CANBY UTILITY
REGULAR BOARD MEETING
SEPTEMBER 26, 2023
7:00 P.M.

AGENDA

I. CALL TO ORDER

II. AGENDA
- Additions, Deletions or Corrections to the Meeting Agenda

III. CONSENT AGENDA
- Approval of Agenda

IV. CITIZEN INPUT ON NON-AGENDA ITEMS *Citizen's wanting to speak virtually, please email or call the Board Secretary-Clerk by 4:30 p.m. on September 26, 2023 with your name, the topic you would like to speak on, and contact information: bbenson@canbyutility.org or 503-263-4312.*

V. RESOLUTION NO. 314 Adopting New Water System Master Plan – Carol Sullivan, General Manager; and Brian Ginter and Libby Barg Bakke of Consor (pp. 1- 86)

VI. BOARD REPORT
- Chair Comments
- Board Member Comments

VII. ADJOURN

CANBY UTILITY

MEMORANDUM
September 21, 2023

TO: Chair Thompson; Members Horrax, Molamphy, and Pendleton

FROM: Carol Sullivan, General Manager

SUBJECT: Canby Utility's Water Master Plan

Suggested Motion: I move to adopt Resolution Number 314, adopting the draft Water Master Plan.

Discussion: Brian Ginter and Libby Barg Bakke of Consor consulting engineers will present a draft Water Master Plan (WMP) for review and approval. The key product of the WMP is the Capital Improvement Plan (CIP). The CIP is the twenty-year roadmap for water system capital replacement and additions.

I have included a copy of the PowerPoint presentation that provides an overview of the master planning process. The CIP anticipates approximately $135 million dollars of capital expenditures over the next twenty years. The most significant capital expenditures are expected to occur over the next five to ten years with the development of a secondary drinking water source and new treatment plant that is critical to meet Canby's long term growth expectations. In addition to the new treatment plant, the WMP also addressed system goals, future demand estimates, engineering evaluation, evaluations of options to meet future demands, financing, projects, and a seismic risk assessment and mitigation plan. See WMP Table 8-1 for the Capital Improvement Program Summary that Consor identified as recommended CIP projects.

The draft WMP was submitted to the Oregon Health Authority for review in August, and all the elements required in Oregon Administrative Rules 333-061-0060(5) have been addressed.

We will answer any questions the Board may have.

CANBY UTILITY

September 26, 2023

consor

Water Master Plan

Presented by:
Brian Ginter, P.E.
Libby Barg Bakke

Agenda

01 History of Canby Utility's Water Supply Planning

02 Water System Recommendations

03 Capital Improvements

04 Water Supply Alternative Analysis

05 Willamette Water Supply & Treatment Plant

06 Q&A

Planning For a Reliable Water Future

1990
Application for Willamette River Water Right (12.4 cfs)

2010
Water Master Plan Update

2011
Water Right Permit Issued

2013
Water Supply Analysis

2018
Exploration of Regional Partnership Opportunities

2021
Water Management and Conservation Plan

2023
Water Master Plan Update

2026
WMCP Progress Report Due

2030-2035
New Supply Source Needed

The Water Master Plan Provides the Information Needed to Make Recommendations

- Planning resource for staff and Board
- Document system components
- Outline plan for system improvements
- Understand financial impact of Capital Improvement Program
- Meet regulatory requirements

Canby Utility's Water System Recommendations

Storage Recommendations

- Complete a water storage study
- Build future storage (gravity versus pumped)
- Abandon 4th and Fir Site (reservoir and pump station)

Pumping Capacity

- Installation of an additional pump at 13th Avenue

Canby Utility's Water System Recommendations

Transmission & Distribution System

- Upgrade system backbone (Area J and future supply)
- Annual pipe rehabilitation/ replacement program

Fire Flow Needs

- Long-term minor local deficiencies improvements
- Immediate-term S Manzanita Ct Project 6" replacement

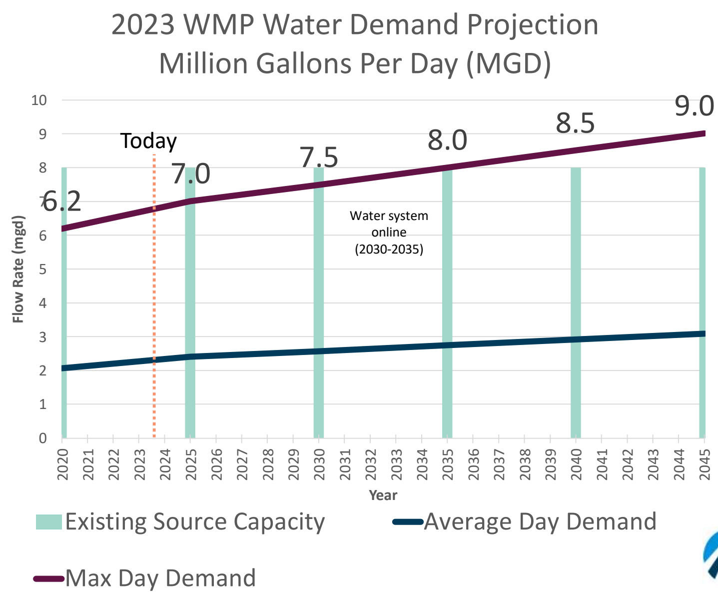
Service Pressure Limits

- No deficiencies

Canby Utility's Water System Recommendations

Source Water

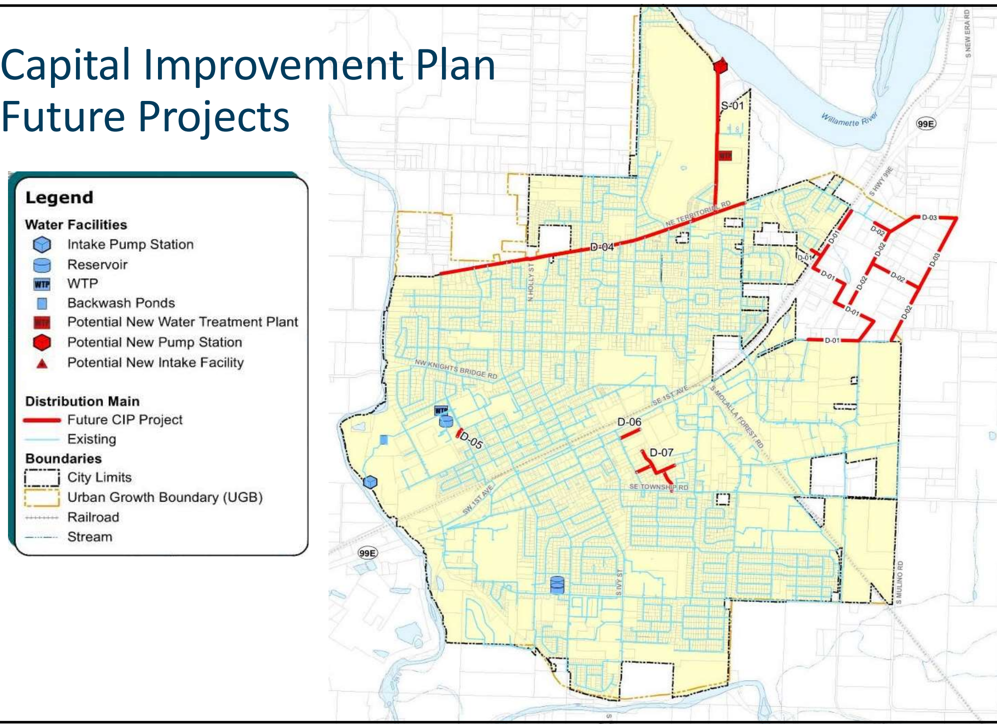
- Existing source capacity is 8 mgd
- Capacity projected to be exceeded around 2035
- Limited opportunity for expansion of Molalla River supply



Water Supply Analysis Update

- **A new water source is needed in less than 10 years** to meet the community's water needs.
- There are **limited opportunities for water supply partnerships** with neighboring communities.
- Expansion of **Molalla River supply lacks reliable capacity and has increasing water quality issues**.
- **Proceed with developing the Willamette River source** near the water right "point of diversion."
- **8 million gallons a day** of expanded supply needed for long-term needs and reliability.

Capital Improvement Plan
Future Projects



Capital Improvement Plan
Early Planning Level Estimated Costs

Category	0-5 Year Project Costs	6-10 Year Project Costs	11+ Year Project Costs
Existing Source and Treatment **New Source and Treatment***	 $82M		$5.5M
Storage Reservoir and Pump Station	$9.5M		
Distribution System Improvements **Annual Replacement / Rehabilitation**	$1.5M $3M	$11M $3M	$11M $6M
Pumping Capacity Improvements	$250K		
Other • Planning Studies • Operational	 $250K $25K	 $200K $700K	
TOTAL	**$97M**	**$15M**	**$23M**
TOTAL 20-year CIP			**$135M**

*2023 dollars

Water Supply Analysis Considered Three Alternatives

A. Clackamas River – South Fork Water Board

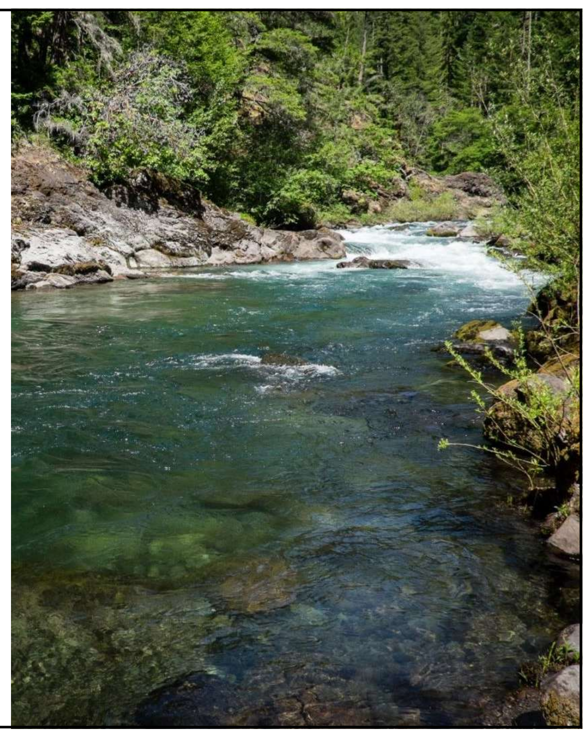
B. Willamette River – City of Wilsonville

C. Willamette River near Canby and new treatment plant

- ✓ Available and reliable supply
- ✓ Ownership
- ✓ Short pipeline routing
- ✓ Property and permit requirements achievable
- ✓ Lower costs
- ✓ Can be developed in needed timeframe

The Willamette River Originates in the Mountains South of Eugene

- Largest river in the United States that **flows south to north**
- 187 miles long, **flowing entirely in Oregon**
- **13 dams store water** for flood protection and summer flows
- **Water source for Oregon communities:** Springfield, Corvallis, Wilsonville, Sherwood and soon Hillsboro, Beaverton and Tualatin Valley Water District



Wilsonville's Willamette Water Treatment Plant

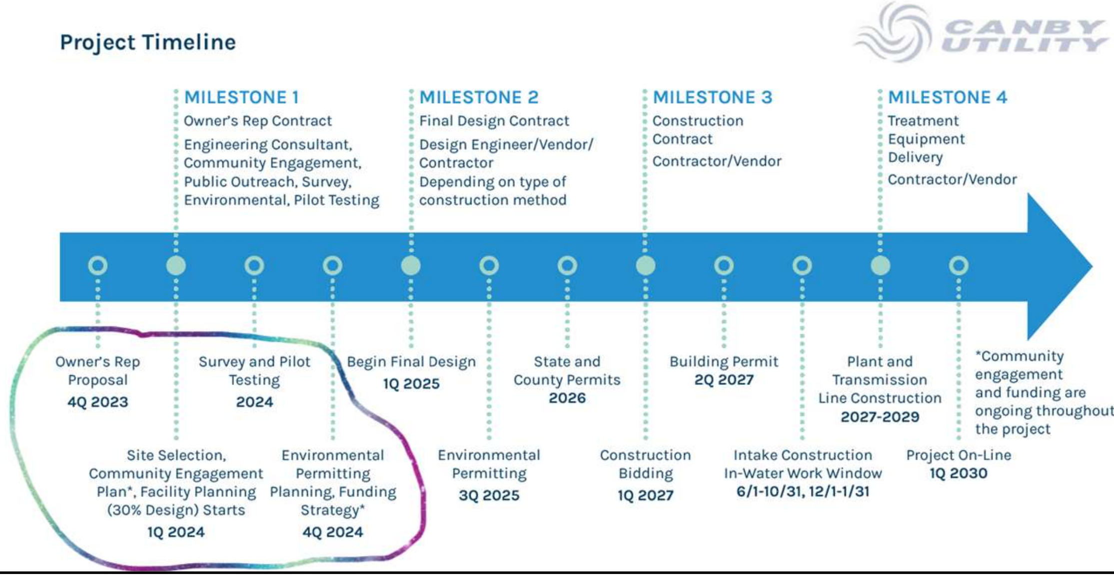
Wilsonville's state-of-the-art plant has been operating since 2002 and has met, or is better than, every safe drinking water standard.

Key Treatment Steps Provide Multi-barrier Protection

1 → 2 → 3 → 4 → 5 → 6 → 7

	1 Intake Screens	2 Enhanced Clarification	3 Ozonation	4 Granular Activated Carbon Filter Layer	5 Sand Filter Layer	6 Ultraviolet Disinfection	7 Chlorination
Turbidity, Silt and Particles		✓			✓		
Pathogens		✓	✓		✓	✓	✓
Dissolved Metals		✓	✓				
Organics		✓	✓	✓			
Tastes & Odors			✓	✓			
Algae		✓	✓	✓	✓		
Algal Toxins		✓	✓	✓			✓
Contaminants of Emerging Concerns		✓	✓	✓			✓

Know Where You Are Going: Set the Foundation for Success



Upfront Research & Strategy Reduces Future Risk

- Site selection
- Water rights
- Survey and pilot testing
- Community engagement plan
- Environmental permitting and land use planning
- Funding strategy
- Facility planning (30% design)

Get your ducks in a row.

Why Have a Communications Strategy?

- Canby's Willamette River supply is a legacy investment—vital to the long-term livability of the community
- There are inherent challenges: high stakes, time pressure, multiple stakeholders, large investment…
- Communications helps manage the challenges

Building Community Support for Projects

- Do the research to understand stakeholder perspectives and interests
- Develop a strategic communications plan that guides the effort
- Keep policymakers informed and prepared
- Seek to maximize partnerships and stakeholder benefits
- Tell your story and include the media
- Say it again (and again)

Board Q&A

RESOLUTION NO. 314

A RESOLUTION OF THE CANBY UTILITY BOARD ADOPTING THE WATER MASTER PLAN.

WHEREAS, Oregon Administrative Rules Chapter 333, Division 61 mandates that the Canby Utility Board prepare a Water Master Plan for approval of the Oregon Health Authority; and

WHEREAS, a Water Master Plan has been prepared by Consor, Canby Utility Board's consulting engineers, which plan has been reviewed and adopted by the Board of Directors.

WHEREAS, the Water Master Plan was submitted to the Oregon Health Authority for review in August, and all the elements required in Oregon Administrative Rules 333-061-0060(5) have been addressed.

NOW THEREFORE, be it Resolved by the Canby Utility Board that the Water Master Plan dated August 2023, which plan is attached hereto as Exhibit A and incorporated herein by reference is hereby adopted by the Canby Utility Board.

BE IT FURTHER RESOLVED that Resolution No. 235 is repealed.

THIS RESOLUTION ADOPTED BY THE CANBY UTILITY BOARD THIS 26th DAY OF SEPTEMBER 2023.

____________________________	____________________________
Melody Thompson, Chair	David Horrax, Member
____________________________	____________________________
John Molamphy, Member	Jack Pendleton, Member
____________________________	____________________________
Vacant	Barbara Benson, Board Secretary

FINAL DRAFT

CANBY UTILITY

Water Master Plan

August 2023

PREPARED BY:
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Water Master Plan

Canby Utility

August 2023

Consor

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Acronyms & Abbreviations

A	
AACE	Association for the Advancement of Cost Engineering
ADD	Average Day Demand
AID	Annual Average Inside Demand
ALA	American Lifelines Alliance
AO	Advanced oxidation
ASCE	American Society of Cibil Engineers
ASR	Aquifer Storage and Recovery
AWIA	American Water Infrastructure Act
AWWA	American Water Works Association
C	
CCI	Construction Cost Index
cfs	Cubic feet per second
CIP	Capital Improvement Program
City	City of Canby
CSZ	Cascadia Subduction Zone
CT	Contact time
D	
DOGAMI	Oregon Department of Geology and Mineral Industries
DUE	Dwelling Unit Equivalent
E	
EBCT	Empty bed contact time
ENR	Engineering News Record
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
F	
FEMA	Federal Emergency Management Agency
G	
GAC	Granular activated carbon
GIS	Geographical Information System
gpcd	Gallons per capita per day
gpd	Gallons per day
gph	Gallons per hour
gpm	Gallons per minute
H	
hp	Horsepower
I	
ID	Inside diameter
ISO	Insurance Services Office, Inc.
L	
LF	Linear feet

M	
MDD	Maximum Day Demand
MG	Million gallons
mgd	Million gallons per day
MIB	Methylisoborneal
MRI	Main River Intake
N	
NTU	Nephelometric Turbidity Units
O	
OAR	Oregon Administrative Rules
OFC	Oregon Fire Code
ORI	Old River Intake
ORP	Oregon Resilience Plan
OWRD	Oregon Water Resources Department
P	
PAC	Powdered activated carbon
PGD	Permanent ground deformation
PGV	Peak ground velocity
PHD	Peak Hour Demand
PMD	Peak Month Demand
POD	Point of diversion
ppt	Parts per trillion
PRC	Portland State University Population Research Center
PRV	Pressure reducing valves
PSD	Peak Season Demand
PSI	Pounds per square inch
R	
RIG	River Infiltration Gallery
RR	Rate of repair
RRA	Risk and Resilience Assessment
S	
SDC	System Development Charge
T	
T&O	Tastes and odors
U	
UGB	Urban Growth Boundary
UV	Ultraviolet
V	
VFD	Variable frequency drive
W	
WMCP	Water Management and Conservation Plan
WMP	Water Master Plan
WRWTP	Willamette River Water Treatment Plant

CHAPTER 1

Introduction

1.1 Purpose

The purpose of the Water Master Plan (WMP) is to perform an analysis of Canby Utility's water system and:

- Document the water system upgrades completed since the 2010 *Water Master Plan*,
- Estimate future water requirements including potential water system expansion areas,
- Summarize and document Canby Utility's long-term water supply strategy,
- Identify deficiencies and recommend water facility improvements that correct deficiencies and provide for growth including a preliminary evaluation of the water system's seismic resilience,
- Recommend an updated water system capital improvement program (CIP) for the water system.

This report is divided into eight chapters to address the goals described above. **Chapter 2**, **Chapter 3**, and **Chapter 4** summarize the existing system and water demands, estimate future water demands, and list the performance criteria used to analyze the system. **Chapter 5**, **Chapter 6**, and **Chapter 7** utilize the prior chapters to identify system deficiencies, evaluate Canby Utility's water supply and treatment facilities, and provide a more detailed seismic resilience analysis. **Chapter 8** summarizes improvement projects to mitigate existing and projected system deficiencies and vulnerabilities into a CIP. The planning and analysis efforts presented in this WMP are intended to provide Canby Utility with the information needed to inform long-term water supply and distribution infrastructure decisions.

Canby Utility staff provided water system documentation, including geographical information system (GIS) data and the existing water system WaterCAD 5.0 hydraulic model.

1.2 Compliance

This plan complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61.

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CHAPTER 2

Existing Water System

2.1 General

This chapter describes and inventories Canby Utility's water service area and water supply and distribution system facilities. Included in this chapter is a discussion of existing supply and transmission facilities, pressure zones, storage and pumping facilities, distribution system piping, and treatment facilities.

2.2 Background and Study Area

Incorporated in 1893, the City of Canby (City) is in the Willamette Valley just southeast of the confluence of the Molalla River and Willamette River in Clackamas County. The City has an estimated population of 18,754 as of 2021, according to the Portland State University Population Research Center (PRC), which creates current and historical population estimates for the State of Oregon (Population Research Center Homepage). The Urban Growth Boundary (UGB) area of the City of Canby is 3,476 acres (Urban Growth Boundary Map, Oregon.gov). The study area of this master plan is entirely within the UGB. Water service is provided for residential, commercial, and industrial uses.

A 1970 City Charter Revision created the Canby Utility Board to provide electrical and water service to the City customers. In 1982, a Charter Amendment returned ownership of the water assets to the City and the Canby Utility Board continued to operate the water system. In 1993, an Intergovernmental Agreement between the City and the Canby Utility Board renewed the relationship. In 1999, the Canby Utility Board changed its name to Canby Utility.

Figure 2-1 illustrates Canby Utility's water service area limits, water system facilities and distribution system piping.

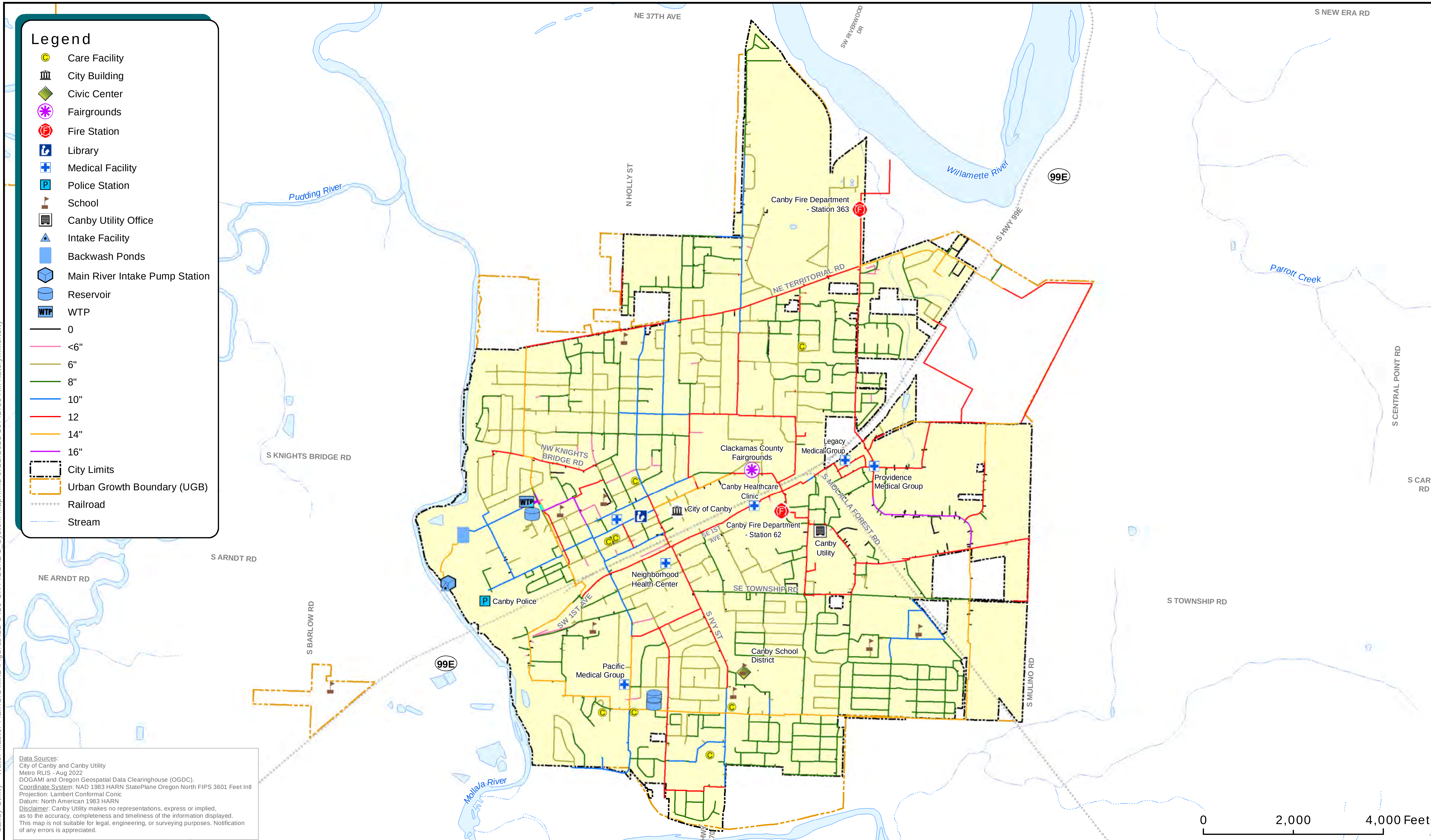
2.3 Supply Sources

2.3.1 Surface Water Sources

Canby Utility's primary source of water is the Molalla River. Surface water intakes on the Molalla River, summarized in **Table 2-1**, include the River Infiltration Gallery (RIG), the Main River Intake (MRI) and Old River Intake (ORI).

Constructed in the early 1970s, the ORI consisted of an intake structure that supplied Molalla River water to the treatment plant. It is currently not in use due to intake capacity limitations at low river levels.

The RIG was constructed in 1980 and consists of an in-water infiltration gallery, wet well, and raw water pumps. The gallery consists of wedge wire collector pipes located approximately eight to ten feet below the riverbed which connect to a common header. The wet well is 15 feet inside diameter and 44.5 feet in depth. This gravel infiltration gallery requires periodic backwashing with raw water from the MRI.



G:\PDX_Projects\22\3420 - Canby Utility - Water Master Plan\GIS\MXD\Figures\22-3420-OR-FIGURE 1_System Map.mxd 6/22/2023 10:42:35 AM Katelyn.McNulty

N W E S

Canby Utility
Water Master Plan

Figure 2-1
Existing System Map

June 2023

Reference Scale: 1:24,000

22-3420

The MRI was constructed in 1997 and consists of a screened intake structure that supplies water to the River Intake Pump Station wet well. The River Intake Pump Station serves both the RIG and MRI and houses two 100 horsepower (hp) pumps and one 150 hp vertical turbine pump extending into the wet well. Raw water can be supplied from a combination of the RIG and MRI. High turbidity levels in the Molalla River source water can result in temporary reduction of the intake's 5,500 gallons per minute (gpm) production capacity. During high turbidity events in the Molalla River, the RIG is the alternate supply source as it serves to minimize influent turbidity levels.

Table 2-1 | Molalla River Intake Water Facilities Summary

Source	Intake Capacity (gpm)	Pumps	Notes
River Infiltration Gallery (RIG)	4,800	2 x 100 hp (2,500 gpm each) 1 x 150 hp (4,500 gpm)	The River Intake Pump Station serves both RIG & MRI.
Main River Intake (MRI)	5,500		
Old River Intake (ORI)[1]	900 – 1,000	1 pump	Capacity limited by low river levels.

Note:

1. Intake capacity for this source is the available capacity, but this capacity is not currently used.

2.3.2 Groundwater Sources

Canby Utility holds water rights for three groundwater sources located along the banks of the Molalla River. Groundwater facilities, as summarized in **Table 2-2**, include the Springs Gallery, the Collection Boxes, and Well No. 10.

Table 2-2 | Groundwater Intake Facilities Summary

Source	Intake Capacity (gpm)	Notes
Springs Gallery	1,000	Low pH and moderate nitrate levels. Used to supplement RIG & MRI.
Collection Boxes	202	Not in use due to high nitrate levels.
Well No. 10	250	Not in use due to water quality issues. High sulfur and hardness.

Around 1934, concrete collection boxes were installed at the base of the ridge near the location of the current Main River Intake. These structures collected water year-round from springs and directed it into a cistern. The cistern previously discharged into the Springs Gallery. Due to water quality constraints, this source has not been used since the 1990s.

In 1944, the City began construction of a concrete collection gallery near the Molalla River known as the Springs Gallery. The gallery is approximately 20 feet in diameter and 28.5 feet deep. By 1951, a new 30-inch diameter, 300-foot long perforated, corrugated metal collection pipe was connected to the existing gallery. The current capacity of the 25 hp pump at the Springs Gallery is approximately 1,000 gpm. Low pH and moderate nitrate concentrations limit the use of the Spring Gallery as a primary source. This source is used to blend with Molalla River water during high turbidity events in the river to reduce treatment plant influent turbidities.

Well No. 10 located near the Springs Gallery has a single 250 gpm pump which discharges into the Springs Gallery. The groundwater from this well is high in sulfur and hardness, therefore the well is not currently used.

2.4 Water Rights Summary

No new water rights were analyzed during this Water Master Plan Update. Canby Utility's water rights were studied and detailed in the Utility's Water Management and Conservation Plan (WMCP) by GSI Water Solutions in 2021. This section provides a summary of Canby Utility's water rights as described in the Utility's current WMCP.

Table 2-3 summarizes the groundwater and surface water rights that Canby Utility holds, which includes four certificates, two permits, and one groundwater registration.

2.4.1 Surface Water Rights

Canby Utility has two surface water rights for use of the Molalla River. Certificate 86087 authorizes the use of up to 10.0 cubic feet per second (cfs) from the river for municipal use. This certificate authorizes diversion at the two locations: the Original River Intake and the New River Intake (the authorized points of diversion for the New River Intake are the RIG and MRI). Canby Utility does not currently use its Original River Intake as a point of diversion to meet system demand.

Canby Utility's Permit S-46199 authorizes the use of up to 10.0 cfs from the Molalla River for municipal use, however, the final order issued by the Oregon Water Resources Department (OWRD) on November 17, 2004, approving the extension of time to develop this permit currently limits diversion to 7.46 cfs. Canby Utility would need to seek access to the remaining 2.54 cfs under the permit through a request in a future WMCP. This permit has a completion date of October 1, 2040. The permit authorizes diversion from the RIG and MRI. Canby Utility is unable to treat this additional undeveloped capacity due to infrastructure limitations, including the capacity of the Water Treatment Plant, and while development of this additional capacity is feasible, low Molalla River flows in the summer limit the available diversion capacity during the times when additional supply could be put to beneficial use.

Certificates 10771 and 10776 authorize the use of water from springs for municipal and domestic use. Certificate 10771 authorizes the use of up to 0.25 cfs and Certificate 10776 authorizes 0.20 cfs. These rights are currently held in reserve due to water quality concerns.

Permit S-54691 authorizes the use of up to 12.4 cfs from the Willamette River for municipal use. This permit has a completion date of January 6, 2031. Canby Utility does not currently use this right but intends to develop the right prior to the completion date and rely on this right as its primary source of supply.

2.4.2 Groundwater Rights

Canby Utility's groundwater registration GR-294 claims the use of 1.78 cfs from the Springs Gallery, 0.45 cfs from Well 2, and 0.50 cfs from Well 3, though Wells 2 and 3 are not currently in use. This registration is used to supplement the Utility's surface water supplies during high turbidity events. Certificate 44140 authorizes the use of up to 1.5 cfs from the same Springs Gallery for municipal use and is also used to supplement surface water supplies.

Certificate 82570 authorizes the use of up to 0.61 cfs from Well 10 for municipal use; Canby Utility does not currently rely on this right to meet system demands due to low flow rates and water quality concerns.

Not included in the water rights discussion and **Table 2-3** is Certificate 30341, a groundwater right issued to John W. Beck authorizing municipal use for the City of Canby. The City no longer receives water under this right and the well is not connected to the Canby Utility distribution system.

Table 2-3 | Water Rights Summary

Source	Application or Claim	Permit	Certificate or Registration	Priority Date	Completion Date	Production Capacity, cfs (gpm)	Notes
Molalla River (ORI, RIG, & MRI)	S-47326	S-35453[1]	86087	7/31/1970 12/22/1970	--	5.0 (2,244) 5.0 (2,244)	10.0 cfs total. (Max 10.0 cfs from RIG & MRI, max 3.12 cfs from ORI)
Molalla River (RIG & MRI RIG & New River Intake)[2]	S-60921	S-46199	--	10/20/1980	10/1/2040	10.0 (4,488)	Authorized diversion currently limited to 7.46 cfs
Willamette River	S-71072	S-54691	--	12/27/1990	1/6/2031	12.4 (5,565)	Intend to develop right
Springs/Collector Boxes	S-15085 S-15264	S-11011 S-11197	10771 10776	8/16/1933 2/10/1934	--	0.25 (112) 0.20 (90)	Held in reserve[3]
Well No. 10	G-7542	G-7013	82570	10/11/1976	--	0.61 (273)	Held in reserve[3]
Springs Gallery	G-5018	G-4784	44140	10/16/1969	--	1.5 (673)	Used if river turbidity high
Springs Gallery	GR-294	--	--	12/31/1944	--	1.78 (800)	Used if river turbidity high
Flowing Well 2				12/31/1938		0.45 (202)	Not in use
Pump Well 3				12/31/1927		0.50 (225)	Not in use
					Total	**37.7 (16,920)**	

Notes:

1. Transferred (T7629, 11/19/1996 and 5/1/1997)
2. The authorized point of diversion for the New River Intake is the RIG and MRI
3. Sources held in reserve are used sparingly, if at all, due to water quality issues

2.5 Water Treatment Facilities

2.5.1 General

Canby Utility's Molalla water treatment plant, located at 591 N Cedar Street, was constructed in 1971. Subsequent incremental expansions of the water treatment plant in 1982, 1996, and 2006 have improved the facilities to the current nominal capacity of 8 million gallons per day (mgd). **Figure 2-2** presents a diagram of the water treatment process and instrumentation.

The Canby Utility water treatment facilities consist of the following components.

- Water intake facilities and pumps, as described above in **Section 2.3**, Supply Sources.
- Pre-treatment injection facilities
- A sedimentation basin
- Four direct filter units with a 1 mgd capacity each
- Four modular upflow clarifier/filter units with a 1 mgd capacity each
- UV disinfection facilities
- A 2.4 MG steel storage reservoir/clearwell
- Cedar Treatment Plant Pump station
- Post-treatment disinfection and pH adjustment chemical injection facilities
- Three backwash ponds

The eight treatment units, treatment aid chemicals (coagulants and polymers) and disinfectant facilities are housed in adjoined buildings that make up the water treatment facilities. Raw water from the River Intake Pump Station is split into two process trains. Train No. 1 includes coagulant dosing, static mixing, limited hydraulic flocculation and sedimentation, and filtration through filter units 1-4. Train No. 2 includes coagulant dosing, static mixing and treatment in modular treatment units using upflow clarification and media filtration through filter units 5-8. The filter water from both trains is combined prior to disinfection with ultraviolet (UV) light, addition of sodium hypochlorite for chlorine residual, and pH adjustment with sodium hydroxide. Water then flows through a baffled, partially buried welded steel clearwell. A booster pump station pumps water from the clearwell to the distribution system and other storage reservoirs. The clearwell and booster pump station are further described later in this section.

2.5.2 Treatment Plant Filter Backwash

Backwash is supplied from the clearwell to the filters. The filters are also configured to allow for filter-to-waste capability for filter startup procedures. Upflow rinse is supplied from raw water. Sedimentation basin blowdown is drained manually to the backwash ponds.

Three backwash ponds were installed in 2007 near the Springs Gallery. These gravel bottom ponds drain primarily through infiltration.

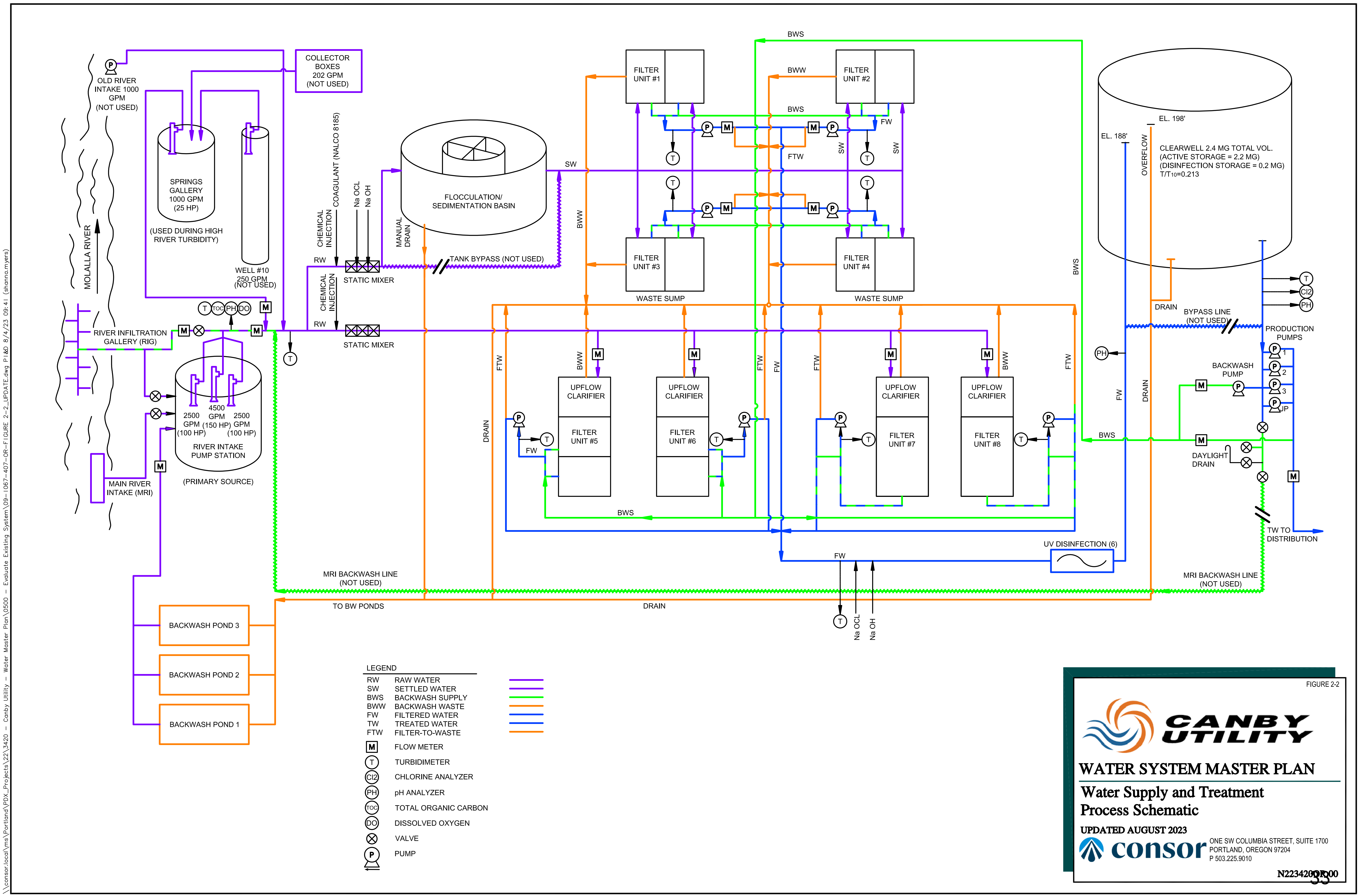


FIGURE 2-2

CANBY UTILITY

WATER SYSTEM MASTER PLAN

Water Supply and Treatment Process Schematic

UPDATED AUGUST 2023

consor
ONE SW COLUMBIA STREET, SUITE 1700
PORTLAND, OREGON 97204
P 503.225.9010

N2234200.00

2.5.3 Process Instrumentation and Controls

Flow for the main river intake and Springs Gallery is metered at the top of the bluff, or "blending vaults", where the pipes for these two supplies combine. Flow is also metered for the treated water effluent for filter units 1-4, the raw water influent for each clarifier (treatment units 5-8), the backwash pump, and downstream of the production pumps. Coagulant doses are monitored and can be controlled manually or automatically based on readings from a streaming current meter. Turbidity meters monitor raw water, each filter effluent, and the combined filter effluent. Chlorine residual and pH are monitored before the water enters the clearwell. Treated water entering the distribution system is also monitored for residual chlorine concentration, pH levels, and flow. Flow in and out of the 13th Avenue reservoirs is also monitored as well as chlorine residual.

2.5.4 Standby Power

Canby Utility has backup generators on site at the intake facilities, the treatment facilities, and the 13th Avenue pump station as well as at their combined service center and a mobile generator held in reserve. See **Table 2-4** for a summary of Canby Utility's back-up generators. The amount of backup power available to Canby Utility allows for operation of the treatment plant at approximately 4,400 gpm (6.3 mgd) as well as pumping from the 13th Ave reservoirs during a power outage.

Table 2-4 | Back-up Generator Summary

Location	Size (kW)	Fuel Capacity (gal)	Notes
River Intake Facility	350	400	
Water Treatment Facility	500	450	Springs Gallery back-up power comes from Water Treatment Facility, not River Intake Facility.
13th Avenue Pump Station	300	660	
Combined Service Center (2)	125 kW / 30 kW	Natural Gas / Diesel	Runs administrative building and operations center, does not directly impact system capacity.
Mobile Reserve Generator	100 kW	155	For use in case of generator failure.

Veolia recently added the ability to carry fuel to the Canby Utility intake facility via a fuel tank attached to a Veolia truck. This was added due to the inability of fuel trucks to reach the intake facility in the icy conditions experienced in 2021.

2.6 Storage Reservoirs

2.6.1 General

Storage in the Canby Utility water system is provided by three ground level finished drinking water storage reservoirs with a total usable capacity of 4.6 million gallons (MG). All of these reservoirs have overflow elevations below the static hydraulic grade of the Canby Utility distribution system and serve as suction supply for booster pump stations which supply water to the distribution system at required service pressures. **Table 2-5** presents a summary of Canby Utility's storage facilities. The 4th Avenue Reservoir is not shown as it is no longer in service. A brief description of each reservoir follows.

Table 2-5 | Reservoir Summary

Reservoir Name	General Location	Nominal Capacity (MG)	Usable Capacity (MG)	Overflow Elevation (feet)	Year Built	Retrofit
Clearwell	Treatment Plant	2.4	1.2	198	1972	N/A
13th Avenue Reservoir A	Southwest 13th Avenue	2.0	1.6	192	1983	2012
13th Avenue Reservoir B	Southwest 13th Avenue	2.0	1.6	192	2009	N/A

2.6.2 Water Treatment Plant Clearwell

A 2.4 MG welded steel reservoir was constructed with the treatment plant in 1971 for use as a clearwell for chlorine contact time (CT) and storage for filter backwash. Despite the addition of UV disinfection as the primary disinfectant, the clearwell volume is still used to achieve chlorine disinfectant CT for virus inactivation. The reservoir has a 50-foot water depth with a floor elevation located 10 feet below grade, and a diameter of 90 feet. The Cedar Treatment Plant Pump Station pump units are located at-grade requiring 10 feet of suction lift to use the full volume of the reservoir. It is understood that the bottom 10 feet of the clearwell is unusable storage due to suction head requirements of the pumps. It is also understood that the reservoir's operational elevation is constrained due to seismic considerations, resulting in an additional 700,000 gallons limitation of its usable capacity.

2.6.3 13th Avenue Reservoirs

In 1983, a 2.0 MG circular prestressed concrete reservoir was constructed on Southwest 13th Avenue. The reservoir has a 24-foot water depth, and 120 feet inside diameter (ID). The reservoir fills through a SCADA controlled valve and provides suction supply for an on-site pump station. This reservoir underwent structural upgrades in 2012, to address seismic concerns.

A new 2.0 MG fusion glass-lined bolted steel reservoir was constructed in 2009 immediately south of the existing reservoir and is similarly configured with a usable storage volume of 2.0 MG.

Both reservoirs were previously connected to the water system by a single pipe, requiring alternating fill and drain cycles, but in 2021 a second pipe was installed to allow for simultaneous fill and drain of the 13th Avenue reservoirs. During periods of low demand, the reservoirs undergo drawdown and refill cycles to ensure the water does not sit stagnant. The reservoir volume is turned over every four days to ensure water quality. Tank refill typically takes about one day. The two reservoirs may be operated individually, in parallel, or in series.

2.6.4 4th Avenue Reservoir – Not in Use

Constructed in 1963, the oldest of Canby Utility's reservoirs was the steel reservoir previously known as the "4th Street Tank" at the 4th and Fir site. The usable volume of this reservoir prior to discontinuing its use was 500,000 gallons. The reservoir is 40 feet high, with a 57-foot diameter. The 4th Avenue Reservoir was removed from service in August 2016 due to the tank's coal tar epoxy lining and the associated risks to water quality. The on-site booster pump station was previously operated to provide additional pressure and supply for Canby Utility's water system, but it is unusable and has been decommissioned now that the reservoir providing the necessary suction head for this pump station is offline.

While the property is not currently actively used by Canby Utility, there have been discussions regarding its potential future uses. The Utility should continue to evaluate the long-term value of this property.

2.7 Distribution System Pump Stations

2.7.1 General

In addition to the raw water intake pumps, Canby Utility operates two distribution system pump stations. A brief description of each station is presented below and **Table 2-6** presents a summary of existing pumping facilities.

Table 2-6 | Pump Station Summary

Pump Station[1]	Original Year Built	Unit	Pumps	Motor Horsepower	Nominal Capacity (gpm)
13th Avenue Pump Station	1983	1	Constant Speed	50	1,000
		2	Constant Speed	50	1,000
		3	Variable Speed	75	1,800
		4	Constant Speed	75	1,800
Cedar Treatment Plant Pump station	1972	1	Variable Speed	100	2,200
		2	Variable Speed	100	2,200
		3	Variable Speed	200	3,500
		4	Constant Speed	25	270

2.7.2 Cedar Treatment Plant Pump Station

The Cedar Treatment Plant Pump Station located at the water treatment plant houses four pumps that pump from the clearwell into the distribution system. The largest pump is a 200 hp split-case vertical pump with a nominal capacity of approximately 3,500 gpm at 70 pounds per square inch (psi). This pump must carefully be operated simultaneously with the other three pump units as they are not hydraulically compatible. The pump station also houses two 100-hp split case horizontal pumps with nominal capacities of approximately 2,200 gpm each. All three of these pumps are controlled by a variable frequency drive (VFD). The smallest pump is a 25-hp split case jockey pump with a nominal capacity of approximately 270 gpm. The firm capacity of the pump station is approximately 4,670 gpm, with a maximum flow of 6,111 gpm limited by the required disinfectant contact time established through a recent tracer test. The Cedar Treatment Plant Pump Station serves as the primary source of supply during normal operation and operates continuously to maintain pressure in the distribution system.

2.7.3 13th Avenue Pump Station

The pump station located at the 13th Avenue Reservoirs houses four pumps. The two 50-hp pumps have a nominal capacity of 1,000 gpm each and the two 75-hp pumps have a nominal capacity of approximately 1,800 gpm each. One of the two 75-hp pumps has a VFD. The pump station has a nominal firm capacity of approximately 5,600 gpm. There is an unused pump barrel, which can house another 1,800 gpm/75 hp pump.

2.7.4 4th Avenue Reservoir Pump Station – Not in Use

The pump station at the 4th Avenue Reservoir previously housed two 40-hp pumps with approximately 750 gpm nominal capacity each. This pump station is no longer in use, with the existing equipment abandoned in place.

2.8 Distribution System

The service area is comprised of a single pressure zone. Elevations served range from approximately 100 to 180 feet above mean sea level. The overflow elevation of the water treatment plant clearwell is approximately 198 feet. The system is served by the Cedar Treatment Plant Pump Station at the water treatment plant and the pump station at the 13th Avenue Reservoirs. While pressure ranges are based on pump characteristics and topography, the average system pressure is VFD controlled to approximately 70 psi. The single pressure zone is comprised of residential, commercial and industrial land uses.

The distribution system consists of approximately 87 miles of pipe ranging in diameter from 4 to 16-inch, with 6 and 8-inch diameter pipes being most numerous. In addition, there is approximately 15,000 feet of pipe less than 4 inches in diameter. Pipe material is largely cast/ductile iron, steel, and PVC with copper and asbestos concrete pipe being less common. The total length of pipe in the distribution system, categorized by diameter, is summarized in **Table 2-7**. Future line sizing will be as follows: 4-inch, 6-inch, 8-inch, 12-inch, 18-inch, and 24-inch.

Table 2-7 | Distribution System Pipe Summary

Pipe Diameter (inches)	Current Total (feet)	Current Total (miles)
4	7010	1.33
6	133347	25.26
8	165528	31.35
10	35672	6.76
12	63940	12.11
14	33073	6.27
16	5184	0.99
Less than 4 or unknown	15450	2.93
Total Length	**459206**	**86.98**

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CHAPTER 3

Water Requirements

3.1 General

This chapter presents population projections and water demand forecasts for the Canby Utility water service area. Population and water demand forecasts are developed from State, County, and City planning data, current land use designations, historical water demand records, and previous Canby Utility water system planning efforts. Also included in this section is a description of the water service area limits.

3.2 Service Area

The current water service area is the area within the existing City limits. Canby Utility's water system planning area includes all land within the current UGB and encompasses a total area of approximately 3,476 acres.

3.3 Planning Period

The planning period for this WMP is approximately 20 years, to the year 2045. Planning and facility sizing efforts will also use estimated water demands at saturation development, also referred to as "build-out". Build-out occurs when all existing developable land within the planning area has been developed to its ultimate capacity according to current land use and zoning designations. Transmission and distribution facility planning is based on build-out conditions for the Canby Utility water system planning area. This assumption allows for a determination of the ultimate size of facilities.

Typically, if substantial improvements are required beyond the planning period in order to accommodate water demands at saturation development, it is recommended to phase improvements for facilities where incremental expansion is feasible. Unless otherwise noted, recommended improvements identified in this plan are sized for 2045 development conditions within the water system planning area.

3.4 Historical Population

Historical population and other planning tools are used to derive population growth projections.

The PRC provided estimates of the City's historical annual population. Data from 2001 through 2022 is summarized in **Table 3-1**. Population growth trends over this period are illustrated in **Figure 3-1**.

Table 3-1 | Historical Population by Year

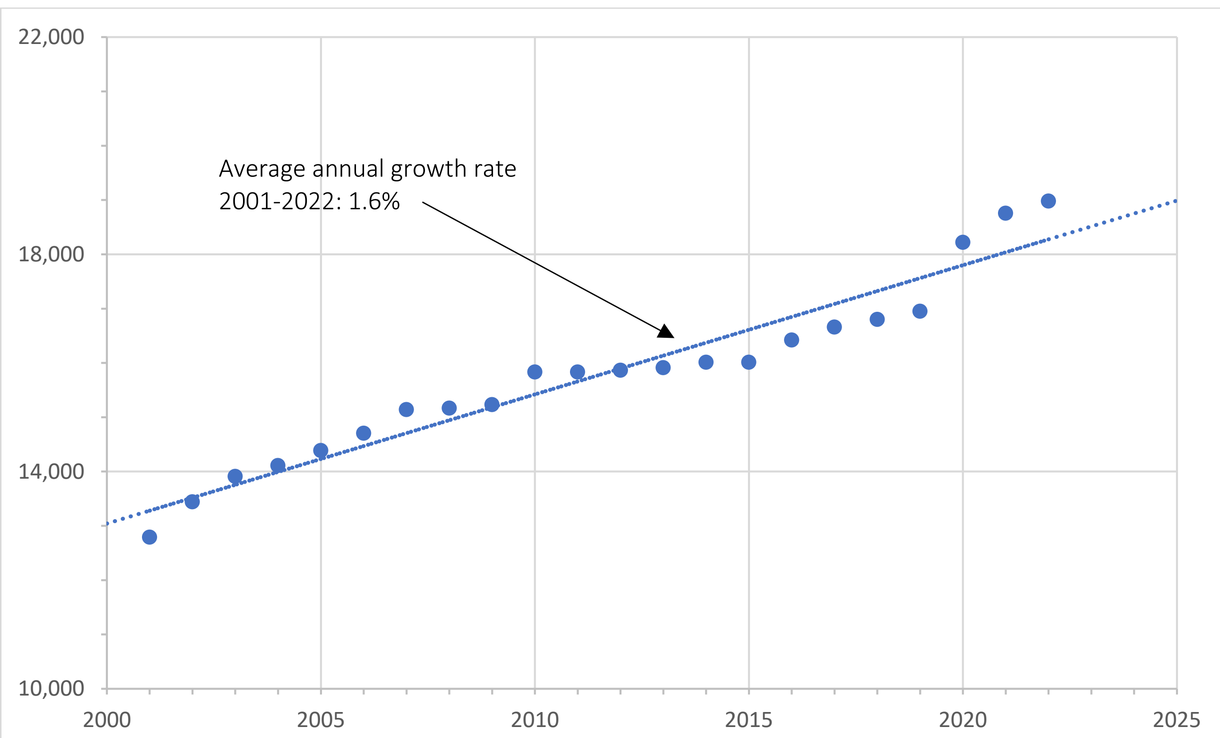
Year	Population	Annual Growth Rate
2022	18,979[1]	1.20%
2021	18,754	2.93%
2020	18,220	7.49%
2019	16,950	0.89%
2018	16,800	0.84%
2017	16,660	1.46%

Year	Population	Annual Growth Rate
2016	16,420	2.56%
2015	16,010	0%
2014	16,010	0.63%
2013	15,910	0.28%
2012	15,865	0.22%
2011	15,830	0%
2010	15,830	3.94%
2009	15,230	0.43%
2008	15,165	0.17%
2007	15,140	2.96%
2006	14,705	2.22%
2005	14,385	1.95%
2004	14,110	1.44%
2003	13,910	3.50%
2002	13,440	5.08%
2001	12,790	

Note:

1. The US Census bureau estimates the 2022 population of Canby, OR to be slightly lower. These differences are due to differing methods of estimating population. PRC estimates adjust based on census data but do not always match census data.

Figure 3-1 | Historical Population Growth



3.5 Water Use Records

Terminology used in this section are defined below:

- ***Water demand*** refers to all water requirements of the system including domestic, commercial, municipal, institutional, industrial, irrigation, and unaccounted-for water.
- ***Water production*** is the amount of water produced, treated, and delivered to the distribution system. Water used for backwash and other operations at the water treatment plant is excluded from this quantity.
- ***Unaccounted-for water*** includes system leakage, water loss, and unmetered uses.
- ***Water consumption*** is the amount of metered water usage billed to customers. This is also referred to as Customer Usage.

Demands are discussed in terms of gallons per unit of time such as gallons per day (gpd), mgd, or gpm. Demands are also discussed in terms of per capita usage as gallons per capita per day (gpcd). Water production is used to estimate actual water demand in the system.

3.5.1 Unaccounted-for Water

Unaccounted-for water is the difference between water production and water consumption. Generally, a distribution system is in good condition when unaccounted-for water is 10 percent or less. From 2018 through 2022 Canby Utility's unaccounted-for water is estimated to be approximately 8.2 percent and has generally declined over this period as Canby Utility has taken action to reduce levels of unaccounted-for water. Canby Utility maintains daily water production records at its supply sources and treatment facilities. **Table 3-2** summarizes annual water production, water consumption and unaccounted-for water estimates.

Table 3-2 | 2018 to 2022 Historical Unaccounted-for Water Summary

Year	Annual Production (MG)	Annual Consumption (MG)	Percent Unaccounted-for Water
2018	790.4	708	10.4
2019	751.4	690.3	8.1
2020	757.3	719.2	5.0
2021	856.8	793.5	7.4
2022	811.0	729.3	10.1
Average	**788.2**	**717.6**	**8.2**

3.6 Historical Water Demands

Historically, average daily demand within the service area had been approximately 2.0 to 2.20 mgd and per capita consumption had ranged from approximately 130 to 150 gpcd. **Table 3-3** summarizes recent system-wide water demand trends from 2018 through 2022. Recent five-year average daily demand has increased to approximately 2.05 to 2.35 mgd and per capita usage has decreased to 115 to 130 gpcd. Maximum daily usage has been as high as 6.2 mgd with a maximum daily demand per capita consumption range of approximately 240 to 400 gpcd.

Table 3-3 | 2018 to 2022 Historical Population and Water Demand Summary

Year	Water Service Area Population	Historical Water Demands[1]									
		Annual Average Inside Demand[2] (AID)		Average Day Demand (ADD)		Peak Season[3] Demand (PSD)		Peak Month[4] Demand (PMD)		Maximum Day[5] Demand (MDD)	
		mgd	gpcd	mgd	gpcd	mgd	gpcd	mgd	gpcd	mgd	gpcd
2018	16,800	1.39	83	2.16	129	3.45	205	4.07	242	6.3	402
2019	16,950	1.35	80	2.06	122	3.15	186	3.73	220	4.5	260
2020	18,220	1.38	76	2.07	114	3.47	190	4.04	222	4.5	242
2021	18,754	1.46	78	2.34	125	3.82	204	4.47	238	6.2	330
2022	**18,979**	**1.41**	**74**	**2.22**	**117**	**4.00**	**211**	**4.48**	**236**	**5.4**	**283**

Notes:

1. Demand is calculated as the total water produced plus any reduction in reservoir storage (in the case of an increase in reservoir storage, this value is negative and is subtracted from produced water).
2. Inside Demand is the average daily demand over November 1 through April 30.
3. Peak Season Demand is the average daily demand for the 92 days of the peak water use season; defined as July 1st to September 30th.
4. Peak Month Demand is the maximum 30-day moving average daily demand. The peak month for the Canby Utility system typically occurs between July and August.
5. Maximum Day Demand is calculated as the 24-hour period with the greatest water demand.

3.7 Population Forecasts

3.7.1 Planning Horizon Population Estimate

The historic annual growth rate for Canby Utility's service area was 1.6 percent from 2001 through 2022. According to PRC projections, this growth rate is expected to slow slightly to 1.4 percent annual population growth through 2045. While short-term growth rates may be more or less than the projected rate of growth, for long-term planning purposes it is anticipated that future growth rates will be the projected 1.4 percent.

3.7.2 Saturation Development Land Use Estimate

In the prior 2010 Water Master Plan, an analysis of available planning documents and Clackamas County GIS data were used to generate an estimate of the saturation development, or build out, population of the Canby Utility water service area. The saturation development analysis was based on the following assumptions:

- Existing agricultural, forest, rural, and vacant zoning will be re-zoned and developed as residential lots at an average density of eight units per acre.
- New developed land would partition into multi-family (10 percent of land area) and single-family residential (70 percent of land area) and roadways (20 percent of land area).
- Existing developed parcels zoned single-family would redevelop into approximately 4,500 square foot lots if the parcel size was greater than 1 acre in size and the property value was less than $200,000 in 2010. Approximately 457 acres of redevelopment were estimated.
- Undeveloped single-family and multi-family residential land would develop at an average overall density of eight dwelling units per acre.
- 20 percent of undeveloped land is allocated to roadway.
- All land within the UGB would fully develop based on these assumptions.
- Each new dwelling unit will have an average of 2.7 people per unit based on the 2000 Census data reported city population of 12,790 and 4,743 dwelling units.

Based on these assumptions the projected saturation development population of the Canby Utility water service area was 46,420 people.

Since the 2010 master plan, no changes to the City's UGB have been made. It is therefore assumed that the prior calculations do not need to be updated.

3.8 Water Demand Projections

Estimates of future water demands were developed from Canby Utility's historical water usage trends from 2018 through 2022 and the population forecasts. For the purposes of this WMP, future estimated average daily water usage is assumed to be approximately 124 gpcd. While this usage is stated as gpcd, this estimate accounts for more than just domestic water use. Total water demand is assigned a per capita value in order to more accurately project water demands with increasing population. Per capita values presented in this

WMP incorporate water produced for all water users and purposes to include distribution system losses. Water demand planning components are summarized in **Table 3-4**.

Estimated water demands are developed by multiplying the estimated per capita water usage by the anticipated population for that year. Peak hourly usage was calculated from continuous data supplied by Veolia and Canby Utility that provided flowrates twice per minute during months of higher demand (June-September). Peak hourly flows are not discussed in gpd but rather in gallons per hour (gph) since these flows are not sustained for a full day. PMD and PSD (July 1 to September 30) forecasts are also developed from the same data set. Water demand forecasts are summarized in **Table 3-5**.

Table 3-4 | Water Demand Projection Criteria Summary

Demand Component	Water Demand (gpcd)	ADD Peaking Factor
Average Day Demand	130	1.00
Peak Season Demand	220	1.69
Peak Month Demand	260	2.00
Maximum Day Demand	360	2.77
Peak Hour Demand[1]	31.8 gpch[1]	6.15

Note:

1. Peak hour demand (PHD) is listed in gph and gpch (gallons per capita hour), as this flow does not persist for the full day. ADD peaking factor accounts for unit conversions.

Table 3-5 | Water Demand and Population Projection Summary

Year	Population	Water Demand (mgd)			
		Average Day Demand	Peak Season Demand[1]	Peak Month Demand[2]	Maximum Day Demand
2025	19,468	2.40	4.25	5.06	7.01
2030	20,796	2.57	4.58	5.41	7.49
2035	22,234	2.75	4.89	5.78	8.00
2040	23,635	2.92	5.20	6.15	8.51
2045	25,056	3.09	5.51	6.51	9.02
Build-out	46,420	5.73	10.21	12.07	16.71

Notes:

1. Peak Season Demand is the average daily demand for the 92 days of the peak water use season; defined as July 1st to September 30th.
2. Peak Month Demand is the maximum 30-day moving average daily demand. The peak month for the Canby Utility system typically occurs between July and August.
3. 2020 population and water demand values based on existing data.

CHAPTER 4

Planning and Analysis Criteria

4.1 General

This chapter presents the planning and analysis criteria used for the Canby Utility's water system analysis. Criteria are presented for water supply source, distribution system piping, service pressures, storage, and pumping facilities. Recommended water needs for fire suppression are also presented. These criteria are used in conjunction with the water demand forecasts presented in **Chapter 3** to complete the analysis of the water distribution system presented in **Chapter 5**.

4.2 Water Supply Source

The water supply should be capable of providing adequate capacity to meet the future MDD projections. Water supply adequacy is measured based on firm capacity of facilities. For a treatment plant, this is the total plant capacity with the largest single treatment train out of service. For a pump station, such as the Emergency Intertie, this is the capacity with the largest pump out of service. If the City develops additional supply sources/systems, consideration should be given to the firm capacity of the combined available sources.

As described in **Chapter 2**, Canby Utility's primary water supply is the Molalla River and is supplemented by groundwater from the Springs Gallery. While Canby Utility has water rights to the Molalla River and adequate intake capacity, the Molalla River's ability to meet long-term demands is limited due to low summer water levels. Therefore, Canby Utility is exploring other long-term supply options, discussed in more detail in **Chapter 6**.

4.3 Distribution System

The water distribution system should be capable of operating within certain system performance limits, or guidelines, under several varying demand and operational conditions. The recommendations of this plan are based on the following performance guidelines, which have been developed through a review of State requirements, American Water Works Association (AWWA) acceptable practice guidelines, Insurance Services Office, Inc. (ISO) guidelines, and operational practices of similar water providers. The recommendations are as follows.

- The distribution system should be capable of supplying the peak hourly demand while maintaining minimum service pressures of not less than approximately 75 percent of normal system pressures.
- The distribution system should be capable of providing the recommended fire flow to a given location while, at the same time, supplying the MDD and maintaining a minimum residual service pressure at any meter in the system of 20 psi. This is the minimum water system pressure required by the State of Oregon Department of Human Services, Drinking Water Program.

Proposed new water mains should be at least 8 inches in diameter in order to supply minimum fire flows. However, in specific scenarios, 6-inch diameter mains are acceptable if no fire hydrant connection is required, there are limited services on the main, the main is dead-ended, and looping or future extension of the main is not anticipated. All new mains shall be looped whenever feasible.

4.4 Service Zones Pressure

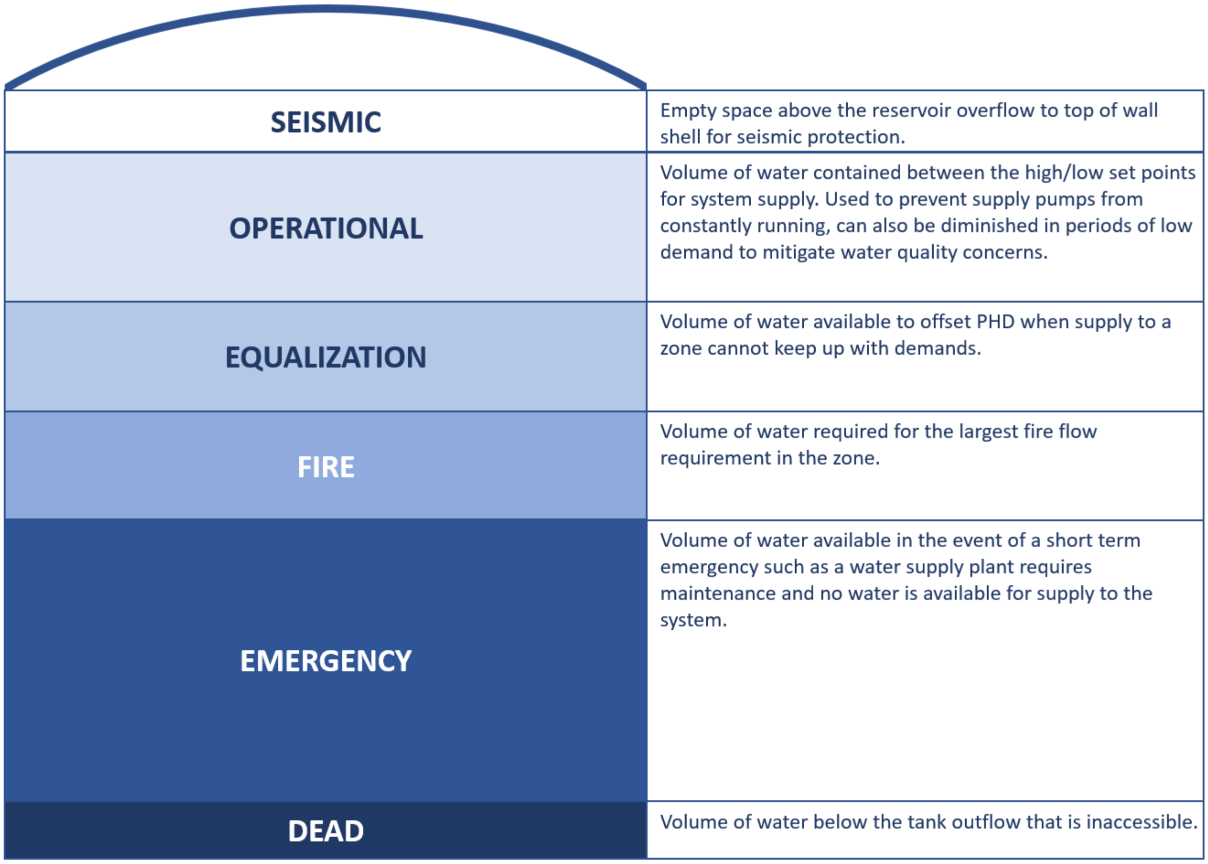
Generally, 80 psi is considered the desirable upper pressure limit and 45 psi the lower limit for Canby Utility's water distribution system. However, conformance to this pressure range may not always be possible or practical due to the topographical relief and existing system configurations. The recommendations are as follows:

- It is desirable to achieve the 45 psi lower limit at the point of the highest elevation service meter within the system or pressure zone.
- While pressures in excess of 100 psi may be acceptable in water mains, services must be equipped with individual pressure reducing valves (PRVs) to maintain their static pressures at no more than 80 psi.
- The minimum service pressure under Fire Flow Conditions must be at least 20 psi.

4.5 Storage Volume

Water storage facilities are typically provided for four purposes: operational storage, equalization storage, fire storage, and emergency storage. Additionally, dead storage and headroom for seismic sloshing should also be included in storage volume calculations. While storage is typically discussed as a volume, limiting factors may actually be based on vertical space in a tank, flow rates, or actual volume of water. **Figure 4-1** provides a visual of the six storage volume components and is followed by a brief discussion of each storage element below, based on the Washington State Water System Design Manual guidelines.

Figure 4-1 | Storage Volumes



A brief discussion of each storage element is provided below. These component criteria for storage volume are commonly used by other water providers and by AWWA.

Recommended system wide storage is the sum of the operational, equalizing, fire and emergency storage volume components.

Available usable storage in existing storage facilities is the total volume minus any reductions for seismic sloshing or dead storage.

4.5.1 Seismic Storage

Seismic storage is the empty space above the overflow of the reservoir to the top of the wall. This volume of storage loss varies based on the type, age, and condition of the reservoir.

4.5.2 Operational Storage

Operational storage is the volume of storage between the on and off setpoints for facilities supplying the reservoir.

4.5.3 Equalization Storage

Equalization storage is required to meet water system demands when zone demands exceed supply delivery capacity. The volume is generally considered to be the difference between PHD and MDD on a 24-

hour duration basis. The Washington Standards calculate equalization storage as (PHD – Qs)x150 minutes, where Qs is the total supply available to the zone.

4.5.4 Fire Storage

Fire storage should be provided to meet the single most severe fire flow demand within each zone. The fire storage volume is determined by multiplying the recommended fire flow rate by the expected duration of that flow. Specific fire flow and duration recommendations are discussed later in this chapter.

4.5.5 Emergency Storage

Emergency storage is often provided to supply water from storage during emergencies such as pipeline failures, equipment failures, power outages or natural disasters. The amount of emergency storage provided can be highly variable depending upon an assessment of risk and the desired degree of system reliability. Provisions for emergency storage in other systems vary from none to a volume that would supply a maximum day's flow or higher. Based on discussions with Canby Utility and Veolia Water North America staff, a storage of 1.5 times ADD was adopted. These criteria considered the following.

- Partial source redundancy (RIG and Springs Gallery)
- Separate water treatment filter units
- Water rationing procedures in place in the event of an emergency.

4.5.6 Dead Storage

Dead storage is the volume of storage lost due to the inaccessibility of water below the tank outflow.

4.6 Pump Station Capacity Requirements

Pump stations supplying constant pressure service without the benefit of gravity storage should have firm pumping capacity to meet PHD while simultaneously supplying fire suppression flow for the largest fire flow demand in the pressure zone. Firm pumping capacity is defined as a station’s pumping capacity with the largest pump out of service.

When considering that the Canby Utility water system has no existing gravity storage and is served by multiple pump stations, these additional criteria should be considered:

- Adequate supply capacity (MDD plus fire flow) should be supplied with the loss of the largest pump.
- As the system has a single supply source, the Cedar Treatment Plant Pump Station must have firm capacity to provide the MDD from the water treatment plant clearwell.
- The total firm capacity of all pumping facilities should be greater than or equal to PHD.

4.7 Fire Flow Recommendations

The water distribution system provides water for domestic use and fire suppression. The amount of water required for fire suppression purposes at a specific location is associated with the local building size and construction type. Zoning and land use are used as analogs for building size when evaluating required fire flows for planning within the City’s water service area.

Fire flow requirements are typically much greater in magnitude than the MDD in any local area. Therefore, fire flow must be considered when sizing pipes to ensure adequate hydraulic capacity is available for these potentially large demands.

Fire protection for Canby Utility's service area is provided by Canby Fire District No. 62. Generally, the 2022 Oregon Fire Code (OFC) has been adopted as the standard. A summary of fire flow recommendations is presented in **Table 4-1**.

4.7.1 Single-Family and Two-Family Dwellings

The 2022 OFC guidelines specify a minimum fire flow of 1,000 gpm for single-family and two-family dwellings with square footage of 3,600 square feet or less. For residential structures larger than 3,600 square feet, the minimum fire flow requirement is 1,500 gpm. The actual fire flow requirement is based on building construction and size and can be found in the OFC, Appendix B, Table B105.1(2).

For the purposes of this WMP, distribution piping fire flow capacity will be tested in the water system hydraulic model with a minimum requirement of 1,500 gpm to accommodate the range of potential future residential development in the City. Where deficiencies are identified in the existing system based on this 1,500 gpm requirement, existing homes that are less than 3,600 square feet will be evaluated at a 1,000 gpm fire flow to confirm if a potential deficiency exists for current customers.

4.7.2 Other Dwelling Types

For buildings that are not single- and two-family residential dwellings, the fire flow requirement is based on building type and size and can be found in the OFC, Appendix B, Table B105.1(2). The fire flow rate and duration requirements are reduced if a building has an automatic sprinkler system. Section B106.1 of the OFC sets the maximum fire flow requirement at 3,000 gpm. This applies to any new, altered, moved, enlarged, or repaired building. Buildings that require more than 3,000 gpm need approval from the fire code official.

Table 4-1 | Summary of Recommended Fire Flows

Land Use Type	Recommended Fire Flow (gpm)	Duration (hours)
Single- or Two-Family Residential <=3,600 square feet	1,000 gpm	2
Residential >3,600 square feet and other Buildings	Use OFC criteria for building size and type up to a maximum of 3,000 gpm	3
Commercial and Industrial	Use OFC criteria for building size and type up to a maximum of 3,000 gpm	3

4.8 Seismic Resilience

Recently, regional emergency preparedness programs have focused on the imminent threat and extreme risk of a Cascadia Subduction Zone (CSZ) earthquake. Following this research, the State of Oregon has developed the Oregon Resilience Plan (ORP) to establish target timelines for utilities to provide service following a seismic event.

As part of this WMP, the City has decided to complete a seismic risk assessment of their existing water system. Seismic criteria and analysis are presented in **Chapter 7**.

4.9 Summary

The criteria developed in this chapter are used in **Chapter 5** to assess the system's ability to provide adequate water service under existing conditions and to guide improvements needed to provide service for future water needs. Planning criteria for Canby Utility's pump stations, distribution system, pressure zones, and storage facilities are summarized as follows:

- *Pump Station Capacity Requirements:* In general, pump stations supplying constant pressure service without the benefit of storage should have firm pumping capacity to meet MDD while simultaneously supplying fire suppression flow for the largest fire flow demand in the pressure zone. The configuration of the Canby Utility water system has additional capacity requirements:
    - Adequate supply capacity (MDD plus fire flow) should be supplied with the loss of a pump station. This requirement should be considered for all stations not supplied with backup emergency power.
    - The system currently operates with a single supply source; as such the Cedar Treatment Plant Pump Station have firm capacity to provide the maximum daily demand from the water treatment plant clearwell. Future long-term supply options are being explored and discussed in further detail in **Chapter 6**.
- *Distribution System Criteria:* The distribution system should be capable of supplying the PHD while maintaining minimum service pressures of not less than approximately 75 percent of normal system pressures.
- *Service Pressure Criteria:* Minimum static system service pressures within each pressure zone should be at least 35 psi, with a recommended maximum upper limit of approximately 80 psi.
- *Storage Volume Criteria:* Recommended storage volume capacity for Canby Utility is the sum of the operational, fire, equalization, and emergency storage volume components.

CHAPTER 5

Water System Analysis

5.1 General

This chapter presents an analysis of the Canby Utility water distribution system based on the planning and analysis criteria from **Chapter 4**. The analysis includes an evaluation of the system's storage and pumping capacity requirements and presents the findings of a computerized hydraulic network analysis of the water distribution system.

Through these evaluations and analysis, deficiencies are identified, and improvement options developed. **Chapter 8** presents a recommended CIP that includes prioritized improvements to correct deficiencies found through the analysis and which provides for system expansion. Population projections and water demand forecasts presented in **Chapter 3** are used to determine the need for certain improvements such as increased storage capacity, distribution system upgrades and increased pumping capacity.

5.2 Distribution System Analysis

5.2.1 General

A hydraulic network analysis computer program was used to evaluate the performance of the existing distribution system and to aid in the development of proposed system improvements. Bentley's WaterCAD V8i is a network analysis program that develops and uses a digital base map of the water distribution system. The purpose of the computer network modeling is to determine pressure and flow relationships throughout the distribution system for a variety of critical hydraulic conditions. System performance and adequacy is then evaluated on the basis of water demand forecasts developed in **Chapter 3** and planning criteria presented in **Chapter 4**.

5.2.2 Hydraulic Model

The original hydraulic model (model) used in this analysis was created and calibrated in conjunction with Canby Utility's 2003 Water Master Plan. The model was subsequently updated in 2009 as part of the 2010 Water Master Plan Update.

As part of this 2023 WMP, the model was updated and calibrated based on current water system GIS data provided by Canby Utility, input from the Utility, and updated system demands developed in **Chapter 3**.

The updated hydraulic model was used to perform the system analysis and to illustrate recommended improvements. All pipes are shown as "links" between "nodes" which represent pipeline junctions or changes in pipe size.

5.2.3 Modeling Conditions

To simulate system operation under maximum usage conditions, it is necessary to determine the water usage anticipated for the highest water use day of the year. For this purpose, the MDDs at 2045 and at saturation development, previously presented as part of **Table 3-8**, were distributed throughout the system.

The computer analysis was performed with all system facilities in operation. In order to use the hydraulic model of the water system to assess system adequacy, several system conditions were examined. The adequacy of the system's major transmission piping and the system's ability to provide recommended fire flows throughout the system were analyzed.

All fire flow modeling was performed assuming that the system must be capable of providing the recommended fire flows while maintaining a minimum system pressure of approximately 20 psi to all services within the system.

5.2.4 Modeling Results

5.2.4.1 Fire Flows

The distribution system analysis under MDD for existing conditions and for the 20-year planning horizon indicate that no improvements are required in order to provide recommended fire flows while maintaining required minimum service pressure. Fire flows were simulated using Canby Utility's model throughout the study area based on the estimated fire flow recommendations for land uses as presented in **Chapter 4**.

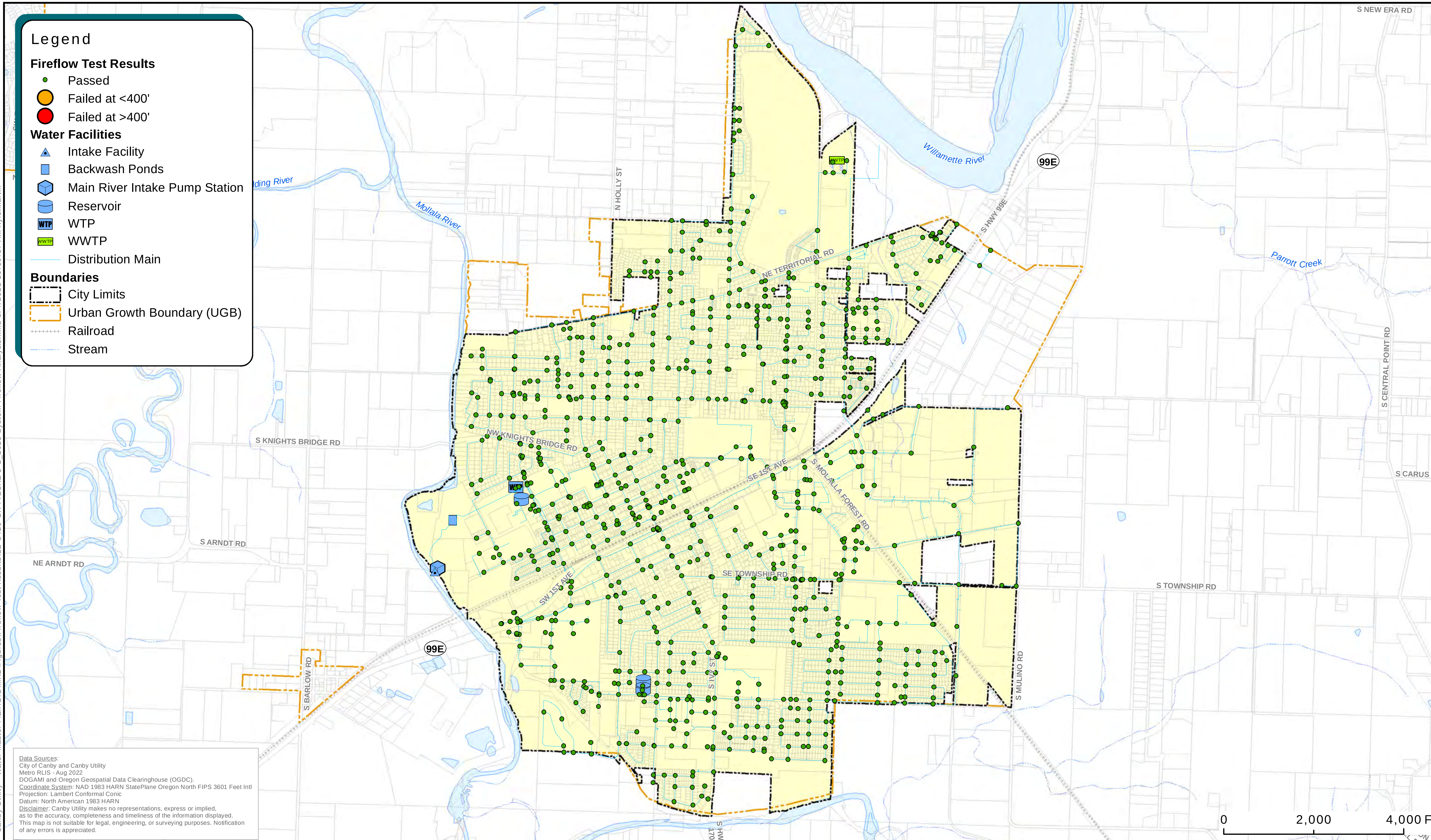
Fire flow scenarios test the distribution system's ability to provide required fire flows at a given location while simultaneously supplying MDD and maintaining a minimum residual service pressure of 20 psi at all services without exceeding a maximum velocity of 14 feet per second in all pipes. Required fire flows are assigned based on the zoning surrounding each node as summarized in **Chapter 4**. Three fire flow scenarios were simulated and are summarized with the correlating figures as follows:

- Existing System (Primary Molalla Source), current demands, shown in **Figure 5-1**
- Existing System (Primary Molalla Source), 2045 demands, shown in **Figure 5-2**
- Future System (Primary Willamette Source), 2045 demands, shown in **Figure 5-3**

Based on the Utility's model, **Table 5-1** lists the existing fire flow deficiencies in the system which are anticipated to be addressed by upsizing existing piping. Generally, Canby Utility's fire flow deficiencies are considered relatively minor as compared to Canby Utility's immediate need of developing a new long-term supply source. Through discussions with Canby Utility, and further discussed in **Chapter 6**, it is recommended the Utility prioritize the long-term supply project, with fire flow deficiency projects to be addressed in the long-term. **Chapter 8** details CIP recommendations based on the fire flow deficiencies. The development of the Utility's new long-term supply source is expected to resolve fire flow deficiencies 4, 5, and 6. Therefore, no CIP projects are proposed to address these deficiencies.

5.2.4.2 Future Transmission System Looping

Canby Utility anticipates completing the following planned transmission system looping projects to support future growth. These areas 1) from SE Hazeldell Way to SE Territorial, along SE 1st Avenue, Otto Road, the new City-planned Industrial Roadway Connection to HWY 99E, 2) SE 1st Avenue to approximately 2483 SE Territorial Road, along S Haines Road and S Carriage Lane, and 3) Transmission piping looping along SE 1st Ave, S Haines Road to approximately 2600 SE Territorial Road. These system extensions are discussed in **Chapter 8** and included on the Future System Analysis in **Figure 5-3**.



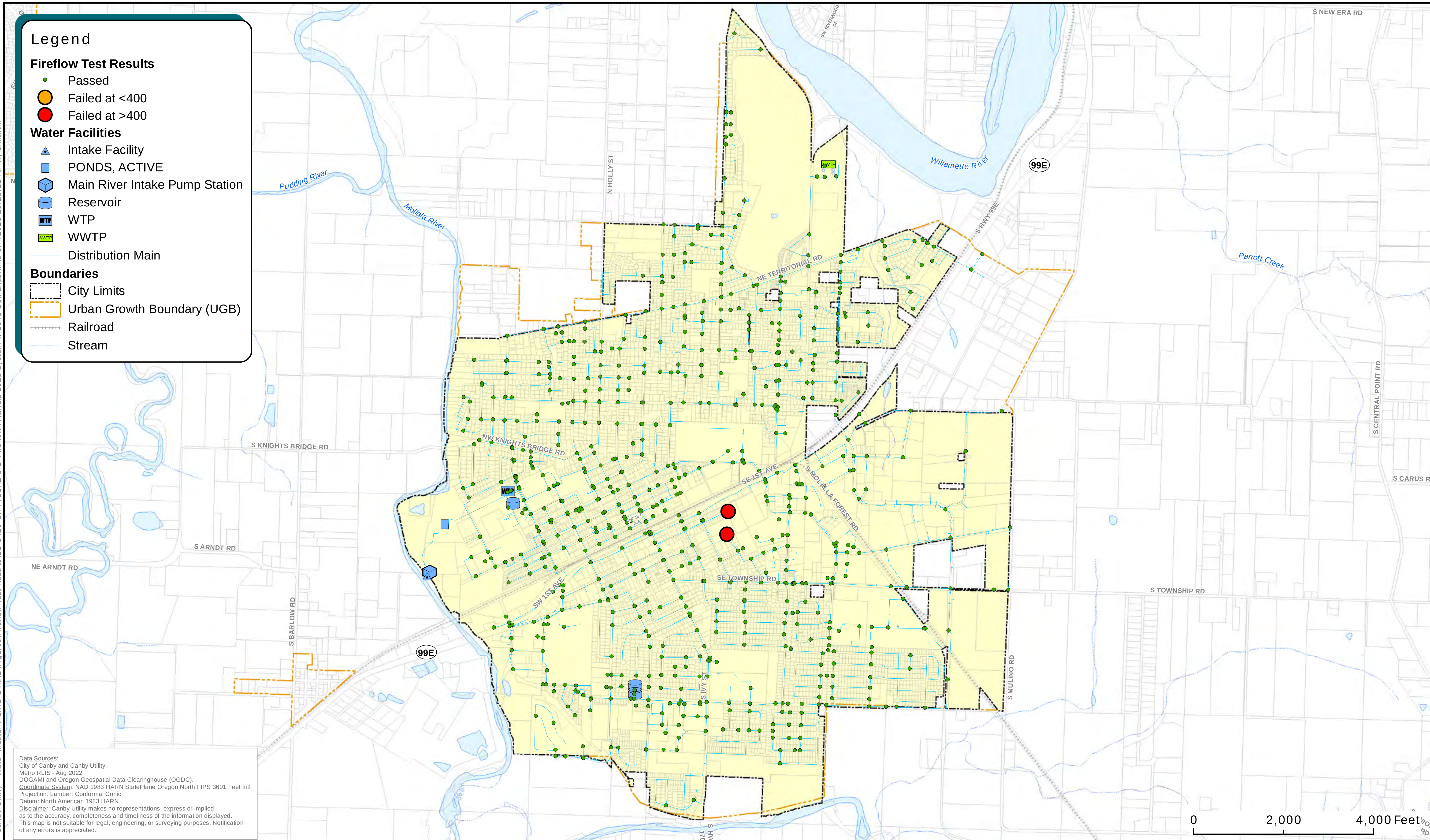
Canby Utility
Water Master Plan

Figure 5-1
2023 System Fireflow Analysis

August 2023

Reference Scale: 1:24,000

22-3420



N W E S

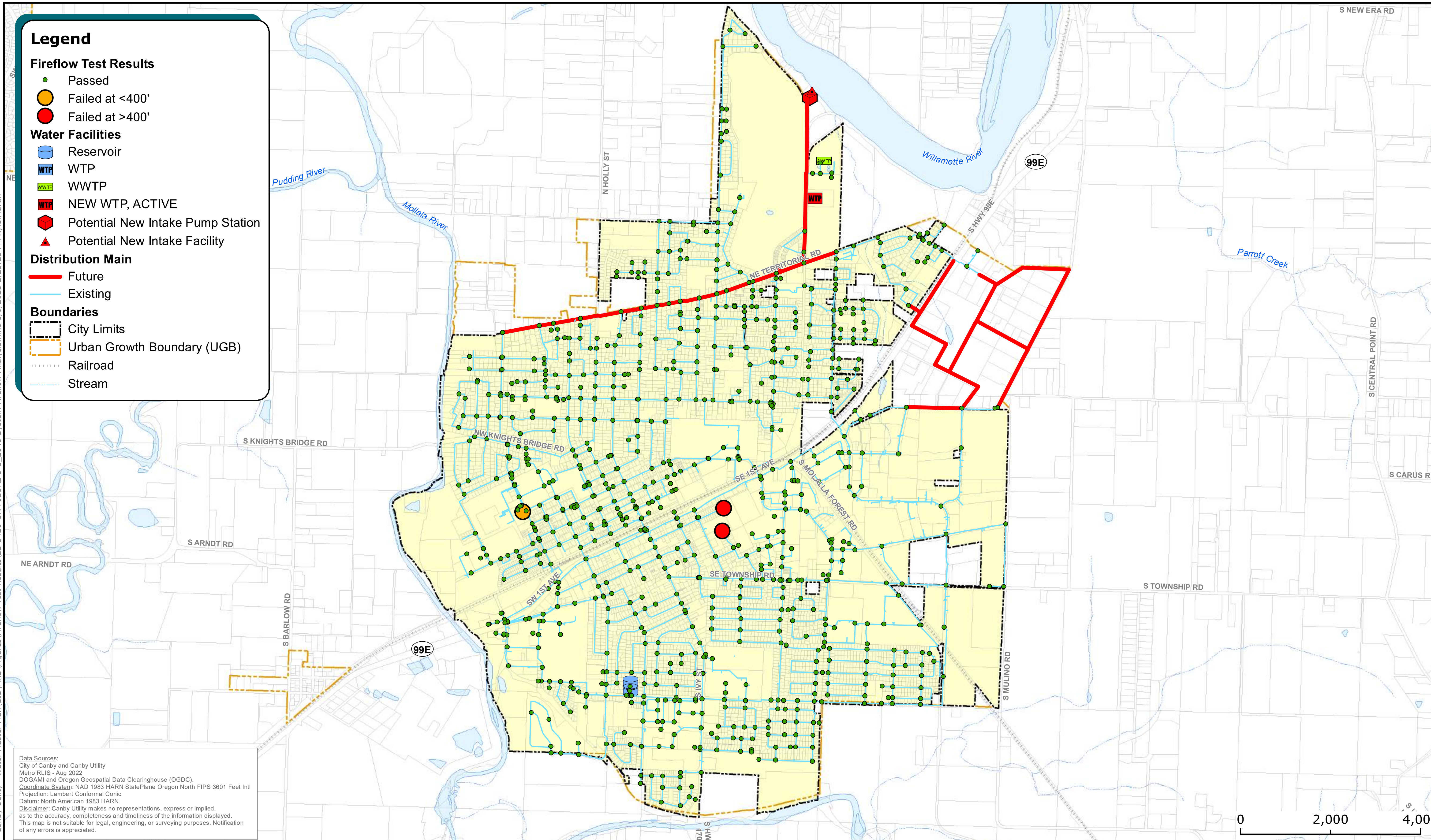
Canby Utility
Water Master Plan

Figure 5-2
Fireflow Analysis
2023 System w/ 2045 Demands

August 2023

Reference Scale: 1:24,000

22-3420



G:\PDX_Projects\22\3420 - Canby Utility - Water Master Plan\GIS\MXD\Figures\Fireflow Test Results\22-3420-OR-FIGURE 5-3_2045 System Fireflow Analysis.mxd 8/9/2023 2:25:23 PM Kyle.Martin

consor CANBY UTILITY

Canby Utility
Water Master Plan

Figure 5-3
2045 System Fireflow Analysis

August 2023

Reference Scale: 1:24,000

22-3420

Table 5-1 | Fire Flow Deficiencies

ID	Site Description	Nearest Street / Intersection	Required Flow (gpm)	Existing System - Available Flow (gpm) (Figure 5-1)	Existing System with 2045 demands - Available Flow (gpm) (Figure 5-2)	Future System with 2045 demands - Available Flow (gpm) (Figure 5-3)	Existing Pipe Dia.	Proposed Size	CIP ID
1	Carriage Court Apartments; cul-de-sac	NW 5th Cir	2,000	2005	1935	1861	6	8	D-05
2	SE 2nd Ave, east of S Locust St	SE 2nd Ave & S Locust St	2,000	2033	1807	1766	6	8	D-06
3	Cul-de-sac	S Manzania Ct	2,000	2096	1849	1818	6	8	D-07
4	Cul-de-sac adjacent to Willamette Plastics	NW 5th Pl	3,000	3005	2910	2950[2]	6	--	--
5	Inside industrial park of ICC Northwest and SMS Auto Fabrics	4th Ave & S Redwood St	3,000	3283	2797	2992[2]	8	--	--
6	Inside industrial park of ICC Northwest and SMS Auto Fabrics	4th Ave & S Redwood St	3,000	3283	2797	2992[2]	8	--	--

Notes:
1. All three hydrants reside in the same business park and consolidated into one CIP project.
2. Deficiencies within 5% of the required fire flow are ignored due to model accuracy.

5.3 Pump Station Capacity Analysis

5.3.1 General

Existing pump station capacities were evaluated with respect to existing and estimated future firm capacity requirements assuming that service continues to be provided through continuous operation pump stations supplied from the existing water treatment plant. Estimated demands at the end of the 20-year planning horizon and at saturation development are used to establish firm pumping requirements for existing and proposed pump stations in accordance with the pump station planning criteria presented in **Chapter 4**. Continuous operation pump stations should supply a firm pumping capacity able to meet MDD plus fire flow or maximum instantaneous demand, whichever is greatest. For the Canby Utility system, MDD plus fire flow governs except under the saturation development condition. **Table 5-2** and **Table 5-3** present a summary of estimated firm pumping capacity requirements for each pump station under existing and future conditions, respectively. Further discussion of the recommended capacities for each pump station is presented below.

Table 5-2 | Existing Pumping Capacity Recommendation Summary

Pump Stations	Estimated Existing Station Capacity (mgd)	Estimated Existing Nominal Firm Capacity (mgd)	Recommended Firm Capacity (mgd)	Capacity Deficit (mgd)
Cedar Treatment Plant Pump Station	11.8	6.7	6.2[1]	0.0
13th Avenue Pump Station	8.1	5.5	4.3[2]	0.0

Notes:
1. The Cedar Treatment Plant Pump Station must deliver maximum daily demand from the WTP to the distribution system.
2. Firm capacity is required to deliver fire flow of 3000 gpm.

Table 5-3 | Future Pumping Capacity Recommendation Summary

Pump Stations	Estimated Existing Station Capacity (mgd)	Estimated Existing Firm Capacity (mgd)	Recommended Firm Capacity (mgd)		Capacity Deficit (mgd)	
			2045	Build-out	2045	Build-out
Cedar Treatment Plant Pump Station	11.8	6.7	9.0	16.7	2.3-	10.0-
13th Avenue Pump Station	8.1	5.5	4.3	4.3	0.0	0.0

Notes:

1. The Cedar Treatment Plant Pump Station must deliver maximum daily demand from the WTP to the distribution system.
2. Firm capacity is required to deliver fire flow of 3,000 gpm.

5.3.2 Cedar Treatment Plant Pump Station

The Cedar Treatment Plant Pump Station is a critical facility. All water supply must pass through this station to reach the distribution system. As such, the station has a minimum required firm capacity equal to the MDD. Firm capacity assumes the scenario of the largest pump at the Cedar Treatment Plant Pump Station is out of service. Existing firm capacity under this scenario is 6.7 mgd. As shown in **Table 5-3**, the Cedar Treatment Plant Pump Station have a firm pumping capacity deficit of 2.3 mgd by the year 2045. Canby Utility is expected to pursue and implement a new source of supply by 2030. Consequently, this deficit will be addressed through the implementation of source and supply capacity improvements discussed further in **Chapter 8**.

5.3.3 13th Avenue Pump Station

The 13th Avenue Pump Station provides emergency and fire flow supply to the distribution system from ground level storage reservoirs. In conjunction with the Cedar Treatment Plant Pump Station meeting MDD, the 13th Avenue Pump Station has adequate capacity to meet system-wide fireflow requirements.

As described in **Chapter 2**, there is an unused pump barrel at the pump station, which can house another 1,800 gpm/75 hp pump. It is recommended that an additional pump be installed to provide expanded system resilience in the event of a disruption of the Cedar Treatment Plant Pump Station. This recommendation is discussed further in **Chapter 8**.

5.3.4 4th Avenue Pump Station – Not in Use

As discussed in **Chapter 2**, this pump station is no longer in use, with the prior equipment abandoned in place. This pump station was not included in the pump station capacity analysis.

5.4 Storage Volume Analysis

As discussed in **Chapter 4**, the total volume of storage required for the Canby Utility's distribution system includes operational storage, emergency storage, equalization storage, and storage for fire suppression. Operational storage volume should be sufficient to supply demand fluctuations throughout the day resulting from typical customer water use patterns. Emergency storage is provided to supply water from storage during emergencies such as pipeline failures, power outages or natural disasters. Equalization storage is provided to meet water system demands when demands exceed supply delivery capacity. A reasonable volume for emergency storage is approximately one-and-one-half (1.5) ADD. Fire storage is provided to meet the single most severe fire flow demand within the service area.

Table 5-4 illustrates the individual storage components and combined storage needs recommended for operational, fire, equalization and emergency purposes under existing demand conditions, projected demands in the year 2045 and at saturation development.

Table 5-4 | Storage Volume Recommendation Summary

Year	Storage Components				Recommended Total Storage (mg)	Existing Storage (mg)	Storage Deficit (mg)
	Operational (mg)	Fire[1] (mg)	Equalization (mg)	Emergency (mg)			
Existing	0.6	0.54	0.0	3.1	4.2	4.4	0.0
Under Existing Conditions Emergency Storage Criteria							
2045	0.9	0.54	0.2	4.6	6.2	4.4	1.8
Build-out	1.7	0.54	1.4	8.6	12.2	4.4	7.8

Notes:
1. Single most severe fire flow demand is assumed to be industrial/commercial at 3000 gpm for a duration of 3 hours.

Over the 20-year planning horizon, there is an anticipated 2045 storage deficit of nearly two million gallons. Beyond 2045 and at saturation development, there is a need for additional storage up to 7.8 mg. It is anticipated that additional storage capacity will be required as Canby Utility pursues a new source of supply. As such, a new reservoir is recommended in the immediate term in conjunction with the Utility's source and supply capacity improvements. Recommendations for adding additional storage capacity are presented in **Chapter 8**.

CHAPTER 6

Water Supply, Treatment Analysis and Recommendations

6.1 General

This chapter describes the evaluation of Canby Utility's water supply and treatment facilities. This analysis is based on water demand projections established in **Chapter 3** as well as criteria established in **Chapter 4**. Findings generated through this analysis are further developed and incorporated into the CIP as presented in **Chapter 8**.

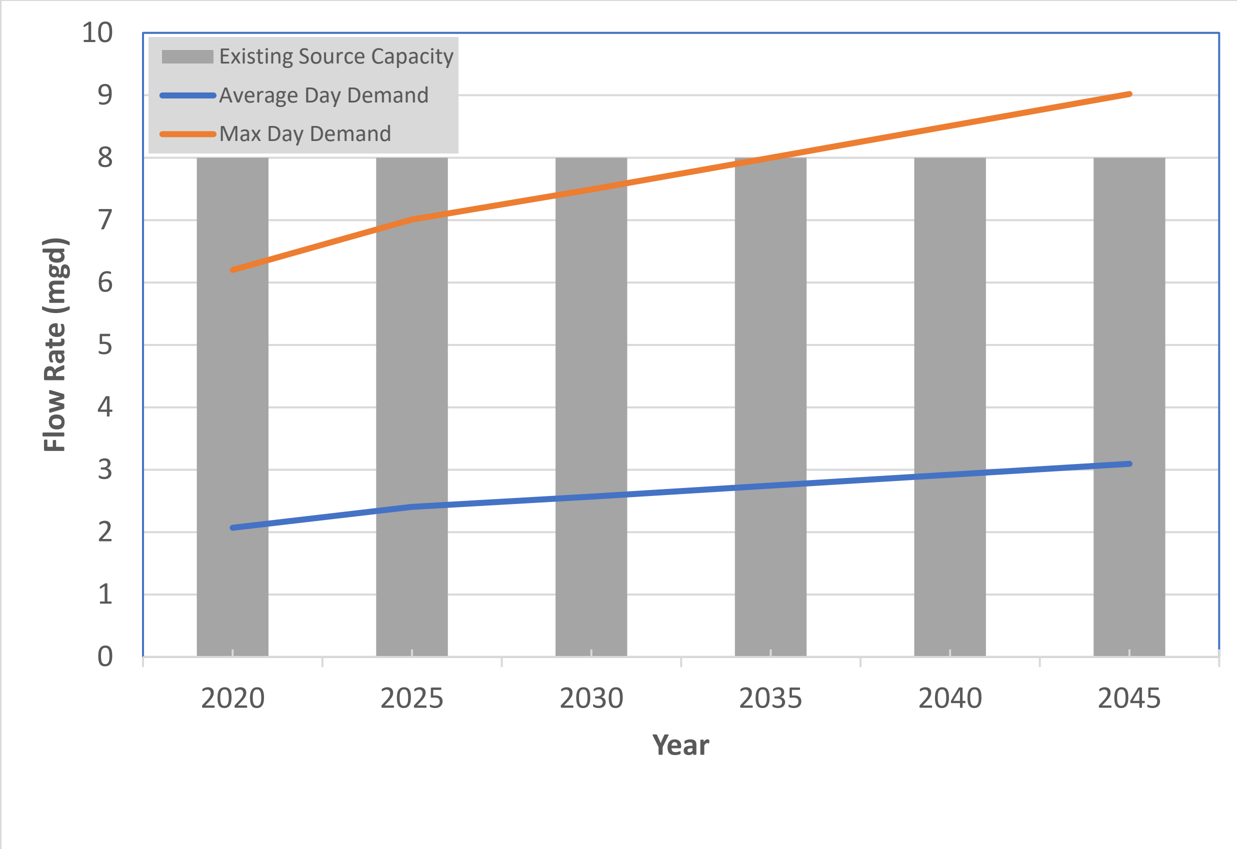
Included in this chapter is an evaluation of Canby Utility's raw water supply source. Securing an additional supply source or expanding capacity of the existing system will be necessary to accommodate growth in the service area over the 20-year planning horizon. A new water treatment facility will be required to expand the potable water supply. Additionally, modifications to the existing water treatment facilities are considered to increase supply resiliency and redundancy.

6.2 Water Supply Analysis

Canby Utility has water rights for 20.0 cfs (12.9 mgd) from the Molalla River, but low flow summer water availability is much less. Based on observed water levels during the summer season, additional Molalla River supply beyond the current treatment capacity of approximately 8.0 mgd is not anticipated to be available year-round. As identified in **Chapter 3**, the forecasted MDD is projected to be above 8.0 mgd by 2035, approaching 10 mgd beyond 2045, with an ultimate build-out MDD of approximately 16.7 mgd.

Consequently, a new long-term supply source needs to be developed to provide a minimum capacity of 8.0 mgd by 2030 and ultimately a capacity of approximately 10 mgd. **Figure 6-1** presents Canby Utility's existing supply capacity from the Molalla River source and forecasted maximum daily demand illustrating the timing and capacity needed for additional long-term supply.

Figure 6-1 | Forecasted Maximum Daily Water Demand and Available Supply



6.2.1 Water Supply Criteria and Considerations

To be considered a feasible option, a long-term water supply source must meet several criteria which are:

- Ability to meet all, or a substantial portion, of the long-term water supply needs for Canby Utility's water service area.
- Ability to cost-effectively integrate source options into current treatment, supply, and distribution system.
- An economical supply source development cost.
- Ability to provide source redundancy and reliability as Canby Utility does not have significant emergency water sources or emergency interties with other water providers.

In previous studies, the 2010 Water Master Plan and a separate Water Supply Analysis Study (2013), alternatives were evaluated to create expanded long-term supply.

6.2.2 Summary of Previous Studies

6.2.2.1 Water Master Plan – Alternatives and Recommendations (2010)

The previous 2010 Water Master Plan presented five long-term supply alternatives for consideration:

1. Expansion of the existing Molalla River supply
2. Development of expanded or new groundwater supplies, including potential use of Aquifer Storage and Recovery (ASR) as a peaking and emergency source
3. Water supply from the Clackamas River in partnership with one of the existing Clackamas River water providers
4. Water supply from the City of Wilsonville Willamette River Water Treatment Plant (WRWTP) with potential joint development of transmission facilities to serve Canby Utility and the Charbonneau area.
5. **Development of new Willamette River supply intake in or adjacent to Canby, and use of the existing water treatment plant (with upgrades and expansion) or new treatment facilities**

Recommended Supply Alternative: After initial screening, Alternatives 4 and 5, the Wilsonville Willamette River Supply and the new Willamette River Intake alternatives, were considered the most feasible from a water rights access and water availability perspective.

The additional cost of expanding the WRWTP (including high-head pumping) to supply Canby made Alternative 4 less favorable. The new Willamette River Intake (Alternative 5) was recommended based on its cost and fewer anticipated project challenges. Alternative 5 was further conceptualized into two separate alternatives, 1) a potential expansion of Canby Utility’s existing water treatment plant, with the construction of a new Willamette River intake structure, and 2) the construction of a new water treatment plant for the Willamette River Supply.

6.2.2.2 Water Supply Analysis Study (2013)

In 2013, Canby Utility further evaluated Alternatives 3, 4, and 5. Alternatives 4 and 5 were further broken down into two and four separate alternatives, respectively. The seven alternatives were ranked, with the most favorable identified as the following:

- New Willamette River Intake at Canby - Existing Canby Utility Willamette Water Right Point of Diversion (POD), downstream of the Molalla River

Canby Utility's current water treatment plant has been expanded as much as possible within the restrictions of its relatively small site; the new water treatment plant would be constructed at an alternate location. Canby Utility currently owns water rights for 12.4 cfs (8 mgd) on the Willamette River with a POD near the Canby Wastewater Treatment Plant on Logging Country Road. Development of this supply at this existing POD requires a new intake structure and water treatment plant and land on which to construct them.

6.3 Advancing with Recommended Alternatives

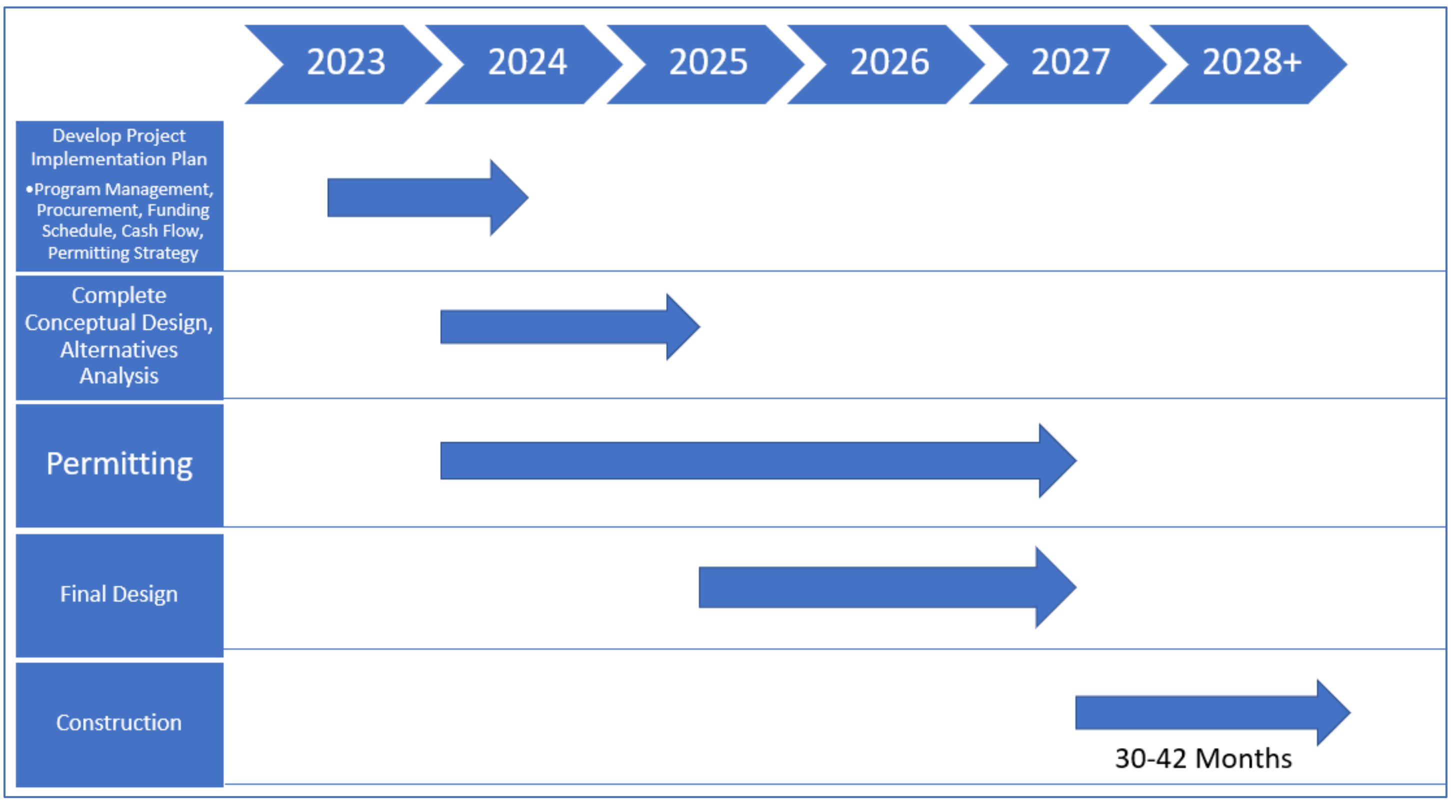
As identified in **Chapter 3**, Canby Utility’s forecasted MDD is projected to surpass its available supply in 2035. The development of supply from the Willamette River near the City would require the planning, land acquisition, design, permitting, and construction of new river intake and treatment facilities. In order for the new facilities to be online by 2030, the Utility needs to begin project implementation immediately.

6.3.1 Timeline

Figure 6-2 presents an approximate timeline to complete the design, permitting, and construction of new source and treatment facilities. Anticipated project costs are discussed in **Chapter 8.** Project components include:

- Project Implementation plan
  - Program Management, Procurement, Funding Schedule, Cash Flow, Permitting Strategy
- Conceptual Design and Alternatives Analysis
- Permitting
- Final Design
- Construction

Figure 6-2 | New Source and Treatment Timeline



6.4 Analysis of Potential Improvements to the Existing WTP

The previous 2010 Water Master Plan presented a brief analysis of the existing water treatment facilities was completed in coordination with Veolia staff to identify potential performance and operational issues at the existing water treatment plant. While Canby Utility is currently prioritizing the development and construction of a new long-term supply source, it will also need to make a decision regarding the future of its existing Molalla Water Treatment Plant. If the Utility elect to retain its existing plant as a redundant supply source, Cost estimates for recommended improvements to facilitate this option are presented in **Chapter 8**.

6.4.1 Pretreatment Improvements

During periods of high turbidity in the Molalla River (which occur sporadically during the rainy season, but especially so during heavy rain/runoff events), operation of the MRI is curtailed and the intake from the RIG and Springs Gallery is used instead. Due to these operational limitations during the fall, winter and spring, the plant capacity is often limited by raw water quality to approximately half the full plant capacity based on observations of Veolia staff. In practice, the plant cannot adequately treat raw water with turbidity above 20 Nephelometric Turbidity Units (NTU).

While the existing circular pretreatment basin provides some sedimentation, it is inadequately sized for the current capacity of the water treatment plant. The basin exhibits severe short-circuiting and cannot reliably form a settleable floc to reduce the solids loading to the package filter units. This significantly reduces filter run durations and increases backwash frequency during high raw water turbidity events. It is recommended that a new common clarification process be considered to feed all filter units allowing for effective pretreatment of high turbidity source water. A common point for chemical coagulant addition is also recommended upstream of the sedimentation process which allows for improved operational flexibility and performance. While a detailed analysis and comparison of pretreatment alternatives is beyond the scope of this study, there are a number of pretreatment process alternatives which can be considered including:

- Conventional horizontal-flow flocculation/sedimentation basins (with or without plate settlers or tube settlers)
- Reactor-clarifiers
- Upflow sludge blanket clarifiers
- Ballasted flocculation/sedimentation using microsand (Actiflo)

The available space for adding pretreatment at the WTP site may limit the alternatives to those with relatively-high surface loading rates. For the purposes of this planning study, it was assumed that Actiflo would be implemented as the preferred pretreatment process, since it will have the smallest footprint requirement. It was also assumed that 8 mgd of clarification pretreatment would be installed to allow production of the maximum plant capacity during all times of the year. A more-detailed analysis of the pretreatment capacity requirements may result in a lower initial installed capacity, perhaps as low as 4 mgd since water demands are typically lower during the periods of the year when high raw water turbidities occur.

6.4.2 SCADA/Instrumentation and Controls Improvements

The existing package filters should be modified and equipped with filter head loss pressure differential transmitters capable of real time indication of the pressure differential across each filter. This will allow for better monitoring of filter performance, improve operational efficiency, and reduce the potential for high turbidity water entering the clearwell.

6.4.3 Taste and Odor Control

Veolia staff reported that the raw water and the finished water exhibited earthy/musty tastes and odors (T&O) during the late summer and early fall of 2009. Staff reported that some customer complaints were received during this period. Limited sampling of the water indicated that measurable levels of methylisoborneal (MIB) and/or geosmin were detected. MWH Americas, Inc., subsequently performed a T&O study in 2015.

Both of these compounds are often found in surface water supplies when elevated concentrations of algae occur (they are metabolytes of algal activity). In the Pacific Northwest, many surface water supplies experience algae and T&O during summer and early fall when flows are low and water temperatures are at their highest. MIB and/or geosmin concentrations as low as 5 parts per trillion (ppt) can be detected by the human nose and/or palate and impart the noticeable earthy/musty attribute. If pre-chlorination of the raw water supply is practiced, this can often exacerbate the intensity of these T&O compounds.

The existing Molalla River Water Treatment Plant is not equipped to remove/reduce challenging T&O compounds such as MIB and geosmin. There are four proven treatment processes which can reduce/remove MIB and geosmin from the water supply including:

1. High doses of powdered activated carbon (PAC) which needs to be added prior to filtration and requires a clarification system to ensure that most of the PAC particles do not carry over to the filters.
2. Granular activated carbon (GAC), either as a filter media in place of anthracite or as a post-filter adsorber. Use of GAC as a filter media requires at least 5 minutes of empty bed contact time (EBCT).
3. Ozone, which is a highly reactive gas produced on-site and injected into the water prior to filtration. It is preferable to add ozone following pretreatment rather than adding it directly to the raw water, to reduce the applied dosage and to lower the capital/operating costs.
4. Advanced oxidation (AO) utilizing a combination of high doses of UV light with hydrogen peroxide. The high required UV dose is significantly higher than can be applied by the existing UV reactors installed at the WTP, and therefore could not be used for T&O control without an expensive retrofit.

All of these options require a significant capital and operating cost investment. A PAC system will have the lowest costs and is usually the best approach for seasonal T&O control on a limited/infrequent basis. A detailed review and comparison of T&O control options is beyond the scope of this study.

Canby Utility has indicated that it does not appear necessary to include T&O control upgrades to the existing water treatment plant based on the limited events which have occurred in the past, and also due to limited customer complaints. *Therefore, no T&O control improvements are included in the recommended CIP*. However, if Canby Utility gives serious consideration to implementing pretreatment improvements at the existing water treatment plant as indicated above, it should consider also including a new PAC storage and feed system for T&O control. The impacts of PAC addition to the residuals/solids handling system should also be investigated.

CHAPTER 7

Seismic Resilience Evaluation

7.1 Introduction

Cities and purveyors throughout the region are increasingly aware of the risk to their infrastructure from potential seismic activity. Following recent seismic research which presented persuasive evidence on the imminent threat and extreme risk of a CSZ earthquake, the State of Oregon developed the ORP. The ORP established target timelines for water utilities to provide service following a seismic event. It also recognized that water providers and existing water infrastructure are currently unable to meet these recovery goals. To improve existing water systems' seismic resilience, one of the ORP's key recommendations was for water utilities to complete a seismic risk assessment and mitigation plan as part of their periodic WMP update. The State of Oregon formalized this recommendation under 333-061-0060(5)(J), and now, utilities located in seismic hazard areas are required to include a seismic risk assessment and mitigation plan in their WMPs.

The overall objective of this evaluation is to identify and document risks and establish a framework for mitigating these risks over a period of 50 years so the Utility's water system achieves a higher level of resilience to seismic events.

7.2 Key Water System Facilities

After a seismic event, it will be important to return service to critical customers and key locations as quickly as possible. The ORP developed target recovery goals for each functional category for water systems (see Figure 7-1). These time frames range from 0 to 24 hours for key facilities and limited fire suppression up to six months to one year for 90 percent distribution system operational.

The recovery goals were based on typical water systems within the Willamette Valley. The ORP recommends that individual systems establish their own target recovery goals. Canby Utility's current priority to increase system resiliency is through the development of a new long-term supply.

Figure 7-1 | States of Recovery for Willamette Valley Water Utilities

KEY TO THE TABLE

TARGET TIMEFRAME FOR RECOVERY:

Desired time to restore component to 80–90% operational	G
Desired time to restore component to 50–60% operational	Y
Desired time to restore component to 20–30% operational	R
Current state (90% operational)	X

TARGET STATES OF RECOVERY: WATER & WASTEWATER SECTOR (VALLEY)

	Event occurs	0–24 hours	1–3 days	3–7 days	1–2 weeks	2 weeks–1 month	1–3 months	3–6 months	6 months –1 year	1–3 years	3 + years
Domestic Water Supply											
Potable water available at supply source (WTP, wells, impoundment)		R	Y		G			X			
Main transmission facilities, pipes, pump stations, and reservoirs (backbone) operational		G					X				
Water supply to critical facilities available		Y	G				X				
Water for fire suppression—at key supply points		G		X							
Water for fire suppression—at fire hydrants				R	Y	G			X		
Water available at community distribution centers/points			Y	G	X						
Distribution system operational			R	Y	G				X		

7.2.1 Water System Backbone

Through a workshop process involving City staff and Canby Utility the project team identified a distribution system backbone and key facilities that should have water service uninterrupted or quickly restored after a seismic event, consistent with ORP guidelines. Critical transmission piping was identified and categorized into two tiers. Tier 1 transmission connects key facilities from the intake to Canby Police, 13th Avenue Reservoir site, and Canby Fire Station 62. Tier 2 transmission extends east from the fire station and creates a looped system to the north and the south, connecting at the intersection of 4th Avenue and Sequoia Parkway. The distribution backbone is illustrated in **Figure 7-2**.

Critical public facilities were also identified along the distribution system backbone that should have water service uninterrupted or quickly restored after a seismic event, consistent with ORP guidelines.

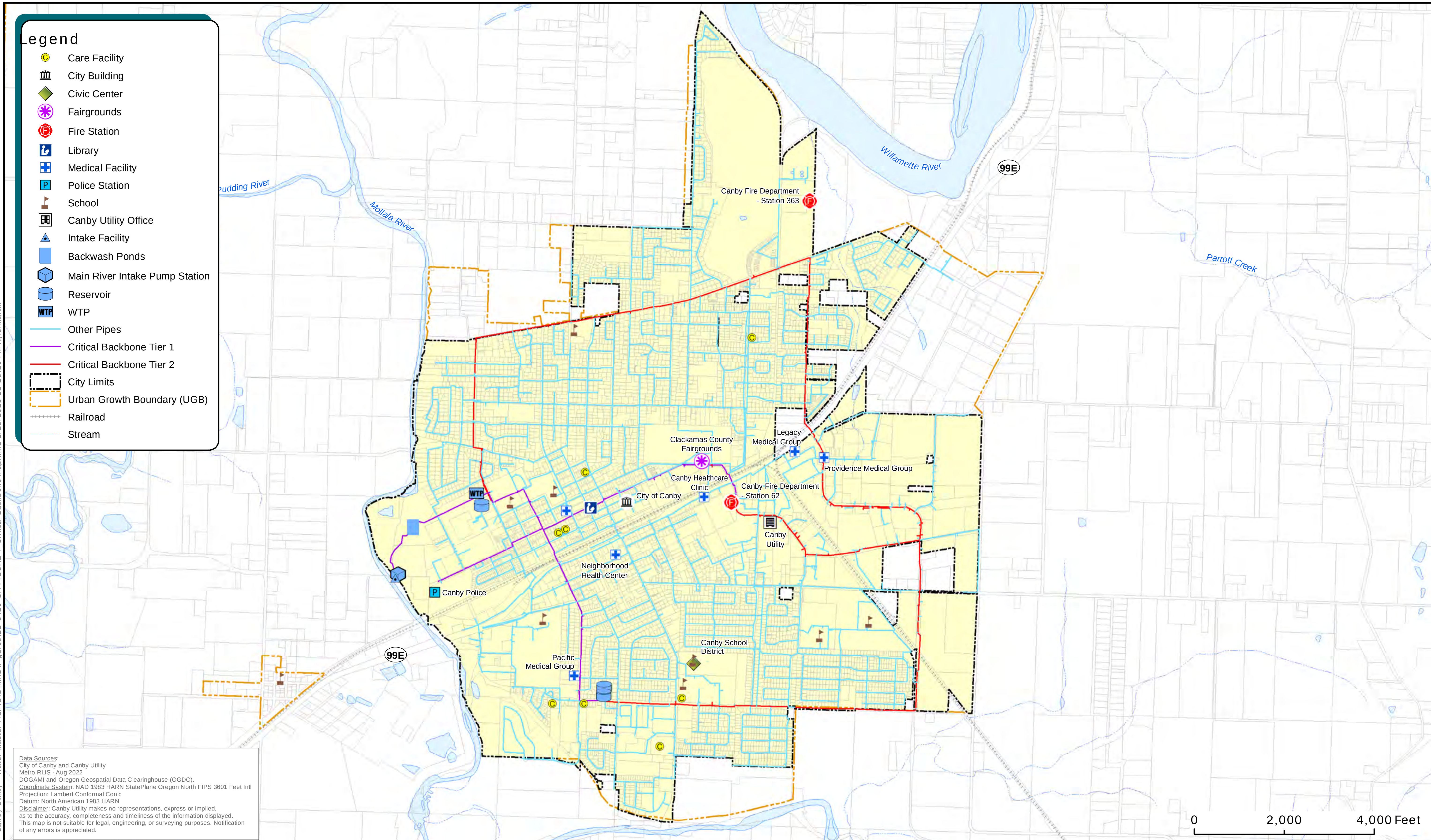
1) The Canby Police Station, located at 1175 NW 3rd Avenue, will operate as the City's Emergency Operations Center.
2) The Canby Fire Department – Station 361, located at 221 S Pine Street, is located near Canby Utility facilities and will provide the ability to respond to fire incidents.
3) The Canby Fire Department – Station 363, located at 1460 NE Territorial Rd, is located near the City shops and the future potential site of the Utility's new Willamette Treatment Plant.

The primary objective of establishing a distribution system backbone and identifying critical facilities is to focus the Utility's investment in mitigating seismic risk on facilities which will be essential to supplying drinking water to the community at discrete locations (and in limited volumes) immediately following a seismic event. Backbone mains are divided into higher-priority Tier 1 mains, which serve the most critical water system facilities and lower-priority Tier 2 mains.

7.3 Seismic Hazards Evaluation

The seismic hazards evaluation was conducted through a review of the Oregon Department of Geology and Mineral Industries (DOGAMI) seismic hazards maps. Seismic hazards were evaluated based on existing M9 CSZ earthquake hazard maps published for the Portland Metro region by the DOGAMI (Madin and Burns, 2012). For this assessment, these maps were refined for Canby Utility's water service area.

Through the review of DOGAMI seismic hazards data, estimates of strong ground shaking, liquefaction-induced settlement, lateral spreading displacement, seismic landslide slope instability were developed and are presented in **Figure 7-3**, **Figure 7-4**, **Figure 7-5**, and **Figure 7-6**.



Data Sources:
City of Canby and Canby Utility
Metro RLIS - Aug 2022
DOGAMI and Oregon Geospatial Data Clearinghouse (OGDC).
Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl
Projection: Lambert Conformal Conic
Datum: North American 1983 HARN
Disclaimer: Canby Utility makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

G:\PDX_Projects\22\3420 - Canby Utility - Water Master Plan\GIS\MXD\Figures\22-3420-OR-FIGURE 4_Critical Backbone Map.mxd 1/25/2023 12:28:29 PM Kyle.Martin

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Canby Utility
Water Master Plan

Figure **7-2**
Water System Backbone

January 2023

Reference Scale: 1:24,000

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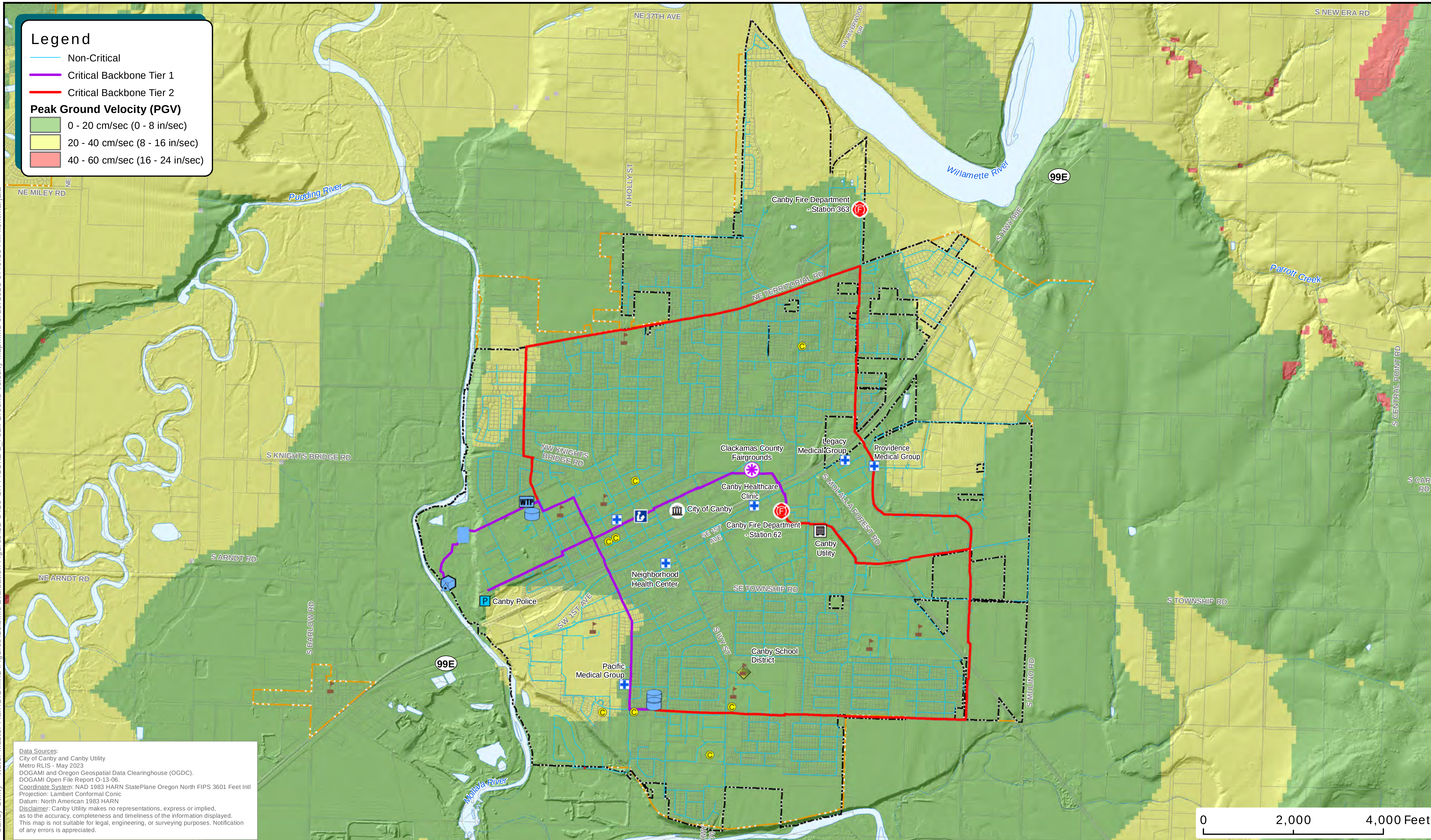

G:\PDX_Projects\22\3420 - Canby Utility - Water Master Plan\GIS\MXD\Figures\Seismic Evaluation Figures\22-3420-OR-FIGURE 2_Peak Ground Velocity Map.mxd 6/29/2023 9:40:15 AM kent.harjala

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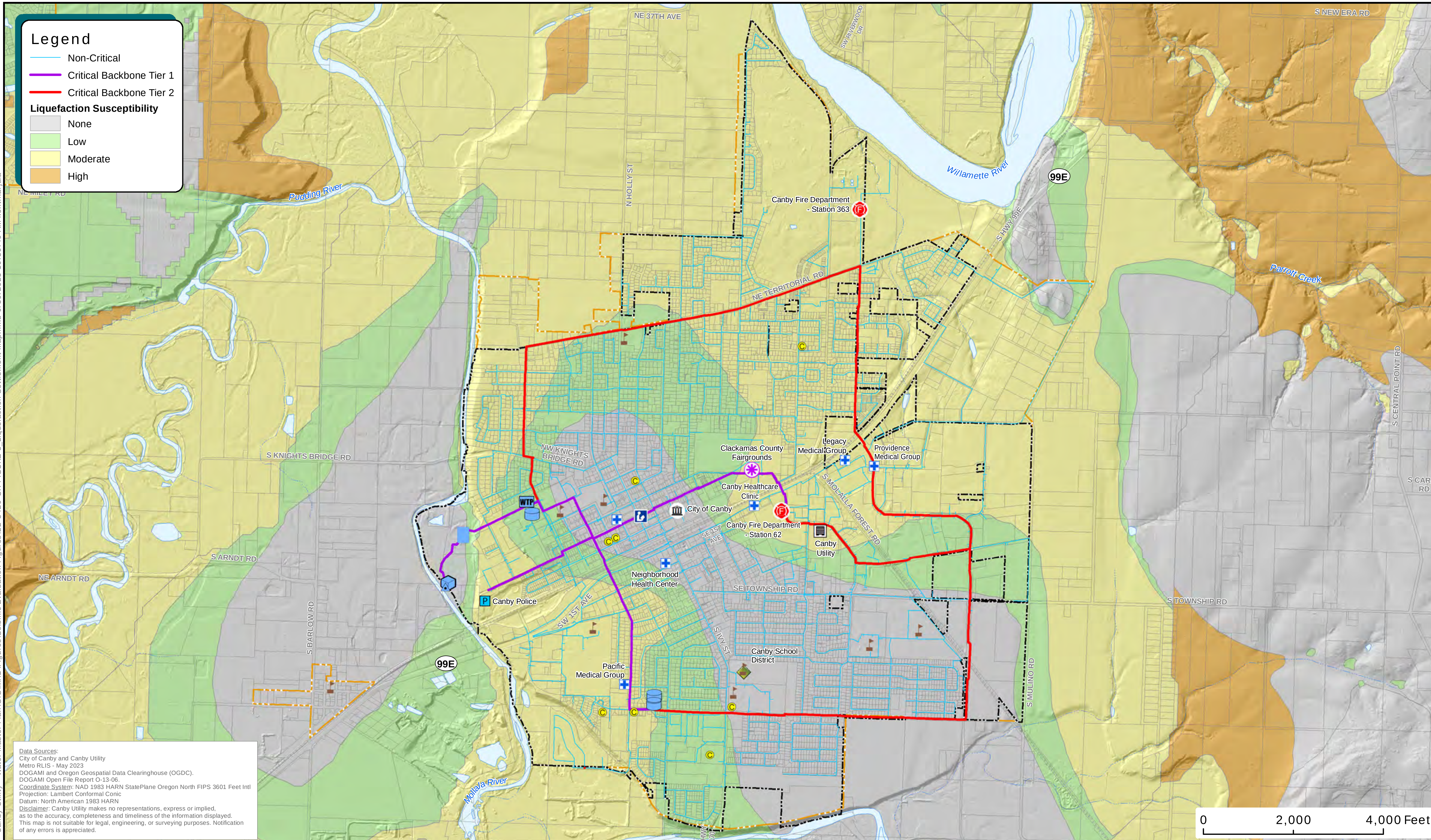
Water Master Plan Seismic Resilience Evaluation

Figure **7-3**
Peak Ground Velocity Map

June 2023

Reference Scale: 1:24,000

22-3420



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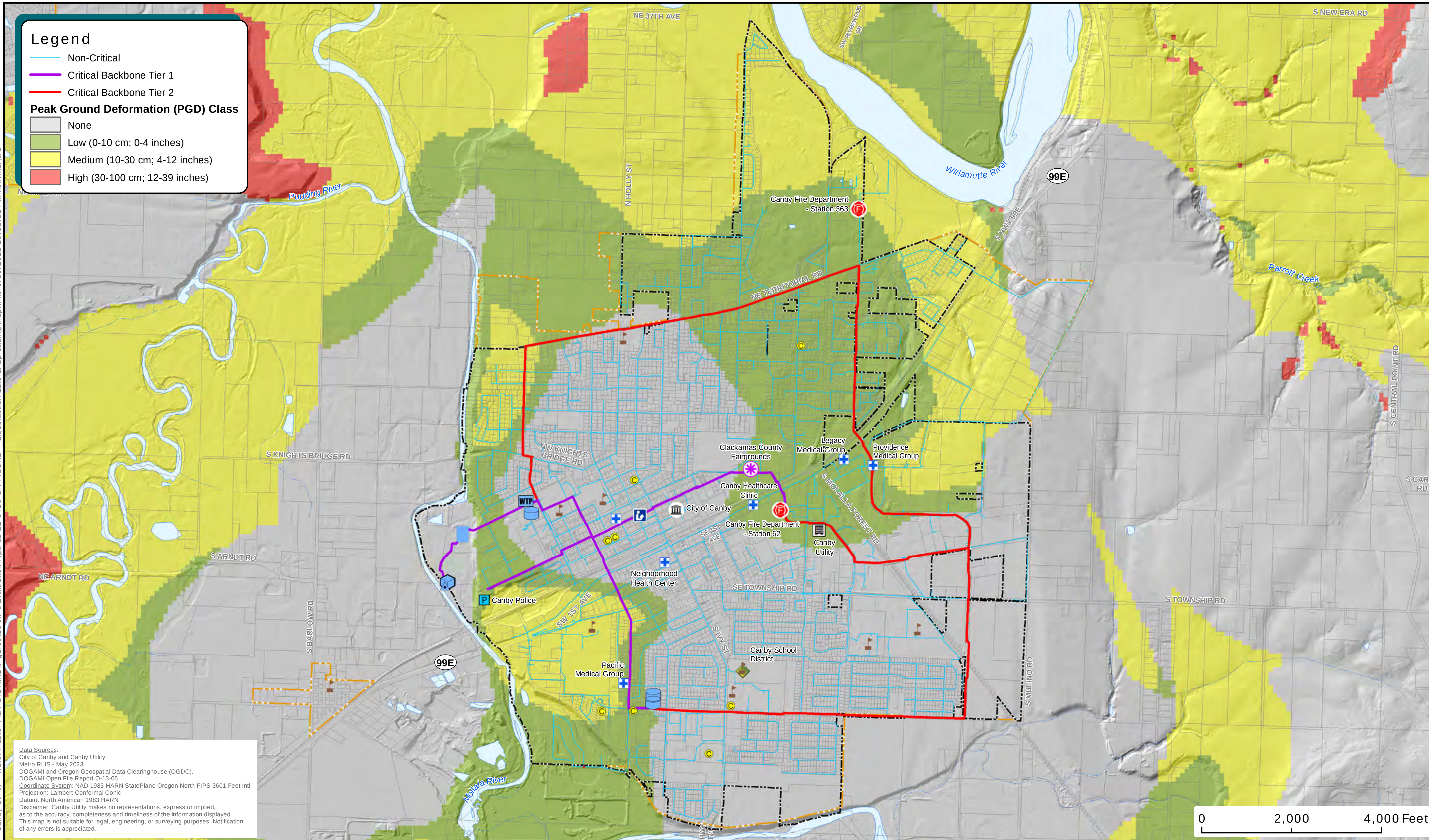
Water Master Plan Seismic Resilience Evaluation

Figure **7-4**
Liquefaction Settlement Map

June 2023

Reference Scale: 1:24,000

22-3420



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Water Master Plan Seismic Resilience Evaluation

Figure 7-5
Liquefaction
Lateral Spreading Map

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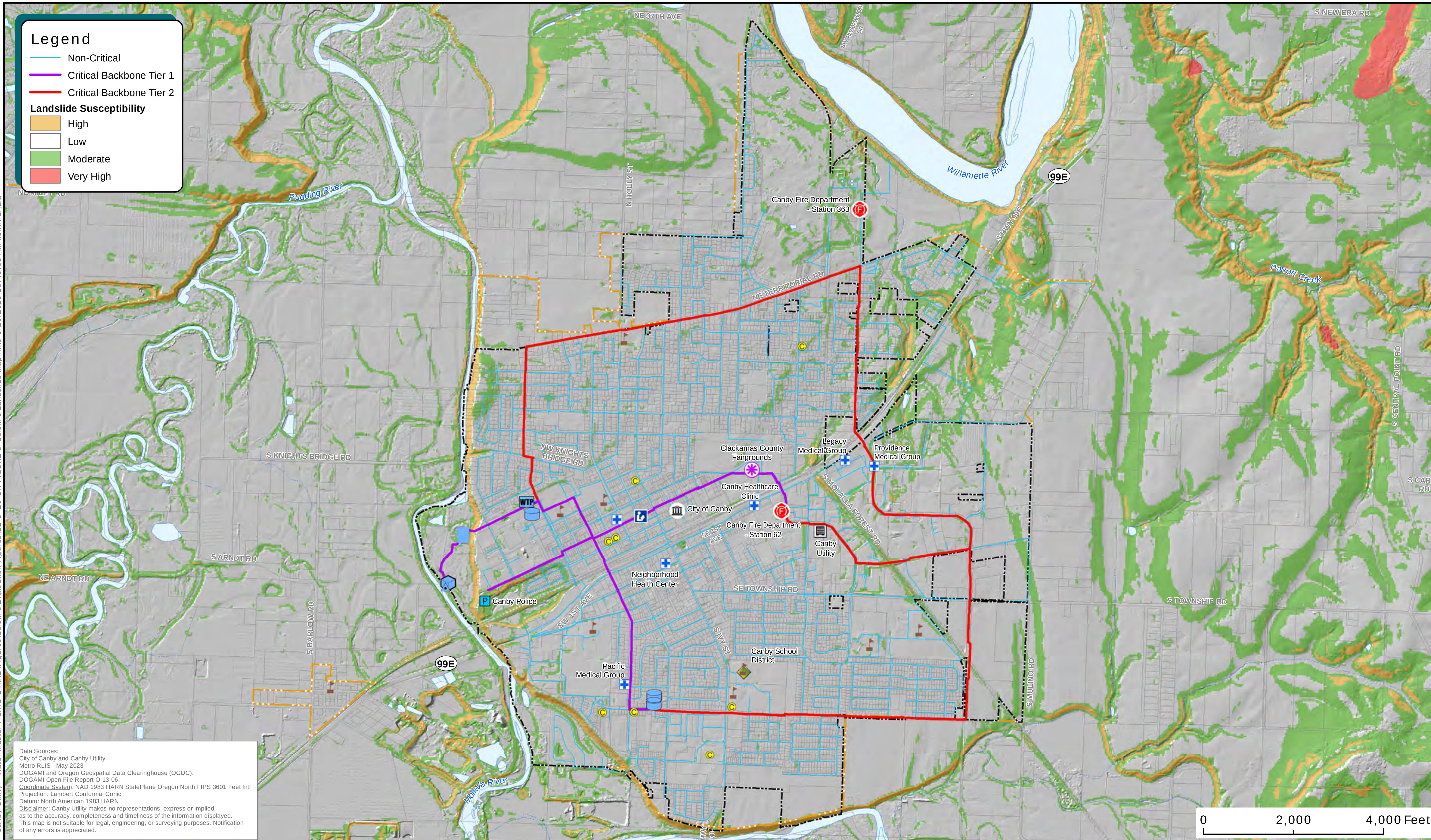
June 2023

Reference Scale: 1:24,000

22-3420



G:\PDX_Projects\22\3420 - Canby Utility - Water Master Plan\GIS\MXD\Figures\Seismic Evaluation Figures\22-3420-OR-FIGURE 5_Seismic Landslide Map.mxd 6/29/2023 10:40:05 AM kent.harjala

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Water Master Plan Seismic Resilience Evaluation

Figure 7-6
Seismic Landslide Map

June 2023

Reference Scale: 1:24,000

22-3420

7.3.1 Seismic Hazard Findings

The likelihood and relative magnitude of four seismic hazards were analyzed, as these hazards all have the potential to damage buried water mains and other water facilities.

Seismic hazards are present for the Utility's water system and discussed below.

7.3.1.1 Strong Ground Shaking

The system backbone primary is located in a low hazard zone. However, there are two areas of the backbone transmission system located in a medium zone, 1) between the intersection of N Birch St and NW 10th Ave and NW Territorial Rd, slightly east of N Birch St, and 2) along S Elm St between SW 3rd Ave and SW 6th Ave.

7.3.1.2 Liquefaction Settlement

The system backbone transmission main primarily runs through areas characterized by low to medium liquefaction settlement hazard zones. Tier 1 transmission main located in Downtown Canby and Tier 2 transmission main on the southeast end of the system are located in areas not subject to liquefaction settlement. Pipe Sections of the backbone in the Northwest, Southwest, and Northeast ends of the system are situated in areas exhibit moderate susceptibility to liquefaction.

7.3.1.3 Lateral Spreading Displacement

In general, the lateral spreading hazard is minimal over most of the system backbone. Areas of the backbone along the northeast, northwest, and southwest are primarily situated in low hazard zones, with localized areas of medium zones.

7.3.1.4 Landslide

The majority of the water system backbone is not subject to a landslide hazard. However, there is a localized area of transmission main backbone located in a high hazard zone near the backwash ponds and along tier 2 piping situated in the northeast and section of the backbone.

7.4 Pipe Fragility Analysis

Pipeline fragility describes the likelihood of pipeline damage by estimating the necessary rate of repair (RR) per 1,000 feet of main following an earthquake. The estimated RR is based on the pipe material, installation, and surrounding ground conditions. While the actual location of pipeline damage cannot be predicted, the pipeline fragility analysis provides a measure of the expected severity of damage to the water system backbone overall and may identify areas of higher relative risk where mitigation efforts should be focused first.

7.4.1 Analysis Method

This analysis focused on estimating RR for the water system backbone mains (not the entire distribution system) illustrated on **Figure 7-2**. Backbone pipeline fragility was evaluated using the pipe data in the Utility's current water system GIS data, seismic geohazards described earlier in this section, and the Seismic Fragility Formulations for Water Systems guideline developed by the American Lifelines Alliance (ALA). The ALA is a partnership between the Federal Emergency Management Agency (FEMA) and the American Society of Civil Engineers (ASCE).

The ALA guideline damage algorithms used to calculate RR per 1,000 linear feet (LF) of pipe are based on empirical evidence catalogued after major earthquakes such as the 1989 Loma Prieta Earthquake in the San Francisco bay area and the 1995 Great Hanshin earthquake in Hyogoken-Nanbu (Kobe), Japan. The guideline recommends using two pipe vulnerability functions, each of which address a different seismic hazard.

1. RR = K1 * 0.00187 * PGV

This function estimates a RR per 1,000 LF of pipe due to seismic wave propagation or ground shaking. The magnitude of ground shaking is represented by peak ground velocity (PGV).

2. RR = K2 * 1.06 * $PGD^{0.319}$

This function estimates a RR per 1,000 LF of pipe due to PGD. PGD can be the result of landslide or lateral spreading due to soil liquefaction.

In the pipe vulnerability equations above, K1 and K2 are empirical fragility constants which are used to scale the RR for different pipe diameters, pipe materials, and joint types. K1 generally represents the strength and flexibility of the pipe material to withstand ground shaking. K2 generally represents the strength and flexibility of the pipe joint to resist separation during ground deformation. A larger K value correlates with higher material or joint vulnerability.

7.4.2 Pipe Installation and Materials (K Value Selection)

The ALA seismic fragility guideline provides a range of K values which scale estimated RR for different pipe materials and joint types. K values are estimated based on empirical damage evidence from previous earthquakes. Thus, the influence of some variables, such as pipe diameter, are inconclusive based on the currently available historical water main damage data. Selected K values for the Utility's water system backbone are summarized in **Table 7-1** based on the ALA guideline.

The pipe material is generally represented by K1. Soil corrosivity also influences K1 values for cast iron and steel pipes. If these pipes are installed in corrosive soils, anticipated damage rates would be higher. Soil data from nearby areas shows that soil corrosivity is likely high throughout the Utility's water service area.

The pipe joint type is generally represented by K2. Joint type is assumed based on pipe material and common construction methods at the time of pipe installation.

Table 7-1 | Pipe Fragility K Values[1]

Pipe Material	Assumed Joint Type	Diameter	K1[2]	K2
Welded Steel	Lap - Arc Welded	Large[3]	0.15	0.15
Welded Steel	Screwed	Small[4]	1.3	0.7
PVC	Rubber Gasket	Small	0.5	0.8
Ductile Iron	Rubber Gasket	Small	0.5	0.5
Ductile Iron	Rubber Gasket	Large	0.5	0.5

Note:

1. Higher K values reflect pipe that has a greater risk of breaks and/or joint failure during a seismic event
2. K1 values depend on corrosivity. These values are recommended by ALA for all soils.
3. Large = 16-inch diameter and greater per the ALA. The ALA does not categorize 14" diameter, as such it is assumed as large.
4. Small = 4- to 12-inch diameter

7.4.3 Pipe Fragility Seismic Hazard Values

Pipe fragility RR per 1,000 LF of pipe are calculated for the following seismic hazards.

- Strong ground shaking, expressed as PGV
- Settlement due to liquefaction, expressed as PGD_{LIQ}
- Liquefaction induced lateral spreading, expressed as PGD_{LAT}
- Landslide, expressed as PGD_{LAND}

Relative potential hazard levels for each of these four hazards are shown as negligible, low, medium, and high. Specific values for PGV and PGD used in the pipe fragility RR calculations in **Table 7-2.**

Table 7-2 | Pipe Fragility Seismic Hazard Values

Seismic Hazard	Variable (units)	Low		Medium		High	
		Range	Pipe Fragility Value	Range	Pipe Fragility Value	Range	Pipe Fragility Value
Ground Shaking	PGV (inches/second)	0 to 8	4	8 to 16	12	16 to 24	20
Liquefaction Settlement	PGD_{LIQ} (inches)	1 to 4	2.5	5 to 8	6.5	>9	9
Landslide	PGD_{LAND} (inches)	0 to 12	6	12 to 48	30	>48	48
Lateral Spreading	PGD_{LAT} (inches)	0 to 4	2	4 to 12	8	12 to 39	25.5

7.4.4 Pipe Fragility Findings

Buried pipeline damage caused by ground failure (liquefaction, landslide, and lateral spreading) will be significantly more severe than damage caused by ground shaking. Empirical data used to develop the ALA's pipe fragility analysis method reveals RRs two orders of magnitude higher for damage caused by ground failure. The HAZUS methodology used by FEMA (HAZUS, FEMA Resource Webpage) to assess potential earthquake damage to buried pipelines also supports this conclusion. For pipeline repairs caused by ground failure, HAZUS assigns 80 percent of the repairs as "breaks" and 20 percent as "leaks". For ground shaking, 20 percent are considered breaks and 80 percent leaks.

In Canby Utility's service area, liquefaction settlement presents the largest risk to transmission mains. **Table 7-3** summarizes the total estimated water system backbone repairs due to both ground shaking and ground failure. Total repairs are split into potential breaks and leaks based on the 80 percent to 20 percent ratios described in the previous paragraph.

For context, this analysis indicates that the average RR for the backbone piping is 1.2 repairs per 1,000 feet of pipe. If the same RR is applied to the remaining distribution system, approximately 87 miles of pipe, the Utility should expect that there may be more than 550 required repairs following a seismic event.

Table 7-3 | Estimated Backbone Repairs

Backbone Tier	Length (LF)	Material	Diameter	Ground Shaking	Ground Failure	Total Est. Leaks	Total Est. Breaks	Total Repairs
Tier 1	2116	PVC	Small	<1	-	-	-	-
	5667	Steel	Small	<1	9	-	9	9
	1453	Ductile Iron	Small	<1	2	-	2	2
	4670	Steel	Large	<1	2	-	2	2
	414	Ductile Iron	Large	<1	-	-	-	-
	3432	Unknown[1]	Small	<1	8	-	8	8
	190	Unknown[1]	Large	<1	-	-	-	-
Tier 2	9461	PVC	Small	<1	19	3	16	19
	10639	Ductile Iron	Small	<1	16	1	16	16
	2573	Steel	Large	<1	2	-	2	2
	12305	Ductile Iron	Large	<1	8	-	8	8
	124	Unknown[1]	Small	<1	-	-	-	-
	146	Unknown[1]	Large	<1	-	-	-	-
Total	**12,770**			<1	**64**	**4**	**72**	**64**

7.5 Next Steps

While there is a need to focus on increasing the resilience of Canby Utility's piping network, beginning with the backbone and eventually extending to the entire distribution system, the Utility's current priority to increase system resiliency is through the development of a new long-term supply. As such, it is anticipated the Utility will assess this target recovery goal framework in its next Water Master Plan Update, with a goal of identifying seismic resilience projects within the next 20-year period.

Seismic resilience projects should be reassessed in the next WMP update. It is recommended that Canby Utility incorporate seismic resilience considerations into the design and prioritization of future improvements. Fully restrained pipe is recommended to maximize joint resilience during a seismic event and pipe joint design should be evaluated on a project-by-project basis.

CHAPTER 8

Recommendations and Capital Improvement Program

8.1 General

This chapter presents recommended water system improvements for the 20-year planning horizon based on the analyses and findings presented in **Chapter 5**, **Chapter 6**, and **Chapter 7**. These improvements include proposed supply source, storage reservoir, pumping facility, water line, and seismic resilience improvements. Also presented is a CIP schedule for all recommended improvements.

8.2 Cost Estimating Data

An estimated project cost has been developed for each recommended improvement project presented in this chapter. Estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule, and other factors. The Association for the Advancement of Cost Engineering (AACE) classifies cost estimates depending on project definition, end usage, and other factors. The cost estimates presented here are considered Class 4 with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Estimated project costs include approximate construction costs and an allowance for administrative, engineering, and other project related costs as well as contingencies.

The estimated costs included in this plan are planning-level budget estimates presented in 2023 dollars.

Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating the recent ENR CCI for Seattle, Washington is 15241.71 (June 2023).

8.3 Recommended Improvements

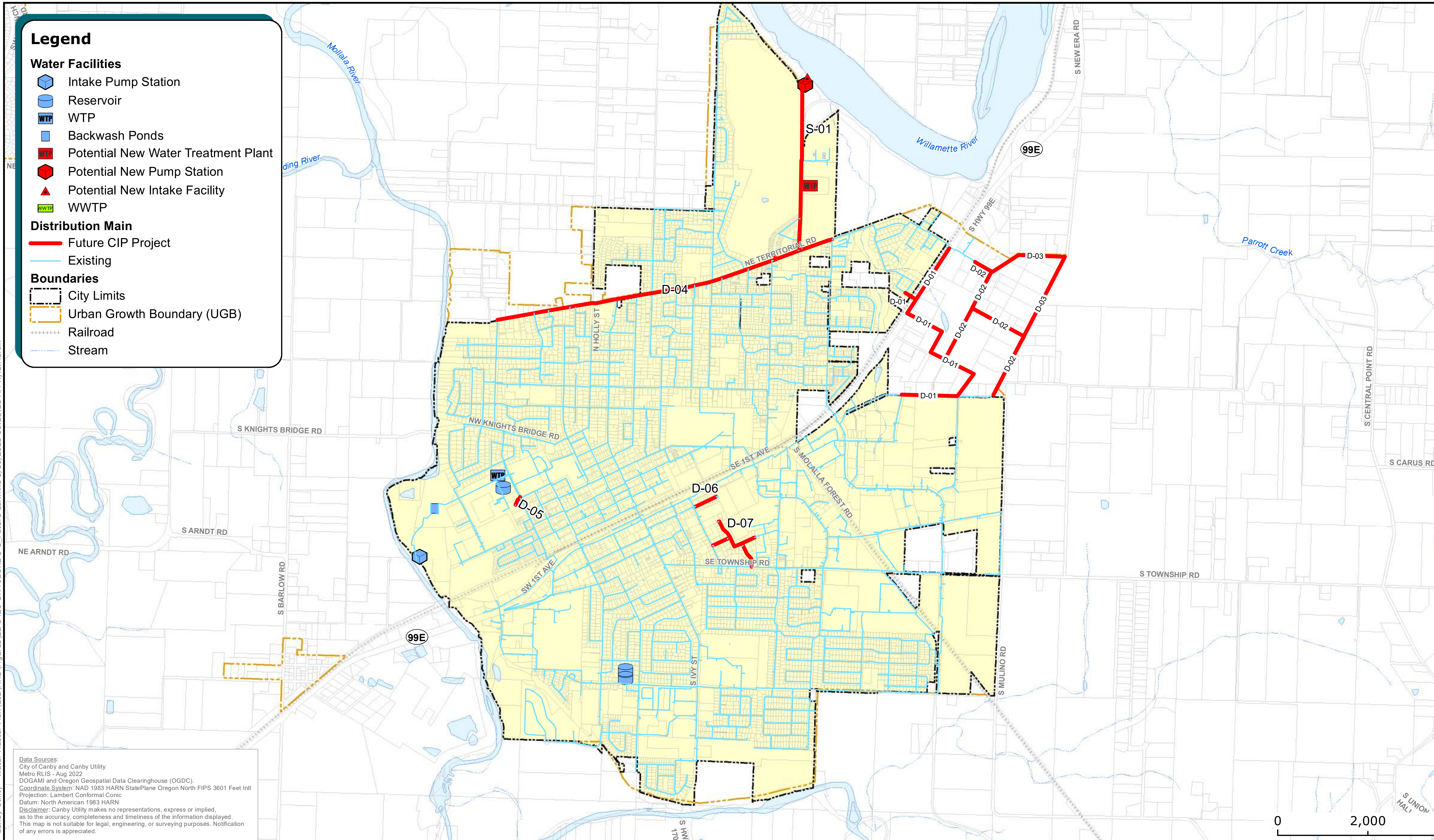
A summary of all the recommended improvements for the 20-year planning horizon is presented in **Table 8-1** and **Figure 8-1**. The CIP table provides for project sequencing by showing projects prioritized by timeframes defined as follows.

- Immediate: recommendations to be completed in the next 1 to 5 years
- Short-term: recommendations to be completed in the next 6 to 10 years
- Long-term: recommendations to be completed in the next 11 to 20 years

Estimated project costs are also summarized in **Table 8-1**. Project categories are identified with the following letter identifiers: S: Supply, TP: Treatment, D: Piping, R: Storage, PC: Pumping, PS: Planning studies, and O: Operational.

Table 8-1
Capital Improvement Program Summary

Category	Project ID	Project Description	Project Location	CIP Schedule and Project Cost Summary			
				Immediate 2024-2028	Short 2029-2033	Long 2034-2043	Estimated Project Cost
Supply	**S-1**	Secondary Source and Supply Development	New Facility for Willamette River Supply	$82,000,000			$82,000,000
			Subtotal	$82,000,000	$0	$0	$82,000,000
Treatment Facilities	**TP-1**	Pretreatment Improvements	Water Treatment Plant			$5,300,000	$5,300,000
			Subtotal	$0	$0	$5,300,000	$5,300,000
Distribution Piping	**D-01**	System Looping Improvements	SE Hazeldell way to SE Territorial, along SE 1st Ave and new Industrial Roadway Connection to HWY 99E		$5,800,000		$5,800,000
	D-02	System Looping Improvements	SE 1st Ave to SE Territorial, along S Haines Rd and S Carriage Ln		$5,200,000		$5,200,000
	D-03	System Looping Improvements	S Haines Rd and SE Territorial, from S Carriage			$3,600,000	$3,600,000
	D-04	Transmission Main Upsizing	NE Territorial between N Holly St and N Redwood St			$6,800,000	$6,800,000
	D-05	Fireflow	NW 5th Cir (Carriage Court Apartments; cul-de-sac)			$240,000	$240,000
	D-06	Fireflow	SE 2nd Ave (east of S Locust St)			$340,000	$340,000
	D-07	Fireflow	S Manzania Ct (Cul-de-sac) + 6" Steel Replacement	$1,240,000			$1,240,000
	D-08	Annual Pipeline Rehabilitation	Various	$3,000,000	$3,000,000	$6,000,000	$12,000,000
			Subtotal	$4,240,000	$14,000,000	$16,980,000	$35,220,000
Storage Facilities	**R-1**	3.0 MG Reservoir & Pump Station		$9,500,000			$9,500,000
			Subtotal	$9,500,000	$0	$0	$9,500,000
Pumping Facilities	**PC-1**	Additional Pumping Capacity	Reservoir 1 (13th Ave) Pump Station	$250,000			$250,000
			Subtotal	$250,000	$0	$0	$250,000
Planning	**PS-1**	Planning Studies	Water Management and Conservation Plan Update	$50,000		$50,000	$100,000
	PS-2		Water Rate and SDC Study	$50,000	$50,000	$100,000	$200,000
	PS-3		Water System Master Plan Update		$115,000	$115,000	$230,000
	PS-4		Preliminary Engineering Study for Improved Storage Use	$100,000			$100,000
	PS-5		AWIA Update	$20,000	$20,000	$40,000	$80,000
			Subtotal	$220,000	$185,000	$305,000	$710,000
Operational	**O-1**	Clearwell Rehabilitation	Water Treatment Plant		Cost to be determined pending PS-4		$0
	O-2	Tank 1A Rehabilitation	13th St Avenue Reservoir Site		$700,000		$700,000
	O-3	Backup Power (MTS)	Blending Vault	$25,000			$25,000
			Subtotal	$25,000	$700,000	$0	$725,000
			Capital Improvement Plan (CIP) Total	**$96,235,000**	**$14,885,000**	**$22,585,000**	**$133,705,000**
				$19,247,000 **5-year annual average**	**$11,112,000** **10-year annual average**	**$6,685,250** **20-year annual average**	



G:\PDX_Projects\22\3420 - Canby Utility - Water Master Plan\GIS\MXD\Figures\22-3420-OR-FIGURE 8-1_Future CIP.mxd 8/16/2023 11:23:25 AM Kyle.Martin

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CANBY UTILITY

Canby Utility
Water Master Plan

Figure 8-1
Future CIP Projects

July 2023

Reference Scale: 1:24,000

22-3420

8.3.1 Supply Recommendations

8.3.1.1 Willamette River Source Recommendations

An additional source of supply is required to meet demands projected to be in excess of the existing Molalla River WTP capacity (8 mgd). Based on the conceptual-level evaluation of the supply alternatives presented in **Chapter 6**, the most viable option at this time includes use of Willamette River water, withdrawn from a new intake and treated at a new WTP located in or near the City.

Canby Utility is currently authorized for the use of up to 12.4 cfs (8.0 MGD) from the Willamette River. Per discussions with Canby Utility, the Utility is currently exploring the ability to transfer existing rights from the Molalla River to the Willamette for additional usage. As such, a 10.0 mgd capacity is assumed for the new Willamette River treatment plant. Project ID S-1, Secondary Source and Supply Development, includes new treatment facilities and treatment plant pumping, a new Willamette River intake structure and raw water pumping facilities, and raw and finished water transmission piping. Budget level costs for the source improvements are provided in **Table 8-2**.

Table 8-2 | Willamette River Source (10.0 mgd Capacity) - Project Cost Estimate Summary

Supply Element	Estimated Project Cost[1]
Treatment Plant Elements	
Raw Water Intake and Pumping Facilities	$7,500,000
Transmission System[2]	$5,750,000
New 10.0 MGD WTP	$40,000,000
Subtotal	**$53,250,000**
Planning & Design Efforts	
Develop Project Implementation Plan, Procure Owner's Representative	$100,000
Complete Conceptual Design and Alternatives Analysis	$3,750,000
Permitting	$2,000,000
Final Design	$9,600,000
Contingency	$13,300,000
Subtotal	**$28,750,000**
Total (Project ID S-1)	**$82,000,000**

Notes:

1. Does not include the cost of land acquisition.
2. One mile (5280 LF) of 24" Ductile Iron Pipe assumed.

It is recommended that Canby Utility budget for a preliminary project implementation plan, including the procurement of an Owner's representative to determine the best approach to providing the additional Willamette source of supply. As part of this preliminary plan, a more-detailed assessment and comparison should be performed to further define the overall project. The budget-level cost estimate for this plan is $100,000. It is anticipated the Owner's representative would 1) develop a conceptual design, 2) perform an alternatives analysis, and 3) initiate the permitting process in parallel with this preliminary plan.

In order to have the new Willamette source online by 2030, it is recommended that Canby Utility procure Owner's representation and begin its preliminary project implementation as soon as this fiscal year.

8.3.1.2 Improvements to the Existing Water Treatment Plant

In addition to Willamette Source Supply development, Canby Utility's 2010 Water Master Plan included additional improvements to the existing Water Treatment Plant. It is recommended Canby Utility consider leveraging its existing water treatment plant and the Molalla River as a secondary source. To do so, pretreatment and possible T&O control improvements to the existing plant are recommended. A planning-level project cost estimate for pretreatment improvements to the existing water treatment plant, as discussed in **Chapter 6**, is $5,300,000 as presented as Project ID TP-1 in **Table 8-1**.

The improvements will increase the ability to treat water during high turbidity events and provide greater operational flexibility. It should be noted that the pretreatment project cost assumes that 8.0 mgd of capacity will be provided. After further review and discussion, Canby Utility may decide to reduce the pretreatment capacity to less than 8.0 mgd, which would then result in lower project costs for this improvement.

Canby Utility may also want to consider improvements to the existing water treatment plant to control seasonal T&O from the Molalla River supply. The costs for providing T&O control vary widely depending on the selected method, and no T&O control costs have been allocated in **Table 8-1**. If the decision is made to implement pretreatment improvements to the existing water treatment plant, then it may be appropriate to consider adding a PAC storage and feed system to provide seasonal T&O control. PAC is typically the lowest cost method for reducing MIB/geosmin concentrations when they occur in the raw water for seasonal/short duration periods. A review of T&O control options should be included in the preliminary engineering study which is recommended to be completed during the review of pretreatment options/methods.

8.3.2 Distribution System Improvements

The proposed improvements are limited to 1) system looping improvements (Project IDs D-01 - D-03), 2) transmission main upsizing (Project ID D-04), and 3) upsizing existing distribution mains to reduce system pressure losses under fire flow demands (Project IDs D-05 through D-07). The improvements are discussed below and summarized in **Table 8-3**. The timing of distribution piping improvements should consider both balancing the capital improvements and operations budgets, as well as taking advantage of cost-sharing opportunities associated with other utility or roadway improvements.

Table 8-3 | Distribution Piping Improvements Project Cost Estimate Summary

Project ID	Piping Element	Estimated Project Cost
D-01	Transmission piping looping: SE Hazeldell Way to SE Territorial, along SE 1st Ave and new Industrial Roadway Connection to HWY 99E	$5,800,000
D-02	Transmission piping looping: SE 1st Ave to approximately 2483 SE Territorial Rd, along S Haines Rd and S Carriage Ln	$5,200,000
D-03	Transmission piping looping along SE 1st Ave, S Haines Rd to approximately 2600 SE Territorial Rd	$3,600,000
D-04	Transmission main upsizing on NE Territorial between N Holly St and N Redwood St	$6,800,000
D-05	Pipe Upsizing at NW 5th Cir for fire flow demands	$240,000
D-06	Pipe Upsizing at SE 2nd Ave for fire flow demands	$340,000
D-07	Pipe Upsizing at S Manzania Ct for fire flow demands. Additional 6” steel pipe replacement due to existing conditions.	$1,240,000
	Subtotal	**$23,220,000**
D-08	Annual Pipeline Rehabilitation at $600,000 ($3,000,000 over five years)	$12,000,000
	20-Year Total	**$35,220,000**

D-01: Planned transmission system expansion includes completing system looping along the northeast side of the existing service area. Recommended piping improvements consist of installing new pipe as described below:

- Approximately 6,200 linear feet of 18-inch diameter ductile iron pipe from SE Hazeldell Way to SE Territorial, along SE 1st Avenue, Otto Rd, the new City-planned Industrial Roadway Connection to HWY 99E.

  Throughout the WMP development, the possibility of tying into the existing distribution system beneath the railroad tracks near N Teakwood Circle was discussed. Canby Utility intends to proceed with the addition of a casing through a City project, which will serve as a prospective tie-in point in the future.

D-02: Planned transmission system expansion includes completing system looping along the northeast side of the existing service area. Recommended piping improvements consist of installing new pipe as described below:

- Approximately 5,500 linear feet of 18-inch diameter ductile iron pipe from SE 1st Ave to approximately 2483 SE Territorial Rd, along S Haines Rd and S Carriage Ln

D-03: Planned transmission system expansion includes completing system looping along the northeast side of the existing service area. Recommended piping improvements consist of installing new pipe as described below:

- Approximately 3,800 linear feet of 18-inch diameter ductile iron pipe along SE 1st Ave, S Haines Road and to approximately 2600 SE Territorial Road.

D-04: The main on NE Territorial Rd between N Holly St and N Redwood St represents a key transmission backbone for the Utility and will become more critical with the development of the new Willamette River supply. This becomes even more critical under peak demand conditions if the existing Cedar WTP Pump Station and 13th Street Pump Station supplies are disrupted in an emergency. A project to upsize approximately 7,300 linear feet of transmission to 18-inch is included in the long-term CIP. The size (18-inch or 24-inch) and timing of this improvement should be further evaluated with the next Water Master Plan Update.

D-05 – D-07: Fire flow deficiencies are summarized in **Chapter 5**. Recommended piping improvements consist of upsizing existing piping as summarized in **Table 8-4** below. Fire flow deficiencies are recommended in Canby Utility's long-term CIP projects, as the Utility's immediate priority is the development of a new long-term primary supply source.

In addition to upsizing pipe for a fire flow deficiency, project ID D-07 includes the upsizing and replacement of additional 6" steel pipe due to existing conditions.

D-08: It is recommended that Canby Utility continue to budget for annual pipe rehabilitation. Candidates for replacement are commonly identified by operations staff based on the age and material of pipe and the frequency of line breaks or leaks. Based upon previously recommended budget levels adjusted for inflation, an average annual budget of $600,000 is recommended.

Table 8-4 | Fire Flow Improvement Projects

CIP ID	Site Description	Nearest Street / Intersection	Existing Pipe Dia.	Proposed Size	Approximate Length of Pipe (FT)
D-05	Carriage Court Apartments; cul-de-sac	NW 5th Cir	6	8	460
D-06	SE 2nd Ave east of S Locust St	SE 2nd Ave	6	8	650
D-07	Cul-de-sac	S Manzania Ct	6	8	2400[1]

Notes:

1. Includes replacement of 6-inch steel pipe, along S Locust Street, SE 4th Avenue, S Manzanita Court, SE 5th Avenue, and S Maple Street.

8.3.3 Storage Capacity Improvements

It is recommended that Canby Utility continue to construct distribution system storage reservoirs to mitigate existing and future storage deficiencies as identified in **Table 5-4.** Within the 20-year planning horizon, an additional storage capacity of 1.8 MG is required. In addition to the improvements identified in the 20-year planning horizon, under saturation development conditions an additional storage capacity of approximately 7.8 MG is required. As the storage deficiencies are primarily the result of required emergency storage, the development of redundant supply facilities should be considered to reduce the need for long-range storage improvements.

Based on the additional need past the 20-year planning horizon, a new reservoir of 3.0 MG is recommended. The storage improvements assume the construction of a primary water treatment facility supplied from the Willamette River, maintaining the Utility's existing treatment plant as a second source of supply. This secondary source of supply offers the greatest level of backup/redundancy compared to other source options available to Canby Utility, and therefore should be able to reduce the required volume of emergency storage.

Additionally, storage reservoirs constructed at-grade will require pumping stations to deliver the needed distribution system pressure and flow. As the Cedar Treatment Plant Pump Station minimum capacity criteria is the delivery of the maximum daily demand, the remaining pump stations associated with other storage facilities need to be able to deliver, at a minimum, a firm capacity equal to operational plus fire flow requirements. In order to meet this requirement, it is recommended that new at-grade storage reservoir pumping facilities have a minimum capacity equal to 2,000 gpm each in order to provide for needed system pressures throughout the distribution system and to provide a minimum reliability in system pumping capacity. A preliminary cost estimate for the new reservoir and pump station is $9,500,000 (Project ID R-1).

In order to explore the possibilities of increasing available usable storage volume in the existing storage facilities and subsequently minimize the additional storage volume required in the planning horizon, it is recommended Canby Utility conduct a preliminary engineering study for improved storage use. This study is detailed later in this section.

8.3.4 Pumping Capacity Improvements

While the existing system currently has adequate pump station capacity, it is expected to have a 2045 pump station capacity deficit of approximately 2.3 mgd (1,600 gpm) at the Cedar Treatment Plant Pump Station. This deficiency is anticipated to be addressed with the construction of the new Willamette River source facilities.

The 13th Avenue Pump Station has adequate pumping capacity to provide emergency and fire flow supply to the distribution system from ground level storage reservoirs. However, the Utility experiences peak hour demands during the summer season when there is significant early morning irrigation use. It is recommended that an additional pump be installed to 1) address peak hour demands and 2) improve long-term reliability and system resilience in the event of a disruption of the Cedar Treatment Plant Pump Station. A budgetary planning level cost estimate for an additional 1,800 gpm/75 hp pump is $250,000 (Project ID PC-1) in the immediate term.

8.4 Recommended Planning Studies

It is recommended that additional engineering studies be conducted to advance the planning work completed in this WMP to a preliminary engineering level. Periodic updating of the cost-of-service (water rate) and System Development Charge (SDC) analysis should be budgeted and conducted. Regular updates to Canby Utility's existing WMCP, American Water Infrastructure Act (AWIA) Risk and Resilience Assessment (RRA) and Emergency Response Plan (ERP), as well as this WMP, will also be required within the 20-year planning horizon. A budget level cost of $115,000 every ten years should be anticipated for Master Plan Updates (Project ID PS-3).

8.4.1 Water Management and Conservation Plan

The OAR for Public Water Systems, Chapter 690, Division 86 requires water systems with water rights to submit a WMCP that documents current water conservation measures, provide a water curtailment plan, evaluate long-term water supply planning, and provide a water rights implementation schedule. Although Canby Utility updated its WMCP in 2021, an updated WMCP will be required within the next 5 years to request authorization to use water under the Utility's Willamette River water right permit.

In addition to the WMCP update required in support of the new Willamette treatment plant, it is required that Canby Utility update its WMCP every 10 years to comply with OWRD requirements (see OAR 690-086-0125). Within the 20-year planning period it will be required for Canby Utility to complete its WMCP update in 2025 and 2035. The estimated project cost is approximately $50,000 per WMCP update (Project ID PS-1).

8.4.2 Financial Evaluation and Plan / Water Rate and SDC Study

Canby Utility may fund the water system capital maintenance and improvement programs from a variety of sources. In general, these sources can be summarized as: 1) governmental grant and loan programs, 2) publicly issued debt, and 3) cash resources and revenues. The Utility intends to prepare an updated financial plan subsequent to this WMP. Sources shall be summarized and described in the financial plan and rate study.

It is anticipated that changes in rates and SDCs will be required to keep pace with inflation and to fund the proposed improvements through build-out of the system. It is recommended that Canby Utility complete a detailed financial plan, including a water rate and SDC analysis with the completion of this WMP to determine specific funding needs and potential funding sources associated with the adopted CIP. It is recommended that these studies also provide guidance to Canby Utility on the best use of the funding options described above. A full financial plan and study in the immediate term is recommended, with a rate and SDC update every five years. A budget level cost for a full study is $50,000. It is also recommended the Utility include a budget level cost of a rate and SDC update of $50,000 every five years (Project ID PS-2).

8.4.3 Preliminary Engineering Study for Improved Storage Use

As discussed in **Chapter 2**, **Chapter 5** and this chapter, Canby Utility maintains a usable storage capacity of 4.4 MG across three reservoirs currently in operation. The Utility will need additional storage as it is expected to have a storage deficit of 1.8 MG in 2045 and ultimately a 7.8 MG deficit under saturation development conditions. It is recommended Canby Utility budget for a preliminary engineering study for improved storage use, considering the following:

- Dead storage: There is approximately 0.8 mg of dead storage at the 13th Avenue Reservoirs due to pumping limitations and 0.7 mg of unusable storage at the Clearwell resulting from seismic constraints on the reservoir. The preliminary engineering will include an evaluation of potential improvements that would increase the usable storage of these reservoirs at a lower incremental cost than construction of new storage facilities to address existing and future storage deficits.

- Clearwell rehabilitation at the existing treatment plant: The clearwell requires a new exterior and interior coating. Due to ongoing operations, it is not currently feasible to take the clearwell offline for a new interior coating. This study will also evaluate the Utility's future plans regarding treatment plant and the associated clearwell, taking into consideration the implementation of the new supply source facilities.

- Siting for a new reservoir: This study involves an assessment of various potential locations, including those currently owned by Canby Utility as well as the new treatment plant site, to identify the most suitable site for a new reservoir. This study should include further investigation of potential gravity storage at a site to the east of the current UGB.

A budget level cost for this study is $100,000 (Project ID PS-4). The study should be conducted in the next five years to verify long-term budget needs, land use acquisition requirements, and storage improvement CIP recommendations and budgets as needed.

8.4.4 AWIA Risk and Resilience Assessment and Emergency Response Plan

Canby Utility completed and certified with the United States Environmental Protection Agency (EPA) its RRA and ERP in 2021. Under AWIA Section 2013, Canby Utility is required by the EPA to review its RRA and ERP every five years, revise, if necessary, and submit a recertification.

The estimated project cost is approximately $20,000 every five years (Project ID PS-5)

8.5 Operational / Additional Improvements

8.5.1.1 Clearwell Rehabilitation

As per the guidance provided by TNEMEC representatives, it was recommended that the interior and exterior be recoated within a five-year timeframe. However, the Utility does not have the ability to take the reservoir offline. The clearwell rehabilitation (Project ID O-1) does not include a cost estimate, due to the concurrent nature of the preliminary engineering study for storage use (Project ID PS-4) and the initial planning elements for the new water supply source facilities. The cost estimate of Project ID O-1 should be evaluated after completion of Project ID PS-4. Additional piping and a new control valve will also need to be constructed to utilize the clearwell as a reservoir once the new treatment plant is online.

8.5.1.2 Reservoir 1A Rehabilitation

Visible damp spots on the reservoir continue to be apparent. DN Tanks conducted an inspection of the reservoir in November 2022. Based on the inspection, it was recommended to perform a comprehensive pressure washing and cleaning for the exterior of the wall, with an optional application of an exterior coating. Additionally, a waterproof coating was recommended for the interior of the reservoir wall. The estimated project cost is $700,000 (Project ID O-2).

8.5.1.3 Backup Power (MTS) at Blending Vault

The project involves implementing power supply and control upgrades at the blending vault. The existing setup lacks a backup power supply when coming off the transformer. To address this, a transfer switch with a backup power supply will be installed at the blending vault.

Currently, there is a 480 V power supply, but a 120 V supply is required. To achieve the necessary voltage, a transformer and circuit breaker will be added to the transfer switch. The estimated project cost is $25,000 (Project ID O-3).

8.6 Summary

This chapter presents recommendations for improvements to Canby Utility's supply source, storage reservoirs, pump stations and distribution system. The total estimated project cost of these improvements is approximately $134 million for the 20-year planning horizon. Of the improvements required in the 20-year planning horizon, approximately $111 million of these improvements are required in the next ten years. Approximately $11 million per year should be budgeted over the next 10 years for the completion of these projects. Financial planning and analysis are recommended to evaluate overall water system financial needs and to identify funding options and alternatives.