Annex J: Tualatin Valley Water District

1. Introduction

1.1. Planning Process Contact

The point of contact during the Washington County Natural Hazard Mitigation Plan (NHMP) planning process for the Tualatin Valley Water District (TVWD) was the Emergency Program Coordinator.

1.2. Annex Organization

This annex has six sections that satisfy mitigation requirements in the Code of Federal Regulations (CFR) Title 44, Part 201 (44 CFR §201):

- **Section 1:** Introduction
- **Section 2:** Planning Process
- **Section 3:** Hazard Identification and Risk Assessment
- **Section 4:** Capability Assessment
- **Section 5:** Mitigation Strategy
- **Section 6:** Action Items

The information provided in this annex is for TVWD alone. All pertinent information that is not identified in this annex is identified in other sections of this NHMP or within the respective appendices.

1.3. NHMP Adoption Process

Once the Washington County NHMP received the designation “Approvable Pending Local Adoption” from the Federal Emergency Management Agency (FEMA), TVWD presented the plan to the Board of Commissioners for final public comment and local adoption. A copy of the resolution was inserted into the NHMP and is held on file at TVWD and Washington County.

2. Planning Process

(In compliance with 44 CFR §201.6(c)(1))

2.1. Development and Adoption Process

To apply for certain types of federal aid, technical assistance, and most post-disaster funding, local jurisdictions and special districts must comply with 44 CFR §201.3, which sets forth the requirement that communities develop a plan outlining their present and proposed efforts to mitigate risks from natural hazards.

District officials recognize the benefits of having a long-term, all-hazards approach to mitigating natural hazards. The passage of the Disaster Mitigation Act of 2000 (DMA 2000) enabled District officials to recognize the benefits of having a long-term, all-hazards approach to hazard mitigation and mitigating natural hazards. The District's involvement in the Washington County NHMP represents the collective efforts of the NHMP Steering Committee members, all participating local Technical Committee members, the public, and stakeholders.

The District developed this annex in accordance with guidance outlined in 44 CFR §201.6(c)(5) of DMA 2000. The complete NHMP and this annex identify hazards and mechanisms to minimize damages associated with these hazards as they occur in the geographical service area of the District.

2.2. Organizing the Planning Effort

A comprehensive approach was taken in developing this NHMP. An open involvement process was established for the public and all stakeholders, which provided an opportunity for everyone to be involved in the planning process and make their views known.

Two teams worked simultaneously on this mitigation plan:

1. **Hazard Mitigation Steering Committee:** This committee consisted of points of contact from each plan participant. The group met to discuss countywide topics, including hazards and mitigation strategies. The points of contact were the leads of their local Technical Committee.
2. **Local Technical Committee:** Each plan participant had a Technical Committee that consisted of the Steering Committee representative for that jurisdiction or special district as well as designated representatives from within the organization. This team met to assess capabilities, hazards, and mitigation strategies within the planning area.

2.2.1. Tualatin Valley Water District Technical Committee

The TVWD annex of the overall NHMP was developed by the local Technical Committee of the TVWD with support from IEM, a consulting firm hired to assist with the planning process. The efforts of the committee, which took place throughout 2022, were led by the Emergency Program Coordinator.

Table 280: Tualatin Valley Water District Technical Committee Members for the 2023 NHMP

Position	Department	Role in Committee and Planning Process
Emergency Program Coordinator	TVWD Administrative Services	General oversight, hazard identification, and plan development
Capital Improvements Program Manager	TVWD Engineering Division	Hazard identification and plan development
Geographic Information System (GIS) Analyst	TVWD Asset Management Division	Hazard identification and plan development
Water Operations Division Manager	TVWD Engineering and Operations	Hazard identification and plan development
Risk Management Coordinator	TVWD Administrative Services	Hazard identification and plan development
Communications and Public Affairs Support	TVWD Customer Service	Communications, community outreach, education, and general support
Chief Operating Officer	TVWD COO	Strategic planning guidance and oversight

In addition, IEM participated in the following activities associated with development, approval, and adoption of the plan:

1. Facilitated the NHMP update process.
2. Based on committee direction and stakeholder and community input, prepared the first draft of the plan and provided technical writing assistance for plan review, editing, and formatting.
3. Submitted the proposed plan to the Oregon Department of Emergency Management (OEM) and the Federal Emergency Management Agency (FEMA) for review and approval and completed any edits requested by these organizations.
4. Coordinated plan adoption processes with TVWD, OEM, and FEMA.

2.3. Public Participation

Public participation is an important component of this NHMP. Public participation offers community members the chance to voice their ideas, interests, and opinions. In addition to FEMA's public participation requirement, Oregon's land use system addresses the need for public participation in Statewide Land Use Planning Goal 1, Citizen Involvement, which ensures the opportunity for the community to be involved in the planning process.

A survey regarding community perceptions of natural hazards and priorities was administered and used to help the Steering and Technical committees update their risk assessments and mitigation strategies. Community members were also provided an opportunity to comment on a draft of the NHMP. See Appendix B of the NHMP for additional information.

3. Hazard Identification and Risk Assessment

(In compliance with 44 CFR §201.6(c)(2)(i), §201.6(c)(2)(ii), §201.6(c)(2)(ii)(A), §201.6(c)(2)(ii)(B), §201.6(c)(2)(ii)(C), §201.6(c)(2)(iii), and §201.6(c)(3)(ii))

The following information serves to assist TVWD in determining and prioritizing appropriate mitigation action items to reduce losses from identified hazards.

3.1. Tualatin Valley Water District Profile

This section provides information on TVWD-specific characteristics. Additional discussion of the planning area's community characteristics is outlined in Appendix A of the NHMP.

Many of these characteristics can affect how natural hazards impact the TVWD service area and how the District chooses to plan for natural hazard mitigation. Considering TVWD-specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

The TVWD was founded in 1991 with the merger of the Wolf Creek and Metzger Water Districts and serves an estimated 224,600 customers throughout Washington County and surrounding areas that include the cities of Beaverton, Hillsboro, and Tigard.[511] The District has 133 employees, covers 26,000 acres, 40 pressure zones, 759 miles of pipe, 21 active storage reservoirs, and 12 pump

[511] Tualatin Valley Water District. (2021, December 20). Annual Comprehensive Financial Report. https://www.tvwd.org/sites/default/files/fileattachments/finance/page/2176/2021_tvwd_acfr_final.pdf

stations.[512,513,514,515] TVWD supplies an average of about 23 million gallons of water per day. The District receives approximately 72% of its water from the Portland Water Bureau (PWB). This water primarily comes from the Bull Run watershed and is piped to a 50-million-gallon storage reservoir on Powell Butte, located on the east side of Portland. Around 28% of TVWD's water comes from the Joint Water Commission (JWC), which is jointly owned by the District and the Cities of Hillsboro, Beaverton, and Forest Grove. The JWC source is comprised of water from Hagg Lake (Scoggins Reservoir) and the Barney Reservoir released into the upper portion of the Tualatin River. When flows are available, water from the Tualatin River is used. When the Willamette Water Supply System (WWSS) is operational in 2026, the Willamette River will be an additional water source. The WWSS is currently under construction and will be operational during the five-year timeframe of this NHMP. The Willamette Water Supply System Commission (WWSS Commission) is an Oregon intergovernmental entity formed by TVWD, the City of Hillsboro, and the City of Beaverton.

The WWSS Commission was formed to build the WWSS in response to planned growth in their service areas. The WWSS will provide an additional, resilient water supply for Washington County.

TVWD has been designated the Managing Agency for the WWSS Commission, and TVWD operates the Willamette Water Supply Program (WWSP) to plan, design, and construct the WWSS. When completed TVWD, as the Managing Agency, will be responsible for future mitigation planning and action. Additional information about the WWSP is in Section 7 of this annex.

[512] Tualatin Valley Water District. (n.d.). Getting Water to You. https://www.tvwd.org/district/page/getting-water-you
[513] Tualatin Valley Water District. (n.d.). Water System and Sources. https://www.tvwd.org/district/page/water-system-and-sources
[514] Carollo Engineers. (2016, May 17). Master Planning for Seismic Reliability and Resiliency: Tualatin Valley Water District. PowerPoint Presentation
[515] TVWD NHMP Planning Documentation

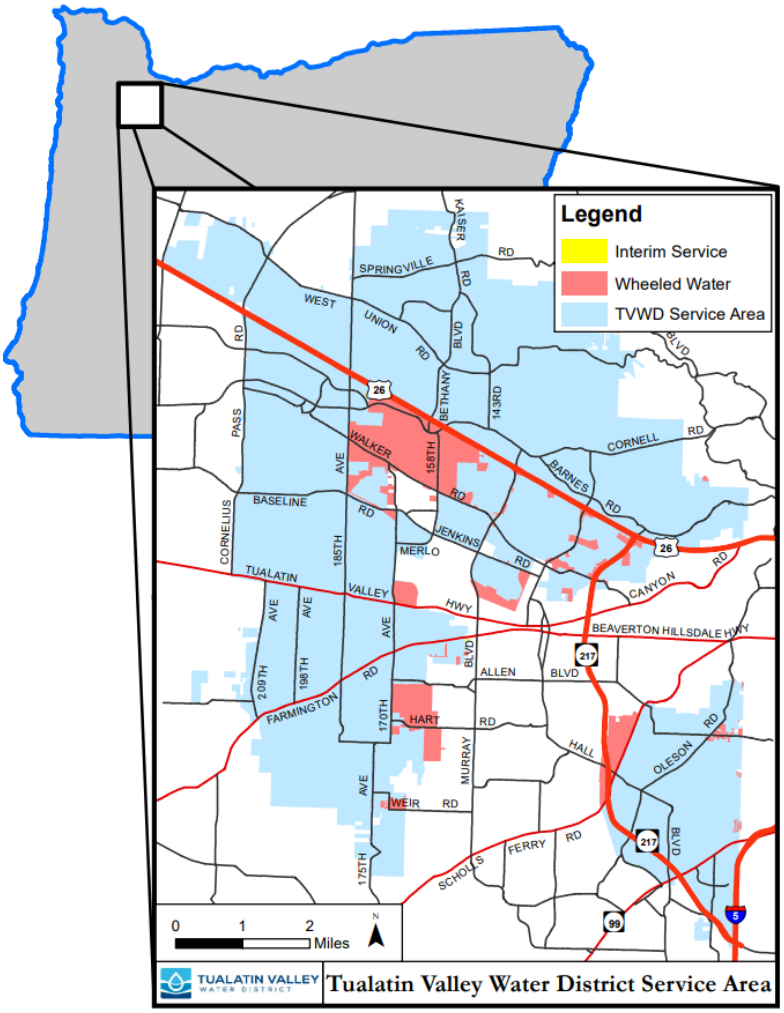

Figure 40: Tualatin Valley Water District Service Area

The District's pipes range from 2 to 60 inches, and pumping stations transmit water from the gravity flow water main to higher elevations within the service area. The gravity flow main is a 60-inch water main serving the District from Portland's Powell Butte Reservoir. The District's gravity line capacity is 42.3 million gallons per day (MGD), with another 14.5 MGD available from the JWC, an amount well above the average and peak daily flow.[516]

Within the system, there are 23 covered reservoirs with a combined storage capacity of 67.35 million gallons. Some reservoirs are belowground, with Tualatin Valley Park & Recreation District tennis courts or soccer fields built on top. The major pumping stations and the reservoirs have full telemetry control systems.[517]

The District's water system is monitored 24 hours a day, 7 days a week. In addition to watching water flows and pressure, the Supervisory Control and Data Acquisition (SCADA) system monitors several water quality parameters and security alarms. If the system identifies anything out of the ordinary, alarms alert an operator to the possible problem and staff are dispatched as needed.

[516] Tualatin Valley Water District. (n.d.). Getting Water to You. https://www.tvwd.org/district/page/getting-water-you
[517] Tualatin Valley Water District. (n.d.). Getting Water to You. https://www.tvwd.org/district/page/getting-water-you

TVWD recognizes the importance of water sector interdependencies and bases planning priorities, mitigation actions, and infrastructure development on these interconnected systems. Figure 41 is a map of these key public sector, infrastructure, and community service partners that rely on TVWD's water system to remain operational. This map has been adapted by WWSS staff from the Water Sector-Specific Plan annex to the National Infrastructure Protection Plan.[518]

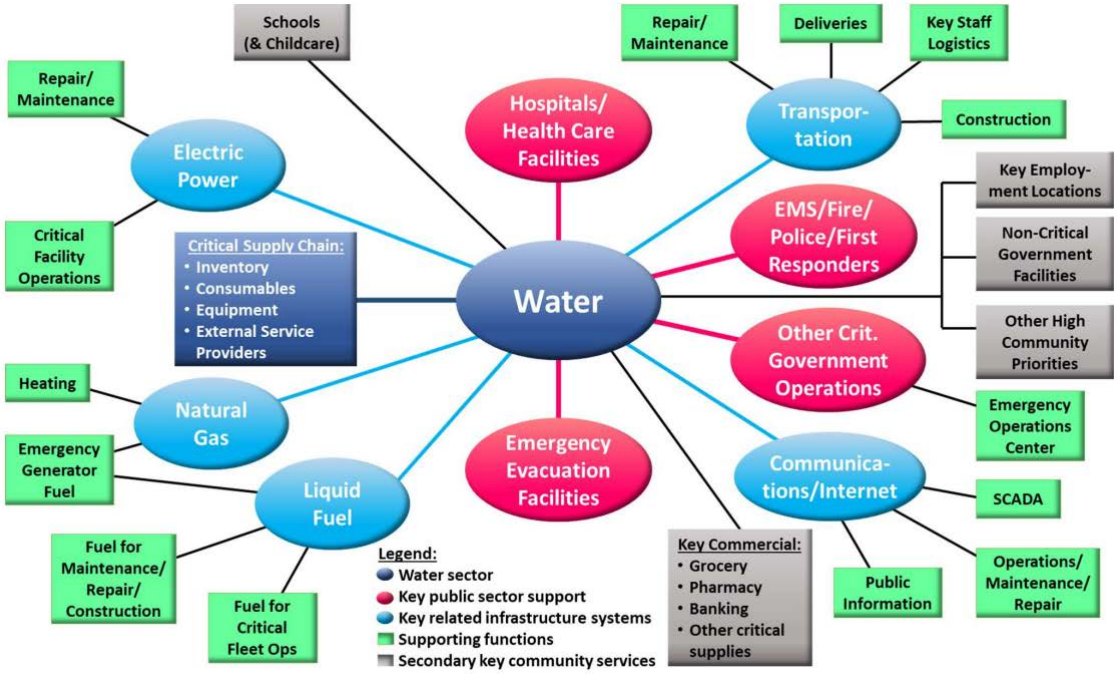

Figure 41: Tualatin Valley Water District Water Sector Interdependencies

TVWD critical and vulnerable facilities listed below in Table 281 may be vulnerable to one or more natural hazards.

[518] TVWD NHMP Planning Documentation; U.S. Department of Homeland Security and U.S. Environmental Protection Agency. (2010). 2010 Water Sector-Specific Plan: An Annex to the National Infrastructure Protection Plan. https://nepis.epa.gov/Exe/ZyPDF.cgi/P100KL4X.PDF?Dockey=P100KL4X.PDF

Table 281: Critical Facility and Asset Inventory

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
Willamette Water Supply Program Office	Infrastructure or Facility	
TVWD Headquarters		
Distribution system, pumps, and pipe system	Infrastructure or Facility	752 miles of pipe, 12 booster pump stations, 39 pressure zones, 21 active reservoirs, and aquifer storage and recovery wells
Pipes, conveyances, and intakes	Infrastructure or Facility	Encompasses the infrastructure that collects and transports water from source water to treatment or distribution facilities.
TVWD 385, 435, 385/435	Infrastructure or Facility	Zones
Cooper Mountain, intertie, pipe, and pump	Infrastructure or Facility	Zones
West Hills, intertie, pipe, and pump	Infrastructure or Facility	Zones
Metzger, intertie, pipe, and pump	Infrastructure or Facility	Zones
Storage and distribution facilities	Infrastructure or Facility	Encompasses all infrastructure used to store water after treatment, maintain water quality, distribute water to customers.
Emergency Underground Storage, WMP 8.5.4.1	Infrastructure or Facility	
Distributed Drinking Well Concept, mitigation plan to make wells more resilient	Infrastructure or Facility	Mitigation work (seismic upgrade) on existing wells and establish distribution point in proximity to the well and/or plan to haul water.
Center Street Tunnel	Infrastructure or Facility	
Grabhorn Reservoir	Infrastructure or Facility	
Generation station (fluoride)	Infrastructure or Facility	
Beaverton–Hillsdale Connection	Infrastructure or Facility	
Cornelius Pass Connection (PRV and fluoride)	Infrastructure or Facility	
Teufel Reservoir	Infrastructure or Facility	
Ridgewood View Reservoir	Infrastructure or Facility	
189th Street Pump Station	Infrastructure or Facility	

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
Goyak Pump Station	Infrastructure or Facility	
Springville Reservoirs	Infrastructure or Facility	
75th Street PRV and Fluoride Station	Infrastructure or Facility	
Taylors Ferry Reservoirs (backup connect to Portland)	Infrastructure or Facility	
Florence Lane Pump Station (Comm Hub)	Infrastructure or Facility	
Ridgewood View Reservoir (Comm Hub)	Infrastructure or Facility	
Florence Lane Reservoirs	Infrastructure or Facility	
Bonny Slope Park Reservoirs N/S	Infrastructure or Facility	
Garden Home Reservoir	Infrastructure or Facility	
North Road Reservoir	Infrastructure or Facility	
Schell Reservoir	Infrastructure or Facility	
Bull Run Connection (Florence Lane and 80th Avenue)	Infrastructure or Facility	
Somerset Reservoir	Infrastructure or Facility	
Sunset Pump Station	Infrastructure or Facility	
Sunset Reservoir	Infrastructure or Facility	
Teufel Pump Station	Infrastructure or Facility	
Thompson Pump Station	Infrastructure or Facility	
Thompson Reservoir	Infrastructure or Facility	
Inglewood Pump Station	Infrastructure or Facility	
Goyak Reservoir	Infrastructure or Facility	
Bethany Pump Station	Infrastructure or Facility	
Center Street PRV	Infrastructure or Facility	
Cooper Mountain Tanks	Infrastructure or Facility	
Inglewood Reservoir	Infrastructure or Facility	
189th Street Reservoir	Infrastructure or Facility	

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
Grabhorn Aquifer Storage and Recovery (ASR)Well	Infrastructure or Facility	
Rosander Reservoir	Infrastructure or Facility	
Cooper Mountain Pump Station	Infrastructure or Facility	
Catlin Crest Pump Station	Infrastructure or Facility	
Viewmont Pump Station	Infrastructure or Facility	
Garden Home Meter	Infrastructure or Facility	
Hoyt Park Connection	Infrastructure or Facility	
Multnomah Connection	Infrastructure or Facility	
Portable Pump (flow and eddy)	Infrastructure or Facility	
Willamette Water Supply System		
Name of Infrastructure, Facility, or Resource	**Type of Asset**	**Comments**
Intake Facilities (RWF_1.0)	Infrastructure or Facility	Under construction. Owned by Water Intake Facilities. Located in the City of Wilsonville in Clackamas County. Not vulnerable to dam failure.
Facilities, 66" Pipeline, Appurtenances (RWF_1.0)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Wilsonville in Clackamas County. Not vulnerable to dam failure.
66" Pipeline, Appurtenances (PLM_1.1)	Infrastructure or Facility	Construction complete. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Wilsonville in Clackamas County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
66" Pipeline, Appurtenances (PLM_1.2)	Infrastructure or Facility	Construction complete. Owned by TVWD and the cities of Hillsboro and Beaverton Located in the City of Wilsonville in Clackamas County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_1.3)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Wilsonville in Clackamas County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_2.0)	Infrastructure or Facility	Construction complete. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Wilsonville in Clackamas County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_3.0)	Infrastructure or Facility	Construction complete. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the cities of Sherwood and Tualatin in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
60 MGD Water Treatment Plant (WTP_1.0)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Sherwood in Washington County. Not vulnerable to dam failure, drought, or flood.
Deferred Projects (WTP_1.0)	Infrastructure or Facility	Future project. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Will be located in the City of Sherwood in Washington County. Will not be vulnerable to dam failure, drought, or flood.

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
On-Site Hypochlorite Generation (WTP_1.0)	Infrastructure or Facility	Future project. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Will be located in the City of Sherwood in Washington County. Will not be vulnerable to dam failure, drought, flood, landslide, or volcanic ash.
66" Pipeline, Appurtenances (PLM_4.1)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Sherwood in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_4.2)	Infrastructure or Facility	Future project; in bidding stage. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Will be located in the City of Sherwood in Washington County. Will not be vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_4.3)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in Washington County. Not vulnerable to drought, extreme heat, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_4.4)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Sherwood in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_5.1)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Tigard in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
66" Pipeline, Appurtenances (PLM_5.2)	Infrastructure or Facility	Construction complete. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Beaverton in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
66" Pipeline, Appurtenances (PLM_5.3)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
15 MG Reservoir, Facilities, 66" Pipeline, Appurtenances (RES_1.0)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in Washington County. Not vulnerable to dam failure, drought, or flood.
15 MG Reservoir, 66" Pipeline, Appurtenances (RES_1.0)	Infrastructure or Facility	Future project. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Will be located in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, windstorm, including tornado, or winter storm.
48" Pipeline, Appurtenances (PLW_1.1)	Infrastructure or Facility	Construction complete. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in the City of Hillsboro in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
48" Pipeline, Appurtenances (PLW_1.2)	Infrastructure or Facility	Construction complete. Owned by TVWD and the City of Hillsboro. Located in the City of Hillsboro in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
66" Pipeline, 48" Pipeline, Appurtenances (PLW_1.3)	Infrastructure or Facility	Under construction. Owned by TVWD and the cities of Hillsboro and Beaverton. Located in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
48" Pipeline, Appurtenances (PLW_2.1)	Infrastructure or Facility	Future project; in bidding stage. Will be owned by TVWD and the City of Hillsboro. Will be located in the City of Hillsboro in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
Facilities, 48" Pipeline, Appurtenances (PLW_2.2)	Infrastructure or Facility	Future project. Will be owned by TVWD and the City of Hillsboro. Will be located in the City of Hillsboro in Washington County. Not vulnerable to dam failure, drought, or flood.
48" Pipeline, Appurtenances (MPE_1.1)	Infrastructure or Facility	Under construction. Owned by TVWD. Located in the City of Beaverton in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.
48" Pipeline, Appurtenances, Facility (MPE_1.2)	Infrastructure or Facility	Under construction. Owned by TVWD. Located in the cities of Beaverton and Tigard in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, or volcanic ash.
48" Pipeline, Appurtenances (MPE_1.3)	Infrastructure or Facility	Future project; in bidding stage. Will be owned by TVWD. Will be located in the cities of Beaverton and Tigard in Washington County. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, wildland fire, windstorm, including tornado, or winter storm.

Name of Infrastructure, Facility, or Resource	Type of Asset	Comments
Fiber Optic Installation (Communications)	Infrastructure or Facility	Future project. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Will be located throughout the service area. Not vulnerable to dam failure, drought, extreme heat, flood, volcanic ash, windstorm, including tornado, or winter storm.
Emergency Spare Parts & Storage Facilities (Parts/Storage)	Infrastructure or Facility	Future project. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Location to be determined. Will likely not be vulnerable to dam failure, drought, extreme heat, flood, or volcanic ash.
ShakeAlert System (Communications)	Warning System	Future project. Will be owned by TVWD and the cities of Hillsboro and Beaverton. Location WTP_1.0. Will likely not be vulnerable to dam failure, drought, extreme heat, flood, landslide, volcanic ash, wildland life, windstorm, including tornado, or winter storm.

3.2. Natural Hazard Profiles

TVWD Technical Committee utilized the OEM's hazard analysis methodology to examine hazard vulnerability and probability by collecting information about history, probability, vulnerability, and maximum threat for each hazard that impacts the District. This methodology does not compare hazards to each other or rank hazards against each other. Instead, this process provides a sense of hazard priorities or relative risk and allows comparison of the same hazard across participants.

Each of the hazards examined by this analysis was scored using a formula that incorporates the four rating criteria, a weight factor, and three levels of severity: low, medium, and high. The score range for this methodology is 24 (lowest possible) to 240 (highest possible). For additional detail about the OEM risk and hazard analysis methodology, see Volume I, Section 2.

The scores for each hazard that impact TVWD are presented below. All natural hazards included in the NHMP have the potential to impact TVWD.

Table 282: Natural Hazard Risk Scores

Natural Hazard	History	Vulnerability	Maximum Threat	Probability	Score
Dam failure	Low	Medium	Medium	High	133
Drought	High	High	Medium	High	186
Earthquake: Cascadia (3–5-minute event)	Low	High	High	Medium	201
Earthquake: Crustal (1-minute event)	Low	High	High	Low	159
Extreme heat	High	Medium	High	High	177
Flooding, including channel migration and streambed erosion	Low	Low	Low	Medium	67
Landslide	High	Low	Low	Medium	88
Volcanic ash	Low	Medium	High	Low	119
Wildland fire	High	Medium	Medium	High	161
Windstorm, including tornado	High	Medium	Medium	High	169
Winter storm	High	Medium	High	High	206

Full descriptions of each hazard are provided in Volume I, Section 2. The potential effects of climate change on the magnitude and frequency of natural hazard events are described in each hazard description in this annex and in Volume I, Section 2.

The timeframe of data collected during the planning process for TVWD was from as far back as available to February 22, 2022. Hazard events that occurred during this period and were deemed significant by the District's Technical Committee are included in this annex's hazard profiles.

The following hazard profiles are in alphabetical order and include a brief hazard description, significant events, if applicable, and potential impacts and vulnerabilities. The potential impacts for each hazard are presented in the same order, as applicable: populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments.

3.2.1. Dam Failure

Because of the mission of TVWD, a dam failure could affect their operations and the customers they serve. Potential impacts of and vulnerabilities to dam failure are identified below.

3.2.1.1. Potential Impacts

The potential impacts of a dam failure event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- **Scoggins Dam and Reservoir:** TVWD obtains about 28% of their water from the JWC. Water is provided from Hagg Lake and Scoggins Dam and Reservoir. A dam failure could reduce the amount of water available for customers.
- **Eldon Mills Dam and Barney Reservoir:** Located at the headwaters of the North Fork Trask River. Should the dam fail, there is the potential for a reduction in water delivered from this source to their customers. The Barney Reservoir Joint Ownership Commission owns and operates the dam and reservoir. Its membership is comprised of five partners: the cities of Hillsboro, Forest Grove, and Beaverton, TVWD, and Clean Water Services.
- **Bull Run Water Shed:** Approximately 70% of TVWD's water is purchased from the City of Portland. Portland's primary source is water from the Bull Run watershed and the City uses pumped groundwater from the Columbia South Shore Well Field next to the Columbia River to augment the Bull Run supply when needed.
- **Aquifer Storage and Recovery (ASR):** During the winter when water is plentiful, TVWD stores treated drinking water underground in the aquifer surrounding the Grabhorn well on Cooper Mountain. During the hot summer months, the stored water is pumped from the aquifer to help meet peak water demands. The Grabhorn ASR well can store in excess of 300 million gallons of treated water. A dam breach could limit the amount of water available and could contaminate the aquifer storage water.

3.2.1.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD that are vulnerable to a dam failure event.

TVWD-specific vulnerabilities include:

- Staff working at all District locations and/or responding to a dam failure event, including those at indoor and outdoor facilities. Personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.
- TVWD's identified critical infrastructure.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Natural environments and acreage utilized and owned by the District.

Vulnerabilities within the TVWD service area include:

- Failure of any of the dams mentioned could adversely affect the population, economies, structures, improved property, critical facilities and infrastructure, historical and cultural resources, and natural environments of the service area via flooding and water shortages.

- The Clean Water Services Hillsboro Treatment Facility is in the potential dam failure impact area. This facility provides wastewater treatment for the cities of North Plains, Banks, the western region of Hillsboro, the southeastern portion of Cornelius, and the northwestern portion of Forest Grove. The facility cleans approximately 4 million gallons of wastewater on an average day.[519]
- The JWC Water Treatment Plant could be vulnerable to flooding created by a Scoggins Dam failure event. The plant could be vulnerable to higher-than-normal water levels and damage to infrastructure due to debris flows, which could lead to changes in the amount of water available for use.

[519] Clean Water Services. (2022). Locations. https://cleanwaterservices.org/about/locations/

3.2.2. Drought

Drought typically occurs as a regional event and often affects more than one city, county, and special district simultaneously. TVWD is a member of the JWC and has water storage reservoirs, therefore it may be impacted by drought differently than other NHMP participants. Significant events and the potential impacts of and vulnerabilities to drought are identified below.

3.2.2.1. Significant Events

TVWD identified three significant drought events.

- **1992:** During 1992, PWB and its wholesale customers, including the District, experienced severe water supply shortages for five reasons: (1) the Bull Run watershed, which serves the Portland metropolitan region, had experienced the lowest spring rainfall and stream flows since the year 1899; (2) demand for water during May and June of that year was unusually high due to record-breaking temperatures that occurred in the region; (3) reservoir levels were low, as is typical in the late summer months; (4) the PWB backup source, the Columbia South Shore wellfield, was unavailable because of concern that a contamination plume would move into the well field aquifer if those wells were used; and (5) voluntary requests to reduce water use were not effective. (Similar shortages also occurred in 1952, 1987, and 1991.)
- **2001:** The summer of 2001 was not particularly hot, but Hagg Lake filled to only 51%. As a result, all municipalities using supplies from the JWC were asked to curtail use in order to leave supplies for more senior irrigation water rights, as well as to leave adequate water supplies for instream use. Evaporation in the lake during the summer further reduced municipal supplies. The District was able to meet its customers' demands by purchasing additional water from the City of Portland.
- **April–August 2021:** April was the driest April on record since 1941. May had only 6 days of measurable rain. There was a heat dome in June 2021. The temperature reached 116 degrees Fahrenheit (°F) on June 28. Dry weather and heat continued until rain in September 2021. There was heat sheltering of staff and restricted operations.

3.2.2.2. Potential Impacts

The potential impacts of a drought event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Reduction or loss of water supply, water use restrictions, and lack of potable water supply.
- Health effects, including increased heat-related, waterborne, and cardiorespiratory illnesses, as well as mental health conditions.
- Reduced economic productivity or business closures, including agriculture, livestock, recreation, energy, tourism, timber, and fisheries.
- Supply chain restrictions, including food shortages.
- Loss of power or reduced availability of electricity due to infrastructure damage and high demand.
- Property and infrastructure damage due to expansive soils, which are clay-based soils that expand and contract based on the amount of moisture in the soil.
- Damage to natural environments, including low water levels in lakes, rivers, and other water bodies, reduced plant growth, local species reduction or extinction, increased water temperature, and deteriorated water quality, which may result in fish kills and increased waterborne pollutants.
- Concurrent hazards, including extreme heat, wildfire, flooding, and landslides.

The District has adopted a four-stage Water Curtailment Plan to be invoked in the event of a water supply shortage. These stages are designed to be initiated and implemented in progressive steps. The plan includes both voluntary and mandatory rationing, depending upon the cause, severity, and anticipated duration of the shortage. The four stages and their initiating conditions are presented below. Curtailment could be initiated by any of the corresponding initiating conditions.

Table 283: Water Curtailment Event Triggers and Stages[520]

Curtailment Stages	Initiating Conditions
Stage 1: Routine Summer Advisory	• Portland Water Bureau (PWB) issues a "notice of drawdown," announcing the release of stored water in the Bull Run System. • PWB activates groundwater wells as part of its supplies. • Hagg Lake fails to fill 100% by May 1. • Barney Reservoir fails to fill 100% by May 1. • The JWC issues a "notice of drawdown," announcing the release of stored water.
Stage 2: Moderate Water Supply Shortage	• PWB is operating under a warm-dry scenario. • Hagg Lake is filled to less than 80% before May 1. • District customer use reaches contractual and/or facility capacity for seven consecutive days.
Stage 3: Severe Water Supply Shortage	• PWB has only groundwater sources available. • PWB cannot meet supply demands of wholesale customers. • JWC reservoirs drop below 40% of "normal conditions"; under such circumstances JWC enacts mandatory curtailment for its members. • Water supplies fail to meet U.S. Environmental Protection Agency Safe Drinking Water Act standards. • The District's distribution system experiences a significant and sustained reduction of water pressure. • District customer use reaches contractual and/or facility capacity for 14 consecutive days.
Stage 4: Critical Water Supply Shortage	• PWB offloads (i.e., ceases serving) the District from its system and JWC cannot meet the District's resulting additional demands for water. • JWC offloads the District from its system, and PWB supplies cannot meet the District's resulting additional demands for water. • Water supplies from the JWC or the PWB are either physically cut off or otherwise become unavailable. • District customer use reaches contractual and/or facility capacity for 28 consecutive days.

[520] Tualatin Valley Water District. (n.d.). Municipal Water Curtailment Element. https://www.tvwd.org/sites/default/files/fileattachments/district/page/2157/tvwd_curtailment_plan.pdf

3.2.2.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to drought. This includes:

- Staff with preexisting health conditions, staff without access to clean water, and staff who are pregnant women and/or older adults.
- TVWD's identified critical infrastructure.
- Water sources used by the District.
- Natural environments and acreage utilized and owned by the District.

3.2.3. Earthquake

The District could experience earthquakes that originate from the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek Fault Zone. It could also experience liquefaction and coseismic landslides as the result of an earthquake. Potential impacts of and vulnerabilities to earthquake are identified below.

3.2.3.1. Potential Impacts

The potential impacts of an earthquake event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Mental health impacts, including post-traumatic stress disorder.
- Public health hazards resulting from disruption of drinking water and wastewater systems.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage to ground utilities; residential, public, and private buildings; and transportation systems above and below.
- Disruption of essential infrastructure systems, such as power systems, public utilities, and telecommunications.
- Blocked roads and rail transportation routes due to debris from trees and damaged property, ground deformation, and liquefaction.
- Downed or damaged powerlines that can lead to wildfires.
- Power outages and natural gas leaks.
- Hazardous material releases due to infrastructure and facility damage.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Change in water flows, including paths of rivers and streams.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards initiated by an earthquake, including flood, wildland fire, and landslide.

3.2.3.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to earthquakes. This includes:

- Staff working at all District locations: The personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.
- TVWD's identified critical infrastructure, particularly the TVWD Headquarters building.[521] The District has done significant planning for seismic reliability and resiliency. Vulnerable facilities and infrastructure, anticipated damage to storage and pumping facilities, anticipated damage to pipelines, estimation of system leakage, and estimation of "time-to-drain" have been evaluated and the findings are on file at TVWD.
- Other critical infrastructure, including power sources and emergency generators.
- The Critical Infrastructure Hub (CEI Hub) is vulnerable to an event, and if damaged, TVWD's ability to obtain fuel could be significantly affected and water supplies may become contaminated. The CEI Hub is a six-mile area in Northwest Portland along the Willamette River. More than 90% of the state's liquid fuel supply is transported through CEI Hub facilities, including gasoline and diesel. Roughly 70% of the fuel arrives by pipe and another 30% arrives by tanker barge. In addition to the fuel storage facilities, the CEI Hub also contains liquid fuel and natural gas pipelines and transfer stations, a liquefied natural gas storage tank, storage of other non-fuel materials, a high-voltage electrical substation, and transmission lines.[522]
    - The CEI Hub is located on top of a high-risk liquefaction zone, as the NW Industrial Area was developed on top of the Willamette River Floodplain. In total, 397 tanks could release stored materials as a result of a Cascadia Subduction Zone earthquake. Based on tank age and location, approximately 365 tanks could release 50 to 100% of their materials, and 32 tanks could release up to 10% of stored materials. Together, the total potential releases from the materials stored in tanks at the CEI Hub range from 94.6 million to 193.7 million gallons. Approximately 57% of the total potential releases would be released onto ground, and 43% have the potential to flow into the Willamette River.[11]
    - A fire at the CEI Hub involving the fuels stored on-site is a likely scenario following a Cascadia Subduction Zone earthquake. Many fuel storage tanks have a metal floating lid which in an earthquake could scrape against the metal perimeter, creating a spark and potentially a fire. Fires within tanks could result in large explosions, further threatening people, property, and environmental resources. There are also power lines throughout the CEI Hub which could fall due to the earthquake and serve as a potential ignition source.[11]
    - Of the 393 active tanks that are not empty and have known contents at the CEI Hub, 200 tanks (approximately 51%) have materials that are known to be flammable. Based on the total estimate of releases, approximately 93% of releases will be of flammable materials. The total capacity of tanks with flammable materials is 298.7 million gallons. Therefore, the contents of these tanks all have the potential to burn, either on land or in the water. Because burning requires both a fuel and an ignition source, the specific amount of materials that would burn are a function of location and event-specific factors.[523]
- Areas near the epicenter of an earthquake event are likely to incur a significant amount of damage to all buildings, infrastructure, facilities, and property.

[521] Carollo. (2019, January 27). R&R Assessment and ERP Update: America's Water Infrastructure Act (AIWA) Compliance, Workshop #4 presentation.
[522] Portland Bureau of Emergency Management. (2022, April). The Mitigation Action Plan. https://www.portland.gov/sites/default/files/2022/mapfulldraft_6-15.pdf
[523] Portland Bureau of Emergency Management. (2022, April). The Mitigation Action Plan. https://www.portland.gov/sites/default/files/2022/mapfulldraft_6-15.pdf

- Buildings with very high or high collapse potential include those constructed prior to 1990.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Natural environments and acreage utilized and owned by the District.

3.2.4. Extreme Heat

Due to a rise in the frequency and severity of extreme heat events and the impacts from those events, the NHMP Steering Committee chose to include this hazard for the first time in the Washington County NHMP. Significant events and the potential impacts of and vulnerabilities to extreme heat are identified below.

3.2.4.1. Significant Events

Extreme heat was not included in previous NHMPs. TVWD identified one significant extreme heat event.

- **June 25–30, 2021:** An unprecedented heat dome enveloped the City of Portland, which is in the TVWD service area, reaching a record-breaking peak temperature of 116 °F on June 28. This surpassed the previous day's record high of 112 °F, which in turn broke the record set the day before of 108 °F. These temperatures reached around 30 to 40 °F higher than the average normal temperatures for these days in previous recorded years. The Governor declared a state of emergency in several Oregon counties. The heat caused roads and sidewalks to crack and forced closures of the Portland Streetcar public transit system. Portland's Bureau of Emergency Communications saw a surge of 911 calls, receiving over 240 calls related to heat incidents between June 24 and June 30. Multiple deaths were recorded due to heat.

3.2.4.2. Potential Impacts

The potential impacts of an extreme heat event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Heat illnesses, including heat rashes, heat cramps, heat exhaustion, heat stroke, and death.
- Extended operational hours of TVWD staff and additional resources needed for response to the event, including the operation of daytime cooling centers and overnight cooling shelters.
- Strain on or loss of water supply due to increased demand.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Economic losses from decreased worker efficiency and effectiveness and time lost on the job when workers take more frequent or longer breaks to avoid overheating.
- Economic impacts of closure of outdoor activities and events, such as farmers markets and concerts.
- Property damage, such as roof expansions, leading to warped, cracked, and leaking shingles; dry, cracked, and leaking caulking around flashing and joints; cracked foundations; excessive drying of wood structures; and melted siding.
- Disruption of essential infrastructure systems from overheated and damaged utilities, including power, water, transportation, and communication systems.
- Impacts to roadways as heat expands concrete or causes cracking and buckling. Public transit can also be impacted due to melted cables, sagging wires, and warping tracks.
- Damage to crops, livestock, vegetation, parks, and natural systems.

- Impacts to greenspaces, such as scorch and sunscald of new foliage, branches or tops of trees dying, and significant stress and die-off of native trees, particularly Douglas fir and cedar. These impacts are intensified if drought is also occurring.
- Concurrent hazards include drought and wildland fire.

3.2.4.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to extreme heat.

Populations substantially vulnerable to extreme heat include:

- Staff who work or spend a significant amount of time outdoors, including those in operations and maintenance.
- Staff who live and/or work in buildings without air conditioning or cooling equipment.
- Staff living, working, or spending time in heat islands within the District's service area.
- Staff with higher heat sensitivity, including older adults, pregnant women, people with preexisting or chronic diseases, and those who take certain medications that affect thermoregulation or block nerve impulses.
- TVWD's identified critical infrastructure.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Vehicles, including District maintenance vehicles, are vulnerable to engine overheating and tire deterioration.
- Aboveground utility and power lines can droop or sag and create a heightened fire risk to staff and District facilities.
- Natural environments and acreage utilized and owned by the District.

3.2.5. Flooding, Including Channel Migration and Streambed Erosion

Flooding to a greater or lesser degree is fairly common in the county, and events typically occur from October through April. As the District is a planning participant whose assets are widely dispersed, its vulnerability to flooding may vary from site to site. The District experiences occasional localized flooding, but historically events have not been significant or severe. Potential impacts of and vulnerabilities to flooding are identified below.

3.2.5.1. Potential Impacts

The potential impacts of a flooding event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Public health concerns, such as the spread of infectious diseases, exposure to hazardous materials and debris, and water quality issues.
- Need for widespread search and rescue operations, including water rescues.
- Displaced residents in need of sheltering.
- Delayed emergency response times and disruption of traffic due to high water, debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal economic impacts of loss of income and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Damage to crops, livestock, vegetation, and parks.

3.2.5.2. Vulnerabilities

TVWD-related population, economic, built environment, critical facility, infrastructure, and natural environment vulnerabilities to flooding include:

- Staff working at all District locations, including indoor and outdoor facilities. Personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.
- TVWD's identified critical infrastructure.

- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Natural environments and acreage utilized and owned by the District.

3.2.6. Landslide

There are several steep slopes in the District's service area; however, they are located outside of TVWD's purview. As such, the District's Technical Committee identified potential landslide impacts to be minimal and secondary. Potential impacts of and vulnerabilities to landslides are identified below.

3.2.6.1. Potential Impacts and Vulnerabilities

The potential impacts of and vulnerabilities to a landslide event are identified below. The type, magnitude, and extent of these can vary based on the scale of the event.

- TVWD's identified critical infrastructure, particularly the TVWD Headquarters building.[524]
- Areas and infrastructure located on or near steep slopes.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Natural environments and acreage utilized and owned by the District.

[524] Carollo. (2019, January 27). R&R Assessment and ERP Update: America's Water Infrastructure Act (AIWA) Compliance, Workshop #4 presentation.

3.2.7. Volcanic Ash

Volcanic activity is possible from mountains near the County. It is anticipated that ashfall from a volcanic eruption from Mount St. Helens or Mount Hood has the potential to impact the District. The scale and types of impacts and vulnerabilities may differ depending on which volcano erupts; the level of eruption; the wind direction during and after eruption; and other weather conditions. Potential impacts of and vulnerabilities to volcanic ash are identified below.

3.2.7.1. Potential Impacts

Though it is unlikely that an event of this type will occur, the impacts of a significant ash fall could be substantial. Impacts may include:

- Indirect injuries and deaths, such as those sustained during ash cleanup operations or in traffic accidents.
- Short-term health effects, including respiratory effects.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation. This includes public water systems that rely on outdoor reservoirs.
- The need to shelter individuals to protect them from poor air quality, including houseless persons and persons displaced from their residences due to poor residential air filtration systems.
- Delayed emergency response times due to decreased visibility and increased traffic hazards.
- Extended operational hours of TVWD staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and cleanup activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, drainage systems, telecommunications, and transportation routes.
- Downed or damaged powerlines can lead to wildfires.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.7.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to volcanic ash. This includes:

- Staff who experience chronic lung problems and/or preexisting health conditions or are older adults.
- Staff working at all District locations, including indoor and outdoor facilities. Personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.

- Staff without access to effective dust masks, eye protection, and drinking water and food uncontaminated by ash.
- TVWD's identified critical infrastructure.
- Other critical infrastructure, including emergency generators and powerlines.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Water sources used by the District could become contaminated.
- Natural environments and acreage utilized and owned by the District.

3.2.8. Wildland Fire

Although the District could experience a wildland–urban interface event, historically it is more likely to be affected by smoke and poor air quality due to wildland fires outside its boundaries. Potential impacts of and vulnerabilities to wildland fire are identified below.

3.2.8.1. Significant Events

TVWD has not been directly impacted by a wildland fire event in recent history; however, it experienced effects from two events that occurred outside the County.

- **September 2–November 30, 2017:** The Eagle Creek Fire was located approximately 45 miles east of Washington County. The fire burned 50,000 acres and the Air Quality Index (AQI) daily average in the County reached as high as 99 particulate matter 2.5 micrometers or smaller ($PM_{2.5}$) during the event.
- **September 2020:** Multiple wildfires throughout Oregon and Washington caused some evacuees to come into the County. The AQI daily average in the County reached as high as 328 $PM_{2.5}$ during the month.[525] During these events, Washington County residents and evacuees were required to take protective actions, such as staying indoors with the doors and windows closed, using air-cleaning filters indoors, and wearing goggles and face masks when outside.

3.2.8.2. Potential Impacts

The potential impacts of a wildfire event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Exposure to wildfire smoke, which can lead to eye, nose, and throat irritation and the worsening of chronic heart and lung diseases.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to blocked transportation routes and debris, congested transportation routes due to evacuations, and damaged infrastructure and vehicles.
- Extended operational hours of TVWD staff and resources needed for response to the event.
- Strain on or loss of water supply due to increased demand.
- Economic impacts to governments, including costs for fire suppression, staff, equipment, supplies, transportation and mobilization of first responders, evacuations, sheltering operations, post-fire recovery, and rebuilding costs associated with government-owned buildings, property, and infrastructure.
- Economic impacts, including loss of local revenue due to business and property tax losses, agriculture production losses, and reduced recreation and tourism activity. Scoggins Valley Park receives one million visitors a year, most during summer, which is when wildland fires tend to occur.

[525] Air Quality Historical Data Platform. (n.d.). City of Beaverton data. https://aqicn.org/data-platform/register/

- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property, causing blocked road and rail transportation routes.
- Downed or damaged powerlines. This impact may be compounded since powerline failures can lead to additional wildfires.
- Power outages and natural gas leaks.
- Hazardous material releases due to infrastructure and facility damage.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including air and water quality issues. Landslide and erosion issues are common following a wildland fire.

3.2.8.3. Vulnerabilities

Given the dynamic nature of wildland fires, all populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to this hazard. This includes:

- Staff who experience chronic lung problems and/or preexisting health conditions or are older adults.
- Staff working at all District locations, including indoor and outdoor facilities. Personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.
- First responders and other personnel working directly on fire protection, suppression, and patrols or near a wildfire can experience burns, smoke exposure, heat-related impacts such as heat stroke, heat exhaustion, dehydration, physical fatigue, mental health challenges, injuries, and death.
- TVWD's identified critical infrastructure.
- Other critical infrastructure, including emergency generators and powerlines.
- Areas and infrastructure located in the wildland/urban interface.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Water sources used by the District could become contaminated.
- Natural environments and acreage utilized and owned by the District.

3.2.9. Windstorm, Including Tornado

TVWD covers 23,000 acres and wind damages could be spread out and significant. Significant events and potential impacts of and vulnerabilities to windstorm, including tornado, are identified below.

3.2.9.1. Significant Events

TVWD identified two significant windstorm events.

- **October 12, 1962:** The "Columbus Day Storm" is the most destructive storm to ever occur in Oregon in recorded history, both in loss of life and property damage. The storm killed 38 people and did upwards of $200 million in damage. Hundreds of thousands of homes were without power for short periods of time, while others were without power for two to three weeks. More than 50,000 homes were seriously damaged and nearly 100 were completely destroyed. Entire fruit and nut orchards were destroyed, and livestock were killed as barns and trees blew over onto animals. Intense wind speeds were recorded in the metropolitan areas, with gusts of 116 mph on the Portland Morrison Bridge.
- **November 13–15, 1981:** Two cyclone-related windstorms hit the Pacific Northwest in quick succession. The strongest winds in Oregon were on November 14, with 85-mph gusts on the Morrison Bridge. Hundreds of thousands lost power, and 12 people died throughout Oregon and Washington.

3.2.9.2. Potential Impacts

The potential impacts of a windstorm event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Extended operational hours of TVWD staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems. Significant damage could lead to the complete loss of structures or totaled vehicles.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked road and rail transportation routes.
- Downed or damaged powerlines can lead to wildfires.
- Power outages.

- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.9.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to windstorms, including tornadoes. This includes:

- Staff working at all District locations, including indoor and outdoor facilities. Personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.
- TVWD's identified critical infrastructure. Downed branches and trees can damage critical infrastructure and debris can clog or impede water flows and equipment.
- Areas and infrastructure located at higher elevations.
- Older buildings and infrastructure in the District not built to withstand high winds.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Natural environments and acreage utilized and owned by the District.

3.2.10. Winter Storm

Heavy snowfall rarely occurs within the District's service area. The bigger risk is from low temperatures causing infrastructure to freeze and ice causing impacts to infrastructure and transportation capabilities. Significant events and the potential impacts of and vulnerabilities to winter storms are identified below.

3.2.10.1. Significant Events

The District identified one significant winter storm event.

- **February 11–14, 2021:** Freezing rain and heavy snow came down, and gusty winds up to 50 mph occurred throughout the service area. Thirty calls for service required response. Two water mains broke and over 18 staff worked the response.

3.2.10.2. Potential Impacts

The potential impacts of a winter storm event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths, including from carbon monoxide poisoning, falls from slick or icy conditions, frostbite, and hypothermia.
- Delayed emergency response times due to debris, blocked transportation routes, damaged infrastructure and vehicles, and difficulty using fire hydrants because of frozen or damaged water system components.
- Stranded travelers due to ice, snow, and transportation impacts.
- Extended operational hours of TVWD staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- An increased number of house fires due to unsafe alternate heating methods.
- Significant property damage and loss of water due to frozen or damaged pipes or the thawing of frozen pipes.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked road and rail transportation routes.
- Downed or damaged powerlines can lead to wildfires, and tree debris can create fuel load for wildfire.
- Power outages.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.

- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including flooding.

3.2.10.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to TVWD are vulnerable to winter storms. This includes:

- Staff working at all District locations, including indoor and outdoor facilities. Personal safety of staff may be a vulnerability as well as staff's inability to get to worksites, move between different locations, and access impeded parking lots.
- TVWD's identified critical infrastructure.
- Areas and infrastructure located at higher elevations.
- Older buildings and infrastructure not built to withstand the weight and impacts of large amounts of snow and ice.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Natural environments and acreage utilized and owned by the District.

3.3. Historical Events

Hazard events that have affected the entire planning area since adoption of the 2017 NHMP are detailed in Volume I, Section 2. This is the first time TVWD has had an NHMP. Hazard events that have impacted the District are described in the hazard profiles above. These occurrences include drought, extreme heat, wildland fire smoke, windstorm, including tornado, and winter storm.

Two disaster declarations were issued by the District since adoption of the 2017 NHMP. Declarations for the COVID-19 pandemic went into effect on March 8, 2020. Resolution 07-20 authorized emergency procurement of good and services by the Board of Commissioners, and Resolution 08-20 declared an emergency and granted the chief executive officer emergency powers to prepare for, prevent, and mitigate the effects of COVID-19. Although pandemic is not a hazard included in this NHMP, this declaration is noted because FEMA provided support and Hazard Mitigation Grant Program funding during the event.

3.4. Overall Vulnerability

Based on the analysis completed by the Technical Committee, winter storm, earthquake, drought, extreme heat, and windstorm, including tornado, present the highest relative risk to the District. These hazards may become widespread events, and all populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments related to the District can be vulnerable to these hazards.

Areas of greatest vulnerability to these hazards within the District include:

- Staff members with higher vulnerability, such as those with preexisting health conditions, older adults, pregnant women, and those who spend significant time outdoors.
- People working in heat islands within the District.
- Commerce losses from power interruptions, damaged buildings and assets, and road closures. The District may also sustain direct losses to buildings, personnel, and other vital equipment.
- Economic impacts to the District, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- TVWD’s identified critical infrastructure.
- Other critical infrastructure, including power sources and emergency generators.
- The CEI Hub.
- Older buildings and infrastructure not built to current building codes or seismic standards may be more vulnerable.
- Transportation networks used to execute daily District functions and transportation systems staff rely on to report to duty. These transportation assets are not all owned by TVWD; however, their vulnerability can affect District operations.
- Water sources used by the District.
- Natural environments and acreage utilized and owned by the District. Plants, animals, ecosystems, and natural environments can be vulnerable to high rates of mortality due to hazard events.

4. Capability Assessment

(In compliance with 44 CFR §201.6(c)(3))

The following capability assessment and safe growth analysis examine the ability of the District to implement and manage a comprehensive mitigation strategy. Strengths, opportunities, and resources of the jurisdiction are identified to develop an effective hazard mitigation action plan. The capabilities identified in this assessment were evaluated collectively to develop feasible recommendations, which support the implementation of effective mitigation activities.

A capability questionnaire was distributed to the District's Technical Committee to initiate this assessment. The survey included questions regarding existing plans, policies, and regulations that contribute to or hinder the ability to implement hazard mitigation activities, including legal and regulatory capabilities, administrative and technical capabilities, education and outreach capabilities, and fiscal capabilities. The Technical Committee also completed a safe growth analysis to identify potential gaps in growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

4.1. Planning and Regulatory Assessment

Planning and regulatory capabilities include plans, policies, codes, and ordinances within the District that can prevent and reduce the impacts of hazards.

The District does not maintain plans that cover activities or areas that fall under the jurisdiction of the local governments it serves, such as land use mapping, transportation management, and public safety. However, its own properties and assets are well mapped, and the District's environmental policies address best practices in maintaining and restoring protective ecosystems. This is an essential part of operating an organization with unique structural and natural assets. City and County development regulations require development outside of sensitive areas. TVWD follows all local regulations and zoning ordinances as they apply to the organization.

TVWD's Capital Improvement Program and infrastructure policies limit expenditures on projects that would encourage development in areas vulnerable to natural hazards and limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards. The Capital Improvement Program provides funding for hazard mitigation projects identified in this NHMP. The District also has an evacuation and sheltering plan to deal with emergencies from natural hazards.

Types of Plans

The following TVWD plans address natural hazards, identify projects to include in the mitigation strategy, and can be used in a formative manner to implement mitigation actions:

- Master Planning for Seismic Reliability and Resiliency, May 2016.
- Water Master Plan Update, December 2018.
- Risk Resilience Assessment Report, February 2021. Supports compliance with America's Water Infrastructure Act of 2018.
- Emergency Response Plan, February 2021. Supports compliance with America's Water Infrastructure Act of 2018. Updates to this plan are ongoing and will be made in relation to the work done by the Regional Disaster Preparedness Organization (RDPO) on Emergency Water Provision and Curtailment tabletop exercises held in 2022.
- Willamette Water Supply Program, Program Formulation Summary, October 2018.
- Continuity of Operations Plan, 2005. This plan is scheduled for review and updating. The current version does not have projects to include in the mitigation strategy; however, future plan updates

will either include mitigation strategies, or the strategies will be contained in the District's Capital Plan or Master Plan, as appropriate.

4.2. Administrative and Technical Assessment

This portion of the assessment includes staff and their skills and tools that can be used for mitigation planning and implementing specific mitigation actions.

The Mitigation Planning Committee works together effectively to update and maintain the NHMP and consists of Emergency Planning Team and Sustainability Committee members. The Asset Management and Water Operations Departments effectively execute mitigation planning efforts.

TVWD's Facilities Supervisor and two Facilities staff members administer maintenance programs to reduce risk, including tree trimming and clearing drainage systems. Contracted services are used to implement additional maintenance programs to reduce risk. The District has multiple effective mutual aid agreements and planning partnerships, including the JWC, the Regional Water Providers Consortium, and the Oregon Water/Wastewater Agency Response Network.

The District has a full time Capital Improvement Program Manager, Emergency Program Coordinator, and a full-time Risk Management Coordinator in the Human Resources Department. A full-time Geographic Information System (GIS) Coordinator is a part of the Asset Management Division.

TVWD has many technical capabilities that have been used to assess or mitigate risk and could be used in future efforts. The WWSS has a grant writer and additional grant writers are contracted with as necessary. A GIS Analyst and Technician work with the Oregon Department of Geology and Mineral Industries (DOGAMI) on hazard data gathering and mapping and collaborate with the RDPO on hazard data and mitigation planning. Additional hazard data and information can be pulled from a variety of sources, including historical records and DOGAMI.

TVWD maintains a Water Master Plan and conducts regular updates to the Water Master Plan. The most recent plan is from 2018. TVWD is compliant with America's Water Infrastructure Act (AWIA). As part of AWIA compliance, TVWD sponsored a Risk and Resilience Assessment Report. The final report was completed in February of 2021. The report is updated every five years, per regulation, and will be used to update mitigation plans.

4.3. Education and Outreach Assessment

Education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information were assessed to determine the District's capabilities.

TVWD has very strong education and outreach capabilities. TVWD's Communications Department sends customers a monthly newsletter via email. Topics covered include learning how to store water, preventing frozen pipes, planning for wildland fires and extreme heat, signing up for emergency alerts, and creating and keeping an emergency kit.

Additionally, the District is a member of the Regional Water Providers Consortium. Members of this group partner together to increase the reach and scale of public education and outreach opportunities. Consortium public engagement efforts TVWD participated in from February 2, 2022, to June 1, 2022 include:

- Toilet leak detection promotion kit: This promotion was advertised on the Consortium's social media, website, and RegionalH2O newsletter, and through a KUNP newsletter. The promotion kit was available in English and Spanish and helps increase water conservation and drought mitigation efforts.

- School assembly programs: Beginning in the spring, the Mad Science program educated students about water, including conservation efforts. A total of 250 students from three schools participated.
- Digital advertising campaigns: Used to promote water-related issues in lieu of in-person events and workshops due to the COVID-19 pandemic.
- Print piece translation review and new graphics: Printed outreach materials were updated with new graphics and translated into seven languages. The new graphics are a result of feedback received from the multilingual how-to video project listening sessions that occurred from fall 2021 to winter 2022. The Consortium worked with Community Engagement Liaisons (CELs) and received $4,000 in Urban Area Security Initiative (UASI) grant money from Multnomah County to help support this work.
- Multilingual how-to video project: Consortium staff met with CELs to complete video scripts and graphics translations and to ensure that the CELs were prepared to act as on-camera spokespeople for the videos. Staff also negotiated with KUNP television so that their on-air newscaster could serve as the Spanish language spokesperson. Staff coordinated a 4-day video shoot involving 19 CELs that resulted in content for 21 videos in 7 languages.
- Public outreach and education campaigns: The 2022 campaigns began in the first week of May with Drinking Water Week and ran through the third week in October with the Great ShakeOut.
    - Drinking Water Week: The Consortium partnered with KATU television to do three on-air interviews and six “shout outs” on their AM Northwest and Afternoon Live shows during Drinking Water Week. The Consortium also produced a 60-second segment, which ran in the weekend news.
    - Conservation Campaign: The campaign incudes radio, digital online, English language television, and Spanish language television advertising.
        - KATU Television: Five on-air interviews, new and updated ads that aired 294 times, digital advertising, and featured content directed people to regionalH2O.org during Jeopardy and the evening news.
        - KUNP Television: A 60-second segment aired 19 times, new and updated ads aired 366 times, digital ads on KUNP.tv and YouTube, three newsletters, and translation support.
        - Garden Time Television: One interview aired.
        - Alpha Media Radio: Seasonally updated ads aired 2,132 times, and two on-air interviews took place.
        - Digital display advertising: Staff developed a series of ads designed to drive traffic to regionalH2O.org and increase sign-ups for the Weekly Watering Number.
        - Summer promotion: Outdoor watering promotion throughout July.
    - Source water protection campaign: The year-long “Clean Water. It’s Our Future” had delivered 487 ads as of April 30. This campaign concluded in June.
    - Emergency preparedness campaign: The campaign includes outreach tailored to help promote the new multilingual how-to videos on YouTube and in the community. Media partners included KATU television, KUNP television, and Intersection (TriMet bus ads).
    - Annual print order: Consortium members had the opportunity to add their logo to print pieces and to receive a start-up supply of the hose nozzle hangtag and several Junior Leak Detective print pieces in English and Spanish.

- Other public outreach projects:
  - RegionalH2O.org website: A new, interactive Region's Water Sources and Providers map was added to the website and a newly designed Weekly Watering Number widget was rolled out. Consortium staff continued updates to make regionalH2O.org accessible to those using assistive technologies and completed seasonal updates, monthly analytics reports, and weekly website maintenance. The website received 36,257 page views from 18,821 visitors from January 1 to April 30, 2022.
  - Consortium newsletters: The Consortium distributed two issues of The Source and one issue of RegionalH2O News.
    - RegionalH2O News: The March issue highlighted the new interactive Regional Water Providers & Water Sources map and Fix a Leak Week and the accompanying toilet leak detection promotion. It went to 979 recipients, with an open rate of 48% and a click rate of 8.5%.
    - The Source: The January issue provided members with a recap of the December tabletop exercise and outreach resources. It went to 158 members and had a 44.5% open rate and a 6.8% click rate. The April issue included updates on the Weekly Watering Number, Drinking Water Week outreach resources, and a celebration of the Consortium's 23-year involvement in the Children's Clean Water Festival. It went to 159 members and had a 41.7% open rate and a 5.6% click rate.
  - Consortium social media: The Consortium maintained an active presence on each of its three social media channels between January 1 and April 30, 2022.
    - Facebook: The Consortium account rose to 912 followers during the reporting period. A total of 83 posts were published, which resulted in 8,782 impressions and 541 engagements.
    - YouTube: The Consortium's 18 how-to videos and media segments were collectively viewed a total 12,495 times for a total of 395.7 hours and resulted in 73,569 impressions.
    - Twitter: The Consortium account has 644 followers and received 3,679 profile visits. A total of 103 tweets were published, which resulted in more than 24,000 impressions.
  - Spanish language outreach: The Consortium worked with community partners to translate more resources and content into Spanish. Translated content included an outdoor print piece, social media messaging, promotion content, and another KUNP newsletter. The KUNP newsletter went to 27,272 recipients and had a 20.85% open rate and a 2.61% click rate.
  - Member messaging toolkits: Messaging toolkit topics for this reporting period were National Engineers Week, Fix a Leak Week, and Water Week. Toolkits included social media copy, website links, graphic and media assets, and sample newsletter articles for members to use in outreach to their customers.

4.4. Financial Assessment

TVWD has access to or is eligible to potentially use the following funding resources for hazard mitigation initiatives:

- Capital improvements project funding obtained from water sales revenue.
- Authority to levy taxes for specific purposes.
- Fees for water services.

- Fees for new development.
- Incurrence of debt through general obligation bonds and/or special tax bonds.
- Incurrence of debt through private activities.
- Federal funding sources, including Building Resilient Infrastructure and Communities and Hazard Mitigation Assistance Grants. Grants for mitigation were sought for the 2016 Master Planning for Seismic Reliability and Resiliency Plan and 2018 Water Master Plan update. It is anticipated that the District will also apply for mitigation grants to update these plans when needed.
- State funding programs.
- Public or private partnership funding sources.

4.5. Capability Expansion and Improvement

Actions that can expand and improve existing authorities, plans, policies, and resources for mitigation include continuing to update plans as necessary to ensure they are current and reflect the needs of the District and its customers; increasing staff levels and natural hazard training for staff as necessary; further development of warning systems and messaging; and ensuring grant opportunities are capitalized upon to meet goals.

5. Mitigation Strategy

(In compliance with 44 CFR §201.6(c)(3)(i), §201.6(c)(3)(ii), §201.6(c)(3)(iii), §201.6(c)(3)(iv), and §201.6(c)(4)(ii))

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) directs local mitigation plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a local mitigation plan lead to and support the mitigation strategy.

5.1. Mitigation Goals

The Steering Committee reviewed and evaluated goals from the 2017 Washington County NHMP, 2020 City of Beaverton NHMP, 2011 Cities of Cornelius and Forest Grove NHMPs, and 2020 State of Oregon NHMP. The goals from each plan were grouped by topic and then synthesized to create the seven goals detailed in Volume I, Section 3. These goals are the basis of this plan and summarize what the Steering Committee will accomplish by implementing this plan.

5.2. Mitigation Successes

Risk Resilience Assessment and Emergency Response Plan Updates

In compliance with the 2018 America's Water Infrastructure Act, TVWD, in partnership with Carollo Engineering, conducted a Risk and Resilience Assessment and published an updated Emergency Response Plan certified with the U.S. Environmental Protection Agency. These February 2021 updates addressed all hazards in this NHMP.

Infrastructure Interdependencies Workshop

A workshop was held in May 2022 to bring together internal and external partners to discuss infrastructure interdependency throughout the service area. TVWD, WWSS, Clean Water Services, Portland General Electric, Washington County, Clackamas County, American Society of Civil Engineers Lifelines 2022 participants, and Cascadia Lifelines Program participants met to identify, assess, and develop mitigation strategies related to improving community resilience.

The activity integrated with the work being done by Metro on the Long-Range Transportation Plan, the RDPO's work with emergency transportation routes, RDPO's work on provisioning of emergency drinking water, and the Regional Water Consortium's work. It aligns with the TVWD Water Master Plan, the Oregon Resiliency Plan, and the plans within Washington County and the RDPO. This workshop addressed all hazards in this NHMP.

Key Customer Meetings

Before the COVID-19 *p*andemic, TVWD held quarterly meetings with key customers, including hospitals and health care organizations, those in the food production, manufacturing, and water quality sectors, fire departments, schools, Tualatin Hills Park & Recreation, Washington County, and the City of Beaverton. These collaboration meetings promoted co-resilience planning and education and helped the District determine each customer's level of mitigation and readiness planning and how that aligned with the Levels of Service as described in the Oregon Resiliency Plan.

The meetings integrated with the work being done by Metro on the Long-Range Transportation Plan, the RDPO's work with emergency transportation routes, RDPO's work on provisioning of emergency drinking water, and the Regional Water Consortium's work. It aligns with the TVWD Water Master Plan, the Oregon Resiliency Plan, and the plans within Washington County and the RDPO. This workshop addressed all hazards in this NHMP.

Emergency Preparedness Email Newsletter

TVWD's Communications Department sends customers a monthly newsletter via email. Topics covered include learning how to store water, preventing frozen pipes, planning for wildland fires and extreme heat, signing up for emergency alerts, and creating and keeping an emergency kit.

Willamette Water Supply System

This ongoing construction project will provide an additional, resilient water supply for Washington County. When complete, the WWSS will be one of Oregon's most seismically-resilient water systems—built to better withstand natural disasters, protect public health, and speed regional economic recovery through restoring critical services more quickly. See Section 7 of this annex for additional information about this system.

Mapping Critical Facilities in Relation to Hazards

TVWD is continually working with the RDPO and Washington County to map critical facilities in relation to exposure and vulnerability to all hazards included in this NHMP.

Development of Supervisory Control and Data Acquisition Master Plan

This ongoing project addresses control system challenges by identifying and prioritizing system upgrades that will increase utility efficiency and safety. The plan will be used for budgeting and planning for future SCADA system additions and enhancements.

Installation of Reservoir Seismic Isolation Layers

Seismic isolation layers were installed on two reservoirs to increase the seismic resiliency of this critical infrastructure.

Development of Emergency Water Provisioning Plan

The RDPO and the Regional Water Providers Consortium, which includes TVWD, are partnering to address how emergency drinking water will be provided to the public following a disaster. The project spans the five-county Portland Metropolitan Region, which includes Clackamas, Clark, Columbia, Multnomah, and Washington Counties.

In the last decade, water providers in the region have been using UASI funds and local budgets to purchase emergency mobile water treatment and distribution systems. Before additional equipment can be funded, the RDPO Steering Committee asked water providers and their partners to develop an emergency water planning framework and identify emergency water gaps to support future grant requests and emergency water distribution efforts. The overarching goal of the project is to advance regionally coordinated planning efforts for the effective and equitable delivery of drinking water post-disaster in the greater Portland metro region.

Vegetation Management

TVWD maintains an ongoing vegetation management program on its properties to decrease wildland fire fuel loads and contribute to wildland fire mitigation efforts in the County.

Emergency Power Supplies and Systems

To align with TVWD's America’s Water Infrastructure Act Risk and Resilience Assessment and the Oregon Resilience Plan, the District has installed backup power generation at its facilities.

Installation of Fuel Storage Tank

The overwhelming majority of TVWD-owned equipment required to construct, operate, and maintain the water system and its facilities is located at TVWD Headquarters, where there is an aboveground 20,000-gallon fuel storage container with the capacity to store and dispense 12,000 gallons of gasoline and 8,000 gallons of diesel. TVWD shares this source of fuel with the Tualatin Hills Park & Recreation District through an intergovernmental agreement for operation and maintenance of the tank and its related fueling infrastructure. This agreement created the Tualatin Regional Fueling Facility.

Provisional Water Trailers

In alignment with the Regional Water Providers and the RDPO Water Provisioning Plan, TVWD maintains and trains for the use of two provisional water trailers that can be used throughout the region in response to an emergency. TVWD has two emergency water distribution systems. These systems are compact and

portable manifold systems comprised of valves, connecting hoses, a circular fan, blivents, and water bags designed to dispense potable water into six-quart, food-grade bags during an emergency. There are additional trailers within the RDPO's area.

Established Radio Communications System

TVWD maintains a very high frequency (VHF) two-way radio system that operates on a Type 3 digital mobile radio (DMR), trunked system. TVWD also operates 1 VHF repeater at the Cooper Mountain Radio Site. The repeater is used for countywide interoperability.

5.3. Plan Incorporation and Integration into Existing Planning Mechanisms

Based on mitigation plan requirement 44 CFR §201.6(c)(4)(ii), the vulnerability and capabilities assessment for TVWD was carefully reviewed and considered when developing the mitigation actions for this plan. TVWD's Technical Committee will establish a process in which the mitigation strategy, goals, objectives, and actions outlined in this plan will be incorporated into the existing local planning strategies.

Once the plan is adopted, the committee will coordinate implementation with the responsible parties in TVWD and with external stakeholders as needed. The primary means for integrating mitigation strategies will be through the revision, update, and implementation of the actions as feasible.

The members of TVWD's Technical Committee will remain charged with ensuring the goals and strategies of new and updated local planning documents for the District are consistent with the goals and actions in the NHMP and will not contribute to increased hazard vulnerability.

5.3.1. Comprehensive Plan

The District's Water System Master Plan update contains mitigation actions, strategies, and goals through the incorporation of a seismic assessment and Capital Improvement Plan. The 2015 Water System Master Plan includes an attachment titled "Seismic Reliability and Resiliency Evaluation" that summarizes gaps and future improvements needed to the system when considering a seismic event. The 2015 Water System Master Plan further separates pipeline projects into groupings described as Tier 1, 2, and 3. When these plans go through regular updates, additional details about hazard mitigation will be added, as applicable. The Water Master Plan was updated in December of 2018. TVWD is currently working on a "Capital Improvement Master Plan."

5.3.2. Public Engagement, Education, and Outreach

TVWD will continue its public engagement efforts, including holding events to educate customers about water conservation and emergency readiness, distributing the TVWD Emergency Preparedness Email Newsletter, hosting school assembly programs, creating new outreach materials in seven languages, and coordinating a public outreach campaign on multiple platforms on the topics of conservation, emergency preparedness, and source water protection. The District will continually assess the need to increase or update engagement opportunities as needed to best serve the organization and its customers.

5.3.3. Emergency Plans That Address Evacuation and Sheltering

The District's 2022 Emergency Response Plan addresses evacuation and sheltering in place, and TVWD works with Washington County, the American Red Cross, and community partners to address sheltering for staff and families. Additionally, specific work regarding evacuation and sheltering is done with Tualatin

Hills Park & Recreation and the Beaverton School District. TVWD will work with its partners to review and update these plans as needed to fit the needs of the District's customers.

5.3.4. Enforcement of Existing Policies

TVWD District's Curtailment Plan has provisions for addressing the District's water curtailment policy that can be implemented during low water levels or water shortages. This policy will be updated as needed to fit the needs of the organization and its customers.

5.3.5. Funding Opportunities

TVWD will continue to review annual, post-disaster, and stand-alone grant opportunities for potential mitigation project funding opportunities. This includes the Hazard Mitigation Grant Program and the Building Resilient Infrastructure and Communities grant program.

6. Action Items

Action items for the 2023 NHMP were determined by TVWD's Technical Committee based on the review of its risk assessment, its existing capabilities, and the status of its previous action items. This range of actions includes structure and infrastructure projects and education and awareness programs. A summary of these actions and full action item planning worksheets are provided in Sections 6.1 and 6.2 below. Additional information about how these actions were developed, evaluated, and prioritized is in Volume I, Section 3.

6.1. Tualatin Valley Water District Action Items: 2023 Washington County NHMP

Table 284: TVWD Action Items

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
1	Florence Lane Pump Station. Retrofit the existing pump station to withstand the effects of natural disasters. This includes upgrading the existing backup power supply system.	Dam Failure, earthquake, extreme heat, flood, landslide, windstorm, including tornado, and winter storm	High
2	Mid-Term Pipeline upgrade to upgrade and retrofit the existing pipeline.	Dam failure, earthquake, flood, landslide, wildland fire, windstorm, including tornado, and winter storm	Medium
3	Retrofit the existing Somerset Reservoir.	Dam failure, earthquake, landslide, windstorm, including tornado, and winter storm	Medium
4	Rosander Pump Station. Upgrade the Sunset Pump Station to withstand seismic and other natural hazards.	Dam failure, earthquake, landslide, windstorm, including tornado, and winter storm	Medium
5	Supply Vulnerability Response Planning for Scoggins Dam. Evaluate supply vulnerability and response to natural hazards associated with Scoggins Dam.	Dam failure, earthquake, flood, landslide, windstorm, including tornado	Medium

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
6	Upgrade the Cornelius Pass Facility to meet current seismic design and provide controls and interconnection between the Willamette Water Supply System and the Joint Water Commission.	Dam failure, earthquake, flood, landslide, volcanic ash, windstorm, including tornado, and winter storm	Low
7	North Road Reservoir. Retrofit the existing structure to withstand anticipated natural hazards.	Dam failure, earthquake, landslide, windstorm, including tornado, and winter storm	Low
8	Partnership with Regional Water Providers Consortium on Public Education efforts.	Drought and earthquake	High
9	Retrofit the Cooper Mountain Pump Station to better withstand the effects of multiple natural hazards.	Earthquake, landslide, windstorm, including tornado, and winter storm	High
10	189th Pump Station seismic upgrade to meet current seismic code requirements and provide automated backup power.	Earthquake, windstorm, including tornado, and winter storm	High
11	Goyak Reservoir. Upgrade/retrofit existing structure to withstand hazards.	Earthquake, flood, windstorm, including tornado, and winter storm	High
12	Goyak Pump Station. Upgrade the existing pump station to withstand the effects of natural hazards, including upgrading the backup power system to be automated.	Earthquake, extreme heat, flood, landslide, wildland fire, windstorm, including tornado, and winter storm	High
13	Taylors Ferry Reservoirs and Site Seismic Improvements. Seismically upgrade water system facilities serving the upper pressure zones in the Metzger service area.	Earthquake, extreme heat, flood, windstorm, including tornado, and winter storm	High
14	Lead joint pipe seismic upgrade to retrofit the existing pump station to withstand the effects of natural disasters. This includes upgrading the existing backup power supply system.	Earthquake	High
15	America's Water Infrastructure Action/Security Recommendation Implementation. Includes adding security cameras to evaluate if sites are in good condition following a hazard event.	Earthquake, flood, landslide, volcanic ash, wildland fire, windstorm, including tornado, and winter storm	Medium

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
16	Meadow and Walker pressure-reducing valves. Upgrade existing facility to improve access and safety.	Flood	High
17	TVWD Headquarters building upgrade so the building can withstand all natural hazards.	All hazards	High
18	Emergency underground storage/water supply well – regional supply planning. Conduct an engineering study to help determine the future ability to use the Emergency Underground Storage sites to assist in the Emergency Drinking Water Provisioning Project and for first responders. Would include, but not be limited to: Scheupbach Well and Grabhorn, Miller, and Copper Mountain aquifer storage and recovery sites.	All hazards	Medium
19	Supply vulnerability planning. Integrate plans and policies into existing plans to identify water supply vulnerabilities and enhance mitigation efforts.	All hazards	Low
20	Supply Vulnerability Planning for the Portland Water Bureau Source. Update and revise existing plans, procedures, and agreements to ensure the water supply system is able to handle various natural disasters.	All hazards	Low
21	Pipeline vulnerability response planning. Evaluate major pipelines that may be vulnerable to natural hazards.	All hazards	Low
22	Retrofit and build an emergency operations center facility to withstand natural hazards.	All hazards	Low
23	Infrastructure interdependencies workshops. TVWD and WWSS activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience.	All hazards	Medium
24	Regional Water Providers Consortium Strategic Plan 2023-28. This will be a TVWD and Regional Water Providers service area activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience.	All hazards	Medium
25	Key and critical customer collaboration. TVWD and WWSS infrastructure interdependency service area activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience. To be held quarterly.	All hazards	High
26	Talkin' Water. Talking to community members about mitigation and preparedness via a virtual forum.	All hazards	High

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
27	Source Water Protection Plan	All hazards	Medium
28	Monthly Mitigation and Preparedness Newsletter. Newsletter sent out to customers of TVWD and covers a monthly emergency readiness / mitigation topic.	All hazards	Low
29	Risk resilience assessment and emergency response plan update in 2025 to support compliance with America's Water Infrastructure Act.	All hazards	Low
30	Increase the District's ability to transfer data among its numerous sites via wired connectivity. To include bandwidth to transmit video data for damage assessment/debris estimate.	All hazards	Medium
31	Increase the District's ability to transfer data among its numerous sites via wireless technology (Public 5G, Private LTE/5G and/or Long Range 5Ghz WiFi.)	All hazards	Medium

6.2. Mitigation Action Information Worksheets

Table 285: Increase Internet Connectivity District Wide (Cable and Fiber Connections)

Mitigation Action Information	
Title of action	Increase Internet Connectivity District Wide (Cable and Fiber Connections)
Type of action	Plans/regulations ☐ Natural systems protection ☐ Structure and infrastructure project ☒ Public education/awareness ☒
Action description	Increase the District's ability to transfer data among its numerous sites via wired connectivity. To include bandwidth to transmit video data for damage assessment/debris estimate.
Hazard(s) addressed	Dam failure ☐ Flood ☐ Windstorm, incl. tornado ☐ Drought ☐ Landslide ☒ Winter storm ☒ Earthquake ☒ Volcanic ash ☐ Extreme heat ☐ Wildland fire ☐
How does the action address identified current or future risks and vulnerabilities?	Existing internet connections are not complete, and during earthquakes, landslides, and winter storms, the current connections are susceptible to disruption of data communication lines that run underground, which can be affected by the natural hazard. The ability to transmit data between our sites ensures business continuity in such a disaster and allows us to act in an emergency ops/response capacity. Also permits seamless communication with the entire service area.
Area of action impact	Entire service area
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? All remote sites, listed in Critical Asset sheet
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☐ Goal 5 ☐ Goal 3 ☐ Goal 6 ☐
Integration into other initiatives	City of Beaverton and Washington County Emergency Operations Plans
Alignment with existing plans and policies	TVWD Emergency Operations Plan
Mitigation Action Implementation Plan	
Priority	Low ☐ Medium ☒ High ☐
Lead position, office, department, or division responsible for implementation	Information Technology and Facilities

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
Information Technology and Facilities	City of Beaverton and Washington County
Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
General Fund and MACC Grant	Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities
Estimated Cost	$1,000,000.00 for installation of internet connections (cable/fiber connection) from vendors. Ongoing licensing and service costs are estimated at $60,000.00 annually.

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Limit disruption of essential infrastructure Enhance the ability of the District to assist in emergency operations	Build resilience in our network infrastructure and add capacity/bandwidth at our hard-to-reach locations. For example, facilities that do not currently have fiber connectivity, and don't exist near current infrastructure to support such connectivity.	$600,000.00

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐	Winter 2026	Winter 2027

Implementation Benchmarks: How Will Success Be Measured?

- Securing funding and project buy-in.
- Completing survey to determine type of equipment needed.
- Procuring equipment.
- Installing equipment.
- Training staff of how to use monitoring software and utilize data.
- Creating and implement maintenance plan**.**

Potential Challenges to Implementation

- Securing ongoing funding for maintenance to equipment and software updates.

Resources and References, if Applicable

- Potential vendors: Ziply and Comcast

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	No action	$0	Continued risks, frequent
Alternative #2	Scale project to four areas	$508,000.00	Continued risks
Alternative #3			
Implementation Progress Report for Plan Maintenance			
Date			
What progress in implementation has been made to date?			
What challenges in implementation have been experienced?			
What are the next steps in implementation?			

Table 286: Increase Wireless Capabilities District-Wide

Mitigation Action Information			
Title of action	Increase Wireless Capabilities District-Wide		
Type of action	Plans/regulations ☐	Natural systems protection ☐	
	Structure and infrastructure project ☒	Public education/awareness ☒	
Action description	Increase the District's ability to transfer data among its numerous sites via wireless technology (Public 5G, Private LTE/5G, and/or Long-Range 5Ghz Wi-Fi)		
Hazard(s) addressed	Dam failure ☐	Flood ☐	Windstorm, incl. tornado ☒
	Drought ☐	Landslide ☐	Winter storm ☒
	Earthquake ☐	Volcanic ash ☐	
	Extreme heat ☐	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	During wildfire and heavy wind events, data communication lines that run on poles as well at underground, which can be affected by the natural hazard. The ability to transmit data between our sites ensures business continuity in such a disaster and allows us to act in an emergency ops/response capacity. Also permits seamless communication with the entire service area.		
Area of action impact	Entire service area		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)?		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☒
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	City of Beaverton and Washington County Emergency Operations Plans		
Alignment with existing plans and policies	TVWD Emergency Operations Plan		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	Information Technology and Facilities		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Information Technology and Facilities		City of Beaverton and Washington County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
General Fund and MACC Grant	Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities
Estimated Cost	$75,000.00 for equipment and $25,000.00 for implementation support. Ongoing licensing and equipment replacement is estimated at $15,000 annually.

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Limit disruption of essential infrastructure, Enhance the ability of the District to assist in emergency operations,	Build resilience in our network infrastructure and add capacity/bandwidth at our hard-to-reach locations. For example, facilities that do not currently have fiber connectivity and don't exist near current infrastructure to support such connectivity.	$600,000.00

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐	Winter 2026	Winter 2027

Implementation Benchmarks: How Will Success Be Measured?

- Securing funding and project buy-in.
- Completing survey to determine type of equipment needed.
- Procuring equipment.
- Installing equipment.
- Training staff of how to use monitoring software and utilize data.
- Creating and implement maintenance plan**.**

Potential Challenges to Implementation

- Securing ongoing funding for maintenance to equipment and software updates.

Resources and References, if Applicable

- Potential vendor

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	No action	$0	Continued risks, frequent.
Alternative #2	Scale project to two areas		

Alternative #3			USGS only installs flood gauges, and the startup and ongoing costs to implement this type of solution are much more expensive.
Implementation Progress Report for Plan Maintenance			
Date			
What progress in implementation has been made to date?			
What challenges in implementation have been experienced?			
What are the next steps in implementation?			

Table 287: Supply Vulnerability Planning

Mitigation Action Information			
Title of action	Supply Vulnerability Planning		
Type of action	Plans/regulations ☒	Natural systems protection ☐	
	Structure and infrastructure project ☐	Public education/awareness ☐	
Action description	Integrate plans and policies into existing plans to identify water supply vulnerabilities and enhance mitigation efforts.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☒	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☒	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	Allows the District to plan for future expenditures to make infrastructure upgrades and capital expenditure decisions that will enhance future hazard mitigation efforts.		
Area of action impact			
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Water supply facilities		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☒	Goal 7 ☐
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	Investing in critical infrastructure		
Alignment with existing plans and policies	Oregon Seismic Resilience Plan		
Mitigation Action Implementation Plan			
Priority	Low ☒	Medium ☐	High ☐
Lead position, office, department, or division responsible for implementation	Engineering & Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
		Joint Water Commission	

Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General funding, Capital Improvement funding		HMGP funding, BRIC funding	
Estimated Cost	$1 million		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Allows plans to be established to help direct funding efforts for supply resilience.		$6 million in financial benefits	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐			
Implementation Benchmarks: How Will Success Be Measured?			
Potential Challenges to Implementation			
Resources and References, if Applicable			

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 288: Supply Vulnerability Response Planning – Portland Water Bureau Source

Mitigation Action Information			
Title of action	Supply Vulnerability Response Planning – Portland Water Bureau Source		
Type of action	Plans/regulations ☒	Natural systems protection ☐	
	Structure and infrastructure project ☐	Public education/awareness ☐	
Action description	Update and revise existing plans, procedures, and agreements to ensure that the water supply system is able to handle various natural disasters.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☒	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☒	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	This planning will allow the District to find alternative sources of supply and identify deficiencies in the Portland Water Bureau source specifically that would require upgrading to supply the District with potable water following a natural hazard event.		
Area of action impact	The entire water District service area.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Facilities which supply water from Portland Water Bureau.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☐
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	Invest in critical infrastructure.		
Alignment with existing plans and policies	Incorporated in the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☒	Medium ☐	High ☐
Lead position, office, department, or division responsible for implementation	Engineering & Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
		Portland Water Bureau	

Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General funding, Capital Improvement funding		BRIC funding, HMGP funding	
Estimated Cost	$1 million		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Allows the District to plan for future supply improvements.		$6 million in potential benefits.	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐			
Implementation Benchmarks: How Will Success Be Measured?			
Potential Challenges to Implementation			
Resources and References, if Applicable			

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 289: Supply Vulnerability Response Planning – Scoggins Dam

Mitigation Action Information			
Title of action	Supply Vulnerability Response Planning – Scoggins Dam		
Type of action	Plans/regulations ☒	Natural systems protection ☐	
	Structure and infrastructure project ☐	Public education/awareness ☒	
Action description	Evaluate supply vulnerability and response to natural hazards associated with Scoggins Dam.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☐	Landslide ☒	Winter storm ☐
	Earthquake ☒	Volcanic ash ☐	
	Extreme heat ☐	Wildland fire ☐	
How does the action address identified current or future risks and vulnerabilities?	Allows agencies to plan appropriately for responding to and recovering from a dam failure following a natural hazard event.		
Area of action impact			
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Scoggins Dam		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☒	Goal 7 ☐
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	Investing in critical infrastructure.		
Alignment with existing plans and policies	Oregon Seismic Resilience Plan		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	Engineering & Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
		Joint Water Commission	

Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General funding, Capital Improvement funding		BRIC funding, HMGP funding	
Estimated Cost	$5 million		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Allows agencies to establish plans to prevent and/or recover from a dam failure.		$30 million in financial benefits	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐			
Implementation Benchmarks: How Will Success Be Measured?			
Potential Challenges to Implementation			
Resources and References, if Applicable			

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 290: Somerset Reservoir

Mitigation Action Information			
Title of action	Somerset Reservoir		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Retrofit the existing reservoir.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☐ Landslide ☒ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	The existing reservoir is the only reservoir in the upper pressure zone in the West Hills area of TVWD. To meet resilience goals, an additional reservoir or a rehabilitated, seismically resilient reservoir would need to be constructed.		
Area of action impact	This impacts the 1045 pressure zone as well as zones served from the Barnes Pump Station.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Somerset Reservoir		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	This meets the District's initiative to invest in critical infrastructure.		
Alignment with existing plans and policies	This aligns with the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	Engineering & Operations		

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
Engineering, operations, safety, risk.	City of Portland, Washington County

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, others to be evaluated.
Estimated Cost	$4 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
District is able to maintain service to the upper West Hills area following a seismic event.	Prevents damage due to potential reservoir failure and the resulting flooding.	$24 million in potential financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐		

Implementation Benchmarks: How Will Success Be Measured?

Potential Challenges to Implementation

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 291: Infrastructure Interdependencies Workshops

Mitigation Action Information	
Title of action	Infrastructure Interdependencies Workshops
Type of action	Plans/regulations ☐ Natural systems protection ☐ Structure and infrastructure project ☐ Public education/awareness ☒
Action description	The TVWD and WWSS infrastructure interdependency service area activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience.
Hazard(s) addressed	Dam failure ☒ Flood ☒ Windstorm, incl. tornado ☒ Drought ☒ Landslide ☒ Winter storm ☒ Earthquake ☒ Volcanic ash ☒ Extreme heat ☒ Wildland fire ☒
How does the action address identified current or future risks and vulnerabilities?	Introduction to "Infrastructure Interdependencies" topic, "Why Now?"; "Hierarchy of infrastructure systems overview"; and "Co-resilience planning" Education within group. • Universe of critical infrastructure systems, from FEMA; includes all the key services represented by the group attending. • Even just for water service, water providers are dependent upon all the other utilities and public services, especially after a disaster. • Recent experience with supply chain issues proves how critical it is to plan ahead and be prepared. What mitigation can we do? • Why now? For WWSP, design is complete, and program activities are transitioning to emergency planning, operational planning, construction, and future mitigation. • Hierarchy of infrastructure dependencies; identify order of problem-solving by specific system at risk, then identify other services needed to address the specific problem; very clear that there are strong interdependencies between utilities.
Area of action impact	Total infrastructure within the service area with combined mitigation activity coordinated within the lifelines and identified infrastructure interdependencies.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? WWSP
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☒ Goal 5 ☒ Goal 3 ☒ Goal 6 ☒
Integration into other initiatives	The program is integrated with the work being done by Metro on the Long Range Transportation Plan, the RDPO work with Emergency Transportation Routes, the RDPO work on Provisioning of Emergency Drinking Water, and the Regional Water Consortium's work.
Alignment with existing plans and policies	Aligned with the Water Master Plan, the Oregon Resiliency Plan, and the plans within Washington County and the RDPO.

Mitigation Action Implementation Plan			
Priority	Low ☐ Medium ☒ High ☐		
Lead position, office, department, or division responsible for implementation	Principal Engineer, TVWD (WWSP)		
Supporting Partners			
Internal Partners	**External Partners, Including Community Partners**		
Willamette Water Supply System (WWSS)/Tualatin Valley Water District Emergency Program Coordinator	• Clean Water Services (wastewater infrastructure) • Portland General Electric (electrical power infrastructure) • Washington County (transportation infrastructure/emergency management) • Clackamas County (emergency management) • ASCE Lifelines 2022 Conference Participants (regional subject matter experts and agencies) • Cascadia Lifelines Program (consortium of lifeline providers)		
Potential Funding Sources			
Non-Federal Funding Sources	**Federal Funding Sources**		
General Funds for staff time and supplies	• Homeland Security Grant Program (HSGP) • Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities		
Estimated Cost	$50,000 per year from TVWD, does not include the funds from the external stakeholders. Estimate $150,000.00 per year required to implement a funded program and implement programs.		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Aligned mitigation planning. Protection of life safety.	Increased understanding of lifelines and infrastructure interdependencies; mitigation actions have added weight and receive higher priority.	$300,000.00 per year	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	May 23, 2022	May 2027	

Implementation Benchmarks: How Will Success Be Measured?
Start date, May 23, 2022. Meeting schedule to meet with individual stakeholders to develop a mission and vision statement. Establishment of framework during 2022 and into 2023. • Align with Lifelines and the Infrastructure Interdependencies. Assessment of current state within TVWD, WWSP, and the listed external partners. • Assessment of the Levels of Service from the Oregon Resiliency Plan. • Assessment of projects within Oregon, and especially within the RDPO and Washington County. • Alignment with FEMA Region 10. • 2023: Establish goals and quarterly workshops. • Work product will be used to inform other programs/projects, as mentioned with the long-range transportation plan and the ETR plans. • Progress measured by infrastructure mitigation work being done, grants awarded, and work started, for example, the two bridges key to the WWSP service. • 2022: Seek sources of funding for the mitigation planning projects.
Potential Challenges to Implementation
• Ability to scale the problem. The mitigation work is significant, our challenge will be to narrow the work, define the scope, and make measurable progress. • Availability of the key stakeholders. • Conflicting projects that are parallel but not integrated. • Work capacity of staff, being able to dedicate time and effort to a non-funded project. • Funding. Currently, this is all in-kind work, and there are no funds for staff time or a budget for supplies.
Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	No action	0	Lack of coordination and collaboration until emergency response required.
Alternative #2	Scale project to only water providers	Year 1 – 10,000.00 Ongoing 10,000.00	Mitigation focused on only one lifeline.
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 292: Taylors Ferry Reservoirs and Site Seismic Improvements

Mitigation Action Information	
Title of action	Taylors Ferry Reservoirs and Site Seismic Improvements
Type of action	Plans/regulations ☐ Natural systems protection ☐ Structure and infrastructure project ☒ Public education/awareness ☐
Action description	Seismically upgrade the water system facilities serving the upper pressure zones in the Metzger service area.
Hazard(s) addressed	Dam failure ☐ Flood ☒ Windstorm, incl. tornado ☒ Drought ☐ Landslide ☐ Winter storm ☒ Earthquake ☒ Volcanic ash ☐ Extreme heat ☒ Wildland fire ☐
How does the action address identified current or future risks and vulnerabilities?	Upgrading the water system facilities includes reservoir upgrades, pump station upgrades, and storage and maintenance facility upgrades that will keep the facilities operational during and after a seismic event. This has additional benefits for protecting the facilities from other natural hazards.
Area of action impact	The upper pressure zones in the Metzger service area, including the 498 and 643 pressure zones. The operations and maintenance building serves the entire Metzger service area.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Taylors Ferry Facilities
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☐ Goal 2 ☐ Goal 5 ☐ Goal 3 ☐ Goal 6 ☐
Integration into other initiatives	This project aligns with the District's initiative to invest in critical infrastructure.
Alignment with existing plans and policies	This aligns with the Oregon Seismic Resilience Plan.
Mitigation Action Implementation Plan	
Priority	Low ☐ Medium ☐ High ☒
Lead position, office, department, or division responsible for implementation	Engineering & Operations

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
Engineering, Operations, Finance, IT, Safety, Security, Facilities	Washington County, TVF&R
Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	HMGP funding
Estimated Cost	$15.8 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
The District is able to maintain essential potable water service to residents and businesses within the service area.	The District is able to better respond to other system needs and is able to provide emergency sources of water supply. This will assist with economic recovery efforts following a natural hazard event.	$94.8 million in potential financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐	April 2023	June 2025

Implementation Benchmarks: How Will Success Be Measured?

- Success measured based on the District's ability to maintain water service following all kinds of anticipated natural hazards.

Potential Challenges to Implementation

- Rising cost of materials and construction costs.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action

	Action Description	Estimated Cost	Evaluation
Alternative #1	Do nothing.		Does not meet the intent of providing a resilient source of supply.
Alternative #2	Rehabilitate.		Does not meet the full hazard mitigation requirements.
Alternative #3	Replace.		Meets all updated seismic standards.

Implementation Progress Report for Plan Maintenance	
Date	August 1, 2022
What progress in implementation has been made to date?	Design efforts are at 90% complete. Awaiting FEMA requests for information to finalize the funding approval and begin construction.
What challenges in implementation have been experienced?	None
What are the next steps in implementation?	Complete design, obtain permits, obtain full FEMA approval of funding, and construct the improvements.

Table 293: North Road Reservoir

Mitigation Action Information			
Title of action	North Road Reservoir		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Retrofit the existing structure to withstand anticipated natural hazards.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☐ Landslide ☒ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	By upgrading the facility, the District will be able to provide potable water to customers in the 820 pressure zone following a natural hazard.		
Area of action impact	The 820 pressure zone and downstream residents who would be impacted by a reservoir failure.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? North Road Reservoir		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	Meets the initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Aligns with the Oregon Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☒	Medium ☐	High ☐
Lead position, office, department, or division responsible for implementation	Engineering and Operations.		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, safety, risk		Multnomah County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, other potential sources to be evaluated.
Estimated Cost	$10 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Allows the District to remain in service and prevents damage to downstream properties following a natural hazard.		$60 million in potential financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2038	2040

Implementation Benchmarks: How Will Success Be Measured?

Potential Challenges to Implementation

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 294: Pipeline Vulnerability Response Planning

Mitigation Action Information	
Title of action	Pipeline Vulnerability Response Planning
Type of action	Plans/regulations ☒ Natural systems protection ☐ Structure and infrastructure project ☐ Public education/awareness ☐
Action description	Evaluate major pipelines that may be vulnerable to natural hazards.
Hazard(s) addressed	Dam failure ☒ Flood ☒ Windstorm, incl. tornado ☒ Drought ☒ Landslide ☒ Winter storm ☒ Earthquake ☒ Volcanic ash ☒ Extreme heat ☒ Wildland fire ☒
How does the action address identified current or future risks and vulnerabilities?	Through studying the vulnerabilities of the existing piping, the District can better prepare for future natural hazards and can prioritize the rehabilitation or replacement of pipelines most in need of seismic or other upgrades to withstand natural hazard events.
Area of action impact	All of TVWD.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Critical pipeline facilities.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☒ Goal 5 ☒ Goal 3 ☐ Goal 6 ☒
Integration into other initiatives	Incorporate this planning and the prioritization into other regional plans and initiatives. This includes District initiatives to invest in critical infrastructure.
Alignment with existing plans and policies	This study will help to align spending on critical pipelines with other critical infrastructure projects done by the county.
Mitigation Action Implementation Plan	
Priority	Low ☒ Medium ☐ High ☐
Lead position, office, department, or division responsible for implementation	Engineering & Operations

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
Engineering, operations, finance	Washington County, Cities of Hillsboro, Beaverton, and Tigard.

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	HMGP funding, BRIC funding, others to be evaluated.
Estimated Cost	$500,000

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Allows the District to coordinate upgrades with other regional infrastructure projects to limit costs and vulnerabilities.		$3 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2028	2029

Implementation Benchmarks: How Will Success Be Measured?

Potential Challenges to Implementation

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 295: Rosander Pump Station

Mitigation Action Information			
Title of action	Rosander Pump Station		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Upgrade the Sunset Pump Station to withstand seismic and other natural hazards.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☐ Landslide ☒ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	Upgrading the Sunset Pump Station by constructing at the Rosander Pump Station and associated pipelines, which will allow the District to serve customers in the West Hills area of the District following natural hazards.		
Area of action impact	West Hills area of the District.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Sunset Pump Station		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	Included in the District's initiative to invest in critical infrastructure.		
Alignment with existing plans and policies	Aligns with the Oregon Resilience Plan		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	Engineering and Operations.		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, facilities, asset management, risk, safety.		Washington County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, others to be evaluated.
Estimated Cost	$8 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Allows the District to maintain service to the West Hills area following a seismic event.		$48 million in potential financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2028	2030

Implementation Benchmarks: How Will Success Be Measured?

Potential Challenges to Implementation

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	Do nothing.		
Alternative #2	Upgrade facility in place.		
Alternative #3	Upgrade facility by constructing at the Rosander site.		

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 296: Goyak Pump Station

Mitigation Action Information			
Title of action	Goyak Pump Station		
Type of action	Plans/regulations ☐		Natural systems protection ☒
	Structure and infrastructure project ☒		Public education/awareness ☐
Action description	Upgrade the existing pump station to withstand the effects of natural hazards, including upgrading the backup power system to be automated.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☐	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☐	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	Upgrading the existing pump station will limit the risk of a failure and enhance the District's ability to serve the higher elevations in the Cooper Mountain Area. By upgrading the facility, the District will be able to maintain service to customers, as well as provide a backup source of supply for the City of Beaverton. Upgrading the backup power system will allow the facility to function without operator involvement and delay due to response times.		
Area of action impact	Cooper Mountain service area for TVWD and City of Beaverton as a backup source of supply.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Goyak Pump Station		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☒	Goal 7 ☐
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	Meets the District's initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Meets goals of the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering and Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, Operations, Risk, Safety		Washington County, City of Beaverton	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	HMGP funding, BRIC funding, others to be evaluated.
Estimated Cost	$2 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Resilient source of potable water to the Cooper Mountain area.	Public confidence that no interruptions anticipated following natural hazard events. Fewer operator challenges following small and large events to keep the facility operational.	$12 million in anticipated benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐	2024	2026

Implementation Benchmarks: How Will Success Be Measured?
• Successful completion of design and construction with backup power online following hazards.

Potential Challenges to Implementation
• Difficult site constraints, impacts to neighbors.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	Do nothing.	$0	Does not meet objective.
Alternative #2	Combine 189th and Goyak Pump Stations, reducing the number of facilities.	$1.5 million	Swap cost of upgrading the facility to installation of a resilient piping connection to 189th Pump Station.
Alternative #3	Seismic upgrade and new backup power.	$2 million	Ongoing maintenance of separate facilities.

Implementation Progress Report for Plan Maintenance	
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What challenges in implementation have been experienced?	
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Table 297: Goyak Reservoir

Mitigation Action Information			
Title of action	Goyak Reservoir		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Upgrade/retrofit the existing structure to withstand hazards.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☒ Landslide ☐ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	Upgrading the existing facility will allow the District to continue potable water service to customers following a natural hazard identified above. Risks currently involve the structure not meeting full current seismic codes and the current drains not meeting desired goals of limiting water loss.		
Area of action impact	The Cooper Mountain area. The reservoir directly serves the 550 and 400 pressure zones, and indirectly serves the upper pressure zones.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Goyak Reservoir		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	This meets the District's initiative to invest in critical infrastructure.		
Alignment with existing plans and policies	Meets the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering & Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, risk, safety			

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	HMPG funding, BRIC funding, others to be evaluated.
Estimated Cost	$1 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Maintains the ability to serve potable water following a seismic event.	Prevents flooding to downstream homes by having a resilient reservoir.	$6 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐	2024	2025

Implementation Benchmarks: How Will Success Be Measured?
• Ability to maintain service following a natural hazard.

Potential Challenges to Implementation
• Site constraints, permitting.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	Do nothing.	$0	Does not meet objectives.
Alternative #2	Construct new reservoir.	$10 million	Does not include land purchase and piping. Inefficient.
Alternative #3	Rehabilitate existing reservoir.	$1 million	

Implementation Progress Report for Plan Maintenance	
Date	
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What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 298: Meadow & Walker PRV

Mitigation Action Information			
Title of action	Meadow & Walker PRV		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Upgrade the existing PRV facility to improve access and safety.		
Hazard(s) addressed	Dam failure ☐ Drought ☐ Earthquake ☐ Extreme heat ☐	Flood ☒ Landslide ☐ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☐ Winter storm ☐
How does the action address identified current or future risks and vulnerabilities?	The existing facility constantly fills with water and road grime, making access and maintenance a challenge. This project will upgrade the facility to improve access and maintenance, reducing the risk of flooding that causes detrimental impacts to the operations of the system.		
Area of action impact	This is a main feed to the 385 pressure zone.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Meadow & Walker PRV facility		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	Aligns with the District's initiative to invest in critical infrastructure.		
Alignment with existing plans and policies	Aligns with District plans to improve safety and access to facilities.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering & Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, risk, safety			
Potential Funding Sources			

Non-Federal Funding Sources	Federal Funding Sources
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMPG funding, others to be determined
Estimated Cost	$1.5 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to maintain infrastructure and avoid failures following natural hazards.		$9 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐	2023	2025

Implementation Benchmarks: How Will Success Be Measured?

Potential Challenges to Implementation

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

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Date	
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What are the next steps in implementation?	

Table 299: Mid-Term Pipeline Upgrade

Mitigation Action Information			
Title of action	Mid-Term Pipeline Upgrade		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☒ Public education/awareness ☐
Action description	Upgrade and retrofit existing pipeline.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☒ Landslide ☒ Volcanic ash ☐ Wildland fire ☒	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	This project will evaluate and upgrade existing critical pipelines within the District's system.		
Area of action impact	All of TVWD.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Critical pipelines.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☒ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	Meets initiatives for investing in critical infrastructure.		
Alignment with existing plans and policies	Aligns with the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	Engineering and Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, risk, safety		Washington County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, others to be evaluated.
Estimated Cost	$98 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Improves the resilience of the water transmission mains and the District's ability to meet operational goals following an event.		$588 million in potential financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2028	2048

Implementation Benchmarks: How Will Success Be Measured?
• District's ability to serve water following a natural hazard.

Potential Challenges to Implementation

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
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What challenges in implementation have been experienced?	
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Table 300: 189th Pump Station Seismic Upgrade

Mitigation Action Information	
Title of action	189th Pump Station Seismic Upgrade
Type of action	Plans/regulations ☐ Natural systems protection ☐ Structure and infrastructure project ☒ Public education/awareness ☐
Action description	Upgrade the 189th Pump Station to meet current seismic codes and provide automated backup power.
Hazard(s) addressed	Dam failure ☐ Flood ☐ Windstorm, incl. tornado ☒ Drought ☐ Landslide ☐ Winter storm ☒ Earthquake ☒ Volcanic ash ☐ Extreme heat ☐ Wildland fire ☐
How does the action address identified current or future risks and vulnerabilities?	The 189th Pump Station is in need of seismic upgrades to meet current code requirements. By upgrading the pump station and providing backup power, the Cooper Mountain area that is served by this pump station will be able to remain in service following the hazards identified. This pump station is also key to providing backup water supply to the City of Beaverton's Cooper Mountain area.
Area of action impact	The Cooper Mountain service area within TVWD.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? 189th Pump Station
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☐ Goal 5 ☐ Goal 3 ☐ Goal 6 ☐
Integration into other initiatives	This meets the District's ongoing initiative of investing in critical infrastructure.
Alignment with existing plans and policies	Meets the Oregon Seismic Resilience Plan.
Mitigation Action Implementation Plan	
Priority	Low ☐ Medium ☐ High ☒
Lead position, office, department, or division responsible for implementation	Engineering and Operations

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
Engineering, Operations, Risk & Safety	Washington County

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC, HMGP, others to be evaluated.
Estimated Cost	$8 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to continue uninterrupted potable water service following major natural hazard events.	Public confidence in the water service which meets anticipated levels of service.Meets District initiatives to invest in critical infrastructure.	$48 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐	2023	2025

Implementation Benchmarks: How Will Success Be Measured?
• Success measured based on pump station availability and ability to meet water demands.

Potential Challenges to Implementation
• Rising costs of implementation and ability to construct improvements within existing land footprint. Potential impacts to neighbors and ability to serve potable water during construction.

Resources and References, if Applicable
• 2018 Water Master Plan Update, 2015 Water Master Plan, 2022 Pre-design (in-progress).

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
	Pump replacements	$100,000	TBD
Alternative #2	Rehabilitate in place	$2 million	TBD
Alternative #3	Full seismic upgrade	$8 million	TBD

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Table 301: Florence Lane Pump Station

Mitigation Action Information			
Title of action	Florence Lane Pump Station		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Retrofit the existing pump station to withstand the effects of natural disasters. This includes upgrading the existing backup power supply system.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☒	Flood ☒ Landslide ☒ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	Upgrading the existing pump station to meet current codes will allow the District to maintain service to customers following a natural hazard. The existing backup power system may not be active following an event, and this project intends to address that as well.		
Area of action impact	The upper pressure zones in the Metzger service area.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)?		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	This meets the District's ongoing initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Meets the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering and Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, risk, safety.		Washington County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, others to be evaluated.
Estimated Cost	$5 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to sustain operations following a natural hazard.	Public confidence in the water system.	$30 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐	2023	2025

Implementation Benchmarks: How Will Success Be Measured?
• Meeting implementation timelines to be online prior to 2026.

Potential Challenges to Implementation
• Site constraints, land use permitting, funding availability.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
	Do nothing		
Alternative #2	Construct new pipeline in Florence Lane		
Alternative #3	Perform upgrades		

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 302: Cooper Mountain Pump Station

Mitigation Action Information			
Title of action	Cooper Mountain Pump Station		
Type of action	Plans/regulations ☐		Natural systems protection ☐
	Structure and infrastructure project ☒		Public education/awareness ☐
Action description	Retrofit the Cooper Mountain Pump Station to better withstand the effects of multiple natural hazards.		
Hazard(s) addressed	Dam failure ☐	Flood ☐	Windstorm, incl. tornado ☒
	Drought ☐	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☐	
	Extreme heat ☐	Wildland fire ☐	
How does the action address identified current or future risks and vulnerabilities?	The existing Cooper Mountain Pump Station does not meet all current seismic codes; in particular, a Cascadia Subduction Zone seismic event would be detrimental to being able to serve potable water to the area. This seismic upgrade would allow the District to meet levels of service for the various hazards before and after the events.		
Area of action impact	Upper pressure zones on Cooper Mountain.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)?		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☐
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	This meets the District's ongoing initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Aligns with the Oregon Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering and Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, Operations, Risk, & Safety		Washington County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC, HMGP, others to be evaluated.
Estimated Cost	$5 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to continue uninterrupted potable water service following major natural hazard events.	Public confidence in the water service that meets anticipated levels of service. Meets District initiatives to invest in critical infrastructure.	$30 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☒ Ongoing ☐	2024	2026

Implementation Benchmarks: How Will Success Be Measured?
• Success measured based on pump station availability and ability to meet water demands following a natural hazard event.

Potential Challenges to Implementation
• Rising costs of implementation, ability to construct improvements adjacent to residential area.

Resources and References, if Applicable
• 2018 Water Master Plan Update, 2015 Water Master Plan, 2022 Pre-design (in-progress).

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	Pump replacements	$100,000	TBD
Alternative #2	Rehabilitate in place	$3 million	TBD
Alternative #3	Seismic upgrade	$5 million	TBD

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What are the next steps in implementation?	

Table 303: Cornelius Pass Facility Upgrade

Mitigation Action Information			
Title of action	Cornelius Pass Facility Upgrade		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Upgrade the Cornelius Pass Facility to meet current seismic design, and provide controls and interconnection between the Willamette Water Supply System and the Joint Water Commission.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☒ Landslide ☒ Volcanic ash ☒ Wildland fire ☐	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	This facility upgrade will allow water to move between two regional supply sources: the Willamette Water Supply System and the Joint Water Commission. It will provide regional connectivity and controls to allow water to be shared, providing resiliency for the risks identified above.		
Area of action impact	Potential to include all water service providers served by the Willamette Water Supply System and the Joint Water Commission.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)?		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☒ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☐	Goal 7 ☒
Integration into other initiatives	This meets the District's ongoing initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Meets the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☒	Medium ☐	High ☐
Lead position, office, department, or division responsible for implementation	Engineering and Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, Operations, Risk, Safety, Finance		Washington County, WWSS, JWC, Hillsboro	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital Reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, others to be evaluated.
Estimated Cost	$20 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to continue uninterrupted potable water service following major natural hazard events.	Public confidence in the water service which meets anticipated levels of service. Meets District initiatives to invest in critical infrastructure.	$120 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2032	2034

Implementation Benchmarks: How Will Success Be Measured?
• Success measured based on water availability, ability to meet water demands, and supply region before, during, and after a natural hazard.

Potential Challenges to Implementation
• Rising costs of implementation and ability to construct improvements within existing land footprint adjacent to wetlands. Property acquisition.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

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What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 304: Emergency Operations Center

Mitigation Action Information			
Title of action	Emergency Operations Center		
Type of action	Plans/regulations ☐		Natural systems protection ☐
	Structure and infrastructure project ☒		Public education/awareness ☐
Action description	Retrofit and build a facility to withstand the natural hazards.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☒	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☒	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	Following a natural disaster, it is essential to be able to convene a response group at a centralized location to provide response and communicate with stakeholders. A fully resilient Emergency Operations Center will allow the District to better respond following an event and will help the District to return to service in a timely manner.		
Area of action impact	Potential to assist with the emergency response in all of Washington County.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Emergency Operations Center		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☒
	Goal 2 ☐	Goal 5 ☒	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	This meets the District's ongoing initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Meets the intent of the Oregon Seismic Resiliency Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☒	Medium ☐	High ☐
Lead position, office, department, or division responsible for implementation	Engineering and Operations		

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
All internal departments.	Washington County

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	HMGP funding, BRIC funding, others to be evaluated.
Estimated Cost	$30 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to respond to system failures following a major natural hazard. Improve communications.	Potentially serve as a location for potable water distribution.	$180 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2032	2035

Implementation Benchmarks: How Will Success Be Measured?
• Ability to respond to disasters, improvement in response times.

Potential Challenges to Implementation
• Location, funding.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
	Do nothing		
Alternative #2	Upgrade existing		
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 305: Emergency Underground Storage/Water Supply Well – Regional Supply Planning

Mitigation Action Information			
Title of action	Emergency Underground Storage/Water Supply Well – Regional Supply Planning		
Type of action	Plans/regulations ☒	Natural systems protection ☒	
	Structure and infrastructure project ☐	Public education/awareness ☐	
Action description	Conduct an engineering study of emergency underground storage and subsequent water use during response and recovery operations. The project would include, but not be limited to, Schuepbach Well, Grabhorn Aquifer Storage and Recovery (ASR), Miller Hill ASR, and Cooper Mountain. ASR. Include feasibility, methods, and required equipment for use of emergency underground stored water. The project would help determine the future ability to use the Emergency Underground Storage sites during an emergency to assist in the Emergency Drinking Water Provisioning Project and the provisioning of water to firefighters for firefighting efforts.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☒	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☒	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	Underground storage capabilities exist, and our service area is within the area projected to be impacted by a Cascadia Subduction Zone Earthquake (CSZE), West Hills Earthquake, or other natural hazards that could impact aboveground water storage infrastructure. As part of the goals of the 2013 Oregon Resilience Plan, water utilities will develop a 50-year mitigation plan for resilience to the impact of the CSZE, magnitude 9.0. Redundant water supply systems provide emergency water supply in the event of an emergency disruption in water supply, like a major earthquake event.		
Area of action impact	All of TVWD's service area.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? The facilities mentioned in the description.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☒	Goal 7 ☒
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☒	
Integration into other initiatives	Fulfills initiative to invest in critical infrastructure.		

Alignment with existing plans and policies	An Emergency Water Supply Study is aligned with TVWD's AWIA Risk and Resilience Assessment and the Oregon Resilience Plan. Also, in alignment with the Regional Water Providers Consortium and Regional Disaster Preparedness Organization. 2015 Water Master Plan, included in the 2018 update to the Water Master Plan.

Mitigation Action Implementation Plan

Priority	Low ☐ Medium ☒ High ☐
Lead position, office, department, or division responsible for implementation	Engineering & Operations.

Supporting Partners

Internal Partners	External Partners, Including Community Partners
Engineering, Operations, Risk, Safety	Washington County

Potential Funding Sources

Non-Federal Funding Sources	Federal Funding Sources
Capital reserves, water sales revenue, revenue bonds.	HMGP funding, BRIC funding, others to be evaluated.

Estimated Cost	$150,000

Estimated Benefit

Primary Benefit(s)	Secondary Benefit(s)	Financial Benefit(s)
Develops a plan that can be implemented to supply emergency water.	Customer involvement and communication can allow public to gain trust and understand the value of water.	$900,000 in estimated financial benefits.

Project Timeline

Expected Timeline for Completion	Potential Start Date	Potential Completion Date
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐	2026	2027

Implementation Benchmarks: How Will Success Be Measured?

- Successful completion of the plan. Readiness ability to meet demands in a timely manner.

Potential Challenges to Implementation

- Resource availability to lead the study.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
Alternative #2			
Alternative #3			
Implementation Progress Report for Plan Maintenance			
Date			
What progress in implementation has been made to date?			
What challenges in implementation have been experienced?			
What are the next steps in implementation?			

Table 306: Lead Joint Pipe Seismic Upgrade

Mitigation Action Information			
Title of action	Lead Joint Pipe Seismic Upgrade		
Type of action	Plans/regulations ☐	Natural systems protection ☐	
	Structure and infrastructure project ☒	Public education/awareness ☐	
Action description	Retrofit the existing pump station to withstand the effects of natural disasters. This includes upgrading the existing backup power supply system.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☐	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☐	
	Extreme heat ☐	Wildland fire ☐	
How does the action address identified current or future risks and vulnerabilities?	Upgrading the existing piping to meet current seismic design standards will allow the District to maintain service to customers following a seismic event.		
Area of action impact	Several areas within the District's service area.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Distribution piping network		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☐
	Goal 2 ☐	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☐	
Integration into other initiatives	This meets the District's ongoing initiative of investing in critical infrastructure.		
Alignment with existing plans and policies	Meets the Oregon Seismic Resilience Plan.		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering and Operations.		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
Engineering, operations, risk, safety.		Washington County	

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
Capital reserves, water sales revenue, revenue bonds.	BRIC funding, HMGP funding, others to be evaluated.
Estimated Cost	$25 million

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Ability to sustain operations following a natural hazard.	Public confidence in the water system.	$125 million in estimated financial benefits.

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☒ Mid-term ☐ Long-term ☐ Ongoing ☐		

Implementation Benchmarks: How Will Success Be Measured?

Potential Challenges to Implementation
• Site constraints, funding availability.

Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1			
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 307: Regional Water Providers Consortium Strategic Plan 2023–28

Mitigation Action Information	
Title of action	Regional Water Providers Consortium Strategic Plan 2023–28
Type of action	Plans/regulations ☒ Natural systems protection ☐ Structure and infrastructure project ☐ Public education/awareness ☒
Action description	The TVWD and Regional Water Providers service area activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience.
Hazard(s) addressed	Dam failure ☒ Flood ☒ Windstorm, incl. tornado ☒ Drought ☒ Landslide ☒ Winter storm ☒ Earthquake ☒ Volcanic ash ☒ Extreme heat ☒ Wildland fire ☒
How does the action address identified current or future risks and vulnerabilities?	Meeting water needs, emergency preparedness, and resiliency by strengthening regional partnerships. Recent experience with emergency tabletop exercises has underscored how critical it is to plan ahead and be prepared, as well as to determine what mitigation we can do to have resilient customers so that we meet our LOS requirements. Addressing common mitigation issues and using the strength of the Regional Water Providers Consortium.
Area of action impact	Total infrastructure within the service area with combined mitigation activity coordinated within the lifelines and identified infrastructure interdependencies.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Hospitals, care centers, fire stations, and other lifelines as defined in the Oregon Resiliency Plan.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☒ Goal 5 ☒ Goal 3 ☒ Goal 6 ☒
Integration into other initiatives	The Regional Water Consortium's five-year strategic plan for 2023–28 is aligned/integrated with the work of the Regional Disaster Preparedness Organization.
Alignment with existing plans and policies	Aligned with the Water Master Plan, the Oregon Resiliency Plan, and the plans within Washington County and the RDPO.
Mitigation Action Implementation Plan	
Priority	Low ☐ Medium ☒ High ☐
Lead position, office, department, or division responsible for implementation	Emergency Program Coordinator

Supporting Partners	
Internal Partners	**External Partners, Including Community Partners**
• Communications and Public Affairs Supervisor	• City of Beaverton • Clackamas River Water • City of Cornelius • City of Forest Grove • Gladstone • Gresham • Hillsboro • Lake Oswego • Milwaukie • Newberg • Oak Lodge Water Services • City of Portland • Raleigh Water District • Rockwood • Sandy • Scapoose • Sherwood • South Fork Water Board • Sunrise Water Authority • Tigard • Tualatin • West Slope Water District • Wilsonville

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
General Funds for staff time and supplies	• Homeland Security Grant Program (HSGP) • Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities
Estimated Cost	$10,000 per year from TVWD

Estimated Benefit		
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**
Aligned mitigation planning. Protection of life safety.	Increased understanding of lifelines and infrastructure interdependencies; mitigation actions have added weight and receive higher priority.	$30,000.00 per year

Project Timeline		
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	2023	2028

Implementation Benchmarks: How Will Success Be Measured?
• Development of strategic plan. • Development of core planning team. • Assessment of the levels of service from the Oregon Resiliency Plan. • Assessment of projects within Oregon and especially within the RDPO and Washington County. • Alignment with FEMA Region 10. • See Strategic Plan 2018–2023 for elements to be updated.
Potential Challenges to Implementation
• Ability to scale the problem. The mitigation work is significant; our challenge will be to narrow the work, define the scope, and make measurable progress. • Availability of the key stakeholders (critical and key customers). • Conflicting projects that are parallel but not integrated. • Work capacity of staff; being able to dedicate time and effort to a non-funded project. • Funding. Currently, this is all in-kind work, and there are no funds for staff time or a budget for supplies.
Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	No action	$0	Lack of coordination and collaboration until emergency response required.
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 308: Infrastructure Interdependencies Workshops

Mitigation Action Information	
Title of action	Infrastructure Interdependencies Workshops
Type of action	Plans/regulations ☐ Natural systems protection ☐ Structure and infrastructure project ☐ Public education/awareness ☒
Action description	The TVWD and WWSS infrastructure interdependency service area activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience.
Hazard(s) addressed	Dam failure ☒ Flood ☒ Windstorm, incl. tornado ☒ Drought ☒ Landslide ☒ Winter storm ☒ Earthquake ☒ Volcanic ash ☒ Extreme heat ☒ Wildland fire ☒
How does the action address identified current or future risks and vulnerabilities?	Introduction to "Infrastructure Interdependencies" topic, "Why Now?"; "Hierarchy of infrastructure systems overview"; and "Co-resilience planning" Education within group. • Universe of critical infrastructure systems, from FEMA; includes all the key services represented by the group attending. • Even just for water service, water providers are dependent upon all the other utilities and public services, especially after a disaster. • Recent experience with supply chain issues proves how critical it is to plan ahead and be prepared. What mitigation can we do? • Why now? For WWSP, design is complete, and program activities are transitioning to emergency planning, operational planning, construction, and future mitigation. • Hierarchy of infrastructure dependencies; identify order of problem-solving by specific system at risk, then identify other services needed to address the specific problem; very clear that there are strong interdependencies between utilities.
Area of action impact	Total infrastructure within the service area with combined mitigation activity coordinated within the lifelines and identified infrastructure interdependencies.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? WWSP
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☒ Goal 5 ☒ Goal 3 ☒ Goal 6 ☒
Integration into other initiatives	The program is integrated with the work being done by Metro on the Long Range Transportation Plan, the RDPO work with Emergency Transportation Routes, the RDPO work on Provisioning of Emergency Drinking Water, and the Regional Water Consortium's work.
Alignment with existing plans and policies	Aligned with the Water Master Plan, the Oregon Resiliency Plan, and the plans within Washington County and the RDPO.

Mitigation Action Implementation Plan			
Priority	Low ☐ Medium ☒ High ☐		
Lead position, office, department, or division responsible for implementation	Principal Engineer, TVWD (WWSP)		
Supporting Partners			
Internal Partners	**External Partners, Including Community Partners**		
Willamette Water Supply System (WWSS)/Tualatin Valley Water District Emergency Program Coordinator	• Clean Water Services (wastewater infrastructure) • Portland General Electric (electrical power infrastructure) • Washington County (transportation infrastructure/emergency management) • Clackamas County (emergency management) • ASCE Lifelines 2022 Conference Participants (regional subject matter experts and agencies) • Cascadia Lifelines Program (consortium of lifeline providers)		
Potential Funding Sources			
Non-Federal Funding Sources	**Federal Funding Sources**		
General Funds for staff time and supplies	• Homeland Security Grant Program (HSGP) • Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities		
Estimated Cost	$50,000 per year from TVWD, which does not include the funds from the external stakeholders. Estimate $150,000.00 per year required to implement a funded program and implement programs.		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Aligned mitigation planning. Protection of life safety.	Increased understanding of lifelines and infrastructure interdependencies; mitigation actions have added weight and receive higher priority.	$300,000.00 per year	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	May 23, 2022	May 2027	

Implementation Benchmarks: How Will Success Be Measured?
Start date, May 23, 2022. Meeting schedule to meet with individual stakeholders to develop a mission and vision statement. Establishment of framework during 2022 and into 2023. • Align with Lifelines and the Infrastructure Interdependencies. Assessment of current state within TVWD, WWSP, and the listed external partners. • Assessment of the Levels of Service from the Oregon Resiliency Plan. • Assessment of projects within Oregon and especially within the RDPO and Washington County. • Alignment with FEMA Region 10. • 2023: Establish goals and quarterly workshops. • Work product will be used to inform other programs/projects, as mentioned with the long-range transportation plan and the ETR plans. • Progress measured by infrastructure mitigation work being done, grants awarded, and work started, for example, the two bridges key to the WWSP service. • 2022: Seek sources of funding for the mitigation planning projects.
Potential Challenges to Implementation
• Ability to scale the problem. The mitigation work is significant, our challenge will be to narrow the work, define the scope and make measurable progress. • Availability of the key stakeholders • Conflicting projects which are parallel but not integrated • Work capacity of staff, being able to dedicate time and effort to a non-funded project. • Funding. Currently, this is all in-kind work, and there are no funds for staff time or a budget for supplies.
Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	No action.	$0	Lack of coordination and collaboration until emergency response required.
Alternative #2	Scale project to only water providers.	Year 1 – $10,000.00 Ongoing $10,000.00	Mitigation focused on only one lifeline.
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 309: Key and Critical Customer Collaboration

Mitigation Action Information	
Title of action	Key and Critical Customer Collaboration
Type of action	Plans/regulations ☐ Natural systems protection ☐ Structure and infrastructure project ☐ Public education/awareness ☒
Action description	The TVWD and WWSS infrastructure interdependency service area activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience.
Hazard(s) addressed	Dam failure ☒ Flood ☒ Windstorm, incl. tornado ☒ Drought ☒ Landslide ☒ Winter storm ☒ Earthquake ☒ Volcanic ash ☒ Extreme heat ☒ Wildland fire ☒
How does the action address identified current or future risks and vulnerabilities?	Reinstate, post-COVID, Key and Critical Customer Collaboration meetings. "Why Now?," Key and Critical Customer Co-resilience Planning and Education within group. • Determine Customer's level of mitigation and readiness planning and how that aligns with our Levels of Service as described in the Oregon Resiliency Plan. • Recent experience with emergency tabletop exercises has underscored how critical it is to plan ahead and be prepared, as well as to determine what mitigation we can do to have resilient customers so that we meet our LOS Requirements. • Hierarchy of lifelines and LOS will define our priority of work during an emergency response.
Area of action impact	Total infrastructure within the service area with combined mitigation activity coordinated within the lifelines and identified infrastructure interdependencies.
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? Hospitals, care centers, fire stations and other lifelines as defined in the Oregon Resiliency Plan
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 ☒ Goal 4 ☐ Goal 7 ☒ Goal 2 ☒ Goal 5 ☒ Goal 3 ☒ Goal 6 ☒
Integration into other initiatives	The program is integrated with the work being done by Metro on the Long Range Transportation Plan, the RDPO work with Emergency Transportation Routes, the RDPO work on Provisioning of Emergency Drinking Water, and the Regional Water Consortium's work.
Alignment with existing plans and policies	Aligned with the Water Master Plan, the Oregon Resiliency Plan, and the plans within Washington County and the RDPO.

Mitigation Action Implementation Plan			
Priority	Low ☐ Medium ☐ High ☒		
Lead position, office, department, or division responsible for implementation	Customer Service Manager		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
• Communications and Public Affairs Supervisor • Tualatin Valley Water District Emergency Program Coordinator		• Hospitals and Health Care • Fire Department • Food Production • Manufacturing, water quality • Schools • Tualatin Hills Parks & Recreation • Washington County • City of Beaverton	
Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General Funds for staff time and supplies		• Homeland Security Grant Program (HSGP) • Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities	
Estimated Cost	$50,000 per year from TVWD, which does not include the funds from the external stakeholders. Estimate $150,000.00 per year required to implement a funded program and implement programs.		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Aligned mitigation planning. Protection of life safety.	Increased understanding of lifelines and infrastructure interdependencies; mitigation actions have added weight and receive higher priority.	$300,000.00 per year	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	May 23, 2022	May 2027	

Implementation Benchmarks: How Will Success Be Measured?
• Define key and critical customers via a review of pre-COVID practice. • Outreach to the key and critical customers. • Meeting schedule to meet with individual stakeholders to develop a mission and vision statement. Establishment of framework during 2022 and into 2023. • Group meeting schedule. • Determine level of mitigation planning, what the key and critical customers have done, and what is their capacity? • Assessment of the Levels of Service from the Oregon Resiliency Plan. • Assessment of projects within Oregon, especially within the RDPO and Washington County. • Alignment with FEMA Region 10. • 2023: Establish goals and quarterly workshops. • Progress measured by infrastructure mitigation work being done, grants awarded, and work started, for example, the two bridges key to the WWSP service. • 2022: Seek sources of funding for the mitigation planning projects.
Potential Challenges to Implementation
• Ability to scale the problem. The mitigation work is significant; our challenge will be to narrow the work, define the scope, and make measurable progress. • Availability of the key stakeholders (critical and key customers). • Conflicting projects that are parallel but not integrated. • Work capacity of staff, being able to dedicate time and effort to a non-funded project. • Funding. Currently, this is all in-kind work, and there are no funds for staff time or a budget for supplies.
Resources and References, if Applicable

Three Alternatives Considered, Including No Action			
	Action Description	**Estimated Cost**	**Evaluation**
Alternative #1	No action	$0	Lack of coordination and collaboration until emergency response required.
Alternative #2	Scale project to only water providers	Year 1 – $10,000.00 Ongoing $10,000.00	Mitigation focused on only one lifeline.
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 310: TVWD HQ Building Upgrade

Mitigation Action Information			
Title of action	TVWD HQ Building Upgrade		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Upgrade the existing headquarters building for TVWD to withstand all natural hazards.		
Hazard(s) addressed	Dam failure ☒ Drought ☒ Earthquake ☒ Extreme heat ☒	Flood ☒ Landslide ☒ Volcanic ash ☒ Wildland fire ☒	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	Upgrading the existing TVWD headquarters building will allow the District to remain operational following a seismic or other natural hazard event. This is the central hub for providing potable water to over 220,000 residents and businesses.		
Area of action impact	The entire TVWD service area.		
Is the action related to a critical facility or facilities?	Yes ☒ No ☐ If yes, what facility(ies)? TVWD HQ Building		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☐ Goal 3 ☐	Goal 4 ☒ Goal 5 ☐ Goal 6 ☐	Goal 7 ☐
Integration into other initiatives	Invest in critical infrastructure		
Alignment with existing plans and policies	Oregon Seismic Resilience Plan		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☐	High ☒
Lead position, office, department, or division responsible for implementation	Engineering & Operations		
Supporting Partners			
Internal Partners		**External Partners, Including Community Partners**	
All TVWD departments		Washington County	

Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General funding, Capital Improvement funding		HMGP funding, BRIC funding	
Estimated Cost	$15 million		
Estimated Benefit			
Primary Benefit(s)	**Secondary Benefit(s)**	**Financial Benefit(s)**	
Allows the District to remain operational and to be an emergency operations center available in times of natural hazard.		$90 million in financial benefits	
Project Timeline			
Expected Timeline for Completion	**Potential Start Date**	**Potential Completion Date**	
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐			
Implementation Benchmarks: How Will Success Be Measured?			
Potential Challenges to Implementation			
Resources and References, if Applicable			

Three Alternatives Considered, Including No Action			
Alternative #1	**Action Description**	**Estimated Cost**	**Evaluation**
Alternative #2			
Alternative #3			

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

7. Willamette Water Supply System

Water needs in Washington County are projected to increase, with new supplies needed as early as 2026. Developing an additional water supply through a partnership improves regional water reliability and supports the region's plans for responsible growth within urban growth boundaries.

The WWSS Commission is an Oregon intergovernmental entity formed by TVWD, the City of Hillsboro, and the City of Beaverton. The WWSS Commission was formed to build the WWSS in response to planned growth in their service areas. The WWSS will provide an additional, resilient water supply for Washington County.

The Willamette River, one of Oregon's largest rivers, is the WWSS' new supply source. The raw water intake is located at the Willamette River Water Treatment Plant in Wilsonville. From there, raw water will be pumped to the WWSS Water Treatment Plant, a new state-of-the-art water filtration plant where multiple treatment processes will produce high-quality drinking water. Drinking water will be pumped to reservoir facilities on Cooper Mountain, then will be gravity-fed to additional storage and customers in the TVWD, Hillsboro, and Beaverton service areas. The new system will be completed by 2026.

TVWD has been designated the Managing Agency for the WWSS Commission, and TVWD operates the Willamette Water Supply Program to plan, design, and construct the WWSS. WWSS staff is comprised of personnel from TVWD and the cities of Hillsboro and Beaverton.

The Willamette Water Supply System Intergovernmental Agreement, effective July 1, 2019, and amended in 2020 and 2021, sets forth the terms for the joint ownership, financing, design, permitting, construction, operation, maintenance, repair, and replacement of the WWSS.

The powers and duties of TVWD as a Managing Agency include creating the "Master Plan" for capital improvements in collaboration with each party participating and maintaining the Capital Improvement Plan budget, which is updated and submitted to the WWSS Board. The TVWD Emergency Program Coordinator also acts as the Emergency Program Coordinator for WWSS.

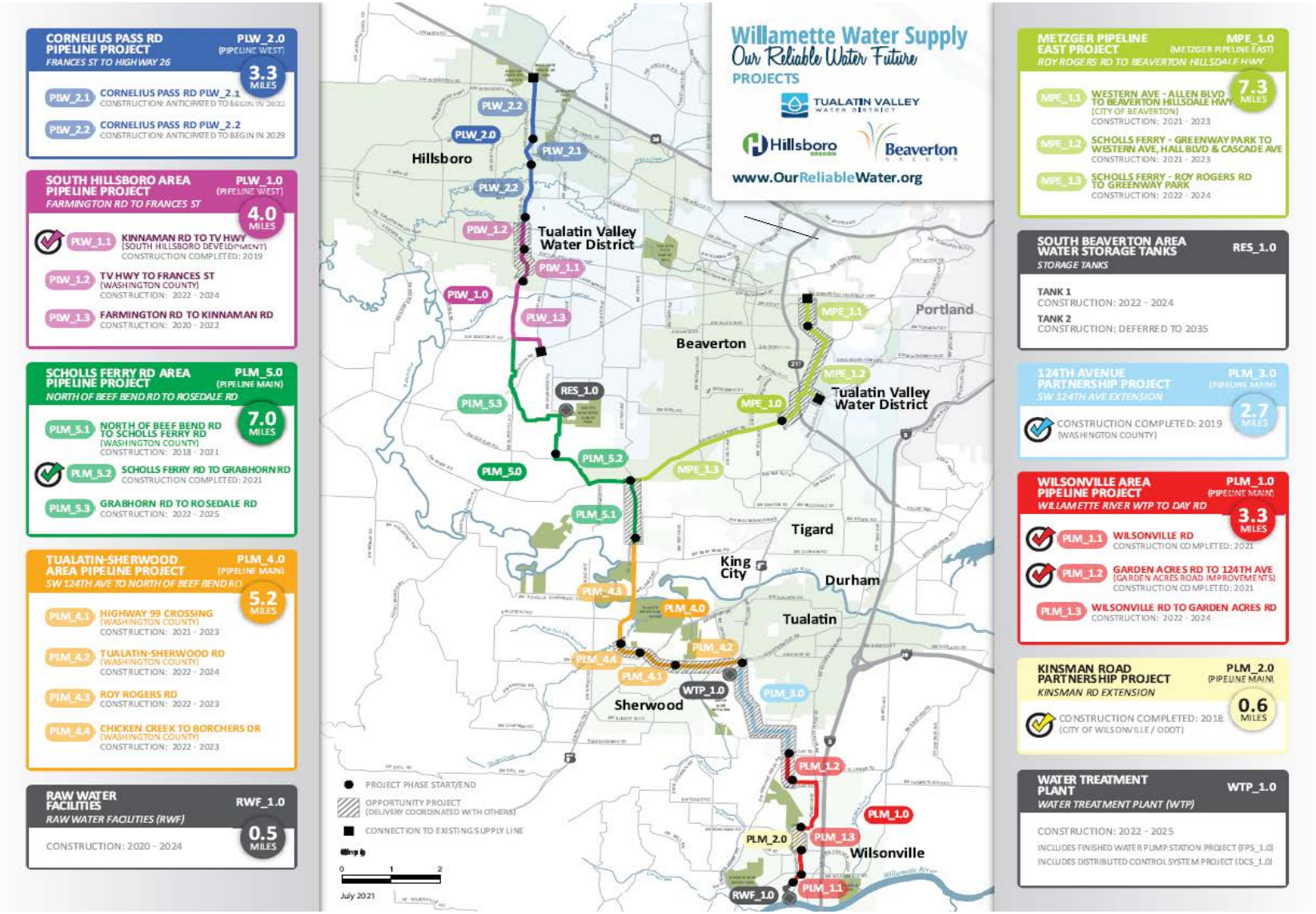

Figure 42: Willamette Water Supply System Project Map

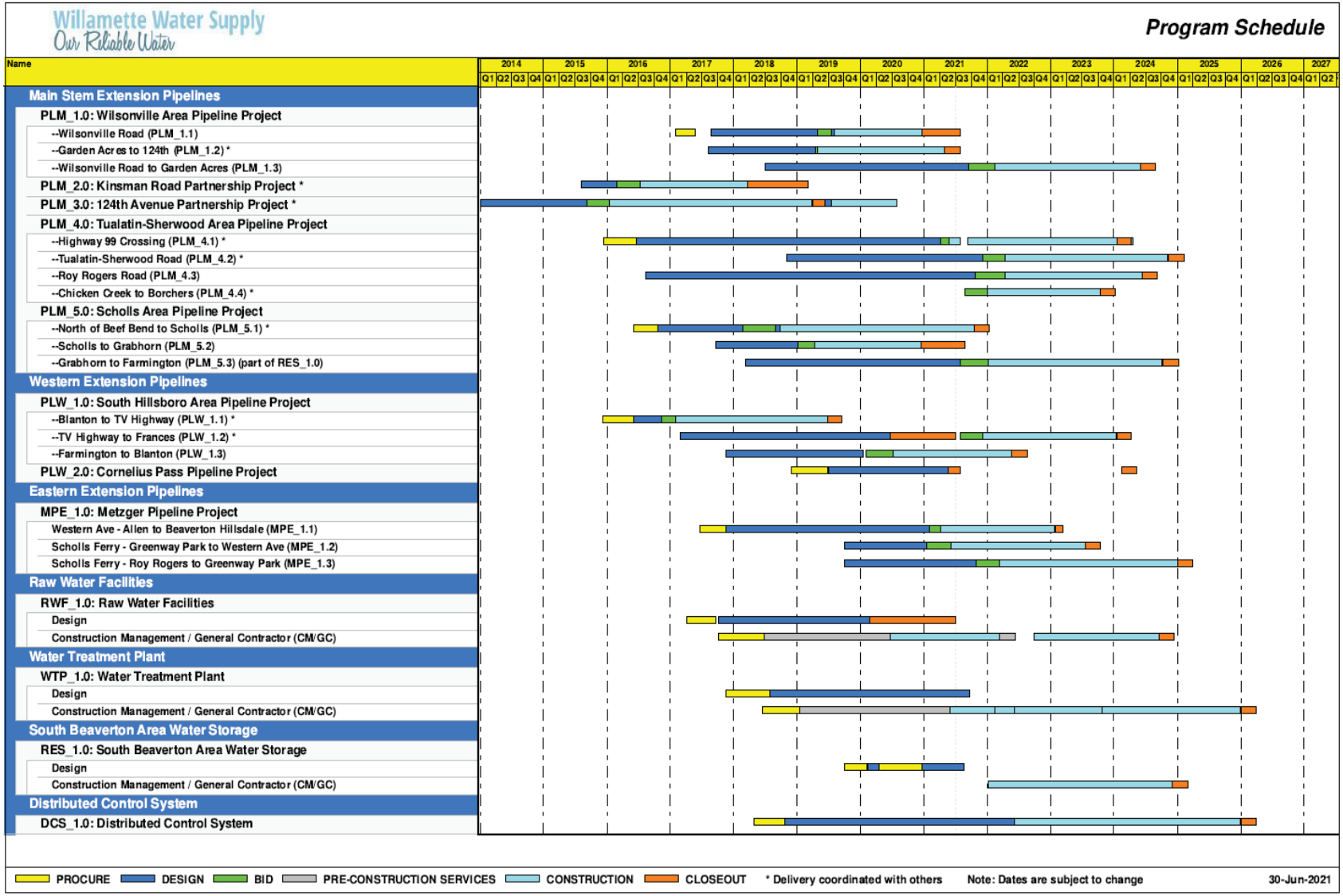

Figure 43: Willamette Water Supply System Program Schedule

7.1. NHMP Planning Process

The WWSS has a three-member Board of Commissioners that serves as the governing body of the WWSS Commission. Once the Washington County NHMP has received the designation “Approvable Pending Local Adoption” from FEMA, WWSS will submit the plan to the Board of Commissioners for final public comment and local adoption. A copy of the resolution will be inserted into the NHMP and held on file in Washington County, TVWD, and WWSS.

WWSP participated in the entire planning process for the NHMP and shared Technical Committee members with TVWD. The TVWD Emergency Program Coordinator was the point of contact for WWSS during the planning process. Additionally, public and stakeholder engagement NHMP requirements for public and stakeholder engagement were executed by TVWD on behalf of WWSS, as it is TVWD’s duty as WWSS Managing Agency to provide public communications and outreach for WWSS. WWSS is being highlighted within the TVWD NHMP annex due to its separate governing body and to ensure the system meets all FEMA planning requirements and is eligible for hazard mitigation assistance grants.

7.2. Hazard Identification and Risk Assessment

WWSS shares natural hazard scores, significant events, potential impacts, vulnerabilities, and overall vulnerability with TVWD for each hazard profiled in this NHMP. Critical facilities and assets identified by WWSS are included in Table 282 of this annex.

7.3. Capability Assessment, Expansion, and Improvement

Because WWSS is managed by TVWD, it has the same planning, regulatory, administrative, technical, educational, public outreach, and financial capabilities and opportunities for capability expansion and improvement as described in Section 4 of this annex. Additionally, because WWSS staff is comprised of personnel from TVWD and the cities of Hillsboro and Beaverton, the system can utilize resources from these three entities if it is ever required.

7.4. Mitigation Strategy

The mitigation goals detailed in Volume I, Section 3 also apply to WWSS, as they were an active participant in the NHMP planning process. The Technical Committee for WWSS will establish a process in which the mitigation strategy, goals, objectives, and actions outlined in this NHMP and the TVWD annex will be incorporated into existing local planning strategies, as applicable. Because WWSS infrastructure is part of the TVWD infrastructure, any mitigation actions taken by either WWSS or TVWD will have a positive impact on the resiliency of the entire water system.

In addition to the TVWD action items included in Section 6.1 of this annex, WWSS identified supplemental action items. A summary of these actions is provided below. Full action item planning worksheets are provided in Section 6.2 of this annex.

Table 311: Willamette Water Supply System Action Items

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
1	ShakeAlert System earthquake early warning network sponsored by the USGS and west coast regional stakeholders.	Earthquake	High
2	Standby power and fuel storage to provide additional standby power generation and associated fuel storage at the Willamette Water Supply System's water treatment plant facility.	Earthquake, extreme heat, wildland fire, windstorm, including tornado, and winter storm	High
3	Emergency Spare Parts and Storage Facility to provide additional emergency spare parts and associated storage facilities for enhanced operations of the Willamette Water Supply System.	Earthquake, extreme heat, wildland fire, windstorm, including tornado, and winter storm	High
4	Seismic Upgrade to two bridges on Roy Rogers Road so they can serve as a critical transportation link within Washington County for critical infrastructure systems and continue to provide critical service to the community following a major seismic event (water, electrical power, transportation, and wastewater).	Earthquake	High
5	Infrastructure interdependencies workshops. TVWD and WWSS activity focused on identification, assessment, and development of mitigation strategies related to improving community resilience. This action is also included in TVWD's action item list.	All hazards	Medium