City of Gervais

Water Master Plan

Final

TETRA TECH

July 2019

Water Master Plan

July 2019

PREPARED FOR

City of Gervais
P.O. Box 329
Gervais, OR 97026

PREPARED BY

Tetra Tech
15350 SW Sequoia Parkway
Suite 220
Portland, OR 97224

Phone: 503-684-9097
Fax: 503-598-0583
tetratech.com

Primary Author:

8/5/2019

Steven L. Kraushaar, PE
Project Manager

Date

Tetra Tech Project No. 200-12578-18001

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ACRONYMS/ABBREVIATIONS

Acronym or Abbreviation	Definition
cfs	cubic feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
MCL	maximum contaminant level
OAR	Oregon Administrative Rule
OM&R	operation, maintenance and replacement
psi	pounds per square inch
PVC	polyvinyl chloride
SDC	system development charge
TDH	total dynamic head
UGB	urban growth boundary

EXECUTIVE SUMMARY

The *City of Gervais Water Master Plan* evaluates the City's water system, identifies current and future needs for water supply, storage and distribution, presents a capital improvement program, assesses water rates, and reviews funding opportunities. It meets state and funding agency requirements and provides a basis for financial planning of recommended improvements.

EXISTING FACILITIES

The Gervais water system has been in operation since 1920. The existing water system, most of which was constructed in 1990, consists of two wells and well pumps, one treatment facility, two storage reservoirs, and the water distribution system. The City's water distribution system is shown in Figure ES-1. Figure ES-2 shows the layout of the City's water plant site, which features storage tanks, one of the City's wells, the water treatment facility, and distribution system booster pumps.

Water Sources

Water Rights

The City was issued a water right of 1.11 cubic feet per second (cfs) for its Elm Avenue Well in 1956, which is no longer in use. The City has a Claim of Beneficial Use permit for a total of 680 gallons per minute (gpm) from Well No. 1 and Well No. 2.

Although the City's Claim of Beneficial Use Permit is valid evidence of the right of the City to use the water, the Oregon Water Resources Department does not recommend operating a municipal system with a beneficial use permit. A municipality can obtain water rights from a beneficial use permit if it can show full usage of the permit, but the City of Gervais has not currently met this criterion. The Oregon Water Resources Department recommends that the City file and pursue a request for changes in points of appropriation for the Elm Avenue Well certificate to Wells No .1 and No 2. With the 1.11 cubic feet per second water right, the City should have sufficient water for current and future needs within the study period.

Supply Wells

The City currently operates two supply wells, Well No. 1 and Well No. 2, which were drilled in 1989. Well No. 1 is located at the treatment plant and Well No. 2 at the south end of Juniper Avenue. Both wells have a 10-inch-diameter well casing and a full well depth of approximately 270 feet. The well pumps are each capable of delivering approximately 340 gpm to the treatment system. The water contains iron and manganese in excess of Oregon Health Authority and U.S. Environmental Protection Agency limits, and consequently is treated for iron and manganese at the treatment plant. According to the Oregon Health Authority, Well No. 1 and Well No. 2 are not considered highly sensitive sources and have no history of contamination, although a 2017 report identified potential contaminant sources.

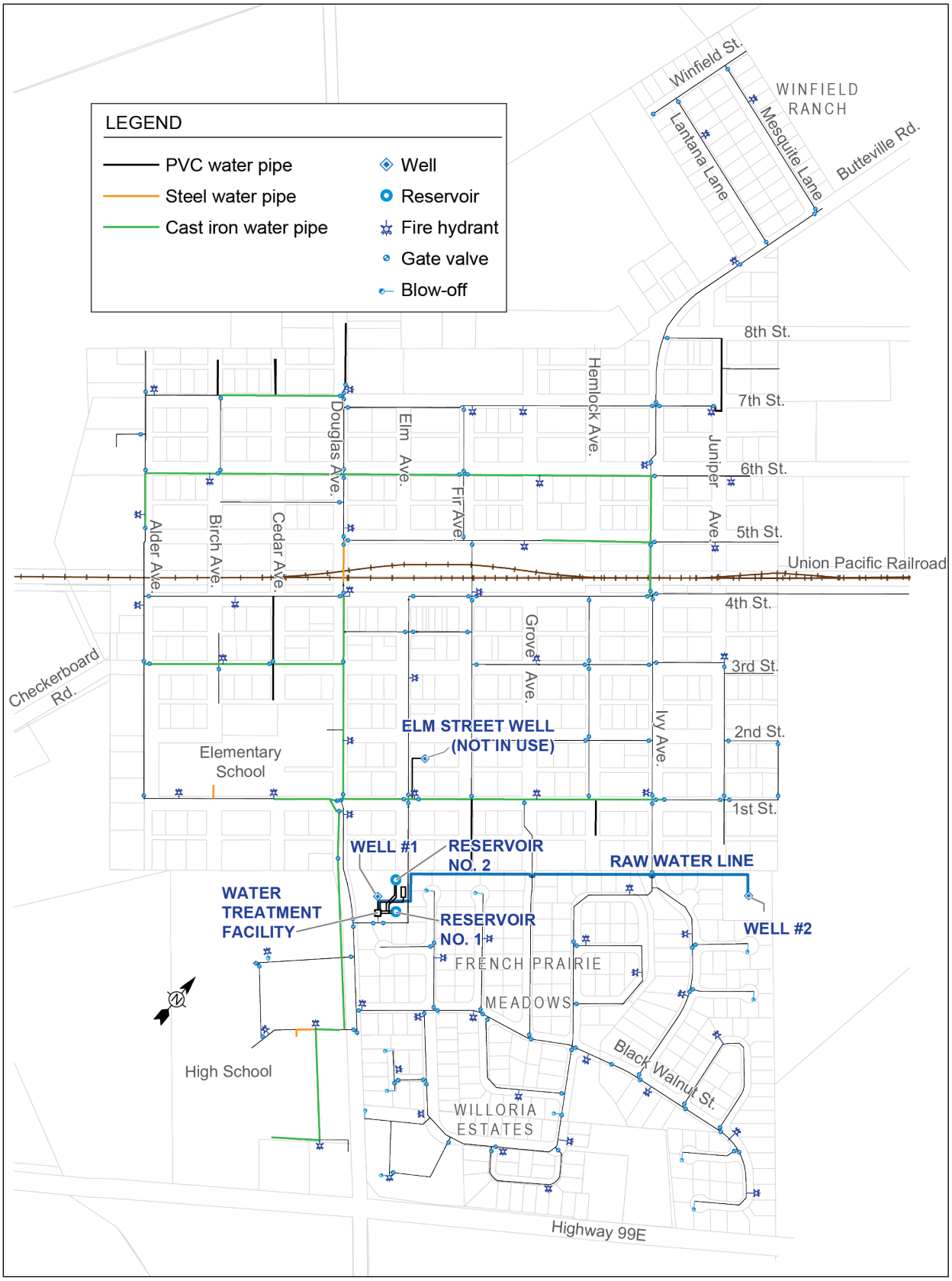


Figure ES-1. City of Gervais Water System Overview

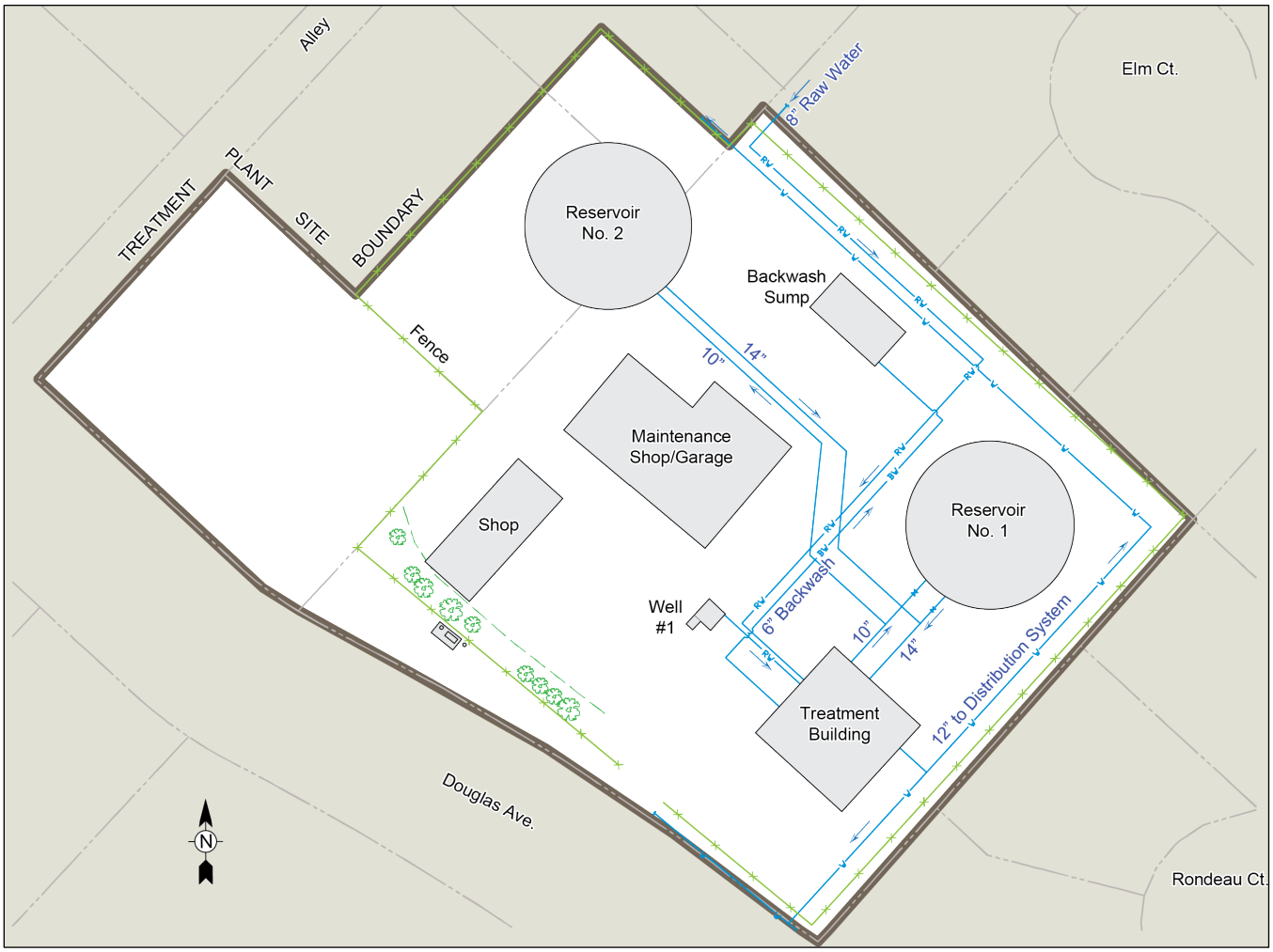


Figure ES-2. City of Gervais Water Plant Site

Water Treatment

In 1990, the City built a water treatment facility including a greensand filter system that has been successful in reducing iron and manganese levels to maintain compliance. The current treatment facility is in a steel-framed metal building and consists of the following:

- Potassium permanganate injection system for flocculation of contaminants prior to filtering
- Four 170-gpm iron and manganese greensand pressure filters, for a total capacity of 680 gpm.
- A liquid sodium hypochlorite disinfection system.
- A generator with automatic transfer switch that powers the plant in the event of a power outage.

Water Storage

The City of Gervais has two water storage reservoirs, both located at the water plant. The reservoirs provide approximately three days of storage at current average-day demand. Data on the reservoirs is presented in Table ES-1. The storage tank locations are shown on Figure ES-2.

Table ES-1. Water System Reservoirs

	Year Built	Type	Operational Capacity	Nominal Capacity
Reservoir No. 1	1991; Recoated 2017	Welded Steel	290,000 gallons	340,000 gallons
Reservoir No. 2	2014	Bolted-Up Steel	290,000 gallons	340,000 gallons

Piping improvements made with Reservoir No. 2's construction allow either reservoir to be taken offline for maintenance. With recent work on Reservoir No. 1 and the 5-year age of Reservoir No. 2, both reservoirs are considered to be in good condition. Seismic upgrades were not included with a 2017 project to recoat Reservoir No. 1, due to budget constraints. Reservoir No. 2 was built in accordance with current seismic code.

System Pressure and Pumping Operation

The water plant has three pumps that, in conjunction with a hydropneumatic tank, maintain pressure in the distribution system. These pumps take potable water from the storage reservoir and pump it directly to the distribution system as needed to meet demand. The booster pumps are designed to maintain a minimum system pressure of 55 pounds per square inch (psi). The smallest pump is the primary pump, and it operates most of each day. The other two pumps—a 15-hp medium-demand pump and a 50-hp high-demand pump—are activated as needed to meet demand. The high-demand pump typically operates only when fire hydrants are opened.

Distribution System

The pipes that make up the distribution system for the City of Gervais vary in age and material. Approximately two-thirds of the older cast-iron pipe system was replaced in 1990 with PVC pipe. The size of some of the older pipes suggests they were built only to provide average-demand flow, with no provision for fire flow.

The system now includes approximately 54,000 feet of distribution pipe ranging in diameter from 1 to 14 inches. About 80 percent of the pipe is PVC constructed since 1990. The remainder of the system is older, mostly cast iron and steel pipe. A few areas of the distribution system are unlooped, which means that there are dead end lines. Isolation valves at various points in the system allow for repairs.

The City has 3/4-inch water meters for all users, except for the high school, middle school and Fiber Fab building. The meters were upgraded in the early 2000s to allow remote reading. According to City officials, the reading systems on many of these meters are failing and need replacement.

SUMMARY OF EXISTING SYSTEM DEFICIENCIES

Since 2010, the City has made significant investment in its water facilities, including treatment capacity and control improvements, storage capacity improvements, and emergency preparedness improvements. Consequently, system deficiencies are limited. They include the following:

- **Fire flows**—Fire flows are below desired levels in several areas of the city. This is a result of the distribution system pipe layout and sizing, as well as the limits of the high-demand pump.
- **Distribution System**—18 to 20 percent of the distribution system is cast iron, transite, or steel pipe that is at least 40 years old, with a portion probably much older. This older pipe presents increased risk of main breaks and should eventually be replaced.
- **Fire Hydrant Spacing**—Additional fire hydrants are needed to provide the 500-foot maximum spacing required by the Woodburn Fire District Fire Chief.

SEISMIC EVALUATION

Gervais is located in seismic Zone VII (moderate) for potential damage from a magnitude 9 Cascadia earthquake. As such, Oregon Health Authority requires earthquake risks to be evaluated, critical infrastructure to be identified and a mitigation plan to be developed if necessary. Based on a 2013 seismic hazard study prepared for the Reservoir No. 2 design, the water system components presented in Table ES-2 are susceptible to damage in a severe earthquake.

Table ES-2. Water System Seismic Vulnerabilities

System Component	Deficiency
Cast Iron and Steel Pipes	Brittle pipe, possible rigid joints
Reservoir No. 1	Foundation, tank and connections do not meet seismic code
Pipeline Connections to Facilities	Insufficient flexibility

The following measures are recommended to provide resiliency to critical water infrastructure:

- Install flexible pipe connections at well heads, Reservoir No. 2 and the treatment facility
- Install five new distribution pipe valves improving the ability to isolate cast iron pipes (see Figure ES-3)
- Perform structural review of treatment facility building

FUTURE POPULATION AND WATER DEMAND

As Gervais continues to grow in the future, demand for water will increase, necessitating future capacity increases. Projected population growth and the associated increase in water demand are shown in Table ES-3.

Table ES-3. Projected Water Demand

Year	Population	Water Demand		
		Average	Peak Day	Peak Hour
2018	2,588	207,040 gpd (144 gpm)	455,000 gpd (316 gpm)	725,000 gpd (503 gpm)
2025	2,996	239,680 gpd (166 gpm)	527,000 gpd (366 gpm)	839,000 gpd (583 gpm)
2030	3,175	254,000 gpd (176 gpm)	559,000 gpd (388 gpm)	889,000 gpd (617 gpm)
2035	3,346	267,680 gpd (186 gpm)	589,000 gpd (409 gpm)	937,000 gpd (651 gpm)
2040	3,494	279,520 gpd (194 gpm)	615,000 gpd (427 gpm)	978,000 gpd (679 gpm)

Source: Population Research Center of Portland State University

SYSTEM IMPROVEMENT RECOMMENDATIONS

Improvements recommended in the Water Master Plan will provide for compliance with regulations, upgrade of the system, and provisions for future growth. The recommendations are shown on Figure ES-3 and Figure ES-4. Table ES-4 shows the prioritization of the recommended water system improvements.

Table ES-5, showing estimated costs and project priorities for the recommended improvements, is the capital improvement plan for the Gervais water system. Timing for long-term projects has been omitted as City financing for these projects within the planning period is not feasible.

The capital costs for the recommended improvements include construction, contingencies, engineering, legal and administrative costs.

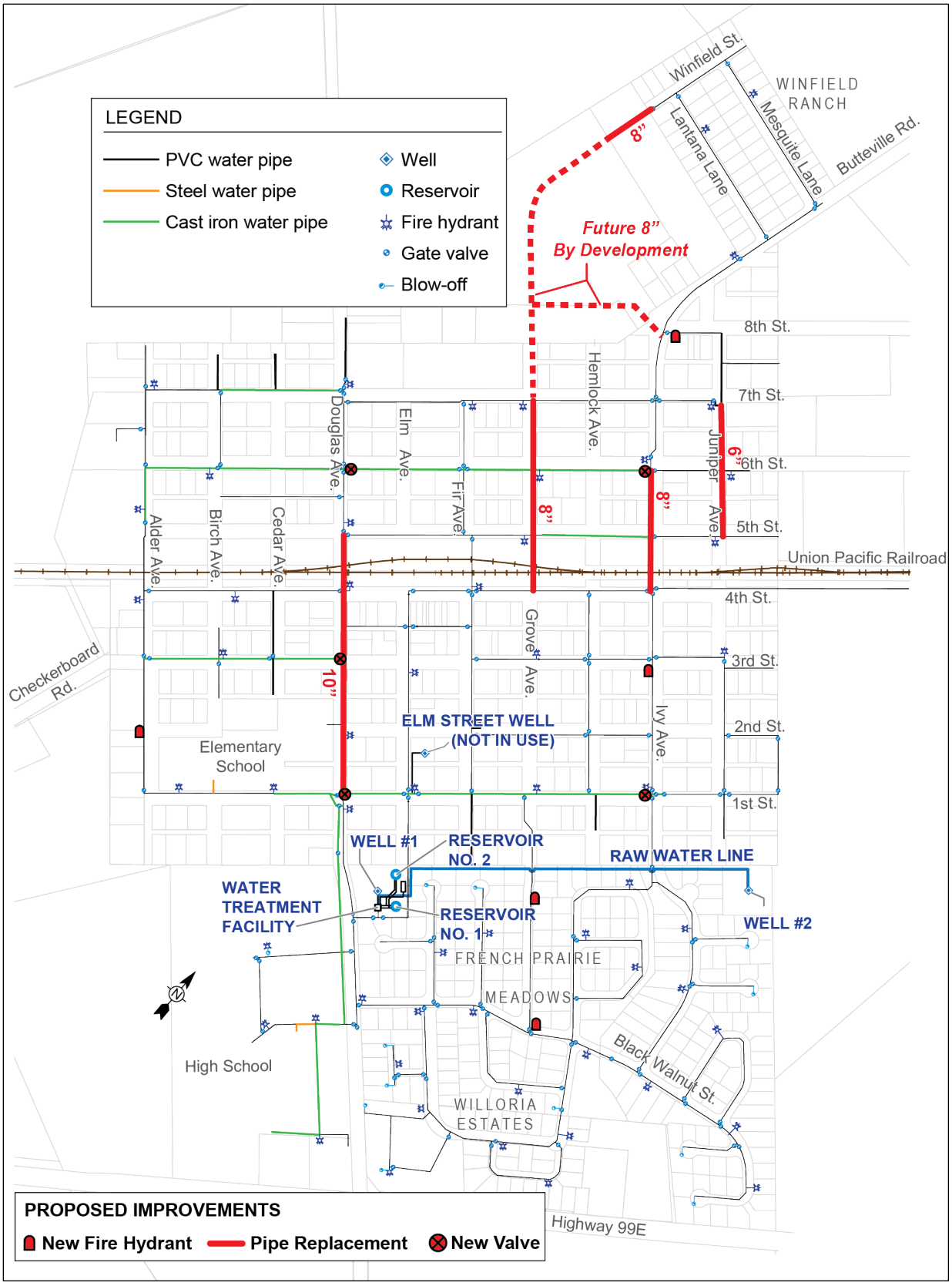


Figure ES-3. Recommended Distribution System Improvements

Figure ES-4. Recommended Improvements at the Water Plant Site

Table ES-4. Improvement Recommendation Prioritization

Category	Recommended Improvements
Short Term Improvements—Projects needed to meet minimum standards or codes or to resolve an existing problem.	
Improvements to Increase Fire Protection	• Install five new fire hydrants to reduce the distance between any two fire hydrants in the City to 500 feet, meeting fire code requirements. • Replace the existing high-demand pump at the water plant with a higher capacity pump. Preliminary sizing calls for a 75-hp pump capable of pumping 1,500 gpm at 150 feet of total dynamic head. • Complete the 8-inch diameter pipe looped connection to Winfield Ranch
Seismic Resiliency Improvements	• Provide flexible connections for Reservoir No. 2 8-inch fill pipe, 14-inch discharge pipe and 6-inch drainpipe, placed at the perimeter of the tank to absorb movement and differential settlement in the event of an earthquake. • Provide five new distribution system valves to better allow vulnerable older pipe segments to be closed off after a seismic event.
Other Improvements	• Replace water meters with upgraded reading equipment. • Hire a certified water right examiner to obtain water rights transfer for Well No. 1 and Well No. 2, including a final proof of survey of the completed use of beneficial use permit G-12015 and performing a well test. • Replace pump for Well No. 1 • Replace 15-hp medium-demand pump with 25-hp pump and variable-frequency drive
Intermediate Term Improvements—Projects that meet overall goals and objectives but are of secondary priority. For pipelines, these projects increase system looping and fire flows and are a step in addressing replacement of older cast iron and steel pipe.	
Pipe Improvements	• Replace 4- and 6-inch steel and cast-iron pipes in Douglas Avenue between 1st Street and 5th Street with 10-inch PVC pipe. • Replace the 6-inch cast iron pipe in Ivy Avenue between 4th Street and 6th Street with an 8-inch PVC pipe. • Install an 8-inch PVC pipe in Grove Avenue between 4th Street and 7th Street.
Long-Term Improvements—Projects needed later to meet long-term capacity needs, aging infrastructure and seismic resiliency.	
Storage Improvements	• Reservoir No. 1 with a 500,000-gallon welded steel reservoir designed for an increased maximum water level that can be used in the future (beyond the planning period) when Reservoir No. 2 needs replacing. • Install a 6-inch PVC pipe in Juniper Avenue between 5th Street and 7th Street. • Recoat Reservoir No. 2

Table ES-5. Capital Improvement Plan

CIP Project	Cost
Short-Term Projects	
New Fire Hydrants	$70,000
Medium-Demand and High-Demand Pump Upgrades	$210,000
Connection to Winfield Ranch	$90,000
Reservoir No. 2 Flexible Connections	$170,000
New Distribution System Valves	$70,000
Water Rights Transfer	$10,000
Water Meter Repairs	$150,000
Replace Pump for Well No. 1	$17,000
Short Term Subtotal	**$770,000**
Intermediate Term (10-20 Year) Projects	
8-inch Grove Avenue Pipeline	$360,000
10-inch Douglas Avenue Pipeline	$500,000
8-inch Ivy Avenue Pipeline	$350,000
Intermediate Term Subtotal	**$1,210,000**
Long Term Projects	
Replace Reservoir No. 1	$1,390,000
6-inch Juniper Ave Pipeline	$190,000
Recoat Reservoir No. 2	$220,000
Cast-Iron Pipe Replacement Program	$440,000
Long Term Subtotal	**$2,240,000**
Total	**$4,220,000**

FINANCIAL PLAN

System Development Charges

System development charges (SDCs) are fees that local governments collect from property developers to offset the cost of public improvements associated with new development. SDCs are one-time fees collected at the time of building permit issuance. The fees collected may only be used for capital improvements for municipal services. Gervais' current water SDC charge is $2,313 per single-family residence (1 EDU), last updated in 2006.

Proposed improvements were evaluated for improvement SDC eligibility. Those having all or some of the cost attributable to future growth are noted in Table ES-6. The appropriate SDC rate for these improvements is determined by allocating the growth-related portion of the cost among the anticipated number of future connections to be served. The results show the SDC being increased to $3,628.

Water Use Rates

Water user rates are monthly fees assessed to all users connected to the water system. The City currently has 637 residential users, 11 commercial and industrial connections, and 5 school connection for a total of 653 users. The City's current base user rate is $31.36 per EDU per month.

As current rates will not meet CIP costs, a rate increase at the beginning of the 2019/2020 fiscal year is recommended. Based on estimates of annual expenses, existing and new debt service, and revenue through the planning period, a base rate increase to $35.50 per month is recommended. The resulting rate schedule for 2020 is shown in Table ES-7. An annual increase of 2.75% each year through the planning period is recommended.

Table ES-6. Costs Attributable to Growth

Project	Cost	Portion for Future Growth	Cost for Future Growth
New Fire Hydrants	$70,000	0.0%	$0
Medium-Demand and High-Demand Pump Upgrades	$210,000	25.9%	$54,453
Connection to Winfield Ranch	$90,000	25.9%	$23,337
Reservoir No. 2 Flexible Connections	$170,000	25.9%	$44,081
New Distribution System Valves	$70,000	25.9%	$18,151
Water Rights Transfer	$10,000	25.9%	$2,593
Water Meter Repairs	$150,000	0.0%	$0
Grove Avenue Pipe	$360,000	25.9%	$93,349
Replace Well No. 1 Pump	$17,000	0	0
Douglas Avenue Pipe	$500,000	25.9%	$129,651
Ivy Avenue Pipe	$350,000	25.9%	$90,756
Replace Reservoir No. 1	$1,390,000	25.9%	$360,429
Juniper Ave Pipeline	$190,000	25.9%	$49,267
Recoat Reservoir No. 2	$220,000	0%	$0
Current SDC Budget Balance[a]			***($38,359)***
Total SDC Eligible Costs			**$866,068**
Cost per Future EDU			**$3,746**

a. The current balance shown represents SDC funds previously collected that have yet to be spent.

Table ES-7. 2020 Proposed Water Rate Schedule

Service Class	Base Rate Cubic Feet	Base Rate/ Month	Cost per Additional 100 Cubic Feet
Residential and Special Residential	700	$ 35.50	$1.97
Commercial-Business	700	$59.17	$2.96
Industrial	700	$59.17	$2.96
Sacred Heart School	2800	$98.62	$2.96
Gervais Elementary School	5600	$197.26	$2.96
Gervais Elem School Cafeteria and Gym	3150	$147.94	$2.96
Gervais High School	5600	$197.26	$2.96

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

The *City of Gervais Water Master Plan* evaluates the City's water system, identifies current and future needs for water supply, storage and distribution, presents a capital improvement program, assesses water rates, and reviews funding opportunities. It meets state and funding agency requirements and provides a firm basis for the design of necessary improvements. Preparation of the Water Master Plan included the following elements:

- Review of data provided by the City, including mapping and operational data, related to the following:
  - Population and zoning
  - Existing and projected future system demand
  - Existing supply facilities, including water rights and well capacity
  - Existing treatment facilities and water quality data (including an evaluation of the treatment facility against regulatory/water quality requirements and system demand)
  - Existing distribution system
- Mapping of the distribution system in AutoCAD
- Hydraulic modeling of the piping network and storage facilities, including existing and proposed scenarios (the model used was Innovyze InfoWater)
- Assessment of the system's vulnerability to a magnitude 9 seismic event, identifying deficiencies and critical infrastructure necessary to maintain limited operation in such an event
- Evaluation of distribution, treatment and storage improvement alternatives (including the most suitable location for any proposed new storage reservoirs) based on system hydraulics, cost, site availability, and geotechnical considerations
- Development of a capital improvement program and budget
- A water rate evaluation and proposed implementation schedule
- A summary of funding alternatives.

1.2 PLANNING BACKGROUND

Existing documentation related to water planning efforts in the City of Gervais includes the following:

- City of Gervais General Plan. December 2015.
- City of Gervais Water Master Plan. Tetra Tech/KCM, Inc. May 2002.
- City of Gervais Wastewater Facilities Plan Update. Tetra Tech, Inc. May 2019.

1.3 STUDY AREA CHARACTERIZATION

1.3.1 Study Area Boundaries

Gervais is located In Marion County, about 2 miles south of the City of Woodburn and 16 miles north of the City of Salem along Highway 99E, as shown in Figure 1-1. Its urban growth boundary (UGB), which extends slightly beyond the city limits, encompasses an area of 332 acres. The City's water system currently serves areas within the city limits. Its service area for the 20-year planning period is defined as the area within the UGB.

The City last expanded its UGB in 2005. A buildable lands inventory and land needs analysis, completed in 2015 with the City's most recent update of its General Plan, found a need to expand the UGB. Since then, the population projections that the analysis were based on were significantly lowered. A new analysis using the revised population projections is necessary to justify any UGB expansion. The Mid-Willamette Council of Governments anticipates that a new study will show there is sufficient undeveloped land within the current UGB, so this Water Master Plan uses that boundary in assessing future water system needs.

1.3.2 Physical Environment

Climate

The Gervais area has a modified marine climate. Rainfall events typical of the study area are characterized by large, intermittent frontal storms that move in from the Pacific Ocean. High intensity, short duration events are uncommon. The average annual precipitation is 40 inches, approximately 95 percent of which falls from November through June.

Floodplains

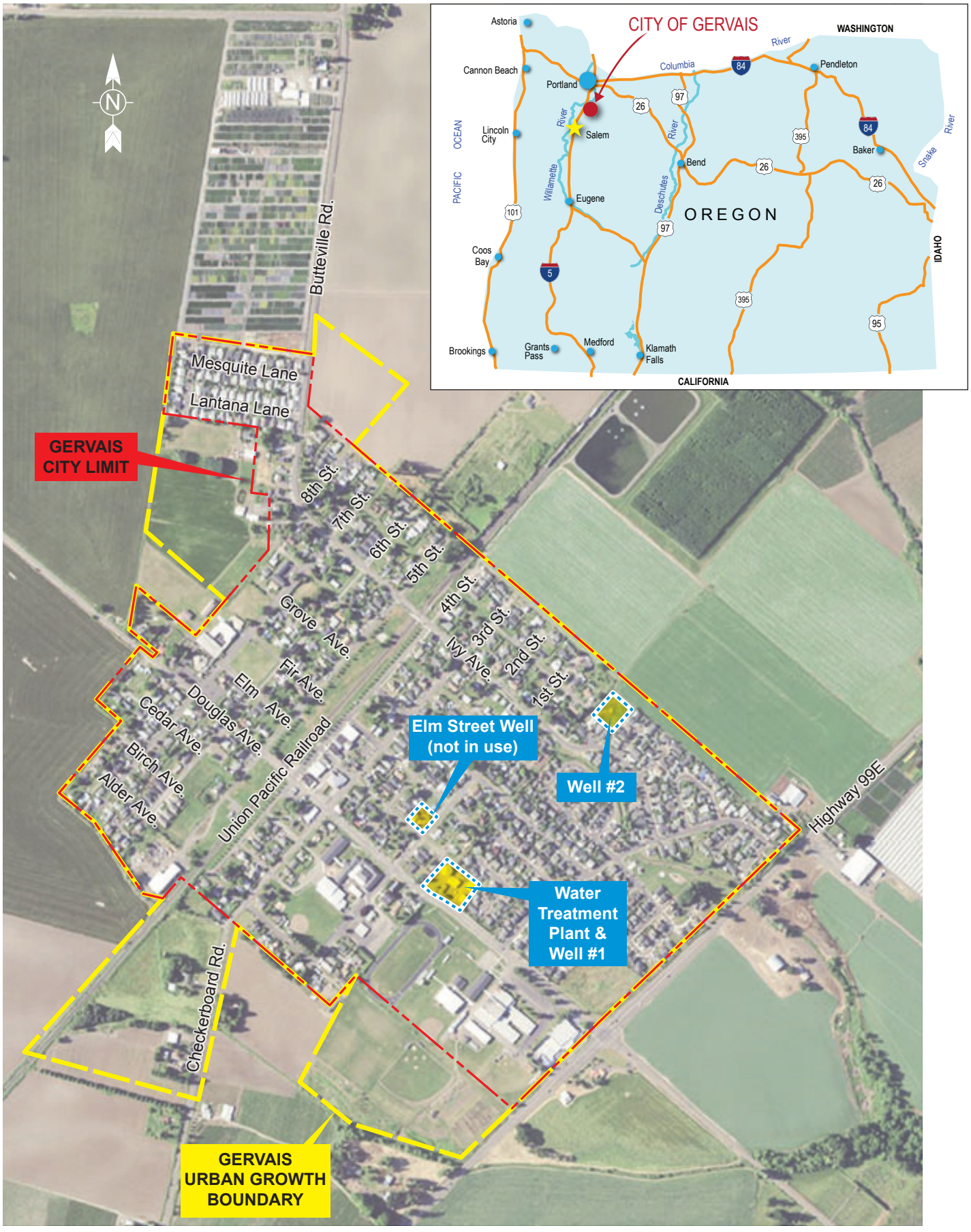
According to a Federal Emergency Management Agency Flood Insurance Study (revised January 19, 2000) the City of Gervais is considered non-flood prone.

Topography and Soils

The City is in the central Willamette Valley, primarily surrounded by agricultural land, with elevations from 175 to 185 feet above sea level. The terrain within the UGB is characterized by flat slopes with poorly defined drainage patterns. There are five soil series in the area: Amity, Concord, Woodburn, Willamette and Dayton. Most of the developed City is situated on Amity and Concord soils. These soils are characterized by a high water table, moderate or slow permeability, and low shear strength for building foundations. The relatively impervious and level terrain promotes slow runoff and ponding during storm events.

1.3.3 Zoning and Land Use

The City of Gervais General Plan designates areas for residential, multi-family, commercial, industrial and public land uses. The General Plan, originally adopted in 1977, was most recently amended in 2015 and describes a planning period through 2034. The zoning map that was published in that report is shown in Figure 1-2. The current acreage for each zone is summarized in Table 1-1. Significant property owned by the Gervais School District is shown as residential on the zoning map, although these areas are shown as public land on the City Comprehensive Plan Map. The public land designation was used for these areas for this Water Master Plan.



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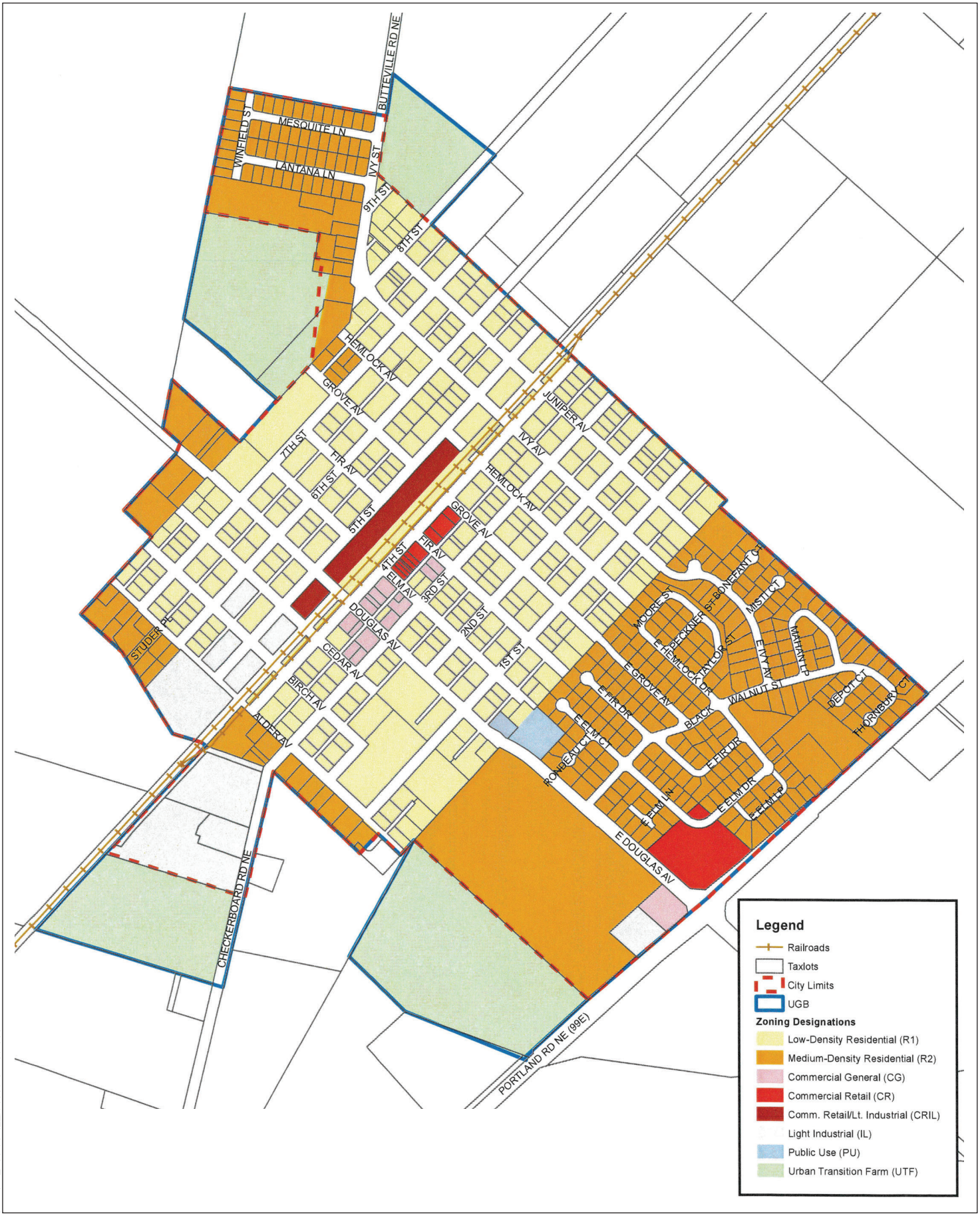
TETRA TECH

15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 1-1.
CITY OF GERVAIS AND VICINITY



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TETRA TECH
15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 1-2.
CITY OF GERVAIS ZONING

Table 1-1. Developable UGB Land Use Zoning

Land Use	Vacant (Acres)	Developed (Acres)	Total
Residential District (R1/R2)	17.01	121.08	**138.09**
Light Industrial (IL)	8.67	4.5	**13.17**
Commercial General District (CG)	0.23	2.14	**2.37**
Commercial Retail District (CR)	3.53	0.45	**3.98**
Commercial/Light Industrial District (CR/IL)	0.0	0.50	**0.50**
Total			**158.11**

Source: City of Gervais General Plan, 2015
Note: Table does not include public land or schools

1.3.4 Population

Historical Population

Since a local lumber mill closed in the 1950s, Gervais has been a bedroom community with most working residents commuting to Salem, Portland or Woodburn. Population change has been minimal, affected primarily by factors outside the community. The largest increase in population took place between 1990 and 2000 due to the development of two residential subdivisions—Winfield Ranch and French Prairie Meadows. Additional growth occurred with an additional subdivision in 2007 and through localized infill development. Table 1-2 shows the City's historical population from 1970 through 2018 and the corresponding average annual growth rates.

Table 1-2. Historical Gervais Population Growth

	1970	1980	1990	2000	2010	2018
Population	746	799	992	2,009	2,464	2,570
Average Annual Growth Rate over Preceding 10 Years		0.8%	2.12%	7.31%	2.06%	0.6%

Source: U.S. Census Data and Portland State University Center for Population Research

Population Projections

The Portland State University Center for Population Research was consulted for population growth projections over the planning period (through 2040). The PSU projections were recently updated and are now lower than the projections used for the City's amended 2015 General Plan. Table 1-3 shows the projected population and corresponding annual growth rates for the planning period using the updated projections.

Table 1-3. Projected Population Growth

	2018	2020	2025	2030	2035	2040
Population	2,570	2,781	2,996	3,175	3,346	3,494
Average Annual Growth Rate		4.1%	1.9%	1.5%	1.3%	1.1%

Source: Population Research Center of Portland State University

A 60-unit subdivision is currently in the planning stages, with possible start of construction in 2019. Beyond that, any significant increase in population would likely require an expansion in the UGB.

1.3.5 Socioeconomic Environment

Gervais has a limited economy, with a small downtown area and several small industrial businesses. The City serves primarily as a bedroom community to larger cities such as Woodburn and Salem. Much of the employment for Gervais residents is in the agricultural production industry.

A DATAUSA profile for the City describes a median annual household income of $51,841, which is greater than the median annual household income for Marion County but less than the median annual household income for nearby cities of Woodburn and Silverton. The poverty rate for Gervais is at 14.4 percent. The median property value is $136,300 and homeownership is at 82 percent.

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2. EXISTING WATER SYSTEM

The Gervais water system has been in operation since 1920. The existing water system consists of two wells and well pumps, one treatment facility, two storage reservoirs, and the water distribution system. The City's water distribution system is shown in Figure 2-1. Figure 2-2 shows the layout of the City's water plant site, which features storage tanks, one of the City's wells, the water treatment facility, and distribution system booster pumps. A schematic of the overall system is shown in Figure 2-3. The following sections describe the components of the water system. Each component is analyzed in greater detail in subsequent chapters.

2.1 WATER SOURCES

2.1.1 Water Rights/Beneficial Use Permits

The City was issued a water right of 1.11 cubic feet per second (cfs) (498 gallons per minute (gpm)) for its Elm Avenue Well, which is no longer in use, by Certified Water Right No. 28241 (Certificate) with a date of priority granted August 2, 1956. The City has a Claim of Beneficial Use permit G-12015 for a total of 680 gpm from Well No. 1 and Well No. 2.

2.1.2 Supply Wells

According to Oregon Water Resource Department records, Well No. 1 and Well No. 2 were drilled in 1989. The Elm Avenue Well has not been used since these wells were put online. The wells are drilled in a geologic region classified as the French Prairie Area, North Willamette Valley, Oregon. The Gervais area is underlain for the top 50 feet by Willamette soils referred to as the Troutdale formation. The Troutdale formation consists of layers of clays, silts, sands, gravels and boulders in alternating layers. The Troutdale formation yields moderate to large quantities of groundwater. The water contains iron and manganese in excess of Oregon Health Authority and U.S. Environmental Protection Agency limits. In 1990 the City built a water treatment facility with an iron and manganese treatment system that has reduced these constituents to acceptable levels.

The Oregon Health Authority's 2002 *Well No. 1 & No. 2 Source Water Assessment Report* indicates that Well No. 1 and Well No. 2 are not considered highly sensitive sources and have no history of contamination. A 2017 update to that report indicates that there are potential contamination risks, particularly for Well No. 1. The update includes recommended management strategies to reduce these risks. The Elm Avenue Well is considered to have a high risk of contamination. The 2002 report and the 2017 update are included in Appendix A. Well logs are included in Appendix B. Oregon Health Authority records for water quality are included in Appendix C.

Well No. 1

Well No. 1 was constructed at the City's water plant in 1990. It is a 10-inch-diameter well with casing of the full well depth of 265 feet. There is a screen from 220 feet to 265 feet. Well No. 1 includes a small building and 20-hp pump capable of delivering 340 gpm at a total dynamic head (TDH) of 170 feet. It produces about one-half of the City's water. A variable frequency drive was installed in 2015. Well No. 1 has shown no signs of capacity reduction over the years or other production problems.

Well No. 2

Well No. 2 was constructed in 1990 east of Juniper Avenue and First Street. It is a 10-inch-diameter well with casing of the full well depth of 279 feet. There is also a screen from 222 feet to 279 feet. Well No. 2 includes a small building and 25-hp pump capable of delivering 340 gpm at 210 feet TDH. The well pump was replaced and a variable frequency drive installed in 2015.

This well produces about one-half of the City's water. Raw water is conveyed to the treatment facility by an 8-inch PVC pipe about 1,400 feet long. Well No. 2 has shown no signs of capacity reduction over the years or other production problems.

Elm Avenue Well (not in use)

According to City records, the Elm Avenue Well was drilled in 1920 and is 142 feet deep with a 12-inch casing to the bottom. The last 12 feet of the casing is reported to be perforated and the well sealed with puddled clay. The Elm Avenue Well is also reported to have a turbine pump rated at 400 gpm with a 40-hp motor that has not been operated in over 30 years. In the 1988 City of Gervais Water Master Plan, it was recommended that use of the Elm Avenue Well be discontinued due to a history of bacterial contamination. Once Well No. 1 and Well No. 2 became operational in 1991, use of the Elm Avenue Well was discontinued. Piping from the Elm Avenue Well may be intact but has not been used for many years.

Well Head Equipment

Well No. 1 and Well No. 2 are each housed in a 12-foot by 8-foot building along with a well pump, shut-off valves, sampling tap and pressure gauge as shown in Figure 2-4. Figure 2-3 includes a schematic of the well piping and controls. The two wells pump water directly to the treatment facility, where it is filtered, chlorinated and stored in the reservoirs.

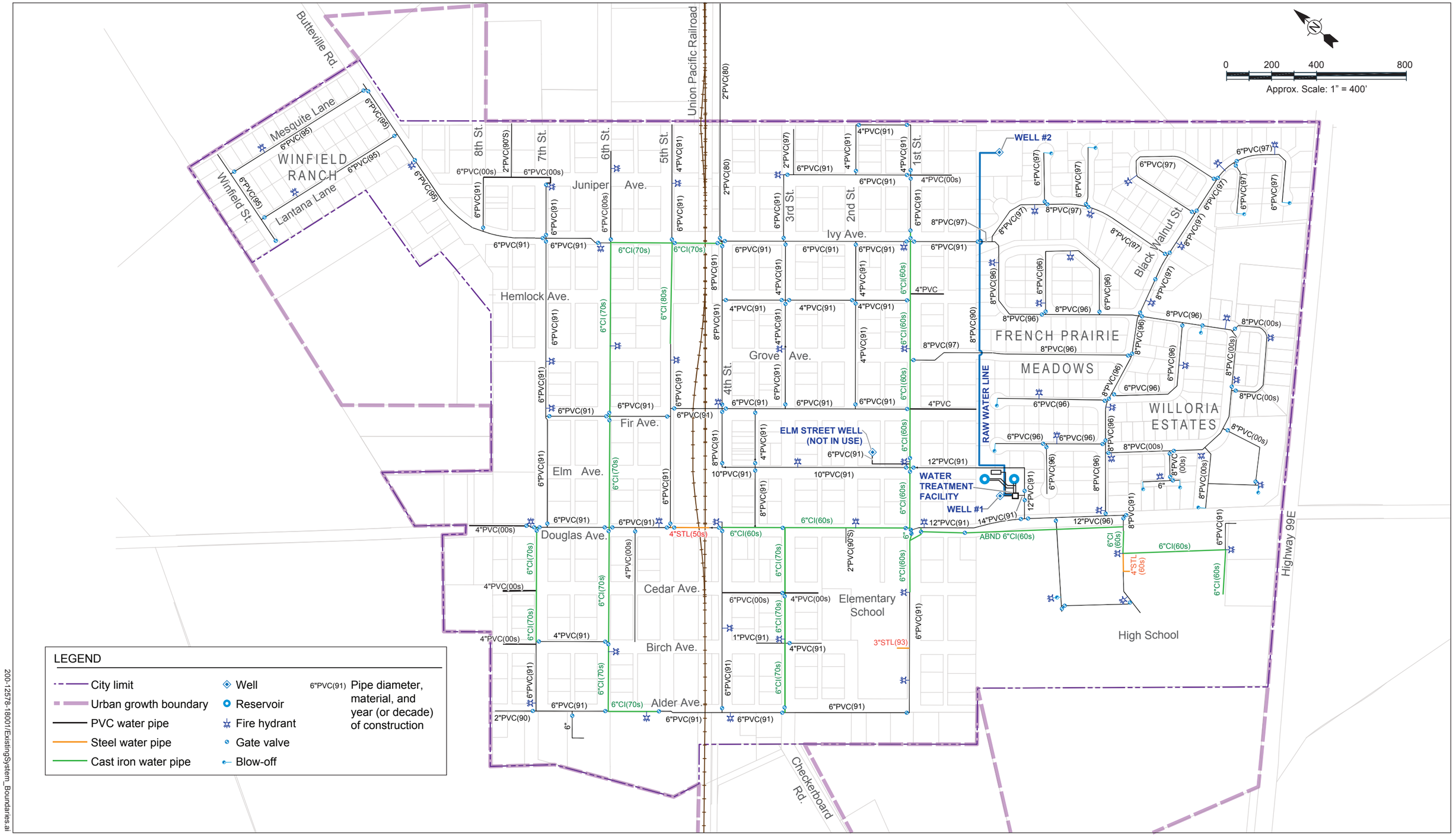
2.1.3 Surface Water Sources

According to State of Oregon Water Resource Department records, the City does not currently have rights to surface water.

2.2 WATER TREATMENT

Because the City was exceeding coliform levels in the 1980s, constant chlorination was recommended by the Oregon Health Authority in 1986 and incorporated in the water treatment facility construction completed in 1991. In the 1980s, the City also experienced iron and manganese concentrations in excess of state and U.S. Environmental Protection Agency maximum contaminant levels. The 1991 water treatment facility included construction of a greensand filter system that has been successful in reducing iron and manganese levels to maintain compliance. In September 2001, the City switched from chlorine gas injection at the water treatment facility to a liquid sodium hypochlorite system at the wells. The treatment facility was upgraded in 2012, adding two new greensand filters and essentially doubling the capacity of the plant.

The current water treatment facility at the City's water plant consists of a steel-framed metal building, four 170-gpm iron and manganese greensand pressure filters (see Figure 2-5), a potassium permanganate dosing system for flocculation, and a hypochlorite disinfection system. Backwash water is conveyed to a dewatering sump north of the building for dewatering. Oregon Health Authority representatives have indicated that the City would likely be required to meet greater disinfection requirements than chlorination if the Elm Avenue Well were used, due to its history of contamination. The treatment facility building also houses a hydropneumatic tank and booster pumps used to maintain distributions system pressure, along with an emergency generator for the largest pump.



200-12578-18001/ExistingSystem_Boundaries.ai

TETRA TECH
15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 2-1.
CITY OF GERVAIS WATER SYSTEM

200-12578-18001/WaterPlant.ai

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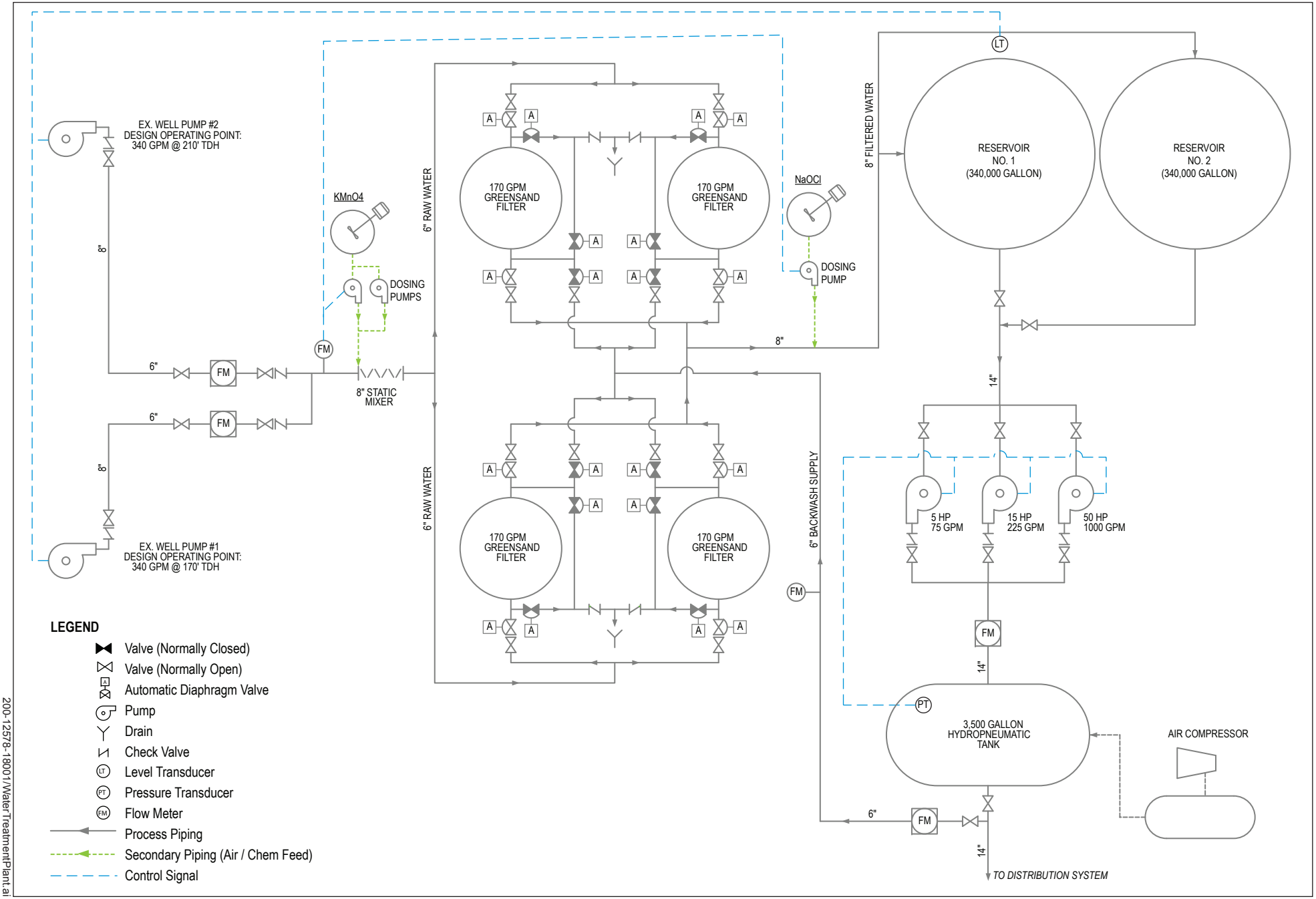
City of Gervais
WATER MASTER PLAN

Figure 2-2.
WATER PLANT SITE LAYOUT



200-12578-18001/WaterTreatmentPlant.ai

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Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 2-3.
WATER SYSTEM SCHEMATIC

Figure 2-4. Well Equipment

Figure 2-5. Two of the Four Greensand Filters

2.3 WATER STORAGE

The City of Gervais has two water storage reservoirs, both located at the water plant (see Figure 2-6 and Figure 2-7). Data on the reservoirs is presented in Table 2-1. Seismic upgrades were not included with the 2017 project to recoat Reservoir No. 1, due to budget constraints. Reservoir No. 2 was built in accordance with current seismic code. The storage tank locations are shown on Figure 2-2.

Figure 2-6. Reservoir No. 1

Figure 2-7. Reservoir No. 2

Table 2-1. Water System Reservoirs

	Year Built	Type	Operational Capacity	Nominal Capacity
Reservoir No. 1	1991; Recoated 2017	Welded Steel	290,000 gallons	340,000 gallons
Reservoir No. 2	2014	Bolted-Up Steel	290,000 gallons	340,000 gallons

Both reservoirs operate at the same hydraulic level. High water levels in both are at an elevation of about 195 feet. Both reservoirs have an 8-inch-diameter inlet, and a 14-inch-diameter outlet. Reservoir No. 1 has a 10-inch-diameter overflow that discharges to an existing storm drain that runs along Douglas Avenue. Reservoir No. 2 has an 8-inch diameter overflow that discharges to the storm drain in Elm Avenue northwest of the water plant. With the recent work on Reservoir No. 1 and the 5-year age of Reservoir No. 2, both reservoirs are considered to be in good condition. The top hatch to both reservoirs is locked and the site is fenced.

Piping improvements made with the Reservoir No. 2 construction allows either reservoir to be taken offline for maintenance purposes.

2.4 WATER PLANT SITE

The City's water plant on Douglas Avenue includes the treatment facility, Well No. 1, and Reservoirs No. 1 and No. 2. It was constructed in 1990 and expanded in 2010 with the construction of Reservoir No. 2. The site also includes a shop, maintenance garage and backwash sump. Figure 2-2 shows the current plant site.

2.5 DISTRIBUTION SYSTEM

2.5.1 Pipes, Valves and Meters

The pipes that make up the distribution system for the City of Gervais vary in age and material. City officials provided information indicating when and where the water distribution system was first installed. Approximately

two-thirds of the older cast-iron pipe system was replaced in 1990 with PVC (AWWA C-900). The size of some of the older pipes suggests they were built only to provide average-demand flow, with no provision for fire flow.

The system now includes approximately 54,000 feet of distribution pipe ranging in diameter from 1 to 14 inches. According to as-built drawings, about 80 of the pipe is PVC constructed since 1990. The remainder of the system is older, mostly cast iron and steel pipe. A few areas of the distribution system are unlooped, which means that there are dead end lines.

Isolation valves at various points in the system allow for repairs. These valves are indicated on Figure 2-1.

The City has 3/4-inch water meters for all users, with the exception of the high school, middle school and Fiber Fab building. Service lines are copper and PVC. The meters were upgraded in the early 2000s to allow remote reading. According to City officials, the reading systems on many of the meters no longer work and need replacement.

2.5.2 System Pressure and Pumping Operation

The water plant has three pumps that, in conjunction with the hydropneumatic tank, maintain pressure in the distribution system (see Figure 2-3). These pumps take the potable water from the storage reservoir and pump it directly to the distribution system as needed to meet demand. The booster pumps are designed to maintain a minimum distribution system pressure of 55 pounds per square inch (psi). If the single 7.5-hp pump cannot maintain 55 psi, the 15-hp medium-demand pump starts. If the 7.5- and 15-hp pumps together cannot maintain 55 psi, the 50-hp high-demand pump starts. The 7.5-hp pump is the primary pump and operates most of each day, the 15-hp pump is second in the total number of hours operated, and the 50-hp high-demand pump is a distant third.

The distribution system has one pressure zone controlled by the hydropneumatic tank and pumps at the water treatment facility (see Figure 2-8). The pressure zone has service elevations ranging from 185 to 176 feet. The hydropneumatic tank and pumps are designed to maintain system pressures in the range of 55 to 70 psi.

2.6 EMERGENCY EQUIPMENT

With control system upgrades installed with the 2010 water plant expansion, an automatic transfer switch and new 175- kilowatt diesel generator were installed, providing automatic activation of backup power in the event of a power outage. The generator's fuel tank is sized to provide 24 hours of continuous operation.

2.7 SUMMARY OF KNOWN SYSTEM DEFICIENCIES

Since 2010 the City has made significant investment in its water facilities, including treatment capacity and control improvements, storage capacity improvements, and emergency preparedness improvements. Consequently, system condition deficiencies are limited. They include the following:

- **Fire flows**—Fire flows are below desired levels in several areas of the city. This is a result of the distribution system pipe layout and sizing, as well as the limits of the high-demand pump.
- **Distribution System**—18 to 20 percent of the distribution system is cast iron, transite, or steel pipe that is at least 40 years old, with a portion probably much older. This older pipe presents increased risk of main breaks and should eventually be replaced.
- **Fire Hydrant Spacing**—Additional fire hydrants are needed to provide the 500-foot maximum spacing required by the Woodburn Fire District Fire Chief.

Figure 2-8. Distribution Piping and Pressure Tank

3. EVALUATION CRITERIA

3.1 WATER USE AND DEMAND

3.1.1 2018 Water Data

Water production and consumption for 2018 is summarized in Table 3-1. Water production data is based on the total volume of both wells reduced by the backwash volume, which is lost to the system. Consumption data is based on service meter records.

Table 3-1. 2018 Water Production and Consumption

	Well No. 1 (MG)	Well No. 2 (MG)	Backwash (MG)	Production (MG)	Consumption Per Service Meter (MG)
January 2018	2.30	2.50	0.09	4.71	3.97
February 2018	1.80	2.55	0.10	4.25	3.76
March 2018	2.23	2.71	0.11	4.83	3.76
April 2018	2.27	2.57	0.11	4.73	3.97
May 2018	3.00	3.45	0.15	6.30	4.08
June 2018	3.78	4.02	0.19	7.61	5.75
July 2018	4.76	4.95	0.24	9.47	7.03
August 2817	4.26	4.57	0.23	8.60	8.29
September 2018	3.06	3.06	0.15	5.97	6.78
October 2018	2.75	2.72	0.13	5.34	4.81
November 2018	2.43	2.53	0.12	4.84	4.35
December 2018	2.41	2.57	0.23	4.75	3.94
Total				**71.40**	**60.48**

MG = million gallons

The 71.4 million gallons (MG) produced for 2018 indicates an average per capita production of 76 gallons per person per day (gpcd), based on a population of 2,570. This is lower than the typical per capita usage, which may be explained by the fact that Gervais is a bedroom community with a large portion of the population working outside the City during the day. The total consumption of 60.5 million gallons equates to an average per capita consumption of 65 gpcd. The difference between the amount of water produced and the amount used (called "water loss") is generally due to leaks in the system, inaccurate meters, unmetered services, overflow events, or inaccurate record-keeping. For this master plan, it is assumed that the differences are due to mostly to leaks in the distribution system and flow meter error.

The Oregon Health Authority recommends water system losses of no more than 10 percent. That is often difficult to meet, and water loss in the range of 10 to 15 percent is considered acceptable. The water loss in the Gervais system is approximately 15 percent. Having a program to address water loss is an important aspect of responsible use of the resource. Because water systems are dynamic and continually aging, addressing water loss is an ongoing process. Maintaining a low water loss can save the City capital dollars in the long run as larger improvements to source, treatment and storage equipment can sometimes be avoided or delayed.

3.1.2 Projected Water Demand

For future projections average consumption is assumed at 80 gpcd. Typical peaking factors (the ratio between peak-day or peak-hour flows and average flows), as presented in the *Civil Engineering Reference Manual*, are 2.0 for peak-day flow and 3.0 for peak-hour flow. Higher values are often appropriate for a small water system such as the system in Gervais, particularly those with little or no commercial or industrial users that use water continuously, attenuating the peaks.

Water records for 2017 and 2018 were reviewed to determine the peaking factor for peak-day flow compared to average annual flow for these years. As shown in Table 3-2, peak-day flows for the last two years are slightly less than twice the average daily flows for the year. Based on this data and experience with similar water systems, the peaking factors used for this master plan are 2.0 for peak-day and 3.0 for peak-hour, which match the data and are also standard peaking factors (*Civil Engineering Reference Manual*). The resulting projected water demand is summarized in Table 3-3.

Table 3-2. 2017 and 2018 Peak Flow to Avg Flow Comparison

	Date	Water Production (gallons)	Average Day Production (gallons)	Peaking Factor
2017 Peak Day	August 3	363,500	194,000	1.86
2018 Peak Day	August 17	362,800	186,000	1.99

Table 3-3. Projected Water Demand

Year	Population	Water Demand		
		Average	Peak Day	Peak Hour
2018	2,588	207,000 gpd (144 gpm)	414,000 gpd (288 gpm)	621,000 gpd (431 gpm)
2020	2,781	222,000 gpd (155 gpm)	445,000 gpd (309 gpm)	667,000 gpd (463 gpm)
2025	2,996	240,000 gpd (166 gpm)	479,000 gpd (333 gpm)	719,000 gpd (499 gpm)
2030	3,175	254,000 gpd (176 gpm)	508,000 gpd (353 gpm)	762,000 gpd (529 gpm)
2035	3,346	268,000 gpd (186 gpm)	535,000 gpd (372 gpm)	803,000 gpd (558 gpm)
2040	3,494	280,000 gpd (194 gpm)	559,000 gpd (388 gpm)	839,000 gpd (583 gpm)

3.2 FIRE FLOW REQUIREMENTS

Fire flow requirements for municipal water systems are established by engineering guidelines, insurance rating services, and fire codes. Interpretation of fire codes in specific instances is usually by local fire officials. The City of Gervais is served by the City of Woodburn Fire District. The Woodburn fire chief was contacted regarding fire flow within the City of Gervais water system. The fire chief's primary concern was that fire hydrants should be spaced at a minimum of 500 feet within the city limits and that fire flows within single family residential areas should be a minimum of 1,000 gpm with a residual pressure of 20 psi. The desired fire flow in residential areas is 1,500 gpm for 2 hours, with a residual pressure of 20 psi.

The Uniform Fire Code (UFC) has fire-flow guidelines for buildings based on the square footage of the structure. The UFC allows fire-flow reduction of up to 75 percent when an institutional or commercial building is provided with an approved automatic sprinkler system. One fire-flow deficiency noted in the 2002 Water Master Plan was the City of Gervais High School. The high school has installed sprinklers with new construction, but all of the older buildings have no fire protection system. Based on UFC recommendations, Gervais High School should have 3,750 gpm available for fire flow. The City's water plant does not have pumping capacity to supply 3,750 gpm, although a new 8-inch looped pipeline installed in 2017 with new connections to existing and new fire hydrants has significantly improved fire protection.

Providing adequate fire flow for the three schools is perhaps the most significant challenge facing the City of Gervais at this time. Meeting UFC fire flow requirements for the largest one or two structures is a challenge, primarily because the distribution system is fed entirely by the booster pumps. Assuming a fire-flow of 2,000 gpm at the high school will provide a reasonable degree of fire protection for a pump-fed system relative to the domestic demand.

3.3 STORAGE

Municipal water storage is provided to meet domestic, fire flow and operational requirements. ISO (the International Standards Organization) has recommended that a water system should be able to provide the peak-day domestic demand plus fire flow for 2 to 3 hours. With the combined operational storage capacity of 580,000 gallons with the two existing reservoirs, currently the system provides approximately 4.5 hours of fire flow (2,000 gpm) at average-day flow and 4.2 hours at a peak-day flow.

The 2040 storage requirement for two hours of 2,000 gpm fire flow plus peak domestic demand is approximately 717,000 gallons. In addition to fire-flow and peak demand, maintaining storage for domestic use and reservoir operation is also advised. In the worst-case scenario, a large fire-flow demand may occur during the peak hour of the peak day when the reservoir is at a low point in its cycle. The total storage recommended for fire-flow, peak demand and operational is 760,000 gallons. This includes a reduction 81,600 gallons for 2 hours of well pump production during this period. As this is well above the current storage capacity, the City should plan for a new reservoir to be constructed before the end of the planning period (2040).

3.4 SYSTEM PRESSURE

State regulations require that a distribution system pressure of 20 psi be maintained at all times. Standard non-fire-flow distribution system design pressures are in the range of 45 to 80 psi. The lower end of this range is the minimum pressure for operation of household appliances such as dishwashers, and municipalities usually receive complaints from customers when the pressures fall much below 45 psi. Pressures above 80 to 85 psi can cause damage to household appliances. Per the Uniform Building Code, individual pressure reducing valves are required when the main line pressure is 80 psi or above.

The system pressure is controlled by the hydropneumatic tank and booster pumps. Assuming an existing and future average and peak day demand, service pressures range from 55 to 70 psi under normal operation (no fire flow). The relatively small range of pressures is consistent with the City’s relatively flat topography.

4. WATER QUALITY REQUIREMENTS

4.1 REGULATORY REQUIREMENTS

Drinking water quality is regulated by federal law, including the Safe Drinking Water Act and its 1986 amendments, and by state law, including the Oregon Administrative Rules (OAR) for public water systems. The U.S. Environmental Protection Agency and state agencies enforce drinking water regulations. In Oregon, the Oregon Health Authority is the primary agency in the enforcement of federal and state regulations for public water systems.

4.1.1 Federal Regulations

The Safe Drinking Water Act, and the amendments thereof, provide the minimum treatment requirements for drinking water quality. States can use these minimum requirements or develop requirements that are more stringent. Oregon's administrative rules for public water systems are the applicable drinking water quality requirements that meet federal regulations. The federal regulatory requirements on the treatment of drinking water are therefore addressed in the discussion on state regulations.

4.1.2 State Regulations

The Gervais Water Department is classified as a "community" water supply by the Oregon Health Authority. OAR Chapter 333 establishes drinking water quality requirements for all public water systems in Oregon. These rules became effective in December 1992. OAR Chapter 333 sets maximum contaminant levels (MCLs) and action levels for various contaminants, outlines treatment requirements and performance standards, covers treatment requirements for corrosion control, provides sampling and analytical requirements, describes public notice guidelines, and presents other requirements related to the construction and operation of water treatment facilities.

MCLs and Action Levels

OAR 333-61-020 defines MCLs as the maximum allowable level of a contaminant in water delivered to the users of a public water system and defines action levels as the concentration of lead or copper in water that determines, in some cases, the treatment processes a water system must provide. The MCLs and action levels are presented in OAR 333-61-030. The regulations further delineate these levels based on water source. In general, there are two types of sources considered: surface water and groundwater under the direct influence of surface water (one type, referred to as surface water in this discussion), and groundwater. The treatment requirements are generally much stricter for surface water sources. The City of Gervais wells are considered groundwater sources and have been analyzed as such in this report. MCLs and actions levels for various inorganic chemicals, summarized in Table 4-1, apply to both types of water sources.

Exceeding the MCL for fluoride requires public notice, as discussed in OAR 333-61-042. The action levels associated with lead and copper are considered to be exceeded if the concentration of the contaminant in more than 10 percent of the tap water samples collected during any monitoring period is higher than the established level. If either of these action levels is exceeded, treatment requirements for corrosion control must be addressed. These treatment requirements are covered in OAR 333-61-034 and discussed later in this chapter.

Table 4-1. MCLs and Action Levels for Inorganic Chemicals

Inorganic Chemical	MCL or Action Level	Latest Test Result
Antimony	0.006 mg/liter	not detected
Arsenic	0.010 mg/liter	0.0051 mg/liter
Asbestos	7 million fibers/liter	
Barium	2 mg/liter	not detected
Beryllium	0.004 mg/liter	not detected
Cadmium	0.005 mg/liter	not detected
Chromium	0.1 mg/liter	not detected
Copper	1.3 mg/liter	not detected
Cyanide	0.2 mg/liter	not detected
Fluoride	4.0 mg/liter	not detected
Lead	0.015 mg/liter	0.0276 mg/liter
Mercury	0.002 mg/liter	not detected
Nickel	0.1 mg/liter	not detected
Nitrate (as N)	10 mg/liter	not detected
Nitrite (as N)	1 mg/liter	not detected
Total Nitrate + Nitrite (as N)	10 mg/liter	not detected
Selenium	0.05 mg/liter	not detected
Thallium	0.002 mg/liter	0.00158 mg/liter

MCLs for organic chemicals apply to both types of water sources and include organics, trihalomethanes volatile organics, and toxic organics. The listing of MCLs for organic chemicals is extensive and can be found in OAR 333-61-030 Section (2).

The MCL for turbidity applies only to surface water sources. The required MCL for turbidity, measured as nephelometric turbidity units, is dependent on whether filtration treatment is provided and on the type of filtration treatment.

MCLs for microbiological contaminants apply to both types of water sources, with specific treatment requirements for each. The MCL is based on the presence or absence of total coliforms in a sample, as outlined in OAR 333-61-030, Section (4). A water supply exceeds or violates the MCL for E. coli if any of the following conditions apply:

- An E. coli-positive repeat sample follows a total coliform-positive routine sample.
- A total coliform-positive repeat sample follows an E. coli-positive routine sample.
- All required repeat samples are not collected following an E. coli-positive routine sample.
- Any repeat sample is not analyzed for E. coli when it tests positive for total coliform.

Radioactive substances are covered in OAR 333-61-030 Section (5) and apply to both types of water sources.

OAR 333-61-020 defines secondary contaminants as those contaminants which, at the levels generally found in drinking water, do not present an unreasonable risk to health, but do have adverse effects on the taste, odor and color of water, produce undesirable staining of plumbing fixtures, and/or interfere with treatment processes applied by water suppliers. Containment levels are identified in OAR 333-61-30 (6) and are listed in Table 4-2.

Table 4-2. Secondary Contaminants

Secondary Contaminant	Contaminant Level
Color	15 color units
Corrosivity	non-corrosive
Foaming agents	0.5 mg/liter
pH	6.5 – 8.5
Hardness (as calcium carbonate)	250 mg/liter
Odor	3 threshold odor number
Total dissolved solids	500 mg/liter
Aluminum	0.05 – 0.2 mg/liter
Chloride	250 mg/liter
Copper	1 mg/liter
Fluoride	2.0 mg/liter
Iron	0.3 mg/liter
Manganese	0.05 mg/liter
Silver	0.1 mg/liter
Sulfate	250 mg/liter
Zinc	5 mg/liter

Treatment Requirements and Performance Standards

Treatment requirements and performance standards are presented in OAR 333-61-032. For systems that use groundwater as the source, continuous disinfection is required only when there are consistent violations of the total coliform rule or when the Oregon Health Authority determines that a potential health hazard exists.

Treatment Requirements for Corrosion Control

The treatment requirements and performance standards for corrosion control are set forth in OAR 333-61-034. All public water systems are required to monitor for lead and copper levels in the system. Monitoring guidelines are outlined in OAR 333-61-034. When the concentration of lead and/or copper exceeds the action levels for these contaminants, as explained earlier in this chapter, the public water system is required to adhere to treatment requirements for corrosion control.

4.1.3 Water Resources Department Integrated Strategy

The Oregon State Water Resources Commission adopted the 2017 Integrated Water Resources Strategy outlining policies and recommended actions for statewide water management. A key element of this strategy for Gervais is water conservation and efficient water use. The City must construct, operate, and maintain its water systems in a manner that prevents waste and minimizes harm to the waters of the state and injury to other water rights. It also must promote voluntary conservation measures through public education.

4.2 GENERAL WATER QUALITY

Water quality information as reported to the Oregon Health Authority Drinking Water Program is included in Appendix C. The records indicate that the City of Gervais has had satisfactory water quality for many years.

Well No. 1 and Well No. 2 are the two current sources of water system. According to Oregon Health Authority records, the City was issued a violation for the lead and copper rule in July 1993 and January 1994 but returned to compliance in May 1996. The City also was cited for not reporting enough coliform tests in January 2000, November 2000 and December 2001. The City also was cited for chemical non-reporting of nitrate in January

2001. Chemical detection of sodium greater than one half of the MCL of 20 mg/liter is considered by the Oregon State Drinking Water Program as an "advisory only" event and does not mean that a problem exists. Sodium levels exceeded the "advisory only" levels in March 1992, March 1993 and April 1996.

4.2.1 Turbidity Removal

As covered in OAR 333-61-030, the MCL for turbidity is applicable only to surface water sources and is dependent on the type of treatment facilities employed. Because the City of Gervais uses groundwater exclusively, turbidity removal and reporting are not required.

4.2.2 Pathogen Removal

As covered in OAR 333-61-032, the pathogen removal (disinfection) requirements are dependent on the type of source water and whether the treatment facilities provide filtration. Although continuous disinfection is not required for groundwater sources, the City has disinfected since approximately 2002 using liquid sodium hypochlorite. Typically, the regulations require that when chlorine is used as the disinfectant the residual disinfectant concentration cannot be less than 0.2 mg/liter after 30 minutes of contact time under all flow conditions. Maximum residual disinfectant levels are addressed in OAR 333-61-031 and are 4.0 mg/liter (as chlorine).

4.2.3 Lead and Copper Levels

The state places stringent limits on lead and copper levels in drinking water and requires an intensive monitoring program for these contaminants. Because lead and copper in drinking water often come from the corrosion of residential plumbing, samples for lead and copper measurement are taken primarily from residences.

The City has maintained compliance for the lead and copper rule for more than 20 years. Unless lead and copper violations re-occur, the City's current treatment system appears satisfactory.

4.2.4 Other Water Quality Issues

Other water quality issues that are controlled by state regulations include organic and inorganic chemicals, radionuclides, and disinfection byproducts. These water quality parameters, and how they relate to the City of Gervais water facilities, are as follows:

- **Organic and Inorganic Chemicals**—The state requires monitoring of many new chemicals, including volatile organic chemicals, synthetic organic chemicals, and inorganic chemicals. Testing of the City water for these chemicals is required. The City appears to be meeting these requirements. Records indicate that the City water has had several instances of high sodium. Sodium is currently listed as a "contaminant candidate" and an MCL has not yet been established.
- **Radionuclides**—The state requires monitoring and control of specific radionuclides. Testing of the City water for radionuclides is required. Records indicate that the City has complied with these requirements.
- **Disinfection Byproducts**—Compliance and testing for disinfection byproducts includes both maximum residual disinfectant levels for chlorine compounds and maximum contaminant levels for disinfection byproducts such as trihalomethanes.

5. WATER SOURCE EVALUATION

5.1 WATER SOURCE FACILITIES ASSESSMENT

Existing water source facility information was obtained from sources including City records, Oregon Health Authority, field reconnaissance, well logs, as-built drawings, and discussions with the water system operator.

5.1.1 Water Source

Based on future water use projections presented in Section 3.1.2, the current total well capacity of 680 gpm should be sufficient to provide peak-day flow through the planning period, which is 388 gpm. It is also enough to meet the projected peak-hour flow of 583 gpm. Well test data from 1989 appears to indicate that enough groundwater exists at both locations for these wells to be expanded to produce higher flows. Additional well tests should be taken and a hydrogeologist consulted when the City explores increased production from these wells in the future.

Well No. 2 is considered to be in good condition as the well pump was replaced approximately three years ago and a variable frequency drive installed at that time. A variable frequency drive was installed on Well No. 1 two years ago, but the pump was not replaced and there is no information available on its last replacement or servicing. It is possible that the current pump is the original well pump, putting its age at 28 years. Neither well has shown any sign of capacity reduction over the years or other water production problems.

5.1.2 Well Transmission Lines

The transmission lines are the pipes from the Well No. 1 and Well No. 2 pumps to the water treatment facility. The well transmission lines were constructed with 8-inch PVC (ASTM C900) piping in 1991 and are assumed to be in good condition.

5.1.3 Water Production

Water Production Evaluation

As shown by the monthly water plant discharge in Table 5-1, peak demand months are May through October when residential irrigation heavily influences consumption levels.

Water Loss and Leaks

Table 5-1 shows monthly production from the water plant for 2018 compared to monthly water consumption for the same time period. The negative value and inconsistency in the lost water amounts is likely a result of monthly readings not be taken on the same day of the month. The 2018 yearly total of 10.91 MG of lost water amounts to 14.9 percent of total production, including backwash water. Although this is the upper range of normal loss rates, the system does not appear to have excessive leaks. Its is recommended that the City develop an ongoing program to identify and reduce water leaks.

Table 5-1. 2018 Monthly Water Production and Usage

Month	Water Plant Discharge (MG)	Water Consumption from Service meters (MG)	Lost Water (MG)
January 2018	4.71	3.97	0.74
February 2018	4.25	3.76	0.49
March 2018	4.83	3.76	1.07
April 2018	4.73	3.97	0.76
May 2018	6.30	4.08	2.22
June 2018	7.61	5.75	1.86
July 2018	9.47	7.03	2.44
August 2018	8.60	8.29	0.31
September 2018	5.97	6.78	(0.81)
October 2018	5.34	4.81	0.53
November 2018	4.84	4.35	0.49
December 2018	4.75	3.94	0.81
Totals	**71.40**	**60.48**	**10.91**

5.1.4 Beneficial Use Permits and Water Rights

Although the City's Claim of Beneficial Use Permit G-12015 for Well No. 1 and Well No. 2 is valid evidence of the right of the City to use the water, the Oregon Water Resources Department does not recommend operating a municipal system with a beneficial use permit. A municipality can obtain water rights from a beneficial use permit if it can show full usage of the permit, but the City of Gervais has not currently met this criterion. The Oregon Water Resources Department recommends that the City file and pursue a request for changes in points of appropriation for Certificate 28241 (the Elm Avenue Well certificate).

Oregon Water Resource Department representatives have noted that Certificate 28241 and Beneficial Use Permit G-12015 appear to develop the same source. If a Water Right Transfer Application is approved by the Oregon Water Resources Department for Well No. 1 and Well No. 2 to use existing Water Right Certificate 28241, the City should have sufficient water for current and future needs.

The 2040 peak-day demand is 388 gpm or 559,000 gpd (see Chapter 3). According to the Oregon Water Resource Department, the Certified Water Right use of 1.11 cfs (498 gpm) can be considered an average. Because of this, the Department has stated that both wells could be operated for short periods during periods of peak demand. Therefore, if the Application for Water Right Transfer is approved, the Elm Street Well Certificate of Water Right is sufficient to meet the City's anticipated needs. The City should hire a consultant to complete an Application for Water Right Transfer form and permitting process for Well No. 1 and Well No. 2 soon. Copies of correspondence related to water rights and Beneficial Use Permits are included in Appendix D.

5.2 WATER SOURCE IMPROVEMENT ALTERNATIVES

Use of the Elm Street Well is not recommended due to historical water quality problems and because operating it would require replacement of its well casing and turbine pump. Two alternatives were identified for use of the Elm Street Well property. The advantages and disadvantages of the two alternatives are as follows:

- Alternative 1—Leave Elm Street Well as Is and Apply for Water Rights Transfer
  - The Elm Street Well has valid water rights of 1.11 cfs that may potentially be transferred to Well No. 1 and Well No. 2.

  - The Elm Street Well could be used as a water source for the City in the future if Well No. 1 and/or Well No. 2 should become contaminated, if disinfection and contact-time requirements are met.

- Alternative 2—Abandon the Elm Street Well

  - Abandoning the Elm Street Well would allow the City to use the existing well site for other purposes. The well building is not currently in use.
  - According to the Oregon Water Resources Department, abandonment of the Elm Street Well is not recommended due to the fact that it has valid water rights of 1.11 cfs that may be transferred to Well No. 1 and Well No. 2.

5.3 RECOMMENDATION

Alternative 1 is recommended because it allows the existing Elm Street Well water rights to be used by the City. Well No. 1 and Well No. 2 operate under a beneficial use permit that requires the City to demonstrate the full use of 1.52 cfs. Current water use records indicate that the full use of the permit is not being met. The Oregon Water Resource Department recommends using an Application for Water Right Transfer to change the points of appropriation for the Elm Street Well Water Right No. 28241 to include Well No. 1 and Well No. 2. If Well No. 1 and Well No. 2 should become severely contaminated, the Elm Street Well could serve as a replacement source, provided disinfection requirements and contact times are carefully monitored. The estimated cost for the recommended improvement is $13,000. Detailed cost estimates are included in Appendix E of this report.

The condition of the pump for Well No. 1 is a concern, as it may have as much as 28 years of service. It is recommended that the pump be replaced. The estimated cost for replacement of the pump is $17,000.

6. WATER TREATMENT EVALUATION

6.1 WATER TREATMENT FACILITIES ASSESSMENT

6.1.1 Condition and Capacity

With the addition of two more greensand filters and replacement of the plant control system in the 2012 treatment facility upgrade, the treatment equipment is generally in good condition. Recent inspection by the Marion County Health Department concluded that in general the water system is being operated and maintained well.

With the 2012 upgrade, the four greensand filters that remove iron and manganese have a peak capacity of 680 gpm. With the current population projections, the water treatment facility will be treating water approximately 15 hours a day on peak summer days in 2040 to meet demand. Based on this, the existing treatment facility has adequate capacity for the planning period.

It should be noted that the greensand in the filters requires replacing every seven to ten years. Sand in the new filters is the original sand from 2012, and sand in the two older filters was replaced in 2015.

6.1.2 Monitoring Requirements

The City monitors a variety of parameters daily, including flow from each well, backwash, totalized flow, pump-operating time and treated water chlorine residual. The only known deficiencies related to monitoring requirements are the apparent discrepancies between the well and backwash flow meters and the plant discharge flow meter. Apparently, the discharge flow meter does not read low flow measurements well, which is likely the cause. It is recommended that all flow meters be calibrated on a regular basis.

6.1.3 Safety Equipment

The water treatment building has fire extinguishers and an indoor eye wash/shower unit. There are no apparent deficiencies related to safety equipment at this time.

6.1.4 Security Threats

Since 2001, there have been heightened concerns in the United States regarding the security of drinking water supplies. America's Water Infrastructure Act of 2018 requires water districts and municipalities serving over 3,000 users to submit certified vulnerability assessments. Although this does not currently affect Gervais, the City should be following best practices with respect to system security. The U.S. Environmental Protection Agency's *Drinking Water Security for Small Systems Serving 3,300 or Fewer Persons* (included in Appendix F) has specific recommendations for the following general topics:

- Vulnerability assessments
- Natural disasters, vandalism and terrorism
- Coordinating actions for effective emergency response
- Investing in security and infrastructure improvements.

6.2 WATER TREATMENT IMPROVEMENTS

With no additional capacity needed as long as the population projections are valid, and with new capacity, control, and backup power equipment installed in 2012, no improvements to the treatment process are recommended at this time. Eventually new treatment capacity will be needed, and it is recommended that this plan be updated by 2028 to ensure this future need is planned for.

7. WATER STORAGE EVALUATION

7.1 WATER STORAGE FACILITIES ASSESSMENT

7.1.1 Reservoir Condition

Both the City's reservoirs are in relatively new condition:

- Reservoir No. 1, constructed of welded steel, was completed in 1991 and repaired and recoated in 2017. It is estimated that this reservoir will be serviceable for another 15 to 20 years until it will require recoating or replacement. To maximize the life span of welded steel reservoirs, they should be inspected regularly and re-coated every 15 to 20 years.
- Reservoir No. 2, constructed in 2013 of shop-coated bolted up steel plates, should also be inspected every 15 to 20 years, although it should be serviceable for another 25 to 30 years.

7.1.2 Structural Considerations

Reservoir No. 1 was built prior to changes in the seismic code and its foundation does not meet current seismic code requirements. Meeting the codes would require replacement of the foundation, which would be prohibitively expensive. This increases the risk of structural failure of this reservoir during a large subduction zone earthquake.

Reservoir No. 2 meets all current seismic design requirements as its design was in accordance with a site-specific seismic analysis. Its steel plate walls were not designed for additional loads.

7.1.3 Service Elevations

The City's water system has one pressure zone, sustained by a hydropneumatic tank and a series of booster pumps at the water treatment facility. The single pressure zone system is designed to operate from about 55 to 70 psi. A modeling analysis determined that distribution system pressures should not drop below 50 psi even during peak-day conditions. Complaints of low pressure are extremely rare and may in part be due to the City's flat terrain.

7.1.4 Storage Requirements

Reservoir storage requirements are generally a sum of three demands: emergency storage, fire flow, and attenuation of daily fluctuations. Calculation of storage requirements is not exact, and there are no minimum requirements. The Woodburn Fire District fire chief may request a minimum storage volume, but the community is not legally bound to provide it.

The three demands noted above are usually calculated and added to determine the total storage volume in larger systems. However, in smaller systems the fire flow requirement can be so large compared to the other two components that it can cause water quality problems. The maximum storage volume should be kept below six days average demand in order to avoid stagnation. When water becomes older than six days the residual chlorine has diminished to almost nothing and the water can taste and smell stale. When this happens, the water must be rechlorinated, which is provided for with a booster pump to recirculate water from the reservoir through the chlorination system and back into the reservoir. For smaller systems like that in Gervais, storage is usually calculated by balancing fire flow storage with maximum volume to avoid stagnation.

Emergency Storage

The volume required for emergency storage depends on the expected needs of the community. It is typically calculated as one day of peak-day demand or three days of average-day demand. Table 3-3 outlines average-day and peak-day water demand for current and future populations. Using the peak day criterion, the emergency storage is calculated as 414,000 and 559,000 gallons for 2018 and 2040 respectively.

Fire Flow Reserve

The Uniform Fire Code recommends providing 2 hours of fire flow at 3,750 gpm for the schools in Gervais but allows a reduction of up to 75 percent when the building is provided with an approved automatic sprinkler. The Gervais Middle School is equipped with a sprinkler system, but the high school is not. If a new high school is built, it should be equipped with a sprinkler system. Building additional reservoir capacity to provide fire flow for a single user is not recommended unless that user participates in the cost. The total recommended fire flow reserve is 2,000 gpm for two hours (240,000 gallons).

Attenuation of Fluctuations

Typically, in large systems, up to 20 percent of the average daily demand is added to the storage volume to account for fluctuation in demand during the day. This is necessary in systems with large users such as food processors who may use large and variable amounts of water depending on the season. City data is not sufficient to definitively analyze this need. However, the City has experienced no problems meeting operational needs with the current 580,000-gallon storage, so it is presumed that fluctuations are being adequately covered.

Total Storage Requirements

A standard guideline used in Oregon is to have enough storage volume for two to three days of average-day demand or one day of peak demand. Table 7-1 shows a range of projected storage needs based on three criteria:

- Minimum storage—One day of peak demand (average-day demand plus fire flow)
- Maximum storage—Six days of average-day demand
- Recommended storage—Three days of average day demand.

The recommended storage of three days of average-day demand is approximately 30 percent higher than the minimum of one day of peak demand and was selected because it balances peak demand and fire flow while minimizing the potential for stale water. The recommended storage in 2040 would be 760,000 gallons.

Table 7-1. Future Storage Requirements

Year	Storage Volume (gallons)		
	Minimum: Average-Day Demand + Fire Flow	Recommended: 3 x Average-Day Demand	Maximum: 6 x Average-Day Demand
2018	387,000	540,000	1,160,000
2020	402,000	586,000	1,253,000
2025	420,000	637,000	1,356,000
2030	434,000	680,000	1,442,000
2035	448,000	721,000	1,524,000
2040	460,000	757,000	1,595,000

7.2 WATER STORAGE IMPROVEMENT ALTERNATIVES

The estimated storage demand will exceed the existing reservoirs' capacity within the planning period. As neither of the City's reservoirs is expandable by increasing its height, a new reservoir will be needed to provide the recommended storage.

It was determined that a new reservoir at a site remote from the City's water plant would not be cost-effective. A new large (8- to 10-inch-diameter) transmission main would need to be constructed from the water treatment facility to the new site to fill the tank. In addition, the existing distribution system is designed for flows coming from the treatment facility with larger pipes originating at that point. Significant distribution system upgrades would be required for a remote location. Therefore, all storage alternatives are sited at the City's water plant.

The City's existing reservoirs have a maximum water depth of approximately 16 feet. As the City grows beyond the planning period, and with limited area to locate storage tanks, eventually the operating depth of ground level tanks will need to increase. Future ground level tanks should be designed for a higher operating depth. For sizing the new tank, a total storage volume of 760,000 was used, which results in a replacement tank of approximately 480,000 gallons. To provide additional fire flow while maintaining less than 6 days storage, a more standard tank size of 500,000 is recommended. This size should be reexamined at the time of design as it will need to be sufficient beyond the end of planning period.

7.2.1 Alternative 1—Replace Reservoir No. 1 with a New Ground Level Tank

Alternative 1 would replace the existing 60-foot diameter tank with a larger tank, either bolt-up or welded steel. With the operating levels needing to match Reservoir No. 2, the resulting diameter of the tank is 80 feet. The location of a New Reservoir No. 1 at the water plant site would have long-term impacts on the future layout of the site as the City grows beyond the planning period. Two tank location options for this alternative were identified.

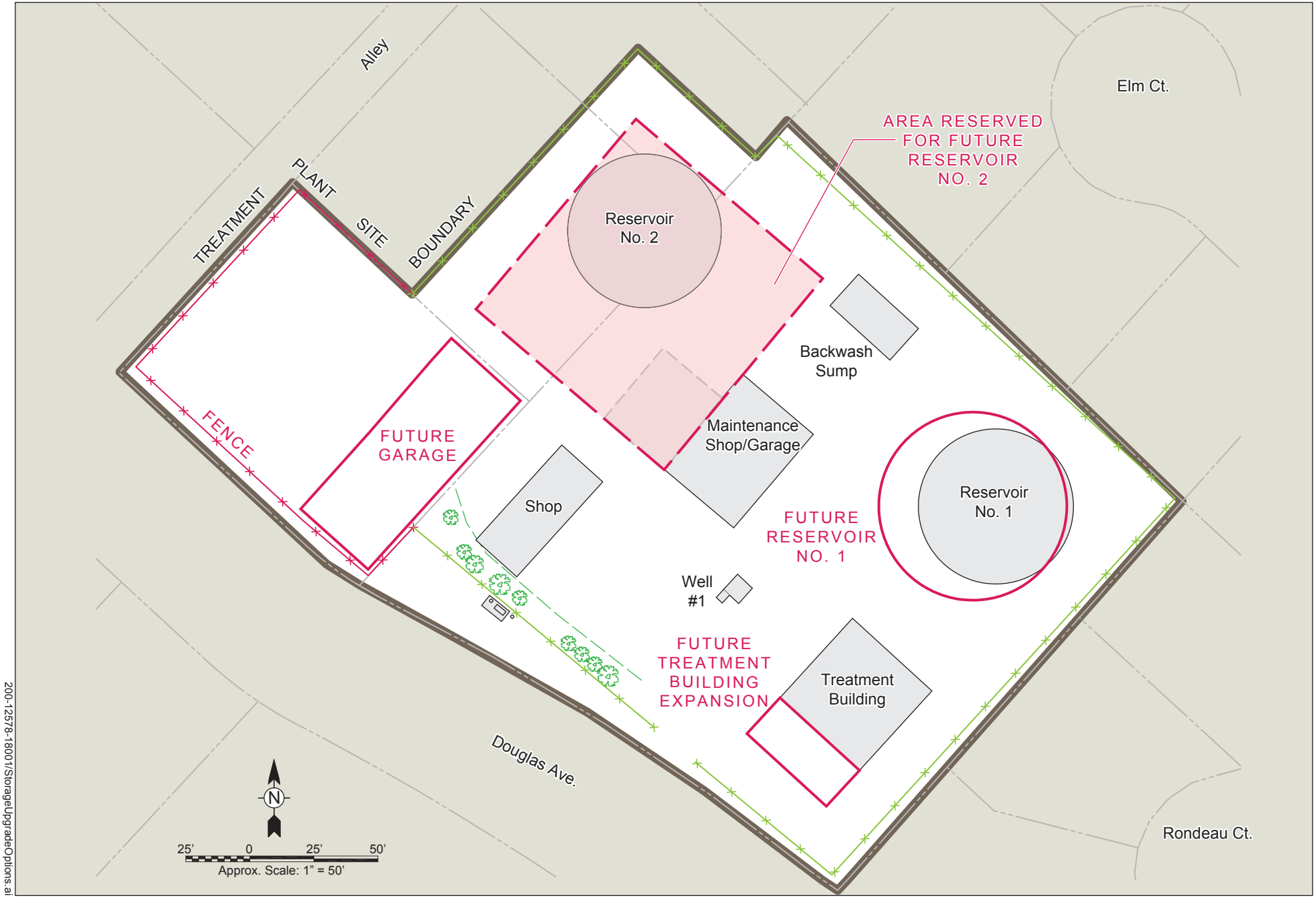
- **Option 1—Maintain the Current Location**—This option, shown in Figure 7-1, would be most cost effective in the short term by maintaining the current site as much as possible. Reconfiguration of much of the site piping would be required for this alternative. With this alterative it is recommended that the tank be designed to be expandable vertically in the future.
- **Option 2—Relocate Reservoir to West**—This option, shown in Figure 7-2, would locate the new tank to the west to provide more space for expanding the treatment building should it be needed in the future. The existing garage would require relocating to the currently unused portion of the site. The backwash sump would be relocated to the area currently occupied by Reservoir No. 1.

Both options provide adequate space should the reservoir need to be upsized in the future

7.2.2 Alternative 2—Replace Reservoir No. 1 with a New Elevated Tank

This alternative would replace Reservoir No. 1 with an elevated tank. The assumed tank size would be 500,000 gallons to meet 2040 demand. This size should be reexamined at the time of design as it will need to be sufficient beyond the end of planning period. With this concept, treated water would be pumped up to the elevated tank, with the height of the water providing the system pressure. An elevated tank is considered more reliable than ground level tanks as the booster pumps and pressure tanks are eliminated, except as a backup system.

There is a 45-foot height limit within the Public Use zoning that applies to most of the water plant. Apparently, there are variances for certain types of structures for which a water tank might apply. It appears the elevated tank would be permissible from a zoning standpoint. For more information regarding site restrictions, see email from the Mid-Willamette Valley COG dated April 15, 2019 in Appendix G.

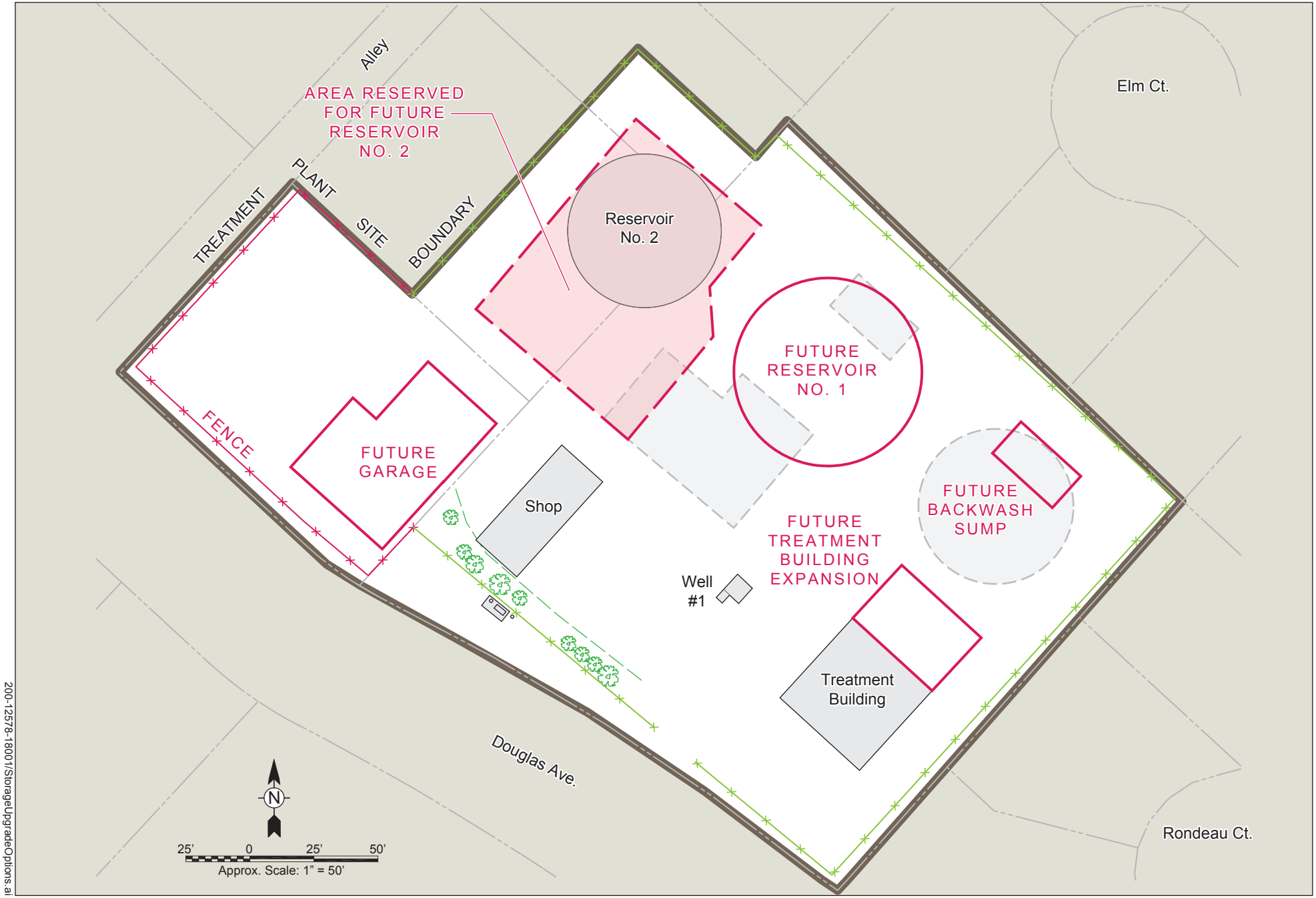


200-12578-18001/StorageUpgradeOptions.ai

TETRA TECH
15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 7-1.
STORAGE ALTERNATIVE 1; OPTION 1, MAINTAIN CURRENT LOCATION



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TETRA TECH
15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

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Figure 7-2.
STORAGE ALTERNATIVE 1; OPTION 2, RELOCATE RESERVOIR TO THE WEST

7.2.3 Evaluation of Alternatives

Cost

Ground level storage is significantly less costly than elevated storage. Options 1 and 2 for Alternative 1 are estimated at $1.4 million (see cost estimates in Appendix E). Alternative 2 would be an estimated $2.4 million.

Maintenance

Steel water tanks typically require recoating every 20 years. Beyond this period, corrosion will start to occur, resulting in the possibility of repairs being required, which increase costs. The cost to recoat Reservoir No. 1 in 2017 was approximately $200,000 not including repair costs. This requires the tank to be taken off-line and drained, necessitating backup storage during the process. The recoating process can take four to five weeks for the size of tank Gervais has. Typically, this work is done during the off-peak non-summer months. With both Alternatives 1 and 2, the City would have a second tank to provide storage during the recoating.

Expandability

As the City will most likely continue to grow beyond the 20-year planning period, an important aspect of water storage is its expandability. As the water plant site has limited area, future additional storage beyond the planning period will likely be achieved by constructing tanks with a higher maximum operating level. Both Alternative 1 options could have taller tanks installed with an expandable operating level or be designed to have the height raised in the future.

Public Acceptance

Although the elevated tank alternative could probably meet the zoning requirements, the acceptance of such a high structure at the water plant is questionable. There would likely be opposition by surrounding residences.

7.3 RECOMMENDATION

The higher reliability benefit of the elevated tank is not significant enough to offset the higher cost and likely public resistance to having an elevated tank adjacent to a residential neighborhood. Consequently, Alternative 1, a ground level tank is preferred.

The advantages and disadvantages for the two options presented for Alternative 1 are identified in Table 7-2. The primary advantage of Option 1 is lower cost and less disruption of treatment operations during construction.

Table 7-2. Storage Tank Summary

Type	Advantages	Disadvantages
Alternative 1, Option 1 (Maintain current reservoir location)	• Less site disruption • Backwash sump stays in its current location	• Limited area for future treatment building expansion
Alternative 1, Option 2 (Move Reservoir to West)	• Allows more room for future treatment building expansion	• Requires relocation of maintenance garage

Future storage improvements will be needed in 15 to 20 years to meet total storage requirements. The recommended improvement is Alternative 1 Option 2, as shown on Figure 7-2. Total estimated cost for the recommended improvements is $1,390,000.

8. DISTRIBUTION SYSTEM EVALUATION

8.1 WATER DISTRIBUTION SYSTEM ASSESSMENT

8.1.1 Piping

The City's PVC water distribution pipe, roughly 80 percent of the system, is less than 30 years old and considered to be in good condition. The remaining older pipes, primarily cast-iron pipe built in the 1950s, has performed well, but increasingly presents higher risk of breaks. Reportedly the only remaining steel pipe in the system is in Douglas Avenue at the crossing of the Union Pacific Railroad. Given its critical location, it is recommended that this pipe be replaced.

The unlooped areas that feature dead-end lines also represent a system deficiency. These unlooped areas have three detrimental effects on the system:

- Dead end lines can cause water quality problems if there is not enough use. If the water sits in the line too long, it will go stagnant. To avoid this, it is standard practice to periodically flush dead-end lines. This is done either at fire hydrants or blow-offs located at the end of the line.
- In general, looped systems can provide more water to any location because there are more pathways to get there. There is less energy loss through the piping system due to friction because the flow through each pipe is lower, but the total flow is higher. This becomes important in high flow situations such as a very large user or fire flow.
- Looping a system is important for maintenance. When repair is required on a section of pipe, a smaller part of the system will need to be shut down if the system is looped.

The largest unlooped area in the City is the Winfield Ranch subdivision. Less important unlooped areas are dead-end streets, usually with three or four houses serviced by 4-inch pipes.

8.1.2 Water Meters

According to City records, the water system has 653 water meters, of which 637 are ¾-inch residential connections. The City installed new meters in the early 2000s that can be read by a radio remote unit. Over the years the remote reading capability has failed in approximately 100 meters. The cost to replace the remote reading unit in these meters is approximately $250/meter.

8.1.3 Fire Hydrants

According to information that was provided by the City, there are 53 fire hydrants in the system. The fire hydrant spacing requested by the Woodburn Fire Department is 500 feet. This is a fairly standard requirement in a community. The 500-foot hydrant spacing is not met in all locations of the City.

8.1.4 Hydropneumatic Tank, Pumps and Emergency Equipment

The hydropneumatic tank and booster pumps used to maintain distribution system pressure are housed in the water treatment facility building, along with the emergency generator. The hydropneumatic tank requires little maintenance and appears to be in good condition. The 7.5-hp and 15-hp booster pumps are also considered in good condition having been replaced in May 2009 and February 2010, respectively. The smaller pump has the most usage at 45,000 hours, which is well under typical industrial motor bearing life, but this should be confirmed against the motor specifications by the operator. There are indications that the 15-hp medium-demand pump is approaching being undersized for summer flows during hot days when use is high. The 50-hp high-demand pump is 28 years old but has few hours on it. The motor likely has significant wear due to the lack of a soft starter, which was only recently installed. System analysis has shown this pump to be undersized for projected fire flows.

There are no strict requirements in the OAR regarding the capacity or redundancy required for emergency equipment, but because the City has an entirely pump-fed distribution system, emergency equipment is particularly important. With the 2012 upgrade project, an automatic transfer switch was installed that will start the emergency generator in the event of a power outage. The generator is capable of powering the high-demand pump. There are no apparent deficiencies related to the emergency equipment.

8.1.5 System Hydraulic Analysis

The distribution system was modeled to identify deficiencies and evaluate solutions. The CAD based Innovyze InfoWater model was used. Information on the model results is included in Appendix H. The system was modeled for existing and future conditions under average and peak-day demand scenarios.

System Pressures

OAR requires that the service pressure be greater than 20 psi at all times, and the City's system meets this condition. The water treatment facility booster pumps and hydropneumatic tank control the pressure in the distribution system. The hydropneumatic tank and booster pumps have been designed to maintain system pressures between 55 and 70 psi. The modeling analysis indicates the pressure at service points typically varies less than that (which may in part be due to the City's relatively flat topography). City staff have said that customers rarely complain about water pressure, which is consistent with the results of the modeling.

Fire Flow Requirements

In general, the minimum pipe diameter required for fire flow is 6 inches on a looped system and 8 inches on an unlooped line. Required sizing on pipes also has to do with total domestic flow and the length of the pipe and the amount of looping.

The modeling results show that portions of the system do not meet the minimum fire flow for residential areas of 1000 gpm with 20 psi residual pressure. The most deficient area is the northern end of the City, particularly the unlooped Winfield Ranch subdivision. As previously mentioned, fire flow at the schools is also below recommended levels.

8.2 WATER DISTRIBUTION IMPROVEMENT ALTERNATIVES

Improvements to the distribution system have been divided into two categories: those that are required by regulation or code, and those that are optional to provide better service to existing customers or provide additional capacity for future growth.

8.2.1 Required Improvements

The following are required improvements to the distribution system:

- Fire hydrants should be installed in certain locations to meet the 500-foot spacing requirements of the Woodburn Fire Chief. Additional fire hydrants are shown on Figure 8-1.
- The existing 50-hp high-demand pump at the water plant should be replaced with a higher capacity pump that can pump at least 1,500 gpm (with 20 psi residual pressure) to all fire hydrants and 2,000 gpm to the hydrants by the schools. The system model was run with larger pumps and it appears that the desired pump is in the range of 75 to 85 hp, with a duty point of 1,500 gpm at 140 feet TDH. A pump with these characteristics was modeled in the system (see Appendix H for pump data) and produced the desired results. Once the pump is selected, it should be verified that maximum residual pressures in the vicinity of the water plant will be acceptable. The existing power supply, as well as the emergency automatic transfer switch and generator, are capable of powering a pump of the recommended size.
- The 15-hp medium-demand pump should be replaced with a larger pump with a variable-frequency drive. This will avoid having the high-demand pump being activated during hot summer days when there is no fire demand.
- The system should be looped wherever possible. This will avoid water quality issues, reduce the number of dead-end lines to be flushed, provide better capacity and provide more flexibility. The largest unlooped area in the City is the Winfield Ranch subdivision. When the undeveloped area within the UGB at the west end of Hemlock and Grove Avenues develops, an 8-inch connection from the pipe in 7th Street to the pipe in Winfield Street should be made, eliminating this unlooped area. After the Ivy Woods Estates develops, a 200-foot unbuilt section will remain. Should this area not occur in the next two to three years as anticipated, the City should acquire the necessary easements and complete the connection.
- Where new and existing fire hydrants are located, distribution pipe sizes should be a minimum of 6 inches.

8.2.2 Optional Distribution System Alternatives

Alternative 1—Repair Distribution System Piping as Needed

This option is the "do-nothing" alternative, or continued use of the existing distribution system. It would require ongoing maintenance and replacement of pipes as they break. The system could be slowly upgraded as old and broken pipes are replaced. However, this approach would not solve the existing problems. The system would still have inadequate fire flow in some locations and potential water quality problems due to dead end lines.

Alternative 2—Replace/Install Additional Distribution System Piping Over the Next 10 Years; Establish Cast-Iron Pipe Replacement Program.

The proposed distribution piping improvements over the next 10-years are shown on Figure 8-1. These proposed improvements have two goals:

- To replace the portions of the older cast iron or steel pipes that are located in the most critical parts of the system, such as railroad crossings or those feeding large areas
- To improve the fire flows to the area west of 7th Street and the looping within the system west of the railroad. Looping provides more flow to any given point, provides redundant supply points should a pipe fail, allows parts of the pipe to be out of service without disrupting all the downstream service, and keeps stagnant water from developing on dead end runs that see little demand.

Pipes through which fire flow is not likely to pass can be 2-, 4-, or 6-inch pipe, depending on daily flows. However, the incremental cost to provide 6-inch pipe instead of 4- or 2-inch pipe is quite small. Generally, the

new pipes should be 6-inch or larger; 4-inch piping may be acceptable on short dead-end mains with no hydrants. On the proposed distribution system layout in Figure 8-1, pipes are 4-inch to 6-inch for general piping and 8-inch for mainlines. Dead-ends with a hydrant at the end should be 6-inch.

A proposed cast-iron pipe replacement program would begin in fiscal year 2027/2028 and extend to the end of the study period. The proposed annual disbursement to this fund is $40,000. The purpose of the program is to make progress over time toward replacing the older, more leak-prone cast-iron pipe, which will all eventually have to be replaced. The goal is to minimize water line breaks and emergency repairs. Specific replacement projects would be determined at the time work is done.

Alternative Evaluation

The advantages and disadvantages of the two distribution system improvement alternatives are as follows:

- Alternative 1—Repair Distribution System Piping as Needed
  - Repairing the distribution system piping as needed would not address the problem of meeting the 500-foot minimum fire hydrant spacing required by the Woodburn Fire Chief.
  - Some of the distribution pipe is over 30 years old and undersized and may contribute to water quality problems and losses or fail unexpectedly.
- Alternative 2—Repair/Upgrade Distribution Piping Over the Next 10 years
  - This alternative would address meeting the 500-foot minimum fire hydrant spacing required by the Woodburn Fire Chief.
  - This alternative would replace undersized and older quality piping that may contribute to water quality problems or pipe failure before they occur.

8.3 RECOMMENDATION

Tetra Tech recommends Alternative 2 for the distribution system. This approach, along with replacement of the high-demand pump, will address the low fire flows in the northwest area of the City. It also begins to address the potential for failure of older pipes and improves system reliability. As shown on Figure 8-1, the recommended improvements include:

- Install five new fire hydrants to provide 500-foot spacing
- Replace the medium-demand and high-demand pumps at the water plant
- Complete the looped connection to Winfield Ranch
- Complete Alternative 2 Pipe improvement

Total estimated cost for the recommended improvements is $1,770,000. Detailed cost estimates are included in Appendix E of this report.

0 200 400 800

Approx. Scale: 1" = 400'

Butteville Rd.

Union Pacific Railroad

WINFIELD RANCH

Mesquite Lane

Lantana Lane

Winfield St.

6"PVC(95)

8th St.

7th St.

6th St.

5th St.

4th St.

3rd St.

2nd St.

1st St.

Juniper Ave.

Hemlock Ave.

Grove Ave.

Ivy Ave.

Fir Ave.

Elm Ave.

Douglas Ave.

Cedar Ave.

Birch Ave.

Alder Ave.

6" Juniper Ave.

8" 5th St. to 4th St.

8" Hemlock Ave.

8" Grove Ave.

Future 8" By Development

WELL #2

RAW WATER LINE

ELM STREET WELL (NOT IN USE)

WATER TREATMENT FACILITY

WELL #1

10" 4th St. to 3rd St.

ABND 6"CI(60s)

FRENCH PRAIRIE MEADOWS

WILLORIA ESTATES

Black Walnut St.

Elementary School

High School

Highway 99E

Checkerboard Rd.

LEGEND

- City limit
- Urban growth boundary
- PVC water pipe
- Steel water pipe
- Cast iron water pipe
- Well
- Reservoir
- Fire hydrant
- Gate valve
- Blow-off
- 6"PVC(91) Pipe diameter, material, and year (or decade) of construction

PROPOSED IMPROVEMENTS

- New Fire Hydrant
- Pipe Replacement
- New Valve

200-12578-18001/ExistingSystem_Boundaries.ai

TETRA TECH

15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 8-1.
PROPOSED DISTRIBUTION SYSTEM IMPROVEMENTS

9. SEISMIC RISK ASSESSMENT

Gervais is located in seismic Zone VII (moderate) for potential damage from a magnitude 9 Cascadia earthquake (*Plate VII Map of Earthquake and Tsunami Damage Potential for a Simulated Magnitude 9 Cascadia Earthquake*, contained in the Open File Report O-13-6; see Appendix I). As such, earthquake risks need to be addressed and a mitigation plan developed if necessary.

9.1 IDENTIFICATION OF VULNERABLE WATER INFRASTRUCTURE

9.1.1 Treatment Facility Building

The treatment facility building, built in 1990, is a 1,750-square-foot single-story metal frame building, with a slab-on-grade floor and a thickened perimeter footing at each column. The structure is bolted to the floor. Based on recent discussions with the geotechnical engineer that performed the 2013 seismic analysis for the design of Reservoir No. 2, the risk of major damage to this building in a magnitude 9 earthquake is low.

9.1.2 Storage Reservoirs

Reservoir No. 1, constructed in 1990, does not comply with seismic code changes made since then. Reservoir No. 2, constructed in 2013, had a seismic analysis included in the geotechnical investigation performed for its design and meets current seismic requirements (*Gervais Water Tank Improvement/Water Relocation*, Foundation Engineering Inc., June 21, 2013; see Appendix I).

The Reservoir No. 2 seismic report concluded that up to 3 inches of liquefaction-induced differential settlement is possible at the water plant site. A settlement analysis of the reservoir loads found that for the design bearing pressure of 2,000 pounds per square foot, the tank foundation could settle between 1 and 1.5 inches. Based on the recommendations of the study, Reservoir No. 2 was constructed on a ring foundation built around the perimeter to support the tank shell.

For this Water Master Plan, it is assumed the analysis performed for Reservoir No. 2 is applicable to Reservoir No. 1 as well as the water plant site in general. Reservoir No. 2 is considered a vulnerable asset in the event of a magnitude 9 earthquake.

Although Reservoir No. 2 is seismically resilient, a review of as-built drawings revealed that the fittings connecting the reservoir piping to the site piping are standard mechanical joint fittings. Improvements to add earthquake-resistant flexible expansion joints at these locations is recommended.

9.1.3 Distribution System

The AWWA C-900 PVC pipe installed after 1991 typically has mechanical joint fittings, which allow for some flexibility at the joints. This pipe is generally earthquake resilient. Joint construction for the cast iron and older pipe is not known. For this reason and the fact that cast iron pipe is generally more brittle than PVC, this pipe would be more prone to earthquake-induced failures.

9.1.4 Fire Protection

With six exceptions, the City's 53 fire hydrants are fed by PVC pipelines, so flow to these hydrants is considered earthquake resilient. The magnitude and duration of flow to these hydrants may be reduced due to breaks in vulnerable cast iron pipes. Water main breaks and leaks are controlled by valving within the system, which would require time to locate and operate, depending on the earthquake damage severity.

9.1.5 Summary

Portions of the water system considered vulnerable to a magnitude 9 earthquake are presented in Table 9-1.

Table 9-1. Water System Vulnerabilities

System Component	Deficiency
Cast iron and Steel Pipes	Brittle pipe, possible rigid joints
Reservoir No. 1	Foundation, tank and connections do not meet seismic code
Pipeline Connections to Facilities	Insufficient flexibility

9.2 IDENTIFICATION OF CRITICAL WATER INFRASTRUCTURE

Access to potable water is critical at all times, with allowances for short outages. Sufficient water to provide for domestic needs and a limited level of fire protection is considered necessary. To provide for the community in the event of a major earthquake, elements of the water system that must continue operating with little or no down time have been identified.

It is assumed that the treatment facility operating at 50 percent of normal capacity for a limited time will be enough to provide for community needs. This allows for one of the source wells, most likely Well No. 2 with its 1,400-foot raw water line, to go offline. It also assumes there will only be one operable reservoir. Critical infrastructure is shown in Figure 9-1 and listed in Table 9-2.

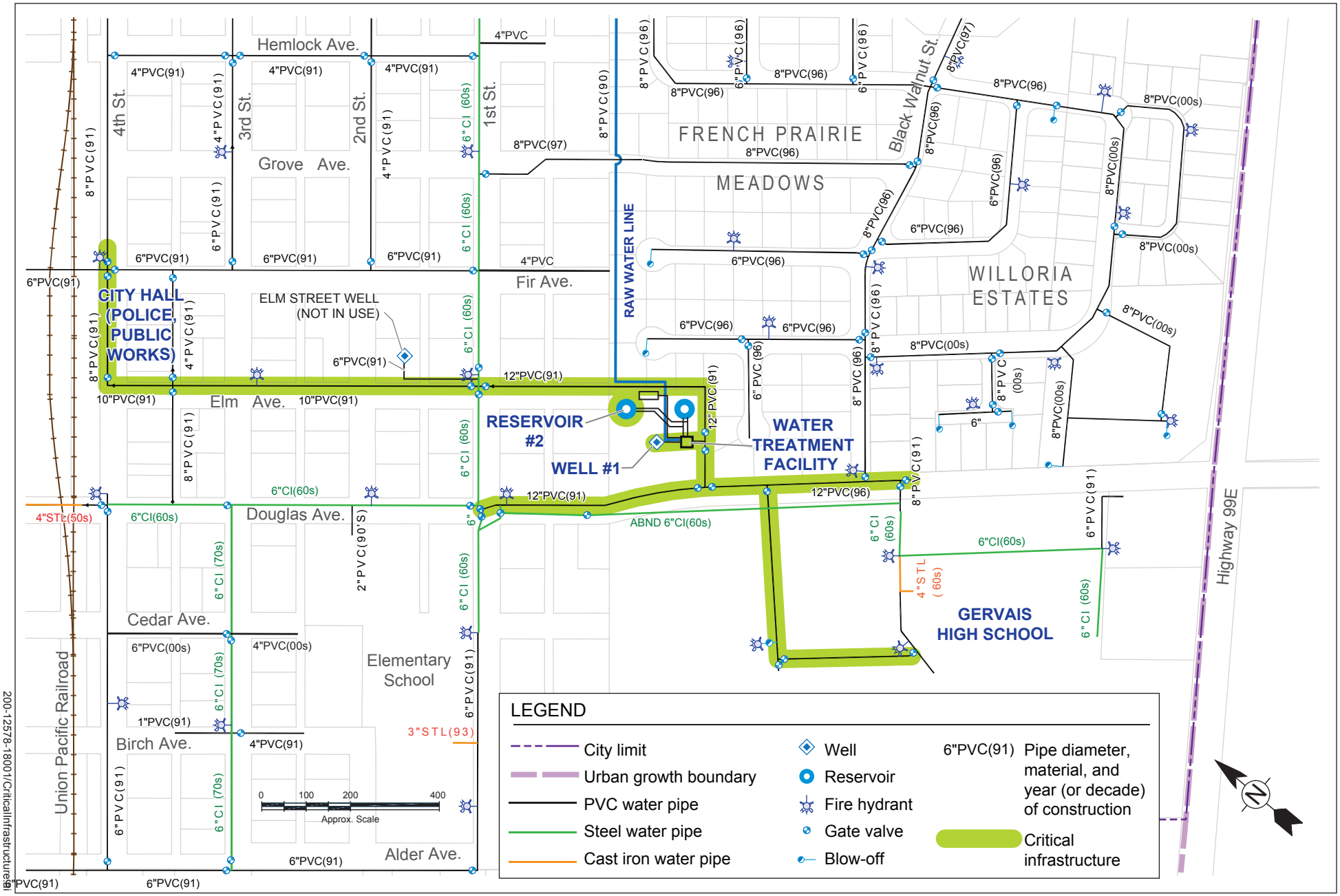
Table 9-2. Critical Water System Infrastructure

Component Description	Purpose
Well No. 1	Water source
Reservoir No. 2	Water storage
Emergency generator at treatment facility	Backup power
Two of four treatment facility pressure filters	Water treatment
All three distribution pumps	Maintain system pressure
Selected transmission mains	Service to Gervais High School, City Hall, Limited fire Protection

9.3 RECOMMENDATION

The following measures are recommended to provide the necessary level of resiliency to the critical water system infrastructure:

- Install flexible pipe connections at well heads, Reservoir No. 2 and the treatment facility
- Install five new distribution pipe valves improving the ability to isolate cast iron pipes (see Figure 8-1)
- Perform structural review of treatment facility building



200-12578-18001/CriticalInfrastructure.ai

TETRA TECH
15350 SW Sequoia Parkway, Suite 220
Portland, Oregon 97224
Tel 503.684.9097 Fax 503.598.0583

City of Gervais
WATER MASTER PLAN

Figure 9-1.
CRITICAL WATER SYSTEM INFRASTRUCTURE

10. System Improvement Recommendations Summary

The improvements outlined in the previous chapters will provide for compliance with regulations, upgrade of the system, and provisions for future growth. This chapter presents improvement project priorities and a capital improvement plan (CIP) for implementing the recommendations. See Figure 8-1 for recommended improvements.

10.1 PRIORITY RATING OF PROJECTS

Recommended improvements to address the needs of the City's water system have been prioritized as follows:

- **Short-Term Improvements**—Projects needed to meet minimum standards or codes or are considered necessary or resolve an existing problem.
- **Intermediate-Term Improvements**—Projects that meet overall goals and objectives but are of secondary priorities. Intermediate term pipeline projects both increase system looping and fire flows, and also are a step in addressing replacement of older cast iron and steel pipe.
- **Long-Term Improvements**—Projects that needed later in the planning period to meet long term capacity needs, aging infrastructure and seismic resiliency.

Table 10-1 shows the prioritization of the recommended water system improvements.

10.2 COST ESTIMATE APPROACH

Budget-level estimates developed for this plan are based on recent work in the area and are reliable to within 20 percent. Estimated costs include a 30-percent construction contingency and 25-percent markup for engineering, legal and administrative costs. Costs are in 2018 dollars unless otherwise noted (ENR 20-city average Construction Cost Index = 11185.51). Detailed spreadsheets for the costs are included in Appendix E of this report. For funding purposes, an appropriate inflation factor should be applied to obtain project costs. The estimates do not include the costs associated with obtaining funding such as application preparation, bond counsel, or interim financing. These costs will be highly dependent upon the funding source and requirements and cannot be estimated with any accuracy.

10.3 CAPITAL IMPROVEMENT PLAN

Table 10-2, showing estimated costs and project priorities for the recommended improvements, is the capital improvement plan for the water system in Gervais.

Table 10-1. Improvement Recommendation Prioritization

Category	Recommended Improvements
Short Term Improvements	
Improvements to Increase Fire Protection	• Install five new fire hydrants to reduce the distance between any two fire hydrants in the City to 500 feet, meeting fire code requirements. • Replace the existing high-demand pump at the water plant with a higher capacity pump. Preliminary sizing calls for a 75-hp pump capable of pumping 1,500 gpm at 150 feet of TDH. • Complete the 8-inch diameter pipe looped connection to Winfield Ranch
Seismic Resiliency Improvements	• Provide flexible connections for Reservoir No. 2 8-inch fill pipe, 14-inch discharge pipe and 6-inch drainpipe, placed at the perimeter of the tank to absorb movement and differential settlement in the event of an earthquake. • Provide five new distribution system valves to better allow vulnerable older pipe segments to be closed off after a seismic event.
Other Improvements	• Replace water meters with upgraded reading equipment. • Hire a certified water right examiner to obtain water rights for Well No. 1 and Well No. 2, including a final proof of survey of the completed use of beneficial use permit G-12015 and performing a well test. • Replace pump for Well No. 1 • Replace the 15-hp medium-demand pump with a 25-hp pump and variable-frequency drive
Intermediate Term Improvements	
Pipe Improvements	• Replace 4- and 6-inch steel and cast-iron pipes in Douglas Avenue between 1st Street and 5th Street with 10-inch PVC pipe. • Replace the 6-inch cast iron pipe in Ivy Avenue between 4th Street and 6th Street with an 8-inch PVC pipe. • Install an 8-inch PVC pipe in Grove Avenue between 4th Street and 7th Street. • Install a 6-inch PVC pipe in Juniper Avenue between 5th Street and 7th Street.
Long-Term Improvements	
Storage Improvements	• Reservoir No. 1 with a 500,000-gallon welded steel reservoir designed for an increased maximum water level that can be used in the future (beyond the planning period) when Reservoir No. 2 needs replacing. • Recoat Reservoir No. 2

Table 10-2. Capital Improvement Plan

CIP Project	Cost
Short-Term Projects	
New Fire Hydrants	$70,000
Medium-Demand and High-Demand Pump Upgrades	210,000
Connection to Winfield Ranch	$90,000
Reservoir No. 2 Flexible Connections	$170,000
New Distribution System Valves	$70,000
Water Rights Transfer	$10,000
Water Meter Repairs	$150,000
Replace Pump for Well No. 1	$17,000
Short Term Subtotal	**$770,000**
Intermediate Term (10-20 Year) Projects	
8-inch Grove Avenue Pipeline	$360,000
10-inch Douglas Avenue Pipeline	$500,000
8-inch Ivy Avenue Pipeline	$350,000
Intermediate Term Subtotal	**$1,210,000**
Long Term Projects	
Replace Reservoir No. 1	$1,390,000
Recoat Reservoir No. 2	$220,000
6-inch Juniper Ave Pipeline	$190,000
Cast-Iron Pipe Replacement Program	$440,000
Long Term Subtotal	**$2,240,000**
Total	**$3,680,000**

11. FINANCIAL ASSESSMENT

Water system improvements may be financed by the City's water user fees (rates), system development charges (SDCs), federal or state loan programs, grants, and bonds. This chapter includes a financial analysis and evaluation of rates and SDCs to fund the recommended CIP and water system through the planning period.

11.1 FUNDING SOURCES

With SDCs funding the growth-related improvements, the City will need to fund the improvements to meet existing needs with a combination of user rate revenue and funding from outside sources. The following is a summary of available local, state and federal funding sources for water system improvements.

11.1.1 Local Funding Sources

Local funding sources for capital improvements other than SDCs and water user fees include various types of loans, bond programs, grants, and ad valorem taxes (property taxes). Local bond funding typically used in Oregon includes general obligation bonds, revenue bonds and improvement bonds (typically used for local improvement districts). Ad valorem taxes provide a tax on all property within the jurisdiction, whether developed or not, and usually are based on assessed value. Connection fees can only include the jurisdiction's actual cost associated with a connection and cannot cover capital improvement costs.

11.1.2 State and Federal Grant and Loan Programs

Several state and federal grant and loan programs are available to help municipalities finance water system improvements. The following are the primary sources of funding available for water system financing:

- The Rural Development Administration, a part of the U.S. Department of Agriculture
- The Oregon Economic and Community Development Department, which administers the Special Public Works Fund, the Water/Wastewater Financing Program, the Community Development Block Grant program, and the Bond Bank Program

Under current programs, the City may qualify for grants available under the Rural Development, Water/Wastewater, or Community Development Block Grant programs.

11.2.3 Safe Drinking Water Revolving Loan Fund

Each federal fiscal year, the U.S. Environmental Protection Agency makes funds (as grants) available to states for the Safe Drinking Water Revolving Loan Fund, a low interest loan program designed to finance drinking water system improvements needed to maintain compliance with the Safe Drinking Water Act. In Oregon, the fund is administered by the Oregon Health Authority.

Community and nonprofit non-community water systems are eligible for this fund. Oregon's grant request process begins by identifying and collecting information about current Oregon drinking water system project

improvement needs. A Letter of Interest from the water system describing drinking water system needs is required to be considered for this fund.

Communities with a Median Household Income below the state average and projected rates above the "affordability rate" are eligible for lower interest loans possible forgivable loan amounts. The affordability rate is the monthly rate for a single EDU defined as the median household income times 1.25% divided by 12. For Gervais, with a median household income of $51,841 (based on 2017 American Community Survey), the affordability rate is $54/month.

11.2 SYSTEM DEVELOPMENT CHARGES

11.2.1 1. General

System Development Charges (SDCs) are fees that local governments collect from property developers to offset the cost of public improvements associated with new development. SDCs are one-time fees collected at the time of building permit issuance. The fees collected may only be used for capital improvements for municipal services. Under Oregon law, SDCs can be charged for capital improvements associated with the following:

- Water supply, treatment and distribution
- Wastewater collection, transmission, treatment and disposal
- Drainage and flood control
- Transportation
- Parks and recreation.

SDCs can consist of an "improvement fee" (for costs of capital improvements to be constructed), a "reimbursement fee" (to pay back municipalities for capital construction already built that included future capacity needs), or a combination of both. The methodology for determining a city's SDC is not fixed in statute. Instead, local municipalities develop the rate structures for any SDCs imposed. Oregon law requires linkages between the charges imposed and the current or projected development. There must be a reasonable connection between the need for new facilities and the new development paying the SDC. SDCs cannot be used for operational costs or for maintenance of existing facilities. SDCs do not require a public vote, but Oregon law requires public notice to adopt or amend SDC methodology.

11.2.2 Current Gervais SDCs

The City Code currently authorizes improvement SDCs for its water utility. The current water charge is $2,313 per single-family residence (1 EDU); last updated in 2006.

11.2.3 SDC Methodology

Proposed improvements were evaluated for improvement SDC eligibility with those having all or some of the cost attributable to future growth noted in Table 11-1. The appropriate SDC rate for these improvements is determined by allocating the growth-related portion of the cost among the anticipated number of future connections to be served. A description of the methodology used to determine the portion of those improvements required for future growth is presented below along with the resulting attributable portion.

Table 11-1. Costs Attributable to Growth

Project	Cost	Portion for Future Growth	Cost for Future Growth
New Fire Hydrants	$70,000	0.0%	$0
Medium-Demand and High-Demand Pump Upgrades	$210,000	25.9%	$28,523
Connection to Winfield Ranch	$90,000	25.9%	$23,337
Reservoir No. 2 Flexible Connections	$170,000	25.9%	$44,081
New Distribution System Valves	$70,000	25.9%	$18,151
Water Rights Transfer	$10,000	25.9%	$2,593
Water Meter Repairs	$150,000	0.0%	$0
Grove Avenue Pipe	$360,000	25.9%	$93,349
Replace Well No. 1 Pump	$17,000	0	0
Douglas Avenue Pipe	$500,000	25.9%	$129,651
Ivy Avenue Pipe	$350,000	25.9%	$90,756
Replace Reservoir No. 1	$1,390,000	25.9%	$360,429
Juniper Ave Pipeline	$190,000	25.9%	$49,267
Recoat Reservoir No. 2	$220,000	0%	$0
Current SDC Budget Balance[a]			***($38,359)***
Total SDC Eligible Costs			**$801,778**
Cost per Future EDU			**$3,746**

a. The current balance shown represents SDC funds previously collected that have yet to be spent.

11.2.4 Summary of Costs Attributable to Growth

The capital costs for the recommended improvements are presented in Table 11-1. The costs include construction, contingencies, engineering, legal and administrative costs. The appropriate SDC rate for these improvements is determined by allocating the growth-related portion of the cost among the anticipated number of future connections (or EDUs) to be served.

Future EDUs are based on a population increase from 2018 to 2040 of 906 persons (see Chapter 2) divided by the assumed persons per household. Based on Portland State population figures, currently Gervais has 4.1 persons per household. Assuming this number of persons per household will continue, the resulting number of future EDUs is 221 and the SDC cost per EDU is $3,746. It is recommended that the SDC charge be adjusted annually to account for inflation, as determined by the rise in the previous year's Consumer Price Index (West Region).

11.2.5 SDCs for Multifamily and Commercial/Industrial Zoning

For the purposes of determining the SDC rates for multifamily and commercial/industrial zoning, 1 EDU is defined at 30 fixture units (per the current Uniform Plumbing Code), the number of fixtures for a typical single-family house. The number of fixture units per each multifamily and commercial/industrial connections will be divided by 30 to determine its EDU total.

11.3 RATE ANALYSIS

The rate analyses performed for this facilities plan centers on the required rate revenue to fund the following:

- New debt service to finance the existing users' share of the capital improvements
- Increased administration costs and operation, maintenance and replacement (OM&R) costs associated with expanded facilities.

11.3.1 Existing and Future Expenses

Debt Service

The City currently services two loans, to USDA with a balance of 176,349 and to Business Oregon with a balance of $242,958. The USDA loan expires in 2025 and the Business loan expires in 2037. Annual payments are approximately $20,000. For this study, it was assumed that the remaining balance on loans will be paid off with user fees over the next 18 years.

Future debt service will be necessary to fund the recommended improvements. For the purposes of the rate analysis three loans through the Safe Drinking Water Revolving Loan Fund were assumed in fiscal years 2020/2021 and 2026/2027, and 2036/2037 to complete funding for the 20-year CIP. The current annual interest rate without special discounts due to income level or rates above the affordability rate discussed in Section 8.22. For a 20-year term is assumed for each loan.

Annual Administration, Operation, Maintenance & Replacement Costs

Annual administration and OM&R costs are recurring costs typically funded through user rates. OM&R includes a set-aside into a fund for future replacement of equipment as needed; the City does not currently set aside any revenue into a replacement fund. The 2017/2018 fiscal year City annual cost for administration, operations and maintenance was $254,604. For this analysis, it was estimated that these costs would increase by 2 percent per year over the planning period, including a set-aside into a replacement fund.

11.3.2 Existing and Future Rate Revenue

Current User Rates

Water user rates are monthly fees assessed to all users connected to the water system. The City currently has 637 residential users, 11 commercial and industrial connections, and 5 school connection for a total of 653 users. The City's current base user rate is $31.36 per EDU per month. According to records provided by the City, 2018 annual revenue from user fees was $318,696. 2018 expenses (personnel services, material services and debt services) totaled 285,848. The schedule of current water rates is summarized in Table 11-2.

Table 11-2. Current Water Rate Schedule

Service Class	Base Rate Cubic Feet	Base Rate/ Month	Cost per Additional 100 Cubic Feet
Residential and Special Residential	700	$ 31.36	$1.74
Commercial-Business	700	$52.27	$2.62
Industrial	700	$52.27	$2.62
Sacred Heart School	2800	$87.12	$2.62
Gervais Elementary School	5600	$174.25	$2.62
Gervais Elem School Cafeteria and Gym	3150	$130.69	$2.62
Gervais High School	5600	$174.25	$2.62

For comparison purposes, the most recent available survey of water user rates was done by the League of Oregon Cities in 2014. The average monthly base water rate for 5,000 gallons (approximately 700 cubic feet) for Cities Gervais' size at that time was $34.04. It is probably approaching $40 now. The Cities of Woodburn and Aurora currently have rates of $34.04 and $39.02 per month, respectively, for a single connection and 700 cubic feet of usage.

Projected User Rate

As current rates do not meet expenses and with additional funding being needed for the CIP, a rate increase at the beginning of the 2019/2020 fiscal year is recommended. Based on estimates of annual expenses, existing and new debt service, and revenue through the planning period, the rate schedule for 2020 shown in Table 11-3 is recommended, with an annual increase of 2.75% each year through the planning period.

Table 11-3. 2020 Proposed Water Rate Schedule

Service Class	Base Rate Cubic Feet	Base Rate/ Month	Cost per Additional 100 Cubic Feet
Residential and Special Residential	700	$ 35.50	$1.97
Commercial-Business	700	$59.17	$2.96
Industrial	700	$59.17	$2.96
Sacred Heart School	2800	$98.62	$2.96
Gervais Elementary School	5600	$197.26	$2.96
Gervais Elem School Cafeteria and Gym	3150	$147.94	$2.96
Gervais High School	5600	$197.26	$2.96

12. ENVIRONMENTAL ASSESSMENT

12.1 ALTERNATIVES TO PROPOSED ACTION

The National Environmental Protection Act requires an environmental evaluation of at least two alternatives for projects that must prepare an environmental review. The proposed project presented in this facilities plan (the Preferred Alternative) consists of the set of recommendations described in Chapter 10, which were developed through an extensive planning analysis. The only identified alternative to the proposed project is to make no improvements (the No-Action Alternative).

Under the No-Action Alternative, no water facilities improvements would be constructed. The City's water system would remain at capacity and be increasingly prone to main breaks and seismic events. Future development within the city limits and urban growth boundary would be limited by the existing capacity of the treatment facility and storage capacity.

12.2 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

12.2.1 Land Use

Affected Environment

The proposed improvements are within the existing property designated for the water plant; no expansion of the site is required.

Environmental Consequences

The proposed water plant improvements will be at the plant site and will not affect land use. Land use will not be affected by the proposed expansion of the reclaimed water use area.

With the No-Action Alternative, new development in the treatment facility's service area could be restricted if the system has inadequate capacity to serve future growth.

Mitigation

The proposed improvements will have no adverse impact on land use, so no mitigation is required.

12.2.2 Floodplains

Affected Environment

There are no designated floodplains within the existing property designated for the water plant.

Environmental Consequences

All of the proposed improvements are outside mapped flood zones and therefore will have no impact on flooding.

The No-Action Alternative would have no temporary or permanent impact on flooding.

Mitigation

The proposed improvements will have no adverse impact on land use, so no mitigation is required.

12.2.3 Wetlands

Affected Environment

All of the proposed improvements are outside mapped wetlands and therefore will have no effect on the wetlands.

Environmental Consequences

All of the proposed improvements are outside mapped wetlands and therefore will have no environmental impact.

The No-Action Alternative would have no temporary or permanent impact on flooding.

Mitigation

The proposed improvements will have no adverse impact on Wetlands, so no mitigation is required.

12.2.4 Wild and Scenic Rivers

Affected Environment

There are no rivers classified as a wild and scenic within the project area.

Environmental Consequences

Neither the proposed project nor the No-Action Alternative would directly or indirectly any wild or scenic river.

Mitigation

No mitigation of any known wild or scenic river is necessary.

12.2.5 Cultural Resources

Affected Environment

The National Register of Historic Places was reviewed and no historic properties within the vicinity of the water plant improvements.

The Digital Archeological Record was reviewed for archaeological sites in the Gervais area and none were found the vicinity of the water facilities.

The improvements at the water plant will all occur within the vicinity of existing water facilities that are developed; therefore, any unknown sites are previously disturbed.

Environmental Consequences

The proposed project would not directly or indirectly impact known historic or cultural resources. However, unknown prehistoric, historic or cultural resources may exist below the surface that are not detectable without subsurface probing or excavation.

The No-Action Alternative would have no temporary or permanent impact on cultural resources.

Mitigation

No mitigation of known historic or cultural resources is necessary. If any historical or archaeological artifacts are discovered during the course of construction, work must be temporarily halted, and the engineer must be contacted. Work may proceed following at the direction of the engineer after consulting with the State Historical Preservation Officer.

12.2.6 Biological Resources

Affected Environment

Investigation of potential impacts on threatened and endangered species was performed as part of the wastewater system upgrades in 2001. At that time there were no listed or proposed species within the project site.

The improvements at the existing water plant and distribution system will all occur within the vicinity of existing water facilities which are developed; therefore, the sites are previously disturbed.

Environmental Consequences

Neither the proposed project nor the No-Action Alternative would directly or indirectly any known threatened or endangered species or their habitat.

Mitigation

No mitigation for threatened or endangered species or their habitat is necessary. All construction shall comply with the Endangered Species Act. If any evidence of threatened or endangered species or their habitat is discovered during the course of construction, work must be temporarily halted, and the engineer must be contacted. Work may proceed following at the direction of the engineer after consulting with the U.S. Fish and Wildlife Services.

12.2.7 Water Quality

Affected Environment

The affected environment for water quality consists of surface water, draining to the Pudding River, and groundwater.

Environmental Consequences

Proposed Project

Construction activities associated with the proposed project may impact water quality in the short term. Construction activities, including clearing and grading, would lead to increased potential for erosion and sedimentation in downstream drainages. Accidental spills of oils, fuels, or solvents during construction could impact groundwater. Release of any potentially toxic materials such as hydraulic fluid, gasoline, chlorine, raw sewage or oil could harm fish habitat.

No-Action Alternative

Under the No-Action Alternative, the water treatment facilities would not be improved and would remain at capacity for the current level of development in the service area.

Mitigation

Mitigation measures for water quality issues include the following:

- A 1200C general NPDES permit will need to be obtained if required for water quality for the construction site.
- Water used to mitigate for dust created during construction activities will be prevented from entering drainages and must be collected and disposed of in accordance with Oregon Department of Environmental Quality water quality standards and NPDES permit requirements.
- To reduce the possibility of chemical spills or releases of contaminants, including any non-stormwater discharge to drainage channels, the contractor will implement appropriate hazardous material management practices.

Water Master Plan

Appendix A. Well Source Water Assessment Report

Public Health Division
Drinking Water Program
Kate Brown, Governor

Oregon Health Authority

444 A St
Springfield, OR 97477
Phone: (541) 726-2587
Fax: (541) 726-2596

Source Water Assessment Update

To: Gervais Water Department
Pat Claxton
PO Box 329
Gervais, OR 97026

Date: June 8, 2017

Re: Source Water Assessment update: PWS # 4100319 – Gervais Water Department

Dear Pat Claxton

The drinking water protection staff of the Oregon Health Authority (OHA) and the Oregon Department of Environmental Quality (DEQ) are pleased to provide you with supplemental Source Water Assessment (SWA) data. Our goal is to provide you and your customers the basic information and resources needed to develop strategies that reduce drinking water contamination risk. Advanced mapping tools and databases were used to identify current land use practices and potential contaminant sources within your mapped Drinking Water Source Area(s). Additional resources are provided to help you identify and implement contamination risk-reduction strategies. OHA staff assembled these materials after a site visit to review potential contaminant sources and obtain feedback regarding the potential contaminant sources of greatest concern to the water system. Based on that visit, we believe the higher priority potential contaminant sources within your drinking water source area are:

- Chemicals used or stored in close proximity to well
- Activities associated with Gervais Public Works & drinking water treatment plant (vehicle repair, motor pool, chemical/fuel storage)
- Waste transfer/recycling stations (Gervais High School)
- Irrigated crops
- Stormwater runoff associated with large parking lots
- Activities associated with residential areas

Management Strategies for reducing risks associated with each of these potential contaminant sources are listed in the table immediately following this letter. These include strategies that can be put to use right away. This report also contains:

- A regional map of nearby drinking water source areas that includes other water systems which may have similar potential contaminant source concerns.
- A zoomed in aerial photo basemap of your drinking water source area(s).
- A map showing land ownership/use and potential contaminant sources within your source area(s). We encourage you to use this map to identify nearby land use authorities and associated potential contaminant sources, as few public water systems have legal jurisdiction over their entire source area(s).
- An inventory table listing the potential contaminant sources (PCSs) identified inside your drinking water source area(s). Using this table in conjunction with the maps will help identify additional potential contaminant sources for risk-reduction strategies.

The appendices include the following drinking water source protection resources:

- **Appendix 1,** a guide for developing and implementing source water protection strategies;
- **Appendix 2,** notes and a key to the Maps and PCS Inventory Table;
- **Appendix 3,** a resource list for water quality, including links to fact sheets;
- **Appendix 4,** funding sources and free or low-cost technical assistance.

This report can be used as a standalone document for drinking water source protection or in conjunction with Source Water Assessment reports previously completed by OHA and DEQ between 1998 and 2005. If available, we encourage you to use the original Source Water Assessment report which contains additional information characterizing well/spring construction, the drinking water source area(s), and susceptibility to potential contaminant sources. Contact OHA at (541) 726-2587 to receive the original SWA Report, or to request a new SWA Report if one was not previously completed.

To further support protection efforts, a statewide Drinking Water Source Protection Resource Guide for groundwater systems is available at: http://www.oregon.gov/deq/wq/programs/Pages/DWP-Source.aspx. For additional assistance regarding drinking water source protection, please contact Tom Pattee at OHA (541) 726-2587 ext.24.

Sincerely,

Gregg Baird
OHA Drinking Water Services

cc: Electronic Source Water Assessment file, Springfield

Management Strategies for High Priority Potential Sources of Pollutants Identified in Gervais Water Department Drinking Water Source Area

Contact Drinking Water Protection Staff with questions or for assistance with any potential sources of contamination not identified in this document.

Potential Pollutant Type	*Potential Impact*	*Pollutant Reduction and Outreach Ideas*
Chemicals stored or used in close proximity to well or spring	Chemicals, fuels, and equipment maintenance materials may impact groundwater source *(Higher potential risk)*	□ Verify that no fuels, pesticides, fertilizers or other chemicals are used within 100 feet of the well or spring or stored near the wellhead or spring, and that all backup fuel supplies have secondary containment. □ Consider increased setbacks based on aquifer sensitivity and degree of hazard. See info on Integrated Pest Management (http://npic.orst.edu/pest/ipm.html) for alternative methods. Alternate methods for vegetation management within the well or spring setback may include mechanical removal, mowing, or non-chemical pre-emergent or post-emergent herbicide. □ Correct any outstanding well/spring box construction or casing seal deficiencies. □ Create a spill response plan. □ Acquire spill response equipment and any regulatory required training. □ Ensure all fuels and chemicals have secondary containment. **Fact Sheets/Resources** *Managing Small Quantity Chemical Use: http://www.deq.state.or.us/wq/dwp/docs/EPA/EPASWPPracticesBulletin_ChemUseSmallQ.pdf *Integrated Pest Management: http://npic.orst.edu/pest/ipm.html
Cropland -- Irrigated (includes orchards, vineyards, nurseries, greenhouses) Non-irrigated (includes Christmas trees, grains, grass seed, pasture)	Over-application or improper handling of pesticides/fertilizers may impact drinking water. Excessive irrigation may transport contaminants or sediments to groundwater/surface water through runoff or infiltration.	□ Encourage farm operator to work with their local SWCD, Oregon State University County Extension Agent, or Natural Resources Conservation Service to develop a Farm Plan, if they have not done so already (websites below). Ensure the Farm Plan addresses: crop production practices, pesticide/fertilizer/petroleum product handling and storage, vehicle/equipment maintenance and repair, livestock waste storage and treatment, hazardous waste management, wastewater disposal/fill, and wells. **Agency Websites:** Soil and Water Conservation Districts: http://oacd.org/conservation-districts/directory OSU Extension: http://extension.oregonstate.edu/find-us Natural Resources Conservation Service, Oregon: http://www.nrcs.usda.gov/wps/portal/nrcs/site/or/home/ Oregon Department of Agriculture: http://www.oregon.gov/ODA/Pages/default.aspx

Potential Pollutant Type	*Potential Impact*	*Pollutant Reduction and Outreach Ideas*
	(Higher risk if irrigated or high precipitation - Moderate risk if drip-irrigated or non-irrigated)	□ Also send relevant fact sheets and information below. **Fact Sheets/Resources** *Managing Agricultural Fertilizer Application (US EPA source): http://www.deq.state.or.us/wq/dwp/docs/EPA/EPASWPPracticesBulletin_AgFertilizer.pdf *Managing Large-Scale Application of Pesticides: http://www.deq.state.or.us/wq/dwp/docs/EPA/EPASWPPracticesBulletin_PesticidesLargeScale.pdf *Irrigation System Maintenance, GW Quality, and Improved Production: https://catalog.extension.oregonstate.edu/em8862 *Guidance for Evaluating Residual Pesticides on Lands Formerly Used for Agricultural Production http://www.deq.state.or.us/lq/pubs/docs/cu/GuidanceEvalResidualPesticides.pdf □ If this land covers a large percentage of your Drinking Water Source Area, notify your local Soil and Water Conservation District (SWCD) of your source area location. □ Identify and document any pesticides used to maintain site and areas applied. *Additional recommendations:* □ Set up or participate in a local material exchange program. http://www.oregon.gov/DEQ/mm/Pages/Material-Recovery-and-Recycling.aspx □ Participate in Pesticide Stewardship or Integrated Pest Management Programs (or other efforts , such as pesticide collection events for unused and legacy pesticides) to reduce use of products that threaten water quality: http://www.oregon.gov/DEQ/wq/programs/Pages/Pesticide.aspx http://www.deq.state.or.us/wq/pubs/factsheets/community/pesticide.pdf □ See DEQ factsheet "Pesticide use in the vicinity of drinking water sources" for additional regulations and recommendations: http://www.deq.state.or.us/wq/dwp/docs/pesticideUse.pdf
Stormwater run-off -- focusing on high density housing (> 1 House/0.5 acre)	Improper use, storage, and disposal of household chemicals may impact the drinking water supply; stormwater run-off or infiltration may carry contaminants to drinking water supply	□ Identify underground injection wells and dry wells for stormwater disposal. Verify permit status. □ Education program on stormwater issues. □ Ongoing public education program on pesticide and fertilizer use, household hazardous waste, pet waste, and household pharmaceutical waste disposal □ Host or facilitate ongoing household hazardous waste, collections □ Work with your municipality to increase emphasis on pre-treatment for stormwater runoff and best management practices for stormwater. □ Develop best management practices and maintenance plan for drywells and injection wells. http://www.deq.state.or.us/wq/uic/docs/guidelines.pdf □ Review Portland's Stormwater Management Manual and the Oregon's Water Quality Model Code and

Potential Pollutant Type	*Potential Impact*	*Pollutant Reduction and Outreach Ideas*
	(Moderate potential risk)	Guidebook (or other stormwater management document), and develop program to address stormwater issues. □ Consider municipal code to address stormwater - see DLCD Water Quality Model Code and Guidebook □ Send applicable information from list below: **Fact Sheets/Resources** *Use of Injection Control Systems and Groundwater Protection: http://www.deq.state.or.us/wq/pubs/factsheets/uic/shallowinjwell.pdf *Managing Stormwater to Prevent Contamination of Drinking Water: http://www.deq.state.or.us/wq/dwp/docs/EPA/EPASWPPracticesBulletin_StormWater.pdf *Water Quality Model Code and Guidebook: http://www.oregon.gov/LCD/waterqualitygb.shtml *Portland's Stormwater Management Manual: http://www.portlandonline.com/bes/index.cfm?c=dfbbh *Best Management Practices (BMPs) for Washing: http://www.deq.state.or.us/wq/pubs/bmps/washactivities.pdf and *Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water: http://www.deq.state.or.us/wq/dwp/docs/EPA/EPASWPPracticesBulletin_PetWaste.pdf *Disposal of Chlorinated Water from Swimming Pools and Hot Tubs: http://www.oregondeq.com/WQ/pubs/bmps/swimpooldisp.pdf *Household Hazardous Waste Program: http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/hhw.aspx *Underground Injection Control (UIC) Program: http://www.oregon.gov/DEQ/wq/wqpermits/Pages/UIC.aspx *Healthy Lawn, Healthy Environment: https://www.epa.gov/sites/production/files/2014-04/documents/healthy_lawn_healthy_environment.pdf
Commercial or industrial sites – includes businesses that 1) do not require permits or 2) regulated facilities like dry cleaners, cleanup sites, hazardous waste/materials sites, underground storage tanks, wastewater and solid waste disposal	Spills, leaks, or improper handling of solvents, petroleum products, wastewater, or other chemicals and materials associated with commercial or industrial activities may impact the drinking water supply *(Higher potential risk)*	□ Review "Drinking Water Protection Strategies for Commercial and Industrial Lane Uses" and consider other general or business sector specific strategies for pollution risk reduction.http://www.deq.state.or.us/wq/dwp/docs/DWPStrategiesCommercialIndustrial.pdf □ Notify the owner or manager of their location within your drinking water source area and send the following general fact sheets: *Basic Tips for Keeping Drinking Water Clean and Safe http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/BasicTips12WQ005.pdf *Groundwater Basics http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/GroundwaterBasics.pdf *Business and Industry tips for reducing water quality impacts (DEQ) http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/busindtips.pdf *Pollution Prevention for Industry and the Environment: http://www.deq.state.or.us/pubs/general/IndustryandEnvironmentPollutionPrevention.pdf

Potential Pollutant Type	*Potential Impact*	*Pollutant Reduction and Outreach Ideas*
		□ Contact owner/operator to verify that any chemical or petroleum product storage (if present) cannot impact groundwater. For example, chemicals could be stored and used inside, or have secondary containment. Encourage business to receive technical assistance from DEQ's non-regulatory Toxics Use/Waste Reduction Technical Assistance Program: http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/Technical-Assistance.aspx □ Implement relevant best management practices (BMPs) from "Best Management Practices for Storm Water Discharges Associated with Industrial Activities" fact sheets. www.deq.state.or.us/wq/stormwater/docs/nwr/indbmps.pdf □ Work with Drinking Water Protection staff or permitting program staff to ensure permitted facilities are in compliance.
Residential lands – private urban or private rural homes	Spills, leaks, or improper handling of chemicals, fuels, wastewater, and other materials may impact drinking water; infiltration containing pesticides or fertilizers may impact drinking water *(Moderate potential risk)*	□ Contact residents (see DEQ drinking water website for example letter) and provide information on their location within your drinking water source area. Outreach can be done through local media or via utility bills. Send (or refer to) relevant fact sheets and web resources from list below. **Fact Sheets/Resources** *DEQ DWP website for Residential/Rural Land Uses (under Management Strategies by Land Use): http://www.oregon.gov/DEQ/wq/programs/Pages/DWP-Source.aspx *Groundwater Basics: http://www.deq.state.or.us/wq/pubs/factsheets/drinkingwater/GroundwaterBasics.pdf *Healthy Lawn, Healthy Environment: https://www.epa.gov/sites/production/files/2014-04/documents/healthy_lawn_healthy_environment.pdf *What is Household Hazardous Waste?: http://www.deq.state.or.us/lq/pubs/docs/sw/hhw/WhatisHHW.pdf *Household Hazardous Waste Program: http://www.oregon.gov/DEQ/Hazards-and-Cleanup/hw/Pages/hhw.aspx *Household Pharmaceutical Waste Disposal: http://www.deq.state.or.us/lq/pubs/factsheets/sw/HouseholdPharmaceuticalWasteDisposal.pdf *Groundwater Friendly Gardening Tips: http://wellwater.engr.oregonstate.edu/groundwater-friendly-gardening Additional measures may include: □ Establish ongoing educational program on household hazardous waste and proper disposal of pharmaceuticals, lawn and landscaping, septic system maintenance.

Potential Pollutant Type	***Potential Impact***	***Pollutant Reduction and Outreach Ideas***
Landfills, composting facility, historic waste dumps, **waste transfer, waste recycling stations**	Water percolating through or coming into contact with waste material may transport contaminants to groundwater supply (Higher potential risk)	□ Notify the landowner or manager of their location within your drinking water source area □ Work with DEQ Drinking Water Protection staff or permitting program staff to review permits and ensure permitted facilities are in compliance. http://www.oregon.gov/DEQ/mm/swpermits/Pages/default.aspx □ For historic landfills, check with the DEQ Site Assessment program to verify status of site: http://www.oregon.gov/DEQ/Hazards-and-Cleanup/env-cleanup/Pages/Site-Assessment.aspx □ Ensure DEQ cleanup program staff are aware of the drinking water source area location, and are working towards "No Further Action" status. For more information, go to: http://www.oregon.gov/DEQ/Hazards-and-Cleanup/env-cleanup/Pages/default.aspx

Figures List:

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[1] The Key provides legend symbols for the accompanying Figures. More detailed information regarding the Key is also provided in Appendix 2.

[2] The purpose of Figure 1, the Drinking Water Source Area and Vicinity Map, is to show other nearby water systems that may be addressing similar concerns with potential contaminant sources. It is often advantageous for water systems with similar concerns to work together when addressing those concerns.

[3] The purpose of Figure 2, the Drinking Water Source Area Map, is to show an up close map of the drinking water source area for the water system overlain on an aerial photo. The aerial photo can be used to help identify general land use practices such as agriculture, forestry, residential, and/or commercial/industrial areas.

[4]The purpose of Figure 3, Drinking Water Source Area with Land Ownership/Use and Potential Sources of Contaminants Map, is to show the location of potential contaminant sources and land ownership/use within the drinking water source area. Many water systems do not own or have management authority over large portions of their mapped drinking water source area. Therefore, when considering effective drinking water protection measures, it is advantageous to work with private land owners and/or agencies that are responsible for managing land use practices within the drinking water source area.

Additional Drinking Water Source Area Maps with more detail or other mapped features are also available upon request by contacting OHA (541) 726-2587. Detailed or expanded maps may be especially useful in areas where a high density of potential contaminant sources are present.

Key to Figures
Source Water Assessment Update
for public water systems using groundwater

General Legend:

- Groundwater 2-yr TOT (Zone 1 for Springs)
- Groundwater Drinking Water Source
- City limits (ODOT, 2013)
- County Boundary

Transportation:

- Interstate
- U.S. Routes
- Oregon Routes
- Roads (BLM)
- Railways (USGS - 2009)

Land Ownership/Use:

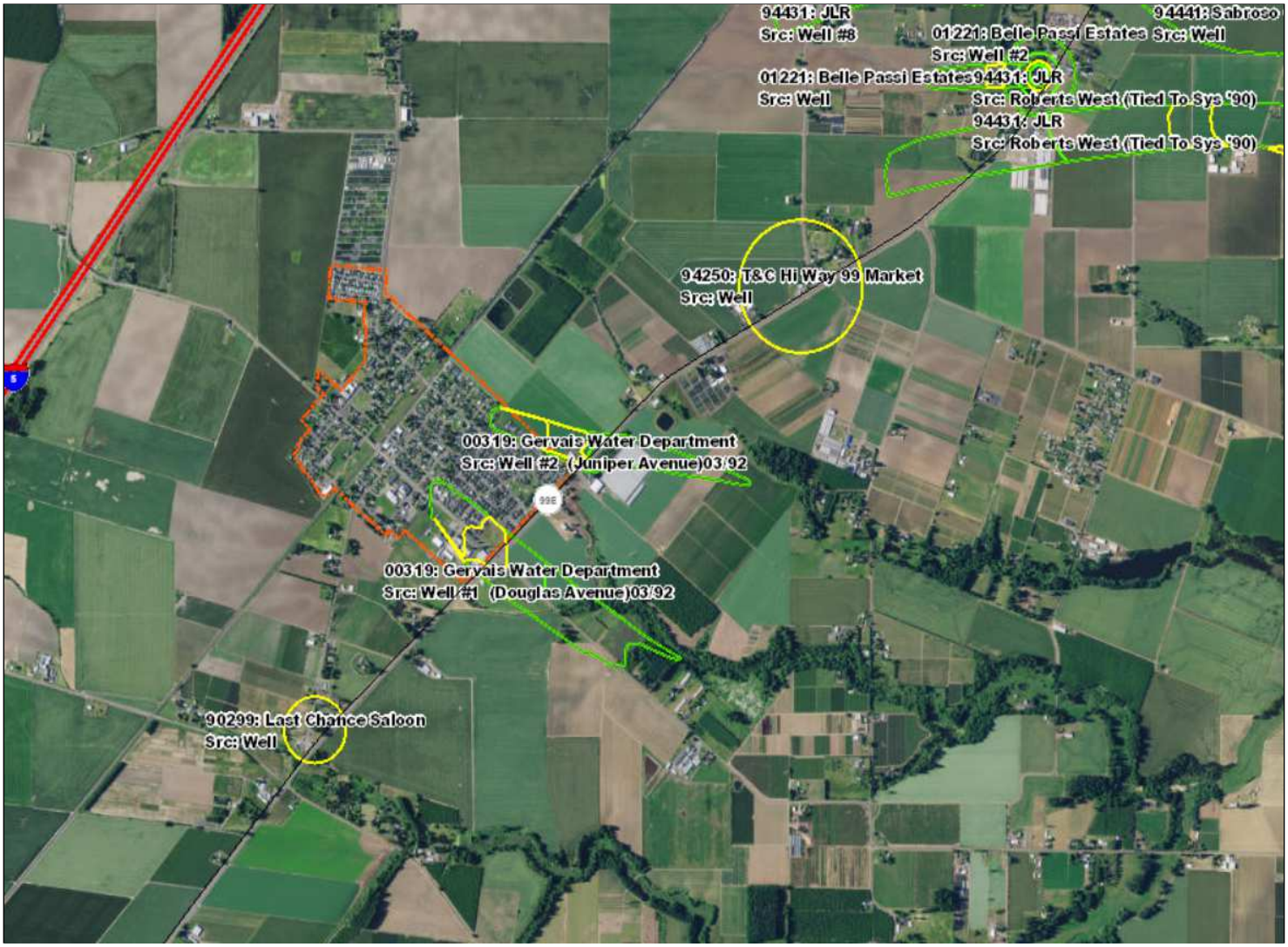
- Private Urban Lands (within city limits)
- Private Rural Lands (private non-industrial outside city limits)
- Agriculture (Ag Zoning (BLM) and NASS 2013)
- Private Industrial Forests (ODF data); Lands Managed by Private Industry (BLM)
- Local Government
- State Dept. of Forestry
- State - Other
- Bureau of Land Management
- U.S. Forest Service
- Federal - Other
- Bonneville Power
- Bureau of Indian
- Undetermined
- Water

Potential Sources of Pollutants identified in State and Federal Regulatory Databases:

- Confined Animal Feeding Operations (ODA as of 2016)
- Dry Cleaner, Active (DEQ as of 2015)
- Dry Cleaner, Dry Store (DEQ as of 2015)
- Dry Cleaner, Closed (DEQ as of 2015)
- Dry Cleaner, Inactive (DEQ as of 2015)
- Dry Cleaner, Solvent Supplier (DEQ as of 2015)
- Environmental cleanup site with known contamination (DEQ as of 01/2016)
- Environmental cleanup site No Further Action required or otherwise lower risk (DEQ as of 01/2016)
- Hazardous Material Large Quantity Generator (DEQ - HW as of 1/02/2016)
- Hazardous Material Small Quantity or Conditionally Exempt Generator (DEQ - HW as of 1/02/2016)
- Hazardous Material Transport, Storage, and Disposal sites (DEQ - HW as of 1/2016)
- Hazardous Substance Information System (OSFM as of 2009)
- Hazardous Substance Information System - AST (OSFM as of 2009)
- Leaking underground storage tank - Confirmed (DEQ as of 9/2012) (Locaton will likely need verification.)
- Leaking underground storage tank with No Further Action required or otherwise lower risk (DEQ as of 9/2015) (Location will likely need verification.)
- Mining permits (DOGAMI as of 1/16/2014)
- Oil and Gas wells (permitted only) (DOGAMI as of 7/2016)
- Original Source Water Assessment Potential Contaminant Source - Area-wide source (DEQ as of 2005)
- Original Source Water Assessment Potential Contaminant Source - Point source (DEQ as of 2005)
- Other Source Water Assessment Potential Contaminant Source - SWA Update (OHA/DEQ as of 2016)
- School Locations OR (DHS as of 2015)
- Solid Waste sites (DEQ - SW as of 1/25/2016)
- Underground Injection Control - Stormwater (UIC - DEQ as of 91/12/2016)
- Underground Injection Control - Non-stormwater (UIC - DEQ as of 91/12/2016)
- Underground Storage Tanks (DEQ as of 1/25/2016) (Location will likely need verificaton.)
- Water Quality domestic wastewater treatment sites (DEQ - SIS as of 1/25/2016)
- Water Quality permits (DEQ - SIS as of 1/25/2016)

Potential sources of pollution: The inventory of potential sources of pollution is based on readily-available state and federal regulatory databases. The primary intent is to identify and locate significant potential sources of contaminants of concern. Non-regulated and non-point sources such as areas with agricultural, septic systems, or managed forests are generally not identified in the regulated databases but are presented in the figures as a factor of land ownership/use. It is important to remember that the sites and areas identified are only potential sources of contamination to the drinking water. Water quality impacts are not likely to occur when contaminants are used and managed properly and land use activities occur in such a way as to minimize contaminant releases. It is highly recommended that the community "enhance" or refine the delineation of the sensitive areas and the identification of the potential contamination sources through further research and local input. If there were no potential sources of contamination identified during the review of regulatory databases or community's enhanced inventory, the water system and community should consider the potential for future development to impact the source water.

Figure 1
Gervais Water Department, (PWS #4100319)
Drinking Water Source Area and Vicinity



This map is provided to assist public water systems and their communities identify other local water systems that may have common concerns. It may be beneficial for communities with similar risks or concerns to develop place-based planning with collaborative partnerships to implement priority actions for risk reduction.

Legend

- Groundwater 2-yr TOT (Zone 1 for Springs)
- Groundwater Drinking Water Source Area
- Surface Water Drinking Water Source Area
- City limits (ODOT, 2013)
- County Boundary

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This product is for informational purposes and may not have be prepared for, or be suitable for legal, engineering or surveying purposes. Users of this information should review of consult the primary data and information sources to ascertain the usability of the information.

Prepared by: Gregg Baird – 6/8/2017

Figure 2
Gervais Water Department, (PWS #4100319)
Drinking Water Source Area

Legend

- Groundwater 2-yr TOT (Zone 1 for Springs)
- Groundwater Drinking Water Source Area
- City limits (ODOT, 2013)
- Streams
- Waterbodies

See original Source Water Assessment for information on delineation method and aquifer/well parameters. If a copy of the Source Water Assessment is needed contact Oregon Health Authority Drinking Water Services at (541) 726-2587.

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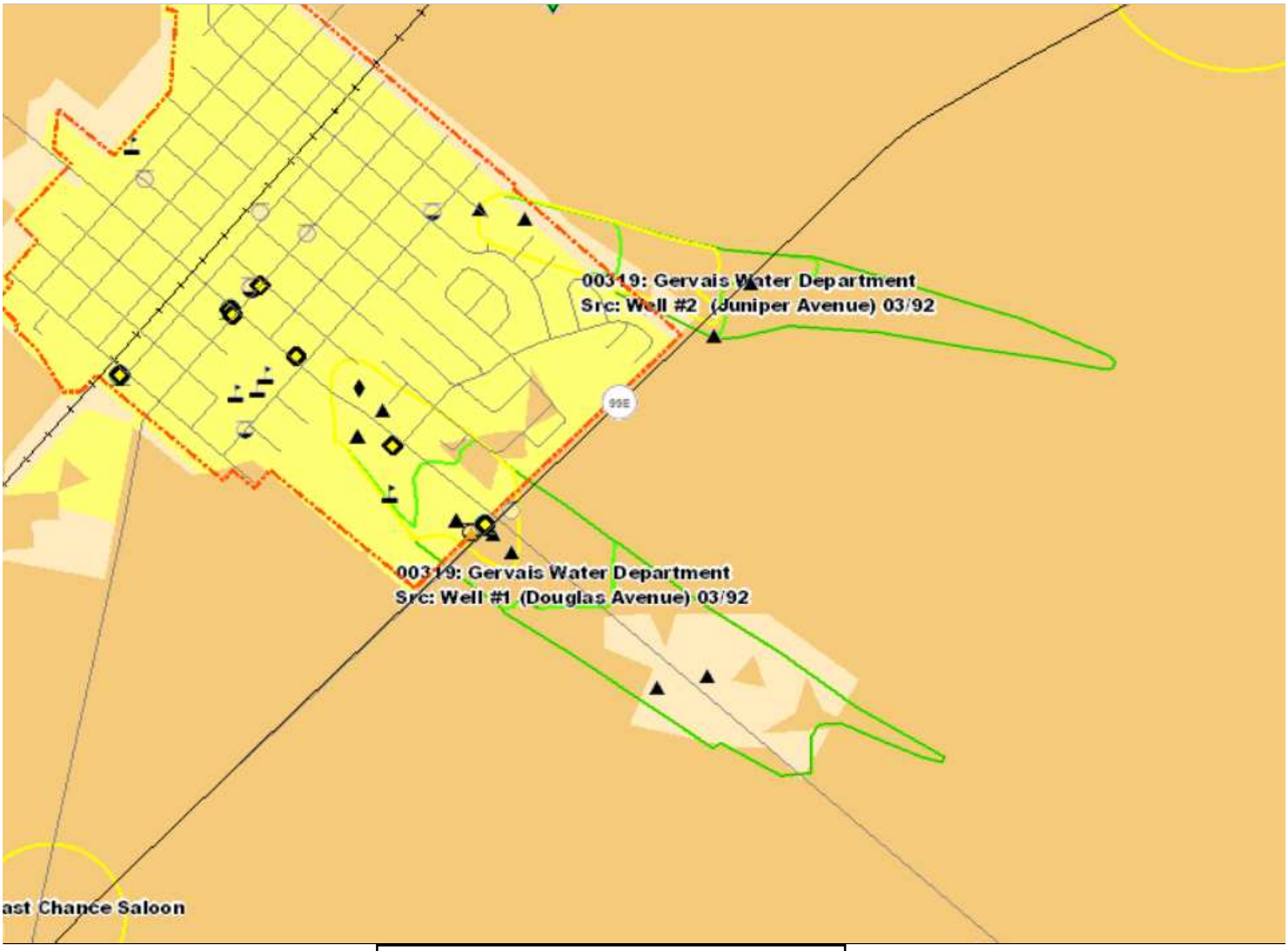
Prepared by: Gregg Baird – 6/8/2017

Figure 3
Gervais Water Department, (PWS #4100319)
Drinking Water Source Area with Land Ownership/Use and Potential Sources of Contamination



Legend:

- Groundwater drinking water source area 2-year time-of-travel (Zone 1 for springs)
- Groundwater drinking water source area
- City limits (ODOT, 2016)
- County Boundary
- Interstate
- U.S. Routes
- Oregon Routes
- Roads (BLM)
- Railways (USGS - 2009)

Key to land ownership/use. Not all may be present in mapped area:

- Private Urban Lands (within city limits)
- Private Rural Lands (private non-industrial outside city limits)
- Agriculture (Ag Zoning (BLM) and NASS 2013)
- Private Industrial Forests (ODF data); Lands Managed by Private Industry (BLM)
- Local Government
- State Dept. of Forestry
- State - Other
- Bureau of Land Management
- U.S. Forest Service
- Federal - Other
- Bonneville Power
- Bureau of Indian
- Undetermined
- Water

N W E S

Notes:

See Key for Figures for symbol key to potential sources of pollution identified on regulatory databases. Additional information also provided in Appendix 2.

Due to limitations for locational data, some mapped locations will need further research to verify presence and location.

Additional detailed maps can be provided for areas where a high density of potential contaminant sources are present.

This product is for informational purposes and may not have be prepared for, or be suitable for legal, engineering or surveying purposes. Users of this information should review of consult the primary data and information sources to ascertain the usability of the information.

Prepared by: Gregg Baird – 6/8/2017

SOURCE WATER ASSESSMENT REPORT

Gervais Water Department
Gervais, Oregon
PWS #4100319

March, 2002

Prepared

by

Oregon Department of Human Services
Health Services
Drinking Water Program

and

Oregon Department of Environmental Quality
Water Quality Division
Drinking Water Protection Program

Available in Alternate Formats by contacting the DHS DWP at (541) 726-2587

Gervais Water Department: Source Water Assessment Report

Summary

The Source Water Assessment Program, mandated by the 1996 Amendments to the Safe Drinking Water Act, requires that states provide the information needed by public water systems to develop drinking water protection plans if they choose. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the Drinking Water Protection Area, an inventory of potential sources of contaminants within the Drinking Water Protection Area, and an assessment of the relative threat that these potential sources pose to the water system.

This report identifies the Drinking Water Protection Area for the Gervais Water Department as the area at the surface that overlies that part of the aquifer that supplies groundwater to the well(s) or spring(s). The Willamette aquifer supplies the drinking water to the system. It is a confined alluvial (sand and gravel) aquifer with water-bearing zones at shallow (<180 feet) and intermediate (220 to 300 feet) depths. The main water-bearing zones used by the City occur at the intermediate depths greater than 220 feet below the surface.

The aquifer is considered moderately sensitive based on moderate infiltration potential score for the wells and the highly permeable soils that occur over part of the Drinking Water Protection Area for well 1. Approximately 25 wells occur in the section containing the systems wells and at this time do not pose a significant risk to the system.

An inventory of potential contamination sources was performed within the City of Gervais' drinking water protection area. The primary intent of this inventory was to identify and locate significant potential sources of contaminants of concern. The inventory was conducted by reviewing applicable state and federal regulatory databases and land use maps, interviewing persons knowledgeable of the area, and conducting a windshield survey by driving through the drinking water protection area to field locate and verify as many of the potential contaminant source activities as possible. It is important to remember the sites and areas identified are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

The delineated drinking water protection area is primarily dominated by agricultural land uses. Eight potential contaminant sources were identified in the two-year time-of-travel zone including the City's Public Works and Water Treatment Plant, the High School facility, local residential areas, State Highway 99E, and area agricultural crop fields. A total of four potential contaminant sources were identified within the five-year and ten/fifteen-year time-of-travel zones of the

drinking water protection area. The potential contaminant sources in this area include two cemeteries, State Highway 99E, and a private tree nursery. Area-wide potential sources such as the agricultural fields and transportation corridors extend from the two-year time-of-travel zone into the five-year and ten-year time-of-travel zone. All of the potential contaminant sources identified pose a relatively higher to moderate risk to the drinking water supply with the exception of the Gervais High School building itself, which poses a lower risk.

The size of the Drinking Water Protection Area is designed to approximate the next 10 years of groundwater supply for the City of Gervais. The two year time-of-travel zone shown on the map is used as a conservative estimate of the survival time of some viruses in groundwater. Given the moderately sensitive nature of the aquifer the drinking water source is not considered to be susceptible to viral contamination.

The costs associated with contaminated drinking water are high. Developing an approach to protecting that resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and well construction issues as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Drinking Water Protection Area) and have identified potential sources of contamination within that area. In addition, we provide you with recommendations, i.e., BMPS, regarding the proper use and practices associated with those potential contamination sources. We believe public awareness is a powerful tool for protecting drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality.

1. City of Gervais: Source Water Assessment Report

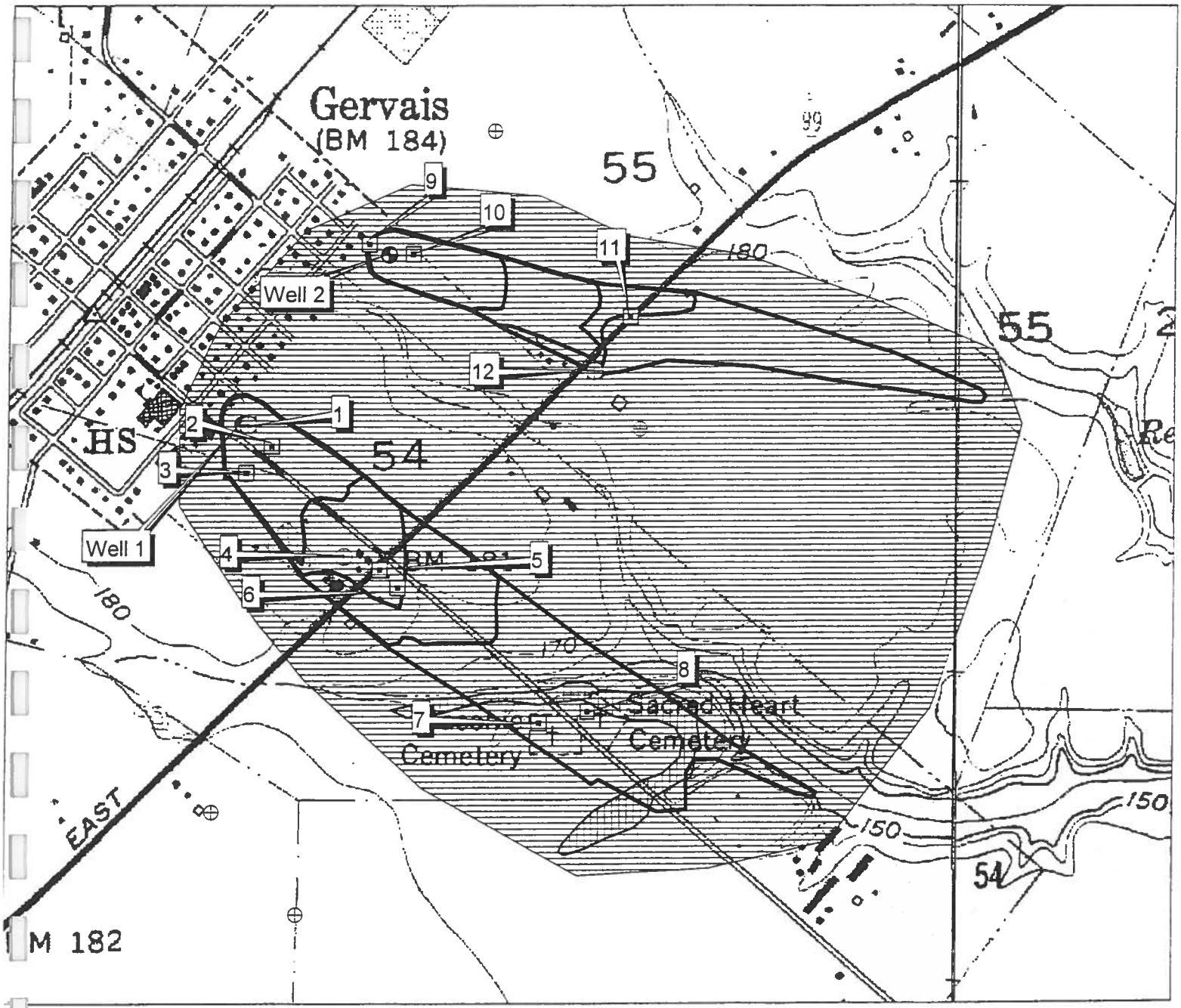
1.1 Introduction and Overview

Traditionally, water systems have relied on proper water system management, water quality monitoring and, if necessary, water treatment to ensure that the water they serve meets drinking water standards. In spite of the best of these efforts, contamination of drinking water still occurs. The costs, both tangible and intangible, to a water system contending with a contaminated water supply are significant. At minimum, there is the cost of increased monitoring that will be required to make certain that the water does not pose a significant health risk. At contaminant concentrations exceeding a drinking water standard, the system may be dealing with the cost of installing and maintaining treatment, the loss of the drinking water source, i.e., a well, and most assuredly, a concerned and often frightened public.

Beginning with the 1986 Amendments to the Safe Drinking Water Act, an additional "barrier to contamination" was recognized at the federal level. A shift from the "reactive" approach of water treatment to a "proactive" approach of prevention began to take place. Although water

City of Gervais Susceptibility Map

Figure 4



rinking Water Protection Area (DWPA) with 1-, 2-, 5- and 10-year time-of-travel for roundwater to move in the aquifer to the well.

otential Contaminant Source Legend

- ⊕ Higher
- ⊡ Moderate
- ◬ Lower

ensitivity Patterns:
Horizontal ruled: moderate
Cross-Hatched: high
No pattern: not determined

Note: Sites and areas noted in this figure are potential sources of contamination to the drinking water identified by Oregon drinking water protection staff. Environmental contamination is not likely to occur when chemicals are used and managed properly.

Features or activities that are identified as high- or moderate-risk that occur within an area designated as high or moderate sensitivity pose a greater risk to drinking water quality than those in areas of low sensitivity

Numbers indicate potential contaminant sources which are explained in Table 2

N

QUADRANGLE LOCATION

APPENDIX C - INVENTORY OF POTENTIAL CONTAMINANT SOURCES
GERVAIS WATER DEPARTMENT - PWS # 4100319
OREGON SOURCE WATER ASSESSMENT

Inventory Results

Table 1. Summary of Potential Contaminant Sources by Land Use

Table 2. Inventory Results - List of Potential Contaminant Sources

Table 3. Results of Regulatory Database Search

Notes for Tables:

Sites and areas identified in these Tables are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

Total number of sources listed in Table 1 in the DWPA may not add up to the total number of potential contaminants sources in Table 2 because more than one type of potential contaminant source may be present at any given facility.

Data collected by Christopher Blakeman Oregon DEQ on 9/26/2001.

Acronyms:

AST - Aboveground Storage Tank
DC - DEQ's Dry Cleaner database
DEQ - Oregon Department of Environmental Quality
DWPA - Drinking Water Protection Area
ECSI - DEQ's Environmental Cleanup Site Information database
HWIMSY - DEQ's Hazardous Waste Information Management System database
LUST - DEQ's Leaking Underground Storage Tank database
NPDES - National Pollution Discharge Elimination System
PCS - Potential Contaminant Source
PWS - Public Water System
SFM - State Fire Marshall's database of hazardous materials
SIS - DEQ's Source Information System database (includes WPCF & NPDES permits)
SWMS - DEQ's Solid Waste Management System database
UST - DEQ's Underground Storage Tank database or Underground Storage Tank
WPCF - Water Pollution Control Facility
WRD - Oregon Water Resources Division database for water rights information

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100319 GERVAIS WATER DEPARTMENT

Residential/Municipal Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Airport - Maintenance/Fueling Area		Higher	0
Apartments and Condominiums		Lower	0
Campgrounds/RV Parks	(1)	Lower	0
Cemeteries - Pre-1945		Moderate	2
Drinking Water Treatment Plants		Moderate	1
Fire Station		Lower	0
Fire Training Facilities		Moderate	0
Golf Courses		Moderate	0
Housing - High Density (> 1 House/0.5 acres)		Moderate	2
Landfill/Dumps	(1)	Higher	0
Lawn Care - Highly Maintained Areas		Moderate	0
Motor Pools		Moderate	0
Parks		Moderate	0
Railroad Yards/Maintenance/Fueling Areas		Higher	0
Schools		Lower	1
Septic Systems - High Density (> 1 system/acre)	(1)	Higher	0
Sewer Lines - Close Proximity to PWS	(1)	Higher	0
Utility Stations - Maintenance Transformer Storage		Higher	0
Waste Transfer/Recycling Stations	(1)	Moderate	1
Wastewater Treatment Plants/Collection Stations	(1)	Moderate	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100319 GERVAIS WATER DEPARTMENT

Commercial/Industrial Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Automobiles - Body Shops		Higher	0
Automobiles - Car Washes		Moderate	0
Automobiles - Gas Stations		Higher	0
Automobiles - Repair Shops		Higher	1
Boat Services/Repair/Refinishing		Higher	0
Cement/Concrete Plants		Moderate	0
Chemical/Petroleum Processing/Storage		Higher	2
Dry Cleaners		Higher	0
Electrical/Electronic Manufacturing		Higher	0
Fleet/Trucking/Bus Terminals		Higher	2
Food Processing		Moderate	0
Furniture/Lumber/Parts Stores		Moderate	0
Home Manufacturing		Higher	0
Junk/Scrap/Salvage Yards		Higher	0
Machine Shops		Higher	0
Medical/Vet Offices	(1)	Moderate	0
Metal Plating/Finishing/Fabrication		Higher	0
Mines/Gravel Pits		Higher	0
Office Buildings/Complexes		Lower	0
Parking Lots/Malls (> 50 Spaces)		Higher	2
Photo Processing/Printing		Higher	0
Plastics/Synthetics Producer		Higher	1
Research Laboratories		Higher	0
RV/Mini Storage		Lower	0
Wood Preserving/Treating		Higher	0
Wood/Pulp/Paper Processing and Mills		Higher	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water.
Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100319 GERVAIS WATER DEPARTMENT

Agricultural/Forest Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Auction Lots	(1)	Higher	0
Boarding Stables	(1)	Moderate	0
Confined Animal Feeding Operations (CAFOs)	(1)	Higher	0
Crops - Irrigated (inc. orchards, vineyards, nurseries, greenhouses)	(2)	Moderate	3
Crops - Nonirrigated (inc. Christmas trees, grains, grass seed, pasture)		Lower	0
Farm Machinery Repair		Higher	0
Grazing Animals (> 5 large animals or equivalent/acre)	(1)	Moderate	0
Lagoons/Liquid Wastes	(1)	Higher	0
Land Application Sites	(1)	Moderate	0
Managed Forest Land - Broadcast Fertilized Areas		Lower	0
Managed Forest Land - Clearcut Harvest (< 35 yrs.)		Moderate	0
Managed Forest Land - Partial Harvest (< 10 yrs.)		Moderate	0
Managed Forest Land - Road Density (> 2 mi./sq. mi.)		Moderate	0
Pesticide/Fertilizer/Petroleum Storage, Handling, Mixing, & Cleaning Ar		Higher	1
Recent Burn Areas (< 10 yrs.)		Lower	0
Managed Forest Lands - Status Unknown		Moderate	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water.
Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100319 GERVAIS WATER DEPARTMENT

Miscellaneous Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Above Ground Storage Tanks - Excluding Water		Moderate	0
Channel Alterations - Heavy		Lower	0
Combined Sewer Outfalls	(1)	Lower	0
Stormwater Outfalls	(1)	Lower	0
Composting Facilities	(1)	Moderate	0
Historic Gas Stations		Higher	0
Historic Waste Dumps/Landfills	(1)	Higher	0
Homesteads - Rural - Machine Shops/Equipment Maintenance		Higher	0
Homesteads - Rural - Septic Systems (< 1/acre)	(1)(3)	Lower	0
Injection/Dry Wells, Sumps - Class V UICs	(1)	Higher	0
Kennels (> 20 Pens)	(1)	Lower	0
Military Installations		Higher	0
Random Dump Sites		Moderate	0
River Recreation - Heavy Use (inc. campgrounds)	(1)	Lower	0
Sludge Disposal Areas	(1)	Moderate	0
Stormwater Retention Basins	(1)	Moderate	0
Transmission Lines - Right-of-Ways		Lower	0
Transportation - Freeways/State Highways/Other Heavy Use Roads		Moderate	2
Transportation - Railroads		Moderate	0
Transportation - Right-Of-Ways - Herbicide Use Areas		Moderate	0
Transportation - River Traffic - Heavy		Lower	0
Transportation - Stream Crossing - Perennial		Lower	0
UST - Confirmed Leaking Tanks - DEQ List		Higher	0
UST - Decommissioned/Inactive		Lower	0
UST - Nonregulated Tanks (< 1,100 gals or Large Heating Oil Tanks)		Higher	0
UST - Not Upgraded and/or Registered Tanks		Higher	0
UST - Upgraded/Registered - Active		Lower	0
UST - Status Unknown		Higher	2
Upstream Reservoirs/Dams		Lower	0
Wells/Abandoned Wells		Higher	0
Large Capacity Septic Systems (serves > 20 people) - Class V UICs	(1)	Higher	0
Construction/Demolition Areas		Moderate	0
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water.
Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 2. INVENTORY RESULTS - LIST OF POTENTIAL CONTAMINANT SOURCES

PWS# 4100319 GERVAIS WATER DEPARTMENT

Reference No. (See Figure)	Potential Contaminant Source Type	Name	Approximate Location	City	Method for Listing	Proximity to Sensitive Areas	Relative Risk Level (1)	Potential Impacts	Comments
1	Chemical/Petroleum Processing/Storage	City of Gervais - Public Works & Drinking Water Plant	Surrounding S wellhead	Gervais	Field-Observation	Within the 2-yr TOT.	Higher	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	No apparent database listing. Windshield survey completed only - PWS did not participate in inventory.
	Fleet/Trucking/Bus Terminals - City motor pool						Higher	Spills, leaks, or improper handling of fuels, grease, solvents, and other materials from vehicle service, fueling, and parking areas may impact the drinking water supply.	No apparent database listing. Windshield survey completed only - PWS did not participate in inventory.
	Parking Lots/Malls (> 50 Spaces)						Higher	Spills and leaks of automotive fluids in parking lots may impact the drinking water supply.	No apparent database listing. Windshield survey completed only - PWS did not participate in inventory.
	Drinking Water Treatment Plants						Moderate	Treatment chemicals and equipment maintenance materials may impact groundwater or surface water source.	No apparent database listing. Windshield survey completed only - PWS did not participate in inventory.
	Automobiles - Repair Shops						Higher	Spills, leaks, or improper handling of automotive fluids, solvents, and repair materials during transportation, use, storage and disposal may impact the drinking water supply.	No apparent database listing. Windshield survey completed only - PWS did not participate in inventory.
2	Housing - High Density (> 1 House/0.5 acres)	Private residential area	N side of St. Louis Rd.	Gervais	Field-Observation	Within the 2-yr TOT.	Moderate	Improper use, storage, and disposal of household chemicals may impact the drinking water supply. Stormwater run-off or infiltration may carry contaminants to drinking water supply.	

Note: Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

(1) Where multiple potential contaminant sources exist at a site, the highest level of risk is used.

(2) See Table 3 for database listings (if necessary).

TABLE 2. INVENTORY RESULTS - LIST OF POTENTIAL CONTAMINANT SOURCES

PWS# 4100319 GERVAIS WATER DEPARTMENT

Reference No. (See Figure)	Potential Contaminant Source Type	Name	Approximate Location	City	Method for Listing	Proximity to Sensitive Areas	Relative Risk Level (1)	Potential Impacts	Comments
3	Parking Lots/Malls (> 50 Spaces)	Gervais High School	S side of St. Louis Rd, W of Hwy 99E	Gervais	Database (2) Field-Observation	Within the 2-yr TOT.	Higher	Spills and leaks of automotive fluids in parking lots may impact the drinking water supply.	
	UST - Status Unknown						Higher	Spills, leaks, or improper handling of stored materials may impact the drinking water supply.	
	Schools						Lower	Over-application or improper handling of cleaning products, pesticides or fertilizers used on the school grounds may impact drinking water. Vehicle maintenance wastes may contribute contaminants.	
	Waste Transfer/Recycling Stations						Moderate	Improper management of water contacting waste material may impact the drinking water supply.	
4	Plastics/Synthetics Producer	Fiber Fab	W corner of Hwy 99E and St. Louis Rd.	Gervais	Database (2) Field-Observation	Within the 2-yr TOT.	Higher	Spills, leaks, or improper handling of solvents and resins during transportation, use, storage and disposal may impact the drinking water supply.	
	Fleet/Trucking/Bus Terminals						Higher	Spills, leaks, or improper handling of fuels, grease, solvents, and other materials from vehicle service, fueling, and parking areas may impact the drinking water supply.	
	UST - Status Unknown						Higher	Spills, leaks, or improper handling of stored materials may impact the drinking water supply.	
	Chemical/Petroleum Processing/Storage						Higher	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	

Note: Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

(1) Where multiple potential contaminant sources exist at a site, the highest level of risk is used.

(2) See Table 3 for database listings (if necessary).

TABLE 2. INVENTORY RESULTS - LIST OF POTENTIAL CONTAMINANT SOURCES

PWS# 4100319 GERVAIS WATER DEPARTMENT

Reference No. (See Figure)	Potential Contaminant Source Type	Name	Approximate Location	City	Method for Listing	Proximity to Sensitive Areas	Relative Risk Level (1)	Potential Impacts	Comments
5	Transportation - Freeways/State Highways/Other Heavy Use Roads	State Highway 99E	Across DWPA	Gervais	Field-Observation	Within the 2-yr TOT.	Moderate	Vehicle use increases the risk for leaks or spills of fuel & other haz. materials. Road building, maintenance & use can increase erosion/slope failure causing turbidity. Over-application or improper handling of pesticides/fertilizers may impact water.	
6	Crops - Irrigated (inc. orchards, vineyards, nurseries, greenhouses)	Irrigated Agricultural Fields	Both sides of St. Louis Rd., E of Hwy 99E	Gervais	Field-Observation	Within the 2-yr TOT.	Moderate	Over-application or improper handling of pesticides/fertilizers may impact drinking water. Excessive irrigation may transport contaminants or sediments to groundwater/surface water through runoff. Drip-irrigated crops are considered to be a low risk.	
7	Cemeteries - Pre-1945	Masonic Cemetery	S side of St. Louis Rd., near end of DWPA	Gervais	Field-Observation	Between 5-yr and 10-yr TOT	Moderate	Embalming fluids (for example, arsenic) and decomposition by-products may impact drinking water supply.	
8	Cemeteries - Pre-1945	Sacred Heart Cemetery	N side of St. Louis Rd., near end of DWPA	Gervais	Field-Observation	Between 5-yr and 10-yr TOT	Moderate	Embalming fluids (for example, arsenic) and decomposition by-products may impact drinking water supply.	
9	Housing - High Density (> 1 House/0.5 acres)	Residential Area	Just W of N wellhead	Gervais	Field-Observation	Within the 2-yr TOT.	Moderate	Improper use, storage, and disposal of household chemicals may impact the drinking water supply. Stormwater run-off or infiltration may carry contaminants to drinking water supply.	
10	Crops - Irrigated (inc. orchards, vineyards, nurseries, greenhouses)	Irrigated Agricultural Fields	E of fenced area around wellhead	Gervais	Field-Observation	Within the 2-yr TOT.	Moderate	Over-application or improper handling of pesticides/fertilizers may impact drinking water. Excessive irrigation may transport contaminants or sediments to groundwater/surface water through runoff. Drip-irrigated crops are considered to be a low risk.	

Note: Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

(1) Where multiple potential contaminant sources exist at a site, the highest level of risk is used.

(2) See Table 3 for database listings (if necessary).

TABLE 2. INVENTORY RESULTS - LIST OF POTENTIAL CONTAMINANT SOURCES

PWS# 4100319 GERVAIS WATER DEPARTMENT

Reference No. (See Figure)	Potential Contaminant Source Type	Name	Approximate Location	City	Method for Listing	Proximity to Sensitive Areas	Relative Risk Level (1)	Potential Impacts	Comments
11	Transportation - Freeways/State Highways/Other Heavy Use Roads	State Highway 99E	Across DWPA	Gervais	Field-Observation	Between 2-yr and 5-yr TOT	Moderate	Vehicle use increases the risk for leaks or spills of fuel & other haz. materials. Road building, maintenance & use can increase erosion/slope failure causing turbidity. Over-application or improper handling of pesticides/fertilizers may impact water.	
12	Pesticide/Fertilizer/Petroleum Storage, Handling, Mixing, & Cleaning Areas	Tree Nursery - un-named	E side of Hwy 99E	Gervais	Field-Observation	Between 2-yr and 5-yr TOT	Higher	Leaks, spills and improper handling of pesticides, fertilizers and petroleum products may impact drinking water source.	
	Crops - Irrigated (inc. orchards, vineyards, nurseries, greenhouses)						Moderate	Over-application or improper handling of pesticides/fertilizers may impact drinking water. Excessive irrigation may transport contaminants or sediments to groundwater/surface water through runoff. Drip-irrigated crops are considered to be a low risk.	

Note: Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

(1) Where multiple potential contaminant sources exist at a site, the highest level of risk is used.

(2) See Table 3 for database listings (if necessary).

TABLE 3. RESULTS OF REGULATORY DATABASE SEARCH

PWS# 4100319 GERVAIS WATER DEPARTMENT

Reference No. (1)	Name	Database Listings (2)
3	Gervais High School	SFM - Paint stored in Can
		SFM - Propane stored in Cylinder
		SFM - Various Chemicals stored in Glass Bottles Or Jugs
		UST list-PWS needs to verify tank permit status
		SFM - Gasoline stored in Steel Drum
4	Fiber Fab	SFM - Bath Brite stored in Plastic Bottles Or Jugs
		HWIMSY list as a conditionally exempt generator.
		SFM - Acetone stored in Aboveground Tank
		UST list-PWS needs to verify tank permit status
		SFM - Catalyst Mekp stored in Plastic Bottles Or Jugs
		SFM - Gel Coat stored in Can
		SFM - Gypsum stored in Bag
		SFM - Magnum Core 7315 stored in Steel Drum
		SFM - Polyester Resin stored in Aboveground Tank
		SFM - Unsaturated Polyester Resin stored in Steel Drum
		LUST list with unknown status

Notes: (1) See Table 2 and Figure. (2) For State Fire Marshals (SFM) list, information on materials in a gaseous-form is not presented since gaseous compounds rarely pose a threat to groundwater or surface water.

Appendix F: Sensitivity Summary: City of Gervais, Well 1

Highly Sensitive Source: ☐ Yes ☒ No

Yes	No	
☐	☒	Unconfined Aquifer: Shallow (< 100 Ft), No significant clay layers
☐	☒	Unconfined Aquifer: Cobbles/gravel
☐	☒	Unconfined Aquifer: Fractured bedrock
☐	☒	Fractured Confined Aquifer <50 feet Below the Surface .....
☐	☒	Other Aquifer (describe: .....
☐	☒	Organic Chemical Detection .....
☐	☒	Inorganic Chemical Detection (>50% MCL) .....
☐	☒	Source-related Coliform: total ..... fecal ..... Date .....
☐	☒	Nitrate-N≥ 5mg/L: Concentration ..... Date .....
☐	☒	Well Construction/Setback or Monitoring Deficiencies from Site Visit: .....
		.....
☐	☒	Well Report Missing/Unavailable
☐	☒	Casing Seal Missing/Unknown
☐	☒	Inappropriate Casing Seal Depth (depth recommendation: .....)
☐	☒	Inappropriate Casing Seal Material
☐	☒	Casing Seal Not Constructed Properly:.....
☐	☒	Traverse Potential >5 (Not performed on TNCWS)
☐	☒	Infiltration Potential >7 (Not performed on TNCWS)

Moderately Sensitive Source: ☒ Yes ☐ No

Yes	No	
☐	☒	Shallow (<50 feet) Confined Alluvial Aquifer and Thin (<15ft) Confining Unit
☐	☒	Deep Unconfined Aquifer
☐	☒	Fractured Bedrock at Surface
☐	☒	Aquifer Character unknown
☐	☒	Commingling of Aquifers Suspected
☐	☒	Nitrate-N 1-4.9 mg/L: Concentration ..... Date .....
☐	☒	Inorganic Chemical Detection (<50% of MCL) .....
☐	☒	Well Construction Deficiencies from Site Visit.....
☐	☒	Well constructed prior to 1979
☐	☒	Other Wells Score ≥ 400
☒	☐	Soil with TOT <65 hours or lack of soil information in DWPA
☒	☐	Infiltration Potential 4 to ≤ 7 (Not performed on TNCWS)
☐	☒	Surface water within 500 feet

1. Note that it is possible for a single system to have criteria from both the high and moderately sensitive lists. Having a criterion checked "yes" indicates that this characteristic contributes to the sensitivity at the indicated level.

Additional Comments Sodium between 20 and 25 mg/L .....
.....

Sensitivity Analysis Completed by: Dennis Nelson ..... **Date:** 3/15/02 .....

Appendix F: Sensitivity Summary: City of Gervais, Well 2

Highly Sensitive Source: ☐ Yes ☒ No

Yes	No	
☐	☒	Unconfined Aquifer: Shallow (< 100 Ft), No significant clay layers
☐	☒	Unconfined Aquifer: Cobbles/gravel
☐	☒	Unconfined Aquifer: Fractured bedrock
☐	☒	Fractured Confined Aquifer <50 feet Below the Surface
☐	☒	Other Aquifer (describe: . . . . .
☐	☒	Organic Chemical Detection . . . . .
☐	☒	Inorganic Chemical Detection (>50% MCL) . . . . .
☐	☒	Source-related Coliform: total . . . . . fecal . . . . . Date . . . . .
☐	☒	Nitrate-N≥ 5mg/L: Concentration . . . . . Date . . . . .
☐	☒	Well Construction/Setback or Monitoring Deficiencies from Site Visit: . . . . .
		. . . . .
☐	☒	Well Report Missing/Unavailable
☐	☒	Casing Seal Missing/Unknown
☐	☒	Inappropriate Casing Seal Depth (depth recommendation: . . . . .)
☐	☒	Inappropriate Casing Seal Material
☐	☒	Casing Seal Not Constructed Properly:. . . . .
☐	☒	Traverse Potential >5 (Not performed on TNCWS)
☐	☒	Infiltration Potential >7 (Not performed on TNCWS)

Moderately Sensitive Source: ☒ Yes ☐ No

Yes	No	
☐	☒	Shallow (<50 feet) Confined Alluvial Aquifer and Thin (<15ft) Confining Unit
☐	☒	Deep Unconfined Aquifer
☐	☒	Fractured Bedrock at Surface
☐	☒	Aquifer Character unknown
☐	☒	Commingling of Aquifers Suspected
☐	☒	Nitrate-N 1-4.9 mg/L: Concentration . . . . . Date . . . . .
☐	☒	Inorganic Chemical Detection (<50% of MCL) . . . . .
☐	☒	Well Construction Deficiencies from Site Visit. . . . .
☐	☒	Well constructed prior to 1979
☐	☒	Other Wells Score ≥ 400
☐	☒	Soil with TOT <65 hours or lack of soil information in DWPA
☒	☐	Infiltration Potential 4 to ≤ 7 (Not performed on TNCWS)
☐	☒	Surface water within 500 feet

1. Note that it is possible for a single system to have criteria from both the high and moderately sensitive lists. Having a criterion checked "yes" indicates that this characteristic contributes to the sensitivity at the indicated level.

Additional Comments Sodium concentrations between 20 and 25 mg/L . . . . . .

Sensitivity Analysis Completed by: Dennis Nelson . . . . . **Date:** 3/15/02 . . . . . .

Water Master Plan

Appendix B. Well Logs

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

(START CARD) # 7905

(1) OWNER: Well Number: 1

Name: City of Cervais

Address: P.O. Box 348

City: Cervais State: OR Zip: 97026

(2) TYPE OF WORK:

☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Other: reverse circulation-rotary

(4) PROPOSED USE:

☐ Domestic ☒ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval: Yes ☐ No ☒ Depth of Completed Well: 257 ft.

Explosives used: Yes ☐ No ☒ Type: Amount:

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
17	0	265	cement	0	30	42 sacks
			cement	~196	216	(X) sacks
			*cement	~257	263	5 sacks
			*inside 10" casing-			placed by dump bailer

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E

☐ Other

Backfill placed from 30 ft. to ~196 ft. Material: sand, peagrvl & bent

Gravel placed from 216 ft. to 265 ft. Size of gravel: 1/4 - 3/8

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	10	+1.5	263.7	.250	☒	☐	☒	☐
	except at screens				☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s):

(7) PERFORATIONS/SCREENS:

☐ Perforations Method:

☒ Screens Type: v-shape wire Material: 304SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
220.6	240.6	150	coor	10	P.S.	☐	☐
245.5	254.5	150	coor	10	P.S.	☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

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

☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
See attached graphs (3)			1 hr.

Temperature of water: ~55 ° F Depth Artesian Flow Found:

Was a water analysis done? x☒ Yes By whom: ~~Interlab~~ & WR&R lab

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: Marion Latitude: ° ' " Longitude: ° ' "

Township: 5S N or S, Range: 2W E or W, WM.

Section: 26 ¼ ¼ of SE ¼

Tax Lot: Lot: Block: Subdivision:

Street Address of Well (or nearest address):

(10) STATIC WATER LEVEL:

54.6 ft. below land surface. Date: 7/3/89

Artesian pressure: 250 lb. per square inch. Date:

(11) WATER BEARING ZONES:

Depth at which water was first found: Indeterminate

From	To	Estimated Flow Rate	SWL
All sand & gravel formations below SWL are			
probably water bearing.			
screened intervals	see (8)		see(10)

(12) WELL LOG: Ground elevation: approx 181

Material	From	To	SWL
~~See attached log~~			
~~W0032.GFR~~			

Date started: 5/19/89 Completed: 8-2-89

(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 well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed: [signature] WWC Number: 1367

Date: 8-2-89

(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 well construction standards. This report is true to the best of my knowledge and belief.

Signed: [signature] WWC Number: 669

Date: 8-2-89

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

SEI 8918 9/88C 3/88

City of Gervais
Well #1
by Schneider Drilling Co. - 1989

0	2	Top soil
2	24	Clay, brown & grey, silty soft
24	25	Sand, grey med. fine
25	52	Clay, grey, silty soft
52	54	Sand, grey fine
54	69	Clay, grey, silty soft
69	84	Sand, multi-color, med, some cem
84	90	Clay, grey, med
90	106	Clay, green & gray, soft
106	113	Gravel, 2" minus
113	115	Clay, grey, soft
115	135	Gravel, 2" minus, some sand, med
165	146	Gravel, 4" minus, some sand, med
146	152	Clay, grey, silty
152	163	Sand, black, med
163	181	Clay, green, med
181	191	Sand, black, med
191	198	Clay, grey & brown w/ wood
198	212	Clay, blue, med
212	214	Sand, black, cemented, some clay
214	220	Clay, dark grey, med, dry
220	240	Gravel, 4" minus w/ little clay
240	245	Clay, grey, med
245	254	Gravel. 4" minus w/ sand & clay
254	265	Clay, grey, med

WELL BORE LOG

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

(START CARD) # 7906

(1) OWNER: Well Number: 2

Name City of Cervais

Address P.O. Box 348

City Cervais State OR Zip 97026

(2) TYPE OF WORK:

☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Other reverse circulation rotary

(4) PROPOSED USE:

☐ Domestic ☒ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☒ Depth of Completed Well 268 ft.

Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
17	0	220	cement	0	30	45 sacks
15	220	279	cement	~190	210	20 sacks
			* cement	268	272	3 sacks

* inside 10" casing placed by dump bailer

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E

☐ Other

Backfill placed from 30 ft. to ~190 ft. Material sand, pengryl & bent

Gravel placed from 210 ft. to 272 ft. Size of gravel C.S.S.T. #8-16

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	10	+2	272	.250	☒	☐	☒	☐
	except at screens				☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☒ Screens Type V-shape wire Material 304SS

From	To	Slot size	Number	Diameter	WRD Tele/pipe size	Casing	Liner
222	236	.050	cont	10	P.S.	☐	☐
246	262	.050	cont	10	P.S.	☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

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

☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
see attached graphs (3)			1 hr.

Temperature of water ~55 °F Depth Artesian Flow Found

Was a water analysis done? ☒ Yes By whom Waterlab & WF & R Lab

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 Marion Latitude ' " Longitude ' "

Township 5S N or S, Range 2W E or W, WM.

Section 26 SE ¼ of NE ¼

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:

58.5 ft. below land surface. Date 7/20/89

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found indeterminate

From	To	Estimated Flow Rate	SWL
all sand & gravel formations below SWL are probably water bearing.			
screened intervals	see(8)		see(10)

(12) WELL LOG: Ground elevation Approx 181'

Material	From	To	SWL
see attached log			

Date started 6/7/89 Completed 7/24/89

(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 well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number 1367

Signed Date 7/28/89

(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 well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 649

Signed Date 7/24/89

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

SET 8919

WRDC 3/86

City of Gervais
Well #2
By Schneider Drilling Co. - 1989

0-2	Top soil
2-15	Clay, brown, silty
15-46	Clay, grey, silty
46-62	Clay, grey, soft, little silty
62-69	Clay, dark grey, soft, silty
69-78	Sand, black, med-fine & some gravel, small
78-92	Clay, grey, soft, silty
92-94	Clay, brown, soft, silty
94-100	Clay, grey, med-soft, silty
100-103	Sand & gravel, brown
103-104	Clay, brown, sandy
104-106	Sand, brown, med & some gravel
106-132	Gravel, 3"-, brown, & sand, med, brown
132-142	Gravel, 5"-, brown & sand, brown, med
142-153	Clay, grey, med
153-161	Sand, black, med
161-174	Clay, grey, med
174-178	Sand, black, med
178-180	Clay, dark grey, med, little sandy
180-187	Sand, black, med-fine
187-199	Clay, brown, med
199-204	Clay, blue-green, med
204-211	Clay, grey, med-soft
211-219	Clay, grey, med-soft, sandy
219-221	Gravel, 4"- & sand, black, med w/clay, grey
221-236	Gravel, 4"- w/some sand, med
236-246	Clay, grey, med, sandy
246-247	Sand, black, med, cementation
247-265	Gravel, 4"- & some sand, cementation
265-269	Sand, black, med-fine
269-279	Clay, grey, soft

WELL BORE LOG

Water Master Plan

Appendix C. Oregon Health Authority Water Quality Records

Oregon Public Health
Drinking Water Data Online

Oregon Health Authority

PWS ID: 00319 ---- GERVAIS WATER DEPARTMENT

For questions regarding these violations contact: MARION COUNTY --- Greg DeBlase/Alisa Zastoupil ---- (503) 588-5407

Violations are displayed for the last 5 years only.
Group Abbreviations: TCR = Total Coliform Rule
Gray shading indicates return to compliance.

Hide Auto-RTC | Show Determination Dates

Click here to see public notices.

Violation History

Violation Number	Auto-RTC?	Monitoring Period Begin	Monitoring Period End	Facility ID	Analyte Group	Violation Type - Analyte Count *Show analytes for all violations*	Enforcement Action - Date *Show history*	Points
900532807	*Y*	*Dec 01, 2014*	*Dec 31, 2014*		*TCR*	*Routine Coliform - Did Not Report Enough - 1*	*Returned To Compliance - Jan 27, 2015*	*1*

SYSTEM SCORE SUMMARY

Unaddressed Points:	0
Number of years the oldest violation has been unaddressed (*n*):	0
System Score:	0
Points under formal enforcement:	0
Points RTC'd:	1

For all compliance errors, please contact Chuck Michael, DWS Compliance Specialist, at 971-673-0420.

Click here for more information on system scores and how they are calculated, including the point values of specific violations.

Violation history last updated 02/26/2019, 3 hours ago.

For further information on this public water system, click on the area of interest below:

System Info :: Report for Lenders :: Alerts :: Violations :: Compliance & Enforcement :: Contacts & Advisories :: Site Visits :: Public Notice
Coliform Summary :: Coliform Results :: Sampling Schedule for Coliform :: Groundwater/GWUDI Source Details :: Plan Review
Chemical Group Summary :: Latest Chemical Results :: Entry Point Detects :: Single Analyte Results
Chemical Schedule Summary :: Chemical Schedule Details
Lead & Copper :: Corrosion Control (LCR) :: Nitrate :: Arsenic :: Radionuclides :: GWR 4-Log :: LT2 :: Cyanotoxins
DBPs :: TOC & Alkalinity :: DBP Sample Sites :: FANLs :: MRDL :: Turbidity :: SWTR :: RAA :: LRAA

PWS ID: 00319 ---- GERVAIS WATER DEPARTMENT

Alerts indicate water quality tests with analytical results greater than the detection limit or one-half of the maximum allowable contaminant level which may require some follow-up actions by the Drinking Water Services. See the Contacts link for reports on follow-up actions. Alerts are not water quality violations. Violations for this water system can be found here

Results: 4 alerts found for this water system. Show response time

Water Quality Alerts

Alert ID	Sample Date	Alert Date	Source ID	Source Name	Alert Type	Contaminant	Result	Alert Level	MCL	Contact Report
CHEM7270	07/20/2016	09/01/2016	EP-A	EP FOR WELLS #1 & #2	SODIUM*	SODIUM	23.5	20		
COLI2892	03/14/2006	03/16/2006	DIST-A	Distribution System	COLI	COLIFORM, TOTAL (TCR)	Present	Present	Present	
COLI2891	03/10/2006	03/13/2006	DIST-A	Distribution System	COLI	COLIFORM, TOTAL (TCR)	Present	Present	Present	
CHEM104	06/25/2002	10/02/2002	EP-A	EP FOR WELLS #1 & #2	SODIUM*	SODIUM	21.5	20		

Non-alert (water quality notice)

Archived Alerts (SWS database)

Date	Source	Chemical	Results mg/l	MCL mg/l
04/11/1996	A--EP FOR WELLS #1 & #2	Sodium	21.3	
03/24/1993	A--EP FOR WELLS #1 & #2	Sodium	26.7	
03/04/1992	AA--WELL #1 (DOUGLAS AVENUE)03/92	Sodium	21.1	

Excel Spreadsheet

PWS ID: 00319 ---- GERVAIS WATER DEPARTMENT

MCL = 0.010 mg/L; MCL exceedances are indicated with red text.
ND = Not detected at the minimum reporting level.

Arsenic Samples

Sample ID	Sample Date	Date Received	Source Name	Source ID	Result (mg/L)	Comments
20160720036-I	07/20/2016	08/30/2016	EP FOR WELLS #1 & #2	EP-A	0.0051	
131029-I	03/14/2013	03/22/2013	EP FOR WELLS #1 & #2	EP-A	0.004	
294328-I	08/28/2009	09/04/2009	EP FOR WELLS #1 & #2	EP-A	ND	
252128	06/09/2005	06/20/2005	EP FOR WELLS #1 & #2	EP-A	ND	
20020625-016I	06/25/2002	08/28/2002	EP FOR WELLS #1 & #2	EP-A	0.0098	

Archived Arsenic Samples

Sample ID	Sample Date	Date Received	Source Name	Source ID	Result
990915041	09/15/1999	11/15/1999	EP FOR WELLS #1 & #2	A	ND
960411-006	04/11/1996	06/03/1996	EP FOR WELLS #1 & #2	A	ND
930324-063	03/24/1993	04/03/1995	EP FOR WELLS #1 & #2	A	ND
-1978055	03/04/1992	05/13/1992	WELL #1 (DOUGLAS AVENUE)03/92	AA	ND
-1978015	03/04/1992	05/13/1992	WELL #2 (JUNIPER AVENUE)03/92	AB	ND
-1978056	03/06/1989	04/24/1989	WELL #1 (DOUGLAS AVENUE)03/92	AA	ND
-1978016	03/06/1989	04/24/1989	WELL #2 (JUNIPER AVENUE)03/92	AB	ND
-1978057	11/01/1985	11/01/1985	WELL #1 (DOUGLAS AVENUE)03/92	AA	ND

Oregon Public Health
Drinking Water Data Online

Introduction :: Data Search Options :: WS Name Look Up :: WS ID Look Up :: DWS Home :: DWS Rules :: Quick Data Links

Coliform Fact Sheet :: Spreadsheet :: MRDL Summary

Sample Types: AS=Assessment, CO=Confirmation, MU=Make-up, RP=Repeat, RT=Routine, SP=Special, TG=Triggered. Show special samples

Recent Coliform Test Results - PWS ID: 00319 ---- GERVAIS WATER DEPARTMENT

Sample Date	# Samples	Sample Type	Coliform Type	Results ID	Repeat of Sample ID	Sample Site	Facility	Cl Residual	Receive Date
Feb 05, 2019	1	RT	Total	Absent--20190205053		115 DOUGLAS SINK	DIST-A	0.20	Feb 13, 2019
Jan 22, 2019	1	RT	Total	Absent--20190122060		115 DOUGLAS AVE SIN	DIST-A	0.20	Jan 29, 2019
Jan 08, 2019	1	RT	Total	Absent--20190108060		115 DOUGLAS AVE SIN	DIST-A	0.20	Jan 14, 2019
Dec 26, 2018	1	RT	Total	Absent--20181226030		592 4TH ST SINK	DIST-A	0.20	Dec 28, 2018
Dec 11, 2018	1	RT	Total	Absent--20181211046		115 DOUGLAS AVE	DIST-A	0.20	Dec 13, 2018
Nov 27, 2018	1	RT	Total	Absent--20181127035		592 4TH ST SINK	DIST-A	0.20	Dec 05, 2018
Nov 13, 2018	1	RT	Total	Absent--20181113041		115 DOUGLAS AVE	DIST-A	0.20	Nov 20, 2018
Oct 16, 2018	1	RT	Total	Absent--20181016033		592 4TH ST	DIST-A	0.20	Oct 23, 2018
Oct 02, 2018	1	RT	Total	Absent--20181002050		115 DOUGLAS AVE SINK	DIST-A	0.20	Oct 08, 2018
Sep 18, 2018	1	RT	Total	Absent--20180918078		592 4TH ST SINK	DIST-A	0.20	Sep 25, 2018
Sep 04, 2018	1	RT	Total	Absent--20180904085		115 DOUGLAS AVE	DIST-A	0.10	Sep 13, 2018
Aug 21, 2018	1	RT	Total	Absent--20180821049		592 4TH ST	DIST-A	0.10	Aug 31, 2018
Aug 07, 2018	1	RT	Total	Absent--20180807106		115 DOUGLAS AVE	DIST-A	0.10	Aug 15, 2018
Jul 24, 2018	1	RT	Total	Absent--20180724060		592 4TH ST SINK	DIST-A	0.10	Jul 26, 2018
Jul 24, 2018	1	AS	Total	Absent--20180724059		WELL 1	SRC-AA		Jul 26, 2018
Jul 24, 2018	1	AS	Total	Absent--20180724058		WELL 2	SRC-AB		Jul 26, 2018
Jul 10, 2018	1	RT	Total	Absent--20180710056		115 DOUGLAS AVE SIN	DIST-A	0.10	Jul 20, 2018
Jun 26, 2018	1	RT	Total	Absent--20180626065		115 DOUGLAS AVE	DIST-A	0.10	Jul 09, 2018
Jun 12, 2018	1	RT	Total	Absent--20180612076		115 DOUGLAS AVE SINK	DIST-A	0.10	Jun 15, 2018
May 15, 2018	1	RT	Total	Absent--20180515042		592 4TH ST SINK	DIST-A	0.10	May 22, 2018

Sample Date	# Samples	Sample Type	Coliform Type	Results--ID	Repeat of Sample ID	Sample Site	Facility	Cl Residual	Receive Date
May 01, 2018	1	RT	Total	Absent--20180501062		115 DOUGLAS AVE SINK	DIST-A	0.20	May 09, 2018
Apr 17, 2018	1	RT	Total	Absent--20180417020		592 4TH ST SINK	DIST-A	0.10	Apr 26, 2018
Apr 03, 2018	1	RT	Total	Absent--20180403033		115 DOUGLAS AVE SIN	DIST-A	0.10	Apr 12, 2018
Mar 20, 2018	1	RT	Total	Absent--20180320062		592 4TH ST SINK	DIST-A	0.10	Mar 22, 2018
Mar 06, 2018	1	RT	Total	Absent--20180306064		115 DOUGLAS AVE SINK	DIST-A	0.10	Mar 20, 2018
Feb 21, 2018	1	RT	Total	Absent--20180221041		592 4TH ST	DIST-A	0.10	Feb 28, 2018
Feb 06, 2018	1	RT	Total	Absent--20180206042		115 DOUGLAS AVE	DIST-A	0.10	Feb 16, 2018
Jan 18, 2018	1	RT	Total	Absent--20180118019		592 4TH ST	DIST-A	0.10	Jan 23, 2018
Jan 03, 2018	1	RT	Total	Absent--20180103035		115 DOUGLAS AVE SIN	DIST-A	0.10	Jan 17, 2018
Dec 19, 2017	1	RT	Total	Absent--20171219036		592 4TH ST	DIST-A	0.10	Dec 22, 2017
Dec 05, 2017	1	RT	Total	Absent--20171205078		115 DOUGLAS	DIST-A	0.20	Dec 15, 2017
Nov 21, 2017	1	RT	Total	Absent--20171121032		592 4TH ST	DIST-A	0.10	Dec 04, 2017
Nov 07, 2017	1	RT	Total	Absent--20171107071		115 DOUGLAS AVE	DIST-A	0.20	Nov 15, 2017
Oct 24, 2017	1	RT	Total	Absent--20171024029		592 4TH ST SINK	DIST-A	0.10	Nov 06, 2017
Oct 10, 2017	1	RT	Total	Absent--20171010068		115 DOUGLAS AVE SINK	DIST-A	0.10	Oct 19, 2017

Sep 26, 2017	1	RT	Total	Absent--20170926019		592 4TH ST SINK	DIST-A	0.10	Oct 03, 2017
Sep 12, 2017	1	RT	Total	Absent--20170912022		115 DOUGLAS AVE	DIST-A	0.10	Sep 22, 2017
Aug 23, 2017	1	AS	Total	Absent--20170823024		WELL 2	SRC-AB		Aug 31, 2017
Aug 23, 2017	1	AS	Total	Absent--20170823023		WELL 1	SRC-AA		Aug 31, 2017
Aug 15, 2017	1	RT	Total	Absent--20170815031		592 4TH ST SINK	DIST-A	0.10	Aug 23, 2017

Sample Date	# Samples	Sample Type	Coliform Type	Results--ID	Repeat of Sample ID	Sample Site	Facility	Cl Residual	Receive Date
Aug 02, 2017	1	RT	Total	Absent--20170802050		115 DOUGLAS SINK	DIST-A	0.10	Aug 15, 2017
Jul 18, 2017	1	RT	Total	Absent--20170718033		592 4TH ST	DIST-A	0.10	Jul 26, 2017
Jul 05, 2017	1	RT	Total	Absent--20170705072		115 DOUGLAS AVE	DIST-A	0.10	Jul 13, 2017
Jun 20, 2017	1	RT	Total	Absent--20170620106		592 4TH ST SINK	DIST-A	0.10	Jun 27, 2017
Jun 06, 2017	1	RT	Total	Absent--20170606059		115 DOUGLAS AVE	DIST-A	0.10	Jun 12, 2017
May 23, 2017	1	RT	Total	Absent--20170523020		592 4TH ST SINK	DIST-A	0.20	Jun 05, 2017
May 09, 2017	1	RT	Total	Absent--20170509026		115 DOUGLAS AVE	DIST-A	0.10	May 16, 2017
Apr 25, 2017	1	RT	Total	Absent--20170425016		592 4TH ST SINK	DIST-A	0.10	Apr 28, 2017
Apr 11, 2017	1	RT	Total	Absent--20170411016		115 DOUGLAS AVE	DIST-A	0.10	Apr 20, 2017
Mar 14, 2017	1	RT	Total	Absent--20170314004		592 4TH ST	DIST-A	0.10	Mar 21, 2017
Mar 01, 2017	1	RT	Total	Absent--20170301052		115 DOUGLAS AVE SINK	DIST-A	0.10	Mar 10, 2017
Feb 15, 2017	1	RT	Total	Absent--20170215022		592 4TH ST SINK	DIST-A	0.10	Feb 22, 2017
Feb 01, 2017	1	RT	Total	Absent--20170201037		115 DOUGLAS AVE SINK	DIST-A	0.10	Feb 07, 2017
Jan 19, 2017	1	RT	Total	Absent--20170119006		592 4TH ST SINK	DIST-A	0.10	Jan 27, 2017
Jan 04, 2017	1	RT	Total	Absent--20170104021		115 DOUGLAS AVE SINK	DIST-A	0.10	Jan 13, 2017
Dec 20, 2016	1	RT	Total	Absent--20161220047		529 4TH ST SINK	DIST-A	0.20	Dec 23, 2016
Dec 06, 2016	1	RT	Total	Absent--20161206031		115 DOUGLAS AVE	DIST-A	0.10	Dec 13, 2016
Nov 22, 2016	1	RT	Total	Absent--20161122029		592 4TH ST SINK	DIST-A	0.20	Nov 30, 2016
Nov 08, 2016	1	RT	Total	Absent--20161108018		115 DOUGLAS AVE SINK	DIST-A	0.20	Nov 16, 2016
Oct 25, 2016	1	RT	Total	Absent--20161025009		5924 4TH ST SINK	DIST-A	0.10	Nov 03, 2016

Sample Date	# Samples	Sample Type	Coliform Type	Results--ID	Repeat of Sample ID	Sample Site	Facility	Cl Residual	Receive Date
Oct 11, 2016	1	RT	Total	Absent--20161011076		115 DOUGLAS AVE	DIST-A	0.20	Oct 26, 2016
Sep 27, 2016	1	RT	Total	Absent--20160927026		592 4TH ST SINK	DIST-A	0.10	Oct 05, 2016
Sep 14, 2016	1	RT	Total	Absent--20160914034		115 DOUGLAS AVE	DIST-A	0.10	Sep 29, 2016
Aug 16, 2016	1	RT	Total	Absent--20160816028		592 4TH ST SINK	DIST-A	0.10	Aug 23, 2016
Aug 02, 2016	1	AS	Total	Absent--20160802046		115 DOUGLAS SOURCE 1	SRC-AA		Aug 23, 2016
Aug 02, 2016	1	RT	Total	Absent--20160802045		115 DOUGLAS AVE	DIST-A	0.10	Aug 23, 2016
Aug 02, 2016	1	AS	Total	Absent--20160802044		35 JUNIPER SOURCE 2	SRC-AB		Aug 23, 2016
Jul 20, 2016	1	RT	Total	Absent--20160720034		592 4TH ST SINK	DIST-A	0.30	Jul 29, 2016
Jul 06, 2016	1	RT	Total	Absent--20160706044		115 DOUGLAS AVE	DIST-A	0.20	Jul 19, 2016
Jun 21, 2016	1	RT	Total	Absent--20160621047		115 DOUGLAS AVE SINK	DIST-A	0.10	Jul 07, 2016
Jun 07, 2016	1	RT	Total	Absent--20160607095		115 DOUGLAS AVE	DIST-A	0.20	Jun 16, 2016
May 25, 2016	1	RT	Total	Absent--20160525044		592 4TH ST SINK	DIST-A	0.10	Jun 07, 2016
May 10, 2016	1	RT	Total	Absent--20160510027		115 DOUGLAS AVE	DIST-A	0.10	May 18, 2016
Apr 26, 2016	1	RT	Total	Absent--20160426024		592 4TH ST SINK	DIST-A	0.10	May 05, 2016
Apr 12, 2016	1	RT	Total	Absent--20160412059		115 DOUGLAS AVE	DIST-A	0.10	Apr 20, 2016
Mar 29, 2016	1	RT	Total	Absent--20160329016		592 4TH ST SINK	DIST-A	0.10	Apr 05, 2016
Mar 15, 2016	1	RT	Total	Absent--20160315030		115 DOUGLAS AVE SINK	DIST-A	0.20	Mar 23, 2016

Mar 01, 2016	1	RT	Total	Absent--20160301056		115 DOUGLAS AVE SINK	DIST-A	0.10	Mar 23, 2016
Feb 16, 2016	1	RT	Total	Absent--20160216026		115 DOUGLAS AVE	DIST-A	0.20	Feb 24, 2016
Feb 02, 2016	1	RT	Total	Absent--20160202020		115 DOUGLAS AVE SINK	DIST-A	0.20	Feb 24, 2016

Sample Date	# Samples	Sample Type	Coliform Type	Results--ID	Repeat of Sample ID	Sample Site	Facility	Cl Residual	Receive Date
Jan 19, 2016	1	RT	Total	Absent--20160119036		592 4TH ST	DIST-A	0.20	Jan 27, 2016
Jan 06, 2016	1	RT	Total	Absent--591082			DIST-A	0.25	Feb 01, 2016
Jan 05, 2016	1	RT	Total	Absent--20160105018		115 DOUGLAS AVE	DIST-A	0.20	Jan 13, 2016

Recent Batch Numbers

Click here to show results prior to 2016
Click here to show results prior to 2002 (opens a different page)

Sample Types AS=Assessment, CO=Confirmation, MU=Make-up, RP=Repeat, RT=Routine, SP=Special, TG=Triggered. Show special samples

Oregon Public Health
Drinking Water Data Online

ND = Not Detected at the Minimum Reporting Level
Spreadsheet

Latest Chemical Results - PWS ID: 00319 ---- GERVAIS WATER DEPARTMENT

Sample ID	Sample Date	Receive Date	Chemical	Source ID	Results	Current MCL	UOM
20180830019	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830019	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830020	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830020	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830021	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830021	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830022	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830022	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830023	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830023	08/30/2018	09/21/2018	LEAD	DIST-A	0.0014000	0.0150000	MG/L
20180830024	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830024	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830025	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830025	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830026	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830026	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830027	08/30/2018	09/21/2018	COPPER	DIST-A	0.1110000	1.3000000	MG/L
20180830027	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180830028	08/30/2018	09/21/2018	COPPER	DIST-A	ND	1.3000000	MG/L
20180830028	08/30/2018	09/21/2018	LEAD	DIST-A	ND	0.0150000	MG/L
20180807105-I	08/07/2018	08/22/2018	NITRATE	EP-A	ND	10.000000	MG/L
20180723036-D	07/23/2018	08/22/2018	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	ND	0.0600000	MG/L
20180723037-D	07/23/2018	08/22/2018	TTHM	DIST-A	0.0015800	0.0800000	MG/L
20171121033-I	11/21/2017	12/06/2017	NITRATE	EP-A	ND	10.000000	MG/L
20170720021-D	07/20/2017	08/18/2017	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0142000	0.0600000	MG/L
20170720022-D	07/20/2017	08/18/2017	TTHM	DIST-A	0.0251000	0.0800000	MG/L
20160720035	07/20/2016	08/24/2016	CYANIDE	EP-A	ND	0.2000000	MG/L
20160720036	07/20/2016	01/23/2017	NICKEL	EP-A	ND	0.1000000	MG/L
20160720036-I	07/20/2016	08/30/2016	ANTIMONY, TOTAL	EP-A	ND	0.0060000	MG/L
20160720036-I	07/20/2016	08/30/2016	ARSENIC	EP-A	0.0051000	0.0100000	MG/L
20160720036-I	07/20/2016	08/30/2016	BARIUM	EP-A	ND	2.0000000	MG/L
20160720036-I	07/20/2016	08/30/2016	BERYLLIUM, TOTAL	EP-A	ND	0.0040000	MG/L
20160720036-I	07/20/2016	08/30/2016	CADMIUM	EP-A	ND	0.0050000	MG/L
20160720036-I	07/20/2016	08/30/2016	CHROMIUM	EP-A	ND	0.1000000	MG/L
20160720036-I	07/20/2016	08/30/2016	FLUORIDE	EP-A	ND	4.0000000	MG/L
20160720036-I	07/20/2016	08/30/2016	MERCURY	EP-A	ND	0.0020000	MG/L
20160720036-I	07/20/2016	08/30/2016	NITRATE	EP-A	ND	10.000000	MG/L
20160720036-I	07/20/2016	08/30/2016	NITRATE-NITRITE	EP-A	ND	10.000000	MG/L
20160720036-I	07/20/2016		NITRITE	EP-A	ND	1.0000000	MG/L
20160720036-I	07/20/2016	08/30/2016	SELENIUM	EP-A	ND	0.0500000	MG/L

20160720036-I	07/20/2016	08/30/2016	SODIUM	EP-A	23.500000		MG/L
20160720036-I	07/20/2016	08/30/2016	THALLIUM, TOTAL	EP-A	ND	0.0020000	MG/L
20160720037-S	07/20/2016	08/24/2016	1,2-DIBROMO-3-CHLOROPROPANE	EP-A	ND	0.0002000	MG/L
20160720037-S	07/20/2016	08/24/2016	2,4,5-TP	EP-A	ND	0.0500000	MG/L
20160720037-S	07/20/2016	08/24/2016	2,4-D	EP-A	ND	0.0700000	MG/L
20160720037-S	07/20/2016	08/24/2016	ATRAZINE	EP-A	ND	0.0030000	MG/L
20160720037-S	07/20/2016	08/24/2016	BENZO(A)PYRENE	EP-A	ND	0.0002000	MG/L
20160720037-S	07/20/2016	08/24/2016	BHC-GAMMA	EP-A	ND	0.0002000	MG/L
20160720037-S	07/20/2016	08/24/2016	CARBOFURAN	EP-A	ND	0.0400000	MG/L
20160720037-S	07/20/2016	08/24/2016	CHLORDANE	EP-A	ND	0.0020000	MG/L
20160720037-S	07/20/2016	08/24/2016	DALAPON	EP-A	ND	0.2000000	MG/L
20160720037-S	07/20/2016	08/24/2016	DI(2-ETHYLHEXYL) ADIPATE	EP-A	ND	0.4000000	MG/L
20160720037-S	07/20/2016	08/24/2016	DI(2-ETHYLHEXYL) PHTHALATE	EP-A	ND	0.0060000	MG/L
20160720037-S	07/20/2016	08/24/2016	DINOSEB	EP-A	ND	0.0070000	MG/L
20160720037-S	07/20/2016	08/24/2016	DIQUAT	EP-A	ND	0.0200000	MG/L
20160720037-S	07/20/2016	08/24/2016	ENDOTHALL	EP-A	ND	0.1000000	MG/L
20160720037-S	07/20/2016	08/24/2016	ENDRIN	EP-A	ND	0.0020000	MG/L
20160720037-S	07/20/2016	08/24/2016	ETHYLENE DIBROMIDE	EP-A	ND	0.0000500	MG/L
20160720037-S	07/20/2016	08/24/2016	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
20160720037-S	07/20/2016	08/24/2016	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
20160720037-S	07/20/2016	08/24/2016	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
20160720037-S	07/20/2016	08/24/2016	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
20160720037-S	07/20/2016	08/24/2016	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
20160720037-S	07/20/2016	08/24/2016	LASSO	EP-A	ND	0.0020000	MG/L
20160720037-S	07/20/2016	08/24/2016	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
20160720037-S	07/20/2016	08/24/2016	OXAMYL	EP-A	ND	0.2000000	MG/L
20160720037-S	07/20/2016	08/24/2016	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
20160720037-S	07/20/2016	08/24/2016	PICLORAM	EP-A	ND	0.5000000	MG/L
20160720037-S	07/20/2016	08/24/2016	SIMAZINE	EP-A	ND	0.0040000	MG/L
20160720037-S	07/20/2016	08/24/2016	TOTAL POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
20160720037-S	07/20/2016	08/24/2016	TOXAPHENE	EP-A	ND	0.0030000	MG/L
20160720038-V	07/20/2016	08/24/2016	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
20160720038-V	07/20/2016	08/24/2016	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
20160720038-V	07/20/2016	08/24/2016	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
20160720038-V	07/20/2016	08/24/2016	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	BENZENE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	CHLOROBENZENE	EP-A	ND	0.1000000	MG/L
20160720038-V	07/20/2016	08/24/2016	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
20160720038-V	07/20/2016	08/24/2016	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
20160720038-V	07/20/2016	08/24/2016	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
20160720038-V	07/20/2016	08/24/2016	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
20160720038-V	07/20/2016	08/24/2016	STYRENE	EP-A	ND	0.1000000	MG/L
20160720038-V	07/20/2016	08/24/2016	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L

20160720038-V	07/20/2016	08/24/2016	TOLUENE	EP-A	ND	1.0000000	MG/L
20160720038-V	07/20/2016	08/24/2016	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
20160720038-V	07/20/2016	08/24/2016	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
20160720038-V	07/20/2016	08/24/2016	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
20160720038-V	07/20/2016	08/24/2016	XYLENES, TOTAL	EP-A	ND	10.000000	MG/L
20160720039	07/20/2016	08/24/2016	COMBINED URANIUM	EP-A	ND	0.0300000	MG/L
20160720039-R	07/20/2016	08/24/2016	COMBINED RADIUM (-226 & -228)	EP-A	ND	5.0000000	PCI/L
20160720039-R	07/20/2016	08/24/2016	GROSS ALPHA, EXCL. RADON & U	EP-A	ND	15.000000	PCI/L
2010706045-D	07/06/2016	08/15/2016	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	ND	0.0600000	MG/L
20160706046-D	07/06/2016	08/15/2016	TTHM	DIST-A	ND	0.0800000	MG/L
20150908063-I	09/08/2015	09/16/2015	NITRATE	EP-A	ND	10.000000	MG/L
20150721035	07/21/2015	09/15/2015	COPPER	DIST-A	ND	1.3000000	MG/L
20150721035	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721038	07/21/2015	09/15/2015	COPPER	DIST-A	0.1470000	1.3000000	MG/L
20150721038	07/21/2015	09/15/2015	LEAD	DIST-A	0.0276000	0.0150000	MG/L
20150721039	07/21/2015	09/15/2015	COPPER	DIST-A	ND	1.3000000	MG/L
20150721039	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721040	07/21/2015	09/15/2015	COPPER	DIST-A	0.1030000	1.3000000	MG/L
20150721040	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721041	07/21/2015	09/15/2015	COPPER	DIST-A	ND	1.3000000	MG/L
20150721041	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721042	07/21/2015	09/15/2015	COPPER	DIST-A	ND	1.3000000	MG/L
20150721042	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721043	07/21/2015	09/15/2015	COPPER	DIST-A	0.1000000	1.3000000	MG/L
20150721043	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721044	07/21/2015	09/15/2015	COPPER	DIST-A	ND	1.3000000	MG/L
20150721044	07/21/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150721036	07/20/2015	09/15/2015	COPPER	DIST-A	0.2000000	1.3000000	MG/L
20150721036	07/20/2015	09/15/2015	LEAD	DIST-A	0.0040000	0.0150000	MG/L
20150721037	07/20/2015	09/15/2015	COPPER	DIST-A	ND	1.3000000	MG/L
20150721037	07/20/2015	09/15/2015	LEAD	DIST-A	ND	0.0150000	MG/L
20150715019-D	07/15/2015	08/06/2015	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	ND	0.0600000	MG/L
20150715020-D	07/15/2015	08/06/2015	TTHM	DIST-A	0.0027500	0.0800000	MG/L
20140709020-D	07/09/2014	08/01/2014	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0058900	0.0600000	MG/L
20140709021-D	07/09/2014	08/01/2014	TTHM	DIST-A	0.0208000	0.0800000	MG/L
20140709022-D	07/09/2014	08/01/2014	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0057000	0.0600000	MG/L
20140709023-D	07/09/2014	08/01/2014	TTHM	DIST-A	0.0202000	0.0800000	MG/L
20140627012-I	06/27/2014	07/07/2014	NITRATE	EP-A	ND	10.000000	MG/L
133278-D	08/02/2013	08/30/2013	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0100000	0.0600000	MG/L
133278-D	08/02/2013	08/30/2013	TTHM	DIST-A	0.0211000	0.0800000	MG/L
131310-S	04/03/2013	04/19/2013	DIQUAT	EP-A	ND	0.0200000	MG/L
131028-I	03/14/2013	03/15/2013	NITRATE	EP-A	ND	10.000000	MG/L
131029-I	03/14/2013	03/22/2013	ARSENIC	EP-A	0.0040000	0.0100000	MG/L
131030-S	03/14/2013	04/19/2013	1,2-DIBROMO-3-CHLOROPROPANE	EP-A	ND	0.0002000	MG/L
131030-S	03/14/2013	04/19/2013	2,4,5-TP	EP-A	ND	0.0500000	MG/L
131030-S	03/14/2013	04/19/2013	2,4-D	EP-A	ND	0.0700000	MG/L
131030-S	03/14/2013	04/19/2013	ATRAZINE	EP-A	ND	0.0030000	MG/L
131030-S	03/14/2013	04/19/2013	BENZO(A)PYRENE	EP-A	ND	0.0002000	MG/L

131030-S	03/14/2013	04/19/2013	BHC-GAMMA	EP-A	ND	0.0002000	MG/L
131030-S	03/14/2013	04/19/2013	CARBOFURAN	EP-A	ND	0.0400000	MG/L
131030-S	03/14/2013	04/19/2013	CHLORDANE	EP-A	ND	0.0020000	MG/L
131030-S	03/14/2013	04/19/2013	DALAPON	EP-A	ND	0.2000000	MG/L
131030-S	03/14/2013	04/19/2013	DI(2-ETHYLHEXYL) ADIPATE	EP-A	ND	0.4000000	MG/L
131030-S	03/14/2013	04/19/2013	DI(2-ETHYLHEXYL) PHTHALATE	EP-A	ND	0.0060000	MG/L
131030-S	03/14/2013	04/19/2013	DINOSEB	EP-A	ND	0.0070000	MG/L
131030-S	03/14/2013	04/19/2013	ENDOTHALL	EP-A	ND	0.1000000	MG/L
131030-S	03/14/2013	04/19/2013	ENDRIN	EP-A	ND	0.0020000	MG/L
131030-S	03/14/2013	04/19/2013	ETHYLENE DIBROMIDE	EP-A	ND	0.0000500	MG/L
131030-S	03/14/2013	04/19/2013	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
131030-S	03/14/2013	04/19/2013	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
131030-S	03/14/2013	04/19/2013	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
131030-S	03/14/2013	04/19/2013	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
131030-S	03/14/2013	04/19/2013	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
131030-S	03/14/2013	04/19/2013	LASSO	EP-A	ND	0.0020000	MG/L
131030-S	03/14/2013	04/19/2013	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
131030-S	03/14/2013	04/19/2013	OXAMYL	EP-A	ND	0.2000000	MG/L
131030-S	03/14/2013	04/19/2013	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
131030-S	03/14/2013	04/19/2013	PICLORAM	EP-A	ND	0.5000000	MG/L
131030-S	03/14/2013	04/19/2013	SIMAZINE	EP-A	ND	0.0040000	MG/L
131030-S	03/14/2013	04/19/2013	TOTAL POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
131030-S	03/14/2013	04/19/2013	TOXAPHENE	EP-A	ND	0.0030000	MG/L
131030-V	03/14/2013	04/19/2013	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
131030-V	03/14/2013	04/19/2013	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
131030-V	03/14/2013	04/19/2013	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
131030-V	03/14/2013	04/19/2013	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	BENZENE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	CHLOROBENZENE	EP-A	ND	0.1000000	MG/L
131030-V	03/14/2013	04/19/2013	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
131030-V	03/14/2013	04/19/2013	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
131030-V	03/14/2013	04/19/2013	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
131030-V	03/14/2013	04/19/2013	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
131030-V	03/14/2013	04/19/2013	STYRENE	EP-A	ND	0.1000000	MG/L
131030-V	03/14/2013	04/19/2013	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	TOLUENE	EP-A	ND	1.0000000	MG/L
131030-V	03/14/2013	04/19/2013	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
131030-V	03/14/2013	04/19/2013	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
131030-V	03/14/2013	04/19/2013	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
131030-V	03/14/2013	04/19/2013	XYLENES, TOTAL	EP-A	ND	10.000000	MG/L
124644	09/21/2012	10/05/2012	COPPER	DIST-A	0.1400000	1.3000000	MG/L
124644	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124645	09/21/2012	10/05/2012	COPPER	DIST-A	0.0640000	1.3000000	MG/L

124645	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124646	09/21/2012	10/05/2012	COPPER	DIST-A	0.0350000	1.3000000	MG/L
124646	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124647	09/21/2012	10/05/2012	COPPER	DIST-A	0.0710000	1.3000000	MG/L
124647	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124648	09/21/2012	10/05/2012	COPPER	DIST-A	0.0930000	1.3000000	MG/L
124648	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124649	09/21/2012	10/05/2012	COPPER	DIST-A	0.1500000	1.3000000	MG/L
124649	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124650	09/21/2012	10/05/2012	COPPER	DIST-A	0.0110000	1.3000000	MG/L
124650	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124651	09/21/2012	10/05/2012	COPPER	DIST-A	0.0630000	1.3000000	MG/L
124651	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124652	09/21/2012	10/05/2012	COPPER	DIST-A	0.1300000	1.3000000	MG/L
124652	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124653	09/21/2012	10/05/2012	COPPER	DIST-A	0.1100000	1.3000000	MG/L
124653	09/21/2012	10/05/2012	LEAD	DIST-A	ND	0.0150000	MG/L
124030-I	08/17/2012	08/24/2012	NITRATE	EP-A	ND	10.000000	MG/L
123771-D	08/03/2012	08/29/2012	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0036300	0.0600000	MG/L
123771-D	08/03/2012	08/29/2012	TTHM	DIST-A	0.0046700	0.0800000	MG/L
114618-I	09/16/2011	09/23/2011	NITRATE	EP-A	ND	10.000000	MG/L
114329-D	09/07/2011	09/30/2011	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	ND	0.0600000	MG/L
114329-D	09/07/2011	09/30/2011	TTHM	DIST-A	0.0238000	0.0800000	MG/L
100837201B-D	08/10/2010	08/27/2010	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0143000	0.0600000	MG/L
100837201B-D	08/10/2010	08/27/2010	TTHM	DIST-A	0.0298000	0.0800000	MG/L
103752-I	08/10/2010	08/13/2010	NITRATE	EP-A	ND	10.000000	MG/L
090903301	08/28/2009	10/08/2009	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0029800	0.0600000	MG/L
090903301	08/28/2009	10/08/2009	TTHM	DIST-A	0.0088100	0.0800000	MG/L
294327-I	08/28/2009	09/04/2009	NITRATE	EP-A	ND	10.000000	MG/L
294328-I	08/28/2009	09/04/2009	ARSENIC	EP-A	ND	0.0100000	MG/L
0811384-S	11/14/2008	12/15/2008	1,2-DIBROMO-3-CHLOROPROPANE	EP-A	ND	0.0002000	MG/L
0811384-S	11/14/2008	12/15/2008	2,4,5-TP	EP-A	ND	0.0500000	MG/L
0811384-S	11/14/2008	12/15/2008	2,4-D	EP-A	ND	0.0700000	MG/L
0811384-S	11/14/2008	12/15/2008	ATRAZINE	EP-A	ND	0.0030000	MG/L
0811384-S	11/14/2008	12/15/2008	BENZO(A)PYRENE	EP-A	ND	0.0002000	MG/L
0811384-S	11/14/2008	12/15/2008	BHC-GAMMA	EP-A	ND	0.0002000	MG/L
0811384-S	11/14/2008	12/15/2008	CARBOFURAN	EP-A	ND	0.0400000	MG/L
0811384-S	11/14/2008	12/15/2008	CHLORDANE	EP-A	ND	0.0020000	MG/L
0811384-S	11/14/2008	12/15/2008	DALAPON	EP-A	ND	0.2000000	MG/L
0811384-S	11/14/2008	12/15/2008	DI(2-ETHYLHEXYL) ADIPATE	EP-A	ND	0.4000000	MG/L
0811384-S	11/14/2008	12/15/2008	DI(2-ETHYLHEXYL) PHTHALATE	EP-A	ND	0.0060000	MG/L
0811384-S	11/14/2008	12/15/2008	DINOSEB	EP-A	ND	0.0070000	MG/L
0811384-S	11/14/2008	12/15/2008	DIQUAT	EP-A	ND	0.0200000	MG/L
0811384-S	11/14/2008	12/15/2008	ENDOTHALL	EP-A	ND	0.1000000	MG/L
0811384-S	11/14/2008	12/15/2008	ENDRIN	EP-A	ND	0.0020000	MG/L
0811384-S	11/14/2008	12/15/2008	ETHYLENE DIBROMIDE	EP-A	ND	0.0000500	MG/L
0811384-S	11/14/2008	12/15/2008	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
0811384-S	11/14/2008	12/15/2008	HEPTACHLOR	EP-A	ND	0.0004000	MG/L

0811384-S	11/14/2008	12/15/2008	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
0811384-S	11/14/2008	12/15/2008	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
0811384-S	11/14/2008	12/15/2008	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
0811384-S	11/14/2008	12/15/2008	LASSO	EP-A	ND	0.0020000	MG/L
0811384-S	11/14/2008	12/15/2008	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
0811384-S	11/14/2008	12/15/2008	OXAMYL	EP-A	ND	0.2000000	MG/L
0811384-S	11/14/2008	12/15/2008	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
0811384-S	11/14/2008	12/15/2008	PICLORAM	EP-A	ND	0.5000000	MG/L
0811384-S	11/14/2008	12/15/2008	SIMAZINE	EP-A	ND	0.0040000	MG/L
0811384-S	11/14/2008	12/15/2008	TOTAL POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
0811384-S	11/14/2008	12/15/2008	TOXAPHENE	EP-A	ND	0.0030000	MG/L
0811384-V	11/14/2008	12/15/2008	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
0811384-V	11/14/2008	12/15/2008	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
0811384-V	11/14/2008	12/15/2008	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
0811384-V	11/14/2008	12/15/2008	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	BENZENE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	CHLOROBENZENE	EP-A	ND	0.1000000	MG/L
0811384-V	11/14/2008	12/15/2008	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
0811384-V	11/14/2008	12/15/2008	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
0811384-V	11/14/2008	12/15/2008	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
0811384-V	11/14/2008	12/15/2008	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
0811384-V	11/14/2008	12/15/2008	STYRENE	EP-A	ND	0.1000000	MG/L
0811384-V	11/14/2008	12/15/2008	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	TOLUENE	EP-A	ND	1.0000000	MG/L
0811384-V	11/14/2008	12/15/2008	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
0811384-V	11/14/2008	12/15/2008	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
0811384-V	11/14/2008	12/15/2008	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
0811384-V	11/14/2008	12/15/2008	XYLENES, TOTAL	EP-A	ND	10.000000	MG/L
0809610	09/19/2008	10/16/2008	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0126000	0.0600000	MG/L
0809610	09/19/2008	10/16/2008	TTHM	DIST-A	0.0259000	0.0800000	MG/L
284573-I	09/05/2008	09/17/2008	NITRATE	EP-A	ND	10.000000	MG/L
PQG1065	07/30/2007	09/04/2007	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0182000	0.0600000	MG/L
PQG1065	07/30/2007	09/04/2007	TTHM	DIST-A	0.0320000	0.0800000	MG/L
273041	07/30/2007	11/23/2007	NITRATE	EP-A	ND	10.000000	MG/L
PPH0803-01	08/15/2006	09/05/2006	TTHM	DIST-A	0.0144000	0.0800000	MG/L
PPH0803-01REI	08/15/2006	09/05/2006	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0104000	0.0600000	MG/L
262874	08/11/2006	08/21/2006	NITRATE	EP-A	ND	10.000000	MG/L
253212	08/12/2005	09/06/2005	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0122000	0.0600000	MG/L
253212	08/12/2005	09/06/2005	TTHM	DIST-A	0.0214000	0.0800000	MG/L
252127	06/09/2005	06/20/2005	NITRATE	EP-A	ND	10.000000	MG/L
252128	06/09/2005	06/20/2005	ARSENIC	EP-A	ND	0.0100000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	1,2-DIBROMO-3-CHLOROPROPANE	EP-A	ND	0.0002000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	2,4,5-TP	EP-A	ND	0.0500000	MG/L

P5F0433-01S	06/09/2005	08/22/2005	2,4-D	EP-A	ND	0.0700000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	ATRAZINE	EP-A	ND	0.0030000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	BENZO(A)PYRENE	EP-A	ND	0.0002000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	BHC-GAMMA	EP-A	ND	0.0002000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	CARBOFURAN	EP-A	ND	0.0400000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	CHLORDANE	EP-A	ND	0.0020000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	DALAPON	EP-A	ND	0.2000000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	DI(2-ETHYLHEXYL) ADIPATE	EP-A	ND	0.4000000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	DI(2-ETHYLHEXYL) PHTHALATE	EP-A	ND	0.0060000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	DINOSEB	EP-A	ND	0.0070000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	DIQUAT	EP-A	ND	0.0200000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	ENDOTHALL	EP-A	ND	0.1000000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	ENDRIN	EP-A	ND	0.0020000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	ETHYLENE DIBROMIDE	EP-A	ND	0.0000500	MG/L
P5F0433-01S	06/09/2005	08/22/2005	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	LASSO	EP-A	ND	0.0020000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	OXAMYL	EP-A	ND	0.2000000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	PICLORAM	EP-A	ND	0.5000000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	SIMAZINE	EP-A	ND	0.0040000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	TOTAL POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
P5F0433-01S	06/09/2005	08/22/2005	TOXAPHENE	EP-A	ND	0.0030000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	BENZENE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	CHLOROBENZENE	EP-A	ND	0.1000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	STYRENE	EP-A	ND	0.1000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	TOLUENE	EP-A	ND	1.0000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
P5F0433-01V	06/09/2005	08/22/2005	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L

P5F0433-01V	06/09/2005	08/22/2005	XYLENES, TOTAL	EP-A	ND	10.000000	MG/L
20040810-028	08/10/2004	09/14/2004	NITRATE	EP-A	ND	10.000000	MG/L
20031118-038R	11/18/2003	02/06/2004	COMBINED RADIUM (-226 & -228)	EP-A	ND	5.0000000	PCI/L
20031118-038R	11/18/2003	02/06/2004	COMBINED URANIUM	EP-A	ND	0.0300000	MG/L
20031030-031	10/30/2003	11/13/2003	NITRATE	EP-A	ND	10.000000	MG/L
20020625-016I	06/25/2002	08/28/2002	ANTIMONY, TOTAL	EP-A	ND	0.0060000	MG/L
20020625-016I	06/25/2002	08/28/2002	ARSENIC	EP-A	0.0098000	0.0100000	MG/L
20020625-016I	06/25/2002	08/28/2002	BARIUM	EP-A	ND	2.0000000	MG/L
20020625-016I	06/25/2002	08/28/2002	BERYLLIUM, TOTAL	EP-A	ND	0.0040000	MG/L
20020625-016I	06/25/2002	08/28/2002	CADMIUM	EP-A	ND	0.0050000	MG/L
20020625-016I	06/25/2002	08/28/2002	CHROMIUM	EP-A	ND	0.1000000	MG/L
20020625-016I	06/25/2002	08/28/2002	CYANIDE	EP-A	ND	0.2000000	MG/L
20020625-016I	06/25/2002	08/28/2002	FLUORIDE	EP-A	ND	4.0000000	MG/L
20020625-016I	06/25/2002	08/28/2002	LEAD	EP-A	ND	0.0150000	MG/L
20020625-016I	06/25/2002	08/28/2002	MERCURY	EP-A	ND	0.0020000	MG/L
20020625-016I	06/25/2002	08/28/2002	NICKEL	EP-A	ND	0.1000000	MG/L
20020625-016I	06/25/2002	08/28/2002	NITRATE	EP-A	ND	10.000000	MG/L
20020625-016I	06/25/2002	08/28/2002	NITRATE-NITRITE	EP-A	ND	10.000000	MG/L
20020625-016I	06/25/2002		NITRITE	EP-A	ND	1.0000000	MG/L
20020625-016I	06/25/2002	08/28/2002	SELENIUM	EP-A	0.0110000	0.0500000	MG/L
20020625-016I	06/25/2002	08/28/2002	SODIUM	EP-A	21.500000		MG/L
20020625-016I	06/25/2002	08/28/2002	SULFATE	EP-A	ND		MG/L
20020625-016I	06/25/2002	08/28/2002	THALLIUM, TOTAL	EP-A	ND	0.0020000	MG/L
20020625-016S	06/25/2002	08/28/2002	1,2-DIBROMO-3-CHLOROPROPANE	EP-A	ND	0.0002000	MG/L
20020625-016S	06/25/2002	08/28/2002	2,4,5-TP	EP-A	ND	0.0500000	MG/L
20020625-016S	06/25/2002	08/28/2002	2,4-D	EP-A	ND	0.0700000	MG/L
20020625-016S	06/25/2002	08/28/2002	ATRAZINE	EP-A	ND	0.0030000	MG/L
20020625-016S	06/25/2002	08/28/2002	BENZO(A)PYRENE	EP-A	ND	0.0002000	MG/L
20020625-016S	06/25/2002	08/28/2002	BHC-GAMMA	EP-A	ND	0.0002000	MG/L
20020625-016S	06/25/2002	08/28/2002	CARBOFURAN	EP-A	ND	0.0400000	MG/L
20020625-016S	06/25/2002	08/28/2002	CHLORDANE	EP-A	ND	0.0020000	MG/L
20020625-016S	06/25/2002	08/28/2002	DALAPON	EP-A	ND	0.2000000	MG/L
20020625-016S	06/25/2002	08/28/2002	DI(2-ETHYLHEXYL) ADIPATE	EP-A	ND	0.4000000	MG/L
20020625-016S	06/25/2002	08/28/2002	DI(2-ETHYLHEXYL) PHTHALATE	EP-A	ND	0.0060000	MG/L
20020625-016S	06/25/2002	08/28/2002	DINOSEB	EP-A	ND	0.0070000	MG/L
20020625-016S	06/25/2002	08/28/2002	DIQUAT	EP-A	ND	0.0200000	MG/L
20020625-016S	06/25/2002	08/28/2002	ENDOTHALL	EP-A	ND	0.1000000	MG/L
20020625-016S	06/25/2002	08/28/2002	ENDRIN	EP-A	ND	0.0020000	MG/L
20020625-016S	06/25/2002	08/28/2002	ETHYLENE DIBROMIDE	EP-A	ND	0.0000500	MG/L
20020625-016S	06/25/2002	08/28/2002	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
20020625-016S	06/25/2002	08/28/2002	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
20020625-016S	06/25/2002	08/28/2002	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
20020625-016S	06/25/2002	08/28/2002	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
20020625-016S	06/25/2002	08/28/2002	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
20020625-016S	06/25/2002	08/28/2002	LASSO	EP-A	ND	0.0020000	MG/L
20020625-016S	06/25/2002	08/28/2002	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
20020625-016S	06/25/2002	08/28/2002	OXAMYL	EP-A	ND	0.2000000	MG/L
20020625-016S	06/25/2002	08/28/2002	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L

20020625-016S	06/25/2002	08/28/2002	PICLORAM	EP-A	ND	0.5000000	MG/L
20020625-016S	06/25/2002	08/28/2002	SIMAZINE	EP-A	ND	0.0040000	MG/L
20020625-016S	06/25/2002	08/28/2002	TOTAL POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
20020625-016S	06/25/2002	08/28/2002	TOXAPHENE	EP-A	ND	0.0030000	MG/L
20020625-016V	06/25/2002	08/28/2002	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
20020625-016V	06/25/2002	08/28/2002	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
20020625-016V	06/25/2002	08/28/2002	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
20020625-016V	06/25/2002	08/28/2002	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	BENZENE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	CHLOROBENZENE	EP-A	ND	0.1000000	MG/L
20020625-016V	06/25/2002	08/28/2002	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
20020625-016V	06/25/2002	08/28/2002	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
20020625-016V	06/25/2002	08/28/2002	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
20020625-016V	06/25/2002	08/28/2002	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
20020625-016V	06/25/2002	08/28/2002	STYRENE	EP-A	ND	0.1000000	MG/L
20020625-016V	06/25/2002	08/28/2002	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	TOLUENE	EP-A	ND	1.0000000	MG/L
20020625-016V	06/25/2002	08/28/2002	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
20020625-016V	06/25/2002	08/28/2002	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
20020625-016V	06/25/2002	08/28/2002	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
20020625-016V	06/25/2002	08/28/2002	XYLENES, TOTAL	EP-A	ND	10.000000	MG/L

Archived Results

Sample Date	Receive Date	Chemical	Source ID	Results	MCL
12/14/2000	12/21/2000	Nitrate	AA	ND	10.000000
12/14/2000	12/21/2000	Nitrate	AB	ND	10.000000
11/27/2000	01/08/2001	Gross Alpha, Excl. Radon & U	AA	ND	15.000000
11/27/2000	01/08/2001	Gross Alpha, Excl. Radon & U	AB	ND	15.000000
09/15/1999	11/15/1999	1,1,1,2-Tetrachloroethane	A	ND	
09/15/1999	11/15/1999	1,1,1-Trichloroethane	A	ND	0.2000000
09/15/1999	11/15/1999	1,1,2,2,-Tetrachloroethane	A	ND	
09/15/1999	11/15/1999	1,1,2-Trichloroethane	A	ND	0.0050000
09/15/1999	11/15/1999	1,1-Dichloroethane	A	ND	
09/15/1999	11/15/1999	1,1-Dichloroethylene	A	ND	0.0070000
09/15/1999	11/15/1999	1,1-Dichloropropene	A	ND	
09/15/1999	11/15/1999	1,2,3-Trichloropropane	A	ND	
09/15/1999	11/15/1999	1,2,4-Trichlorobenzene	A	ND	0.0700000
09/15/1999	11/15/1999	1,2-Dibromo-3-Chloropropane (DBCP)	A	ND	0.0002000
09/15/1999	11/15/1999	1,2-Dichloroethane	A	ND	0.0050000
09/15/1999	11/15/1999	1,2-Dichloropropane	A	ND	0.0050000
09/15/1999	11/15/1999	1,3-Dichloropropane	A	ND	
09/15/1999	11/15/1999	1,3-Dichloropropene	A	ND	
09/15/1999	11/15/1999	2,2-Dichloropropane	A	ND	
09/15/1999	11/15/1999	2,4,5-TP Silvex	A	ND	0.0500000

09/15/1999	11/15/1999	2,4-D	A	ND	0.0700000
09/15/1999	11/15/1999	3-Hydroxycarbofuran	A	ND	
09/15/1999	11/15/1999	Adipates (Di(2-Ethylhexyl))	A	ND	0.4000000
09/15/1999	11/15/1999	Alachlor (Lasso)	A	ND	0.0020000
09/15/1999	11/15/1999	Aldicarb	A	ND	
09/15/1999	11/15/1999	Aldicarb Sulfone	A	ND	
09/15/1999	11/15/1999	Aldicarb Sulfoxide	A	ND	
09/15/1999	11/15/1999	Aldrin	A	ND	
09/15/1999	11/15/1999	Antimony Total	A	ND	0.0060000
09/15/1999	11/15/1999	Arsenic	A	ND	0.0500000
09/15/1999	11/15/1999	Atrazine	A	ND	0.0030000
09/15/1999	11/15/1999	Barium	A	ND	2.0000000
09/15/1999	11/15/1999	Benzene	A	ND	0.0050000
09/15/1999	11/15/1999	Benzo (A) Pyrene	A	ND	0.0002000
09/15/1999	11/15/1999	Beryllium Total	A	ND	0.0040000
09/15/1999	11/15/1999	BHC-gamma (Lindane)	A	ND	0.0002000
09/15/1999	11/15/1999	Bromobenzene	A	ND	
09/15/1999	11/15/1999	Bromodichloromethane	A	ND	
09/15/1999	11/15/1999	Bromoform	A	ND	
09/15/1999	11/15/1999	Bromomethane	A	ND	
09/15/1999	11/15/1999	Butachlor	A	ND	
09/15/1999	11/15/1999	Cadmium	A	ND	0.0050000
09/15/1999	11/15/1999	Carbaryl	A	ND	
09/15/1999	11/15/1999	Carbofuran	A	ND	0.0400000
09/15/1999	11/15/1999	Carbon Tetrachloride	A	ND	0.0050000
09/15/1999	11/15/1999	Chlordane	A	ND	0.0020000
09/15/1999	11/15/1999	Chloroethane	A	ND	
09/15/1999	11/15/1999	Chloroform	A	ND	
09/15/1999	11/15/1999	Chloromethane	A	ND	
09/15/1999	11/15/1999	Chromium	A	ND	0.1000000
09/15/1999	11/15/1999	Cis-1,2-Dichloroethylene	A	ND	0.0700000
09/15/1999	11/15/1999	Cyanide	A	ND	0.2000000
09/15/1999	11/15/1999	Dalapon	A	ND	0.2000000
09/15/1999	11/15/1999	Dibromochloromethane	A	ND	
09/15/1999	11/15/1999	Dibromomethane	A	ND	
09/15/1999	11/15/1999	Dicamba	A	ND	
09/15/1999	11/15/1999	Dichloromethane (Methylene Chloride)	A	ND	0.0050000
09/15/1999	11/15/1999	Dieldrin	A	ND	
09/15/1999	11/15/1999	Dinoseb	A	ND	0.0070000
09/15/1999	11/15/1999	Diquat	A	ND	0.0200000
09/15/1999	11/15/1999	Endothall	A	ND	0.1000000
09/15/1999	11/15/1999	Endrin	A	ND	0.0020000
09/15/1999	11/15/1999	Ethylbenzene	A	ND	0.7000000
09/15/1999	11/15/1999	Ethylene Dibromide (EDB)	A	ND	0.0000500
09/15/1999	11/15/1999	Fluoride	A	ND	4.0000000
09/15/1999	11/15/1999	Glyphosate	A	ND	0.7000000
09/15/1999	11/15/1999	Heptachlor	A	ND	0.0004000
09/15/1999	11/15/1999	Heptachlor Epoxide	A	ND	0.0002000

09/15/1999	11/15/1999	Hexachlorobenzene (HCB)	A	ND	0.0010000
09/15/1999	11/15/1999	Hexachlorocyclopentadiene	A	ND	0.0500000
09/15/1999	11/15/1999	Lead	A	ND	0.0150000
09/15/1999	11/15/1999	M-Dichlorobenzene	A	ND	
09/15/1999	11/15/1999	Mercury	A	ND	0.0020000
09/15/1999	11/15/1999	Methomyl	A	ND	
09/15/1999	11/15/1999	Methoxychlor	A	ND	0.0400000
09/15/1999	11/15/1999	Metolachlor	A	ND	
09/15/1999	11/15/1999	Metribuzin	A	ND	
09/15/1999	11/15/1999	Monochlorobenzene (Chlorobenzene)	A	ND	0.1000000
09/15/1999	11/15/1999	Nickel	A	ND	0.1000000
09/15/1999	11/15/1999	Nitrate	A	ND	10.000000
09/15/1999	11/15/1999	Nitrite	A	ND	1.0000000
09/15/1999	11/15/1999	O-Chlorotoluene	A	ND	
09/15/1999	11/15/1999	O-Dichlorobenzene	A	ND	0.6000000
09/15/1999	11/15/1999	P-Chlorotoluene	A	ND	
09/15/1999	11/15/1999	P-Dichlorobenzene	A	ND	0.0750000
09/15/1999	11/15/1999	Pentachlorophenol	A	ND	0.0010000
09/15/1999	11/15/1999	Phthalates (Di(2-Ethylhexyl))	A	ND	0.0060000
09/15/1999	11/15/1999	Picloram	A	ND	0.5000000
09/15/1999	11/15/1999	Propachlor	A	ND	
09/15/1999	11/15/1999	Selenium	A	ND	0.0500000
09/15/1999	11/15/1999	Simazine	A	ND	0.0040000
09/15/1999	11/15/1999	Sodium	A	19.800000	
09/15/1999	11/15/1999	Styrene	A	ND	0.1000000
09/15/1999	11/15/1999	Sulfate	A	ND	
09/15/1999	11/15/1999	Tetrachloroethylene	A	ND	0.0050000
09/15/1999	11/15/1999	Thallium Total	A	ND	0.0020000
09/15/1999	11/15/1999	Toluene	A	ND	1.0000000
09/15/1999	11/15/1999	Total Polychlorinated Biphenyls (PCB)	A	ND	0.0005000
09/15/1999	11/15/1999	Total Xylenes	A	ND	10.000000
09/15/1999	11/15/1999	Toxaphene	A	ND	0.0030000
09/15/1999	11/15/1999	Trans-1,2-Dichloroethylene	A	ND	0.1000000
09/15/1999	11/15/1999	Trichloroethylene	A	ND	0.0050000
09/15/1999	11/15/1999	Vinyl Chloride	A	ND	0.0020000
09/15/1999	11/15/1999	Vydate (Oxamyl)	A	ND	0.2000000
03/20/1998	05/26/1998	Nitrate	A	ND	10.000000
08/13/1997	08/27/1997	Nitrate	A	ND	10.000000
04/11/1996	06/03/1996	1,1,1,2-Tetrachloroethane	A	ND	
04/11/1996	06/03/1996	1,1,1-Trichloroethane	A	ND	0.2000000
04/11/1996	06/03/1996	1,1,2,2,-Tetrachloroethane	A	ND	
04/11/1996	06/03/1996	1,1,2-Trichloroethane	A	ND	0.0050000
04/11/1996	06/03/1996	1,1-Dichloroethane	A	ND	
04/11/1996	06/03/1996	1,1-Dichloroethylene	A	ND	0.0070000
04/11/1996	06/03/1996	1,1-Dichloropropene	A	ND	
04/11/1996	06/03/1996	1,2,3-Trichloropropane	A	ND	
04/11/1996	06/03/1996	1,2,4-Trichlorobenzene	A	ND	0.0700000
04/11/1996	06/03/1996	1,2-Dibromo-3-Chloropropane (DBCP)	A	ND	0.0002000

04/11/1996	06/03/1996	1,2-Dichloroethane	A	ND	0.0050000
04/11/1996	06/03/1996	1,2-Dichloropropane	A	ND	0.0050000
04/11/1996	06/03/1996	1,3-Dichloropropane	A	ND	
04/11/1996	06/03/1996	1,3-Dichloropropene	A	ND	
04/11/1996	06/03/1996	2,2-Dichloropropane	A	ND	
04/11/1996	06/03/1996	2,4,5-TP Silvex	A	ND	0.0500000
04/11/1996	06/03/1996	2,4-D	A	ND	0.0700000
04/11/1996	06/03/1996	3-Hydroxycarbofuran	A	ND	
04/11/1996	06/03/1996	Adipates (Di(2-Ethylhexyl))	A	ND	0.4000000
04/11/1996	06/03/1996	Alachlor (Lasso)	A	ND	0.0020000
04/11/1996	06/03/1996	Aldicarb	A	ND	
04/11/1996	06/03/1996	Aldicarb Sulfone	A	ND	
04/11/1996	06/03/1996	Aldicarb Sulfoxide	A	ND	
04/11/1996	06/03/1996	Aldrin	A	ND	
04/11/1996	06/03/1996	Antimony Total	A	ND	0.0060000
04/11/1996	06/03/1996	Arsenic	A	ND	0.0500000
04/11/1996	06/03/1996	Atrazine	A	ND	0.0030000
04/11/1996	06/03/1996	Barium	A	ND	2.0000000
04/11/1996	06/03/1996	Benzene	A	ND	0.0050000
04/11/1996	06/03/1996	Benzo (A) Pyrene	A	ND	0.0002000
04/11/1996	06/03/1996	Beryllium Total	A	ND	0.0040000
04/11/1996	06/03/1996	BHC-gamma (Lindane)	A	ND	0.0002000
04/11/1996	06/03/1996	Bromobenzene	A	ND	
04/11/1996	06/03/1996	Bromodichloromethane	A	ND	
04/11/1996	06/03/1996	Bromoform	A	ND	
04/11/1996	06/03/1996	Bromomethane	A	ND	
04/11/1996	06/03/1996	Butachlor	A	ND	
04/11/1996	06/03/1996	Cadmium	A	ND	0.0050000
04/11/1996	06/03/1996	Carbaryl	A	ND	
04/11/1996	06/03/1996	Carbofuran	A	ND	0.0400000
04/11/1996	06/03/1996	Carbon Tetrachloride	A	ND	0.0050000
04/11/1996	06/03/1996	Chlordane	A	ND	0.0020000
04/11/1996	06/03/1996	Chloroethane	A	ND	
04/11/1996	06/03/1996	Chloroform	A	ND	
04/11/1996	06/03/1996	Chloromethane	A	ND	
04/11/1996	06/03/1996	Chromium	A	ND	0.1000000
04/11/1996	06/03/1996	Cis-1,2-Dichloroethylene	A	ND	0.0700000
04/11/1996	06/03/1996	Cyanide	A	ND	0.2000000
04/11/1996	06/03/1996	Dalapon	A	ND	0.2000000
04/11/1996	06/03/1996	Dibromochloromethane	A	ND	
04/11/1996	06/03/1996	Dibromomethane	A	ND	
04/11/1996	06/03/1996	Dicamba	A	ND	
04/11/1996	06/03/1996	Dichloromethane (Methylene Chloride)	A	ND	0.0050000
04/11/1996	06/03/1996	Dieldrin	A	ND	
04/11/1996	06/03/1996	Dinoseb	A	ND	0.0070000
04/11/1996	06/03/1996	Diquat	A	ND	0.0200000
04/11/1996	06/03/1996	Endothall	A	ND	0.1000000
04/11/1996	06/03/1996	Endrin	A	ND	0.0020000

04/11/1996	06/03/1996	Ethylbenzene	A	ND	0.7000000
04/11/1996	06/03/1996	Ethylene Dibromide (EDB)	A	ND	0.0000500
04/11/1996	06/03/1996	Fluoride	A	ND	4.0000000
04/11/1996	06/03/1996	Glyphosate	A	ND	0.7000000
04/11/1996	05/17/1996	Gross Alpha, Excl. Radon & U	A	ND	15.000000
04/11/1996	06/03/1996	Heptachlor	A	ND	0.0004000
04/11/1996	06/03/1996	Heptachlor Epoxide	A	ND	0.0002000
04/11/1996	06/03/1996	Hexachlorobenzene (HCB)	A	ND	0.0010000
04/11/1996	06/03/1996	Hexachlorocyclopentadiene	A	ND	0.0500000
04/11/1996	06/03/1996	Lead	A	ND	0.0150000
04/11/1996	06/03/1996	M-Dichlorobenzene	A	ND	
04/11/1996	06/03/1996	Mercury	A	ND	0.0020000
04/11/1996	06/03/1996	Methomyl	A	ND	
04/11/1996	06/03/1996	Methoxychlor	A	ND	0.0400000
04/11/1996	06/03/1996	Metolachlor	A	ND	
04/11/1996	06/03/1996	Metribuzin	A	ND	
04/11/1996	06/03/1996	Monochlorobenzene (Chlorobenzene)	A	ND	0.1000000
04/11/1996	06/03/1996	Nickel	A	ND	0.1000000
04/11/1996	06/03/1996	Nitrate	A	ND	10.000000
04/11/1996	06/03/1996	Nitrite	A	ND	1.0000000
04/11/1996	06/03/1996	O-Chlorotoluene	A	ND	
04/11/1996	06/03/1996	O-Dichlorobenzene	A	ND	0.6000000
04/11/1996	06/03/1996	P-Chlorotoluene	A	ND	
04/11/1996	06/03/1996	P-Dichlorobenzene	A	ND	0.0750000
04/11/1996	06/03/1996	Pentachlorophenol	A	ND	0.0010000
04/11/1996	06/03/1996	Phthalates (Di(2-Ethylhexyl))	A	ND	0.0060000
04/11/1996	06/03/1996	Picloram	A	ND	0.5000000
04/11/1996	06/03/1996	Propachlor	A	ND	
04/11/1996	06/03/1996	Selenium	A	ND	0.0500000
04/11/1996	06/03/1996	Simazine	A	ND	0.0040000
04/11/1996	06/03/1996	Sodium	A	21.300000	
04/11/1996	06/03/1996	Styrene	A	ND	0.1000000
04/11/1996	06/03/1996	Sulfate	A	5.4000000	
04/11/1996	06/03/1996	Tetrachloroethylene	A	ND	0.0050000
04/11/1996	06/03/1996	Thallium Total	A	ND	0.0020000
04/11/1996	06/03/1996	Toluene	A	ND	1.0000000
04/11/1996	06/03/1996	Total Polychlorinated Biphenyls (PCB)	A	ND	0.0005000
04/11/1996	06/03/1996	Total Xylenes	A	ND	10.000000
04/11/1996	06/03/1996	Toxaphene	A	ND	0.0030000
04/11/1996	06/03/1996	Trans-1,2-Dichloroethylene	A	ND	0.1000000
04/11/1996	06/03/1996	Trichloroethylene	A	ND	0.0050000
04/11/1996	06/03/1996	Vinyl Chloride	A	ND	0.0020000
04/11/1996	06/03/1996	Vydate (Oxamyl)	A	ND	0.2000000
11/13/1995	12/01/1995	Nitrate	A	ND	10.000000
03/24/1993	04/03/1995	1,1,1,2-Tetrachloroethane	A	ND	
03/24/1993	04/03/1995	1,1,1-Trichloroethane	A	ND	0.2000000
03/24/1993	04/03/1995	1,1,2,2,-Tetrachloroethane	A	ND	
03/24/1993	04/03/1995	1,1,2-Trichloroethane	A	ND	0.0050000

03/24/1993	04/03/1995	1,1-Dichloroethane	A	ND	
03/24/1993	04/03/1995	1,1-Dichloroethylene	A	ND	0.0070000
03/24/1993	04/03/1995	1,1-Dichloropropene	A	ND	
03/24/1993	04/03/1995	1,2,3-Trichloropropane	A	ND	
03/24/1993	04/03/1995	1,2,4-Trichlorobenzene	A	ND	0.0700000
03/24/1993	04/03/1995	1,2-Dibromo-3-Chloropropane (DBCP)	A	ND	0.0002000
03/24/1993	04/03/1995	1,2-Dichloroethane	A	ND	0.0050000
03/24/1993	04/03/1995	1,2-Dichloropropane	A	ND	0.0050000
03/24/1993	04/03/1995	1,3-Dichloropropane	A	ND	
03/24/1993	04/03/1995	1,3-Dichloropropene	A	ND	
03/24/1993	04/03/1995	2,2-Dichloropropane	A	ND	
03/24/1993	04/03/1995	2,4,5-TP Silvex	A	ND	0.0500000
03/24/1993	04/03/1995	2,4-D	A	ND	0.0700000
03/24/1993	04/03/1995	3-Hydroxycarbofuran	A	ND	
03/24/1993	04/03/1995	Adipates (Di(2-Ethylhexyl))	A	ND	0.4000000
03/24/1993	04/03/1995	Alachlor (Lasso)	A	ND	0.0020000
03/24/1993	04/03/1995	Aldicarb	A	ND	
03/24/1993	04/03/1995	Aldicarb Sulfone	A	ND	
03/24/1993	04/03/1995	Aldicarb Sulfoxide	A	ND	
03/24/1993	04/03/1995	Aldrin	A	ND	
03/24/1993	04/03/1995	Antimony Total	A	ND	0.0060000
03/24/1993	04/03/1995	Arsenic	A	ND	0.0500000
03/24/1993	04/03/1995	Atrazine	A	ND	0.0030000
03/24/1993	04/03/1995	Barium	A	ND	2.0000000
03/24/1993	04/03/1995	Benzene	A	ND	0.0050000
03/24/1993	04/03/1995	Benzo (A) Pyrene	A	ND	0.0002000
03/24/1993	04/03/1995	Beryllium Total	A	ND	0.0040000
03/24/1993	04/03/1995	BHC-gamma (Lindane)	A	ND	0.0002000
03/24/1993	04/03/1995	Bromobenzene	A	ND	
03/24/1993	04/03/1995	Bromodichloromethane	A	ND	
03/24/1993	04/03/1995	Bromoform	A	ND	
03/24/1993	04/03/1995	Bromomethane	A	ND	
03/24/1993	04/03/1995	Butachlor	A	ND	
03/24/1993	04/03/1995	Cadmium	A	ND	0.0050000
03/24/1993	04/03/1995	Carbaryl	A	ND	
03/24/1993	04/03/1995	Carbofuran	A	ND	0.0400000
03/24/1993	04/03/1995	Carbon Tetrachloride	A	ND	0.0050000
03/24/1993	04/03/1995	Chlordane	A	ND	0.0020000
03/24/1993	04/03/1995	Chloroethane	A	ND	
03/24/1993	04/03/1995	Chloroform	A	ND	
03/24/1993	04/03/1995	Chloromethane	A	ND	
03/24/1993	04/03/1995	Chromium	A	ND	0.1000000
03/24/1993	04/03/1995	Cis-1,2-Dichloroethylene	A	ND	0.0700000
03/24/1993	04/03/1995	Cyanide	A	ND	0.2000000
03/24/1993	04/03/1995	Dalapon	A	ND	0.2000000
03/24/1993	04/03/1995	Dibromochloromethane	A	ND	
03/24/1993	04/03/1995	Dibromomethane	A	ND	
03/24/1993	04/03/1995	Dicamba	A	ND	

03/24/1993	04/03/1995	Dichloromethane (Methylene Chloride)	A	ND	0.0050000
03/24/1993	04/03/1995	Dieldrin	A	ND	
03/24/1993	04/03/1995	Dinoseb	A	ND	0.0070000
03/24/1993	04/03/1995	Diquat	A	ND	0.0200000
03/24/1993	04/03/1995	Endothall	A	ND	0.1000000
03/24/1993	04/03/1995	Endrin	A	ND	0.0020000
03/24/1993	04/03/1995	Ethylbenzene	A	ND	0.7000000
03/24/1993	04/03/1995	Ethylene Dibromide (EDB)	A	ND	0.0000500
03/24/1993	04/03/1995	Fluoride	A	ND	4.0000000
03/24/1993	04/03/1995	Glyphosate	A	ND	0.7000000
03/24/1993	04/03/1995	Heptachlor	A	ND	0.0004000
03/24/1993	04/03/1995	Heptachlor Epoxide	A	ND	0.0002000
03/24/1993	04/03/1995	Hexachlorobenzene (HCB)	A	ND	0.0010000
03/24/1993	04/03/1995	Hexachlorocyclopentadiene	A	ND	0.0500000
03/24/1993	04/03/1995	Lead	A	ND	0.0150000
03/24/1993	04/03/1995	M-Dichlorobenzene	A	ND	
03/24/1993	04/03/1995	Mercury	A	ND	0.0020000
03/24/1993	04/03/1995	Methomyl	A	ND	
03/24/1993	04/03/1995	Methoxychlor	A	ND	0.0400000
03/24/1993	04/03/1995	Metolachlor	A	ND	
03/24/1993	04/03/1995	Metribuzin	A	ND	
03/24/1993	04/03/1995	Monochlorobenzene (Chlorobenzene)	A	ND	0.1000000
03/24/1993	04/03/1995	Nickel	A	ND	0.1000000
03/24/1993	04/03/1995	Nitrate	A	ND	10.000000
03/24/1993	04/03/1995	Nitrite	A	ND	1.0000000
03/24/1993	04/03/1995	O-Chlorotoluene	A	ND	
03/24/1993	04/03/1995	O-Dichlorobenzene	A	ND	0.6000000
03/24/1993	04/03/1995	P-Chlorotoluene	A	ND	
03/24/1993	04/03/1995	P-Dichlorobenzene	A	ND	0.0750000
03/24/1993	04/03/1995	Pentachlorophenol	A	ND	0.0010000
03/24/1993	04/03/1995	Phthalates (Di(2-Ethylhexyl))	A	ND	0.0060000
03/24/1993	04/03/1995	Picloram	A	ND	0.5000000
03/24/1993	04/03/1995	Propachlor	A	ND	
03/24/1993	04/03/1995	Selenium	A	ND	0.0500000
03/24/1993	04/03/1995	Simazine	A	ND	0.0040000
03/24/1993	04/03/1995	Sodium	A	26.700000	
03/24/1993	04/03/1995	Styrene	A	ND	0.1000000
03/24/1993	04/03/1995	Sulfate	A	3.1000000	
03/24/1993	04/03/1995	Tetrachloroethylene	A	ND	0.0050000
03/24/1993	04/03/1995	Thallium Total	A	ND	0.0020000
03/24/1993	04/03/1995	Toluene	A	ND	1.0000000
03/24/1993	04/03/1995	Total Polychlorinated Biphenyls (PCB)	A	ND	0.0005000
03/24/1993	04/03/1995	Total Xylenes	A	ND	10.000000
03/24/1993	04/03/1995	Toxaphene	A	ND	0.0030000
03/24/1993	04/03/1995	Trans-1,2-Dichloroethylene	A	ND	0.1000000
03/24/1993	04/03/1995	Trichloroethylene	A	ND	0.0050000
03/24/1993	04/03/1995	Vinyl Chloride	A	ND	0.0020000
03/24/1993	04/03/1995	Vydate (Oxamyl)	A	ND	0.2000000

05/21/1992	07/14/1992	Gross Alpha, Excl. Radon & U	AB	ND	15.000000
03/04/1992	05/13/1992	Arsenic	AA	ND	0.0500000
03/04/1992	05/13/1992	Barium	AA	ND	2.0000000
03/04/1992	05/13/1992	Cadmium	AA	ND	0.0050000
03/04/1992	05/13/1992	Chromium	AA	ND	0.1000000
03/04/1992	05/13/1992	Fluoride	AA	ND	4.0000000
03/04/1992	05/13/1992	Lead	AA	ND	0.0150000
03/04/1992	05/13/1992	Mercury	AA	ND	0.0020000
03/04/1992	05/13/1992	Nitrate	AA	ND	10.000000
03/04/1992	05/13/1992	Selenium	AA	ND	0.0500000
03/04/1992	05/13/1992	Silver	AA	ND	0.1000000
03/04/1992	05/13/1992	Sodium	AA	21.100000	
03/04/1992	05/13/1992	Arsenic	AB	ND	0.0500000
03/04/1992	05/13/1992	Barium	AB	ND	2.0000000
03/04/1992	05/13/1992	Cadmium	AB	ND	0.0050000
03/04/1992	05/13/1992	Chromium	AB	ND	0.1000000
03/04/1992	05/13/1992	Fluoride	AB	ND	4.0000000
03/04/1992	05/13/1992	Lead	AB	ND	0.0150000
03/04/1992	05/13/1992	Mercury	AB	ND	0.0020000
03/04/1992	05/13/1992	Nitrate	AB	ND	10.000000
03/04/1992	05/13/1992	Selenium	AB	ND	0.0500000
03/04/1992	05/13/1992	Silver	AB	ND	0.1000000
03/04/1992	05/13/1992	Sodium	AB	18.800000	
03/07/1990	12/20/1990	1,1,1-Trichloroethane	AA	ND	0.2000000
03/07/1990	12/20/1990	1,1-Dichloroethylene	AA	ND	0.0070000
03/07/1990	12/20/1990	1,2-Dichloroethane	AA	ND	0.0050000
03/07/1990	12/20/1990	Benzene	AA	ND	0.0050000
03/07/1990	12/20/1990	Carbon Tetrachloride	AA	ND	0.0050000
03/07/1990	12/20/1990	P-Dichlorobenzene	AA	ND	0.0750000
03/07/1990	12/20/1990	Trichloroethylene	AA	ND	0.0050000
03/07/1990	12/20/1990	TThm	AA	ND	0.1000000
03/07/1990	12/20/1990	Vinyl Chloride	AA	ND	0.0020000
03/07/1990	04/19/1990	1,1,1-Trichloroethane	AB	ND	0.2000000
03/07/1990	04/19/1990	1,1-Dichloroethylene	AB	ND	0.0070000
03/07/1990	04/19/1990	1,2-Dichloroethane	AB	ND	0.0050000
03/07/1990	04/19/1990	Benzene	AB	ND	0.0050000
03/07/1990	04/19/1990	Carbon Tetrachloride	AB	ND	0.0050000
03/07/1990	04/19/1990	P-Dichlorobenzene	AB	ND	0.0750000
03/07/1990	04/19/1990	Trichloroethylene	AB	ND	0.0050000
03/07/1990	04/19/1990	Vinyl Chloride	AB	ND	0.0020000
03/06/1989	04/24/1989	Arsenic	AA	ND	0.0500000
03/06/1989	04/24/1989	Barium	AA	ND	2.0000000
03/06/1989	04/24/1989	Cadmium	AA	ND	0.0050000
03/06/1989	04/24/1989	Chromium	AA	ND	0.1000000
03/06/1989	04/24/1989	Fluoride	AA	ND	4.0000000
03/06/1989	04/24/1989	Lead	AA	ND	0.0150000
03/06/1989	04/24/1989	Mercury	AA	ND	0.0020000
03/06/1989	04/24/1989	Nitrate	AA	1.7500000	10.000000

03/06/1989	04/24/1989	Selenium	AA	ND	0.0500000
03/06/1989	04/24/1989	Silver	AA	ND	0.1000000
03/06/1989	04/24/1989	Arsenic	AB	ND	0.0500000
03/06/1989	04/24/1989	Barium	AB	ND	2.0000000
03/06/1989	04/24/1989	Cadmium	AB	ND	0.0050000
03/06/1989	04/24/1989	Chromium	AB	ND	0.1000000
03/06/1989	04/24/1989	Fluoride	AB	ND	4.0000000
03/06/1989	04/24/1989	Lead	AB	ND	0.0150000
03/06/1989	04/24/1989	Mercury	AB	ND	0.0020000
03/06/1989	04/24/1989	Nitrate	AB	2.8100000	10.000000
03/06/1989	04/24/1989	Selenium	AB	ND	0.0500000
03/06/1989	04/24/1989	Silver	AB	ND	0.1000000
05/09/1988	06/06/1988	Gross Alpha, Excl. Radon & U	AA	ND	15.000000
03/24/1986	03/24/1986	Nitrate	AA	ND	10.000000
11/01/1985	11/01/1985	Arsenic	AA	ND	0.0500000
11/01/1985	11/01/1985	Barium	AA	ND	2.0000000
11/01/1985	11/01/1985	Cadmium	AA	ND	0.0050000
11/01/1985	11/01/1985	Chromium	AA	ND	0.1000000
11/01/1985	11/01/1985	Fluoride	AA	0.4100000	4.0000000
11/01/1985	11/01/1985	Lead	AA	ND	0.0150000
11/01/1985	11/01/1985	Mercury	AA	ND	0.0020000
11/01/1985	11/01/1985	Selenium	AA	0.0020000	0.0500000
11/01/1985	11/01/1985	Silver	AA	ND	0.1000000

A blank or a 0 in the MCL column indicates that a MCL has not been set for that chemical
*This list represents the latest test results for **all** sources and entry points the system has. For systems with multiple sources the list will probably be a mix of results from all sources. But these are the latest results.*

Water Master Plan

Appendix D. Water Rights Correspondence

Oregon
John A. Kitzhaber, M.D., Governor

Water Resources Department
Commerce Building
158 12th Street NE
Salem, OR 97301-4172
(503) 378-3739
FAX (503) 378-8130
www.wrd.state.or.us

June 24, 2002

Bill Long, PE, CE
TETRA TECH/KCM, INC.
7080 SW Fir Loop
Portland, OR 97223

Reference: File No. G-12015, Permit No. G-10979; Certificate No. 28241 - City of Gervais

Dear Mr. Long:

Thank you for your letter of June 18, 2002, requesting the status of the water rights for the City of Gervais (City). A Claim of Beneficial Use and Site Report (Report) was received in this office on September 29, 1993, for permit G-10979.

Permit No. G-10979 (Permit) allows for the use of 1.52 cubic feet per second (2.35 million gallons of water per day [mgpd]) of water from two wells for municipal purposes. The date for completely applying the water to beneficial use as described in the permit is October 1, 1992.

Certificate of Water Right No. 28241(Certificate) allows for the use of 1.11 cubic feet per second (1.7 mgpd) of groundwater from a well for municipal purposes with a date of priority of August 2, 1956. This well was constructed to a depth of 142 feet on August 28, 1956. A copy of the water well drillers report and certificate are inclosed.

In addition to the two rights described above, the City holds Groundwater Certificate of Registration No. GR-202, which allows for the use of 300 gallons per minute of water from a well for municipal purposes. Reference to this right is only to inform you of all the rights held by the City. A final determination of the status of this right will be made at a later date if an adjudication proceeding is held.

The wells authorized under Certificate 28241 and Permit No. G-10979 appear to develop water from the same source. If this is the case, the use of groundwater beyond the amount authorized under the existing certificate, has yet to be accomplished and no proof of beneficial use under the terms of the permit beyond what is already perfected can be demonstrated at this time.

However, since the wells described by the Permit, are not authorized under the Certificate, you may submit a transfer application request to either change the location of the authorized points of appropriation or add the additional wells to the existing Certificate. If approved, the City would be authorized to appropriate up to 1.7 mgpd under their existing right from their two wells currently in use. Based upon your water use reports submitted, this quantity of water far exceeds the amount of water actually used by the City to this date (September 2001 water use 11.8 million gallons or 0.4 mgpd).

June 24, 2002
City of Gervais

You are aware, the City may file for an extension, but the Department will not require submission of proof of completion, attempt to cancel, or compel an application for extension of the time limits of the Permit. The reason for not requiring extensions is to allow the Community Water Supply Work Group to develop recommendations regarding permit extensions for community water suppliers.

If you are able to provide additional information regarding the use of water by the City or determine the source of water described under the Certificate is different that what is allowed by the Permit, I will reconsider your request for a certificate under the Permit. If you are not able to provide evidence of the use of water under the terms of the permit, in addition to the amount already allowed by the Certificate, no proof of water has been made to the satisfaction of the Director.

I recommend the City file and pursue a request for changes in points of appropriation of their existing Certificate and await the outcome of the recommendations of the Community Supply Work Group to determine what action, if any, will be required to complete the use of water under the Permit.

Please feel free to contact me if you have any questions and I will be happy to address any concerns you may have.

Sincerely,

Steve Brown
Program Analyst
Water Rights Division

c: City of Gervais
Dwight French, Manager
Bill Fujii, Region Liaison

TETRA TECH/KCM, INC.
7080 SW Fir Loop Portland, OR 97223
(503) 684-9097 • FAX (503) 598-0583

June 18, 2002

Steve Brown
Program Analyst
Oregon Water Resources Department
158 12th ST. NE
Salem, OR 97301-4172

Attn: Steve Brown

Subject: Status of City of Gervais Water File G-12015

Dear Steve:

I am writing a follow-up letter to our discussion regarding the status of the City of Gervais Application of Water Rights File G-12015 (under Permit G-10979) on June 18, 2002. The purpose of this letter is to request a written summary from the Oregon Water Resources Department noting any deficiencies that may exist in File G-12015. During the course of our discussion I was advised to provide the Oregon Water Resources Department Full Size Drawings of the Well #1 and Well #2 Well Test Data and the City of Gervais peak day demand prior to October 1992. I have attached the Well Test Data (sheets 7 & 8 of 18) to this document for your review. I have contacted the City of Gervais regarding the obtaining peak day data prior to October 1992 and have been informed that the 1992 daily records no longer exist. The Oregon Water Resources web site has monthly water use records for the City of Gervais during 1992. According to the monthly records June was the peak month prior to October 1992 with a usage of 443,987 cubic feet/month or 0.17 cfs. Determining a peak day without actual data requires some estimation. A common multiplier used in engineering calculations for peak day estimates is 2.5 which would correspond to a peak day flow of 0.42 cfs or approximately 28% of the Beneficial Use Permit of 1.52 cfs. During our conversation I believe it was mentioned that if we could show use of over 25% of existing beneficial use permit the City of Gervais could file an extension of time. Looking forward to obtaining a written summary of the status of the Gervais Application of Water Rights File G-12015.

Sincerely,
Tetra Tech/KCM, Inc.

Bill A. Long, P.E.
Civil Engineer

BAL: 2280020

Permit A-424—7-58 State Printing 1958

STATE OF OREGON

COUNTY OF MARION

CERTIFICATE OF WATER RIGHT

This Is to Certify, That CITY OF GERVAIS

of Gervais, 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 a well a tributary of Willamette River. for the purpose of municipal.

under Permit No. G-314 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 August 2, 1956

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 1.11 cubic feet per second,

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the NW¼ SE¼ as projected within Depot DLC 54, Section 26, T. 5 S., R. 2 W., W.M.; N. 31° W. 865 ft. most easterly S.E. corner Bonenfount DLC 43.

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 _____ of one cubic foot per second per acre,

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

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

municipal

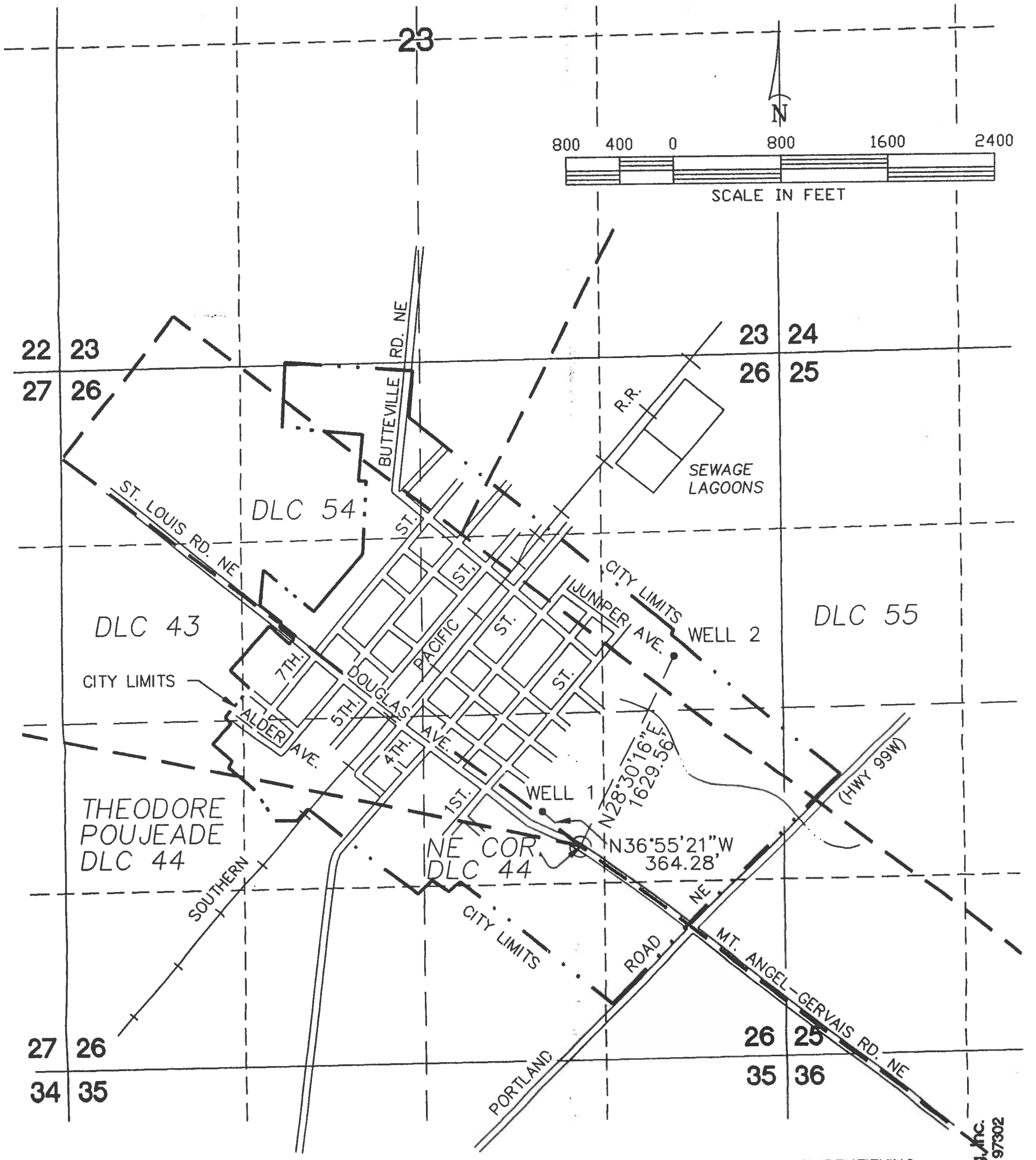
Lot 1 (NW¼ NE¼)
NW¼ NE¼ as projected within Brown DLC 55
W½ NE¼ as projected within Depot DLC 54
S½ NE¼ as projected within Brown DLC 55
SE¼ NE¼ as projected within Depot DLC 54
NE¼ NW¼ as projected within Depot DLC 54
Lot 2 (NE¼ NW¼)
S½ NW¼ as projected within Bonenfount DLC 43
SE¼ NW¼ as projected within Depot DLC 54
NE¼ SW¼ as projected within Bonenfount DLC 43
SE¼ SW¼ as projected within Poujeade DLC 44
N½ SE¼ as projected within Depot DLC 54
NW¼ SE¼ as projected within Bonenfount DLC 43
W½ SE¼ as projected within Poujeade DLC 44
Section 26
T. 5 S., R. 2 W., W.M.

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

WITNESS the signature of the State Engineer, affixed this date. February 24, 1961

LEWIS A. STANLEY
State Engineer

Recorded in State Record of Water Right Certificates, Volume 20, page 28241



— — DLC BOUNDARY

—·—·— CITY LIMITS BOUNDARY

THIS MAP WAS PREPARED FOR THE PURPOSE OF IDENTIFYING THE LOCATION OF THE WATER RIGHT ONLY AND HAS NO INTENT TO PROVIDE DIMENSIONS OR LOCATION OF PROPERTY OWNERSHIP LINES.

Certified Water Right Examiner
171 WRE
Loren F. Jay
May 17, 1988
STATE OF OREGON

CITY OF GERVAIS

T.5 S. R.2 W. W.M.

MARION COUNTY, OREGON

RECEIVED
SEP 29 1993
WATER RESOURCES DEPT
SALEM, OREGON

FINAL PROOF SURVEY

Application No. G-12015
Permit No. G-10979

Cascade Pacific Engineering, Inc.
890 Promontory Pl. SE Salem, OR 97302
PH (503) 363-8780

CLAIM OF BENEFICIAL USE AND SITE REPORT
PERMIT NO. G - 12015

The permittee for the water right is the City of Gervais; P.O. Box 348; Gervais, Oregon 97026. Dave Miller is the Public Works Director and was on site at the time of the inspection on September 20, 1993.

The type of use is municipal in and for the City of Gervais. The boundary of service area remains the same as shown on the Water Rights Application. Wells 1 and 2, as shown on the final proof map, are the sources of the water used by the City. The limits of use and the points of diversion are shown on the final proof map.

Well No. 1 uses a Worthington Model 6H18, 5 stage, 6-inch, 20 HP motor and can produce 340 GPM at 170 TDH. The well is 265 feet deep. The well was drilled in May of 1989. Well details, bore log, and well test data sheet is included in this report.

Well No. 2 uses a Worthington Model 6H18, 6 stage, 6-inch, 25 HP motor and can produce 340 GPM at 210 TDH. The well is 279 feet deep. The well was drilled in June 1989. Well details, bore log, and well test data sheet is included in this report.

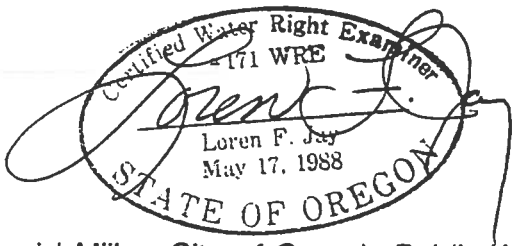
The distribution system consists of a 350,000 gallon welded steel storage tank that rests on a concrete ring wall. The tank is 60 feet in diameter and has a sidewall height of 16 feet. Both the inlet and outlet connections are inside, under the floor. The plant is equipped with three electric, and one propane fueled, distribution pumps. The operating pressure range of the three electrical pumps have been staggered to conserve energy. The pumps deliver water in the range of 40 to 64 psi at 75 to 1000 GPM. A 3,500 gallon hydro-pneumatic tank and air compressor serve to maintain system pressures within a range of 20 psi under all demand conditions.

There is approximately 44,400 feet of piping in the distribution system. The piping consists of approximately 6,000 feet of 3/4 to 1-inch pipe; 12,000 feet of 2-inch; 7,000 feet of 4-inch; 16,000 feet of 6-inch pipe; 1,100 feet of 8-inch; 600 feet of 10-inch; and 1,700 feet of 12-inch.

Measuring devices are installed at both wells. Dave Miller measures and records the static level and draw down 3 to 4 times per year at each well.

The boundary of the water use was derived from existing mapping showing the City's boundary. Both wells were tied to the NE corner of DLC 44 within Sec. 26 of T. 5 S., R. 2 W., W.M. with a theodolite and EDM total station.

The final proof survey and inspection of the use as found to be complete under terms and conditions of Permit No. G - 12015 was completed by me on the 20th of September 1993, and the facts contained in this report and accompanying final proof map are correct to the best of my knowledge.



Loren F. Jay, CWRE
Certified Water Rights Examiner

I, David Miller, City of Gervais Public Works Director, agree to the findings of the CWRE and do submit this site report and map as my Claim of Beneficial Use of the water as provided under the terms and conditions of my Permit No. G - 12015.

David Miller
Gervais Public Works Director

LFJ/cs
gerv4/gerv23wr.doc

Darleen Cogburn
City Recorder/Manager

STATE OF OREGON

COUNTY OF MARION

PERMIT TO APPROPRIATE THE PUBLIC WATERS

THIS PERMIT IS HEREBY ISSUED TO

CITY OF GERVAIS
524 FOURTH STREET
PO BOX 348
GERVAIS, OREGON 97026

503-792-4222

to use the waters of TWO WELLS in the PUDDING RIVER BASIN for MUNICIPAL USES.

This Permit is issued approving Application G-12015. The date of priority is JANUARY 19, 1990. The use is limited to not more than 1.52 CUBIC FEET PER SECOND, or its equivalent in case of rotation, measured at the well.

The wells are located as follows:

NW 1/4 SE 1/4, SE 1/4 NE 1/4, SECTION 26, T 5 S, R 2 W, W.M.; WELL 1 - NORTH 36 DEGREES 55 MINUTES 21 SECONDS WEST, 364.28 FEET; WELL 2 - NORTH 28 DEGREES 30 MINUTES 16 SECONDS EAST, 1629.56 FEET, BOTH FROM NE CORNER, DLC 44.

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

A description of the proposed place of use under the permit is as follows:

NW 1/4 NE 1/4
S 1/2 NE 1/4
E 1/2 NW 1/4
N 1/2 SW 1/4
SE 1/4
SECTION 26
TOWNSHIP 5 SOUTH, RANGE 2 WEST, W.M.

The well 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 level elevations in the well at all times. When required by the department, the permittee shall install and maintain a weir, meter, or other suitable measuring device, and shall keep a complete record of the amount of ground water withdrawn.

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.

Actual construction work shall begin on or before MARCH 9, 1991, and shall be completed on or before October 1, 1991. Complete application of the water shall be made on or before October 1, 1992.

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 beneficial use of water without waste. The water user is advised that new regulations may require 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.

Issued this date, MARCH 9, 1990.

William H. Young

Water Resources Department
William H. Young
Director

Oregon

WATER
RESOURCES
DEPARTMENT

November 2, 1992

City of Gervais
524 Fourth Street, P O Box 348
Gervais, Oregon 97026

REFERENCE: File G-12015

The date for the complete application of water to a beneficial use for your water use Permit G-10979 was October 1, 1992. To date we have not received notice that your project was completed.

If the project was completed, you should promptly submit the notice of complete application of water (Form C, attached). If you were unable to complete the project within the time allowed, you may wish to request an extension of the time limits. Forms will be furnished upon request.

In order to obtain a certificate of water right, you are required by law to hire a certified water right examiner to conduct the final proof survey of the completed use. This must be done within one year after the use is reported as being complete or within one year after the beneficial use date allowed in the permit, whichever occurs first. Accordingly, the map and claim of beneficial use must be received in this office on or before October 1, 1993. A list of certified water right examiners is enclosed for your information.

Upon receipt of the map and claim of beneficial use, the information will be reviewed and a brief field inspection may be conducted by a representative of this office. Following that, a proposed certificate of water right will be mailed to you for review.

If you are no longer interested in the project, please let us know. We will provide forms for you to authorize the cancellation of the permit.

If you have any questions, please contact the Water Rights Section at 378-3739.

WCM:cam

enclosure

3850 Portland Rd NE
Salem, OR 97310
(503) 378-3739
FAX (503) 378-8130

Russ Fetrow Engineering Inc.

890 Promontory Pl. S.E., Salem, Oregon 97302

(503) 363-8760 Fax (503) 588-7716

COPY

August 23, 1989

Mayor and City Council
City of Gervais
P.O. Box 348
Gervais, OR 97026

RE: GERVAIS, CITY OF
MUNICIPAL WELLS
PROJECT EXECUTIVE STUDY

Dear Mayor Canter:

On May 19, 1989, Schneider Equipment Company started operations to drill two (2) new municipal wells on the east side of the City on two (2) plots of land purchased from Pete Olsen of Wilsonville. Well #1 was drilled on the plot closest to the high school, while Well #2 was drilled on the plot approximately 1750 feet to the north. Well #1 was completed in late June, while Well #2 was completed by July 28th. Both wells were sealed by August 4th, after bacteriological tests for coliform bacteria yielded negative results.

Twenty-four hour test pumping after well development indicated a sustained yield of 975 GPM for Well #1 and 935 GPM for Well #2. Both wells are high yield wells drawing on aquifers approximately 230 deep. Drawdown measurements taken on nearby, shallower wells indicated that the newer, deeper wells had no influence on the older, shallower wells. With three (3) filters in service, each well will be called on for 423 GPM for up to six hours on an alternating basis.

The geology in the Gervais area proved to be a mix of intermixed medium and fine sand, brown and grey clay, black sand and coarse gravel in the aquifers. The clay layers provided a tight seal for the 15-inch and 16-inch casing, but the fine black sand worked loose easily and required extended well development time to be cleared. Because of the geology in the area, both wells contain split aquifers between the 220 foot and 260 foot levels with clay layers in the middle. Schneider Equipment added graded gravel pack between the well screens and the casing before well development. After careful packing during development they were successful in terminating the flow of black sand in Well #1. Well #2 sealed better below 200 feet when the driller converted from a 16-inch bit to a 15-inch bit, then forced the 16-inch casing down through the 15-inch clay layers. Well #2 development took far less time than was necessary for Well #1.

Both wells were checked for well alignment, which is item "D" of the contract. Well #1 demonstrated some drift, but was still within the allowable deviation of 1-1/2 feet per 250 feet of depth. Well #2 was drilled with a drift of no more than 3 inches the total length of the shaft.

During test pumping, water samples were taken to measure primary and secondary inorganic levels. Tests revealed both wells are capable of producing high quality potable water with similar constituent levels of inorganics. The total dissolved solids level of 220-295 mg/l is below the maximum limit of 500 mg/l established by the Health Division for potable water. Residents concerned with sodium will be pleased by the very low level, 19-21 mg/l, of this constituent. Iron levels in both wells are well below the secondary limit of 0.3 mg/l; however, manganese levels exceed the maximum secondary limit of 0.05 mg/l by four times as much. Also, the manganese greensand filters will reduce the manganese below the maximum level of 0.05 mg/l. The water tested moderately hard, which can be expected from well water. All other inorganic constituents tested were within acceptable limits for drinking water.

Both wells were disinfected according to Health Division regulations by the well driller. However, it was necessary to repeat chlorination several times to achieve a negative bacteria count.

The negotiated cost for the construction of the wells was $56,680.00. The contractor incurred $5,574.50 in additional costs during the course of construction. The final cost for construction of the wells is $62,254.50.

Respectfully,

RUSS FETROW ENGINEERING, INC.

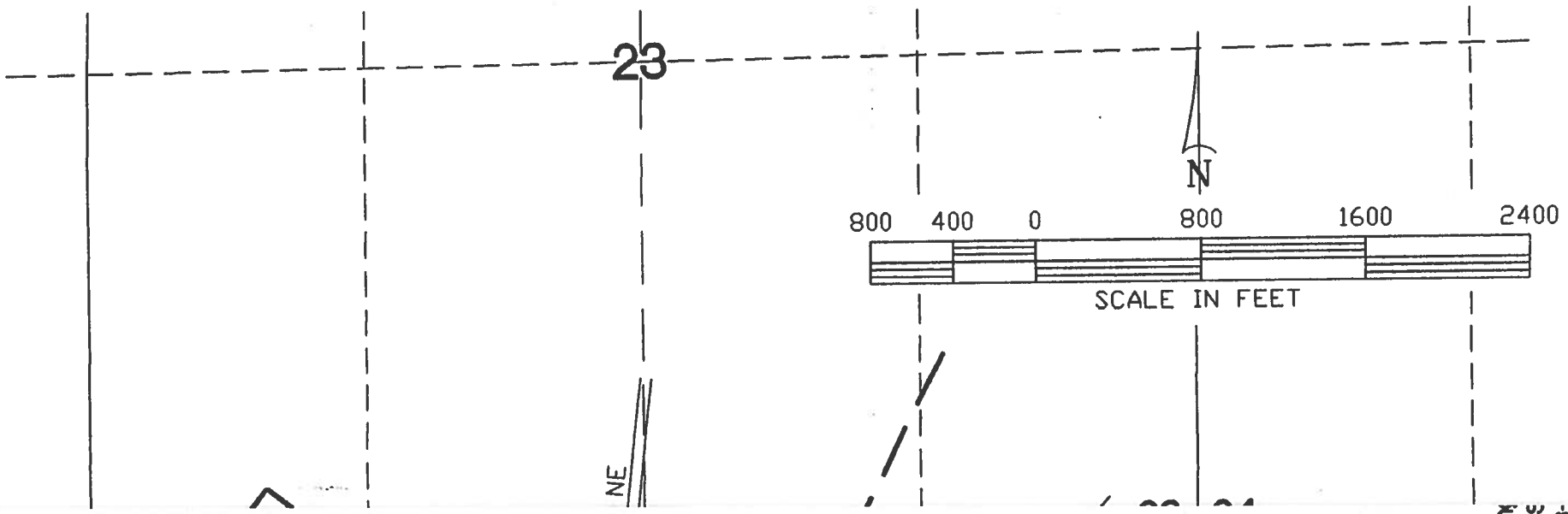
Robert A. Funk

By: Robert A. Funk
Sanitary Engineering Associate

BAF/ss
mayor.ltr/gervais

Att: Well Logs #1 and #2
Well Alignments Logs #1 and #2
Water Analysis Reports #1 and #2
Coliform Bacteria Report
Summary of Contract Cost Changes

cc: file (2)



CITY OF GERVAIS

Certified Water Right Examiner
#171 WRE
Loren F. Jay
May 17, 1988
STATE OF OREGON

T.5 S. R.2 W. W.M.

MARION COUNTY, OREGON

RECEIVED
SEP 29 1993
WATER RESOURCES DEPT
SALEM, OREGON

FINAL PROOF SURVEY

Application No. G-12015
Permit No. G-10979

Cascade Pacific En
890 Promontory Pl, SE
PH (503) 363-

Water Master Plan

Appendix E. Detailed Cost Estimates

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs

WATER SUPPLY

Water Rights Transfer

Item	Qty	Unit	Unit Cost	Total Cost
Hire Consultant or Certified Water Rights Examiner	1	LS	$10,000	$10,000
Construction Subtotal				**$10,000**
Construction Contingencies (% of total)			30%	$3,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			0%	$0
Total Project Cost				**$13,000**

Replace Well Pump No. 1

Item	Qty	Unit	Unit Cost	Total Cost
Remove and Replace Pump	1	LS	$13,000	$13,000
Construction Subtotal				**$13,000**
Construction Contingencies (% of total)			30%	$4,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			0%	$0
Total Project Cost				**$17,000**

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs
WATER STORAGE IMPROVEMENTS

Option 1 - Replace Reservoir No. 1 with 500,000 Gallon Reservoir in Existibng Location

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization	1	LS	$52,258	$52,258
Demo Existing Reservoir	1	LS	$20,000	$20,000
80 ft dia reservoir	1	Gal	$460,000	$460,000
Excavation & Foundation Pad Prep	0	CY	$70	$0
Relocate8" Backwash	130	LF	$85	$11,050
14" DI Piping	95	LF	$170	$16,150
8" Piping	105	LF	$85	$8,925
Relocate 10" Raw Water	150	LF	$115	$17,250
Relocate Valve Nest	1	LS		$0
14" Tie in	1	EA	$12,000	$12,000
14" Butterfly Valve	3	EA	$5,500	$16,500
14" Tee	1	EA	$3,000	$3,000
14" Fittings	1	LS	$50,000	$50,000
10" Fittings	1	LS	$25,000	$25,000
8" Gate Valve	3	EA	$2,000	$6,000
8" Tee	1	EA	$850	$850
8" 45 Degree Bend	3	EA	$1,000	$3,000
Relocated Electrical and Telemetry	100	LF	$20	$2,000
Erosion Control	1	LS	$1,500	$1,500
Construction Subtotal				**$706,000**
Construction Contingencies (% of total)			30%	$212,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$230,000
Total Project Cost				**$1,150,000**

Option 2 - Replace Reservoir No. 1 with 500,000 Gallon Reservoir to West

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization	1	LS	$63,117	$63,117
Demo Existing Reservoir	1	LS	$20,000	$20,000
Demo E. Garage & BW Sump	1	LS	$15,000	$15,000
80 ft dia reservoir	1	Gal	$460,000	$460,000
Excavation & Foundation Pad Prep	631	CY	$70	$44,197
8" Backwash Piping & Fittings	220	LF	$85	$18,700
14" DI Piping	210	LF	$170	$35,700
8" Piping	160	LF	$85	$13,600
Relocate 10" Raw Water	120	LF	$115	$13,800
New Prefab Steel Garage	2500	SF	$30	$75,000
Garage Floor Slab	2500	SF	$8	$20,000
Garage Foundation	185	CY	$70	$12,963
Backwash Foundation	42.2	CY	$80	$3,378
Concrete (New Backwash Sump)	30.8	CY	$750	$23,121
Relocated Electrical and Telemetry	100	LF	$20	$2,000
Temporary Facilities (Backwash)	1	LS	$30,000	$30,000
Erosion Control	1	LS	$1,500	$1,500
Construction Subtotal				**$853,000**
Construction Contingencies (% of total)			30%	$256,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$277,000
Total Project Cost				**$1,390,000**

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs

Install Siesmic Connection at Reservoir No.2

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$15,000	$15,000
Install 8" Fill Pipe Flexible Fittings	3	EA	$15,000	$45,000
Install 14" Flexible Connection	1	EA	$30,000	$30,000
Main Reconnections	4	EA	$3,000	$12,000
Construction Subtotal				**$102,000**
Construction Contingencies (% of total)			30%	$31,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$33,000
Total Project Cost				**$170,000**

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs
DISTRIBUTION SYSTEM IMPROVEMENTS

New Fire Hydrants

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$2,200	$2,200
Fire Hydrant Assembly	5	EA	$5,500	$27,500
Surface Restoration	5	EA	$1,500	$7,500
Construction Subtotal				**$38,000**
Construction Contingencies (% of total)			30%	$11,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$12,000
Total Project Cost				**$70,000**

Douglas Ave Pipeline Replacement

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$22,000	$22,000
10" PVC C900 Water Main (w/Fittings)	1,060	EA	$109	$115,540
Bore 18" Stl Casing at UPRR Crossing	150	LF	$550	$82,500
Surface Restoration	427	SY	$50	$21,333
Service Reconnections	16	EA	$300	$4,800
Main Reconnections	6	EA	$3,000	$18,000
6-inch Gate Valve Assembly	2	EA	$2,000	$4,000
10-inch Gate Valve Assembly	4	EA	$4,800	$19,200
Traffic Control	1	LS	$10,000	$10,000
Erosion Control	1	LS	$5,000	$5,000
Construction Subtotal				**$303,000**
Construction Contingencies (% of total)			30%	$91,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$99,000
Total Project Cost				**$500,000**

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs
Ivy Ave Pipeline Replacement

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$16,000	$16,000
8" PVC C900 Water Main (w/Fittings)	610	EA	$85	$51,850
Bore 16" Stl Casing at UPRR Crossing	150	LF	$520	$78,000
Surface Restoration	227	SY	$50	$11,333
Service Reconnections	16	EA	$300	$4,800
Main Reconnections	6	EA	$3,000	$18,000
6-inch Gate Valve Assembly	2	EA	$2,000	$4,000
8-inch Gate Valve Assembly	4	EA	$3,000	$12,000
Traffic Control	1	LS	$10,000	$10,000
Erosion Control	1	LS	$5,000	$5,000
Construction Subtotal				**$211,000**
Construction Contingencies (% of total)			30%	$63,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$69,000
Total Project Cost				**$350,000**

Grove Ave. Pipeline

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$16,000	$16,000
8" PVC C900 Water Main (w/Fittings)	790	EA	$85	$67,150
Bore 16" Stl Casing at UPRR Crossing	150	LF	$520	$78,000
Surface Restoration	307	SY	$50	$15,333
Service Reconnections	10	EA	$300	$3,000
Main Reconnections	3	EA	$3,000	$9,000
6-inch Gate Valve Assembly	2	EA	$2,000	$4,000
8-inch Gate Valve Assembly	4	EA	$3,000	$12,000
Traffic Control	1	LS	$10,000	$10,000
Erosion Control	1	LS	$5,000	$5,000
Construction Subtotal				**$220,000**
Construction Contingencies (% of total)			30%	$66,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$72,000
Total Project Cost				**$360,000**

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs
Connection to Winfield Estates

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$15,000	$15,000
8" PVC C900 Water Main (w/Fittings)	210	EA	$85	$17,850
Surface Restoration	20	SY	$50	$1,000
Service Reconnections	0	EA	$300	$0
Main Reconnections	2	EA	$3,000	$6,000
6-inch Gate Valve Assembly	3	EA	$2,000	$6,000
Traffic Control	0	LS	$10,000	$0
Erosion Control	1	LS	$5,000	$5,000
Construction Subtotal				**$51,000**
Construction Contingencies (% of total)			30%	$15,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$17,000
Total Project Cost				**$90,000**

Medium and High Demand Pump Upgrades

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$15,000	$15,000
Piping modfications	1	LS	$8,000	$8,000
New High Demand 75 Hp Pump and Motor	1	LS	$50,000	$50,000
Replace 15 Hp Pump with 25 Hp, Motor and VFI	1	LS	$20,000	$20,000
Pump Installation	1	LS	$15,000	$15,000
Electrical	1	LS	$10,000	$10,000
Soft Start	1	LS	$10,000	$10,000
Construction Subtotal				**$128,000**
Construction Contingencies (% of total)			30%	$38,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$42,000
Total Project Cost				**$210,000**

CITY OF GERVAIS
WATER FACILITIES MASTER PLAN UPDATE
Estimated Costs
Juniper Avenue Pipeline

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$15,000	$15,000
8" PVC C900 Water Main (w/Fittings)	550	EA	$85	$46,750
Surface Restoration	200	SY	$50	$10,000
Service Reconnections	2	EA	$300	$600
Main Reconnections	4	EA	$3,000	$12,000
6-inch Gate Valve Assembly	8	EA	$2,000	$16,000
Traffic Control	1	LS	$10,000	$10,000
Erosion Control	1	LS	$5,000	$5,000
Construction Subtotal				**$116,000**
Construction Contingencies (% of total)			30%	$35,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$38,000
Total Project Cost				**$190,000**

New Distribution Valves for Siesmic Resiliency

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8%	LS	$2,200	$2,200
Install 6-inch Gate Valves	5	EA	$5,500	$27,500
Surface Restoration	5	EA	$1,500	$7,500
Erosion Control	1	LS	$4,000	$4,000
Construction Subtotal				**$42,000**
Construction Contingencies (% of total)			30%	$13,000
Engr, Arch, Admin, Legal Fees (% of Total Constr. & Contingency)			25%	$14,000
Total Project Cost				**$70,000**

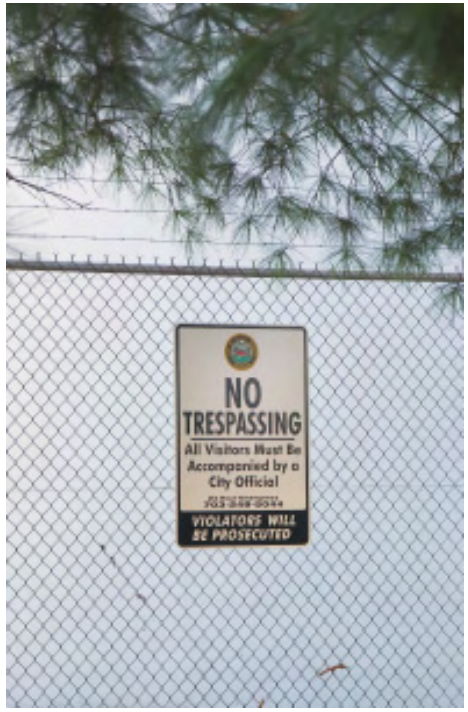
Water Master Plan

Appendix F. Drinking Water Security Guidance

United States
Environmental Protection
Agency

Drinking Water Security for Small Systems Serving 3,300 or Fewer Persons

One of the Simple Tools for Effective Performance (STEP) Guide Series



Disclaimer

The U.S. Environmental Protection Agency (EPA) prepared this guide to help you enhance the security of your water system. This document does not impose legally binding requirements on EPA, states, tribes, or the regulated community, and it may or may not be applicable to a particular situation depending on the circumstances. EPA and state decision makers retain the discretion to adopt approaches on a case-by-case basis that may differ from this guidance where appropriate. Any decisions regarding a particular community water system will be made based on the applicable statutes and regulations. Therefore, interested parties are free to raise questions and objections about the appropriateness of the application of this guide to a particular situation, and EPA will consider whether the recommendations or interpretations in this guide are appropriate in that situation based on the law and regulations. EPA may change this guidance in the future. To determine whether EPA has revised this guide or to obtain additional copies, contact the Safe Drinking Water Hotline at (800) 426-4791.

Contents

Is This Guide for Me?

This guide is designed for community water systems (CWSs) serving 3,300 or fewer persons. CWSs include all publicly and privately owned systems providing drinking water to at least 25 year-round residential customers or 15 year-round service connections. This guide may be useful for:

- Small town systems
- Rural water districts
- Tribal systems
- Manufactured home communities
- Homeowners' associations
- Small private systems
- Public Service Districts (PSDs)

This guide presents basic information and steps you can take to improve security and emergency preparedness at your water system. It explains why security improvements are important and discusses Vulnerability Assessments (VAs) and Emergency Response Plans (ERPs) – tools that you can use to improve security at your system.

Additional copies of this guide may be obtained by calling the Safe Drinking Water Hotline at (800) 426-4791. You may also download the guide from EPA's Water Security Web site at http://epa.gov/safewater/watersecurity.

Your state (see box below) can provide additional security-related material and help you implement appropriate security measures at your water system. State contact information can be found in Appendix A. Drinking water industry associations and technical assistance providers also are actively involved with water security issues. See "**Where Can I Find Additional Help?**" on page 34 for their contact information.

Please note that the term "state" is used in this guide to refer to your Drinking Water Primacy Agency. The Primacy Agency for most systems is the State Drinking Water Agency. However, the Primacy Agency for systems located in the Navajo Nation is the tribal office. The Primacy Agency for systems located on other tribal lands, in the State of Wyoming, or in the District of Columbia is the EPA regional office.

What Will I Learn?

Part of providing safe drinking water is protecting your system from various threats and preparing for emergencies. Everyone involved in water system ownership, management, and operation – owners, operators, board members, and local officials – has a responsibility for water system security. If you are part of any of these groups, this guide will help you by:

- Explaining what Vulnerability Assessments (VA) and Emergency Response Plans (ERP) are
- Describing the main activities and steps involved in completing VAs and ERPs
- Identifying user-friendly tools, templates, software, and checklists that can help you work through your VA and ERP

In this guide, you will learn about drinking water security initiatives and how to take practical actions to improve security at your system. You will also learn how to help ensure that your system is prepared to handle an emergency.

What Are Systems Serving More than 3,300 Persons Doing?

In response to the 2001 terrorist attacks, Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act (Public Law 107-188) in 2002. This law requires that a CWS serving more than 3,300 persons conduct a VA. A copy of the VA must be sent to EPA according to a schedule specified in the law. CWSs serving more than 3,300 persons must also prepare or revise an ERP and certify to the EPA Administrator that the plan has been completed within 6 months of completing the VA. The ERP should incorporate the results of the VA and provide details on the actions a system will take to respond to an emergency.

Although the Act's requirements do not apply to systems serving 3,300 or fewer persons, it is important for systems of all sizes to understand their vulnerabilities and plan for emergencies. Systems serving 3,300 or fewer persons should consider completing a VA and an ERP to improve their preparedness and response capabilities.

It is important to note that some states have their own VA and ERP requirements. Be sure to check with your state to determine if there are requirements you must consider.

Building a Team

You will need the help of everyone involved with your water system's ownership, management, and operations to improve security and emergency preparedness at your system. Build a team made up of water system operators, board members, and owners and make a team commitment to improving security and emergency preparedness at your water system.

Why Is It Important to Improve Security and Prepare for Emergencies?

There are many threats that may put at risk your ability to provide a reliable and safe supply of water to your customers. Your system may face various man-made threats, both intentional and accidental, such as:

- Accidents (e.g., construction, traffic)
- Backflow
- Fire/arson
- Hazardous material releases
- Terrorism
- Vandalism

The idea that your system could be the target of terrorism may seem far-fetched to you. Man-made threats, however, are only some of many potential causes of emergencies at water systems. Natural disasters that might cause an emergency at your system include:

- Earthquakes
- Floods
- Forest and brush fires
- Hurricanes
- Severe cold weather/ice storms
- Tornadoes
- Waterborne disease outbreaks

Your responsibility is to protect your customers from the negative outcomes of these threats. These outcomes could include:

- A shortage of drinking water
- Illnesses or deaths
- Public panic and fear of drinking the water from your system
- Costs of rehabilitating, rebuilding, or decontaminating your water system
- Long-term contamination of your water supply
- Interruption of firefighting capability
- Interruption of sanitary services

To deliver safe drinking water to your customers, you should have appropriate security measures in place, and you should know how to respond to an emergency. If your system is vulnerable to any threat, the health of your customers is at risk. If you are not prepared to respond to a crisis, the negative effects of the emergency will be magnified. Ignoring vulnerabilities and failing to properly plan for emergencies jeopardizes the safety of the water you deliver and the health of the people who depend on it. On the other hand, if you act now, you and your customers will have more confidence and peace of mind knowing that you are improving your system's security and emergency-response capability.

You will see this key throughout the guide. Pay special attention to these "key points," which highlight critical information for you and your system.

What Is a Vulnerability Assessment?

A VA is a step-by-step evaluation of your system and its operations that assesses your ability to reduce the risk of different threats. A VA identifies weaknesses in your system's security and focuses on the types of possible threats that could keep you from providing a safe and reliable supply of water to your customers. Once your VA is completed, you should know which of your system's components might be vulnerable, and you will have begun to identify and prioritize the security upgrades and operational changes that will reduce risks to your system.

HOW DO I CONDUCT A VULNERABILITY ASSESSMENT?

Identifying potential security threats and completing a VA might seem like an overwhelming challenge. You might think that you need an expert to properly evaluate your system's security. This section, however, outlines a few basic steps that will allow YOU to examine the risks facing your system. Using this approach, along with available tools, you can evaluate your system's security and begin to address any problems or needed improvements – without the help of outside consultants or security experts. Build a team made up of the water system operator, board members, and owners. This team will help you develop a complete VA.

It is important to note that some states have their own VA requirements. Be sure to check with your state to determine if there are requirements you must consider. Your state can also be a good source of assistance if you have questions about VAs.

How you perform your VA is completely up to you and should reflect the needs and characteristics of your system. That said, there are six basic steps that everyone should follow when conducting a VA of their system (see the figure below).[1] The steps described in this section offer a general overview that will help you understand the activities necessary for an effective VA. Completing these steps will help you take a thorough look at the security risks your system faces.

To complete your VA, follow the six steps on the following pages. The graphic below will help you track the steps as you move from page to page. There are a number of worksheets, checklists, and other aids that can help you conduct a VA and accomplish these six basic steps; these tools are listed in "**Where Can I Find Additional Help?**" on page 34.

1: Evaluate System → *2: Identify Threats* → *3: Consider Consequences* → *4: Assess Likelihood* → *5: Evaluate Measures* → *6: Plan Action*

[1] These six steps are based on the six basic elements listed in ***Vulnerability Assessment Factsheet***, **EPA Office of Water (EPA 816-F-02-005);** November 2002.

VA Step 1

YOUR SYSTEM AND ITS COMPONENTS – KNOWING AND EVALUATING CRITICAL RELATIONSHIPS

In this step you should think about your entire water system, including your primary goals, the customers you serve, and your system's components. To tackle this step, you should:

Identify different groups among your customers and consider their specific needs.

- Examples of customers include the general public, hospitals, fire departments, industry, and retail operations.

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Identify your primary system goals.

- If water service during an emergency is especially important to any of these groups (e.g., firefighters), highlight them so that you can be sure to consider any special activities needed to protect their service.

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Think about your facilities and how your system operates.

- You'll want to include information about your water source, treatment, storage, chemical use and storage, supervisory control and data acquisition (SCADA) and computer systems, and your distribution system.
- Highlight critical facilities and "single points of failure," or components that are especially important to providing a safe and reliable supply of water, and describe any special problems they might face (e.g., dependency on electricity, lack of back-up capacity, etc.).

Although you may feel that you already are familiar with your system and how it works, evaluating each system component (including system personnel and water source) both independently and as part of overall system operations is the key to identifying its possible weaknesses. It is important to identify "single points of failure" in the system, or system components or processes that, if they failed, would interrupt the system's ability to supply reliable, safe water. It is also especially important for you to identify your critical customers (e.g., hospitals, fire departments), services, and components to help you prioritize your activities. It is important to provide yourself with an accurate picture of your system in this step. The rest of the VA process relies on this information!

1: Evaluate System → *2: Identify Threats* → *3: Consider Consequences* → *4: Assess Likelihood* → *5: Evaluate Measures* → *6: Plan Action*

VA Step 2

IDENTIFY POSSIBLE THREATS TO YOUR SYSTEM

The second step of your VA gives you the chance to identify the types of threats that could disrupt your system's ability to provide a reliable and safe supply of water. To complete this step, you should:

Look at the critical system facilities and components that you identified in VA Step 1 and think about whether a threat could realistically harm each of them. At a minimum, you should consider the following components in your assessment:

- Source water
- Physical barriers
- Treatment facilities
- Storage facilities
- Distribution and transmission pipes
- Computers or other automated systems (e.g., SCADA)
- Use, handling, and storage of chemicals
- Knowledge base (e.g., water system operator)
- Operations and maintenance practices

Consider each possible threat and which part(s) of the system it would affect. Consider all types of threats, including:

- Physical damage to the system
- Contamination of water at any point in the system
- Release of chemicals
- Interruption of electricity
- Loss or destruction of critical infrormation (e.g., stolen system schematics)
- Loss of computers or SCADA systems

Take the time necessary to think through all of the potential threats that could affect your system. Work with law enforcement officials to get a better idea of the threats you may face. By coming up with the most complete list you can, you will ensure that your VA considers as many risks as possible. Making sure you really understand where and how your system is vulnerable will help you tackle VA Step 3.

1: Evaluate System → *2: Identify Threats* → *3: Consider Consequences* → *4: Assess Likelihood* → *5: Evaluate Measures* → *6: Plan Action*

VA Step 3

CONSIDER POSSIBLE CONSEQUENCES

There are numerous negative outcomes that can result from threats against your system, and it's important for you to understand the possibilities. To complete this step, you should:

Look at the types of threats you identified in VA Step 2. Carefully consider:

- The type of threat (e.g., physical damage, water contamination)
- The critical component(s) or "single point(s) of failure" it could affect

Consider how each threat you identified could affect your system, from the smallest possible impact to the worst-case scenario. Include these factors in your thinking:

- Customers who will be affected and for how long
- The potential for illnesses or deaths
- The potential cost of the emergency (including repair, decontamination, or replacement costs for damaged components and revenue lost during a service outage)
- The impact of the emergency on public confidence in your system
- The long-term problems resulting from the emergency

Focus on the threats that would most harm your system's ability to provide a reliable and safe supply of water. You should be as thorough as possible in thinking about the possible consequences of any threat. The plans that you make to reduce risk in VA Step 6 will aim to prevent or reduce the likelihood of these consequences. The more thorough you are, the better your plan will be.

1: Evaluate System → *2: Identify Threats* → *3: Consider Consequences* → *4: Assess Likelihood* → *5: Evaluate Measures* → *6: Plan Action*

VA Step 4

ASSESS THE LIKELIHOOD OF NEGATIVE CONSEQUENCES

This task can be very difficult because often there is too little information to make a good assessment. To help you do the best job you can, you should:

Contact your state, local law enforcement office, and public health officials to determine whether they have information on the types of threats that are most likely in your area.

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Contact nearby water utilities to see what types of threats they might have faced.

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Review your own incident reports from the past few years to better understand past security problems at your system.

Assessing the likelihood of specific intentional acts (as opposed to natural or accidental events) and their consequences will be challenging, but remember that figuring out which threats are most likely will determine how your system will reduce risk and plan for emergencies. Take advantage of all of the information you have and make sure you continuously re-evaluate the likelihood of specific acts and their consequences. Additional tools for gathering information are discussed in "Where Can I Find Additional Help?" beginning on page 34.

1: Evaluate System → *2: Identify Threats* → *3: Consider Consequences* → *4: Assess Likelihood* → *5: Evaluate Measures* → *6: Plan Action*

VA Step 5

EVALUATE EXISTING MEASURES

Before you can decide what additional measures need to be taken, you should evaluate the effectiveness of what you already do to protect your system. To complete this step, you should answer the following questions:

What method(s) does your system currently use to detect threats? The answers to this question could include:

- Intrusion detection systems
- Water quality monitoring
- Operational alarms
- Accidental discovery
- Neighborhood watch group
- Weather service warnings (natural threats)

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Intentional threats, such as vandalism, arson, and terrorism, require the most extensive security measures, but these measures could also help protect your system against natural or accidental threats. What measures are currently in place to delay threats against your system? These could include:

- Locks and key-control policies
- Fencing and other proper protection of critical system components
- Cross-connection control

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What policies and procedures does your system currently have in place to respond to indications of threats? Have staff members received training on them? Threat indicators include:

- Intrusion alarms
- System malfunction alarms
- Phone threats
- Water quality indicators

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What security policies and procedures do you have now and how well do you follow them? You might have policies and procedures covering:

- Personnel safety
- Hiring new employees and performing background checks
- Security of the physical facilities and components
- Key and access badge control
- Chemical deliveries, handling, and storage
- Security training
- Handling phoned-in threats

In answering these questions, you probably found that some system components are already adequately protected, while others are not. This information will help you prioritize the steps you take to protect your system. Be sure to distinguish between measures that are properly executed and well maintained and those that provide little or no protection because they are poorly executed or maintained. It is important that you do not overlook vulnerabilities caused by inadequate security measures or lack of knowledge about existing policies and procedures.

VA Step 6

PLAN TO REDUCE RISKS

Based on the assessment you've worked through in VA Steps 1 through 5, you can now develop a plan to reduce the risks facing your system. The analysis that you've done should allow you to identify your most urgent security needs and develop a plan that addresses these needs first. To develop your plan you should:

Develop a list of recommended actions that will reduce your system's vulnerability to threats. Specific actions are discussed in more detail in later sections of this guide. In general, these actions fall into three categories:

- Sound business practices, including changes to policies, procedures, and training
- System upgrades, including changes in equipment, infrastructure, or the way you operate your system
- Security upgrades, including changes that improve your ability to detect, delay, or deter threats against your system

Rank the actions by the urgency of the need that each action addresses.

- Does it address a threat that is very likely or severe?
- Does it address an inadequate but critical existing security measure?

Consider short- and long-term solutions to each of the vulnerabilities you identified in your assessment.

- Possible short-term activities are discussed in "**What Security Improvements Can I Make Immediately?**" on page 12
- Possible long-term activities are discussed in "**How Do I Maintain and Upgrade Security in the Long Run?**" on page 27

Try to identify actions that will produce multiple benefits for your system or that can be made as part of other planned system upgrades, for example:

- Improved treatment processes can reduce system vulnerabilities and enhance the day-to-day operation of your system

Take the time to review the work you did in VA Steps 1 through 5. This will help to ensure that your plan considers all possible weaknesses and vulnerabilities. One final word of caution: your VA contains a lot of important and sensitive information — **keep it secure, and keep a second copy in a safe offsite location**.

What's Next?

Your VA has identified a number of system vulnerabilities, and you have begun to address those vulnerabilities with a plan to reduce risk. The next two sections of this guide provide more details on the two methods you can use to reduce risk:

1. You can enhance your system's security by taking direct measures that improve your ability to detect, deter, or delay threats to your system. The next section briefly describes these concepts and offers basic security improvements that can address vulnerabilities.

2. The results of a VA should be included in your system's ERP so that you can respond effectively should vulnerable parts of your system be threatened. "What Is an Emergency Response Plan?" on page 16 describes an ERP and takes you through a step-by-step process for preparing one.

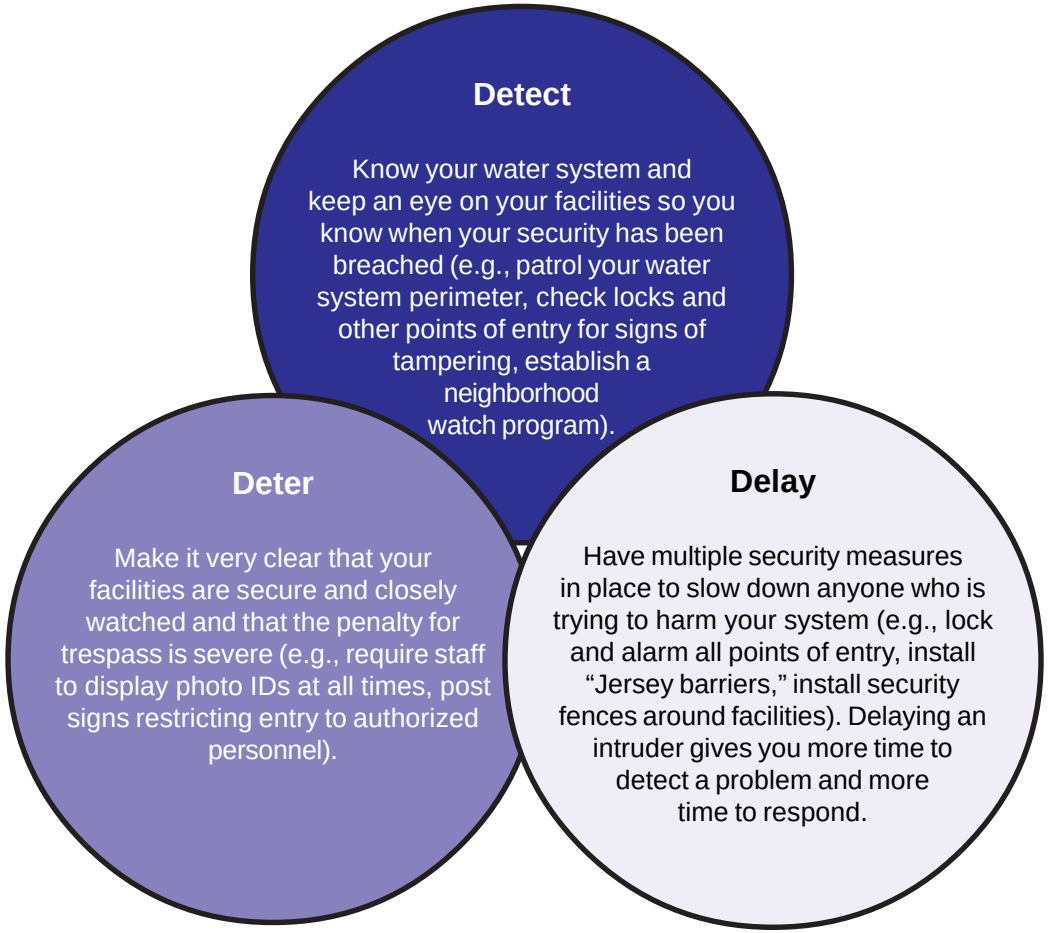
What Security Improvements Can I Make Immediately?

This section will help you develop a prioritized list of improvements that will reduce your system's vulnerability to threats. Although security improvements vary in complexity and cost, you will see in this section relatively inexpensive, practical changes that can be implemented immediately. You may not have to hire consultants or invest in top-of-the-line technology to act right now and increase the protection of your customers at a very reasonable cost.

The basic security measures described in this section will help improve your ability to **DETECT, DETER,** and **DELAY** security threats (see circles below).

Because many water systems share common vulnerabilities, there are a number of solutions that most systems should consider. Several common security actions are described on the pages that follow. These security actions tend to focus on intentional threats or acts, but some improvements can produce several benefits and make your system more secure against other threats (e.g., accidents, natural disasters) as well.

Remember that some of the measures suggested on the following pages may not be needed at your system. Some might be more complex than you need; others might address vulnerabilities that you've already remedied. Look at your VA and choose the actions that remedy your system's highest priority security needs.



Restrict access to critical water system components to authorized personnel only:	
One of the quickest and least expensive ways to dramatically increase the security of your system is to deny unauthorized personnel access to critical system components and "single points of failure." Supervised guests may be allowed, but unsupervised or uninvited guests could cause major problems, even if they do not intend to. And remember, disgruntled former employees have sabotaged systems in the past.	1. Require staff to display current photo IDs at all times. 2. Post signs restricting entry to authorized personnel. 3. Record who has keys and stamp keys "DO NOT DUPLICATE." 4. Change locks and access codes regularly. 5. Require personnel to wear uniforms or other identifying clothing. 6. Identify all system vehicles prominently. 7. Require vehicles to be locked at all times. 8. Remove critical information (e.g., source water maps, plans) from vehicles before parking them overnight. 9. Require terminated employees to return photo IDs, keys, access codes, and uniforms. 10. Install security fences around facilities. 11. Lock and consider alarming all points of entry: doors, windows, hatches, vents, and gates. 12. Lock all access points to finished water, even those within a locked or manned building. 13. Consider installing "Jersey Barriers" to block vehicle access to system facilities. 14. Remove objects that could be used to aid an intruder, such as ladders, overgrown shrubs, and large rocks, near windows and other points of entry. 15. Block access to elevated storage tanks by putting physical barriers around supports.

Increase monitoring and oversight:	
Once access to your system is restricted and tight, back up that security by patrolling and monitoring your facilities so that you can detect any threats and intrusions. All water system personnel should know and practice their roles in protecting your system.	1. Patrol fence perimeters and the water system (periodically and randomly). 2. Check locks and other points of entry for evidence of tampering. 3. Check critical system components regularly. 4. Install adequate exterior lighting around critical components. 5. Clear fence lines of vegetation and overhanging branches. 6. Do not park vehicles where they will block your view of critical components. 7. Update your O&M manual to include evaluation of security systems. 8. Establish a neighborhood watch program with nearby neighbors. 9. Consider expanding monitoring parameters for raw and treated water (e.g., pH, color, odor). Develop and maintain a baseline value for each monitored parameter.

Communicate and coordinate with local law enforcement:	
Local law enforcement is a very important resource that you should use to make your system more secure, but most police officers are not familiar with water system facilities or processes. A police presence might deter someone from threatening your system.	1. Give police officers a tour of your water system to familiarize them with key processes and equipment. 2. Arrange for periodic patrols of your facilities. Educate police about the types of suspicious activities that could take place throughout the water system. 3. Document suspicious calls and activities. Sample checklists and forms for documenting suspicious calls and activities are included in some of the tools found in "**Where Can I Find Additional Help?**" on page 34.

Improve communication and security when dealing with vendors and suppliers:	
Even if you improve the security at your own facilities, chemical suppliers and repair persons are potential sources of vulnerability. The chemicals delivered and stored at your system deserve special attention because of the risk that they pose to system staff and the public if improperly handled or released. Safeguards will delay and deter threats to these dangerous chemicals.	1. Verify that your suppliers take precautions to ensure their products are not contaminated. 2. Ensure that all deliveries are made in the presence of water system personnel. 3. Keep a delivery log. 4. Store all chemicals in a secure area designated for storage only. 5. Keep tools and equipment needed to respond to an emergency onsite. 6. Accept only deliveries scheduled in advance. 7. Require drivers to show vendor-issued ID. 8. Verify IDs of communication company employees who have access to water supply structures for maintenance and repair of antennas and related equipment.

Upgrade computer and records security:	
If your water system uses computers for operations or to store sensitive information, you should take some of these steps to make sure that information is protected and backed-up. By safeguarding your computers and paper records, you are delaying possible acts of sabotage.	1. Password-protect and virus-protect all computers. Change passwords and update virus protection programs regularly. 2. Back-up files, programs, and computers regularly. 3. Ensure that no sensitive information about your system is available on Web sites. 4. Store maps, records, and other important documents in a secure location. 5. Store backup copies of maps, records, and other important documents in a secure, off-site location. 6. Label all sensitive information "confidential" and require its return after projects are completed. 7. Keep a record of employees who accessed sensitive information and the dates on which they accessed the information.

Don’t be intimidated by the length of these lists. Any security improvements you make will decrease the risks your system faces and will protect the health of your customers. By detecting, deterring, and delaying threats, you are reducing your system’s vulnerabilities. Any risks you can’t minimize through security measures should be addressed as part of your ERP, which is discussed in the next section.

What Is an Emergency Response Plan?

An ERP is a written, well-thought-out series of planned actions that help you respond to emergencies of all types. An effective ERP for a small drinking water system makes use of the system's VA (see "**What Is a Vulnerability Assessment?**" on page 4) by addressing possible consequences of vulnerabilities identified in the VA. An ERP presents clear and logical steps to take in response to possible emergencies, designates persons responsible for specific actions, provides for training and planned practice exercises, and ensures effective coordination with first responders, law enforcement, and health officials.

If your water system does not have an ERP, you should prepare one. An ERP will help you organize your response to emergencies **before** they happen. An emergency can happen at any time, and any problem with the drinking water supply will become a top priority for you and the affected members of your community. An emergency could generate tremendous and immediate pressures on system operators, emergency response professionals, law enforcement, local health officials, and the public. A system that has an ERP and has practiced organized emergency response exercises will have a much better chance of minimizing the effects of emergencies. Therefore, having a well-planned system response to foreseeable emergencies makes good sense.

Preparing an ERP can take some effort. You should build an internal team of water system operators, board members, and owners to develop a complete ERP. The steps below can help you prepare a new ERP (or update your existing ERP). Keep in mind that the most effective ERP for your system will build on the findings of your VA. And remember that your state can be a good source of assistance should you have questions or need help in developing your ERP. Finally, because every system is different, you may need to modify the ERP development process described below to make it work for you.

It is important to note that some states may have their own ERP requirements. Make sure you check with your state to see whether it has established specific requirements that you must address.

Keep in mind that the steps that follow offer only a general overview of the activities you should undertake to complete an ERP. There are a number of resources that offer detailed worksheets or other tools to help you. They are listed in "**Where Can I Find Additional Help?**" on page 34.

To complete your ERP, follow the five steps listed on the following pages. The graphic below will help you track the steps as you move from page to page.

1: Preparation → *2: Core Elements* → *3: Putting it Together* → *4: Action Plans* → *5: Next Steps*

ERP Step 1

ERP PREPARATION

In developing an ERP, you should identify and form partnerships with the people and organizations whose help your system will need in an emergency, including:

- Local police and fire departments
- Public health officials
- Local Emergency Planning Committees
- Local government/city managers
- State and federal agencies
- Nearby water utilities (for developing interconnections and mutual aid agreements)
- Health care providers
- Equipment suppliers
- News media

Forming effective partnerships with these organizations and individuals will help you better develop the core elements of your ERP and better coordinate emergency activities when the ERP is put into action. The partnerships also will help everyone become better prepared for emergency response.

Many communities have Local Emergency Planning Committees (LEPCs). A typical LEPC is made up of representatives of the municipal government, fire department, hospitals, environmental organizations, citizen groups, law enforcement and other emergency response officials, industry, and other interested parties. EPA maintains a database of over 3,000 LEPCs and their contact information. Visit http://www.epa.gov/ceppo/lepclist.htm to see whether your community has an LEPC. If it does, you should work especially closely with the LEPC when developing your ERP. Doing so will help ensure that your response to any emergency is coordinated as efficiently as possible.

Reach out to potential partners, describe your plans and objectives to them, and solicit their input and assistance. Helping your partners understand your goals and including your partners in the development of your ERP will improve your plan and help you develop more effective relationships with your partners.

ERP Step 2

THE EMERGENCY RESPONSE PLAN – CORE ELEMENTS

A number of core elements should be included in any ERP, including yours. These elements will help ensure that your ERP and emergency response capabilities enable you to respond to any kind of emergency or threat. At the same time, the elements are flexible enough to ensure that your ERP meets the specific needs of your system. The core elements are discussed below.

Core Element 1: System-Specific Information

In an emergency, you should be able to provide basic technical information to personnel who will provide emergency assistance. In most cases, the organizations providing assistance will be those with which you formed partnerships under ERP Step 1. To ensure that you can provide the necessary system-specific information quickly and accurately, it is important that you include it as an easily accessible part of your ERP.

The basic information that you should include in this section of your ERP is:

- Owner name, operator name(s), and Public Water System Identification (PWSID) number, which identifies your system to your state and to EPA
- Population served and number of service connections
- Key information about critical system components (e.g., source water, treatment plant, water and chemical storage, and distribution system)
- How to isolate parts of your system when the need arises

ERP Step 2 (Continued)

Core Element 2: Roles and Responsibilities

You should specify roles and responsibilities for yourself and for your partners from outside of your system. First, you should designate an Emergency Response Leader (and a back-up) who will be the main point of contact and the primary decision maker during an emergency. Other system personnel and your partners also should understand their roles, responsibilities, and place in the chain of command. While it is important not to get bogged down in terminology and titles, it is also important that you and your Emergency Response Leader make sure all parties are clear about their roles.

Everyone also should be familiar with what is known as "command structure language." The Federal Emergency Management Agency (FEMA) and other federal agencies are using the National Incident Management System (NIMS) to coordinate emergency efforts. Your state and local government may also have adopted NIMS. The NIMS Incident Command System (ICS) is the standard organizational structure for all major domestic incidents. It helps to coordinate the efforts of many emergency responders. NIMS will enable responders at all levels to work together more effectively to manage domestic incidents no matter what the cause, size, or complexity. You can obtain more information on NIMS and the NIMS ICS from FEMA at http://www.fema.gov/nims.

At a minimum, your ERP should include the following basic information for your Emergency Response Leader and one back-up point of contact:

- Name
- Cell phone number (if applicable)
- Work telephone number
- Pager number (if applicable)
- Home telephone number
- Address

You should also identify other key individuals and partners and describe their roles, responsibilities, and places in the chain of command. Remember to communicate this information to your partners verbally and in writing.

ERP Step 2 (Continued)

Core Element 3: Communication Procedures - Who, What, and When

Timely communication with a variety of audiences is an essential component of your ERP. You should plan to notify three groups of people: system personnel, emergency response partners, and the public/news media.

- System personnel – Your Emergency Response Leader or backup should be the first person notified of an emergency. Other appropriate personnel should then be contacted.
- Emergency partners – These are the partners you identified in ERP Step 1. They should be contacted as necessary depending on the type of emergency.
- Public and news media – You should designate in advance a spokesperson who will handle public and media communications during an emergency. This spokesperson should not be the Emergency Response Leader. You should also develop a plan that your spokesperson can follow in communicating with the media and the public. This plan will help your spokesperson maintain a message that is clear, accurate, and easily understood by your audience. For more information about communicating with your water consumers, see "**How Should I Communicate with My Customers?**" on page 30.

Your ERP should include contact information for all individuals and organizations that fall into the groups discussed above. The list should include contact names, addresses, and all phone numbers for each contact. Update this list regularly to ensure that information is current and organize it to ensure that the highest priority calls are made first. States and technical assistance providers may have sample contact list templates you can use.

ERP Step 2 (Continued)

Core Element 4: Personnel Safety

Protecting the health and safety of your personnel is an important part of your ERP. In your ERP, you should write out basic safety precautions, identify the location of first aid supplies, and identify locations where personnel should meet in the event of an emergency. You should also make sure that your personnel are regularly trained in all of your safety procedures.

The personnel safety section of your ERP should, at a minimum, include the following:

- Directions for proper first aid and medical treatment
- Procedures for using and maintaining emergency response equipment
- Identification of evacuation routes and evacuation procedures
- Identification of assembly areas and procedures for locating all personnel

ERP Step 2 (Continued)

Core Element 5: Identification of Alternate Sources of Water

Your ERP should identify alternate sources of water that can address short-term (hours to days) and long-term (weeks to months) outages. There are a number of different options for short-term and long-term water supplies. Short-term options include bottled water from outside sources or retailers and bulk water from a variety of sources. Long-term options may include connecting your distribution system to a neighboring system. These alternate sources should be clearly identified in your ERP, and the agreements or arrangements for accessing the alternate sources should be clearly spelled out. Your source list and the agreements with these sources should be kept up to date.

You should also plan for the impact of various public health notifications, including "boil water," "do not drink," and "do not use" notices. The different steps you may need to take to deal with each of these notifications should be addressed clearly in your ERP. See "**How Should I Communicate with My Customers?**" on page 30 for guidance on notifying your customers and providing them with instructions on how to protect themselves.

The important thing to remember is to identify short-term and long-term alternate water sources in your ERP and to establish agreements with these partners before an emergency occurs. Your ERP should list your alternate water sources, along with the relevant contact information. You should also file copies of your agreements with your ERP.

Core Element 6: Equipment and Chemical Supplies

Using the results of your system's VA, you should identify in your ERP where to find the equipment, repair parts, and chemicals needed in the event of an emergency.

This section of your ERP should include an updated list of:

- Current equipment
- Repair parts
- Chemical supplies
- Agreements with nearby systems to share portable generators and spare parts
- Contact information for any partners who can assist you with equipment and chemical supplies

ERP Step 2 (Continued)

Core Element 7: Property Protection

Protecting your facilities, equipment, and records is very important for getting your system running again after an emergency. Your ERP should clearly describe procedures to secure and protect important assets.

In this section of your ERP, you should consider describing how you will lock down your facilities, how you will control access to your facilities, and the steps you will take to protect other crucial property and records.

Core Element 8: Water Sampling

Sampling is critical to determining whether the water your system produces is safe for your customers to drink and use. In your ERP, you should address water sampling and monitoring issues that could arise during an emergency. Water sampling and analysis is critical during the detection of an incident and during recovery from an incident. When developing your ERP, you should consult with your state on water sampling and monitoring requirements, including responsibility for water quality monitoring, during an emergency. Make sure you know what to do in an emergency before an emergency occurs.

You should include the following information in this section of your ERP:

- Proper sampling procedures
- The location and number of required samples
- Who is responsible for taking samples
- Contact information for laboratories or partners who will help analyze the samples and explain the results

ERP Step 3

PUTTING YOUR ERP TOGETHER AND KNOWING WHEN TO PUT IT INTO ACTION

Now that you've addressed the core elements of your ERP, you should organize and document that information in a useful way. If you have an existing ERP or other emergency management documents, now is the time to update all of them with the work you've done in ERP Steps 1 and 2. The goal, of course, is to produce a single, complete ERP that is accessible and easy to use. How you organize and document your ERP is up to you and should reflect the specific needs of your system; however, you should check with your state to see whether it has any requirements that might affect your finished ERP.

During this step you should also develop procedures for deciding when to put your ERP into action. Knowing when to use your ERP is as important as preparing and documenting it. In a natural emergency such as a tornado, earthquake, or flood, the decision to put your ERP into action is obvious. This type of emergency is easy to confirm.

It is more difficult to decide when to put your ERP into action when it comes to intentional acts. Here, the decision is critically important. While it is essential that you pay attention to any threat, you need to carefully think through and document a process to screen out hoaxes and avoid false alarms. During each threat incident, it is critical that you or your Emergency Response Leader consider three key questions:

- Is the threat possible?
- Is the threat credible?
- Has the incident been confirmed?

Remember, the answers to these questions will most likely differ with each incident and will probably determine what parts of your ERP need to be implemented. You or your Emergency Response Leader should exercise judgment when determining how to respond to a specific threat. More information about assessing threats is offered in some of the tools listed in "**Where Can I Find Additional Help?**" on page 34.

ERP Step 4

ACTION PLANS – RESPONDING TO DIFFERENT TYPES OF EMERGENCIES

An Action Plan provides your system with quick approaches for responding to specific types of emergencies. The Action Plans that you develop should complement the general activities outlined in the core elements of your ERP and should be tailored to specific events (e.g., floods, tornadoes). Action Plans should be short and concise "rip and run" documents that can be detached from your ERP and taken into the field by emergency responders. The activities listed in the Action Plans should complement actions already initiated under your ERP. You should develop Action Plans for intentional acts and for natural disasters and other significant events.

Intentional Acts

Action Plans should cover the following incidents and threats of such incidents (e.g., hoaxes):

- Contamination
- Structural damage/physical attack
- Intentional hazardous chemical release
- SCADA, computer, or cyber attack

Natural Disasters and Other Significant Events

You may want to incorporate or modify existing plans to deal with a variety of natural disasters and other significant events. If you don't have existing plans, it makes sense to develop new plans to cover such events that may affect your system, including:

- Fire
- Flood
- Hurricane and tornado
- Severe weather (snow, ice, temperature, lightning, drought)
- Earthquake
- Electrical power outage
- Mechanical failure
- Water supply interruption
- Contaminated water treatment chemicals
- Accidental hazardous spill/release
- Construction accidents
- Personnel problems (loss of operator, medical emergencies)

Remember, your Action Plans should be clear, concise, and accessible. They should be well organized to make sure that the proper Action Plan can be found quickly by the staff members who need it. Your Action Plans should include the following basic information:

- Special notification requirements
- Special response steps necessary for the specific type of emergency
- Recovery actions to bring your system back into operation
- Remediation actions needed to make sure your system is fully restored

ERP Step 5

NEXT STEPS

Completing your written ERP is only the first step in making sure that your system is prepared to deal with an emergency. Your ERP should be a "living" document that you review and update regularly to make sure that all of your information is correct and up to date. Training in how to use your ERP is just as important as developing and updating it; even the best ERP will be difficult to implement during an emergency if people do not know their responsibilities. You should regularly practice implementing your ERP. Orientation exercises, table-top workshops, functional exercises, and full-scale drills are all ways in which you can help to make sure that your well-planned ERP is executed properly and efficiently when a real emergency arises. You can find more information about these training exercises in the tools listed in "**Where Can I Find Additional Help?**" on page 34.

How Do I Maintain and Upgrade Security in the Long Run?

Completing your VA and ERP does not mean you have reached the finish line; a lapse in security and preparedness can be disastrous. You should continually assess your weaknesses, upgrade your system's security, and plan for unforeseen events. You should regularly reassess your vulnerabilities and revise your ERP as threats and personnel change. Remember to regularly practice implementing your ERP, especially if you make changes to it.

Re-examine Your Vulnerabilities

Part of your long-term security strategy should be to re-evaluate your vulnerabilities. Ask your state if it has changed any of its security requirements. Your state is also a great resource for finding the latest information available on system vulnerability and security. Perhaps a new threat has emerged in your area, a new security measure is available, or new funding programs have been created. In addition, you should continue to train staff members so they understand the system's vulnerabilities and their roles in keeping the system secure.

Neighborhood Watch Program

From "BexarMet Recruits Customers for Community Watch Program," *Wilson County News*, February 12, 2003:

In February 2003, The Bexar Metropolitan Water District (BexarMet) in Texas began asking customers who live near water facilities to keep a watchful eye on any unusual activity. Participants were asked to call BexarMet any time of the day or night if they observed suspicious activity around a water facility.

Customers of BexarMet who live near water facilities received a letter requesting their assistance. The letters outlined the program and identified situations when residents should call 911 or BexarMet dispatchers. In addition, volunteers were given magnets with the phone number of BexarMet dispatchers. Pablo and Angelita Gallegos were the first volunteers. They live near a water storage tank and see the program as a good step forward. "We're here all the time," said Pablo Gallegos, "and whenever I see something, I'll call because we like to help."

Upgrade Your Security

Besides keeping your understanding of your system's vulnerabilities current, you might continue to reduce risks by implementing security upgrades that are more costly or take more time to put in place. As your vulnerabilities change, you might need new security upgrades. The table below lists some long-run security measures that can detect, deter, and delay threats.

Remember that upgrading your security may also benefit other areas of your system operation. For example, properly sealed wells provide source water protection, backflow prevention programs improve the quality of water you deliver to your customers, and increased knowledge of your system can lead to improved technical, financial, and managerial capacity.

Upgrade Security Policies:

1. Screen all potential employees through a job application, professional references, and a background check.
2. Develop a procedure to deal with public information requests.
3. Develop a procedure to receive notifications of suspected disease outbreaks immediately after their discovery by local health agencies.
4. Create a procedure to advise the community of contamination immediately after its discovery.
5. Put in place a procedure to respond immediately to customer complaints about a new taste, odor, color, or other detectable change in water quality.
6. Implement policies regarding access to critical information.
7. Develop and implement computer security policies.
8. Use security warnings and bulletins provided by state, federal, and non-governmental agencies or organizations.

Upgrade Physical Security:

1. Replace critical doors and hinges that aren't constructed of heavy-duty reinforced material.
2. Make sure hinges on exterior doors are located on the inside of the building.
3. Make sure windows are bolted and reinforced with wire mesh or iron bars.
4. Require authorization and backflow prevention assemblies if a hydrant is used for any purpose other than fire fighting.
5. Implement a backflow prevention program.
6. Properly seal wellheads.
7. Make sure vents and caps are properly installed and cannot be removed.
8. Cap all abandoned wells.
9. Install fencing around your surface water source(s).
10. Install valves that allow you to isolate your storage tank.
11. Lock priority fire hydrants to deter contamination (should be done in consultation with fire department).
12. Install a sampling tap on each storage tank to detect contamination.
13. Monitor and maintain positive pressure in your distribution system.
14. Properly protect your computer equipment.
15. Keep your system illuminated.

Update Your ERP

In addition to minimizing the risks posed to your customers, you should continue to prepare for emergencies. You should re-examine your ERP, especially as your system and its vulnerabilities change, so that you can respond to a crisis. Make sure that you do not let the relationships and communication channels that you've built deteriorate over time. If possible, you should conduct drills regularly to make certain that your system is as prepared as it can be for an emergency.

Threat Response

From Daniel Borunda, "Utilities Take Steps to Protect Water Supplies," *El Paso Times*, November 23, 2003:

In September 2003, system managers at Las Cruces Water Utilities (TX) emptied a city water tank after an alarm signaled a break-in. Lacking a means to quickly determine if the water was contaminated, operators elected to drain the entire storage tank.

The system flushed and refilled the tank, returning it to service the following day. In the meantime, the system used backup tanks to supply users.

"Our system worked very well," Water Resources Administrator Gilbert Morales said. "There were a couple of areas that we found where our system could have been better, but this helped us identify those shortcomings and will help us respond more quickly in the future." The system was able to isolate the problem to the tank, and its customers were not at risk.

Remember that your VA and ERP contain sensitive information and should be stored in a safe place. In addition, copies should be kept in a secure off-site location. Access to your security information should be limited to staff members and to local and state officials on a need-to-know basis only.

How Should I Communicate with My Customers?

Good communication with your customers is an important part of your emergency response efforts. The people who depend on you for drinking water will need immediate, clear, and honest information during an emergency. Without this information, your customers may erroneously assume your water is unsafe and stop drinking it. Even worse, your customers may continue to drink contaminated tap water because they have not received the message that it is unsafe.

This section will help you develop a plan for communicating with your customers during an emergency or other crisis. There are several steps. The first step is to identify your critical customers, the customers who could be most affected by a problem with their water supply. The second step is to establish relationships with different groups in your community that could help you get your message out when you need to. The third step is to prepare a plan for notifying your customers during an emergency. The relationships you built during the second step will help you do so quickly and efficiently.

CRITICAL CUSTOMERS

In the event of an emergency, your critical customers will need to be alerted quickly and may require an alternate supply of water. Critical customers are those most vulnerable to poor-quality water and insufficient quantities of water. Among them are children, the elderly, and the sick, as well as important institutions such as fire departments, hospitals, and power plants. You should establish communication channels with these customers now so they can be alerted at the first sign of an emergency.

BUILDING RELATIONSHIPS FOR EFFECTIVE COMMUNICATION

Once you better understand whom you need to notify, you should build relationships and plan how you will distribute critical public health information during an emergency or other crisis. These decisions can and should be made long before you face an emergency so that you are prepared to act quickly and effectively. Your emergency communication will only be as strong as the relationships you build before a crisis.

You should build relationships with local media outlets, including radio stations, television stations, and newspapers. Your local media are important because they may be the easiest and quickest way for your system to notify the public. They are also less likely to exaggerate or misreport an event if they understand the issues ahead of time. You should designate a spokesperson in advance who will handle media relations during an emergency. This spokesperson should NOT be the Emergency Response Leader. Even before an emergency arises the system spokesperson should meet with local media representatives to determine exactly what information they will need, how best to get it to them, and when they will need it to meet their deadlines. Using this input, you should develop a plan for communicating with the media that your spokesperson can follow during an emergency.

Existing community networks, such as homeowners' associations, can also help you efficiently notify your customers during an emergency. It is important that you identify and test these networks before a threat or other emergency occurs. You might want to consider developing an e-mail distribution list or a calling chain so that you can notify the lead contact in each network as quickly as possible.

Helpful Tips for Working with the Media

- At the top of the press release, write "**PRESS RELEASE FOR PUBLIC SAFETY**" to emphasize its importance.
- Answer questions as well as you can, and don't be defensive or afraid to say that you need to check on something if there is a question you cannot answer.
- Be sensitive to the fact that media representatives may have tight deadlines and other pressing needs.
- Monitor local media to check whether they are reporting the information accurately.
- Don't be upset if media coverage is not exactly as you would want. Politely inform the media outlet if important information is wrong or missing.
- If a media outlet will not publish or air your warning, you might need to buy ad space.

The information in this section is taken from EPA's "Public Notification Handbook" (EPA 816-R-00-010-2000). You can find more information on public notification in the handbook, available for downloading at http://www.epa.gov/safewater/pn.html or from the Safe Drinking Water Hotline at (800) 426-4791.

PLAN FOR EMERGENCY NOTIFICATION

All of the preparation and relationships discussed to this point are important because they allow you to communicate quickly and effectively with your customers during an emergency. Don't forget that you might be communicating with your customers to minimize overreaction by reassuring them that their water is safe to drink despite the crisis. Here are some practical rules you should keep in mind when communicating with your customers:

- Be truthful and up-front
- Use simple language that everyone can understand
- Make notifications "short and sweet"
- Translate alerts for non-English speakers
- Clearly identify the name of your system and your service area, especially if your community is served by more than one water system
- Explain the exact nature of the emergency, the population at risk, actions that consumers should take, and alternative sources of water (if necessary)
- Provide a telephone number for more information
- Limit written warnings to one page designed to catch your customers' attention (bright colors and large text)

There are many ways you can communicate with your customers. The method you choose depends on which of your customers you are trying to reach, your available resources, and the urgency of the threat. Keep in mind that you will probably need to use a mixture of communication tools, since you may not reach all of your customers using only one method (e.g., some customers may not listen to the radio, watch TV, or read a newspaper). The options available to you make it that much more important that you plan ahead so that you are not overwhelmed during an emergency. A partial list of the communication outlets that you might use is found on page 33.

! WARNING: When communicating with customers, keep in mind that you want to provide enough information to enable them to act appropriately, but not so much that you increase the system's vulnerability to a threat. For instance, most customers will know if they live down the street from a water treatment facility, but they do not need to be informed of that facility's particular vulnerabilities. !

COMMUNICATION OUTLETS

BROADCAST MEDIA – Television and radio, if available in your community, may be the quickest way to inform the most customers. Check with your state to determine whether you can broadcast an alert over the federal Weather Radio alert system. See the box on page 31 for more tips on dealing with the media.

NEWSPAPERS – Depending on the urgency of the situation, you might want to work with the local paper. This outlet can be especially helpful when you need to keep customers updated during a prolonged crisis.

POSTINGS – Signs can be delivered to each business and residence or posted in public places. For instance, a campground may post signs in restrooms and at park entrances. If you have the time and staff, you can combine postings with word of mouth by trying to talk to customers as you post the alert. Remember to make the notices from materials that will hold up against wind and rain.

PERSONAL NOTIFICATION – Word of mouth is the oldest and potentially most time-consuming method. You may call, e-mail, and go door-to-door to notify customers. E-mail might be particularly effective in a university or office park, while calling may be the quickest method to notify a homeowners' association. Some systems may use an automatic dialing service to systematically call every customer and play a recorded message. Though more time-consuming, going door-to-door might be the best way to make sure that all your customers receive the alert.

In addition, you should use any other methods of communicating with your customers that you think will work well for your system. For example, broadcasting a public health warning from moving vehicles (such as a police vehicle) can be effective if your customers are at home or in a concentrated area, such as a beach. You should use whatever means you need to communicate with all your customers as quickly as possible.

Where Can I Find Additional Help?

While improving the security and preparedness of your system takes a lot of work, it's an important step in protecting your system and your customers. Fortunately, many resources are available to help you accomplish the activities outlined in this STEP Guide. This section provides an overview of some of these sources of assistance. They include your state, EPA, drinking water associations, and technical assistance providers.

The first place you should look for help is your state (see Appendix A for contact information). States and EPA have been working together to identify ways to help systems address their security vulnerabilities and implement ERPs. Many state efforts, such as sanitary surveys, optimization programs, source water protection activities, and capacity development, enable the state to provide you with security technical assistance and possibly even funding. For instance, the state inspector conducting a sanitary survey of your system might be able to help you identify some of your system's vulnerabilities. Since many states consider security an essential part of technical and managerial capacity, you might also be able to take advantage of state financial and technical assistance programs.

EPA can also be a source of information and assistance. The Agency has established a water system security page on its Web site (http://epa.gov/safewater/watersecurity). EPA provides an updated, comprehensive list of publications, information, and other resources for small and large drinking water systems. In addition, the Web site includes security resources geared specifically towards small system security, public involvement in water system security, and information sharing between water systems and public and private sector organizations.

Drinking water industry associations and technical assistance providers can be very important partners in efforts to improve system security and emergency preparedness. Several organizations have produced valuable security tools, ranging from simple how-to books to sophisticated software. In addition, these organizations are valuable sources of information on the experiences (both positive and negative) of other water systems, and they may be able to provide information on and evaluations of various security technologies. These organizations also offer training opportunities, as well as meetings, conferences, and forums where you can find the latest information on water system security.

Major Providers of Technical Assistance to Drinking Water Systems

American Water Works Association	http://www.awwa.org/ (800) 926-7337
National Rural Water Association	http://www.nrwa.org/ (580) 252-0629
Rural Community Assistance Partnership	http://www.rcap.org/contact.html (888) 321-7227
National Environmental Services Center	http://www.nesc.wvu.edu/nesc/nesc_about.htm (800) 624-8301

The "Helpful Links" and "Alerts and Bulletins" sections that follow are good starting points for identifying the resources available to help you understand your security vulnerabilities, reduce your risks, and prepare for an emergency. You may also find it useful to hire a consultant to evaluate your system, help you address your vulnerabilities, or assist you in developing an ERP. Contact your state or technical assistance provider for a referral to someone who can help.

HELPFUL HINTS

EPA's Security Web site provides links to a number of security tools, training opportunities, outreach materials, and other information. Visit http://epa.gov/safewater/watersecurity and click on the appropriate links for a list of all materials available. The following paragraphs list some of the materials you can find through the Web site:

VA Tools (click on "Vulnerability Assessments")

- **Self-Assessment Guide for Very Small (Serving Fewer than 3,300 Persons) Systems.** Developed by the Association of State Drinking Water Administrators (ASDWA) and NRWA in consultation with EPA, this document is available from ASDWA's Web site (www.asdwa.org). Scroll down to the middle of the page to view this document.

- **Video: Security Vulnerability Assessment for Water Systems.** EPA's Drinking Water Academy and the National Environmental, Safety, and Health Training Association (NESHTA) have produced a video for water systems serving fewer than 3,300 persons to aid in assessment of their vulnerability. You can obtain the video using the order form available at http://www.neshta.org/PDFs/orderform.pdf.

- **New England Water Works Association (NEWWA) Automated Security Survey and Evaluation Tool (ASSET).** The ASSET VA software is available from NEWWA by visiting http://www.newwa.org/asset_software/index.php.

- **Security and Emergency Management System (SEMS).** Contact an NRWA affiliate in your area for more information on this combination VA and ERP software package.

ERP Tools (click on "Emergency/Incident Planning")

- **Video: Emergency Response Plan for Water Systems Serving 3,301 – 10,000 persons.** NESHTA has developed a video for small water systems serving populations between 3,301 and 10,000 persons, although smaller systems may also find the video helpful. The video highlights the relationship between VA results and ERP development. You can download an order form at http://neshta.org/Publications/Security.htm or call (602) 956-6399 to place your order.

- **Emergency Response Tabletop CD-ROM Exercises for Drinking Water and Wastewater Systems (EPA-817-C-05-001).** This CD-based tool contains tabletop exercises to help train water and wastewater utility workers in preparing and carrying out ERPs. The exercises provided on the CD can help strengthen relationships between a water supplier and its emergency response team.

Items with EPA document numbers can be ordered through the Safe Drinking Water Hotline, (800) 426-4791.

Outreach Products (click on "Publications" and then on "Outreach Materials")

- **Water Watchers: We're All in This Together (EPA 810-F-03-006).** This brochure for residents describes how they can help local authorities protect the water utilities in their communities.

- **Top Ten List: Water Supply Emergency Preparedness and Security for Law Enforcement (EPA 901-H-03-002).** This list is also available as a poster (11" x 17") for display in local municipal facilities to help in coordinating the efforts of law enforcement, the water supply industry, and public health officials.

- **Water Security Posters.** EPA has developed a number of posters to help alert and educate communities about water security. In addition to the Top Ten List poster, "Report Suspicious Activity at Reservoirs, at Utilities, and at Water Mains" (EPA 810-F-03-001) and "Report Suspicious Activity - Watch Out! Help Out! Report It!" (EPA 810-F-03-002, 003, or 004), are available.

ALERTS AND BULLETINS

Many states have begun implementing alert or bulletin systems to provide water systems with critical security information. Regular alerts and bulletins can be provided via e-mail or fax. Contact your state to see whether an alert or bulletin is available and to find out how you can join the system.

On a national level, the Water Security Channel (WaterSC) provides alerts and vital security information to key personnel at drinking water systems and states. WaterSC is a free e-mail notification system that can send notices to mobile devices configured to receive e-mail. WaterSC maintains a secure Web site that contains an archive of federal alerts, advisories, and bulletins. The service is free and systems can register at www.watersc.org or by calling 1-888-H2O-SC4U.

NRWA has developed a new free Rural Water Alert System (RWAS) to share security information with rural water systems. NRWA expects to launch RWAS by the end of 2005. The system will provide security information to rural water systems who may not subscribe to the WaterSC. RWAS will be comparable to the WaterSC in the type of information provided and will be accessible via the Internet. However, RWAS is not a rapid alert system. More information on RWAS is available through state NRWA affiliates.

Appendix A: Safe Drinking Water Act Primacy Agencies

State Contact Information	Web site	Phone Number
Alabama Department of Environmental Management: Water Supply Branch	www.adem.state.al.us/WaterDivision/Drinking/DWMainInfo.htm	(334) 271-7700
Alaska Department of Environmental Conservation: Drinking Water Program	www.state.ak.us/dec/eh/dw	(907) 269-7647
American Samoa Environmental Protection Agency	www.asg-gov.com/agencies/epa.asg.htm	(684) 633-2304
Arizona Department of Environmental Quality: Safe Drinking Water Program	www.azdeq.gov/environ/water/dw/index.html	(602) 771-2300
Arkansas Department of Health: Division of Engineering	www.healthyarkansas.com/eng/	(501) 661-2623
California Department of Health Services: Division of Drinking Water and Environmental Management	www.dhs.ca.gov/ps/ddwem/technical/dwp/dwpindex.htm	(916) 449-5577
Colorado Department of Public Health and Environment: Drinking Water Program	www.cdphe.state.co.us/wq/drinking_water/drinking_water_program_home.htm	(303) 692-3500
Connecticut Department of Public Health: Drinking Water Division	www.dph.state.ct.us/BRS/water/dwd.htm	(860) 509-7333
Delaware Health and Social Services: Division of Public Health	www.state.de.us/dhss/dph/about.html	(302) 744-4700

State Contact Information	Web site	Phone Number
District of Columbia Environmental Protection Agency Region 3	www.epa.gov/reg3wapd/drinkingwater	(215) 814-2300
Florida Department of Environmental Protection: Drinking Water Program	www.dep.state.fl.us/water/drinkingwater/index.htm	(850) 245-8335
Georgia Department of Natural Resources: Water Resources Branch	www.gaepd.org/	(404) 657-5947
Guam Environmental Protection Agency: Water Programs Division	www.guamepa.govguam.net/programs/water	(671) 475-1658
Hawaii Department of Health: Environmental Health Division	www.hawaii.gov/health/environmental/water/sdwb/index.html	(808) 586-4258
Idaho Department of Environmental Quality: Water Quality Division	www.deq.state.id.us/water/	(208) 373-0194
Illinois Environmental Protection Agency: Bureau of Water	www.epa.state.il.us/water/index-pws.html	(217) 785-8653
Indiana Department of Environmental Management: Drinking Water Branch	www.in.gov/idem/water/dwb/	(317) 232-8603
Iowa Department of Natural Resources: Water Supply Program	www.iowadnr.com/water/drinking/index.html	(515) 725-0275
Kansas Department of Health and Environment: Bureau of Water	www.kdhe.state.ks.us/pws/	(785) 296-5503
Kentucky Department for Environmental Protection: Division of Water	www.water.ky.gov/dw	(502) 564-3410
Louisiana Office of Public Health: Safe Drinking Water Program	www.oph.dhh.louisiana.gov/engineerservice/safewater/	(225) 765-5038
Maine Maine Department of Health and Human Services: Drinking Water Program	www.state.me.us/dhs/eng/water/	(207) 287-2070

State Contact Information	Web site	Phone Number
Maryland Department of the Environment: Water Supply Program	www.mde.state.md.us/programs/WaterPrograms/Water_Supply/index.asp	(410) 537-3000
Massachusetts Department of Environmental Protection: Drinking Water Program	www.mass.gov/dep/brp/dws/dwshome.htm	(617) 292-5770
Michigan Department of Environmental Quality: Water Bureau	www.michigan.gov/deq	(517) 373-7917
Minnesota Department of Health: Drinking Water Protection Section	www.health.state.mn.us/divs/eh/water/index.html	(651) 215-0770
Mississippi Department of Health: Water Supply Division	www.msdh.state.ms.us/msdhsite/index.cfm/44,0,76,html	(601) 576-7518
Missouri Department of Natural Resources: Water Protection and Soil Conservation Division	www.dnr.state.mo.us/wpscd/wpcp/index.html	(573) 751-1300
Montana Department of Environmental Quality: Public Water Supply Program	www.deq.state.mt.us/wqinfo/pws/index.asp	(406) 444-4071
Nebraska Department of Health and Human Services: Public Water Supply Program	www.hhs.state.ne.us/enh/pwsindex.htm	(402) 471-0521
Nevada State Health Division: Safe Drinking Water Program	http://ndep.nv.gov/bsdw/index.htm	(775) 687-6353
New Hampshire Department of Environmental Services: Water Division	www.des.state.nh.us/wseb/	(603) 271-2153
New Jersey Department of Environmental Protection: Water Supply Administration	www.state.nj.us/dep/watersupply/	(609) 292-5550
New Mexico Environment Department: Drinking Water Bureau	www.nmenv.state.nm.us/dwb/dwbtop.html	(505) 827-1400

State Contact Information	Web site	Phone Number
New York New York State Department of Health: Bureau of Water Supply Protection	www.health.state.ny.us/nysdoh/water/main.htm	(518) 402-7650
North Carolina Department of Environment and Natural Resources: Public Water Supply Section	www.deh.enr.state.nc.us/pws/	(919) 733-2321
North Dakota Department of Health: Division of Water Quality	www.health.state.nd.us/mf/	(701) 328-5211
Ohio Environmental Protection Agency: Division of Drinking and Ground Water	www.epa.state.oh.us/ddagw/	(614) 644-2752
Oklahoma Department of Environmental Quality: Water Quality Division	www.deq.state.ok.us/WQDnew/index.htm	(405) 702-8100
Oregon Department of Human Services: Drinking Water Program	http://oregon.gov/DHS/ph/dwp/index.shtml	(971) 673-0405
Pennsylvania Department of Environmental Protection: Office of Water Management	www.dep.state.pa.us/dep/deputate/watermgt/wsm/WSM.htm	(717) 772-4018
Puerto Rico Department of Health: Public Water Supply Supervision Program	www.epa.gov/region02/cepd/prlink.htm	(787) 977-5870
Rhode Island Department of Health: Office of Drinking Water Quality	www.health.ri.gov/environment/dwq/index.php	(401) 222-6867
South Carolina Department of Health and Environmental Control: Drinking Water Program	www.scdhec.net/eqc/water/html/dwater.html	(803) 898-4300
South Dakota Department of Environment and Natural Resources: Drinking Water Program	www.state.sd.us/denr/des/drinking/dwprg.htm	(605) 773-3754

State Contact Information	Web site	Phone Number
Tennessee Department of Environment and Conservation: Division of Water Supply	www.state.tn.us/environment/dws/index.html	(615) 532-0191
Texas Texas Commission on Environmental Quality	www.tceq.state.tx.us/nav/util_water/	(512) 239-4691
Utah Department of Environmental Quality: Division of Drinking Water	www.drinkingwater.utah.gov	(801) 536-4200
Vermont Vermont Agency of Natural Resources	www.anr.state.vt.us/dec/watersup/wsd.htm	(802) 241-3400
Virgin Islands Department of Planning and Natural Resources: Division of Environmental Protection	http://dpnr.gov.vi/dep/home.htm	(340) 773-1082
Virginia Department of Health: Office of Drinking Water	www.vdh.state.va.us/dw/index.asp	(804) 864-7500
Washington Division of Environmental Health: Office of Drinking Water	www.doh.wa.gov/ehp/dw/	(360) 236-3100
West Virginia Bureau for Public Health: Department of Health and Human Resources	www.wvdhhr.org/oehs/eed/	(304) 558-6715
Wisconsin Department of Natural Resources: Bureau of Drinking Water and Ground Water	www.dnr.state.wi.us/org/water/dwg/	(608) 266-0821
Wyoming EPA Region 8: Wyoming Drinking Water Program	www.epa.gov/region08/water/dwhome/wycon/wycon.html	(303) 312-6812

Appendix B: EPA Regional Contacts

To determine which region your state is in, visit http://cfpub.epa.gov/watersecurity/stateinfo.cfm.

US EPA Regional Contacts		
EPA Region 1	http://www.epa.gov/NE/eco/drinkwater/dw-security.html	(617) 918-1694
EPA Region 2	http://www.epa.gov/region2/water/	(212) 637-3879
EPA Region 3	http://www.epa.gov/reg3wapd/	(215) 814-5668
EPA Region 4	http://www.epa.gov/region4/water/	(404) 562-9446
EPA Region 5	http://www.epa.gov/region5/water/	(312) 886-0190
EPA Region 6	http://www.epa.gov/Arkansas/6wq/swp/security/	(214) 665-2776
EPA Region 7	http://www.epa.gov/region7/security/index.htm	(913) 551-7585
EPA Region 8	http://www.epa.gov/region8/compliance/security/secure.html	(303) 312-7021
EPA Region 9	http://www.epa.gov/region9/water/	(415) 947-3561
EPA Region 10	http://yosemite.epa.gov/R10/WATER.NSF/webpage/Water+Issues+in+Region+10	(206) 553-1389

Appendix C: Other STEP Documents

This guide is one in a series of Simple Tools for Effective Performance (STEP) documents for small drinking water systems. The STEP documents can be obtained from EPA by calling the Safe Drinking Water Hotline at (800) 426-4791 and requesting the document by its publication number. The documents can also be found at www.epa.gov/safewater/smallsys/ssinfo.htm. Other titles in the series are:

- *Small Systems Guide to the Total Coliform Rule (TCR)*
  Publication number: EPA 816-R-01-017A
  Published: June 2001

- *Safe Drinking Water Act (SDWA) Regulation Overview Brochure for Small Systems*
  Publication number: EPA 816-R-03-017
  Published: September 2003

- *Complying With the Revised Drinking Water Standard for Arsenic: Small Entity Compliance Guide*
  Publication number: EPA 816-R-02-008A
  Published: August 2002

- *Asset Management Workbook*
  Publication number: EPA 816-R-03-016
  Published: September 2003

- *Strategic Planning Workbook*
  Publication number: EPA 816-R-03-015
  Published: September 2003

- *Taking Stock of your Water System: A Simple Asset Inventory for Very Small Systems*
  Publication number: EPA 816-K-03-002
  Published: October 2004

Water Master Plan

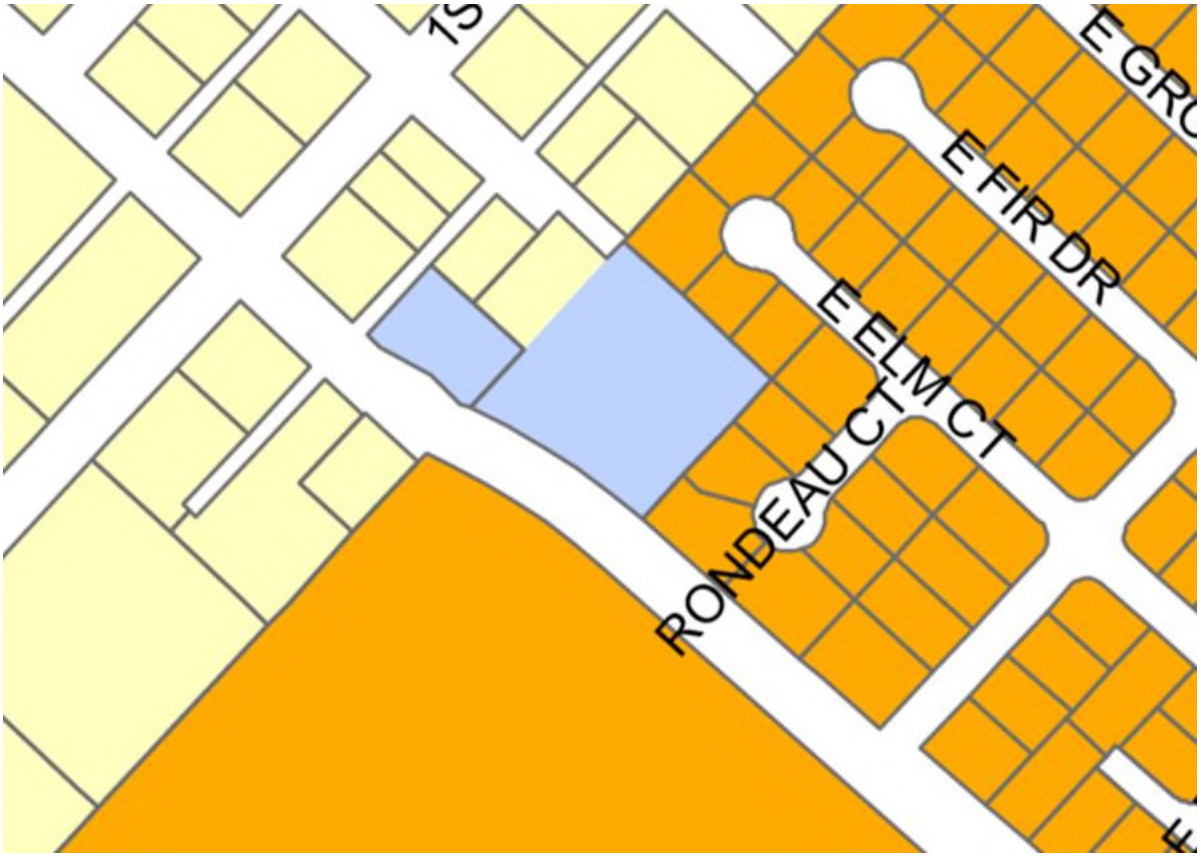
Appendix G. Correspondence on Potential Tank Site Restrictions

Kraushaar, Steven

From: Byram, Holly <HByram@mwvcog.org>
Sent: Monday, April 15, 2019 3:41 PM
To: Kraushaar, Steven
Cc: Susie Marston (SMarston@cityofgervais.com)
Subject: RE: City of Gervais Water Tank
Attachments: Hubbard Water Tank Info.pdf

Good afternoon Steve and Susie,

So it appears that the City owns two contiguous properties just east of Douglas at 1st. The smaller vacant one is zoned P-Public, and the larger one with the tanks and pump utility buildings on it is split-zoned P-Public and R1-Low Density Residential. The split zoning resulted from the City's 2012 Property Line Adjustment with the neighboring property owner (file# PLA 2012-01). I found a note on file from the previous planner explaining that when the City opted to undergo a Conditional Use Permit for the newest water tank in the R1 Zone portion with the 2012 Site Development Review (file# CUP/ SDR 2012-01), rather than taking the extra time/effort/expense of doing a Comprehensive [General] Plan Amendment and Zone Change for that portion of property. It should be redesignated/rezoned to Public in the future so that everything is squared away. This can be wrapped into a future effort (City-initiated UGB expansion or similar).



Chapter 17.32 - PUBLIC FACILITY (PF)
17.32.020 - Permitted uses.
The following uses are permitted in the PF district and subject to a site development review:
C. Public utility structures and buildings, such as pump stations, communication or transmission towers, reservoirs, electric substations, water and sewage treatment facilities and necessary right-of-way for identified public utilities; including office or administrative buildings;

The PF- Public Facility Zone lists a maximum building height of 45 feet. All setbacks (front, rear, side) adjacent to a residential district are 20 feet.

17.32.060 - Development standards.
All development in the public facility district shall comply with the applicable provisions of Chapters 17.120 through 17.128. In addition, the following specific standards shall apply:
A. Off-street parking. Off-street parking shall conform to the standards of Chapter 17.56.
B. Signs. Signs shall conform to the provisions of Chapter 17.68.
C. Development review. All new development or expansion of existing structure or use shall be subject to the site development review procedures of Chapter 17.144.
D. Subdivisions and partitions. All land divisions shall be reviewed in accordance with the provisions of Chapters 17.160—17.164.
E. Landscaping. Landscaping improvements shall be installed and maintained in all yard areas accordance with Chapter 17.72.

The way I read the Gervais Development Code is that a water tower [elevated storage tank] would be an outright permitted use in the Public Zone. The tank would be required to undergo Site Development Review, just like in 2012. 20-foot setbacks would apply adjacent to the residential district. The catch is that this zone has a 45-foot height limit. There may be two possible options to enable a 120-foot tower at this location:

1) GDC Chpt. 17.124 General Exceptions provides a list of exceptions to building height limits of an underlying zone. Included within that list is the word "tower." I don't believe that an elevated water tank is truly the intent

of this word, but the GDC does not define it, so the City could apply for a Code Interpretation/Similar Use determination from the City Council as to whether or not they believe that a water tower fits with the intention of this height exception category. If they believe yes it does, then the 120-foot height could be permitted through a SDR land use review.

Chapter 17.124 - GENERAL EXCEPTIONS
17.124.010 - General exception to building height.
Projections such as chimneys, spires, domes, elevator shaft housing, towers, aerials, flagpoles, and other similar objects not used for human occupancy are not subject to the building height limitations of the underlying zone.

2) When the City applies for Site Development Review for the storage tank, the City could apply for a Major Variance to allow this facility to exceed the 45-foot height limit.

I believe the important question is whether the neighborhood / community would support a facility of this scale at this very visible location, adjacent to the residential area. I understand that there was at least one concerned citizen on record during the 2012 approval of the newest at-grade tank. I also don't know if such a facility could impact nearby home-owners insurance coverage in the event of a leak or failure? If it becomes a controversial issue, the City Council could take a lot of heat for this. I would defer to Susie for a read on the political favorability of this. Some communities integrate art and community/school pride into their towers. That might soften the impact? Just to help myself understand the scale, I referenced the City of Hubbard's water tower (scanned page attached). I believe they are also undergoing a water master plan update.

Thank you,

Holly C. Byram

Associate Planner,
Mid-Willamette Valley Council of Governments (MWVCOG)

Direct (503) 540-1617
100 High Street SE, Ste. 200
Salem, OR 97301
hbyram@mwvcog.org
www.mwvcog.org

From: Kraushaar, Steven <Steven.Kraushaar@tetratech.com>
Sent: Thursday, April 11, 2019 3:09 PM
To: Byram, Holly <HByram@mwvcog.org>
Cc: Susie Marston (SMarston@cityofgervais.com) <SMarston@cityofgervais.com>
Subject: City of Gervais Water Tank

Hi Holly,

One of the things we're looking at with the water master plan is a new elevated storage tank. This would probably at the treatment plant site on Douglas, just east of 1st St. The tank would be about 120 feet high, about 30 to 40 feet in diameter. Would this meet zoning conditions with the residential development adjacent to the plant? If so, neighborhood acceptance of it might be a problem. At this stage I'm trying to determine if this is a viable option.

Any thoughts on this would be appreciated.

Steve

Steven L. Kraushaar | Civil Engineer, Project Manager
Direct **(503) 598-2525** | Office **(503) 684-9097** | Fax **(503) 598-0583** | steven.kraushaar@tetratech.com

Tetra Tech | Complex World, Clear Solutions™
15350 SW Sequoia Parkway, Suite 220 | Portland, OR 97224 | tetratech.com

Water Master Plan

Appendix H. Distribution System Hydraulic Model Information

TETRA TECH

Gervais 2019 Water Master Plan Update – Modeling Summary

A water distribution model for the City of Gervais was created from the ground up using InfoWater software. The pipe network was built based on a recent water distribution map update that is current as of May 2019. The City of Gervais uses three pumps to maintain system pressure between 55-70 psi. The two smaller pumps, a 7.5 HP and a 15HP pump, are designed to meet average day and most peak day demands. The largest pump, a 50 HP pump, is provides for fire flow scenarios or when pressures drop below 55 psi. Pump operating levels and head vs. flow curves were taken from the pump curves submitted at the time of installation.

The following lists the assumptions made in producing the model.

- All PVC pipes were modeled with the same roughness coefficient regardless of age, same for steel and cast iron pipes.
- Pipe lengths were calculated in InfoWater based on the North American 1983 HARN Geographic Coordinate System.
- All scenarios were modeled under steady-state conditions
- Except as noted, scenarios were modeled under the assumption Winfield Ranch would be serviced via the existing 6" PVC line along Ivy and a new 8" PVC line connecting Winfield St to Grove Ave. as shown in Figure 1-1 below.

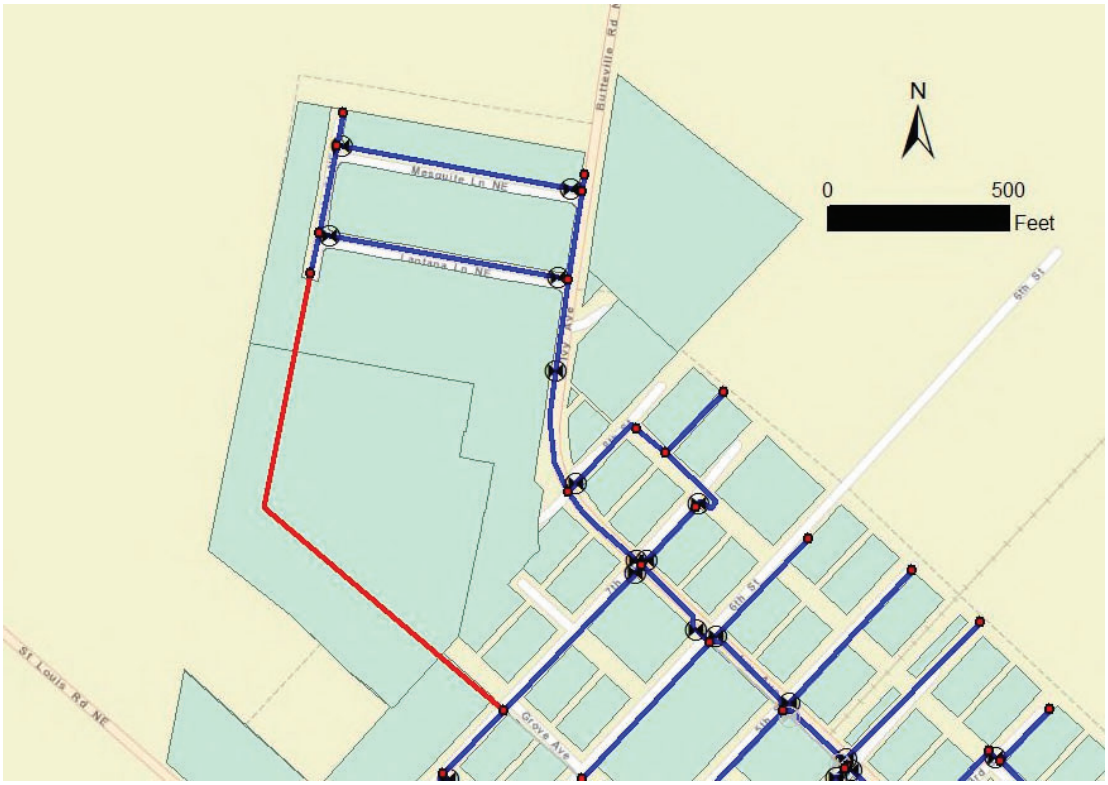


Figure 1: New 8" PVC shown in red

- The pressure tank at the water treatment plant that dictates pump operation was not included in the analysis.

15350 SW Sequoia Parkway, Suite, Portland, Oregon 97224
Tel 503-684-9097 **Fax** 503-598-0583 **tetratech.com**

- The groundwater production well was not included in the analysis.

The distribution system was modeled using average and peak day demands based on population projections for the year 2040. The data used to determine demand came from a mix of projections in the Water Master Plan and total consumption data in 2018. The cumulative average daily demand was uniformly distributed among all nodes in the model. Table 1-1 summarizes the demand used in the model.

Table 1. Demand Data

Demand Data	
ADD (MGD)	0.280
Peak Day (MGD	0.615
Peak Hour (MGD)	0.978
Peak Day Factor	2.2
Peak Hour Factor	3.5

The model was calibrated using hydrant tests performed by AKS Engineering in 2018. The model was calibrated by first matching the static pressure reported in each test. Residual pressures were used to adjust pipe roughness until the model sufficiently reflected hydrant test results. Only pipe roughness by pipe type was adjusted to approximate existing conditions. Minor losses from bends, fittings and valves were not included in the model. All hydraulic modeling was performed under steady-state conditions.

The Oregon Fire Code(OFC) section B105, fire flow requirements for buildings, served as the minimum requirement to determine system deficiencies and assess performance. The code requires 1,000 GPM sustained over an hour for all buildings without an automatic sprinkler system under 3,600 SF. For all modeling scenarios a minimum flow of 1500 GPM was assessed at 3 critical hydrants to determine system performance. The hydrants included in Table 2 below were either selected due because they were the most hydraulically distant hydrants from the Water Treatment Plant or due to its high public safety priority.

Table 2. Critical Hydrants

Hydrant ID	Hydrant Location	Current available Flow at 20 PSI* (GPM)
J101	Northern most hydrant in Winfield Ranch	618
J100	Western most hydrant in Winfield Ranch	650
J26	Main hydrant servicing Gervais High School	1,552

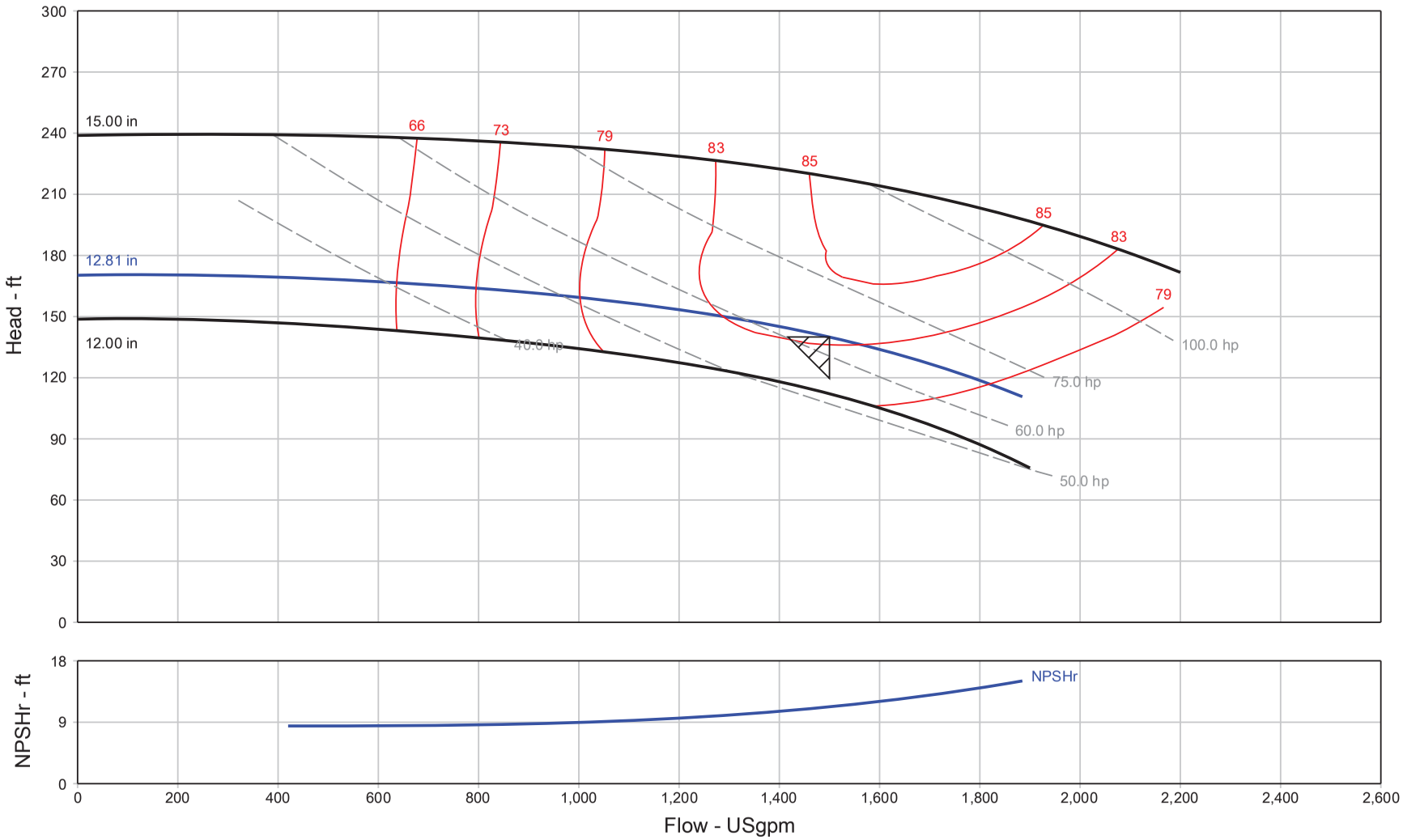
*current available flow does not reflect the addition of and 8" line shown in figure 1.

Modeling scenarios were based around possible improvements to increase fire flows around Winfield Ranch. Results are summarized in Table 3 shown below. The proposed pump curve is attached.

Scenario	Description	Hydrant ID	Available Flow at 20 PSI (GPM)
FF-EX8	Fire Flow: 1500 GPM Existing Pumps w/ addition of 8" PVC in Figure 1	J101	930
		J100	1,050
		J26	1,550
FF-PR	Fire Flow: 1500 GPM Proposed pump upgrade w/ addition of 8" PVC in Figure 1	J101	1,280
		J100	1,500
		J26	2,730
FF-EX-G	Fire Flow: 1500 GPM Existing Pumps 8" Pipe installed along Grove Ave. 7th St to 4th St	J101	1,020
		J100	1,200
		J26	1,550
FF-PR-G	Fire Flow: 1500 GPM Proposed pump upgrade 8" Pipe installed along Grove Ave. 7th St to 4th St	J101	1,440
		J100	1,800
		J26	2,730
FF-EX-ID	Fire Flow: 1500 GPM Existing Pumps Ivy Ave 6th to 4th upsized to 10" Douglas Ave 5th to 1st upsized to 10"	J101	970
		J100	1,120
		J26	1,550
FF-PR-ID	Fire Flow: 1500 GPM Proposed pump upgrade Ivy Ave 6th to 4th upsized to 10" Douglas Ave 5th to 1st upsized to 10"	J101	1,350
		J100	1,630
		J26	2,730

The proposed pump was selected to based on its ability to satisfy minimum fire flow requirements while still maintaining an acceptable service pressure. Figure 2 shown below illustrates the pressure effect of the proposed pump under fire flow conditions.

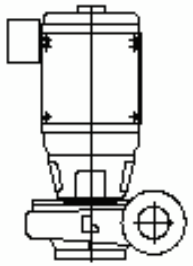
Pump Performance Curve



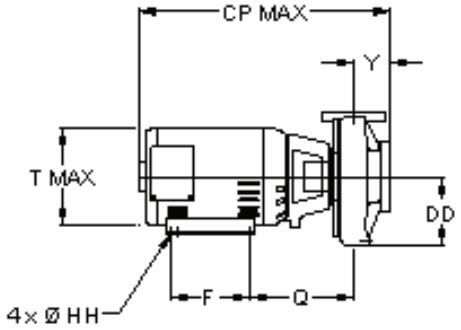
Project name	: tetra tech	Tag Number	: 001	Speed, rated	: 1780 rpm
Consulting engineer	:	Service	:	Flow, rated	: 1,500.0 USgpm
Customer	:	Model	: 50157 LC	Differential head / pressure, rated	: 140.0 ft
Customer ref. / PO	:	Quantity	: 1	Rated power (based on duty point)	: 63.59 hp
Quote Number / ID	: 982204	Quoted By (Sales Office)	: PUMPTECH INC	Max power (non-overloading)	: 68.25 hp
Date last saved	: 05/21/2019 12:46 PM	Quoted By (Sales Engineer)	: Frank Baker	Efficiency	: 83.35 %
		Stages	: 1	Based on curve number	: RC2113 Rev 1

General Arrangement

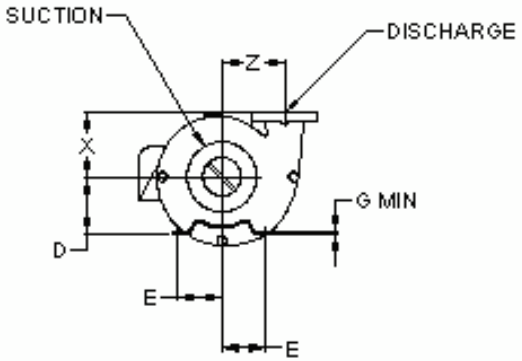
Project name	: tetra tech	Tag Number	: 001
Consulting engineer	:	Service	:
Customer	: PUMPTECH INC	Model	: 50157 LC
Customer ref. / PO	:	Quantity of pumps	: 1
Quote Number / ID	: 982204	Quoted By (Sales Office)	: PUMPTECH INC
Date last saved	: 05/21/2019 12:46 PM	Quoted By (Sales Engineer)	: Frank Baker



PLAN



SIDE VIEW



END VIEW

NOT FOR CONSTRUCTION, Unless certified and referenced on order

Units	Frame	Suct(in)	Disch(in)	CP	D	DD	E	F	G	HH	Q	T	X	Y	Z	Weight ea
inches	**365TCZ**	**6**	**5**	**45.00**	**9.00**	**11.00**	**7.00**	**12.25**	**1.00**	**0.66**	**16.63**	**18.25**	**10.00**	**5.75**	**9.88**	**1,175.0**

Conditions of Service		Motor Data			
Flow: 1,500.0 USgpm	Fluid: Cold Water	HP: 75	Encl: ODP	Phase: 3	Efficiency: Premium
TDH: 140.0 ft	Temp.: 68.00 deg F	RPM: 1780 rpm	Hz: 60	Voltage: 230/460	S.F.: 1.15

Water Master Plan

Appendix I. Reservoir No. 2 Seismic Analysis

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
www.OregonGeology.org
W. Lawrence Givens, Governing Board Chair
Vicki S. McConnell, Director and State Geologist
Andree V. Pollock, Assistant Director, Geologic Survey and Services
Rachel L. Smith, Project Operations Manager
Ian P. Madin, Chief Scientist

Map of Earthquake and Tsunami Damage Potential for a Simulated Magnitude 9 Cascadia Earthquake

2013

OPEN-FILE REPORT O-13-06

Ground Motion and Ground Deformation Data and Maps for the 2012 Oregon Resilience Plan for Cascadia Subduction Zone Earthquakes

by Ian P. Madin and William J. Burns

PLATE 7

BACKGROUND

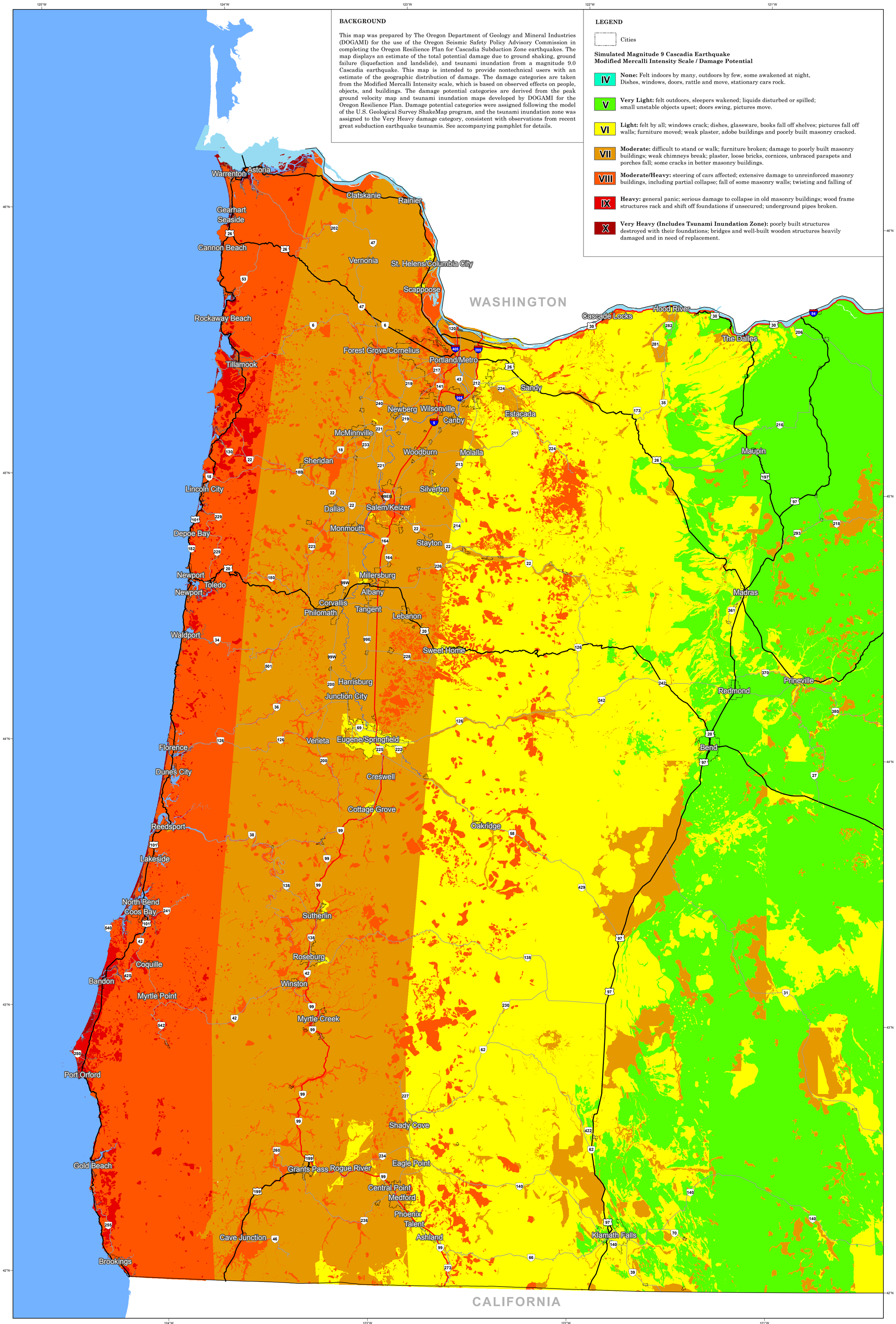
This map was prepared by The Oregon Department of Geology and Mineral Industries (DOGAMI) for the use of the Oregon Seismic Safety Policy Advisory Commission in completing the Oregon Resilience Plan for Cascadia Subduction Zone earthquakes. The map displays an estimate of the total potential damage due to ground shaking, ground failure (liquefaction and landslide), and tsunami inundation from a magnitude 9.0 Cascadia earthquake. This map is intended to provide nontechnical users with an estimate of the geographic distribution of damage. The damage categories are taken from the Modified Mercalli Intensity scale, which is based on observed effects on people, objects, and buildings. The damage potential categories are derived from the peak ground velocity map and tsunami inundation maps developed by DOGAMI for the Oregon Resilience Plan. Damage potential categories were assigned following the model of the U.S. Geological Survey ShakeMap program, and the tsunami inundation zone was assigned to the Very Heavy damage category, consistent with observations from recent great subduction earthquake tsunamis. See accompanying pamphlet for details.

LEGEND

Cities

Simulated Magnitude 9 Cascadia Earthquake
Modified Mercalli Intensity Scale / Damage Potential

- **IV** — **None:** Felt indoors by many, outdoors by few, some awakened at night, Dishes, windows, doors, rattle and move, stationary cars rock.
- **V** — **Very Light:** felt outdoors, sleepers wakened; liquids disturbed or spilled; small unstable objects upset; doors swing, pictures move.
- **VI** — **Light:** felt by all; windows crack; dishes, glassware, books fall off shelves; pictures fall off walls; furniture moved; weak plaster, adobe buildings and poorly built masonry cracked.
- **VII** — **Moderate:** difficult to stand or walk; furniture broken; damage to poorly built masonry buildings; weak chimneys break; plaster, loose bricks, cornices, unbraced parapets and porches fall; some cracks in better masonry buildings.
- **VIII** — **Moderate/Heavy:** steering of cars affected; extensive damage to unreinforced masonry buildings, including partial collapse; fall of some masonry walls; twisting and falling of
- **IX** — **Heavy:** general panic; serious damage to collapse in old masonry buildings; wood frame structures rack and shift off foundations if unsecured; underground pipes broken.
- **X** — **Very Heavy (Includes Tsunami Inundation Zone):** poorly built structures destroyed with their foundations; bridges and well-built wooden structures heavily damaged and in need of replacement.



Coordinate System: NAD 1983 CORS96 Oregon Statewide Lambert Ft Intl
Projection: Lambert Conformal Conic
Geographic Coordinate System: NAD 1983 CORS96
Datum: NAD 1983 CORS96

Data layers: Earthquake and tsunami damage: DOGAMI; see Background text on this plate and accompanying pamphlet for details. Roads: Oregon Department of Transportation, 2008. Urban growth boundaries: Oregon Department of Land Conservation and Development (DLCD) (2011).
Cartography by Ian P. Madin.

0 10 20 30 40 50 Miles
0 25 50 Kilometers

TRUE NORTH

NOTICE
This map cannot serve as a substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from those shown on the maps. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government.

For copies of this publication contact:
Nature of the Northwest Information Center
800 NE Oregon Street, #28, Ste. 965
Portland, Oregon 97232
telephone (971) 673-2331

DRAFT

Foundation Report and Seismic Hazard Study

Gervais Water Improvements/
Water Tank Relocation

Gervais, Oregon

Prepared for:

Tetra Tech/KCM, Inc.
Portland, Oregon

June 21, 2013

Professional Geotechnical Services

Foundation Engineering, Inc.

DRAFT

Appendix D

Seismic Hazard Study

Professional Geotechnical Services

Foundation Engineering, Inc.

GERVAIS WATER IMPROVEMENTS
WATER TANK RELOCATION
SEISMIC HAZARD STUDY
GERVAIS, OREGON

INTRODUCTION

The seismic hazard study was completed to identify potential geologic and seismic hazards and evaluate the effect these hazards may have on the proposed project. The study fulfills the requirements presented in the 2010 Oregon Structural Specialty Code (OSSC), Section 1803.7, for site-specific seismic hazard reports for essential and hazardous facilities and major and special-occupancy structures.

LITERATURE REVIEW

Available geologic and seismic publications and maps were reviewed to characterize the local and regional geology and evaluate relative seismic hazards at the site. We also reviewed local water well logs, available from the Oregon Department of Water Resources website, and nearby geotechnical and seismic investigations to establish an estimate of the subsurface conditions prior to our site investigation.

SEISMIC CONSIDERATIONS

Regional Geologic and Tectonic Setting

The project site lies within the northern Willamette Valley, a broad, gently deformed, north-south-trending basin separating the Coast Range to the west from the Cascade Range to the east. In the early Eocene (±50 to 58 million years ago), the Willamette Valley was part of a broad continental shelf extending from the Western Cascades west beyond the present coastline. Basement rock underlying most of the Valley includes the Siletz River Volcanics, which erupted as part of a submarine oceanic island-arc. The thickness of the basement volcanic rock is unknown; however, it is estimated that the thickness may be ±3 to 4 miles (Yeats et al., 1996). The island-arc collided with and was accreted to the western margin of the converging North American plate near the end of the early Eocene. Volcanism subsided and a fore arc basin was created and infilled with marine sediments throughout the late Eocene and Oligocene and continental Little Butte Volcanics of the Oligocene (Orr and Orr, 1999). These marine sediments typically overlie but are also interbedded with the basalt and volcanics of both the Siletz Volcanics and younger Tertiary volcanics.

After emerging from a gradually-shallowing ocean, the marine and volcanic formations were covered by the terrestrial Columbia River Basalt, which poured through the Columbia Gorge from northeastern Oregon and southwestern Washington, spreading as far south as Salem (±17 to 10 million years ago) (Tolan et al., 2000), and some flows reaching west to the Pacific Ocean (Orr and Orr, 1999). Uplift and tilting of the Coast Range and the Western Cascades during the late Miocene formed the trough-like configuration of the Willamette Valley. Thick layers of Pleistocene and Holocene fluvial and floodplain deposits blanket the

Columbia River Basalt and older Tertiary deposits (Crenna and Yeats, 1994; Orr and Orr, 1999; Tolan et al., 2000).

Catastrophic flood deposits later appeared during the Pleistocene (over 12,700 years ago) and now mantle the Valley floor as far south as Eugene (Hampton, 1972; Yeats et al., 1996; Burns et al., 1997). These deposits originated from a series of glacial-outburst floods that periodically drained Glacial Lake Missoula in western Montana. The older deposits, typically found within the Portland Basin, usually consist of layers of cobbles/boulders, gravel and sand during a period of time when the river(s) had sufficiently high flow to move large boulders (erratics). However, in the Southern Willamette Valley, turbid floodwater eventually settled, depositing a relatively thick layer (50 to 100 feet) of silt and clay (Orr and Orr, 1999).

The northern Willamette Valley lies ±130 miles inland from the surface expression of the Cascadia Subduction Zone (CSZ) (Goldfinger et al., 1992), a converging, oblique plate boundary where the Juan de Fuca plate is being subducted beneath the western edge of the North American continent (Geomatrix Consultants, 1995). The CSZ extends from central Vancouver Island in British Columbia, Canada, through Washington and Oregon to Northern California. Available information indicates the CSZ is capable of generating earthquakes within the descending Juan de Fuca plate (intraplate), along the inclined interface between the two plates (interface or subduction zone), or within the overriding North American Plate (crustal) (Weaver and Shedlock, 1996). Therefore, western Oregon is located in an area of potentially high seismic activity due to its proximity to the CSZ.

Local and Regional Faults

A review of nearby faults was completed to investigate the seismic setting and mapped potential seismic sources. Numerous concealed and inferred crustal faults are mapped within ±10 miles of the site (Bela, 1981; Yeats et al., 1996). However, none of these faults show any evidence of movement in the last ±1.6 million years (Geomatrix Consultants, 1995; USGS, 2006). Sixteen potentially active Quaternary (<1.6 million years or less) crustal fault zones have been mapped within ±40 miles of the site (Geomatrix Consultants, 1995; Personius et al., 2003; USGS, 2006) and are listed in Table 1.

The approximate locations of the mapped Northern Willamette Valley faults summarized in Table 1 are shown on Figure 1D (attached), and additional fault information is available in the literature (Personius et al., 2003; USGS, 2006).

Table 1. Potentially Active Quaternary Crustal Faults within ± 40 miles of Gervais Water Improvments/Water Tank Relocation

Fault Name	Length (miles)	Distance from Site (miles)	Last Known Activity	Slip Rate (mm/yr)
Mount Angel (#873)	±19	±3 NE	<15,000 years	0.067*
Newberg (#717)	±3	±13 N-NW	<1.6 million years	0.016*
Waldo Hills (#872)	±8	±13 S-SW	<1.6 million years	<0.2
Canby – Mollala (#716)	±31	±15 NE	<15,000 years	<0.2
Mill Creek (#871)	±11	±19 S-SW	<1.6 million years	<0.2
Gales Creek (#718)	±45	±21 NW	<1.6 million years	0.016*
Bolton (#874)	±6	±24 NE	<1.6 million years	0.013*
Beaverton (#715)	±9	±25 N	<750,000 years	<0.2
Portland Hills (#877)	±31	±25 NE	<1.6 million years	0.1*
Oatfield (#875)	±18	±27 NE	<1.6 million years	<0.2
Damascus – Tickle Creek (#879)	±11	±28-36 NE	<750,000 years	<0.2
East Bank (#876)	±18	±30 NE	<15,000 years	<0.2
Grant Butte (#878)	±6	±31 NE	<750,000 years	0.11*
Helvetia (#714)	±4	±30 N-NW	<1.6 million years	0.014*
Corvallis (#869)	±25	±33 SW	<1.6 million years	<0.20
Owl Creek (#870)	±9	±38 SW	<750,000 years	<0.20

Note: Fault data based on USGS (2006). * From Table H-1 (Petersen et al., 2008).

All but the Bolton and Corvallis faults are considered USGS Class A faults. Class A faults have geologic evidence supporting tectonic movement in the Quaternary, known or presumed to be associated with large-magnitude earthquakes.

The USGS (2002) interactive deaggregation indicates the primary seismic sources affecting the site are the CSZ, Mount Angel fault, and other potential unknown crustal faults (Western US shallow gridded) located nearby.

Historic Earthquakes

No significant interface (subduction zone) earthquakes have occurred on the CSZ in historic times; however, several large-magnitude (>M ~8.0, M = unspecified magnitude) subduction zone earthquakes are thought to have occurred in the past few thousand years. This is evidenced by recently discovered tsunami inundation deposits, combined with evidence for episodic subsidence along the Oregon and Washington coasts (Peterson et al., 1993; Atwater et al., 1995). The Oregon Department of Geology and Mineral Industries (DOGAMI) estimates the maximum

magnitude of an interface subduction zone earthquake ranges from moment magnitude (M_w) 8.5 to M_w 9.0 (Wang and Leonard, 1996; Wang et al., 1998; Wang et al., 2001), and the rupture may potentially occur along the entire length of the CSZ (Weaver and Shedlock, 1996). Interface earthquakes are believed to have an average return period of ±400 to 700 years (Nelson and Personius, 1996), with the last event occurring ±300 years ago (Nelson et al., 1995).

Intraplate (subduction zone) earthquakes occur within the Juan de Fuca Plate at depths of ±28 to 37 miles (Weaver and Shedlock, 1996). The maximum estimated magnitude of an intraplate earthquake is about M_w 7.5 (Wang et al., 2001). No intraplate earthquakes have been recorded in Oregon in modern times. However, the Puget Sound region of Washington State has experienced three intraplate events in the last ±57 years including a surface wave magnitude (M_s) 7.1 event in 1949 (Olympia), a M_s 6.5 event in 1965 (Seattle/Tacoma) (Wong and Silva, 1998), and a M_w 6.8 event in 2001 (Nisqually) (USGS, 2001).

Crustal earthquakes dominate Oregon's seismic history. Crustal earthquakes occur within the North American Plate, typically at depths of ±6 to 12 miles. The estimated maximum magnitude of a crustal earthquake is about M_w 6.5 (Wang and Leonard, 1996; Wang et al., 1998; Wang et al., 2001). Only two major crustal events in Oregon have reached Richter local magnitude (M_L) 6 (the 1936 Milton-Freewater M_L 6.1 earthquake and the 1993 Klamath Falls M_L 6.0 earthquake) (Wong and Bott, 1995). The majority of Oregon's larger crustal earthquakes are in the M_L 4 to 5 range (Wong and Bott, 1995).

Locally, the 1993 Scotts Mills earthquake, with a moment magnitude (M_W) of 5.6 and a local Modified Mercalli intensity (MM) of VII, is the largest recent earthquake felt in the Gervais area (Black, 1996). This quake caused damage in Salem, Mount Angel, Woodburn, Newberg, Molalla, and Canby, and had a local MM intensity of VI-VII (Madin et al., 1993).

Table 2 summarizes earthquakes with a M of 3.5 or greater that have occurred within a ±50-mile radius of Gervais in the last 180 years (Johnson et al., 1994; ANSS, 2013). Note that the March 25, 1993, M_L 5.6 Scotts Mills Earthquake (Modified Mercalli Intensity V-VI) is listed (Wong and Bott, 1995).

Table 2. Historic Earthquakes within 50-mile Radius of Gervais

Year	Month	Day	Hour	Minute	Latitude	Longitude	Depth (miles)	Magnitude
1960	03	05	00	00	45.6	-122.7	unknown	M = 3.5
1961	08	19	04	56	44.7	-122.5	unknown	M_L = 4.5
1961	11	7	01	29	45.7	122.4	unknown	M = 5.0
1962	09	05	05	37	44.5	-122.9	unknown	M = 3.5
1963	03	07	23	53	44.9	-123.5	29.2	M_b = 4.6
1963	12	27	02	36	45.7	-123.4	20.5	M_b = 4.5
1964	10	01	12	31	45.7	-122.8	20.5	M_b = 5.3
1964	10	12	04	31	45.7	122.8	unknown	M = 4.3
1968	01	27	08	28	45.6	-122.6	23.0	M = 3.7
1968	05	13	18	52	45.6	-122.6	unknown	M = 3.8
1969	03	05	11	43	45.6	122.8	unknown	M = 3.5
1970	06	25	07	48	45.5	-122.8	unknown	M = 3.6
1989	08	01	23	25	45.6	-122.5	8.9	M_c = 3.7
1989	09	15	10	28	45.4	-121.7	3.2	M_c = 3.5
1991	07	22	09	04	45.6	-122.9	12.3	M_c = 3.5
1993	03	25	13	34	45.0	-122.6	12.8	M_L = 5.6
1993	06	08	00	01	45.0	-122.6	12.6	M_c = 3.7
1995	02	08	09	10	45.1	-122.7	19.7	M_c = 3.6
2003	04	24	19	26	45.6	-122.7	10.8	M_c = 3.9
2006	08	03	08	39	45.8	-122.6	9.1	M_c = 3.8
2007	09	24	06	20	45.1	-123.0	14.6	M_c = 3.6

Note: M = unspecified magnitude, M_b = compressional body wave magnitude, M_c = primary coda magnitude, and M_L = local Richter magnitude

It should be noted that seismic events in Oregon were not comprehensively documented until the 1840's (Wong and Bott, 1995). According to Wong and Bott (1995), seismograph stations sensitive to smaller earthquakes ($M_L \leq 4$ to 5) were not implemented in northwestern Oregon until 1979 when the University of Washington expanded their seismograph network to Oregon. Prior to 1979, few seismograph stations were installed in Oregon. Oregon State University (Corvallis) likely had the first station installed in 1946 (Wong and Bott, 1995). The local Richter magnitude (M_L) of events occurring prior to the establishment of seismograph stations have been estimated based on correlations between magnitude and Modified Mercalli (MM) intensities. Some discrepancy exists in the correlations.

A sample of distant, strong earthquakes felt in the Gervais area include the following (Modified Mercalli Intensities (MM) in parentheses): the 2001 Nisqually,

Washington, earthquake (II-IV); the 1993 Scotts Mills earthquake (VI-VII); the 1981 Elk Lake, Washington earthquake (II-IV); the 1965 Seattle-Tacoma earthquake (I-IV); the 1962 Portland earthquake (V); the 1961 Lebanon/Albany earthquake (IV); the 1961 Cougar, Washingon earthquake (I-III); the 1961 NW Oregon earthquake (III-IV); the 1957 NW Salem earthquake (I-IV); the 1953 Portland earthquake (I-IV); the 1949 Olympia, Washington earthquake (VI); the 1877 Cascades, Washington earthquake (III); and the 1873 Crescent City earthquake (IV) (Noson et al., 1988; Bott and Wong, 1993; Stover and Coffman, 1993; Wiley et al., 1993; Wong and Bott, 1995; Black, 1996; USGS, 2001). None of these events caused significant damage in Gervais or northern Marion County.

Seismic Hazards

Section 1803.7 of the 2010 OSSC requires the evaluation of risks from a range of seismic hazards. Geologic and seismic hazard studies by DOGAMI have been completed and include the project site (Wang and Leonard, 1996; Burns et al., 2008). We have also developed conclusions regarding seismic hazards based on previous geotechnical and seismic studies performed within the project vicinity, our knowledge of the site geology, and the soil profile encountered in the explorations.

Ground Motion Amplification. Ground motion amplification is the influence of a soil deposit on the earthquake motion. As seismic energy propagates up through the soil strata, the energy is typically increased (i.e., amplified) or decreased (i.e., attenuated) to some extent.

Willamette Silt from the ground surface to the bottom of the exploration at ±66.5 feet. Soft, low to medium plasticity silt was encountered from the ground surface to ±8 feet, followed by medium stiff silt. The silt becomes interbedded with non-plastic silt with trace sand at ±12 feet to the limits of the exploration. The relative density of the silt varies with depth from medium stiff to very stiff, with the exception of the sample obtained at ±40 feet where an N-value of 1 was recorded. The exploration was terminated in very stiff silt.

The site is underlain by alluvial deposits including soft to medium stiff, low to medium plasticity silt interbedded with non-plastic silt and silty sand. It is our opinion that the potential for ground amplification in these soils is moderate to high. This conclusion is consistent with DOGAMI's ground motion amplification maps. The ground motion amplification map of Marion County (Burns et al., 2008) classifies amplification hazard using a scale of Very Low (A, NEHRP site classification, lowest amplification susceptibility) to Very High (E and F NEHRP site classification, highest amplification susceptibility). The project site is mapped as High (site class D).

Ground Rupture. We anticipate the potential for ground rupture at the site is relatively low due to the lack of known faulting beneath the site. However, hidden and/or deep-seated active faults could remain undetected. Additionally, recent crustal seismic activity cannot always be tied to observable faults. In the event of a catastrophic earthquake with a large seismic moment, inactive faults could

potentially be reactivated. It is noted that the site is relatively close to the potentially-active Mount Angel fault, located ±3 miles northeast of the site.

Landslides and Earthquake-Induced Landslides. General slope instability and instability induced by earthquake shaking are significant hazards for many parts of western and eastern Marion County. The proposed site is located on flat terrain. Based on our observations of surface features, results of subsurface explorations, and the anticipated site grading, it is our opinion that the risk of landslides or earthquake-induced landslides is negligible. This conclusion is consistent with the landslide susceptibility maps, which indicate the project site is mapped within a low landslide susceptibility zone with no identified landslide areas in Gervais (Burns et al., 2008).

Liquefaction, Lateral Spreading and Settlement. Liquefiable soils typically consist of saturated, loose sand and non-plastic or low plasticity silt. It is our opinion that the risk of liquefaction and liquefaction-induced settlement is moderate due to the proximity of the site to potential seismic sources, the presence of relatively high ground water and loose to medium dense silty sand and soft to medium stiff non-plastic silt. The risk of lateral spreading is considered low due to the flat terrain.

DOGAMI's liquefaction susceptibility map for the Marion County area classifies the liquefaction hazard using a scale of rare (no liquefaction susceptibility) to very high liquefaction susceptibility. The site is located within an area mapped with moderate susceptibility of liquefaction (Burns et al., 2008).

The liquefaction hazard is discussed in greater detail in the main report. The report includes an evaluation of the liquefaction risk and estimated liquefaction-induced settlement. A discussion of options to reduce the potential impacts of the liquefaction hazard is also provided.

Tsunami/Seiche. Tsunami inundation is not applicable to this site since it is not on the Oregon Coast. Seiche (the back and forth oscillations of a water body during a seismic event) is also not a concern due to the absence of large bodies of water near the site.

SEISMIC DESIGN

Design Earthquakes

The 2010 OSSC, Section 1803.3.2.1, requires that the design of structures classified as essential or hazardous facilities and major and special-occupancy structures address, at a minimum, the following earthquakes:

Crustal: A shallow crustal earthquake on a real or assumed fault near the site with a minimum moment magnitude (M_W) of 6.0 or the design earthquake ground motion acceleration determined in accordance with OSSC Section 1613.

Intraplate: A deep subduction earthquake with a moment magnitude (M_W) of 7.0 or greater on the seismogenic part of the subducting plate (Juan de Fuca) of the Cascadia Subduction Zone (CSZ).

Interface: A subduction earthquake with a minimum moment magnitude (M_W) of 8.5 on the seismogenic part of the interface between the Juan de Fuca and the North American Plates on the CSZ.

The design maximum considered earthquake ground motion maps provided in OSSC 2010 are based on the 2002 maps prepared by USGS for an earthquake with a 2% probability of exceedence in 50 years (i.e., a ±2,475-year return period). USGS released updated maps in 2008. These maps are used in the 2012 IBC and will presumably be adopted into the next edition of the OSSC.

The 2002 and 2008 USGS maps were established based on probabilistic studies and include aggregate hazards from a variety of seismic sources. Information obtained from the USGS National Earthquake Hazard Mapping website indicates the following earthquake magnitudes and source-to-site distances were used for the 2002 USGS maps (USGS, 2002):

Crustal: M_W 6.0 to 6.8 earthquake located ±3 miles from the site on the Mount Angel Fault.

Subduction: M_W 8.3 earthquake located ±54 to 55 miles from the site.

Subduction: M_W 9.0 earthquake located ±53 to 55 miles from the site.

The following earthquake magnitudes and source-to-site distances were used for the 2008 USGS maps (USGS, 2008):

Crustal: M_W 6.0 to 6.8 earthquake located ±2.8 to 5.5 miles from the site on the Mount Angel Fault.

Subduction: M_W 8.3 to 8.7 earthquake located ±46 to 52 miles from the site.

Subduction: M_W 9.0 to 9.2 earthquake located ±46 to 52 miles from the site.

The earthquake magnitudes and source-to-site distances used to generate the 2002 and 2008 USGS maps satisfy the requirements of OSSC 2010. Refer to the Seismic Design section of the main report for a discussion of the peak bedrock acceleration and parameters for constructing the site response spectrum (Figure 3A, Appendix A).

CONCLUSION

Based on the findings presented herein, it is our opinion there is a potential liquefaction hazard at the proposed Gervais Water Improvments/Water Tank Relocation site. Site-specific foundation design recommendations and mitigation options are discussed in the Geotechnical Investigation Memorandum.

This site-specific seismic hazard investigation for the Gervais Water Improvments/Water Tank Relocation in Gervais, Oregon, was prepared by Brooke Running, R.G., C.E.G.

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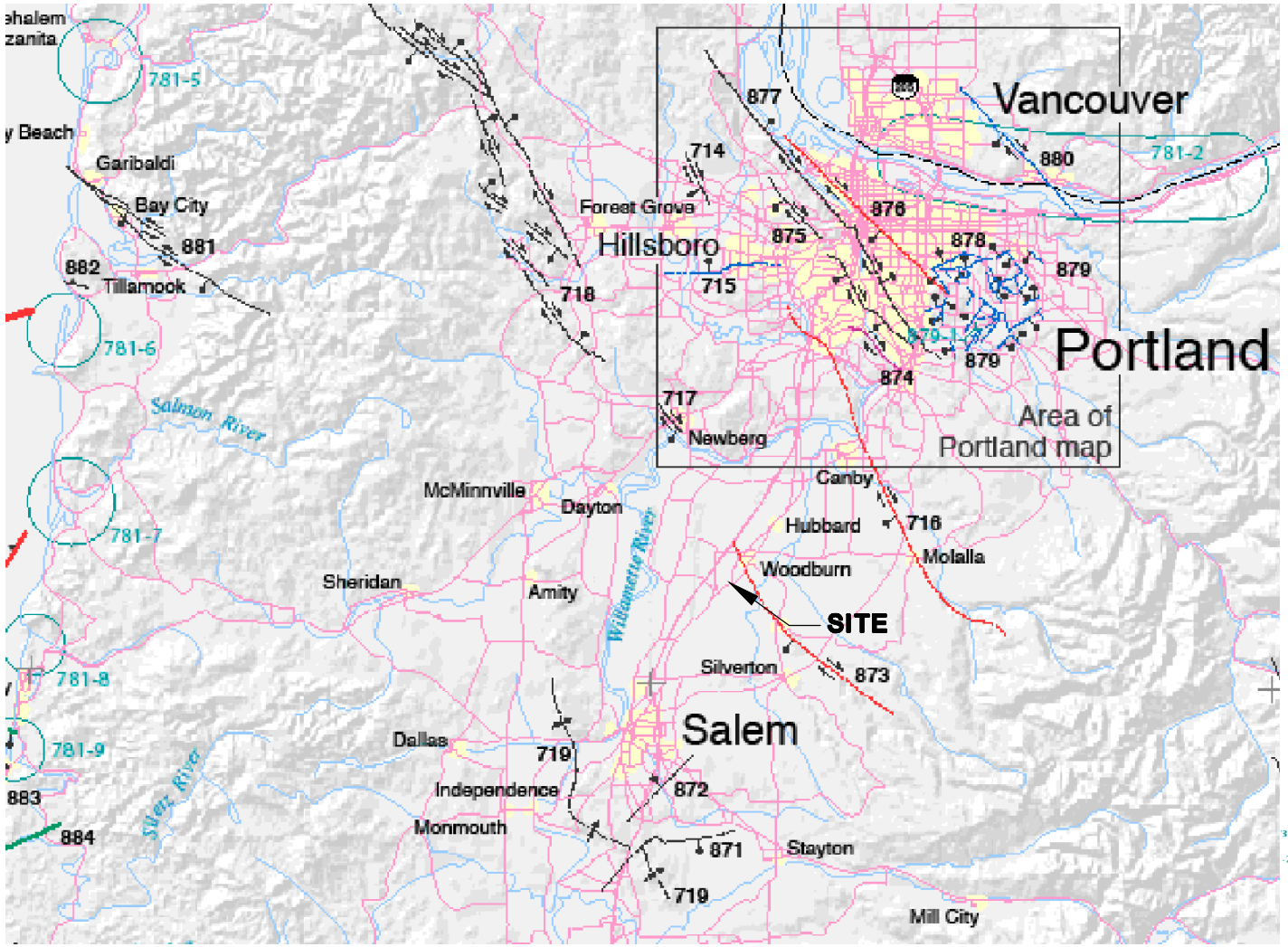

NOT TO SCALE

LEGEND

TIME OF MOST RECENT SURFACE RUPTURE
- Holocene (<10,000 years) or post last glaciation (<15,000 years; 15 ka); no historic ruptures in Oregon to date
- Late Quaternary (<130,000; post penultimate glaciation)
- Late and middle Quaternary (<750,000 years; 750 ka)
- Quaternary, undifferentiated (<1,600,000 years; <1.6 Ma)
- Class B structure (age or origin uncertain)

SLIP RATE
- >5 mm/year
- 1.0-5.0 mm/year
- 0.2-1.0 mm/year
- <0.2 mm/year

TRACE
- Mostly continuous at map scale
- Mostly discontinuous at map scale
- Inferred or concealed

STRUCTURE TYPE AND RELATED FEATURES
- Normal or high-angle reverse fault
- Strike-slip fault
- Thrust fault
- Anticlinal fold
- Synclinal fold
- Monoclinal fold
- Plunge direction of fold
- Fault section marker

DETAILED STUDY SITES
- Trench site
- Subduction zone study site

CULTURAL AND GEOGRAPHIC FEATURES
- Divided highway
- Primary or secondary road
- Permanent river or stream
- Intermittent river or stream
- Permanent or intermittent lake

NOTES:

1. PORTION OF MAP BASED ON MAP OF QUATERNARY FAULTS AND FOLDS IN OREGON (PERSONIUS ET AL., 2003).
2. SEE SITE SPECIFIC HAZARD STUDY FOR A DISCUSSION OF LOCAL FAULTING.
3. FAULTS: #714= HELVETIA; #715= BEAVERTON; #716= CANBY–MOLALLA; #717= NEWBERG; #718= GALES CREEK; #869= CORVALLIS; #870= OWL CREEK; #871= MILL CREEK; #872= WALDO HILLS; #873= MOUNT ANGEL; #874= BOLTON; #875= OATFIELD; #876= EAST BANK; #877= PORTLAND HILLS; #878= GRANT BUTTE; AND #879= DAMASCUS–TICKLE CREEK.

FOUNDATION ENGINEERING INC.
PROFESSIONAL GEOTECHNICAL SERVICES
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CORVALLIS, OR 97330-4517
BUS. (541) 757-7645 FAX (541) 757-7650

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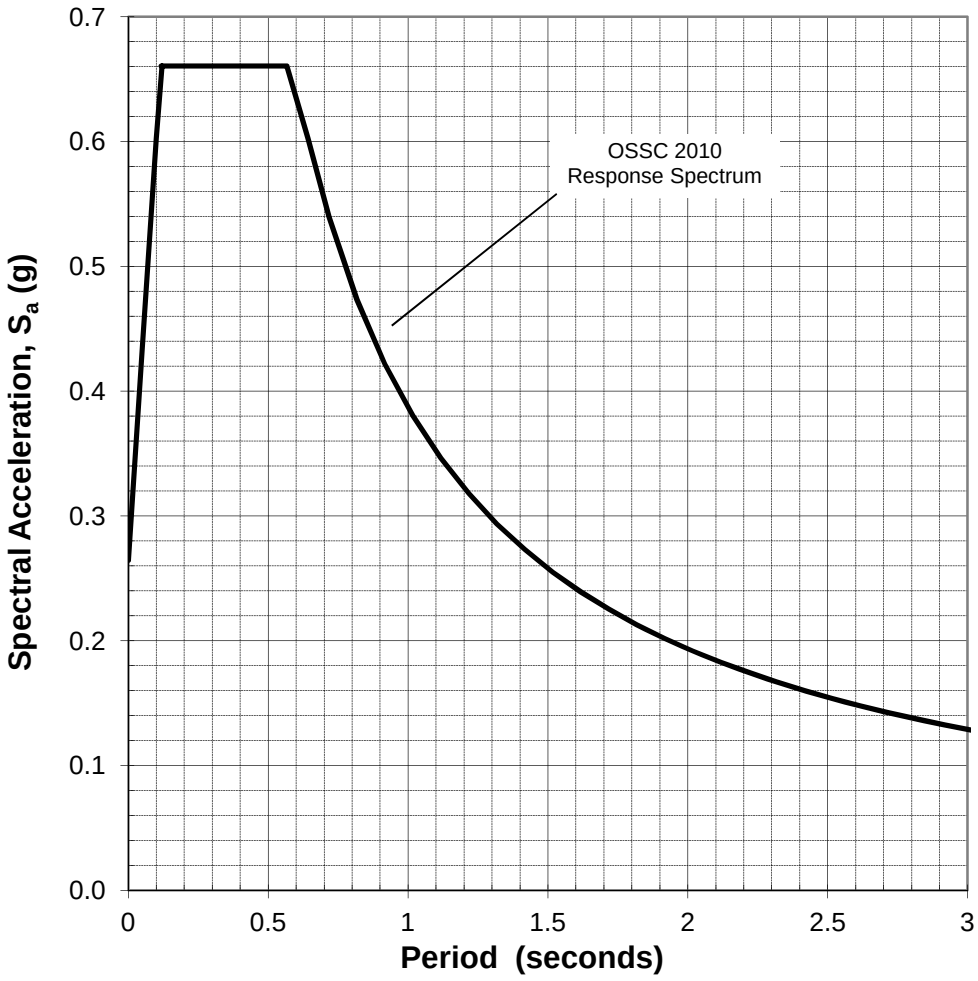
APPR.
REVIS.
PROJECT NO.
2132005

QUATERNARY CRUSTAL FAULT MAP
NORTHERN WILLAMETTE VALLEY
GERVAIS WATER IMPS/WATER TANK RELOCATION
GERVAIS, OREGON

FIGURE NO.
1D

FILE NAME:FIGURE 1C



Notes:

1. The Design Response Spectrum is based on OSSC 2010 Section 1613 using the following parameters:

   Site Class= D Damping = 5%

S_S =	0.86	F_a =	1.16	S_{MS} =	0.99	S_{DS} =	0.66
S_1 =	0.33	F_v =	1.74	S_{M1} =	0.58	S_{D1} =	0.39

2. S_S and S_1 values for 5% damping are based on the USGS 2002 mapped maximum considered earthquake spectral acclerations for 2% probability of exceedence in 50 years. The corresponding peak ground acceleration on rock is 0.36g.

3. F_a and F_v were established based on OSSC, Tables 1613.5.3(1) and 1613.5.3(2) using the selected S_S and S_1 values. S_{DS} and S_{D1} values include a 2/3 reduction on S_{MS} and S_{M1} as discussed in OSSC 2010 Section 1613.5.4.

4. Site location is: Latitude 45.106, Longitude -122.895.

FIGURE 3A
OSSC 2010 SITE RESPONSE SPECTRUM
Gervais Water Improvements/Tank Relocation
Gervais, Oregon
FEI Project 2132005