reductions. The total required fire-flow may be reduced by one of the following options, but in no case shall the resulting fire-flow be less than 1500 gallons per minute (5678 L/min) at 20 pounds per square inch (138 kPa) residual.

B105.3.1.1 Sprinkler systems. A reduction in required fire-flow of up to 75 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13) or 903.3.1.2 (NFPA 13R).

B105.3.1.2 Fire alarm systems. A reduction in required fire-flow of 25 percent is allowed when the building is provided with an approved automatic and manual fire alarm system that is installed throughout the building and is monitored by an approved central receiving station. The systems shall meet all requirements of NFPA 72 as specified for a central station fire alarm system providing total (complete) coverage by detection devices.

B105.4 Occupancy hazard modifiers. Where a single occupancy classification, as defined by NFPA 13, or a single high-piled combustible storage commodity classification, as specified in Section 2303, is present in a building, the minimum fire-flow required by Table B105.1 shall be multiplied by the appropriate factor in Table B105.4 to determine the total required fire-flow, but in no case shall the resulting fire-flow be less than 1500 gallons per minute (5678 L/min) at 20 pounds per square inch (138 kPa) residual.

B105.4.1 Multiple occupancy hazards. Where more than one occupancy classification, or commodity classification is present in a building, the minimum fire-flow required by Table B105.1 shall be proportioned by percentage of the floor area used for each hazard. The proportioned building fire-flow shall by multiplied by the factor, relating to that portion of the building, in Table B105.4 and totaled to determine the total required fire-flow, but in no case shall the resulting fire-flow be less than 1500 gallons per minute (5678 L/min) at 20 pounds per square inch (138 kPa) residual.

TABLE B105.4

Light hazard occupancies	0.75
Ordinary hazard (Group 1)	0.85
Ordinary hazard (Group 2) and HPCS[a] Classes I & II	1.00
Extra hazard (Group 1) and HPCS Class III	1.15
Extra hazard (Group 2) and HPCS Classes IV & High Hazard	1.25

a. HPCS—High-piled combustible storage

SECTION B106
LIMITING FIRE-FLOW REQUIREMENTS FOR BUILDINGS IN PROTECTED AREAS WITH ADEQUATE AND RELIABLE WATER SYSTEMS

B106.1 General. The provisions of Section B106 are intended for use by the fire code official in addition to the provisions specified in Section B105 as authorized by Section B103.3. This section is intended to apply in protected areas in which adequate and reliable water systems exist.

B106.2 Limiting required fire-flow. No building shall be constructed, altered, enlarged, moved, or repaired in a manner that by reason of size, type of construction, number of stories, occupancy, or any combination thereof creates a need for a fire-flow in excess of 3,000 gallons per minute (11 356 L/min) at 20 pounds per square inch (138 kPa) residual pressure as specified in Table B105.1, or exceeds the available fire-flow at the site of the structure.

Exception: Fire-flow requirements in excess of 3,000 gallons per minute (11 356 L/min) may be allowed if, in the opinion of the fire code official, all reasonable methods of reducing the fire-flow have been included within the development and no unusual hazard to life and property exists.

B106.3 Existing buildings. Existing buildings that require a fire-flow in excess of 3,000 gallons per minute (11 356 L/min) are not required to comply with the fire-flow requirements of this section. However, changes in occupancies or the character of occupancies, alterations, additions or repairs shall not further increase the required fire-flow for buildings.

SECTION B107
FIRE-FLOW REQUIREMENTS FOR BUILDINGS IN PROTECTED AREAS WITHOUT ADEQUATE AND RELIABLE WATER SYSTEMS

B107.1 Areas without water supply systems. The provisions of Section B107 are intended for use by the fire code official in protected areas in which adequate and reliable water supply systems do not exist. In determining the fire-flow for buildings, the fire code official is authorized to utilize the following nationally recognized standards; NFPA 1142, the *International Urban-Wildland Interface Code* or the *ISO Guide for Determining Needed Fire Flow, 2005 Edition.*

TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

SECTION B108
FIRE-FLOW REQUIREMENTS FOR BUILDINGS IN UNPROTECTED AREAS (RESERVED)

SECTION B109
REFERENCED STANDARDS

ICC	IBC-09	International Building Code	B104.2, Table B105.1
ICC	IFC	International Fire Code	B105.3
ICC	IWUIC-09	International Wildland-Urban Interface Code	B107.1
NFPA	1142-07	Standard on Water Supplies for Suburban and Rural Fire Fighting	B107.1
ISO		Guide for Determining Needed Fire Flow, 2005 Edition	B107.1

APPENDIX C

FIRE HYDRANT LOCATIONS AND DISTRIBUTION

The provisions contained in this appendix are adopted by the State of Oregon.

SECTION C101
GENERAL

C101.1 Scope. Fire hydrants shall be provided in accordance with this appendix for the protection of buildings, or portions of buildings, hereafter constructed.

SECTION C102
LOCATION

C102.1 Fire hydrant locations. Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets.

SECTION C103
NUMBER OF FIRE HYDRANTS

C103.1 Fire hydrants available. The minimum number of fire hydrants available to a building shall not be less than that listed in Table C105.1. The number of fire hydrants available to a complex or subdivision shall not be less than that determined by spacing requirements listed in Table C105.1 when applied to fire apparatus access roads and perimeter public streets from which fire operations could be conducted.

SECTION C104
CONSIDERATION OF EXISTING FIRE HYDRANTS

C104.1 Existing fire hydrants. Existing fire hydrants on public streets are allowed to be considered as available. Existing fire hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstruction of such roads.

SECTION C105
DISTRIBUTION OF FIRE HYDRANTS

C105.1 Hydrant spacing. The average spacing between fire hydrants shall not exceed that listed in Table C105.1.

Exception: The fire chief is authorized to accept a deficiency of up to 10 percent where existing fire hydrants provide all or a portion of the required fire hydrant service.

Regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in Table C105.1.

TABLE C105.1
NUMBER AND DISTRIBUTION OF FIRE HYDRANTS

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a, b, c] (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more[e]	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Reduce by 100 feet for dead-end streets or roads.

b. Where streets are provided with median dividers which cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

d. Reduce by 50 feet for dead-end streets or roads.

e. One hydrant for each 1,000 gallons per minute or fraction thereof.

Appendix 4.2

City of Wheeler Comprehensive Plan, Public Facilities (Excerpt)

Ordinance No. 81-4, Policies and Regulations for the Municipal Water System

CITY OF WHEELER

COMPREHENSIVE PLAN

ADOPTED
DECEMBER 1979
WITH AMENDMENTS THROUGH
JANUARY 2010

5. The substantive requirements of the Wheeler zoning and subdivision ordinance shall apply within the urban growth boundary.

STRATEGIES:

It is recommended that the City participate in and encourage the activities of the Lower Nehalem Watershed Council.

PUBLIC FACILITIES

POLICIES:

1. Land uses and densities developed in the urban service area shall be coordinated with and shall not exceed capacity for existing or planned public facilities.

2. Key public facilities and services (water, sewer, the storm water drainage system, and approval of transportation) shall be provided in an orderly and efficient manner.

3. New developments requiring City water service, City fire protection, public sewer, storm water drainage system, or other urban area services shall be provided by the City of Wheeler only after annexation to the City.

4. Adequate storm water drainage facilities, as approved by the City, shall be part of all subdivision, planned unit developments or other developments which may impact storm drainage patterns.

    a. Proposals involving discharge into developed areas shall be consistent with the capacity of existing storm water facilities in the developed area:

    b. Proposals involving discharge into natural drainages should make special precautions including larger stream setbacks, larger lot sizes, reduced lot coverage, holding ponds or other methods as approved by the City;

    c. All developers shall work with the City to insure that natural drainages or drainage facilities installations are adequate to handle drainage for proposed and potential future development.

5. Adequate water, sewage treatment, and storm water drainage capacity shall be available prior to the approval of uses having major impacts on those services.

6. The extension of sewer, water, and storm water drainage services shall be at the affected property owner's expense.

7. Large developments or heavy water users shall make equitable contributions to the improvement of the water system and shall pay all costs associated with the extension of water lines.

8. Water lines in proposed developments shall be adequately sized to meet future needs at the projected density or usage, including fire flow requirements.

9. The City will cooperate with Tillamook County to develop and locate new solid waste management facilities.

10. The City shall cooperate with the School District to insure that growth of the City does not outstrip the District's ability to provide facilities. Subdivisions or other major developments that could generate large enrollment increases shall be permitted only after consideration of their impact on schools.

11. Because of the major impacts such activity has on the life of the community, major highway and railroad developments, such as realignment, relocation, purchase of additional right-of-way, construction of intersections or abandonment of rail lines, should be controlled through the City's Conditional Use procedure. Minor improvement such as repaving, and addition of bike lanes in existing rights-of-way shall be outright use.

STRATEGIES:

1. The capital improvements program for upgrading the water system should be implemented.

2. The City will cooperate with Tillamook County to find ways to manage solid waste disposal including recycling.

3. The City should consider establishing a joint venture street paving and drainage program whereby the City and adjacent property owners would share in the costs of improvements.
4. The City should consider the establishment of a parks and recreation sinking fund in order to accumulate matching funds for State or Federal programs.

5. The City needs to undertake a study of System Development Charges.

ORDINANCE NO. 81-4

AN ORDINANCE ESTABLISHING POLICIES AND REGULATIONS FOR THE MUNICIPAL WATER SUPPLY SYSTEM OF THE CITY OF WHEELER, TILLAMOOK COUNTY, OREGON AS AMENDED

The CITY OF WHEELER ordains:

ARTICLE 1. INTRODUCTION PROVISIONS

Section 1.010 Purpose: The purpose of this ordinance is to set policies and regulations to facilitate future improvements and the orderly expansion of the holding, treatment and distribution system; to direct the responsibility for the operation and maintenance of the system; and in general to promote the public health, safety, convenience and general welfare.

Section 1.020 Operation and Maintenance: The City Water Department, under the supervision of the Superintendent of Public Works, shall have the responsibility for the operation and maintenance of the water system as well as for keeping adequate records and for the submission of all reports that are required by the Federal Enviromental Protection Agency, the Oregon State Health Division, or any other governmental agency.

Section 1.030 Definitions:

(1) "Adequate": A domestic or municipal water supply source and distribution system, sufficient in capability to supply all peak daily domands and instantaneous demands during periods of maximum use, without reduction in pressure, except during an emergency.

(2) "Approval" or "Approved": Approved in writing.

(3) "Backflow": The flow of water or other fluid substance or mixture thereof into the domestic water supply system from any source other than the intended source of water supply.

(4) "Check Valve": A valve which allows flow in only one direction. It must be carefully machined to have free moving parts and assured water tightness and seat readily and completely. The face of the closure element and valve seat must be molded synthetic rubber, composition, or other non-corrodible material which will seat tightly under all prevailing conditions of field use. Pins and bushings shall be of bronze or other non-corrodible, non-sticking materials, machined for easy, dependable operation. The closure element shall be internally loaded to promote rapid and positive closure in all sizes where this feature is obtainable.

(5) "Chlorine Residual": The amount of chlorine remaining in the distribution system after the water has been treated with chlorine.

(6) "Chlorine Treatment": A process to disinfect water by treating it with chlorine.

(7) "Commercial Service": The plumbed location at which a customer of the City's Water Department carries on his activities of gaining a livelihood or performing a public service, as distinguished from his residence, and such activity may be a business, industrial, professional, or public nature. of

(8) "Contaminate": Any physical, chemical, biological or radiological substance or matter in the water.

2.10-1.030(23) 2.10-2.010(7)

(23) "Service Connection": That portion of the service line which extends from the main in the street to the curb or property line.

(24) "Service Line": The connection between the distribution system and the customer's system which is subject to the plumbing code.

(25) "Tentative Plans": Designs, specifications, materials and locations proposed for construction.

(26) "Turbidity": Opaque or muddy with particles of extraneous matter.

ARTICLE 2. STANDARDS

Section 2.010 Water Quality Standards:

(1) The water quality standards apply to water leaving the source facilities and to water entering the user's service line.

(2) The City Water Department shall have a routine chemical sampling of finished water collected and analyzed for each source at such time as to represent conditions of average water quality for a surface source before July 1st of each year.

(3) The City Water Department shall have a daily sample of finished water collected and analyzed for turbidity from each source where turbidity contamination may be present. One turbidity unit (TU), as determined by a monthly average is the maximum contamination level for turbidity.

In the event that analysis indicates that any physcal quality limit has been exceeded, the sampling and analysis shall be repeated promptly. the results of the two measurements shall be averaged, and recordered.

The City Water Department may require that additional physical quality sampling and analysis be performed when it is known or suspected that substandard water quality has occured in the distribution system.

(4) The City Water Department shall have microbiological samples collected at points which are representative of the conditions within the distribution system or points of water use. The samples shall be collected at regular intervals and in numbers proportionate to the population served by the water system. In no case shall the frequency be less than one sample per month form each source.

(5) Whenever the maximum contaminate levels for coliform are exceeded, resampling from the same point shall be initiated until the results obtained from at least two consecutive samples show the absence of coliform organisms. The location at which the special resamples are taken shall not be eliminated from future sampling because of a history of questionable water quality. Resamples required by this section shall not be included in calculating the total number of samples routinely collected each month to meet the sampling frequency requirements.

(6) Microbiological water samples shall be analyzed by a laboratory approved by the Enviromental Protection Agency.

(7) The City Water Department shall submit a summary of the analytical reports to the Enviromental Protection Agency and the State Health Division by

2.10-22020(8)

2.10-3.010(3)

(b) Facilities which meet the construction standards and yield potable water.

(c) Facilities which meet the construction standards and supply adequate water.

(d) Vicinity map of the proposed project relative to the existing system or established landmarks.

Plans shall be on standard size drafting sheets and drawn to scale.

Incomplete plans will not be considered tentative plans and may be returned.

(8) The City Water Department shall either approve submitted tentative plans for public water supply systems, as originally submitted, or shall propose modifications within 21 days of submission.

(9) Tentative plans amended to include modifications pursuant to the City Water Department's requests and resubmitted shall be considered approved upon resubmission and approval.

(10) Within 10 days after resubmission of the modified tentative plans pursuant to subsection (9) of this section, the City Water Department shall issue a written statement of approval of the tentative plans.

(11) Final plans shall accurately and completely illustrate and describe the completed system. Such plans shall be submitted to and approved by the City Water Department before any water is made available using the system. Where a significant change is found from tentative plans which have been approved, the tentative plans must be revised and resubmitted to the City Water Department for approval. Submission of final plans shall be interpreted as meaning the work has been completed in accordance with applicable law, rules and the approved tentative plans, and the engineer shall certify the final plans as being complete and accurate.

(12) Approval of final plans shall not be required prior to use of water from a system being replaced where the existing users would be without water while the final plans would be prepared, submitted to and reviewed by the City Water Department. The replaced system must, however, yield water safe for consumption prior to use.

Section 2.030 Minimum Pipe Size Standards:

(1) All pipe must meet City approval.

ARTICLE 3. OPERATION AND MAINTENANCE OF THE WATER SYSTEM

Section 3.010 Operation and Maintenance: The water system shall be operated and maintained in a manner that will continuously assure production and delivery of adequate and potable water. To assure this:

(1) All phases and components of the system shall operate effectively in the manner designed.

(2) Leaks and broken or malfunctioning equipment shall be promptly repaired or replaced.

(3) Proper equipment, tools, and parts shall be readily available and in good condition to make repairs. When possible, notice shall be given to users of impending work that will affect the quality or continuity of their

2.10-3.040(1)

Water quality sampling shall be done according to City Water Department, Federal, and State rules;

(1) When a bacteriological sample does not meet the standards, the City Water Department shall make a survey to attempt to determine the source of the contamination. Corrective action indicated by the survey shall be taken promptly, and a report of the same put on file. A resample shall betaken promptly from the same sampling point and this process continued until two consecative acceptable samples are obtained.

(2) A chemical analysis shall be performed as prescribed in Section 2.010 (2) of these rules and records shall be kept as required in subsection (3) above.

(3) Turbidity analysis shall be performed on samples from each point where finished water enters the system as required in section 2.010 (3). Results of turbidity readings shall be kept on record as required in subsection (4) above.

Chlorination practices and use of other chemicals; The operation and maintenance of chlorination and/or other chemical use equipment shall be in accordance with the manufactures recommendations and shall be such as to continuously produce water in accordance with City Water Department, Federal, and State treatment standards.

It shall be the duty of the owner of the property served to keep backflow protective devices in good working condition at all times. It shall be the duty of the owner of the property at any premise where backflow protective devices are installed to have thorough inspections and leakage tests made at least once a year or more often in those instances where successive inspections indicate failure. These devices shall be repaired, overhauled or replaced at the expense of the owner of the property they whenever they are found to be defective. Records of such tests, repairs and overhauls shall be kept by the City Water Department.

Section 3.050 Service Connections: No service connection shall be made to the City Water System, without the property owner first having made application for water service to the City Recorder, and a minimum of 24 hours notice having been given to the City Water Department.

No service shall be initiated until the connection fee has been paid. For individual service, the connection fee shall accompany the service application. There shall be no part time or seasonal service.

Section 3.060 Service Line Check Valve: With the construction of a new service line or the rehabilitation of an old service line, it shall be the policy of the City Water Department to withhold service beyond the meter box unless an approved check valve has been installed in the property owner's service line. The property owner shall install the check valve at his or her expense. A check valve is necessary to prevent a syphon action from the building plumbing system which may be brought on by line breakage or by action of the City Fire Department. A check valve will also help prevent the syphoning of contaminated water into the water system.

Section 3.070 Separation of Services: In the construction or rehabilitation of buildings with multi-purpose use or multiple dwelling units, each unit shall be served independently of the other units, but any present apartment complex, hotel, motel, or other commercial service now being served by one service line, may continue to be served in this manner at the option of the City Water Department, on either a flat rate or a metered basis. The owner of the establishment applying for such service shall be responsible for the total charges for the service rendered, as determined from the applicable filed commercial flat rate or metered rate schedule.

2.10-4.010
ARTICLE 4. ADMINISTRATIVE

Section 4.010 Application for Service: Application for water service, including turn on, transfer of account, and new service connection, must be made in writing to the City Recorder and shall contain an agreement by the applicant to abide by and accept all of the provisions of this ordinance as conditions governing the use of the City Water System by the applicant.

Section 4.020 Responsibility of Payment of Bills: The property owner of record shall be responsible for payment of all charges for service. The City shall submit billings for all user fees and charges to the property owner.

Section 4.030 Rates: All property upon which any building has been or may hereafter be erected having a connection with any water supply line, which is or may be hereafter constructed, placed or used in connection with the City Water System, shall pay a regular rate according to a schedule adopted by the City Council. This shall list all service connection charges and user rates, and shall be by resolution to enable its revision by the City Council to provide a current rate sufficient to meet the expense and obligations of the City Water Department. A current copy of such rate schedule shall be kept by the City Recorder, and shall be open to public inspection.

Section 4.040 Billings: Billings for water use shall be dated and sent out at such time as may be directed by the City Council.

Section 4.050 Separate Billings: All commercial services shall be billed independently from any residential service, with the exception of motels and apartment houses.

Section 4.060 Meter Readings: The City Water Department shall read or cause to be read every water meter used in the City at such time as may be directed by the City Council.

Section 4.070 Service Termination or Change of Occupancy: Customers vacating a premise where water service is provided must notify the City. The Water Department will render a final bill promptly, based on the applicable rate schedule, either flat rate or metered rate after making a final meter reading. A final bill will be due at once. Billing for portions of months will be prorated for actual days of use. There will be a charge to cover the cost of turning water off or on.

Section 4.080 Delinquent Accounts:

(1) A water account is delinquent if it is not paid on or before the tenth (10) day following the date of the mailing or presentation of a statement of account.

(2) A reminder of account delinquent notice may be sent to each delinquent account on or about thirty (30) days after the account becomes delinquent.

(3) Ninety (90) days after an account becomes delinquent, a turnoff notice shall be sent to each account which is delinquent. That notice shall specify that water service shall be turned off on a specified date if the delinquent account is not paid in full.

(4) On the turnoff date, the meter reader or other agent of the City Water Department shall deliver a written notice to the customer stating that water service is being turned off until all delinquent charges have

2.10-4.110 2.10-4.170

by the City Water Department, or by a contractor approved by the City, and to the specifications of the City Water Department. All materials used must be approved by the City Water Department and the extension will become a part of the City Water System. Where extensions are made by the City, when requested, they shall be paid by advance payment by the person or persons requesting them, at actual cost plus normal City overhead.

Whether the property owner pays a private contractor or the City to construct the waterline extensions, he shall for a period of ten (10) years be entitled to a reimbursement by the owner of propertythat obtains water service from the extension at a later date. An assessment shall be computed on a front foot (or square foot) basis and no new service connection shall be permitted to the extension until the person desiring the service has paid the assessment against his property.

The assessment is charges in addition to the regular service connection fee, and payment shall be made to the City Recorder at the time of application for water service is made, and the City Recorder shall have the obligation to repay the property owner who orginally paid to have the extension constructed.

Section 4.120 Water Line Assessments: The City Recorder shall record each waterline extension project on a form and enter it in the assessment book, listing all benefitted property, the owner's name, the legal description or assessor's description, stating those owners paying the extension costs, the names of owners still owing an assessment, the amount owed, and the date the project was completed, as well as the date the assessment will expire.

Section 4.130 Water Pressures: The City Water Department will endeavor to furnish water at a desireble service pressure. Where service pressures are higher than needed, or desired, customers may install and maintain within their premises any required pressure regulators for their convenience. If any customer desires more pressure, he may install a pressure pump on his own service line, at his own expense, on his own property, and operate and maintain it at his own expense. The City Water Department will not be responsible for damage if caused by variations in pressure within the system.

Section 4.140 Liability: The City Water Department will not be liable for any damage or injury for leakage or the running of water on the premises from pipe lines, plumbing fixture, open faucets, vlaves fixtures, devices, appurtenances and hoses located between the meter box and the premises served.

ction 4.150 Tampering: It shall be unlawful for any person or persons not authorized by the City Water Department to tamper with, alter, or damage any part of the water system.

Section 4.160 Resale and Unauthorized Uses: No water shall be resold or distributed by the recipient thereof from the City Water System to any premises or property other than that for which application has been made, except in cases of emergency. Any person found furnishing water shall be in violation of this ordinance, and shall be charged two (2) times the applicable schedule rate for this use.

Section 4.170 Service Outside the City: Water service generally will not be available to properties outside the City of Wheeler boundaries, unless the Council determines, after a hearing, that adequate water is available to serve such property. Upon such determination, the Council may enter into a contract for watef service with the owner of the applicant property. Such contract shall provide that water service may be cancelled at any time that the available supply of water is inadequate to meet the requirements of City users. It shall also provide for a rate schedule which will be comparable to cost of water to City users, including taxes paid by them.

CITY ORDINANCE NO. 91-04

AN ORDINANCE AMENDING THE CITY OF WHEELER WATER SYSTEM ORDINANCE NO.81-4

WHEREAS, The Water Ordinance has a provision for placing a lien on property where the water bill is not paid for ninety (90) days, and

WHEREAS, under present State Statute fees charged to a property instead of to a person, makes those fee charges a tax rather than a fee,

NOW, THERFORE THE CITY OF WHEELER ORDAINS AS FOLLOWS:

Section 4.090 Water Charges Liens; of ARTICLE 4. ADMINISTRATIVE is deleted.

Passed by the Common Council this 16th day of July, 1991 by the following vote;

3 ayes, 0 nays, 0 abstensions.

Robert Turner

Robert Turner, Mayor

ATTEST:

Darrell R. Olson

Darrell R. Olson, City Recorder

Appendix 4.3

Intergovernmental Agreement between the City of Wheeler and the City of Manzanita

INTERGOVERNMENTAL AGREEMENT
BETWEEN
THE CITY OF WHEELER AND THE CITY OF MANZANITA
(PERSON IN DIRECT-RESPONSIBLE-CHARGE)

This AGREEMENT is between the CITY OF WHEELER, an Oregon Municipal Corporation (hereinafter "Wheeler"), and the CITY OF MANZANITA, an Oregon Municipal Corporation (hereinafter "Manzanita").

RECITALS:

1. The City of Manzanita and the City of Wheeler entered into an Intergovernmental Cooperative Agreement (IGA) dated October 24, 2000 for the operation and maintenance of a jointly operated well water system.
2. Pursuant to OAR 333-061-0225 "General Requirements Applying to Water Systems", each water system owner delegates the responsibility of operating the water system to a certified operator known as the person in direct responsible charge.
3. The Oregon Department of Health Services/Drinking Water Program (DHS/DWP) interprets "system owner" for the purpose of delegating a person in direct responsible charge, to be the "Holder on Record" of the Water Right.
4. The Water Rights for the jointly operated well field are listed under the City of Wheeler's name.
5. Wheeler wishes to comply with requirements of OAR 333-061-0225 for employing, contracting with and designating an operator to be in Direct Responsible Charge - (DRC Treatment) of the water system.
6. The design of the recently completed system is such that, any changes at the well site also affects the operation of the City of Manzanita Treatment Plant.
7. Manzanita employs staff persons who are qualified to serve as the person in direct responsible charge of the treatment system (DRC –Treatment)

NOW, THEREFORE, IT IS AGREED BY AND BETWEEN THE PARTIES HERETO AS FOLLOWS:

1. DRC (DIRECT RESPONSIBLE CHARGE) DELEGATION. Manzanita will make available a City staff person who will be designated by Wheeler as the Person in Direct Responsible Charge (DRC - Treatment) of the jointly operated well system. Such staff person shall possess the certifications at or above the level required by the State of Oregon for the operation of the ground water well portion of the system. The Person in Direct Responsible Charge will supervise the technical operations of the system, establish and execute specific practices and policies for operating the system in accordance with policies and practices of the Cities and the requirements of the public water system rules, and will be engaged in the actual day-to-day operation and/or supervision of the system.
2. DURATION: This agreement shall be effective upon approval and execution by both City of Wheeler and City of Manzanita. The initial term of this agreement shall be from February 1, 2005 to January 31, 2006 and shall be automatically renewed for one year on

February 1 of each year thereafter unless either Wheeler or Manzanita provides to the other written notice of intent not to renew at least sixty (60) days prior to the annual renewal date.

3. TERMINATION: This agreement may be terminated by mutual consent of both parties; ~~or by either party at any time,~~ upon sixty days (60) notice in writing and delivered by certified mail or personal service.

4. DISPUTE RESOLUTION: If a dispute arises as to the operation of the joint system by the Person in Direct Responsible Charge, the two City Administrators shall first attempt to develop a solution. If both City Councils do not approve of the solution, the Mayors of both Cities shall call a special joint meeting of the two City Councils to discuss the dispute and attempt to reach a solution. In the event the City Councils cannot reach an agreement on the dispute, both City Councils agree to mediate the dispute. A mediator, agreeable to both City Councils, shall be selected. If mediation fails, the two Cities may pursue judicial resolution through the court system.

5. WRITTEN NOTICE ADDRESS: All written notices required under this Agreement shall be sent to:

WHEELER: City Manager
City of Wheeler
P.O. Box 177
Wheeler, OR. 97147

MANZANITA: City Manager
City of Manzanita
P.O. Box 129
Manzanita, OR. 97130-0129

IN WITNESS WHEREOF, the parties have caused this instrument to be executed in two (2) duplicate originals, either as individuals, or by their officers, thereunto duly authorized.

Dated this 9th day of March, 2005.

CITY OF MANZANITA

By: _____
Mayor

By: _____
City Manager

CITY OF WHEELER

By: _____
Mayor

By: _____
City Manager

INTERGOVERNMENTAL COOPERATIVE AGREEMENT
BETWEEN
THE CITY OF WHEELER AND THE CITY OF MANZANITA

This AGREEMENT is between the CITY OF WHEELER, an Oregon Municipal Corporation (hereinafter "Wheeler"), and the CITY OF MANZANITA, an Oregon Municipal Corporation (hereinafter "Manzanita").

RECITALS:

1. Wheeler and Manzanita are under Compliance Orders by the Oregon Health Division to bring their water systems into compliance with the Safe Drinking Water Act's surface water treatment rules.

2. While Wheeler is presently experiencing moderate growth and Manzanita substantial growth, available studies conclude that more growth in north Tillamook County is inevitable.

3. Based on present water regulations, a groundwater source of water is the most cost effective and long term solution to meet present and future water needs for the area.

4. A groundwater source of water has been located at river mile 10.6 on the South Fork of the Nehalem River and tests have concluded that sufficient water is available for a 40-50 year period. Although a groundwater source is not subject to the filtration requirements of surface water, future tests may determine some form of filtration is necessary.

5. Wheeler and Manzanita acknowledge that they have authority to execute this Cooperative Agreement pursuant to the powers of the respective municipal charters and pursuant to ORS 225.050.

NOW, THEREFORE, IT IS AGREED BY AND BETWEEN THE PARTIES HERETO AS FOLLOWS:

1. PURPOSE: The purpose of this Agreement is to develop, manage, maintain, and control a water supply distribution system to provide wholesale finished domestic water supply to Wheeler, Manzanita and future contractual surplus water purchasers.

2. JOINT SYSTEM: The joint system shall mean the well field, wells, disinfection plant, the transmission line from the wells to the intersection of Highway 101 and Highway 53, and two (2) master meters. Decisions on major changes to the joint system are subject to approval of both City Councils. Major changes are defined as one or more of the following:

(1) Addition or discontinuation of a water treatment process;
(2) Addition of a wholesale water customer, including addition of a wholesale customer to an individual City system, not anticipated in the original regional Master Plan.
(3) Increase in number of wells or capacity of existing wells;
(4) Increase in size of transmission line;
(5) Any contract for maintenance of the jointly operated facilities;
(6) Non-emergency repairs with a cost greater than 15% of the previous year's operations costs;
(7) Any capital improvements intended to become part of the joint system.

3. OWNERSHIP OF THE JOINT SYSTEM: Wheeler shall own the well field (T2N, R9W, Section 5, Tax Lot 201), access easement thereto, wells, and a telemetry monitoring station. Manzanita shall own the disinfection plant, the telemetry system, the transmission line from the wells to the junction of Highway 101, and the two (2) master meters.

   Manzanita shall be responsible for the design and construction of the joint system as part of its water system improvement project. This water system improvement project will also include the construction of a new water filtration plant which will be used to filter the Anderson Creek water source and the transmission line extending west from the intersection of Highway 101 and Highway 53 to Manzanita.

   Wheeler shall be given a reasonable opportunity to review and comment on the plans and specifications, change orders, and proposed cost overruns in relation to to the design and construction of the joint system. If the two parties cannot agree on the plans, specifications, change orders, or cost overruns, then this dispute shall be resolved in accordance with paragraph 14.

4. OTHER TRANSMISSION LINES: The transmission line extending west from the intersection of Highway 101 and Highway 53 to Manzanita, and the water filtration plant for Anderson Creek shall be owned and maintained by the City of Manzanita. The transmission line extending southeast from the intersection of Highway 101 and Highway 53 to Hemlock Street in Wheeler shall be owned by the City of Manzanita and maintained by the City of Wheeler. These transmission lines and filtration plant are not part of the joint system.

5. WATER RIGHTS: Water rights to the groundwater, certificates and permits shall be in the name of and owned by Wheeler.

6. WATER COST DISTRIBUTION: Manzanita will take responsibility for reading meters and billing wholesale customers along the jointly operated portion of the water system, from which funds received will be applied to directly offset joint system operation costs. Manzanita will bill on a monthly basis for water usage measured at Wheeler's master meter. The rate per gallon Wheeler will be charged will be based on the two cities' best

estimate of the actual operating costs for the previous year. The allocation of actual costs of operating the joint system will be reconciled annually by using the following procedure:

The cost of providing water through the well system will be compiled by Manzanita in March of each year for the previous twelve (12) month period ending the last day of February. Such costs shall include labor and materials provided by each City to operate and maintain the wells, disinfection plant, and the transmission line to the intersection of Highway 101 and Highway 53, electricity, permits and mileage. Debt amortization will not be considered a cost for this purpose, except for repayment of State of Oregon loans #A92003 and #V94009. Operations costs will include filtration plant operations costs of supplying water requested by Wheeler in the event the well field is shut down.

The total costs shall be divided as follows: The costs associated with the readiness to serve or standby capability of the joint system will be divided based on each City's percentage of equivalent dwelling units served by the total of the two communities. The costs in this category will be those which would be incurred even if no water was used (e.g., permits, line repair and labor). The costs associated with the actual production of water (e.g., electricity, chlorine, labor) will be divided based on the percentage of actual water usage by the respective Cities for the previous twelve (12) month period ending on the last day of February as determined by the master meters.

Based on this formula, if one City owes the other City money, the debt will be payable by May 31st of that year.

7. OPERATION, MAINTENANCE AND ADMINISTRATION OF JOINT SYSTEM: Routine joint system operation, maintenance and administration will be the responsibility of Manzanita and Wheeler through the use of existing staff and equipment. While both Cities will provide staff and equipment when needed, Manzanita shall have primary responsibility for repairs and billing. Manzanita will provide quarterly reports to Wheeler as to maintenance activities and the related costs. The telemetry system will be located in Manzanita and Wheeler will have a monitoring station directly linked to it.

8. TERMINATION OF AGREEMENT: After receipt of either grant assistance or loans from Rural Utility Service (RUS) to Manzanita and/or grant assistance or loans from RUS to Wheeler, this agreement cannot be terminated without the written consent of RUS.

9. ASSUMPTION OF BONDED DEBT: Any outstanding debt related to capital improvements not part of the joint system shall remain the responsibility of the respective party.

10. RESPONSIBILITY FOR OBLIGATIONS: All debts, liabilities and obligations related to the operation of the joint system shall be borne by the parties based on the proportionate share of operation costs in effect at the time the obligation is incurred.

11. SALES TO OUTSIDE USERS: Requests for permanent access to the joint system shall be required and approved by a respective majority of the Manzanita and Wheeler City Councils. For purposes of this section, outside users are those entities or individuals which are not presently full or part time customers of either Manzanita or Wheeler. Requests for permanent access to the joint system shall be reviewed on an individual basis and shall include a proposed rate analysis to reimburse the joint system for any capital expenditures and operation costs. In the event a majority of the Manzanita and Wheeler City Councils vote to deny any person in the service areas of Manzanita or Wheeler access to the joint system, before this denial shall be final RUS must concur in the denial.

12. TERMS OF AGREEMENT: This Agreement shall remain in effect for an initial period of forty (40) years from the date of the proposed loans from RUS to Manzanita and Wheeler. This agreement shall continue after the fortieth (40^{th}) anniversary of such date on a year-to-year basis unless terminated by one of the parties. The agreement shall terminate upon either party giving the other six (6) months advance written notice of such termination. Prior to receipt of either grants or loans by both Cities from RUS, this Agreement may be terminated by a majority vote by each of the City Councils of Manzanita and Wheeler.

13. AMENDMENT PROVISIONS: Terms of this Agreement may be amended by mutual agreement of the parties with approval by RUS. Any such agreement shall be in writing and shall refer specifically to this agreement and shall be executed by the parties.

14. DISPUTE RESOLUTION: If a dispute arises as to the operation of the joint system, the two City Administrators shall first attempt to develop a solution. If both City Councils do not approve of the solution, the Mayors of both Cities shall call a special joint meeting of the two City Councils to discuss the dispute and attempt to reach a solution. In the event the City Councils cannot reach an agreement on the dispute, both City Councils agree to mediate the dispute. A mediator, agreeable to both City Councils, shall be selected. If mediation fails, the two Cities may pursue judicial resolution through the court system.

15. EFFECTIVE DATE: This Agreement shall be effective on the date signed by the respective Mayor and City Administrator of the City of Wheeler and the City of Manzanita following adoption of this agreement by the respective City Councils.

16. WRITTEN NOTICE ADDRESS: All written notices required under this Agreement shall be sent to:

WHEELER: City Manager
City of Wheeler
P.O. Box 177
Wheeler, OR. 97147

MANZANITA: City Manager
City of Manzanita
P.O. Box 129
Manzanita, OR. 97130-0129

RUS: Rural Utilities Service
101 SW Main, Suite 1410-A
Portland, OR 97204-3222

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals as of the date and year herein below written.

Wheeler is acting in this matter pursuant to Ordinance No.2000-04 and adopted by the Wheeler City Council on the 24th day of October, 2000.

Manzanita is acting in this matter pursuant to Ordinance No. 00-02 and adopted by the Manzanita City Council on the 4th day of October, 2000.

CITY OF MANZANITA

By: _____
Mayor

By: _____
City Manager

CITY OF WHEELER

By: _____
Mayor

By: _____
City Manager

Appendix 5.1

Manzanita/Wheeler Water Management & Conservation Plan, April 2010 Update

Update by John Handler, City of Manzanita, April 2010; HGE, Inc., September 2005

Manzanita / Wheeler

Water Management & Conservation Plan

April 2010 Update

Updated by: *John Handler* WD2/WT2/CCS
City of Manzanita - Consultant

5/6/2010 - Final Documents copied and delivered to;
Jerry Taylor – City of Manzanita Manager
Frank Sinclair – City of Wheeler Manager

5/6/2010 - Emailed copies sent to;
Dan Weitzel – City of Manzanita DRC
Bill Fujii – OWRD Field Services
WALT TRIBBLE – WHEELER MAYOR
JERRY TAYLOR – MANZ. CITY MGR

HGE INC

ARCHITECTS
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541.269.1166
FAX 541.269.1833
general@hge1.com

PROJECT #: 04.71

CITY OF MANZANITA/ CITY OF WHEELER

WATER MANAGEMENT AND CONSERVATION PLAN

for:
City of Manzanita/City of Wheeler, Oregon

September 2005
Data Updated - April 2010
By; John Handler - City of Manzanita

Project #: 04.71

City of Manzanita

City of Wheeler

WATER MANAGEMENT AND CONSERVATION PLAN

September 2005
Data Updated - April 2010
By; John Handler - City of Manzanita
City of Manzanita
543 Laneda Ave
Manzanita, OR 97130

City of Wheeler
P.O Box 147
Wheeler, OR 97147

Prepared by:
HGE, Inc., Architects, Engineers, Surveyors & Planners
19 NW 5th Ave
Suite 300
Portland, OR 97420

TABLE OF CONTENTS

SECTION 1: INTRODUCTION

1.1 BACKGROUND

The City of Manzanita and the City of Wheeler in (2003) completed extensive water system improvements including two supply wells and transmission mains that form the backbone of what was ultimately planned as a regional water supply. Currently the system serves the City of Manzanita, the City of Wheeler, and the communities of Zaddach Water Coop, Tideland Water Coop and Nehalem Bay State Park. Joint elements of the water system are covered by an (IGA) Intergovernmental Cooperative Agreement between Wheeler and Manzanita. Neither City has previously submitted a water management and conservation plan.

1.2 PURPOSE

Water rights permit G-13479 which governs withdrawals at the system's two new wells includes a requirement that a water management and conservation plan (WMCP) consistent with OAR Chapter 690, Division 86, be submitted to the Oregon Water Resources Department (OWRD). The purpose of this document is to fulfill the permit requirement.

1.3 PLAN DEVELOPMENT

The City of Manzanita and the City of Wheeler provided most of the information and data used to develop this plan. Overall plan development is consistent with described objectives and discussions with representatives of both cities.

1.4 PROPOSED PROGRESS REPORT AND UPDATE SCHEDULE

Because of high area development (growth) rates and potential for adding additional communities to the system, it is recommended that an update of the WCMP be completed in five years (2015). The update should include a review of system progress in meeting the objectives and schedules include in this WCMP.

1.4.1 DATA UPDATE – April 2010

Based on a meeting held in the Salem OWRD office on Mar 10th, 2010, the data in this document has been updated to include the interim period since initial submission of this plan to include the additional timeframe from Jan 1st, 2005 thru March 1st, 2010.

SECTION 2: MUNICIPAL SUPPLIER DESCRIPTION

2.1 SERVICE AREA AND POPULATION

2.1.1 Service Area

The service area for the Manzanita/Wheeler water system is shown in Exhibit 2.1 (at the end of Section 2). Currently, the system includes the City of Manzanita, the City of Wheeler, Communities including, Zaddach Water Coop, Tideland Water Coop and Nehalem Bay State Park. There is an emergency connection with the City of Nehalem. Water Rights, sources and transmission mains are located outside the service area in the hills above Manzanita, Wheeler and near the Nehalem River to the east.

2.1.2 Resident Population Estimates and Census Data

Table 2.1 includes recent decennial census population figures and population estimates from the Center for Population and Census at Portland State University.

Table 2.1: Historical and Recent Residential U.S. Census Populations

Year	City of Manzanita Total Population (+)	City of Wheeler Total Population	Zaddach Coop and Tideland Coop Total Population (*)	Water System Total Population
1980	443	319		
1990	513	335		
2005	660	420	89	1169
2006	690	435	89	1214
2007	725	445	89	1259
2008	735	460	89	1284
2009	745	460	89	1294

	City of Manzanita and City of Wheeler figure sources: ... U.S. Census for 1980, and 1990, figures. ... Center for Population Research for 2005 thru 2009 figures.
(+)	**Manzanita's True Population is not reflected in these figures due to the very high number of vacation homes in the service area. ... A more accurate number may be obtained by multiplying total services times 2000 Census figure of 1.84 persons per occupied household. (Manzanita)**
(*)	**Zaddach Coop and Tideland Coop Figures: > Estimate based on 40 service connections and 2000 Census figure of 2.22 persons per occupied household (for Wheeler)**

2.1.3 Non-resident Population Estimates

Both Manzanita and Wheeler have significant non-resident populations that are not included in the official census figures and population estimates. Non-resident populations peak during the summer, however there are significant presence in shoulder periods extending into spring and fall based on weather.
Seasonal peaking occurs on summer weekends and holidays throughout the year (such as the 4th of July, Christmas, etc.) Both cities are located on Hwy 101 and receive considerable tourist traffic during the summer season. In addition, proximity to Portland and other major municipalities facilitates visits by non-resident homeowners throughout the year.

Census 2000 figures for Manzanita and Wheeler do show relative proportions of resident and non-resident housing occupancy.

Table 2.2:
Housing Occupancy Percentages ... (Source: U.S. Census 2000 Data)
Housing Units based on actual counts ... (Actual count from billing records)

Per Year 2000 U.S. Census Data	City of Manzanita		City of Wheeler	
Total Housing Units (December 31st, 2009) (Actual Count) >>	1652		250	
	(%) per 2000 census	Units December 2009	(%) per 2000 census	Units December 2009
Occupied Housing Units (residents)	28.5%	471	72.1%	180
Seasonal, Recreational, or Occasional use housing units	67.1%	1108	23.1%	58
Other (City & vacant) housing units	1.8%	30 (Actual count)	4.8%	12
Average household size of occupied (resident) units	1.84	Per 2000 census	2.22	Per 2000 census

Manzanita in particular, exhibits a very high ratio of non-resident to resident housing units.

2.2 WATER CUSTOMERS

2.2.1 Communities Served

Communities currently served by the water system include:

City of Manzanita – Feb 28th, 2010	1,652 service connections
City of Wheeler – Feb 28th, 2010	253 service connections
Tideland Coop – Feb 28th, 2010	16 service connections
Zaddach Coop – Feb 28th, 2010	24 service connections
Nehalem Bay State Park – Feb 28th, 2010	1 bulk service connection
Total	**1,946 service connections**

2.2.2 City of Manzanita Customers

Based on February 28th, 2010 data, the City of Manzanita serves the following customers:

Residential (3/4" meter)	1,560 meters
Commercial (< 2" meters)	59 meters
Commercial (2" or larger meter)	2 meters
Bulk (Nehalem Bay St. Park 2" meter)	1 meter
City of Manzanita Services	14 meters
Service temp turned off	16 meters
Total	**1,652 meters**

2.2.3 City of Wheeler Customers

Based on February 28th, 2010 data, the City of Wheeler serves the following customers:

Residential (3/4" meter)	213 meters
Commercial	40 meters
Total	**253 meters**

2.2.4 Other Communities – February 28th, 2010

Zaddach Coop – Residential (3/4" meter)	24 meters
Tideland Coop – Residential (3/4" meter)	16 meters
Total	**40 meters**

Nehalem Bay State Park is included in Section 2.2.2, since it is fed directly from the City of Manzanita distribution system. ... The City of Nehalem receives some finished water through one connection under emergency or high demand periods.

2.3 SOURCE OF SUPPLY

2.3.1 Summary of Existing Water Rights

Water Rights. City of Manzanita and City of Wheeler Water Rights are described in Table 2.3

Table 2.3: Water Summary
City of Manzanita and City of Wheeler

Owner	Priority Date	Permit No.	Certificate No.	Use	Type	Rate (cfs)	Description
Manzanita	12/15/1978	43756	NA	MU	S	0.50	West Fork Anderson Creek
Manzanita	12/10/1945	17073	4775	MU	S	0.25	Middle Fork Anderson Creek
Manzanita	12/10/1945	17073	4775	MU	S	0.25	North Fork Anderson Creek
Manzanita	8/14/1950	21913	21707	MU	S	0.867	Neahkahnie Creek
Manzanita	9/14/1948	18634	21684	MU	S	0.50	Alder Creek
Manzanita	6/12/1951	21913	21708	MU	R	1.23 ac/ft	Alder Creek / Neahkahnie Cr.
Manzanita	8/14/1950	21913	21707	MU	S	0.433	Alder Creek
Wheeler	1/24/1913	S1455	2440	MU	S	3.00	Jarvis Creek
Wheeler	3/14/1930	S9558	9250	MU	S	0.28	Jarvis Creek
Wheeler	8/15/1974	S39355	NA	MU	S	4.00	Vosburg Creek
Wheeler	7/29/1993	G12196	NA	MU	GW	3.60	**Well #1 & Well #2**

Abbreviations:
NA – not applicable
MU – municipal
S – surface source
R – reservoir
GW – ground water

Wheeler currently relies on Well #1 and Well #2 for it's (potable) municipal supply. Wheeler has connected its Jarvis Creek surface source to a hydrant located on 3rd Street and Rowe Street with the intent of using the water for City related purposes exclusive of potable consumption.

Manzanita, and other parts of the system, utilize Well #1 and Well #2, and the Anderson Creek surface sources for municipal supply. Manzanita has not

utilized its other surface water sources in recent years due to low flows and high iron concentration.

2.4 SUMMARY OF RECENT USE

2.4.1 Recent Water Withdrawals

Well #1 and #2, and the Manzanita Water Treatment Plant, came on-line in March 2003. Zaddach Coop came on-line in September 2004. Tideland Coop came on-line in October 2007.

Prior to March 2003, Manzanita and Wheeler had separate systems.

Water withdrawals for years 2007-2008 and 2008-2009 are shown in Table 2.4 on the next page, for each active source.

Table 2.4

SEE NEXT PAGE

Table 2.4: Recent Water Withdrawals

(Source: OWRD Water Use Reporting Forms) with **corrected numbers**[1]

2007-2008

Month/Year	Well #1	Well #2	Anderson Cr. N. Fork	Anderson Cr. W Fork	TOTAL
Oct 2007[1]	4,995,407	**4,168,635**	802,084	802,084	**10,768,210**
Nov 2007	4,048,637	5,155,262	336,215	336,215	**9,876,329**
Dec 2007	3,575,544	4,663,023	743,537	743,537	**9,725,641**
Jan 2008	3,916,823	4,805,269	863,461	863,461	**10,449,014**
Feb 2008	3,292,059	5,747,016	459,020	459,020	**9,957,115**
Mar 2008[1]	4,064,797	**5,538,739**	619,021	619,021	**10,841,578**
Apr 2008	3,418,987	5,978,367	330,772	330,772	**10,058,898**
May 2008	1,494,696	9,049,838	353,312	353,312	**11,251,158**
Jun 2008	5,235,505	6,121,794	218,131	218,131	**11,793,561**
Jul 2008	6,010,370	9,853,143	154,334	154,334	**16,172,181**
Aug 2008	60,487	14,460,026	436,269	436,269	**15,393,051**
Sep 2008	3,751	11,101,108	277,273	277,273	**11,659,405**
2007-08 Totals	**40,117,063**	**86,642,220**	**5,593,429**	**5,593,429**	**137,946,141**
% of Total	**29.08%**	**62.81%**	**4.05%**	**4.05%**	**100.00%**

2008-2009

Month/Year	Well #1	Well #2	Anderson Cr. N. Fork	Anderson Cr. W Fork	TOTAL
Oct 2008	0	9,262,170	251,251	251,251	**9,764,672**
Nov 2008	0	8,603,261	208,046	208,046	**9,019,353**
Dec 2008	0	8,980,608	339,633	339,633	**9,659,874**
Jan 2009	0	7,713,973	366,448	366,448	**8,446,869**
Feb 2009	0	6,106,399	152,923	152,923	**6,412,245**
Mar 2009	0	6,904,934	136,000	136,000	**7,176,934**
Apr 2009	0	6,156,787	202,662	202,662	**6,562,111**
May 2009	0	7,913,237	170,314	170,314	**8,253,865**
Jun 2009	2,082,021	7,165,274	312,000	312,000	**9,871,295**
Jul 2009	4,004,437	10,442,288	95,500	95,500	**14,637,725**
Aug 2009	7,583,265	5,742,797	0	0	**13,326,062**
Sep 2009	3,549,091	5,886,080	0	0	**9,435,171**
2008-09 Totals	**17,218,814**	**90,877,808**	**2,234,777**	**2,234,777**	**112,566,176**
% of Total	**15.30%**	**80.73%**	**1.99%**	**1.99%**	**100.00%**

[1] **Oct 2007 & Mar 2008 OWRD data errors, > corrected water usage shown in RED!**

2.4.2 Seasonal Usage and Peaking

Seasonal peaking typically occurs in July and August with the largest (recent) water withdrawal in July 2008 (see Table 2.4). Annual average withdrawal for the system is 343,168 gpd (October 2007 – September 2009). Peak month average is 531,168 gpd (July 2008). For the month of July 2008, Manzanita utilized an average of 341,219 gpd, with a peak day of 665,000 gpd; the ratio of peak day to peak month is 1.25. Table 2.5 shows measured and estimated peaking for system's raw source water.

Table 2.5: Raw Water Withdrawals

2007-2009

Parameters	gpd	gpm	cfs	Peaking Factor
Average day	343,168	238	0.53	1.00
Peak month	532,000	369	0.82	1.55
Peak day	665,000	462	1.03	1.94 [2]

2.5 FACILITIES DESCRIPTION

2.5.1 Water System - General

Exhibit 2.1 shows the general location of key water components. Exhibit 2.2 shows the water system in schematic form.

2.5.2 Source / Treatment

Well #1 and Well #2 were constructed and brought on-line (March 2003). All phases of their planning, funding, design, construction and operation were conducted in compliance with prevailing standards and regulatory requirements. Water quality is excellent and treatment is limited to pH adjustment (with soda ash) and disinfection (with hypochlorite). Each well is provided with a 50 HP pump and variable frequency drive. Well #1 is rated at 500 gpm; installed maximum pumping rate is 520 gpm (748,800 gpd). Well #2 is rated at 1,000 gpm (1,440,000 gpd); installed maximum pumping capacity is 525 gpm. Duplex well pumping capacity is 750 gpm.

The Anderson Creek sources are located high in the watershed. Locked gates

[2] **Product of 1.55 X 1.25**

Restrict access to the area. The North Fork and West Fork have small, permanent diversion dams to facilitate withdrawals. The Middle Fork diversion dam washed out a few years ago and has not yet been repaired completely. Water quality is generally excellent. Citizens of Manzanita, in numerous meetings, expressed preference and support for continued utilization of the surface water sources rather than reliance on the new groundwater source. Citizen demands resulted in construction of the new membrane filtration plant to treat Anderson Creek water and bring the City into compliance with surface water treatment rules.

The recently constructed Manzanita Water Treatment Plant came online in March of 2003. The facility utilizes a microfiltration membrane process with an installed capacity of 350 gpm. Overall design allows for a future capacity expansion to 690 gpm. Filtered water is disinfected and pumped directly to the City's reservoirs. The facility is new and functioning well.

2.5.3 Transmission

Well water transmission mains were constructed in 2002. The mains are HDPE and include: 1,200 LF of parallel 8" main between the wells and the well control building, 22,000 LF of 12" main between the well control building and the Wheeler Inter-tie, 3,300 LF of 8" main between the Wheeler Inter-tie and Wheeler at 1st Street, and 16,900 LF of 12" main between the Wheeler Inter-tie and the City of Manzanita Water Treatment Plant.

The Anderson Creek sources have collector lines of approximately 1,000 LF each that join to the primary raw water transmission main. The transmission main includes a 15,200 LF section of predominately 8" AC pipe and a 5,000 LF section of 8" PVC pipe that extends to the new treatment facility in Manzanita.

2.5.4 Distribution

The Manzanita distribution system includes two pressure zones and over 15 miles of pipelines. Diameters range from 2" to 10". Approximately 63 percent of the lines are 6" or smaller. Materials are predominately AC, PVC and HDPE. Lower areas of the city have static pressures of approximately 47-95 psi.

The Wheeler distribution system was extensively upgraded in 2003. The system has two pressure zones. Many older AC mains are still in use. Prior to the departure of the Public Works director in September of 2005, several large main leaks were repaired.

2.5.5 Storage

Finished water storage facilities in Manzanita and Wheeler are summarized in Table 2.6:

Table 2.6: Finished Water Storage Facilities

Owner	Description	Capacity	Construction Date
Manzanita	Reservoir #2 (concrete)	0.25 MG	1960
Manzanita	Reservoir #1 (welded steel)	0.50 MG	1979
Manzanita	Reservoir #3 (fused glass steel)	1.60 MG	1997
Manzanita	Treatment Plant Clearwell	0.07 MG	2003
Wheeler	Jarvis (bolted steel)	0.25 MG	2003
Wheeler	Vosburg (bolted steel)	0.25 MG	2003
Manzanita Total Storage Capacity		**2.42 MG**	
Wheeler Total Storage Capacity		**0.50 MG**	

2.6 SYSTEM EFFICIENCY

2.6.1 Typical Residential Water Usage

Typical residential water usage in Manzanita and Wheeler is shown in Table 2.7 on the next page.

Table 2.7: Typical Residential Water Usage
Manzanita data: March 2009 - February 2010
Wheeler data: March 2009 - February 2010
Figures based on estimated population, as noted below ... and actual water usages!

	Manzanita		Wheeler	
Parameter	**gal.**	**period**	**gal.**	**period**
Gallons per Day (gpd)				
Minimum [3]	139,238	Apr 2009	33,547	Jan 2010
Average	202,522	3/1/09 - 2/28/10	49,911	3/1/09 - 2/28/10
Maximum	341,219	Jul 2009	69,727	Jul 2009
Gallons per Capita per Day (gpcd) [1]				
Minimum	47.5	April 2009	72.9	April 2009
Average	69.0	3/1/09 - 2/28/10	108.5	3/1/09 - 2/28/10
Maximum	116.3	"	151.6	"
Gallons per Residential Connection Day [2]				
Minimum	89.3	3/1/09 - 2/28/10	157.5	3/1/09 - 2/28/10
Average	129.8	"	234.3	"
Maximum	218.7	"	327.4	"

[1] – Based on ... Manzanita resident population: 2,933; and Wheeler resident population: 460

[2] – Based on ... Manzanita: 1,560 residential connections; Wheeler 213 Residential connections

[3] – Based on ...Minimum usage for April 2009 > Lowest 2009 monthly usage!

Manzanita pop estimate - 1560 serv x 1.88 residents/serv = 2,933 Dec 31st, 2009 estimated population

Wheeler pop estimate - 213 serv x 2.16 residents/serv = 460 Dec 31st, 2009 estimated population

Per 2000 census data, Manzanita has 1.88 persons per household; ... Per 2000 census data, Wheeler has 2.16 persons per household

The per capita figures for Manzanita are somewhat misleading in that there is a significant non-resident presence in this vacation community, even in winter.

2.6.2 Unaccounted Water

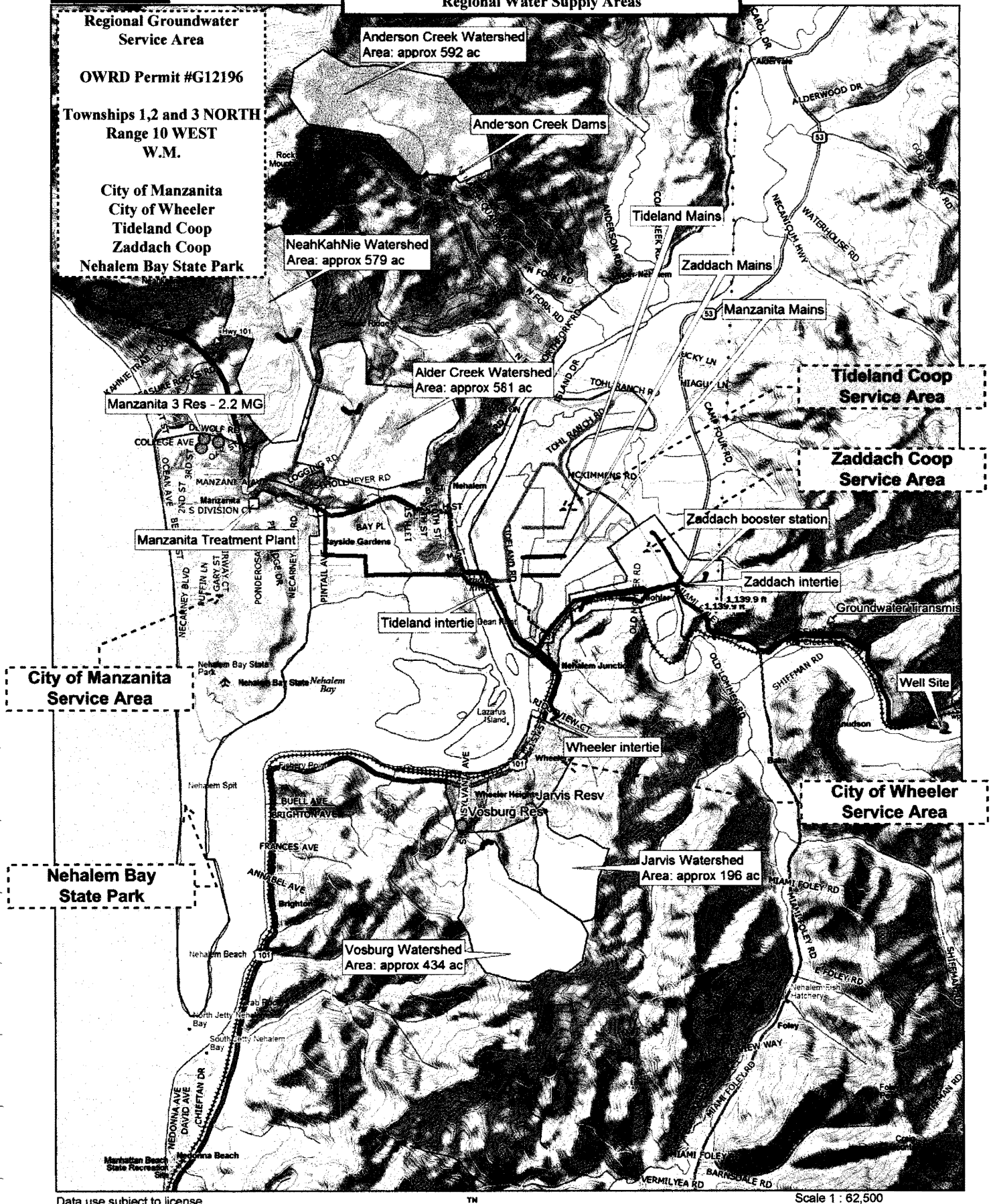
For the one year period (January 2009 thru Dec 2009), Manzanita produced a total of 67,982,200 gals of finished water. The service meter total for the same period is 65,098,079 gals. Based on this data there is an estimated unaccounted for water fraction of 4.4 percent. Manzanita calculates this number quarterly and it has ranged from 8.8% to 2.4% each quarter during this time frame.

For the one year period (Jan 2009 thru Dec 2009), Wheeler master meter indicated 20,206,331 gallons supplied to the City thru the master meter. The accounted for water for this period was 15,430,785 gals. Based on this data, the estimated unaccounted for water was 23.6 percent. Previous to the water 2003 water project, estimates for unaccounted for water normally exceeded 50 percent. The latest first period 2010 billing indicates water loss at 21.2 percent and continues to fall as the new Wheeler water distribution employee locates and repairs leaks.

DeLORME

EXHIBIT 2.7.1 - Manzanita/Wheeler Regional Water Supply Areas

Topo USA® 6.0



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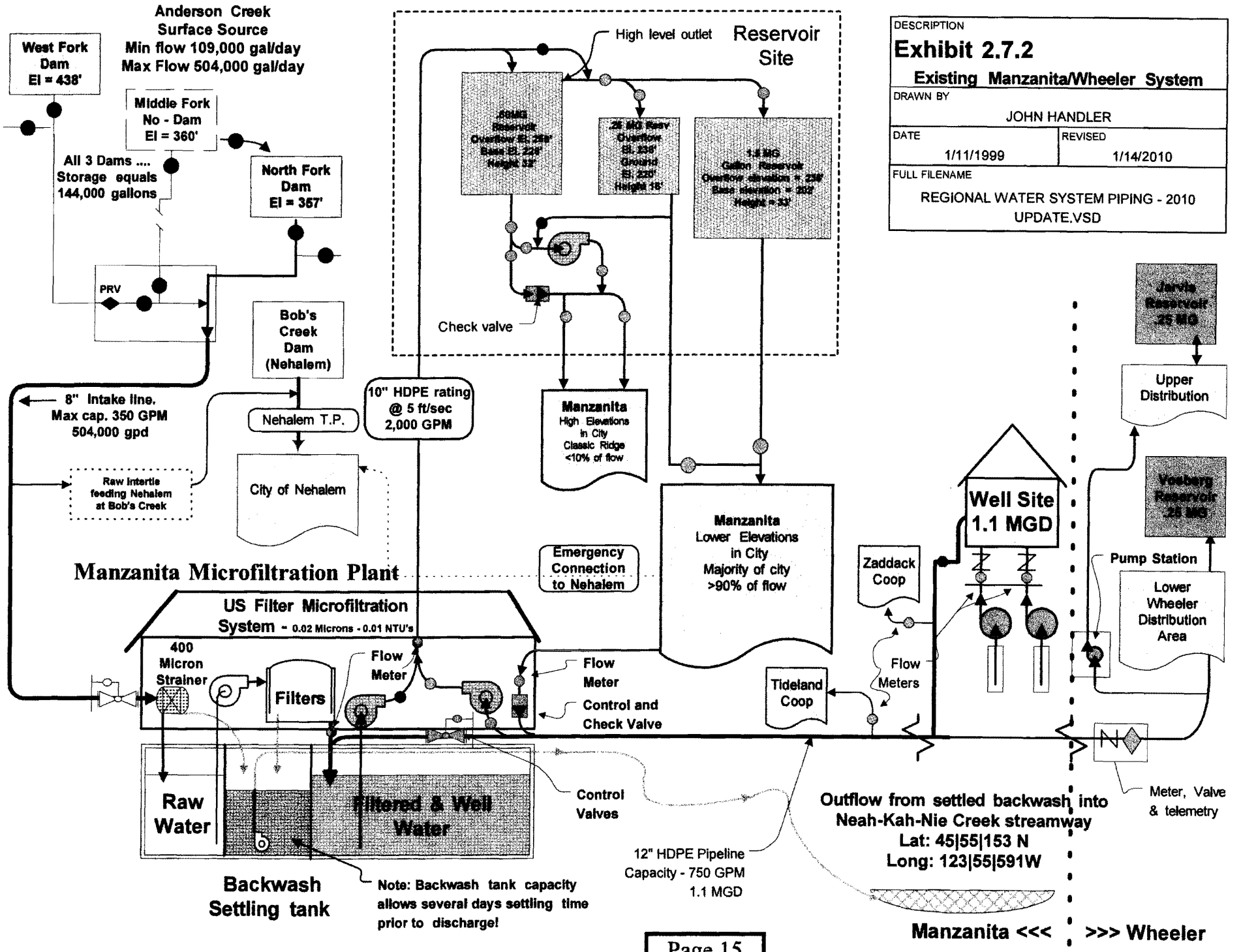
TN

MN (16

Scale 1 : 62,500

1" = 5,208.3 ft

Data Zoom 12-0


Anderson Creek
Surface Source
Min flow 109,000 gal/day
Max Flow 504,000 gal/day
West Fork Dam El = 438'
Middle Fork No - Dam El = 360'
All 3 Dams .... Storage equals 144,000 gallons
North Fork Dam El = 357'
PRV
Bob's Creek Dam (Nehalem)
8" Intake line. Max cap. 350 GPM 504,000 gpd
Raw intertie feeding Nehalem at Bob's Creek
Nehalem T.P.
City of Nehalem
10" HDPE rating @ 5 ft/sec 2,000 GPM
Reservoir Site
High level outlet
.25 MG Reserv Overflow El. 336' Ground El. 320' Height 16'
1.5 MG Gallon Reservoir Overflow elevation = 236' Base elevation = 203' Height = 33'
Check valve
Manzanita High Elevations in City Classic Ridge <10% of flow
Manzanita Lower Elevations in City Majority of city >90% of flow
Emergency Connection to Nehalem
Manzanita Microfiltration Plant
US Filter Microfiltration System - 0.02 Microns - 0.01 NTU's
400 Micron Strainer
Filters
Flow Meter
Flow Meter
Control and Check Valve
Raw Water
Filtered & Well Water
Control Valves
Backwash Settling tank
Note: Backwash tank capacity allows several days settling time prior to discharge!
12" HDPE Pipeline Capacity - 750 GPM 1.1 MGD
Zaddack Coop
Tideland Coop
Flow Meters
Well Site 1.1 MGD
Pump Station
Jarvis Reservoir .25 MG
Upper Distribution
Vosberg Reservoir .25 MG
Lower Wheeler Distribution Area
Meter, Valve & telemetry
Outflow from settled backwash into Neah-Kah-Nie Creek streamway
Lat: 45|55|153 N
Long: 123|55|591W
Manzanita <<< >>> Wheeler
DESCRIPTION
Exhibit 2.7.2
Existing Manzanita/Wheeler System
DRAWN BY
JOHN HANDLER
DATE
1/11/1999
REVISED
1/14/2010
FULL FILENAME
REGIONAL WATER SYSTEM PIPING - 2010 UPDATE.VSD

TITLE

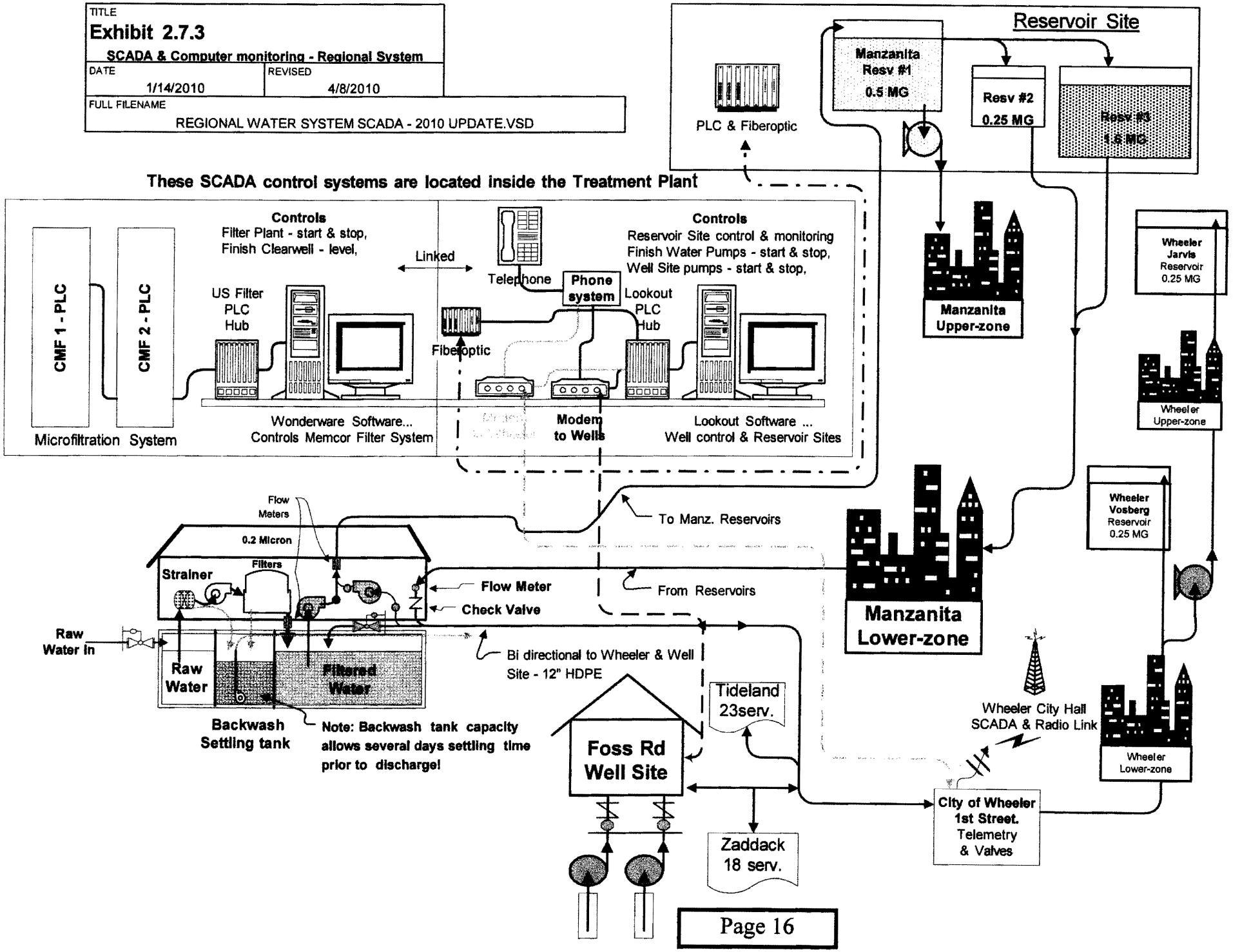
Exhibit 2.7.3

SCADA & Computer monitoring - Regional System

DATE	REVISED
1/14/2010	4/8/2010

FULL FILENAME

REGIONAL WATER SYSTEM SCADA - 2010 UPDATE.VSD



SECTION 3: CONSERVATION ELEMENT

3.1 PREVIOUS AND CURRENT CONSERVATION EFFORTS

3.1.1 Metering

Metering and data acquisition is currently in place for:

- All raw water sources. Anderson Creek North Fork and West Fork water passes thru the same meter; Manzanita assumes a 50/50 contribution from each of these sources.
- All interties and bulk sales. The only exception is the emergency finished water intertie with Nehalem. Manzanita has purchased a new 4" meter which is scheduled to be installed during the summer of 2010. This connection has not been used over the past 18 months.
- All customer service connections.
- Reservoir inlets.
- Treatment processes including backwashing and discharge to waste.

Full metering of customer service connections provides data for usage based rates and billing. Metering and usage rates are probably the single most effective means of promoting water conservation. Both Manzanita and Wheeler are fully metered and water billings in part are based on metered water usage.

Service meters are read quarterly in Manzanita and every odd numbered month in Wheeler.

Manzanita has an active meter testing and replacement program. Approximately one tenth of Manzanita's service meters are replaced annually.

3.1.2 Monitoring

Manzanita is highly vigilant in monitoring data for changes, discrepancies, or other indicators of problems in the system. The City's SCADA system is set up to compile and compare usage throughout the system, including Wheeler's.

Leaks as small as that occurring in ¾" service lines can be detected. (The SCADA system is configured to establish the general area in which a leak occurs; it cannot establish the exact location.)

Manzanita's Public Works Department maintains exhaustive computer files and spreadsheets that track and compare planning, flow, water quality and usage data. These are located at the Treatment Plant/ SCADA location. The City's billing software also tracks usage and notes departures from previous usage patterns and / or excessive use.

3.1.3 Leak Detection and Repair

Reported Leaks and potential leaks identified by the SCADA system or billing programs are promptly addressed by public works personnel. Manzanita also monitors (via SCADA) Wheelers system and notifies Wheeler Public Works if there is a potential leak detected.

Manzanita has installed new valves in many areas to facilitate isolation of lines and repairs. Manzanita has replaced sections of the raw water transmission line from the Anderson Creek sources to correct leaks. This line also has a pressure detection system connected to the SCADA system, which is used for monitoring potential leaks.

Both Manzanita and Wheeler have replaced many older AC lines. Manzanita replaced approximately 1+ miles of distribution mains throughout the downtown area in 2008.

Wheeler has located and repaired several large leaks in the 2005 thru 2009 time period that has reduced consumption by almost 40% from pre 2003 usage.

3.1.4 Policies

Manzanita currently requires installation of Lo-Flow water fixtures on all new (or remodel) construction. The City also recommends native plant landscaping during plan review; however, there are no requirements that recommendations be implemented. The City reports that most new homes in the area are opting for native landscaping. Drip irrigation is recommended for those that do choose to irrigate plantings. The City also reports a significant number of residents have changed their plantings to low (or no-use) water demand landscaping because of the relatively high water rates stemming, in part, from debt service on recent improvements.

Manzanita Public Works will check suspected leaks, or customers' suspicions of a leak, at no charge to the customer. Customers who have a leak repaired are eligible to have the effected billing adjusted to what the average billing would have been upon proof of the repair (such as a receipt from a plumber) and a City follow-up check of the water meter. Manzanita also follows up (with an on-site visit) on water accounts that are flagged by the City's billing software as exhibiting abnormal usage.

3.2 PLANNED CONSERVATION MEASURES

3.2.1 City of Manzanita - Conservation

Currently the area has sufficient water rights and source development to meet customer needs and to allow for system growth; consequently, conservation efforts are not being driven by water demand. Both Manzanita and Wheeler have recently completed extensive improvement projects including source development/expansion and a new surface water treatment plant in Manzanita; consequently, conservation efforts are also not being driven by economics. Manzanita's conservation efforts to date reflect a progressive attitude toward the inherent benefits of conservation and the long-term sustainability and reliability of its water supply. It also reflects a commitment by the City and Public Works Department to promptly address system deficiencies within the constraints of affordability and practicability. Manzanita extends its assistance to Wheeler in monitoring the system and providing technical assistance.

Policies and practices currently in place are anticipated to be carried forth indefinitely into the future. Additional measures to be implemented by the City of Manzanita include:

- Install a water meter on the (finish) water line that connects to the City of Nehalem's system. The line is currently unmetered and used for emergencies only. ... *Meter is purchased, installation scheduled for summer 2010*
- Replace the existing transmission line from the Anderson Creek sources. The line is old and susceptible to breakage. ... *Ongoing*
- Replace AC and other old mains as practicable and affordable. ... *Ongoing*
- Develop short articles and information on conservation for inclusion in the City's quarterly newsletter. ... *Included in Annual CCR to customers*
- Annual water audit that includes detailed estimates of all unmetered usage (such as hydrant flushing). ... *Ongoing and completed quarterly*
- Complete a new Water Master Plan. ... *Completed May 2006*

OAR 690-086-0150(4) requires all water suppliers to implement the following conservation measures:

- An annual audit. ... *Ongoing and completed quarterly*
- Full metering of service connections. ... *Both systems are 100% metered*

- A meter testing and maintenance program.
- A rate structure that reflects and incorporates consideration of metered water consumption. ... *Implemented in 2005*
- A leak detection program if the annual water audit indicates system leakage in excess of 10 percent. ... *Manzanita audit indicated leakage at < 5%*
- A public education program to encourage efficient water use and low water use landscaping.

Manzanita is largely in compliance with these requirements.

3.2.2 City of Wheeler - Conservation

Wheeler needs to develop programs and policies that reflect the requirements noted under OAR 690-086-0150(4). The City of Wheeler has not, to date, implemented specific conservation related measures other than replacement of defective mains, and repairs of leaks, to the extent practicable and affordable.

Wheeler has completed metering on 100 percent of service connections, and the implementation of usage based water rates.

The City of Wheeler has recently hired a new employee for the Public Works duties. This new employee has multiple responsibilities and a very limited public works budget. Implementation of new conservation measures is unlikely until the new employee is oriented and allowed to catch up on other pressing matters. The implementation schedule reflects this consideration.

Specific conservation measures to be implemented by Wheeler include:

- Compile list of known and suspected leaks (if any) that need to be checked or corrected.
- Develop a plan to check and correct known or suspected leaks.
- Implement leak correction plan.
- Conduct an annual audit. The audit should include all metered connections and estimates of unmetered usage (such as hydrant flushing).
- Develop a plan for service meter testing/repair and/or replacement.
- Implement service meter plan.

- Develop a public education program that, at a minimum, provides information on low water use landscaping, encourages efficient water use, and provides information on Wheeler's conservation activities and implementation schedule.

- Implement public education program.

3.3 CONSERVATION MEASURE SUMMARY AND 5-YEAR IMPLEMENTATION PLAN

3.3.1 City of Manzanita ... 5-Year Plan

OAR 690-086-0150(4) requires a list of the 5-year conservation measures (benchmarks) and an implementation schedule. 5-year benchmarks and implementation schedules are provided below in Table 3.1 for Manzanita.

Manzanita completed a Water System Master Plan in May 2006, which addresses recommended Near-Term Capital Improvement Projects; consequently, improvement scheduling is noted in that plan and included in Table 3.1.

3.3.2 City of Wheeler ... 5-Year Plan

OAR 690-086-0150(4) requires a list of the 5-year conservation measures (benchmarks) and an implementation schedule. 5-year benchmarks and implementation schedules are provided below in Table 3.2 for Wheeler.

Wheeler last completed a Water System Master Plan in 1994, which addresses recommended projects; scheduling is noted in that plan and included in Table 3.2.

Wheeler has had several staff changes in recent years; consequently, there is limited knowledge/experience base or extant records upon which to draw for planning and implementation of the measures listed. The benchmark schedule for Wheeler is therefore also tentative and subject to change; however, the overall goal is full implementation of the listed measures prior to the WMCP update in five years (2015).

Table 3.1: City of Manzanita 5-Year Conservation Benchmarks

Benchmark	Date (Goal)	Frequency
Ongoing Efforts		
Service meter replacement	September 2005	10 year cycle
Service meter checking	September 2005	On-call
System monitoring	September 2005	Varies by parameter
Leak detection and repair	September 2005	As required
Lo-flow fixture requirements	September 2005	Policy
Financial incentives for leak repair	September 2005	Policy
Water audit	September 2005	Annually
Newsletter with information on conservation	September 2005	Annually
Upgrade Anderson Creek transmission main	2005 - 2015	As required
Complete water system master plan	November 2005	**Completed May 2006**
Replace selected AC and other old mains	2005 – 2015	Ongoing projects
Planned programs		
Install water meter on Nehalem connection	2010	-
Public information on conservation	January 2010	Quarterly

Table 3.2: City of Wheeler 5-Year Conservation Benchmarks

Benchmark	Date (Goal)	Frequency
Planned programs		
Compile list of known or suspected leaks	June 2010	-
Develop plan to check and correct leaks	July 2010	-
Implement leak correction	August 2010	-
Develop public education program	October 2010	According to plan
Implement public education plan	November 2010	According to plan
Conduct annual water audit	March 2011	Annually
Develop plan for service meter check/repair and/or replacement program	June 2011	-
Implement service meter plan	July 2011	According to plan

SECTION 4: CURTAILMENT PLAN ELEMENTS

4.1 CONTEXT

With development of the new well source and transmission mains, it is unlikely that water supply will be affected by seasonal weather patterns or changes in raw water availability. Disruptions in supply will likely be limited to emergencies or localized impacts from construction or maintenance activities. Manzanita has prepared a detailed emergency response plan, updated annually, that addresses water related emergencies. Construction and maintenance activities are typically coordinated to avoid unnecessary disruptions of water supplies.

4.2 CURTAILMENT PLAN

A proposed curtailment plan is described in Table 4.1. Development of a water curtailment ordinance would allow designated City authorities to promulgate a water supply emergency, enact the curtailment plan, and police customer compliance through the issuance of warnings and fines. Without an ordinance, the curtailment plan becomes an advisory plan that can be used as a reference to base requests for public actions to reduce consumption. The issue is complicated by the multiple jurisdictions involved. It is strongly recommended that Manzanita and Wheeler coordinate prior to the development and adaption of curtailment ordinances (should they desire to do so) so as to maintain consistency and to avoid potential conflicts.

Table 4.1: Proposed Curtailment Plan

Stage	Trigger	Goal	Implementation Measures
Mild	Use reaches 80% of capacity	General awareness and Modest reductions in Consumption.	• Activate curtailment plan • Provide information (guidance) to the public on conservation methods. • Request customers to limit irrigation. • Avoid flushing hydrants
Moderate	Use reaches 90% of capacity	Enhanced awareness and moderate reductions in consumption.	• Continue "mild" stage measures. • Request irrigation be minimized to that necessary for plant survival. • No lawn irrigation.
Critical	Use reaches 95% of capacity	Awareness of critical supply shortage and maximum reduction in consumption.	• Continue "moderate" stage measures. • No outdoor irrigation • No vehicle washing. • No hosing of paved surfaces.

SECTION 5: MUNICIPAL WATER SUPPLY ELEMENT

5.1 FUTURE SERVICE AREA

Planning for the regional water system anticipated the eventual future connection of: Neahkahnie Water District, Brighton, City of Nehalem, City of Rockaway Beach, and Watseco/Barview Water District to the regional system. There is no schedule for adding communities; communities must obtain approval from both Manzanita and Wheeler City Council's before being admitted to the regional system. Since there are no requirements for the identified communities to join the system, motivation or reticence will likely be driven by local politics and the perception of an actual or impending water supply crisis.

Resident population growth in both Manzanita and Wheeler has averaged approximately 1.5 percent per year since 1990. Tillamook County's recent long term projects for the County as a whole and for each municipality incorporates a rate of 0.98 percent on an average annual growth basis. County provided (high) projections for the municipalities potentially involved with the water system are included in Table 5.1.

Table 5.1: Population Projections
(Source: Tillamook County)

City	2015	2020	2025	2040
Manzanita	690	728	764	874
Nehalem	354	373	391	448
Rockaway	1,516	1,598	1,677	1,920
Wheeler	468	493	518	592

The most significant additions in resident population for the water system is likely to be the addition of new communities, Rockaway in particular, rather than in population growth within the service area.

The existing and potential service area can be characterized as having considerable potential for expansions in non-resident presence and the businesses that cater to them. Between 1989 and 1996, Manzanita's total water service connection grew at a rate of 3.84 percent per year. High development levels have persisted and as a consequence Manzanita uses a planning figure 3% AAGV (average annual growth rate). Growth pressures have increased in Wheeler as well and the City is seeing considerable activity and interest in new residential development. Accommodating the growth does not appear problematic. Both Manzanita and Wheeler have available undeveloped land for continued development.

Infill development and subdivisions are also occurring: in April 2005 Manzanita reported 2014 platted lots in developed areas – an increase of 12 percent over the November 2000 figure of 1799 lots.

Manzanita's general planning figure of 3 percent AAGR will be used for future planning of the joint water system until more accurate planning data is available. If one of the larger communities, such as Rockaway, requests to become part of the regional system, planning figures will be need to be adjusted and the impacts of the connection assessed. It must also be borne in mind that future system connections, such as Rockaway, may not rely fully on the regional water system and only use it to supplement their own supplies during periods of high demand or for emergencies. The 3 percent AAGR figure should be evaluated and adjusted in the next update of this WCMP in 2015.

5.2 FUTURE DEMAND

Future water demand based on 3% average annual growth are presented in Table 5.1. As noted in Section 5.1, this is a tentative planning figure and does not take into account major system expansions, to accommodate new communities, as discrete events.

Table 5.1: Future System Water Demand
(Based on 3% AAGR)

	Actual	Estimated >>>					
Parameter	**2007-2009**	**2015**	**2020**	**2025**	**2030**	**2040**	**2050**
Average Day							
gdp	343,168	409,761	475,025	550,684	638,394	857,948	1,153,010
gpm	238	285	330	382	443	596	801
cfs	0.53	0.63	0.74	0.85	0.99	1.33	1.78
Peak Month							
gdp	532,000	635,236	736,412	853,704	989,677	1,330,043	1,787,466
gpm	369	441	511	593	687	924	1,241
cfs	0.82	0.98	1.14	1.32	1.53	2.06	2.77
Peak Day							
gdp	665,000	794,045	920,516	1,067,130	1,237,096	1,662,553	2,234,333
gpm	462	551	639	741	859	1,155	1,552
cfs	1.03	1.23	1.42	1.65	1.91	2.57	3.46

The demand figures do not take into account reductions in demand due to conservation efforts in Wheeler. Wheeler has old water service meters, and based on very low per capita usage (Table 2.7), it is possible the meters are, on average, under reporting. With implementation of improved auditing and conservation measures in Wheeler, more accurate data should be available for the WCMP update in 2015.

5.3 LONG RANGE SUPPLY PLAN

5.3.1 Capacity Assessment

The regional system has permitted access to 3.6 cfs at the well site. Current installed well capacity (duplex mode) is 750 gpm (1.67 cfs). Based on Table 5.1, installed well capacity should be adequate to meet peak demands for the next 15-20 year period; however addition of any new communities to the system will shorten the timeline according to the size of the communities added and their need (whether it is full water supply or only to supplement existing sources).

With Manzanita's Anderson Creek sources (0.75 cfs of water rights currently utilized), the regional system should be well positioned to serve the needs through the next 20 year planning period under the 3% AAGR and qualifications previously discussed.

5.3.2 Projected 20-year Withdrawals

Projected 20-year withdrawals are presented in Table 5.3. The figures are consistent with discussions and qualifications presented elsewhere in Section 5.

Table 5.3: 20-year Peak Withdrawals and Permitted Capacity

Permit No.	Permitted Capacity		20-year Peak Withdrawal	
	(cfs)	(gpm)	(cfs)	(gpm)
43756	0.50	224.4	0.50	224.4
17073	0.50	224.4	0.50	224.4
G12196	3.60	1,615.7	1.67	750.0

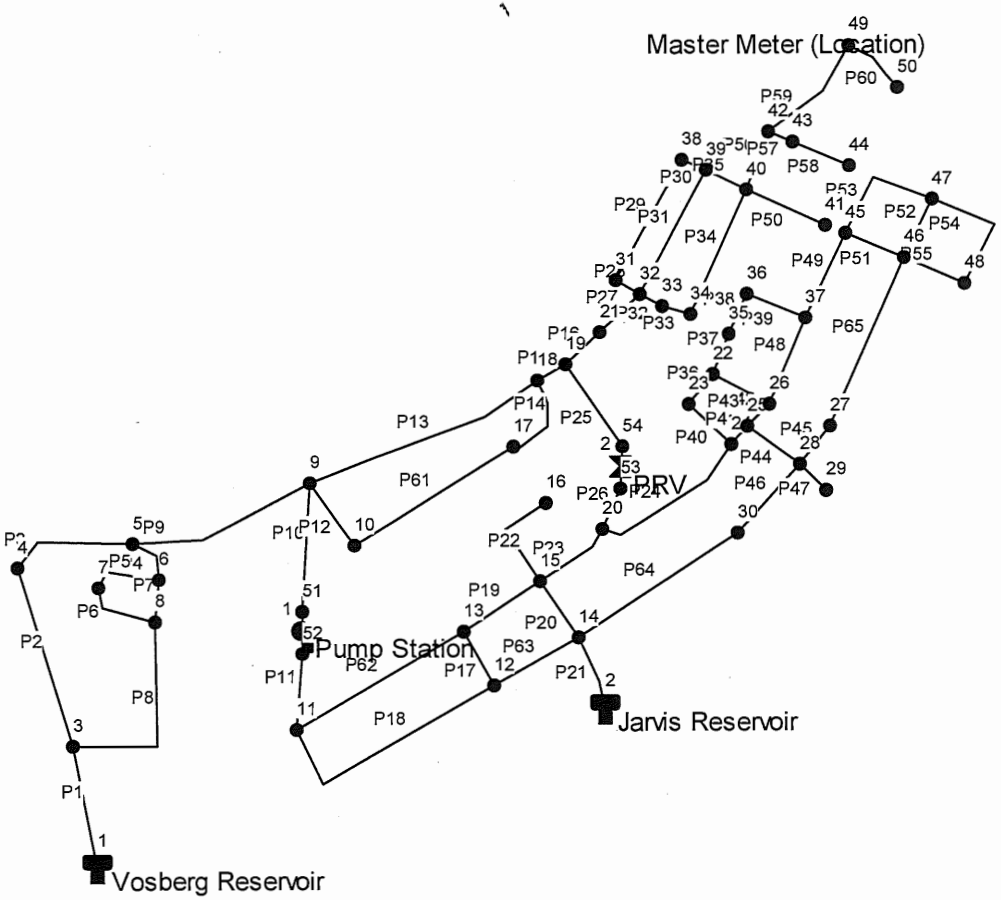
Table 5.3 reflects both Manzanita's preference to use its surface water source during flooding events at the well site and the need, at times, to operate both wells simultaneously. Other permitted sources may be utilized on occasion for non-potable municipal use; however there are no specific plans or estimates in place.

5.3.3 SCHEDULE FOR BENEFICIAL USE

Existing water right permits and certificates are listed in Table 2.3. Perfection of the groundwater permit (G12196) is unlikely within the next 20 years unless there is a significant expansion of the regional system. Manzanita will likely continue using its Anderson Creek supply for emergencies and upgrade transmission piping as necessary. The City may decide to pursue perfection of Permit 43756 after improvements have been completed. The issue will be addressed in the 2015 update.

Appendix 6.1

EPANET Hydraulic Model


Master Meter (Location)
PRV
Pump Station
Jarvis Reservoir
Vosberg Reservoir

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi
Junc 3	160	2	2.00	239.46	34.43
Junc 4	100	2	2.00	239.44	60.42
Junc 5	35	2	2.00	239.43	88.58
Junc 6	70	3	3.00	239.43	73.42
Junc 7	110	0	0.00	239.44	56.09
Junc 8	80	3	3.00	239.44	69.09
Junc 9	30	2	2.00	239.38	90.73
Junc 10	75	2	2.00	239.38	71.23
Junc 11	60	1	1.00	328.49	116.34
Junc 12	195	1	1.00	328.49	57.84
Junc 13	170	3	3.00	328.49	68.67
Junc 14	265	0	0.00	328.49	27.51
Junc 15	205	2	2.00	328.49	53.51
Junc 16	160	1	1.00	328.49	73.01
Junc 17	80	2	2.00	239.34	69.04
Junc 18	50	2	2.00	239.34	82.04
Junc 19	40	2	2.00	239.34	86.37

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi
Junc 20	170	1	1.00	328.48	68.67
Junc 21	20	2	2.00	239.33	95.04
Junc 22	85	1	1.00	328.47	105.50
Junc 23	80	1	1.00	328.48	107.66
Junc 24	140	1	1.00	328.48	81.67
Junc 25	140	0	0.00	328.48	81.67
Junc 26	135	1	1.00	328.47	83.83
Junc 27	215	1	1.00	328.48	49.17
Junc 28	215	1	1.00	328.48	49.17
Junc 29	250	1	1.00	328.48	34.00
Junc 30	190	1	1.00	328.48	60.00
Junc 31	15	2	2.00	239.33	97.20
Junc 32	20	4	4.00	239.33	95.04
Junc 33	40	2	2.00	239.33	86.37
Junc 34	65	2	2.00	239.33	75.54
Junc 35	120	1	1.00	328.47	90.33
Junc 36	140	1	1.00	328.47	81.66
Junc 37	150	1	1.00	328.47	77.33

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi
Junc 38	15	2	2.00	239.33	97.20
Junc 39	35	2	2.00	239.33	88.54
Junc 40	60	2	2.00	239.33	77.70
Junc 41	120	0	0.00	239.33	51.70
Junc 42	45	2	2.00	239.33	84.20
Junc 43	60	2	2.00	239.33	77.70
Junc 44	80	2	2.00	239.33	69.04
Junc 45	120	1	1.00	328.47	90.33
Junc 46	120	1	1.00	328.47	90.33
Junc 47	108	1	1.00	328.47	95.53
Junc 48	155	1	1.00	328.47	75.16
Junc 49	20	1	1.00	239.33	95.03
Junc 50	45	0	0.00	239.33	84.20
Junc 51	32	0	0.00	239.38	89.86
Junc 52	32	0	0.00	328.49	128.47
Junc 53	135	0	0.00	328.48	83.84
Junc 54	135	2	2.00	239.34	45.21
Tank 1	215.5	#N/A	-49.00	239.50	10.40

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi
Tank 2	304.5	#N/A	-24.00	328.50	10.40

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe P1	700	8	140	49.00	0.31	0.06	Open
Pipe P2	1000	8	140	26.57	0.17	0.02	Open
Pipe P3	750	8	140	24.57	0.16	0.02	Open
Pipe P4	250	6	130	-14.43	0.16	0.03	Open
Pipe P5	450	6	140	0.00	0.00	0.00	Closed
Pipe P6	440	6	140	0.00	0.00	0.00	Closed
Pipe P7	250	6	130	-17.43	0.20	0.04	Open
Pipe P8	1050	8	130	-20.43	0.13	0.01	Open
Pipe P9	1050	8	130	37.00	0.24	0.04	Open
Pipe P10	790	4	130	0.00	0.00	0.00	Open
Pipe P11	550	6	130	0.00	0.00	0.00	Open
Pipe P12	400	4	130	2.00	0.05	0.01	Open
Pipe P13	1350	8	140	33.00	0.21	0.03	Open
Pipe P14	400	8	140	2.00	0.01	0.00	Open
Pipe P15	200	8	130	29.00	0.19	0.03	Open
Pipe P16	250	8	130	25.00	0.16	0.02	Open
Pipe P17	375	8	130	2.00	0.01	0.00	Open

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe P18	1380	8	130	1.00	0.01	0.00	Open
Pipe P19	500	8	130	-5.00	0.03	0.00	Open
Pipe P20	375	8	140	-24.00	0.15	0.02	Open
Pipe P21	450	8	140	-24.00	0.15	0.02	Open
Pipe P22	600	8	130	1.00	0.01	0.00	Open
Pipe P23	450	8	140	16.00	0.10	0.01	Open
Pipe P24	900	8	130	15.00	0.10	0.01	Open
Pipe P25	900	8	140	2.00	0.01	0.00	Open
Pipe P26	250	8	140	0.00	0.00	0.00	Open
Pipe P27	300	8	130	23.00	0.15	0.02	Open
Pipe P28	100	8	140	7.78	0.05	0.00	Open
Pipe P29	750	8	140	5.78	0.04	0.00	Open
Pipe P30	100	8	140	3.78	0.02	0.00	Open
Pipe P31	750	8	140	6.63	0.04	0.00	Open
Pipe P32	180	6	130	4.59	0.05	0.00	Open
Pipe P33	120	4	130	2.59	0.07	0.01	Open
Pipe P34	750	8	140	0.59	0.00	0.00	Open
Pipe P35	250	8	140	-8.41	0.05	0.00	Open

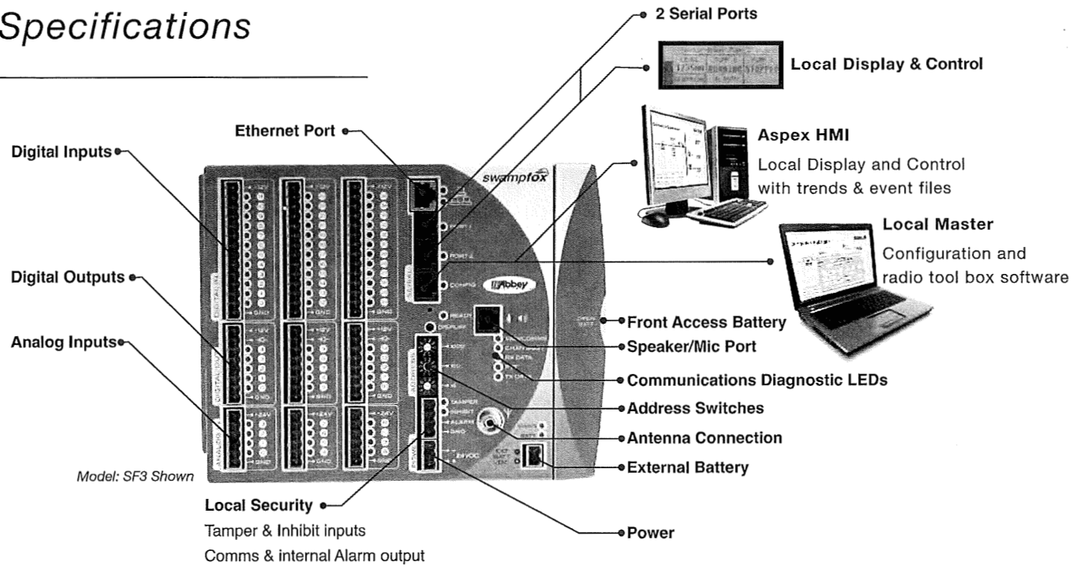
Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe P36	175	4	130	3.97	0.10	0.02	Open
Pipe P37	250	4	130	0.00	0.00	0.00	Closed
Pipe P38	250	4	130	-1.00	0.03	0.00	Open
Pipe P39	350	6	140	-2.00	0.02	0.00	Open
Pipe P40	330	6	130	-4.97	0.06	0.00	Open
Pipe P41	120	8	130	9.03	0.06	0.00	Open
Pipe P42	150	4	130	5.03	0.13	0.03	Open
Pipe P43	350	8	130	2.97	0.02	0.00	Open
Pipe P44	340	8	130	4.00	0.03	0.00	Open
Pipe P45	330	8	130	1.00	0.01	0.00	Open
Pipe P46	480	8	130	1.00	0.01	0.00	Open
Pipe P47	200	8	130	1.00	0.01	0.00	Open
Pipe P48	500	6	130	7.00	0.08	0.01	Open
Pipe P49	500	6	130	4.00	0.05	0.00	Open
Pipe P50	420	8	140	0.00	0.00	0.00	Open
Pipe P51	350	6	130	2.42	0.03	0.00	Open
Pipe P52	1000	12	100	0.61	0.00	0.00	Open
Pipe P53	700	4	130	0.58	0.01	0.00	Open

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe P54	700	4	130	0.18	0.00	0.00	Open
Pipe P55	350	6	130	-0.82	0.01	0.00	Open
Pipe P56	350	8	140	7.00	0.04	0.00	Open
Pipe P57	100	6	130	4.00	0.05	0.00	Open
Pipe P58	380	12	100	2.00	0.01	0.00	Open
Pipe P59	600	8	140	1.00	0.01	0.00	Open
Pipe P60	400	6	130	0.00	0.00	0.00	Closed
Pipe P61	1000	8	140	0.00	0.00	0.00	Closed
Pipe P62	1000	8	140	0.00	0.00	0.00	Closed
Pipe P63	500	8	140	0.00	0.00	0.00	Closed
Pipe P64	1050	8	140	0.00	0.00	0.00	Closed
Pipe P65	950	8	140	0.00	0.00	0.00	Closed
Pump 1	#N/A	#N/A	#N/A	0.00	0.00	0.00	Closed
Valve 2	#N/A	6	#N/A	0.00	0.00	0.00	Closed

Appendix 6.2

Swampfox SCADA Brochure

Specifications



I/O Capacity							Inbuilt I/O	
	Digital in	Digital out	Analog in	Tamper in	Inhibit in	Alarm relay out	Status	Measurements
SF1	12	5	4	1	1	1	11	12
SF3	36	15	12	1	1	1	11	12

Specifications

Hardware

Processor
32 bit CPU
512K Flash, 512K battery backed RAM
Multiple 16 bit slave CPUs

Power
12V / 24VDC

Battery
NiMH 2.5 AHr *(~8-15 hrs duration)*

Environmental
Temp range -20 to +60 deg C
Humidity 5-95% non condensing
Shock 60G 15m/s 3 pulses/axis
EMI/EMC meets FCC requirements

Dimensions
SF1 H168mm, W175mm, D125mm
Weight 2kg

SF3 H168mm, W240mm, D125mm
Weight 2.8kg

Communications Options

Cellular
Enables cellular communication with the site

5 watt VHF radio
136-174MHz
CTCSS 12.5/25kHz
16 channel programmable adjustable power settings

4 watt UHF radio
400-470MHz, 450-530MHz
CTCSS 12.5/25kHz
16 channel programmable adjustable power settings

External radio interface
(for higher power radios)
Hi-Z unbalanced interface

Firmware Capability

Slave protocols
Modbus
Allen-Bradley DF-1
DNP3
HDLC

Master protocols
DNP3
Modbus
Allen-Bradley DF-1
Starflow
FloPro

Programming (incl)
MPL programming language for logic capability

Datalogging
25,000 time stamped events for later downloading & display

Options

Aspex HMI
Local display and control software

Local display
Local display via modbus LCD

Configuration software
Powerlink Local Master configuration software

Fibre optic interfaces
(powered from Swampfox)
RS-232 <> glass / plastic POF
RS-485 <> glass / plastic POF

Converters
(powered from Swampfox)
RS-232/RS-485 for multi-dropped serial devices

Analog Output module
4 x 0-20mA 12bit Analog outputs
Din mount external PCB

Specifications may be subject to change without notice

New Zealand

Abbey Systems Ltd
L4, 220 Willis Street
PO Box 27 497
Wellington, New Zealand
Ph +64 4 385 6611
Fax +64 4 385 6848
Email sales@abbey.co.nz
www.abbey.co.nz

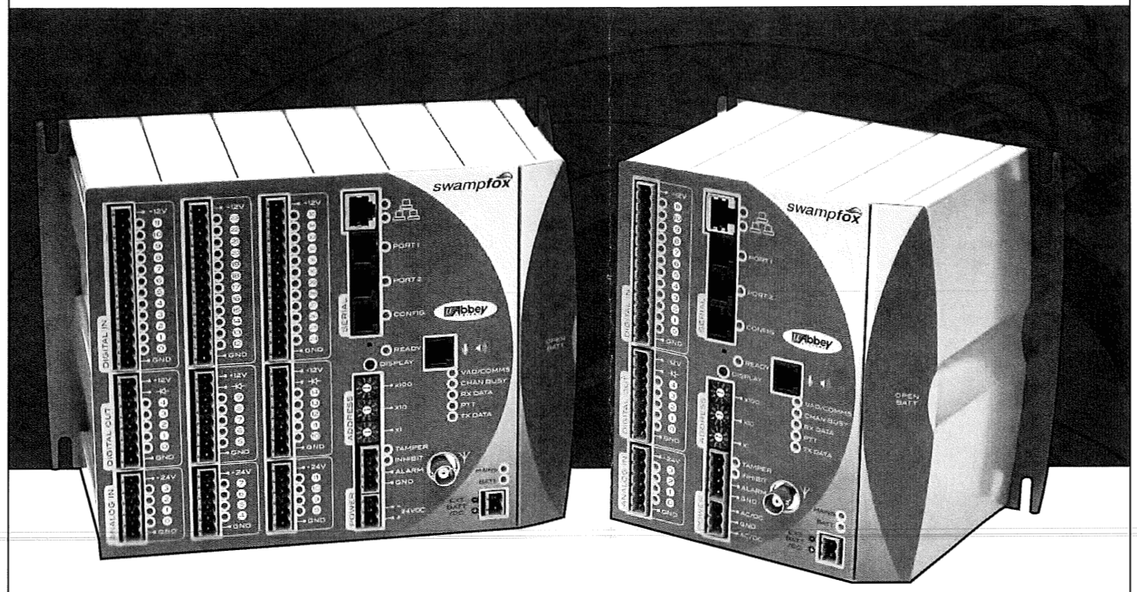
United States

Abbey Systems, Inc
965 Tyinn St Unit 7
Eugene, OR97402
USA
Ph +1 (541) 357 4386
Fax +1 (541) 357 4386
Mobile +1 (801) 699 3370
Email walt@abbeysystems.com

Remote Control Systems
3596 South 300 West, Unit 3
Salt Lake City, UT84115
USA
Ph +1 (801) 268 1198
rich@rcsutah.com

BR-605-3.3-2012-May

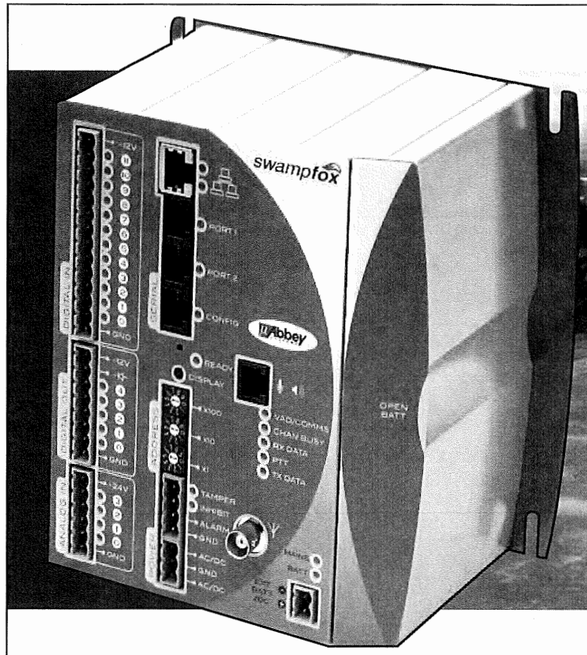
swampfox™

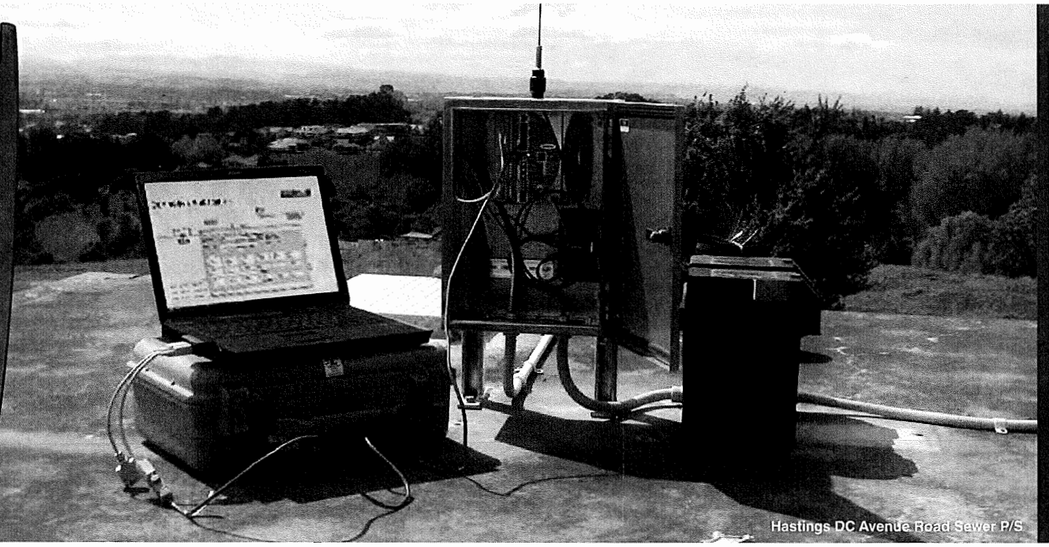


A complete pump station and reservoir communications and control system in one box

- Communicate using cellular, internal, external or IP radio, or fibre optics
- Ethernet and serial interfaces
- Local display option
- Multiple communications protocols
- Configure over the comms network or onsite
- Inbuilt program logic & datalogging options
- RFI immunity with aluminium housing
- Battery; easy access & condition testing

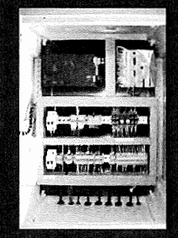
INNOVATORS IN REMOTE CONTROL TECHNOLOGY



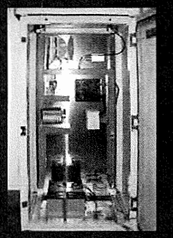


Typical Installations

Greater Wellington Regional Council – Bradey Reservoir inlet control valve enclosure

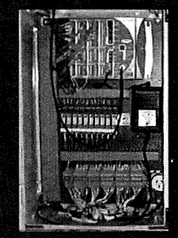


Powerco Gas – nationwide cellular pressure monitoring and Alarm System, typical enclosure



Hastings District Council – Otene Rd, valves and flumes RTU enclosure

Hastings District Council – Johnston Way stormwater RTU enclosure



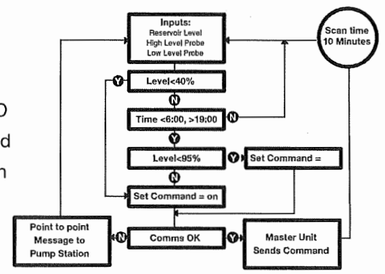
Swampfox Communications [RTU function]

Swampfox is designed for use in telemetry systems with multiple communications channels over a number of different media including VHF/ UHF radio, line, fibre optic, cellular and IP networks. Several features unique to telemetry are included; Remotely Initiate a Message [RIM] back to the Master when an input identified as an Alarm occurs. Send Commands only once, not on every scan. Message frame numbering means that should a Swampfox not receive the message addressed to it then it will be resent from the Master.

The ability to communicate with multiple serial devices e.g. VSDs, Meters, PLCs and Displays means I/O from these can be combined, reported back to the SCADA Master, or used in logic or datalogging tasks.

Swampfox Logic [PLC function]

Programming allows the Swampfox to fulfill the role of a PLC, managing pump stations, small treatment plants and reservoirs. It is an online, realtime language which is self-documenting and simple to use. IF tests, FOR conditions and DO commands form the basis of the language which runs in the Swampfox and at Abbey Systems SCADA Master stations. Logic allows Swampfox to activate backup programs should the RTU detect there is a communications failure. Programs can be written at the SCADA Master and downloaded over the communications channel.



Example of logic

Swampfox Datalogging [Timestamped data storage function]

Datalogging lets Swampfox store statuses and measurements in memory for later retreival. Datalogging can be triggered in multiple ways including; time, status change, system command or derived from a logic program e.g.

- store Turbidity, Chlorine, & Bore levels every minute for Drinking Water Standards reporting
- store Pump motor currents during the motor start
- store Rainfall only when it's raining
- store all changes when the cabinet door is open

The SCADA Master can later retrieve these automatically or manually, over the communications channel, or by using a laptop PC. They can be displayed in an Aspex trend, or exported in a CSV file or to an SQL database

As a Pump Station Controller these three functions of RTU, PLC and Datalogger are combined to provide users with useful functions e.g. the Swampfox can operate as a Pump Station Controller.

Pump Control

- start & stop pumps
- second pump start
- duty pump change
- change the start & stop levels
- manual or automatic operation

Alarms

- high level and overflow
- pump run-on, cavitation, over-current
- mains fail, batt low, time to overflow
- security

Site Performance monitoring

- inflow calculation (without using a flow meter)
- individual pump run hours, number of starts
- pumped volume
- battery state, holdup duration estimate
- RTU quiescent load
- temperature
- attendance record

Battery Condition monitoring

Smart battery management optimises the holdup time the Swampfox has in a Mains Fail situation and will report a failing battery before it occurs. Periodically the battery is removed from charge by the Swampfox; a load is applied and the measured battery voltage stored. This value is reported back to the SCADA Master along with several other values also recorded. Combined with the battery age and measured external series resistance [ESR] a holdup time estimate is determined and can be displayed on the SCADA HMI.

Battery Drawer with NiMH Battery

Software Tools

Local Master software tools allow the Swampfox I/O to be configured e.g. invert an input, set debounce time, latch or pulse an output, set the communications timings, also create and test local logic programs, and review I/O in connected serial equipment e.g. Meters, PLCs or Displays.

Radio Toolbox software allows users to change radio channels from the "CONFIG" port if replacing a Swampfox in the field.

Appendix 8.1

Resolution No. 2005-20

Current Water Rate Schedule

CITY OF WHEELER

RESOLUTION NO. 2005-20

A RESOLUTION TO SET WATER RATES

WHEREAS, the City of Wheeler has reviewed the City Budget and Finance Reports of Fiscal Year 2005-2006 regarding the Water Fund;

WHEREAS, it has been determined that the increased costs to the City to operate its Water Fund is negatively affecting the Beginning Cash Balance of this fund;

WHEREAS, the City Council wants all users of the system to pay their fair shares of the costs of maintaining the system and treating the water; and

WHEREAS, the current water rate schedule was established in March, 1998;

NOW, THEREFORE, BE IT RESOLVED, that every connection to the water system pays a "to the tap" charge and that charge will be increased;

BE IT FURTHER RESOLVED, that every connection to the water system pays a water usage charge based on the number of gallons of water used and that charge will be increased;

BE IT FURTHER RESOLVED, that the attached "WATER RATES SCHEDULE" listing "to the tap" charges and water usage rates be adopted effective January 1, 2006, and

BE IT FURTHER RESOLVED, the aforementioned schedule be made part of this resolution.

WATER RATES SCHEDULE, EFFECTIVE JANUARY 1, 2006

	Customer class	Monthly service charge
1.	Residential	20.70
2.	Multifamily / motel	34.50
3.	Bars / Restaurants	34.50
4.	General commercial	20.70
5.	Paradise Cove	34.50
6.	Care Center	34.50

	Meter size	Meter capacity rating factor
a.	less than 1"	1
b.	1"	1.67
c.	1.5"	3.33
d.	2"	5.33
e.	4"	16.66

The meter capacity rating factor times the monthly service charge equals the monthly "to the tap" charge.

WATER USAGE RATE

The usage rate for water is $0.0028 per gallon of water. The usage rate times the number of gallons used equals the monthly water usage charge.

Appendix 8.2

SDC Methodology

Ordinance 2000-01

LEE ENGINEERING, INC.

F. DUANE LEE, P.E.
DAVID A. LEE, P.E., P.L.S.

October 19, 1999

Project No. 1749.10

Mayor Stevie Burden and
City Council
City of Wheeler
P.O. Box 177
Wheeler, Oregon 97147

Re: Proposed Water System Development Charges

Dear Mayor Burden and City Council:

Enclosed is a copy of a proposed Water System Development Charges report prepared for the City of Wheeler, as you have requested. The report recommends a System Development Charge of $3,670 per single-family equivalent dwelling. The recommended SDC varies with meter sizes and charges, as shown in Table 1 on page 3 of the report.

The System Development Charge, as proposed herein, assumes the City will proceed on its own without participation from Manzanita. If the City eventually works with Manzanita to develop an independent System Development Charge, it would be broken into essentially two parts. First, the City would need to recover costs for its own improvements, and a rough calculation of this SDC would be about $1,060. This assumes the City would bear the local share of about $505,000 in loan costs for their project. The regional SDC, as estimated before, would be about $800, which would need to be added to the City's SDC. Therefore, the total SDC with Manzanita's participation may be in the range of $1,860, or approaching about $2,000. Clearly, the SDC impact will be highly dependent upon Manzanita's participation in the regional water supply.

Since we do not know at this time whether Manzanita will participate, it is important for the City to adopt a charge that will cover its expenses, in the event it must proceed by independent action. The System Development Charge needs to be adopted by the City Council by ordinance. Randy Ealy and I are hoping that we will receive clear direction during the discussion this evening at your regular Council meeting so that we can bring back to you a final document for adoption in your November Council meeting.

CITY OF WHEELER
PROPOSED WATER SYSTEM DEVELOPMENT CHARGES

Basis for Assessing SDC Charges

Oregon Revised Statutes 223.297 through 223.314 provide a uniform framework for the imposition of System Development Charges by governmental units for specific purposes and require that charges may be used only for capital improvements. The statutes set forth specific requirements for levying this fee. The System Development Charge is typically levied by Oregon municipalities as a means by which growth pays its fair share for capital improvements to systems that are specifically constructed to serve the growth faction in any community.

The Act allows for collection of fees to provide assets for the construction of:

1. Water supply, treatment and distribution systems;
2. Wastewater collection, transmission, treatment and disposal;
3. Drainage and flood control;
4. Transportation; or
5. Parks and recreation.

The fee may include a portion for costs associated with capital improvements to be constructed, or it may include a reimbursement fee, which means a fee for costs associated with capital improvements already constructed or under construction to serve future growth.

Application of Fees

The moneys from the System Development Charge fees may only be spent on the facilities used to establish the fee and/or the debt service payments associated with construction of these facilities. This implies that before System Development Charges can be calculated, a system or plan must be in place that identifies the needs for future growth. System Development Charge revenues are to be deposited in designated accounts for such moneys. The City is to provide an annual accounting for the System Development Charge account showing the total amounts of the System Development Charges collected for each system and the projects that may have been funded in any given year.

Oregon statutes specify that capital obtained through water connection charges, as opposed to SDC charges, in excess amounts necessary to reimburse the City for its cost of inspecting and installing connections, are SDC's and subject to the same SDC provisions. In other words, moneys received in excess of costs to provide for connection to the City's water system (costs in excess of the actual service line, meter and associated costs), are considered to be SDC's no matter the name used by the local jurisdictions. The SDC's set forth in this report are the only

Therefore, the estimated cost per single-family equivalent is the proposed $1,750,000 cost divided by 477 single-family equivalents, or approximately $3,669 per single-family equivalent unit.

The full cost recovery System Development Charges recommended are as shown in the following Table 1. The tabulation basically equates a single-family equivalent unit to be served by a 5/8" by 3/4" meter. For meter sizes larger than 5/8" by 3/4", appropriate multiplication factors should be used to arrive at an equitable SDC. For example, a standard residential meter can produce approximately 20 gallons per minute to serve the internal plumbing and requirements for a typical residence. A 1" meter, however, can serve up to 50 gallons per minute, or 2-1/2 times that served by a standard residential meter. Therefore, a 1" meter should be charged at least 2-1/2 times the proposed charge for a proposed single-family equivalent unit. The argument promoted in this regard is that charges should be made based on the demand an individual service will place on the system, not necessarily the total amount of water used.

The table further extrapolates the System Development Charge for 5/8" to 4" meters. The equivalent factor is taken from standard American Water Works Association information indicating the recommended maximum demand for any given meter. The meter should be sized based on the plumbing needs and other demands of any connection. Guidelines are presented in the *American Water Works Association Manual of Water Supply Practices, Sizing Water Service Lines and Meters, AWWA Manual M22.* The City should utilize this manual in determining the required service size for any future service connection.

TABLE 1

RECOMMENDED SDC BY METER SIZE

Meter Size	Equivalent Factor	Recommended SDC
5/8" x 3/4"	1.0	$3,670
1"	2.5	9,175
1-1/4"	N.A.	N.A.
1-1/2"	5.0	18,350
2"	8.0	29,360
2.5"	N.A.	N.A.
3"	15.0	55,050
4"	25.0	91,750

Implementation and Adoption

In order to accommodate the provision of Measure 5 (the 1-1/2% property tax limitation), System Development Charges should be charged at the time the application for new services is made. The SDC is not a charge to the property. Rather, it is a claim by the service on the capacity of the existing water system. This capacity is not required for the property. It is needed to serve the anticipated functions for which the service application is made.

CITY OF WHEELER

ORDINANCE NO. 2000-01

AN ORDINANCE ESTABLISHING A WATER SYSTEM DEVELOPMENT CHARGE, ESTABLISHING METHODOLOGY FOR CHARGE, ESTABLISHING APPEALS PROVISIONS.

WHEREAS, the 1989 Session of the Oregon Legislature enacted new state law relating to system development charges (ORS 223.297 through 223.314), and

WHEREAS, it is important to the City of Wheeler that costs of growth are equitable and rationally shared by new growth and development activities,

NOW, THEREFORE, the City of Wheeler does hereby ordain as follows:

Section 1.0 Purpose. The purpose of the water system development charge is to provide reimbursement to the City of Wheeler for previously incurred costs in providing a water supply, treatment, and distribution system for City of Wheeler use. This charge is for additional capacity of the system to provide for additional development and growth within the City and upon all lands outside the boundary of the City which will connect to or otherwise use the water system.

Section 2.0 Scope. The system development charge imposed by this ordinance is separate from, and in addition to, any applicable tax, assessment, charge, or fee otherwise provided by law or imposed as a condition of development.

Section 3.0 Definitions. For purposes of this Ordinance, the following terms shall mean:

3.1 Capital Improvements. Facilities or assets used for:

3.1.1 Water supply, treatment and distribution;

3.2 Development. Taking any action relating to land which requires a building permit, a land use approval, or an application to connect to City water. Any new construction or existing uses being converted that cause an increase in the rate of water usage.

3.3 Developer. That person, firm, corporation or partnership causing development to occur and making application to the City of Wheeler Water Department for a water connection.

5.3 The methodology used to establish the water reimbursement fee shall be as shown in the attachments.

5.4 The methodology used to establish the water improvement fee shall be as shown in the attachments..

Section 6. Authorized Expenditures.

6.1 Funds generated from reimbursement fees shall be applied only to capital improvements for the water system, including expenditures relating to repayment of indebtedness.

6.2 Improvement fees.

6.21 Improvement fees shall be spent only on capacity-increasing capital improvements, including expenditures relating to repayment of future debt for the improvements. An increase in system capacity occurs if a capital improvement increases the level of performance or service provided by existing facilities or provides new facilities. The portion of the capital improvements funded by improvement fees must be related to demands created by current or projected development.

6.22 A capital improvement being funded wholly or in part from revenues derived from the improvement fee shall be included in the plan adopted by the City pursuant to Section 8 of this ordinance.

6.3 Notwithstanding subsections 6.1 and 6.2 of this section, system development charge revenues may be expended on the direct costs of complying with the provisions of this ordinance, including the costs of developing system development charge methodologies and providing an annual accounting of system development charge expenditures.

Section 7. Expenditure Restrictions

7.1 System development charges shall not be expended for costs associated with the construction of administrative office facilities that are more than an incidental part of other capital improvements.

7.2 System development charges shall not be expended for costs of the operation or routine maintenance of capital improvements.

issued by the City as of the effective date of this Ordinance shall also be exempt from a system development charge.

10.2 Additions to single-family dwellings that do not constitute the addition of a dwelling unit, as defined by the State Uniform Building Code, are exempt from all portions of the system development charge.

10.3 An alteration, addition, replacement or change in use that does not increase the parcel's or structure's rate of use of the water system facility are exempt from all portions of the system development charge.

10.4 A development owned by the City is exempt from all portions of the system development charge.

10.5 A service connection the City believes will not be in existence for more than six consecutive months is exempt from all portions of the system development charge. Such service, if it continues for more than six consecutive months, shall be fully subject to all applicable systems development charges.

Section 11 Credits

11.1 Change of Use When a system development charge is required to be paid because of a Changed Use (Section 3.2 above) a credit shall be given for the system development charge that is applicable to the prior use.

11.2 A credit shall be given to the permittee for the cost of a qualified public improvement upon acceptance by the City of the public improvement. The credit shall not exceed the improvement fee even if the cost of the qualified public improvement exceeds the applicable improvement fee and shall only be for the improvement fee charged for the type of improvement being constructed.

11.3 If a qualified public improvement is located in whole or in part on or contiguous to the property that is the subject of development approval and is required to be built larger or with greater capacity than is necessary for the particular development project, a credit shall be given for the cost of the portion of the improvement that exceeds the City's minimum standard facility size or capacity needed to serve the particular development project or property. The applicant shall have the burden of demonstrating that a particular improvement qualifies for a credit under this subsection. The

Section 13. Segregation and Use of Revenue

13.1 All funds derived from a particular type of system development charge are to be segregated by accounting practices from all other funds of the City. System development charges shall be used for no purpose other than those set forth in Section 6 of this ordinance.

13.2 The City Recorder shall provide the City Council with an annual accounting, based on the City's fiscal year, for system development charges showing the total amount of system development charge revenues collected and the projects funded from each account.

Section 14. Appeal Procedures for Expenditures of System Development Charge Revenues

14.1 A person challenging the propriety of an expenditure of system development charge revenues may appeal the decision or the expenditure to the City Council by filing a written request with the City Recorder describing with particularity the decision of the City and the expenditure from which the person appeals. An appeal of an expenditure must be filed within two years of the date of the alleged improper expenditure.

14.2 After providing notice to the appellant, the City Council shall determine whether the City Recorder's decision or the expenditure is in accordance with this ordinance and the provisions of ORS 223.297 to 223.314 and may affirm, modify, or overrule the decisions. If the City Council determines that there has been an improper expenditure of the system development charge revenues, the City Council shall direct that a sum equal to the misspent amount shall be deposited within one year to the credit of the account or fund from which it was spent. The decision of the City Council shall be reviewed only as provided in ORS 34.010 to 34.100, and not otherwise.

Section 15. Legal Challenge to System Development Charge Methodology. A legal action challenging any methodology adopted by the City Council pursuant to Section 5 shall not be filed later than 60 days after the adoption. A person shall contest the methodology used for calculating a system development charge only as provided in ORS 34.010 to 34.100, not otherwise.

Appendix 8.3

Oregon Water & Wastewater Funding and Resource Guide

RCAC, 2014

2014

OREGON WATER & WASTEWATER FUNDING AND RESOURCE GUIDE

Compiled by:

RCAC
www.rcac.org

Oregon Water & Wastewater Funding and Resource Guide
April 2014

Background and Purpose

Rural Community Assistance Corporation (RCAC), a private non-profit organization serving 13 states in the West, helps rural communities achieve their vision and goals through training, technical assistance, and access to resources. RCAC works with funding and regulatory agencies and partners to address utility compliance issues for lower income rural communities.

The purpose of the RCAC Oregon Water Wastewater Funding and Resource Guide is to provide an easy to use document which identifies water and wastewater funding programs, agencies, and organizational resources. RCAC hopes that this guide will be used as a tool to help you move forward with water and wastewater infrastructure projects in your community**.**

Scope

The Guide provides information on primary agency funding programs which support planning, predevelopment, and construction of drinking water and wastewater infrastructure projects. It also includes information on resources available to assist communities with completing drinking water and wastewater projects, addressing regulatory compliance, drinking water protection, improving water quality and local public health. Additional resources may be available. Please contact RCAC to suggest a resource to include in this guide.

Contents

- Agencies serving water/wastewater needs for small Oregon communities
- Funding programs for water and wastewater projects

Key Project Stages

- Planning
- Predevelopment
- Engineering and Design
- Construction

This publication was made possible by Grant Number 90EF0069-04-00 from Health and Human Services and Rural Community Development Activities Program. The information was compiled in partnership with agencies and organizations by Rural Community Assistance Corporation (RCAC). RCAC is the Western regional affiliate of the Rural Community Assistance Partnership, Inc. (RCAP).

For more information on Rural Community Assistance Corporation, visit: www.rcac.org

Agencies Serving Water/Wastewater Needs of Small Oregon Communities

U.S. Environmental Protection Agency

EPA Region 10 Oregon Operations Office
805 SW Broadway, Suite 500
Portland, OR 97205
Joel Salter Oregon Water Programs Coordinator
Phone: (503) 326-2653
Email: Salter.Joel@epa.gov

Drinking Water SRF Site:
http://yosemite.epa.gov/r10/water.nsf/Drinking+Water/State+Revolving+Fund

Clean Water SRF Site:
http://yosemite.epa.gov/R10/ecocomm.nsf/state+revolving+fund/cwsrf

United States Department of Agriculture Rural Development (USDA RD)

1201 NE Lloyd Blvd., Ste. 801
Portland, OR 97232-1274
Sam Goldstein, Community Programs Director
Phone: (503) 414-3362
Email: Sam.goldstein@or.usda.gov

Website: http://www.rurdev.usda.gov/ORcp.html

U.S. Department of Health and Human Services

Portland Area Indian Health Service
1414 NW Northrup Street, Suite 800
Portland, OR 97209
Phone**:** (503) 414-5555
Website: www.ihs.gov

U.S. Department of Commerce Economic Development Administration (EDA)

121 SW Salmon Street, Suite 244
Portland, OR 97204
David Porter, Economic Development Representative
Phone: (503) 326-3078
Email: dporter@eda.doc.gov

Oregon Health Authority (OHA)

Drinking Water Services
PO Box 14450
Portland, OR 97293-0450
Phone: (971) 673-0422
Website: http://healthoregon.org/dwp

Adam DeSemple, Safe Drinking Water Revolving Loan Fund, (971) 673-0422

Tony Fields, Planning Protection & Certification Manager, (971) 673-2269

Debra Lambeth, Environmental Review Coordinator, (971) 673-0414

Tom Pattee, Groundwater Protection, (541) 726-2587 x 24

Kari Salis, Technical Services Region 1, (971) 673-0423

Karen Kelley, Technical Services Region 2, (541) 726-2587 x 22

Julie Wray, Plan Review, (971) 673-0408

Technical Assistance:
HBH Consulting Engineers, Inc., (503) 625-8065

Oregon Business Development Department (OBDD)

Infrastructure Finance Authority (IFA)
775 Summer St. NE, Suite 200
Salem, OR 97301-1280
Phone: (503) 986-0123
Email: infrastruture.info@state.or.us

Website: www.orinfrastructure.com

Agencies Serving Water/Wastewater Needs of Small Oregon Communities *Continued*

Oregon Department of Environmental Quality (DEQ)

811 SW Sixth Avenue
Portland, OR 97204-1390

Clean Water State Revolving Fund (CWSRF)
Katie Foreman, Program Coordinator: (503) 229-5622
Kathy Estes, Loan Specialist: (503) 229-6814
Website: www.deq.state.or.us/wq/loans/loans.htm

Drinking Water Protection Program
Sheree Stewart, Program Coordinator: (503) 229-5413
Julie Harvey, Drinking Water Specialist: (503) 229-5664

Website: www.deq.state.or.us/wq/dwp/dwp.htm

Rural Community Assistance Corporation (RCAC)

1020 S.W. Taylor Street Suite 450
Portland, OR 97205

Chris Marko, Rural Development Specialist
(503) 228-1780 cmarko@rcac.org

RosAnna Noval, Rural Development Specialist
(503) 308-0207 rnoval@rcac.org

Website: www.rcac.org

Additional Resources for Water and Wastewater Needs

Association of Oregon Counties 1201 Court St NE Suite 300 Salem, OR 97301 Laura Cleland Phone: (503) 585-8351 Website: www.aocweb.org LOCAP Underwriter: Wedbush Securities, Katie Schwab, (503) 471-6798	**League of Oregon Cities** 1201 Court St. NE, Suite 200 Salem, OR 97301 Susan Muir Phone: (503) 588-6550 Website: www.orcities.org LOCAP Underwriter: Wedbush Securities, Katie Schwab, (503) 471-6798
Special Districts Association of Oregon PO Box 12613 Salem, OR 97309 Phone: (503) 371-8667 Website: www.sdao.com Luann Richey, (503) 371-8667 x 113	**Oregon Water Resources Department** 725 Summer Street NE, Suite A Salem, OR 97301 Phone: (503) 986-0900 Website: www.oregon.gov/owrd
Oregon Association of Water Utilities 935 N Main Street Independence, Oregon 97351 Phone: (503) 837-1212 Website: www.oawu.net	**Oregon Watershed Enhancement Board** 775 Summer St. NE Suite 360 Salem, OR 97301 Phone: (503) 986-0178 Website: www.oregon.gov/OWEB

Federal Regulatory Information:

Safe Drinking Water Act (SDWA): www.epa.gov/safewater/sdwa

Clean Water Act (CWA): http://www.epa.gov/oecaagct/lcwa.html

National Pollutant Discharge Elimination System (NPDES): http://cfpub.epa.gov/npdes/cwa.cfm?program_id=45

FUNDING PROGRAMS FOR WATER AND WASTEWATER PROJECTS IN OREGON
Planning and Predevelopment

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
OBDD Infrastructure Finance Authority (IFA) **Community Development Block Grant (CDBG)**	Preliminary engineering and planning – water master plans, wastewater facilities plans, water conservation and management plans, capital improvement plans, inflow and infiltration studies. Final engineering – preliminary engineering reports, studies	Projects must principally benefit low to moderate income people in non-entitlement cities and counties. Projects must serve primarily residential needs, not primarily for capacity building.	• Grants up to $175,000 for preliminary engineering and planning • Grants up to $3,000,000 for final design engineering and construction	Competitive applications are accepted year-round and reviewed quarterly. All awards are subject to funding availability. Contact the Oregon Business Development Department (OBDD) at (503) 986-0123 and ask for your regional coordinator, or view program details at: www.orinfrastructure.com
OBDD IFA **Special Public Works Fund (SPWF)**	Preliminary engineering studies; and economic investigations related to municipal utility projects (water, wastewater, stormwater)	Cities, counties, county service districts (ORS Chapter 451), Tribes, ports, & districts (ORS 198.010)	• Grants up to $60,000 or 85% of project costs. • Loans available at reduced interest rates/7-year term.	Apply year-round based on funding availability. Contact OBDD at (503) 986-0123 and ask for your regional coordinator or view program details at: www.orinfrastructure.com
OBDD IFA **Water Wastewater (WWF)**	Preliminary planning, engineering studies and economic investigations in preparation for construction projects that address an existing or pending compliance issue.	Cities, counties, county service districts (ORS Chapter 451), tribes, ports and districts (ORS 198.010). For a population of less than 15,000 with a Notice of Non-compliance or potential notice.	• Grants up to $20,000 • Loans up to $20,000	Apply year-round based on funding availability. Contact OBDD at (503) 986-0123 and ask for the regional coordinator or view program details at: www.orinfrastructure.com
USDA-Rural Development Pre-development Planning Grant (PPG)	Water and/or wastewater planning; preliminary engineering reports, environmental reports, and other work to assist in developing a project that is expected to be funded by RD in the next 12 – 18 months.	Public bodies (such as municipality, county, district or authority); non-profit organizations, and Indian tribes. Priority given to the smallest and poorest communities and systems with limited resources.	• Maximum $25,000 grant or 75% of project costs, whichever is less.	Apply year-round based on funding availability. Contact USDA-Rural Development Oregon State Office at (503) 414-3360 and ask for your regional loan specialist or view program details at: www.rurdev.usda.gov/UWP-predevelopment.htm

FUNDING PROGRAMS FOR WATER AND WASTEWATER PROJECTS IN OREGON
Planning and Predevelopment continued

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
USDA-Rural Development Special Evaluation Assistance for Rural Communities and Households **(SEARCH)**	Water and/or wastewater planning; preliminary engineering reports, environmental reports, and other work to assist in developing a project that is expected to be funded by RD in the next 12-18 months.	Public bodies (such as municipality, county, district or authority); non-profit organizations, and Indian tribes. Priority given to the smallest and poorest communities and systems with limited resources.	• Maximum $30,000 grant or 100% of project costs, whichever is less	Apply year-round based on funding availability. Contact USDA-Rural Development Oregon State Office at (503) 414-3360 and ask for your regional loan specialist or view program details at: www.cfda.gov (Number 10.759)
Rural Community Assistance Corp. Loan Fund Feasibility and Predevelopment	Water and/or wastewater planning; environmental work; and other work to assist in developing an application for infrastructure improvements	Nonprofit organizations, public agencies and tribal governments serving rural areas with a population of 50,000 or less; or 10,000 if guaranteed by RD financing	• Max $50,000 for feasibility loan • Max $350,000 for predevelopment loan • 1 year term • Interest rate @ 5.5%	Applications accepted anytime Contact: Josh Griff at (720) 951-2163 or jgriff@rcac.org. Applications available on-line at www.rcac.org
EDA Technical Assistance Grants Feasibility Studies	EDA's mission is to help economically distressed communities in ways that help them build long-term economic development capacity. Projects must foster the creation or retention of higher-skilled, higher-wage employment opportunities for local displaced workers and attract private-sector capital investment.	Indian Tribes; state, county, city or other political subdivisions of a state; institutions of higher education; public or private non-profit organizations or associations	• $50,000 to $75,000 • Local match required • Grant funds received from other Federal Agencies may **not** be used to satisfy local share match.	Visit agency website at www.eda.gov and review latest "Federal Funds Announcement" (FFO). Submit application through www.grants.gov
Clean Water State Revolving Fund (CWSRF)	Loans are available for planning and design projects associated with: publicly owned wastewater treatment and stormwater facilities and systems, non-point source water quality improvement projects and estuary management projects.	Federally recognized tribal governments, cities, counties, sanitary districts, soil and water conservation districts, irrigation districts, various special districts and certain intergovernmental entities.	• Loan only • Up to 5 years • Substantially discounted interest rate • No annual fee	Applications accepted year round with scheduled review and ranking in February, June and October. Contact the Oregon Department of Environmental Quality (DEQ); call Katie Foreman at (503) 229-5622.

FUNDING PROGRAMS FOR WATER AND WASTEWATER PROJECTS IN OREGON
Construction

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
OBDD IFA **Community Development Block Grant (CDBG)**	All projects must be in accordance with an approved water plan or wastewater plan. Eligible activities include: construction engineering; acquisition of property (including easements); grant administration; and audits. Projects addressing an existing or pending compliance issue will score higher.	Projects must principally benefit low to moderate income people in non-entitlement cities and counties. Projects must serve primarily residential needs and not be for capacity building.	• Maximum Grant of $3 million, subject to the maximum $3 million per project limitation during a five-year period. • Single grant may be awarded to cover final engineering and construction.	Competitive applications accepted year-round and reviewed quarterly. All awards are subject to funding availability. Contact OBDD at (503) 986-0123 and ask for your regional coordinator or view program information at www.orinfrastructure.com
OBDD IFA **Special Public Works Fund (SPWF)**	Planning for raising and managing funds, pre-construction and construction of water, wastewater, stormwater projects. Projects must be publically owned and support economic and community development in Oregon.	Cities, counties, county service districts (ORS Chapter 451), tribes, ports and districts (ORS 198.010)	• Primarily a loan program • Maximum $10 million loan • 25 year term maximum. • Grants based on retention or creation of jobs, up to max. of $5,000 per job • Grants cannot exceed $500,000 or 85% of the project cost, whichever is less	Apply year-round, based on funding availability. Contact OBDD at (503) 986-0123 and ask for your regional coordinator or view program details at www.orinfrastructure.com
OBDD IFA **Water Wastewater Financing (WWF)**	Planning, pre-construction, and construction improvements of drinking water, wastewater, or stormwater projects. Projects must be publically owned and address an existing or pending compliance issue.	Cities, counties, county service districts (ORS Chapter 451), tribes, ports, & districts (ORS 198.010)	• Maximum $10 million loan • 25 year term maximum • Grant eligibility based on median household income • Maximum $750,000 grant	Competitive applications are accepted year-round and reviewed quarterly. All awards are subject to funding availability. Contact OBDD at (503) 986-0123 and ask for your regional coordinator, or view program details at www.orinfrastructure.com

FUNDING PROGRAMS FOR WATER AND WASTEWATER PROJECTS IN OREGON
Construction continued

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
Oregon Health Authority **Safe Drinking Water Revolving Loan Fund (SDWRLF)**	Drinking water system projects must resolve *existing* or *future* non-compliance with *current* or *future* state and federal drinking water standards, that addresses the most serious human health risks, or that is essential to create a new drinking water system improvement that will substantially benefit public health. *Eligible Activities:* Planning, engineering, design, water source construction, land or easement acquisition, treatment, storage, transmission/distribution, system purchase, system consolidation, system creation, system security, restructuring	Public and privately owned community and non-profit non-community public water systems. Federally owned systems are not eligible.	• Projects requesting $3 million or more require additional review and approval from the Drinking Water Advisory Committee • Interest rate fluctuates quarterly (set at 80% of the previous quarters municipal bond rate) • 20-year term maximum • 30-year term maximum for disadvantaged communities • Principal Forgiveness • Green Project Reserve (GPR) financial incentive • Circuit Rider assistance for eligible systems under 10,000 in population	A Letter of Interest (LOI) may be submitted anytime to be eligible for funding consideration. Contact Oregon Health Authority's Drinking Water Services at (971) 673-0405 or go to the OHA website: http://healthoregon.org/srf You may also contact Business Oregon's Infrastructure Finance Authority (IFA) at (503) 986-0123 or visit their website at: http://www.orinfrastructure.org/LOI-Form/ to take you directly to the LOI.
Oregon Health Authority **Drinking Water Source Protection Fund (DWSPF)**	Drinking Water Source Protection projects that lead to risk reduction within a delineated source water area or that would contribute to a reduction in contaminant concentration within the drinking water source.	Any public and privately owned community and non-profit non-community water systems with a completed Source Water assessment. Federally owned systems are not eligible.	• Max $30,000 Grant • Max $100,000 loan • Interest rate fluctuates quarterly (set at 80% of previous quarter's municipal bond rate). • 20 year term • 30-year term maximum for disadvantaged communities	A letter of interest must be submitted to be eligible for funding consideration. Check with OHA on submittal schedule. Contact Oregon OHA Drinking Water Services at (971) 673-0405 or visit http://healthoregon.org/srf or contact OBDD at (503) 986-0123 or visit www.orinfrastructure.com

FUNDING PROGRAMS FOR WATER AND WASTEWATER PROJECTS IN OREGON
Construction continued

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
Clean Water State Revolving Fund (CWSRF)	Loans and bond purchase agreements are available for planning, design, and construction projects associated with: publicly owned wastewater treatment and stormwater facilities and systems, non-point source water quality improvement projects and estuary management projects. Interim financing is also available.	Indian tribal governments, cities, counties, sanitary districts, soil and water conservation districts, irrigation districts, various special districts and certain intergovernmental entities.	• Loan: Up to 20 year term, or life of asset • Bond purchase agreement: Up to 30 year term or life of asset • Interest may be discounted depending on funding type and community demographics • Low annual fee (planning loans exempt from this fee) • Possible principle forgiveness	Applications accepted year round with scheduled review and ranking in the first week of February, June and October. Contact the Oregon Department of Environmental Quality (DEQ); call Katie Foreman at (503) 229-5622, email foreman.katie@deq.state.or.us or contact your local project officer. For a list of project officers, go to: http://www.deq.state.or.us/wq/loans/contacts.htm
USDA-Rural Development Water Environmental Programs (WEP) Direct Loan & Grant Program	Pre-construction & construction associated with constructing, repairing, or improving water, sewer, solid waste or storm wastewater disposal facilities.	Public bodies (such as municipality, county, district, or authority); non-profit organizations and Indian tribes serving financially needy communities with service area populations<10,000.	• Primarily loan program • Grants based on need • Interest rates track AA rated 20 yr. muni. bonds and fixed for life of loan • Lower income communities receive an interest rate subsidy • Up to 40-year loan term	Apply year-round based on funding availability. Contact USDA-Rural Development, Oregon State Office at (503) 414-3360 and ask for your regional loan specialist or view program details at: www.rurdev.usda.gov/ORcp.html
LOCAP Full Faith and Credit Obligations **Bridge financing and full project financing**	New capital projects having a useful life greater than 1 year or refunding outstanding bonds and loans. Includes soft costs, such as staff time, design and professional services, directly related to the project.	Cities and counties that are members of the League of Oregon Cities and Association of Oregon Counties and their component units (i.e., service districts and urban renewal agencies)	• Municipal bond market • Interest at market rates • No maximum principal amount	Applications are accepted anytime. Contact the LOCAP coordinator, Katie Schwab, Wedbush Securities, at (503) 471-6798 or email katie.schwab@wedbush.com
LOCAP Utilities Revenue Bonds **Full project financing**	New capital projects for water, sewer, and stormwater systems having a useful life greater than 1 year or refunding outstanding utility revenue bonds. Includes soft costs, such as staff time, design and professional services, directly related to the project.	Cities and counties that are members of the League of Oregon Cities and Association of Oregon Counties and their component units (i.e., service districts and urban renewal agencies)	• Municipal bond market • Interest at market rates • No maximum principal amount • Requires a Debt Service Reserve Fund and satisfactory coverage	Applications are accepted anytime. Contact the LOCAP coordinator, Katie Schwab, Wedbush Securities, at (503) 471-6798 or email katie.schwab@wedbush.com

FUNDING PROGRAMS FOR WATER AND WASTEWATER PROJECTS IN OREGON
Construction continued

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
RCAC Loan Fund **Construction**	Water, wastewater, solid waste and storm facilities that primarily serve low income rural communities. Includes predevelopment costs	Non-profit organizations, public agencies, and tribal governments rural areas with populations of 50,000 or less, or 10,000 if using RD financing as the takeout	• Max $2 million with commitment letter for permanent financing • Security in permanent loan letter of conditions • 1-3 year term • 1% loan fee • Interest rate 5.5%	Applications are accepted anytime. Contact Josh Griff at (720) 951-2163 or email jgriff@rcac.org Applications available on-line at: www.rcac.org
RCAC Loan Fund **Intermediate Term Loans**	Water, wastewater, solid waste and storm facilities that primarily serve low income rural communities. Includes predevelopment costs	Non-profit organizations, public agencies, and tribal governments rural areas with populations of 50,000 or less; or 10,000 if using RD financing as the takeout	• For smaller capital needs projects • Normally not to exceed $100,000 • Up to 20 year term • Interest rate 5.0%	Applications are accepted anytime. Contact Josh Griff at (720) 951-2163 or email jgriff@rcac.org Applications available on-line at: www.rcac.org
US Economic Development Administration **Public Works Grants**	EDA's mission is to help economically distressed communities in ways that help them build long-term economic development capacity. Projects must foster the creation or retention of higher-skilled, higher-wage employment opportunities for local displaced workers and attract private-sector capital investment.	Indian Tribes; state, county, city or other political subdivisions of a state; institutions of higher education; public or private non-profit organizations or associations	• Public Works grant awards are in the range of $500,000 – $2,500,000 with 50% local matching funds required. • Grant funds received from other Federal Agencies may not be used to satisfy local share match.	Visit agency website at www.eda.gov and review latest "Federal Funds Opportunities" (FFO). Submit application through www.grants.gov